1 CCPP variables provided by model SCM vs requested by pool of physics

1.1 List of variables

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FV3-GFS_Coupling_type
FV3-GFS_Diag_type
FV3-GFS_Diag_type_all_blocks
FV3-GFS_Grid_type
FV3-GFS_Grid_type_all_blocks
FV3-GFS_Interstitial_type
FV3-GFS_Radtend_type
FV3-GFS_Sfcprop_type
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FV3-GFS_Stateout_type
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Monin-Obukhov_similarity_function_for_momentum
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air_temperature_at_previous_time_step
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cloud_area_fraction

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cloud_condensed_water_conversion_threshold

cloud_condensed_water_mixing_ratio

cloud_condensed_water_mixing_ratio_at_lowest_model_layer

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cumulative_change_in_y_wind_due_to_convective_gravity_wave_drag

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cumulative_cloud_work_function

cumulative_lwe_thickness_of_convective_precipitation_amount

cumulative_lwe_thickness_of_convective_precipitation_amount_in_bucket

cumulative_snow_deposition_sublimation_upward_latent_heat_flux_multiplied_by_timestep

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cumulative_surface_downwelling_diffuse_near_infrared_shortwave_flux_for_coupling_multiplied_by_timestep

cumulative_surface_downwelling_diffuse_ultraviolet_and_visible_shortwave_flux_for_coupling_multiplied_by_timestep

cumulative_surface_downwelling_direct_near_infrared_shortwave_flux_for_coupling_multiplied_by_timestep

cumulative_surface_downwelling_direct_ultraviolet_and_visible_shortwave_flux_for_coupling_multiplied_by_timestep

cumulative_surface_downwelling_longwave_flux_for_coupling_multiplied_by_timestep

cumulative_surface_downwelling_shortwave_flux_for_coupling_multiplied_by_timestep

cumulative_surface_ground_heat_flux_multiplied_by_timestep

cumulative_surface_net_downward_diffuse_near_infrared_shortwave_flux_for_coupling_multiplied_by_timestep

cumulative_surface_net_downward_diffuse_ultraviolet_and_visible_shortwave_flux_for_coupling_multiplied_by_timestep

cumulative_surface_net_downward_direct_near_infrared_shortwave_flux_for_coupling_multiplied_by_timestep

cumulative_surface_net_downward_direct_ultraviolet_and_visible_shortwave_flux_for_coupling_multiplied_by_timestep

cumulative_surface_net_downward_longwave_flux_for_coupling_multiplied_by_timestep

cumulative_surface_net_downward_shortwave_flux_for_coupling_multiplied_by_timestep

cumulative_surface_snow_area_fraction_multiplied_by_timestep

cumulative_surface_upward_latent_heat_flux_for_coupling_multiplied_by_timestep

cumulative_surface_upward_latent_heat_flux_for_diag_multiplied_by_timestep

cumulative_surface_upward_potential_latent_heat_flux_multiplied_by_timestep

cumulative_surface_upward_sensible_heat_flux_for_coupling_multiplied_by_timestep

cumulative_surface_upward_sensible_heat_flux_for_diag_multiplied_by_timestep

cumulative_surface_x_momentum_flux_for_coupling_multiplied_by_timestep

cumulative_surface_x_momentum_flux_for_diag_multiplied_by_timestep

cumulative_surface_y_momentum_flux_for_coupling_multiplied_by_timestep

flag_for_mom4_coupling

flag_for_morrison_gettelman_microphysics_scheme

flag_for_mountain_blocking

flag_for_nsstm_run

flag_for_output_of_longwave_heating_rate

flag_for_output_of_shortwave_heating_rate

flag_for_precipitation_effect_on_radiation

flag_for_precipitation_type

flag_for_precipitation_type_algorithm

flag_for_radar_reflectivity

flag_for_reduced_drag_coefficient_over_sea

flag_for_ruc_land_surface_scheme

flag_for_scale_aware_TKE_moist_EDMF_PBL

flag_for_shoc

flag_for_solar_constant

flag_for_stochastic_shum_option

flag_for_stochastic_skeb_option

flag_for_stochastic_surface_perturbations

flag_for_stochastic_surface_physics_perturbations

flag_for_surface_emissivity_control

flag_for_sw_clouds_without_sub-grid_approximation

flag_for_thompson_microphysics_scheme

flag_for_using_climatology_albedo

flag_for_using_prescribed_global_mean_co2_value

flag_for_vertical_index_direction_control

flag_for_wsm6_microphysics_scheme

flag_for_zhao_carr_microphysics_scheme

flag_for_zhao_carr_pdf_microphysics_scheme

flag_gocart

flag_idealized_physics

flag_mg3_as_mg2

instantaneous_deep_convective_cloud_condensate_mixing_ratio_on_dynamics_time_step

instantaneous_specific_humidity_at_2m_for_coupling

instantaneous_surface_air_pressure_for_coupling

instantaneous_surface_downwelling_diffuse_near_infrared_shortwave_flux_for_coupling

instantaneous_surface_downwelling_diffuse_ultraviolet_and_visible_shortwave_flux_for_coupling

instantaneous_surface_downwelling_direct_near_infrared_shortwave_flux_for_coupling

instantaneous_surface_downwelling_direct_ultraviolet_and_visible_shortwave_flux_for_coupling

instantaneous_surface_downwelling_longwave_flux_for_coupling

instantaneous_surface_downwelling_shortwave_flux_for_coupling

instantaneous_surface_ground_heat_flux

instantaneous_surface_net_downward_diffuse_near_infrared_shortwave_flux_for_coupling

instantaneous_surface_net_downward_diffuse_ultraviolet_and_visible_shortwave_flux_for_coupling

instantaneous_surface_net_downward_direct_near_infrared_shortwave_flux_for_coupling

instantaneous_surface_net_downward_direct_ultraviolet_and_visible_shortwave_flux_for_coupling

instantaneous_surface_net_downward_longwave_flux_for_coupling

instantaneous_surface_net_downward_shortwave_flux_for_coupling

instantaneous_surface_potential_evaporation

instantaneous_surface_skin_temperature_for_coupling

instantaneous_surface_upward_latent_heat_flux

instantaneous_surface_upward_latent_heat_flux_for_coupling

instantaneous_surface_upward_latent_heat_flux_for_diag

instantaneous_surface_upward_sensible_heat_flux

instantaneous_surface_upward_sensible_heat_flux_for_coupling

instantaneous_surface_upward_sensible_heat_flux_for_diag

instantaneous_surface_x_momentum_flux

instantaneous_surface_x_momentum_flux_for_coupling

instantaneous_surface_x_momentum_flux_for_diag

instantaneous_surface_y_momentum_flux

instantaneous_surface_y_momentum_flux_for_coupling

instantaneous_surface_y_momentum_flux_for_diag

instantaneous_temperature_at_2m_for_coupling

sw_fluxes_top_atmosphere

temperature_at_2m

temperature_at_zero_celsius

tendency_of_air_temperature_due_to_longwave_heating_assuming_clear_sky_on_radiation_time_step

tendency_of_air_temperature_due_to_longwave_heating_assuming_clear_sky_on_radiation_timestep

tendency_of_air_temperature_due_to_longwave_heating_on_radiation_time_step

tendency_of_air_temperature_due_to_longwave_heating_on_radiation_timestep

tendency_of_air_temperature_due_to_model_physics

tendency_of_air_temperature_due_to_radiative_heating_assuming_clear_sky

tendency_of_air_temperature_due_to_radiative_heating_on_physics_time_step

tendency_of_air_temperature_due_to_shortwave_heating_assuming_clear_sky_on_radiation_time_step

tendency_of_air_temperature_due_to_shortwave_heating_assuming_clear_sky_on_radiation_timestep

tendency_of_air_temperature_due_to_shortwave_heating_on_radiation_time_step

tendency_of_air_temperature_due_to_shortwave_heating_on_radiation_timestep

tendency_of_cloud_droplet_number_concentration_due_to_model_physics

tendency_of_graupel_mixing_ratio_due_to_model_physics

tendency_of_ice_cloud_water_mixing_ratio_due_to_model_physics

tendency_of_ice_friendly_aerosol_number_concentration_due_to_model_physics

tendency_of_ice_number_concentration_due_to_model_physics

tendency_of_liquid_cloud_water_mixing_ratio_due_to_model_physics

tendency_of_lwe_thickness_of_precipitation_amount_for_coupling

tendency_of_lwe_thickness_of_snow_amount_for_coupling

tendency_of_ozone_mixing_ratio_due_to_model_physics

tendency_of_rain_water_mixing_ratio_due_to_microphysics

tendency_of_rain_water_mixing_ratio_due_to_model_physics

tendency_of_snow_water_mixing_ratio_due_to_model_physics

tendency_of_tracers_due_to_model_physics

tendency_of_vertically_diffused_tracer_concentration

tendency_of_water_friendly_aerosol_number_concentration_due_to_model_physics

tendency_of_water_friendly_surface_aerosols_at_surface

tendency_of_water_vapor_specific_humidity_due_to_model_physics

y_wind_updated_by_physics

zenith_angle_temporal_adjustment_factor_for_shortwave_fluxes

1.2 Description of variables

FV3-GFS_Cldprop_type

```
long_name      derived type GFS_cldprop_type in FV3
units          DDT
rank           0
type           GFS_cldprop_type
kind
source         MODULE gmtb_scm_type_defs TYPE physics_type
local_name     physics%Cldprop(i)
requested      GFS_phys_time_vary_run
               GFS_rrtmg_pre_run
physics set    physics
```

FV3-GFS_Cldprop_type_all_blocks

```
long_name      derived type GFS_cldprop_type in FV3
units          DDT
rank           1
type           GFS_cldprop_type
kind
source         MODULE gmtb_scm_type_defs TYPE physics_type
local_name     physics%Cldprop(:)
requested      NOT REQUESTED
physics set
```

FV3-GFS_Control_type

long_name	derived type GFS_control_type in FV3
units	DDT
rank	0
type	GFS_control_type
kind	
source	MODULE gmtb_scm_type_defs TYPE physics_type
local_name	physics%Model(i)
requested	GFS_phys_time_vary_init
	GFS_phys_time_vary_run
	GFS_rad_time_vary_run
	GFS_rrtmg_post_run
	GFS_rrtmg_pre_run
	GFS_suite_interstitial_1_run
	GFS_suite_interstitial_2_run
	GFS_suite_interstitial_phys_reset_run
	GFS_time_vary_pre_run
	rrtmg_lw_post_run
	rrtmg_lw_pre_run
	rrtmg_sw_post_run
	rrtmg_sw_pre_run
physics set	physics

FV3-GFS_Coupling_type

```
long_name      derived type GFS_coupling_type in FV3
units          DDT
rank           0
type           GFS_coupling_type
kind
source         MODULE gmtb_scm_type_defs TYPE physics_type
local_name     physics%Coupling(i)
requested      GFS_rrtmg_post_run
               GFS_rrtmg_pre_run
               rrtmg_lw_post_run
               rrtmg_sw_post_run
physics set    physics
```

FV3-GFS_Diag_type

```
long_name      derived type GFS_diag_type in FV3
units          DDT
rank           0
type           GFS_diag_type
kind
source         MODULE gmtb_scm_type_defs TYPE physics_type
local_name     physics%Diag(i)
requested      GFS_phys_time_vary_run
               GFS_rrtmg_post_run
               GFS_suite_interstitial_1_run
               GFS_suite_interstitial_2_run
               rrtmg_sw_post_run
physics set    physics
```

FV3-GFS_Diag_type_all_blocks

```
long_name    derived type GFS_diag_type in FV3
units        DDT
rank         1
type         GFS_diag_type
kind
source       MODULE gmtb_scm_type_defs TYPE physics_type
local_name   physics%Diag(:)
requested    NOT REQUESTED
physics set
```

FV3-GFS_Grid_type

```
long_name    derived type GFS_grid_type in FV3
units        DDT
rank         0
type         GFS_grid_type
kind
source       MODULE gmtb_scm_type_defs TYPE physics_type
local_name   physics%Grid(i)
requested    GFS_phys_time_vary_init
             GFS_phys_time_vary_run
             GFS_rrtmg_post_run
             GFS_rrtmg_pre_run
             GFS_suite_interstitial_1_run
             GFS_suite_interstitial_2_run
             rrtmg_lw_post_run
             rrtmg_lw_pre_run
             rrtmg_sw_post_run
             rrtmg_sw_pre_run
physics set  physics
```

FV3-GFS_Grid_type_all_blocks

```
long_name     derived type GFS_grid_type in FV3
units         DDT
rank          1
type          GFS_grid_type
kind
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Grid(:)
requested     NOT REQUESTED
physics set
```

FV3-GFS_Interstitial_type

```
long_name     derived type GFS_interstitial_type in FV3
units         DDT
rank          0
type          GFS_interstitial_type
kind
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Interstitial(i)
requested     GFS_suite_interstitial_phys_reset_run
              GFS_suite_interstitial_rad_reset_run
physics set   physics
```

FV3-GFS_Radtend_type

```
long_name      derived type GFS_radtend_type in FV3
units          DDT
rank           0
type           GFS_radtend_type
kind
source         MODULE gmtb_scm_type_defs TYPE physics_type
local_name     physics%Radtend(i)
requested      GFS_rrtmg_post_run
               GFS_rrtmg_pre_run
               GFS_suite_interstitial_2_run
               rrtmg_lw_post_run
               rrtmg_lw_pre_run
               rrtmg_sw_post_run
               rrtmg_sw_pre_run
physics set    physics
```

FV3-GFS_Sfcprop_type

```
long_name      derived type GFS_sfcprop_type in FV3
units          DDT
rank           0
type           GFS_sfcprop_type
kind
source         MODULE gmtb_scm_type_defs TYPE physics_type
local_name     physics%Sfcprop(i)
requested      GFS_phys_time_vary_run
               GFS_rrtmg_pre_run
               GFS_suite_interstitial_1_run
               rrtmg_lw_pre_run
               rrtmg_sw_pre_run
physics set    physics
```

FV3-GFS_Sfcprop_type_all_blocks

```
long_name    derived type GFS_sfcprop_type in FV3
units        DDT
rank         1
type         GFS_sfcprop_type
kind
source       MODULE gmtb_scm_type_defs TYPE physics_type
local_name   physics%Sfcprop(:)
requested    NOT REQUESTED
physics set
```

FV3-GFS_Statein_type

```
long_name    derived type GFS_statein_type in FV3
units        DDT
rank         0
type         GFS_statein_type
kind
source       MODULE gmtb_scm_type_defs TYPE physics_type
local_name   physics%Statein(i)
requested    GFS_rad_time_vary_run
             GFS_rrtmg_post_run
             GFS_rrtmg_pre_run
             GFS_suite_interstitial_1_run
             GFS_suite_interstitial_2_run
physics set  physics
```

FV3-GFS_Statein_type_all_blocks

```
long_name     derived type GFS_statein_type in FV3
units         DDT
rank          1
type          GFS_statein_type
kind
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Statein(:)
requested     NOT REQUESTED
physics set
```

FV3-GFS_Stateout_type

```
long_name     derived type GFS_stateout_type in FV3
units         DDT
rank          0
type          GFS_stateout_type
kind
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Stateout(i)
requested     NOT REQUESTED
physics set
```

FV3-GFS_Tbd_type

```
long_name     derived type GFS_tbd_type in FV3
units         DDT
rank          0
type          GFS_tbd_type
kind
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Tbd(i)
requested     GFS_phys_time_vary_init
              GFS_phys_time_vary_run
              GFS_rad_time_vary_run
              GFS_rrtmg_pre_run
              GFS_time_vary_pre_run
physics set   physics
```

FV3-GFS_Tbd_type_all_blocks

```
long_name     derived type GFS_tbd_type in FV3
units         DDT
rank          1
type          GFS_tbd_type
kind
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Tbd(:)
requested     NOT REQUESTED
physics set
```

Monin-Obukhov_similarity_function_for_heat

```
long_name     Monin-Obukhov similarity function for heat
units         none
rank          1
type          real
kind          kind_phys
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Sfcprop(i)%ffhh
requested     gmtb_scm_sfc_flux_spec_run
              hedmf_run
              sfc_diag_run
              sfc_ex_coef_run
physics set   physics
```

Monin-Obukhov_similarity_function_for_heat_at_2m

```
long_name     Monin-Obukhov similarity parameter for heat at 2m
units         none
rank          1
type          real
kind          kind_phys
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Interstitial(i)%fh2
requested     sfc_diag_run
              sfc_ex_coef_run
physics set   physics
```

Monin-Obukhov_similarity_function_for_momentum

    long_name   Monin-Obukhov similarity function for momentum
    units   none
    rank   1
    type   real
    kind   kind_phys
    source   MODULE gmtb_scm_type_defs TYPE physics_type
    local_name   physics%Sfcprop(i)%ffmm
    requested   gmtb_scm_sfc_flux_spec_run
                   hedmf_run
                   sfc_diag_run
                   sfc_ex_coef_run
    physics set   physics

Monin-Obukhov_similarity_function_for_momentum_at_10m

    long_name   Monin-Obukhov similarity parameter for momentum at 10m
    units   none
    rank   1
    type   real
    kind   kind_phys
    source   MODULE gmtb_scm_type_defs TYPE physics_type
    local_name   physics%Interstitial(i)%fm10
    requested   sfc_diag_run
                   sfc_ex_coef_run
    physics set   physics

accumulated_lwe_thickness_of_convective_precipitation_amount_cnvc90

```
long_name    accumulated convective rainfall amount for cnvc90 only
units        m
rank         1
type         real
kind         kind_phys
source       MODULE gmtb_scm_type_defs TYPE physics_type
local_name   physics%Tbd(i)%acv
requested    cnvc90_run
physics set  physics
```

accumulated_lwe_thickness_of_graupel_amount

```
long_name    accumulated graupel precipitation
units        kg m-2
rank         1
type         real
kind         kind_phys
source       MODULE gmtb_scm_type_defs TYPE physics_type
local_name   physics%Diag(i)%totgrp
requested    GFS_MP_generic_post_run
physics set  physics
```

accumulated_lwe_thickness_of_graupel_amount_in_bucket

```
long_name    accumulated graupel precipitation in bucket
units        kg m-2
rank         1
type         real
kind         kind_phys
source       MODULE gmtb_scm_type_defs TYPE physics_type
local_name   physics%Diag(i)%totgrpb
requested    GFS_MP_generic_post_run
physics set  physics
```

accumulated_lwe_thickness_of_ice_amount

```
    long_name     accumulated ice precipitation
    units         kg m-2
    rank          1
    type          real
    kind          kind_phys
    source        MODULE gmtb_scm_type_defs TYPE physics_type
    local_name    physics%Diag(i)%totice
    requested     GFS_MP_generic_post_run
    physics set   physics
```

accumulated_lwe_thickness_of_ice_amount_in_bucket

```
    long_name     accumulated ice precipitation in bucket
    units         kg m-2
    rank          1
    type          real
    kind          kind_phys
    source        MODULE gmtb_scm_type_defs TYPE physics_type
    local_name    physics%Diag(i)%toticeb
    requested     GFS_MP_generic_post_run
    physics set   physics
```

accumulated_lwe_thickness_of_precipitation_amount

```
    long_name     accumulated total precipitation
    units         m
    rank          1
    type          real
    kind          kind_phys
    source        MODULE gmtb_scm_type_defs TYPE physics_type
    local_name    physics%Diag(i)%totprcp
    requested     GFS_MP_generic_post_run
    physics set   physics
```

accumulated_lwe_thickness_of_precipitation_amount_in_bucket
```
     long_name     accumulated total precipitation in bucket
     units         m
     rank          1
     type          real
     kind          kind_phys
     source        MODULE gmtb_scm_type_defs TYPE physics_type
     local_name    physics%Diag(i)%totprcpb
     requested     GFS_MP_generic_post_run
     physics set   physics
```

accumulated_lwe_thickness_of_snow_amount
```
     long_name     accumulated snow precipitation
     units         kg m-2
     rank          1
     type          real
     kind          kind_phys
     source        MODULE gmtb_scm_type_defs TYPE physics_type
     local_name    physics%Diag(i)%totsnw
     requested     GFS_MP_generic_post_run
     physics set   physics
```

accumulated_lwe_thickness_of_snow_amount_in_bucket
```
     long_name     accumulated snow precipitation in bucket
     units         kg m-2
     rank          1
     type          real
     kind          kind_phys
     source        MODULE gmtb_scm_type_defs TYPE physics_type
     local_name    physics%Diag(i)%totsnwb
     requested     GFS_MP_generic_post_run
     physics set   physics
```

adjusted_vertical_layer_dimension_for_radiation

```
long_name     adjusted number of vertical layers for radiation
units         count
rank          0
type          integer
kind
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Interstitial(i)%lmk
requested     GFS_rrtmg_pre_run
              rrtmg_lw_run
              rrtmg_sw_run
physics set   physics
```

adjusted_vertical_level_dimension_for_radiation

```
long_name     adjusted number of vertical levels for radiation
units         count
rank          0
type          integer
kind
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Interstitial(i)%lmp
requested     GFS_rrtmg_pre_run
              rrtmg_lw_run
              rrtmg_sw_run
physics set   physics
```

aerosol_asymmetry_parameter_for_longwave_bands_01-16

```
long_name      aerosol asymmetry parameter for longwave bands 01-16
units          none
rank           3
type           real
kind           kind_phys
source         MODULE gmtb_scm_type_defs TYPE physics_type
local_name     physics%Interstitial(i)%faerlw(:,:,:,3)
requested      GFS_rrtmg_pre_run
physics set    physics
```

aerosol_asymmetry_parameter_for_shortwave_bands_01-16

```
long_name      aerosol asymmetry parameter for shortwave bands 01-16
units          none
rank           3
type           real
kind           kind_phys
source         MODULE gmtb_scm_type_defs TYPE physics_type
local_name     physics%Interstitial(i)%faersw(:,:,:,3)
requested      GFS_rrtmg_pre_run
               rrtmg_sw_run
physics set    physics
```

aerosol_aware_parameter_deep_convection

```
long_name      aerosol-aware parameter inversely proportional to CCN number concentraion from Lim (2011) for deep conv.
units          none
rank           0
type           real
kind           kind_phys
source         MODULE gmtb_scm_type_defs TYPE physics_type
local_name     physics%Model(i)%asolfac_deep
requested      samfdeepcnv_run
physics set    physics
```

aerosol_aware_parameter_shallow_convection

```
long_name     aerosol-aware parameter inversely proportional to CCN number concentraion from Lim (2011) for shal conv.
units         none
rank          0
type          real
kind          kind_phys
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Model(i)%asolfac_shal
requested     samfshalcnv_run
physics set   physics
```

aerosol_optical_depth_for_longwave_bands_01-16

```
long_name     aerosol optical depth for longwave bands 01-16
units         none
rank          3
type          real
kind          kind_phys
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Interstitial(i)%faerlw(:,:,:,1)
requested     GFS_rrtmg_pre_run
              rrtmg_lw_run
physics set   physics
```

aerosol_optical_depth_for_shortwave_bands_01-16

```
long_name     aerosol optical depth for shortwave bands 01-16
units         none
rank          3
type          real
kind          kind_phys
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Interstitial(i)%faersw(:,:,:,1)
requested     GFS_rrtmg_pre_run
              rrtmg_sw_run
physics set   physics
```

aerosol_optical_properties_for_longwave_bands_01-16

```
long_name      aerosol optical properties for longwave bands 01-16
units          various
rank           4
type           real
kind           kind_phys
source         MODULE gmtb_scm_type_defs TYPE physics_type
local_name     physics%Interstitial(i)%faerlw
requested      GFS_rrtmg_setup_init
physics set    physics
```

aerosol_optical_properties_for_shortwave_bands_01-16

```
long_name      aerosol optical properties for shortwave bands 01-16
units          various
rank           4
type           real
kind           kind_phys
source         MODULE gmtb_scm_type_defs TYPE physics_type
local_name     physics%Interstitial(i)%faersw
requested      GFS_rrtmg_setup_init
physics set    physics
```

aerosol_single_scattering_albedo_for_longwave_bands_01-16

```
long_name      aerosol single scattering albedo for longwave bands 01-16
units          frac
rank           3
type           real
kind           kind_phys
source         MODULE gmtb_scm_type_defs TYPE physics_type
local_name     physics%Interstitial(i)%faerlw(:,:,:,2)
requested      GFS_rrtmg_pre_run
               rrtmg_lw_run
physics set    physics
```

aerosol_single_scattering_albedo_for_shortwave_bands_01-16

long_name	aerosol single scattering albedo for shortwave bands 01-16
units	frac
rank	3
type	real
kind	kind_phys
source	MODULE gmtb_scm_type_defs TYPE physics_type
local_name	physics%Interstitial(i)%faersw(:,:,:,2)
requested	GFS_rrtmg_pre_run
	rrtmg_sw_run
physics set	physics

air_pressure
```
    long_name    mean layer pressure
    units        Pa
    rank         2
    type         real
    kind         kind_phys
    source       MODULE gmtb_scm_type_defs TYPE physics_type
    local_name   physics%Statein(i)%prsl
    requested    GFS_MP_generic_post_run
                 GFS_suite_interstitial_3_run
                 gfdl_cloud_microphys_run
                 gwdc_run
                 gwdps_run
                 h2ophys_run
                 hedmf_run
                 ozphys_run
                 rayleigh_damp_run
                 samfdeepcnv_run
                 samfshalcnv_run
                 zhaocarr_gscond_run
                 zhaocarr_precpd_run
    physics set  physics
```

air_pressure_at_interface
```
     long_name     air pressure at model layer interfaces
     units         Pa
     rank          2
     type          real
     kind          kind_phys
     source        MODULE gmtb_scm_type_defs TYPE physics_type
     local_name    physics%Statein(i)%prsi
     requested     GFS_MP_generic_post_run
                   GFS_suite_interstitial_3_run
                   cnvc90_run
                   get_prs_fv3_run
                   gwdc_run
                   gwdps_run
                   hedmf_run
     physics set   physics
```

air_pressure_at_interface_for_radiation_in_hPa
```
     long_name     air pressure at vertical interface for radiation calculation
     units         hPa
     rank          2
     type          real
     kind          kind_phys
     source        MODULE gmtb_scm_type_defs TYPE physics_type
     local_name    physics%Interstitial(i)%plvl
     requested     GFS_rrtmg_pre_run
                   rrtmg_lw_run
                   rrtmg_sw_run
     physics set   physics
```

air_pressure_at_layer_for_radiation_in_hPa

```
long_name     air pressure at vertical layer for radiation calculation
units         hPa
rank          2
type          real
kind          kind_phys
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Interstitial(i)%plyr
requested     GFS_rrtmg_pre_run
              rrtmg_lw_run
              rrtmg_sw_run
physics set   physics
```

air_pressure_at_lowest_model_layer

```
long_name     mean pressure at lowest model layer
units         Pa
rank          1
type          real
kind          kind_phys
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Statein(i)%prsl(:,1)
requested     gmtb_scm_sfc_flux_spec_run
              lsm_noah_run
              sfc_ex_coef_run
              sfc_nst_run
              sfc_sice_run
physics set   physics
```

air_pressure_difference_between_midlayers

long_name	air pressure difference between midlayers
units	Pa
rank	2
type	real
kind	kind_phys
source	MODULE gmtb_scm_type_defs TYPE physics_type
local_name	physics%Interstitial(i)%del
requested	GFS_MP_generic_post_run
	get_prs_fv3_run
	gfdl_cloud_microphys_run
	gwdc_pre_run
	gwdc_run
	gwdps_run
	hedmf_run
	ozphys_run
	samfdeepcnv_run
	samfshalcnv_run
	zhaocarr_precpd_run
physics set	physics

air_temperature
```
    long_name    model layer mean temperature
    units        K
    rank         2
    type         real
    kind         kind_phys
    source       MODULE gmtb_scm_type_defs TYPE physics_type
    local_name   physics%Statein(i)%tgrs
    requested    GFS_suite_stateout_reset_run
                 GFS_suite_stateout_update_run
                 get_prs_fv3_run
                 gwdc_run
                 gwdps_run
                 hedmf_run
    physics set  physics
```

air_temperature_at_interface_for_radiation
```
    long_name    air temperature at vertical interface for radiation calculation
    units        K
    rank         2
    type         real
    kind         kind_phys
    source       MODULE gmtb_scm_type_defs TYPE physics_type
    local_name   physics%Interstitial(i)%tlvl
    requested    GFS_rrtmg_pre_run
                 rrtmg_lw_run
                 rrtmg_sw_run
    physics set  physics
```

air_temperature_at_layer_for_radiation

```
long_name      air temperature at vertical layer for radiation calculation
units          K
rank           2
type           real
kind           kind_phys
source         MODULE gmtb_scm_type_defs TYPE physics_type
local_name     physics%Interstitial(i)%tlyr
requested      GFS_rrtmg_pre_run
               rrtmg_lw_run
               rrtmg_sw_run
physics set    physics
```

air_temperature_at_lowest_model_layer

```
long_name      mean temperature at lowest model layer
units          K
rank           1
type           real
kind           kind_phys
source         MODULE gmtb_scm_type_defs TYPE physics_type
local_name     physics%Statein(i)%tgrs(:,1)
requested      GFS_surface_generic_post_run
               dcyc2t3_run
               gmtb_scm_sfc_flux_spec_run
               lsm_noah_run
               sfc_ex_coef_run
               sfc_nst_run
               sfc_sice_run
physics set    physics
```

air_temperature_at_lowest_model_layer_for_diag

```
long_name      layer 1 temperature for diag
units          K
rank           1
type           real
kind           kind_phys
source         MODULE gmtb_scm_type_defs TYPE physics_type
local_name     physics%Diag(i)%t1
requested      GFS_surface_generic_post_run
physics set    physics
```

air_temperature_at_lowest_model_layer_updated_by_physics

```
long_name      temperature at lowest model layer updated by physics
units          K
rank           1
type           real
kind           kind_phys
source         MODULE gmtb_scm_type_defs TYPE physics_type
local_name     physics%Stateout(i)%gt0(:,1)
requested      sfc_diag_run
physics set    physics
```

air_temperature_at_previous_time_step

```
long_name      air temperature at previous time step
units          K
rank           2
type           real
kind           kind_phys
source         MODULE gmtb_scm_type_defs TYPE physics_type
local_name     physics%Tbd(i)%phy_f3d(:,:,3)
requested      zhaocarr_gscond_run
physics set    physics
```

air_temperature_save

long_name	air temperature before entering a physics scheme
units	K
rank	2
type	real
kind	kind_phys
source	MODULE gmtb_scm_type_defs TYPE physics_type
local_name	physics%Interstitial(i)%save_t
requested	GFS_DCNV_generic_post_run
	GFS_DCNV_generic_pre_run
	GFS_MP_generic_post_run
	GFS_MP_generic_pre_run
	GFS_SCNV_generic_post_run
	GFS_SCNV_generic_pre_run
	gwdc_pre_run
physics set	physics

air_temperature_two_time_steps_back

long_name	air temperature two time steps back
units	K
rank	2
type	real
kind	kind_phys
source	MODULE gmtb_scm_type_defs TYPE physics_type
local_name	physics%Tbd(i)%phy_f3d(:,:,1)
requested	zhaocarr_gscond_run
physics set	physics

air_temperature_updated_by_physics

```
long_name    temperature updated by physics
units        K
rank         2
type         real
kind         kind_phys
source       MODULE gmtb_scm_type_defs TYPE physics_type
local_name   physics%Stateout(i)%gt0
requested    GFS_DCNV_generic_post_run
             GFS_DCNV_generic_pre_run
             GFS_MP_generic_post_run
             GFS_MP_generic_pre_run
             GFS_SCNV_generic_post_run
             GFS_SCNV_generic_pre_run
             GFS_suite_stateout_reset_run
             GFS_suite_stateout_update_run
             get_phi_fv3_run
             gfdl_cloud_microphys_run
             gwdc_post_run
             gwdc_pre_run
             ozphys_run
             samfdeepcnv_run
             samfshalcnv_run
             zhaocarr_gscond_run
             zhaocarr_precpd_run
physics set  physics
```

angle_from_east_of_maximum_subgrid_orographic_variations

long_name	angle with_respect to east of maximum subgrid orographic variations
units	degrees
rank	1
type	real
kind	kind_phys
source	MODULE gmtb_scm_type_defs TYPE physics_type
local_name	physics%Interstitial(i)%theta
requested	gwdps_pre_run
	gwdps_run
physics set	physics

anisotropy_of_subgrid_orography

long_name	anisotropy of subgrid orography
units	none
rank	1
type	real
kind	kind_phys
source	MODULE gmtb_scm_type_defs TYPE physics_type
local_name	physics%Interstitial(i)%gamma
requested	gwdps_pre_run
	gwdps_run
physics set	physics

array_dimension_of_2d_arrays_for_microphysics

long_name	number of 2D arrays needed for microphysics
units	count
rank	0
type	integer
kind	
source	MODULE gmtb_scm_type_defs TYPE physics_type
local_name	physics%Model(i)%num_p2d
requested	GFS_rrtmg_setup_init
physics set	physics

array_dimension_of_3d_arrays_for_microphysics

long_name	number of 3D arrays needed for microphysics
units	count
rank	0
type	integer
kind	
source	MODULE gmtb_scm_type_defs TYPE physics_type
local_name	physics%Model(i)%num_p3d
requested	GFS_DCNV_generic_post_run
	GFS_rrtmg_setup_init
	samfshalcnv_post_run
physics set	physics

array_dimension_of_random_number

long_name	second dimension of random number stream for RAS
units	count
rank	0
type	integer
kind	
source	MODULE gmtb_scm_type_defs TYPE physics_type
local_name	physics%Model(i)%nrcm
requested	GFS_MP_generic_post_run
physics set	physics

asymmetry_of_subgrid_orography

```
long_name      asymmetry of subgrid orography
units          none
rank           2
type           real
kind           kind_phys
source         MODULE gmtb_scm_type_defs TYPE physics_type
local_name     physics%Interstitial(i)%oa4
requested      gwdps_pre_run
               gwdps_run
physics set    physics
```

atmosphere_boundary_layer_thickness

```
long_name      pbl height
units          m
rank           1
type           real
kind           kind_phys
source         MODULE gmtb_scm_type_defs TYPE physics_type
local_name     physics%Diag(i)%hpbl
requested      hedmf_run
               samfshalcnv_run
physics set    physics
```

atmosphere_diffusivity_coefficient_factor

```
long_name      multiplicative constant for atmospheric diffusivities
units          none
rank           0
type           real
kind           kind_phys
source         MODULE gmtb_scm_type_defs TYPE physics_type
local_name     physics%Model(i)%moninq_fac
requested      hedmf_run
physics set    physics
```

atmosphere_heat_diffusivity
```
    long_name    diffusivity for heat
    units        m2 s-1
    rank         2
    type         real
    kind         kind_phys
    source       MODULE gmtb_scm_type_defs TYPE physics_type
    local_name   physics%Interstitial(i)%dkt
    requested    hedmf_run
    physics set  physics
```

atmosphere_heat_diffusivity_background
```
    long_name    background vertical diffusion for heat q
    units        m2 s-1
    rank         0
    type         real
    kind         kind_phys
    source       MODULE gmtb_scm_type_defs TYPE physics_type
    local_name   physics%Model(i)%xkzm_h
    requested    hedmf_run
    physics set  physics
```

atmosphere_heat_diffusivity_background_maximum
```
    long_name    maximum background value of heat diffusivity
    units        m2 s-1
    rank         0
    type         real
    kind         kind_phys
    source       MODULE gmtb_scm_type_defs TYPE physics_type
    local_name   physics%Model(i)%xkzminv
    requested    hedmf_run
    physics set  physics
```

atmosphere_momentum_diffusivity_background

```
long_name      background vertical diffusion for momentum
units          m2 s-1
rank           0
type           real
kind           kind_phys
source         MODULE gmtb_scm_type_defs TYPE physics_type
local_name     physics%Model(i)%xkzm_m
requested      hedmf_run
physics set    physics
```

atmosphere_optical_thickness_due_to_ambient_aerosol_particles

```
long_name      vertical integrated optical depth for various aerosol species
units          none
rank           2
type           real
kind           kind_phys
source         MODULE gmtb_scm_type_defs TYPE physics_type
local_name     physics%Interstitial(i)%aerodp
requested      GFS_rrtmg_post_run
               GFS_rrtmg_pre_run
               GFS_rrtmg_setup_init
physics set    physics
```

block_number

```
long_name      for explicit data blocking:  block number of this block
units          index
rank           0
type           integer
kind
source         MODULE gmtb_scm_type_defs TYPE physics_type
local_name     physics%Tbd(i)%blkno
requested      NOT REQUESTED
physics set
```

bounded_vegetation_area_fraction

```
long_name     areal fractional cover of green vegetation bounded on the bottom
units         frac
rank          1
type          real
kind          kind_phys
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Interstitial(i)%sigmaf
requested     GFS_surface_generic_pre_run
              lsm_noah_run
              sfc_ex_coef_run
physics set   physics
```

bulk_richardson_number_at_lowest_model_level

```
long_name     bulk Richardson number at the surface
units         none
rank          1
type          real
kind          kind_phys
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Interstitial(i)%rb
requested     gmtb_scm_sfc_flux_spec_run
              hedmf_run
              sfc_ex_coef_run
physics set   physics
```

canopy_upward_latent_heat_flux

long_name	canopy upward latent heat flux
units	W m-2
rank	1
type	real
kind	kind_phys
source	MODULE gmtb_scm_type_defs TYPE physics_type
local_name	physics%Interstitial(i)%evcw
requested	GFS_surface_generic_post_run
	lsm_noah_pre_run
	lsm_noah_run
physics set	physics

canopy_water_amount

long_name	canopy water amount
units	kg m-2
rank	1
type	real
kind	kind_phys
source	MODULE gmtb_scm_type_defs TYPE physics_type
local_name	physics%Sfcprop(i)%canopy
requested	lsm_noah_run
physics set	physics

ccpp_error_flag

long_name	error flag for error handling in CCPP
units	flag
rank	0
type	integer
kind	
source	MODULE ccpp_types
local_name	cdata%errflg (local_name not used)
requested	GFS_DCNV_generic_post_run
	GFS_DCNV_generic_pre_run
	GFS_MP_generic_post_run
	GFS_MP_generic_pre_run
	GFS_PBL_generic_post_run
	GFS_PBL_generic_pre_run
	GFS_SCNV_generic_post_run
	GFS_SCNV_generic_pre_run
	GFS_phys_time_vary_init
	GFS_phys_time_vary_run
	GFS_rad_time_vary_run
	GFS_rrtmg_post_run
	GFS_rrtmg_pre_run
	GFS_rrtmg_setup_finalize
	GFS_rrtmg_setup_init
	GFS_rrtmg_setup_run
	GFS_suite_interstitial_1_run
	GFS_suite_interstitial_2_run
	GFS_suite_interstitial_3_run
	GFS_suite_interstitial_4_run
	GFS_suite_interstitial_phys_reset_run
	GFS_suite_interstitial_rad_reset_run
	GFS_suite_stateout_reset_run
	GFS_suite_stateout_update_run
	GFS_surface_generic_post_run
	GFS_surface_generic_pre_run
	GFS_surface_loop_control_part1_run
	GFS_surface_loop_control_part2_run
	GFS_time_vary_pre_finalize
	GFS_time_vary_pre_init
	GFS_time_vary_pre_run

ccpp_error_message

long_name	error message for error handling in CCPP
units	none
rank	0
type	character
kind	len=512
source	MODULE ccpp_types
local_name	cdata%errmsg (local_name not used)
requested	GFS_DCNV_generic_post_run
	GFS_DCNV_generic_pre_run
	GFS_MP_generic_post_run
	GFS_MP_generic_pre_run
	GFS_PBL_generic_post_run
	GFS_PBL_generic_pre_run
	GFS_SCNV_generic_post_run
	GFS_SCNV_generic_pre_run
	GFS_phys_time_vary_init
	GFS_phys_time_vary_run
	GFS_rad_time_vary_run
	GFS_rrtmg_post_run
	GFS_rrtmg_pre_run
	GFS_rrtmg_setup_finalize
	GFS_rrtmg_setup_init
	GFS_rrtmg_setup_run
	GFS_suite_interstitial_1_run
	GFS_suite_interstitial_2_run
	GFS_suite_interstitial_3_run
	GFS_suite_interstitial_4_run
	GFS_suite_interstitial_phys_reset_run
	GFS_suite_interstitial_rad_reset_run
	GFS_suite_stateout_reset_run
	GFS_suite_stateout_update_run
	GFS_surface_generic_post_run
	GFS_surface_generic_pre_run
	GFS_surface_loop_control_part1_run
	GFS_surface_loop_control_part2_run
	GFS_time_vary_pre_finalize
	GFS_time_vary_pre_init
	GFS_time_vary_pre_run

ccpp_loop_counter

long_name	loop counter for subcycling loops in CCPP
units	index
rank	0
type	integer
kind	
source	MODULE ccpp_types
local_name	cdata%loop_cnt (local_name not used)
requested	GFS_surface_loop_control_part1_run
	GFS_surface_loop_control_part2_run
physics set	physics

cell_area

long_name	area of the grid cell
units	m2
rank	1
type	real
kind	kind_phys
source	MODULE gmtb_scm_type_defs TYPE physics_type
local_name	physics%Grid(i)%area
requested	gfdl_cloud_microphys_run
	samfdeepcnv_run
	samfshalcnv_run
physics set	physics

cell_size

```
long_name    size of the grid cell
units        m
rank         1
type         real
kind         kind_phys
source       MODULE gmtb_scm_type_defs TYPE physics_type
local_name   physics%Grid(i)%dx
requested    gwdc_pre_run
physics set  physics
```

change_in_ozone_concentration

```
long_name    change in ozone concentration
units        kg kg-1
rank         3
type         real
kind         kind_phys
source       MODULE gmtb_scm_type_defs TYPE physics_type
local_name   physics%Diag(i)%dq3dt(:,:,6:6+physics%Interstitial(i)%oz_coeff-1)
requested    ozphys_run
physics set  physics
```

characteristic_grid_length_scale

```
long_name    representative horizontal length scale of grid box
units        m
rank         1
type         real
kind         kind_phys
source       MODULE gmtb_scm_type_defs TYPE physics_type
local_name   physics%Interstitial(i)%dlength
requested    gwdc_pre_run
             gwdc_run
physics set  physics
```

cloud_area_fraction

```
long_name      fraction of grid box area in which updrafts occur
units          frac
rank           1
type           real
kind           kind_phys
source         MODULE gmtb_scm_type_defs TYPE physics_type
local_name     physics%Interstitial(i)%cldf
requested      gwdc_pre_run
               gwdc_run
physics set    physics
```

cloud_area_fraction_for_radiation

```
long_name      fraction of clouds for low, middle, high, total and BL
units          frac
rank           2
type           real
kind           kind_phys
source         MODULE gmtb_scm_type_defs TYPE physics_type
local_name     physics%Interstitial(i)%cldsa
requested      GFS_rrtmg_post_run
               GFS_rrtmg_pre_run
physics set    physics
```

cloud_condensed_water_conversion_threshold

```
long_name      water and ice minimum threshold for Zhao
units          none
rank           1
type           real
kind           kind_phys
source         MODULE gmtb_scm_type_defs TYPE physics_type
local_name     physics%Model(i)%wminco
requested      zhaocarr_precpd_run
physics set    physics
```

cloud_condensed_water_mixing_ratio

```
long_name     moist (dry+vapor, no condensates) mixing ratio of cloud water (condensate)
units         kg kg-1
rank          2
type          real
kind          kind_phys
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Statein(i)%qgrs(:,:,scm_state%cloud_water_index)
requested     GFS_PBL_generic_pre_run
physics set   physics
```

cloud_condensed_water_mixing_ratio_at_lowest_model_layer

```
long_name     moist (dry+vapor, no condensates) mixing ratio of cloud water at lowest model layer
units         kg kg-1
rank          1
type          real
kind          kind_phys
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Statein(i)%qgrs(:,1,scm_state%cloud_water_index)
requested     NOT REQUESTED
physics set
```

cloud_condensed_water_mixing_ratio_at_surface

```
long_name     moist cloud water mixing ratio at surface
units         kg kg-1
rank          1
type          real
kind          kind_phys
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Sfcprop(i)%clw_surf
requested     NOT REQUESTED
physics set
```

cloud_condensed_water_mixing_ratio_updated_by_physics

long_name	moist cloud condensed water mixing ratio updated by physics
units	kg kg-1
rank	2
type	real
kind	kind_phys
source	MODULE gmtb_scm_type_defs TYPE physics_type
local_name	physics%Stateout(i)%gq0(:,:,scm_state%cloud_water_index)
requested	gfdl_cloud_microphys_run
	zhaocarr_gscond_run
	zhaocarr_precpd_run
physics set	physics

cloud_droplet_number_concentration

long_name	number concentration of cloud droplets (liquid)
units	kg-1
rank	2
type	real
kind	kind_phys
source	MODULE gmtb_scm_type_defs TYPE physics_type
local_name	physics%Statein(i)%qgrs(:,:,physics%Model(i)%ntlnc)
requested	GFS_PBL_generic_pre_run
physics set	physics

cloud_droplet_number_concentration_updated_by_physics

```
long_name     number concentration of cloud droplets updated by physics
units         kg-1
rank          2
type          real
kind          kind_phys
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Stateout(i)%gq0(:,:,physics%Model(i)%ntlnc)
requested     NOT REQUESTED
physics set
```

cloud_fraction_updated_by_physics

```
long_name     cloud fraction updated by physics
units         frac
rank          2
type          real
kind          kind_phys
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Stateout(i)%gq0(:,:,scm_state%cloud_amount_index)
requested     gfdl_cloud_microphys_run
physics set   physics
```

cloud_ice_mixing_ratio

```
long_name     moist cloud ice mixing ratio
units         kg kg-1
rank          2
type          real
kind          kind_phys
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Interstitial(i)%clw(:,:,1)
requested     GFS_DCNV_generic_post_run
              zhaocarr_gscond_run
physics set   physics
```

cloud_ice_water_mixing_ratio_save

```
long_name      cloud ice water mixing ratio before entering a physics scheme
units          kg kg-1
rank           2
type           real
kind           kind_phys
source         MODULE gmtb_scm_type_defs TYPE physics_type
local_name     physics%Interstitial(i)%save_q(:,:,scm_state%cloud_ice_index)
requested      GFS_suite_interstitial_3_run
               GFS_suite_interstitial_4_run
physics set    physics
```

cloud_ice_water_path

```
long_name      layer cloud ice water path
units          g m-2
rank           2
type           real
kind           kind_phys
source         MODULE gmtb_scm_type_defs TYPE physics_type
local_name     physics%Interstitial(i)%clouds(:,:,4)
requested      GFS_rrtmg_pre_run
               rrtmg_lw_run
               rrtmg_sw_run
physics set    physics
```

cloud_liquid_water_mixing_ratio

```
    long_name      moist cloud water mixing ratio
    units          kg kg-1
    rank           2
    type           real
    kind           kind_phys
    source         MODULE gmtb_scm_type_defs TYPE physics_type
    local_name     physics%Interstitial(i)%clw(:,:,2)
    requested      GFS_DCNV_generic_post_run
                   zhaocarr_gscond_run
    physics set    physics
```

cloud_liquid_water_mixing_ratio_save

```
    long_name      cloud liquid water mixing ratio before entering a physics scheme
    units          kg kg-1
    rank           2
    type           real
    kind           kind_phys
    source         MODULE gmtb_scm_type_defs TYPE physics_type
    local_name     physics%Interstitial(i)%save_q(:,:,scm_state%cloud_water_index)
    requested      GFS_suite_interstitial_3_run
                   GFS_suite_interstitial_4_run
    physics set    physics
```

cloud_liquid_water_path

```
long_name    layer cloud liquid water path
units        g m-2
rank         2
type         real
kind         kind_phys
source       MODULE gmtb_scm_type_defs TYPE physics_type
local_name   physics%Interstitial(i)%clouds(:,:,2)
requested    GFS_rrtmg_pre_run
             rrtmg_lw_run
             rrtmg_sw_run
physics set  physics
```

cloud_optical_depth_layers_678

```
long_name    cloud optical depth from bands 6,7,8
units        none
rank         2
type         real
kind         kind_phys
source       MODULE gmtb_scm_type_defs TYPE physics_type
local_name   physics%Interstitial(i)%clouds(:,:,11)
requested    GFS_rrtmg_post_run
             GFS_rrtmg_pre_run
             rrtmg_lw_run
             rrtmg_sw_run
physics set  physics
```

cloud_optical_depth_weighted

```
long_name      cloud optical depth, weighted
units          none
rank           2
type           real
kind           kind_phys
source         MODULE gmtb_scm_type_defs TYPE physics_type
local_name     physics%Interstitial(i)%clouds(:,:,10)
requested      GFS_rrtmg_post_run
               GFS_rrtmg_pre_run
               rrtmg_lw_run
               rrtmg_sw_run
physics set    physics
```

cloud_rain_water_path

```
long_name      cloud rain water path
units          g m-2
rank           2
type           real
kind           kind_phys
source         MODULE gmtb_scm_type_defs TYPE physics_type
local_name     physics%Interstitial(i)%clouds(:,:,6)
requested      GFS_rrtmg_pre_run
               rrtmg_lw_run
               rrtmg_sw_run
physics set    physics
```

cloud_snow_water_path
```
    long_name    cloud snow water path
    units        g m-2
    rank         2
    type         real
    kind         kind_phys
    source       MODULE gmtb_scm_type_defs TYPE physics_type
    local_name   physics%Interstitial(i)%clouds(:,:,8)
    requested    GFS_rrtmg_pre_run
                 rrtmg_lw_run
                 rrtmg_sw_run
    physics set  physics
```

cloud_work_function
```
    long_name    cloud work function
    units        m2 s-2
    rank         1
    type         real
    kind         kind_phys
    source       MODULE gmtb_scm_type_defs TYPE physics_type
    local_name   physics%Interstitial(i)%cld1d
    requested    GFS_DCNV_generic_post_run
                 samfdeepcnv_run
    physics set  physics
```

coefficient_c_0

long_name	coefficient 1 to calculate d(Tz)/d(Ts)
units	none
rank	1
type	real
kind	kind_phys
source	MODULE gmtb_scm_type_defs TYPE physics_type
local_name	physics%Sfcprop(i)%c_0
requested	sfc_nst_run
physics set	physics

coefficient_c_d

long_name	coefficient 2 to calculate d(Tz)/d(Ts)
units	none
rank	1
type	real
kind	kind_phys
source	MODULE gmtb_scm_type_defs TYPE physics_type
local_name	physics%Sfcprop(i)%c_d
requested	sfc_nst_run
physics set	physics

coefficient_for_evaporation_of_rainfall

long_name	coeff for evaporation of largescale rain
units	none
rank	0
type	real
kind	kind_phys
source	MODULE gmtb_scm_type_defs TYPE physics_type
local_name	physics%Model(i)%evpco
requested	zhaocarr_precpd_run
physics set	physics

coefficient_from_cloud_ice_to_snow
```
long_name     auto conversion coeff from ice to snow
units         none
rank          1
type          real
kind          kind_phys
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Model(i)%psautco
requested     zhaocarr_precpd_run
physics set   physics
```

coefficient_from_cloud_water_to_rain
```
long_name     auto conversion coeff from cloud to rain
units         none
rank          1
type          real
kind          kind_phys
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Model(i)%prautco
requested     zhaocarr_precpd_run
physics set   physics
```

coefficient_w_0
```
long_name     coefficient 3 to calculate d(Tz)/d(Ts)
units         none
rank          1
type          real
kind          kind_phys
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Sfcprop(i)%w_0
requested     sfc_nst_run
physics set   physics
```

coefficient_w_d

```
long_name    coefficient 4 to calculate d(Tz)/d(Ts)
units        none
rank         1
type         real
kind         kind_phys
source       MODULE gmtb_scm_type_defs TYPE physics_type
local_name   physics%Sfcprop(i)%w_d
requested    sfc_nst_run
physics set  physics
```

column_precipitable_water

```
long_name    precipitable water
units        kg m-2
rank         1
type         real
kind         kind_phys
source       MODULE gmtb_scm_type_defs TYPE physics_type
local_name   physics%Diag(i)%pwat
requested    GFS_MP_generic_post_run
physics set  physics
```

components_of_surface_downward_shortwave_fluxes

```
long_name    derived type for special components of surface downward shortwave fluxes
units        W m-2
rank         1
type         cmpfsw_type
kind
source       MODULE gmtb_scm_type_defs TYPE physics_type
local_name   physics%Interstitial(i)%scmpsw
requested    GFS_rrtmg_post_run
             rrtmg_sw_post_run
             rrtmg_sw_run
physics set  physics
```

convective_cloud_cover

```
long_name     convective cloud cover
units         frac
rank          2
type          real
kind          kind_phys
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Interstitial(i)%cnvc
requested     GFS_DCNV_generic_post_run
              samfdeepcnv_run
              samfshalcnv_post_run
              samfshalcnv_run
physics set   physics
```

convective_cloud_cover_in_phy_f3d

```
long_name     convective cloud cover in the phy_f3d array
units         frac
rank          2
type          real
kind          kind_phys
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Tbd(i)%phy_f3d(:,:,physics%Model(i)%ncnvw+1)
requested     GFS_DCNV_generic_post_run
              samfshalcnv_post_run
physics set   physics
```

convective_cloud_switch

```
long_name      index used by cnvc90 (for convective clouds)
units          none
rank           0
type           real
kind           kind_phys
source         MODULE gmtb_scm_type_defs TYPE physics_type
local_name     physics%Model(i)%clstp
requested      cnvc90_run
physics set    physics
```

convective_cloud_water_mixing_ratio

```
long_name      moist convective cloud water mixing ratio
units          kg kg-1
rank           2
type           real
kind           kind_phys
source         MODULE gmtb_scm_type_defs TYPE physics_type
local_name     physics%Interstitial(i)%cnvw
requested      GFS_DCNV_generic_post_run
               samfdeepcnv_run
               samfshalcnv_post_run
               samfshalcnv_run
physics set    physics
```

convective_cloud_water_mixing_ratio_in_phy_f3d

```
long_name      convective cloud water mixing ratio in the phy_f3d array
units          kg kg-1
rank           2
type           real
kind           kind_phys
source         MODULE gmtb_scm_type_defs TYPE physics_type
local_name     physics%Tbd(i)%phy_f3d(:,:,physics%Model(i)%ncnvw)
requested      GFS_DCNV_generic_post_run
               samfshalcnv_post_run
physics set    physics
```

convective_transportable_tracers

```
long_name      array to contain cloud water and other convective trans.  tracers
units          kg kg-1
rank           3
type           real
kind           kind_phys
source         MODULE gmtb_scm_type_defs TYPE physics_type
local_name     physics%Interstitial(i)%clw
requested      GFS_SCNV_generic_post_run
               GFS_suite_interstitial_3_run
               GFS_suite_interstitial_4_run
               samfdeepcnv_run
               samfshalcnv_run
physics set    physics
```

convexity_of_subgrid_orography

long_name	convexity of subgrid orography
units	none
rank	1
type	real
kind	kind_phys
source	MODULE gmtb_scm_type_defs TYPE physics_type
local_name	physics%Interstitial(i)%oc
requested	gwdps_pre_run
	gwdps_run
physics set	physics

cosine_of_latitude

long_name	cosine of the grid latitude
units	none
rank	1
type	real
kind	kind_phys
source	MODULE gmtb_scm_type_defs TYPE physics_type
local_name	physics%Grid(i)%coslat
requested	dcyc2t3_run
physics set	physics

cosine_of_solar_declination_angle

long_name	cos of the solar declination angle
units	none
rank	0
type	real
kind	kind_phys
source	MODULE gmtb_scm_type_defs TYPE physics_type
local_name	physics%Model(i)%cdec
requested	GFS_rrtmg_setup_run
	dcyc2t3_run
physics set	physics

cosine_of_zenith_angle

```
long_name     mean cos of zenith angle over rad call period
units         none
rank          1
type          real
kind          kind_phys
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Radtend(i)%coszen
requested     dcyc2t3_run
              rrtmg_sw_run
physics set   physics
```

countergradient_mixing_term_for_temperature

```
long_name     countergradient mixing term for temperature
units         K
rank          1
type          real
kind          kind_phys
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Interstitial(i)%gamt
requested     hedmf_run
physics set   physics
```

countergradient_mixing_term_for_water_vapor

```
long_name     countergradient mixing term for water vapor
units         kg kg-1
rank          1
type          real
kind          kind_phys
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Interstitial(i)%gamq
requested     hedmf_run
physics set   physics
```

critical_relative_humidity

long_name	critical relative humidity
units	frac
rank	2
type	real
kind	kind_phys
source	MODULE gmtb_scm_type_defs TYPE physics_type
local_name	physics%Interstitial(i)%rhc
requested	GFS_suite_interstitial_3_run
	zhaocarr_gscond_run
	zhaocarr_precpd_run
physics set	physics

critical_relative_humidity_at_PBL_top

long_name	critical relative humidity at the PBL top
units	frac
rank	0
type	real
kind	kind_phys
source	MODULE gmtb_scm_type_defs TYPE physics_type
local_name	physics%Interstitial(i)%rhcpbl
requested	GFS_suite_interstitial_1_run
	GFS_suite_interstitial_3_run
physics set	physics

critical_relative_humidity_at_surface

long_name	critical relative humidity at the surface
units	frac
rank	0
type	real
kind	kind_phys
source	MODULE gmtb_scm_type_defs TYPE physics_type
local_name	physics%Interstitial(i)%rhcbot
requested	GFS_suite_interstitial_1_run
	GFS_suite_interstitial_3_run
physics set	physics

critical_relative_humidity_at_top_of_atmosphere

long_name	critical relative humidity at the top of atmosphere
units	frac
rank	0
type	real
kind	kind_phys
source	MODULE gmtb_scm_type_defs TYPE physics_type
local_name	physics%Interstitial(i)%rhctop
requested	GFS_suite_interstitial_1_run
	GFS_suite_interstitial_3_run
physics set	physics

cumulative_atmosphere_detrainment_convective_mass_flux

long_name	cumulative detrainment mass flux
units	Pa
rank	2
type	real
kind	kind_phys
source	MODULE gmtb_scm_type_defs TYPE physics_type
local_name	physics%Diag(i)%det_mf
requested	GFS_DCNV_generic_post_run
physics set	physics

cumulative_atmosphere_downdraft_convective_mass_flux

```
long_name     cumulative downdraft mass flux
units         Pa
rank          2
type          real
kind          kind_phys
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Diag(i)%dwn_mf
requested     GFS_DCNV_generic_post_run
physics set   physics
```

cumulative_atmosphere_updraft_convective_mass_flux

```
long_name     cumulative updraft mass flux
units         Pa
rank          2
type          real
kind          kind_phys
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Diag(i)%upd_mf
requested     GFS_DCNV_generic_post_run
physics set   physics
```

cumulative_canopy_upward_latent_heat_flu_multiplied_by_timestep

```
long_name     cumulative canopy upward latent heat flux multiplied by timestep
units         W m-2 s
rank          1
type          real
kind          kind_phys
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Diag(i)%evcwa
requested     GFS_surface_generic_post_run
physics set   physics
```

cumulative_change_in_ozone_mixing_ratio_due_to_PBL

```
long_name      cumulative change in ozone mixing ratio due to PBL
units          kg kg-1
rank           2
type           real
kind           kind_phys
source         MODULE gmtb_scm_type_defs TYPE physics_type
local_name     physics%Diag(i)%dq3dt(:,:,5)
requested      GFS_PBL_generic_post_run
physics set    physics
```

cumulative_change_in_temperature_due_to_PBL

```
long_name      cumulative change in temperature due to PBL
units          K
rank           2
type           real
kind           kind_phys
source         MODULE gmtb_scm_type_defs TYPE physics_type
local_name     physics%Diag(i)%dt3dt(:,:,3)
requested      GFS_PBL_generic_post_run
physics set    physics
```

cumulative_change_in_temperature_due_to_deep_convection

```
long_name      cumulative change in temperature due to deep conv.
units          K
rank           2
type           real
kind           kind_phys
source         MODULE gmtb_scm_type_defs TYPE physics_type
local_name     physics%Diag(i)%dt3dt(:,:,4)
requested      GFS_DCNV_generic_post_run
physics set    physics
```

cumulative_change_in_temperature_due_to_longwave_radiation

    long_name   cumulative change in temperature due to longwave radiation
    units   K
    rank   2
    type   real
    kind   kind_phys
    source   MODULE gmtb_scm_type_defs TYPE physics_type
    local_name   physics%Diag(i)%dt3dt(:,:,1)
    requested   NOT REQUESTED
    physics set

cumulative_change_in_temperature_due_to_microphysics

    long_name   cumulative change in temperature due to microphysics
    units   K
    rank   2
    type   real
    kind   kind_phys
    source   MODULE gmtb_scm_type_defs TYPE physics_type
    local_name   physics%Diag(i)%dt3dt(:,:,6)
    requested   GFS_MP_generic_post_run
    physics set   physics

cumulative_change_in_temperature_due_to_shal_convection

    long_name   cumulative change in temperature due to shal conv.
    units   K
    rank   2
    type   real
    kind   kind_phys
    source   MODULE gmtb_scm_type_defs TYPE physics_type
    local_name   physics%Diag(i)%dt3dt(:,:,5)
    requested   GFS_SCNV_generic_post_run
    physics set   physics

cumulative_change_in_temperature_due_to_shortwave_radiation_and_orographic_gravity_wave_drag

```
long_name    cumulative change in temperature due to SW rad and oro.  GWD
units        K
rank         2
type         real
kind         kind_phys
source       MODULE gmtb_scm_type_defs TYPE physics_type
local_name   physics%Diag(i)%dt3dt(:,:,2)
requested    gwdps_post_run
physics set  physics
```

cumulative_change_in_water_vapor_specific_humidity_due_to_PBL

```
long_name    cumulative change in water vapor specific humidity due to PBL
units        kg kg-1
rank         2
type         real
kind         kind_phys
source       MODULE gmtb_scm_type_defs TYPE physics_type
local_name   physics%Diag(i)%dq3dt(:,:,1)
requested    GFS_PBL_generic_post_run
physics set  physics
```

cumulative_change_in_water_vapor_specific_humidity_due_to_deep_convection

```
long_name    cumulative change in water vapor specific humidity due to deep conv.
units        kg kg-1
rank         2
type         real
kind         kind_phys
source       MODULE gmtb_scm_type_defs TYPE physics_type
local_name   physics%Diag(i)%dq3dt(:,:,2)
requested    GFS_DCNV_generic_post_run
physics set  physics
```

cumulative_change_in_water_vapor_specific_humidity_due_to_microphysics

```
long_name      cumulative change in water vapor specific humidity due to microphysics
units          kg kg-1
rank           2
type           real
kind           kind_phys
source         MODULE gmtb_scm_type_defs TYPE physics_type
local_name     physics%Diag(i)%dq3dt(:,:,4)
requested      GFS_MP_generic_post_run
physics set    physics
```

cumulative_change_in_water_vapor_specific_humidity_due_to_physics

```
long_name      cumulative change in water vapor specific humidity due to physics
units          kg kg-1
rank           3
type           real
kind           kind_phys
source         MODULE gmtb_scm_type_defs TYPE physics_type
local_name     physics%Diag(i)%dq3dt
requested      NOT REQUESTED
physics set
```

cumulative_change_in_water_vapor_specific_humidity_due_to_shal_convection

```
long_name      cumulative change in water vapor specific humidity due to shal conv.
units          kg kg-1
rank           2
type           real
kind           kind_phys
source         MODULE gmtb_scm_type_defs TYPE physics_type
local_name     physics%Diag(i)%dq3dt(:,:,3)
requested      GFS_SCNV_generic_post_run
physics set    physics
```

cumulative_change_in_x_wind_due_to_PBL

    long_name   cumulative change in x wind due to PBL
    units   m s-1
    rank   2
    type   real
    kind   kind_phys
    source   MODULE gmtb_scm_type_defs TYPE physics_type
    local_name   physics%Diag(i)%du3dt(:,:,1)
    requested   GFS_PBL_generic_post_run
    physics set   physics

cumulative_change_in_x_wind_due_to_convective_gravity_wave_drag

    long_name   cumulative change in x wind due to convective gravity wave drag
    units   m s-1
    rank   2
    type   real
    kind   kind_phys
    source   MODULE gmtb_scm_type_defs TYPE physics_type
    local_name   physics%Diag(i)%du3dt(:,:,4)
    requested   gwdc_post_run
    physics set   physics

cumulative_change_in_x_wind_due_to_deep_convection

    long_name   cumulative change in x wind due to deep convection
    units   m s-1
    rank   2
    type   real
    kind   kind_phys
    source   MODULE gmtb_scm_type_defs TYPE physics_type
    local_name   physics%Diag(i)%du3dt(:,:,3)
    requested   GFS_DCNV_generic_post_run
    physics set   physics

cumulative_change_in_x_wind_due_to_orographic_gravity_wave_drag

      long_name   cumulative change in x wind due to orographic gravity wave drag
      units   m s-1
      rank   2
      type   real
      kind   kind_phys
      source   MODULE gmtb_scm_type_defs TYPE physics_type
      local_name   physics%Diag(i)%du3dt(:,:,2)
      requested   GFS_PBL_generic_post_run
                    gwdps_post_run
      physics set physics

cumulative_change_in_y_wind_due_to_PBL

      long_name   cumulative change in y wind due to PBL
      units   m s-1
      rank   2
      type   real
      kind   kind_phys
      source   MODULE gmtb_scm_type_defs TYPE physics_type
      local_name   physics%Diag(i)%dv3dt(:,:,1)
      requested   GFS_PBL_generic_post_run
      physics set physics

cumulative_change_in_y_wind_due_to_convective_gravity_wave_drag

      long_name   cumulative change in y wind due to convective gravity wave drag
      units   m s-1
      rank   2
      type   real
      kind   kind_phys
      source   MODULE gmtb_scm_type_defs TYPE physics_type
      local_name   physics%Diag(i)%dv3dt(:,:,4)
      requested   gwdc_post_run
      physics set physics

cumulative_change_in_y_wind_due_to_deep_convection
```
long_name     cumulative change in y wind due to deep convection
units         m s-1
rank          2
type          real
kind          kind_phys
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Diag(i)%dv3dt(:,:,3)
requested     GFS_DCNV_generic_post_run
physics set   physics
```

cumulative_change_in_y_wind_due_to_orographic_gravity_wave_drag
```
long_name     cumulative change in y wind due to orographic gravity wave drag
units         m s-1
rank          2
type          real
kind          kind_phys
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Diag(i)%dv3dt(:,:,2)
requested     GFS_PBL_generic_post_run
              gwdps_post_run
physics set   physics
```

cumulative_cloud_work_function
```
long_name     cumulative cloud work function (valid only with sas)
units         m2 s-1
rank          1
type          real
kind          kind_phys
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Diag(i)%cldwrk
requested     GFS_DCNV_generic_post_run
physics set   physics
```

cumulative_lwe_thickness_of_convective_precipitation_amount
```
     long_name     cumulative convective precipitation
     units         m
     rank          1
     type          real
     kind          kind_phys
     source        MODULE gmtb_scm_type_defs TYPE physics_type
     local_name    physics%Diag(i)%cnvprcp
     requested     GFS_DCNV_generic_post_run
                   samfshalcnv_post_run
     physics set   physics
```

cumulative_lwe_thickness_of_convective_precipitation_amount_in_bucket
```
     long_name     cumulative convective precipitation in bucket
     units         m
     rank          1
     type          real
     kind          kind_phys
     source        MODULE gmtb_scm_type_defs TYPE physics_type
     local_name    physics%Diag(i)%cnvprcpb
     requested     GFS_DCNV_generic_post_run
                   samfshalcnv_post_run
     physics set   physics
```

cumulative_snow_deposition_sublimation_upward_latent_heat_flux_multiplied_by_timestep
```
     long_name     cumulative latent heat flux from snow depo/subl multiplied by timestep
     units         W m-2 s
     rank          1
     type          real
     kind          kind_phys
     source        MODULE gmtb_scm_type_defs TYPE physics_type
     local_name    physics%Diag(i)%sbsnoa
     requested     GFS_surface_generic_post_run
     physics set   physics
```

cumulative_snow_freezing_rain_upward_latent_heat_flux_multiplied_by_timestep

```
    long_name     cumulative latent heat flux due to snow and frz rain multiplied by timestep
    units         W m-2 s
    rank          1
    type          real
    kind          kind_phys
    source        MODULE gmtb_scm_type_defs TYPE physics_type
    local_name    physics%Diag(i)%snohfa
    requested     GFS_surface_generic_post_run
    physics set   physics
```

cumulative_soil_upward_latent_heat_flux_multiplied_by_timestep

```
    long_name     cumulative soil upward latent heat flux multiplied by timestep
    units         W m-2 s
    rank          1
    type          real
    kind          kind_phys
    source        MODULE gmtb_scm_type_defs TYPE physics_type
    local_name    physics%Diag(i)%evbsa
    requested     GFS_surface_generic_post_run
    physics set   physics
```

cumulative_surface_downwelling_diffuse_near_infrared_shortwave_flux_for_coupling_multiplied_by_timestep

```
    long_name     cumulative sfc nir diff downward sw flux multiplied by timestep
    units         W m-2 s
    rank          1
    type          real
    kind          kind_phys
    source        MODULE gmtb_scm_type_defs TYPE physics_type
    local_name    physics%Coupling(i)%dnirdf_cpl
    requested     GFS_surface_generic_post_run
    physics set   physics
```

cumulative_surface_downwelling_diffuse_ultraviolet_and_visible_shortwave_flux_for_coupling_multiplied_by_timestep

long_name	cumulative sfc uv+vis diff dnwd sw flux multiplied by timestep
units	W m-2 s
rank	1
type	real
kind	kind_phys
source	MODULE gmtb_scm_type_defs TYPE physics_type
local_name	physics%Coupling(i)%dvisdf_cpl
requested	GFS_surface_generic_post_run
physics set	physics

cumulative_surface_downwelling_direct_near_infrared_shortwave_flux_for_coupling_multiplied_by_timestep

long_name	cumulative sfc nir beam downward sw flux multiplied by timestep
units	W m-2 s
rank	1
type	real
kind	kind_phys
source	MODULE gmtb_scm_type_defs TYPE physics_type
local_name	physics%Coupling(i)%dnirbm_cpl
requested	GFS_surface_generic_post_run
physics set	physics

cumulative_surface_downwelling_direct_ultraviolet_and_visible_shortwave_flux_for_coupling_multiplied_by_timestep

long_name	cumulative sfc uv+vis beam dnwd sw flux multiplied by timestep
units	W m-2 s
rank	1
type	real
kind	kind_phys
source	MODULE gmtb_scm_type_defs TYPE physics_type
local_name	physics%Coupling(i)%dvisbm_cpl
requested	GFS_surface_generic_post_run
physics set	physics

cumulative_surface_downwelling_longwave_flux_for_coupling_multiplied_by_timestep
```
     long_name      cumulative sfc downward lw flux mulitplied by timestep
     units          W m-2 s
     rank           1
     type           real
     kind           kind_phys
     source         MODULE gmtb_scm_type_defs TYPE physics_type
     local_name     physics%Coupling(i)%dlwsfc_cpl
     requested      GFS_surface_generic_post_run
     physics set    physics
```

cumulative_surface_downwelling_shortwave_flux_for_coupling_multiplied_by_timestep
```
     long_name      cumulative sfc downward sw flux multiplied by timestep
     units          W m-2 s
     rank           1
     type           real
     kind           kind_phys
     source         MODULE gmtb_scm_type_defs TYPE physics_type
     local_name     physics%Coupling(i)%dswsfc_cpl
     requested      GFS_surface_generic_post_run
     physics set    physics
```

cumulative_surface_ground_heat_flux_multiplied_by_timestep
```
     long_name      cumulative groud conductive heat flux multiplied by timestep
     units          W m-2 s
     rank           1
     type           real
     kind           kind_phys
     source         MODULE gmtb_scm_type_defs TYPE physics_type
     local_name     physics%Diag(i)%gflux
     requested      GFS_surface_generic_post_run
     physics set    physics
```

cumulative_surface_net_downward_diffuse_near_infrared_shortwave_flux_for_coupling_multiplied_by_timestep

```
    long_name     cumulative net nir diff downward sw flux multiplied by timestep
    units         W m-2 s
    rank          1
    type          real
    kind          kind_phys
    source        MODULE gmtb_scm_type_defs TYPE physics_type
    local_name    physics%Coupling(i)%nnirdf_cpl
    requested     GFS_surface_generic_post_run
    physics set   physics
```

cumulative_surface_net_downward_diffuse_ultraviolet_and_visible_shortwave_flux_for_coupling_multiplied_by_timestep

```
    long_name     cumulative net uv+vis diff downward sw rad flux multiplied by timestep
    units         W m-2 s
    rank          1
    type          real
    kind          kind_phys
    source        MODULE gmtb_scm_type_defs TYPE physics_type
    local_name    physics%Coupling(i)%nvisdf_cpl
    requested     GFS_surface_generic_post_run
    physics set   physics
```

cumulative_surface_net_downward_direct_near_infrared_shortwave_flux_for_coupling_multiplied_by_timestep

```
    long_name     cumulative net nir beam downward sw flux multiplied by timestep
    units         W m-2 s
    rank          1
    type          real
    kind          kind_phys
    source        MODULE gmtb_scm_type_defs TYPE physics_type
    local_name    physics%Coupling(i)%nnirbm_cpl
    requested     GFS_surface_generic_post_run
    physics set   physics
```

cumulative_surface_net_downward_direct_ultraviolet_and_visible_shortwave_flux_for_coupling_multiplied_by_timestep

```
long_name      cumulative net uv+vis beam downward sw rad flux multiplied by timestep
units          W m-2 s
rank           1
type           real
kind           kind_phys
source         MODULE gmtb_scm_type_defs TYPE physics_type
local_name     physics%Coupling(i)%nvisbm_cpl
requested      GFS_surface_generic_post_run
physics set    physics
```

cumulative_surface_net_downward_longwave_flux_for_coupling_multiplied_by_timestep

```
long_name      cumulative net downward lw flux multiplied by timestep
units          W m-2 s
rank           1
type           real
kind           kind_phys
source         MODULE gmtb_scm_type_defs TYPE physics_type
local_name     physics%Coupling(i)%nlwsfc_cpl
requested      GFS_surface_generic_post_run
physics set    physics
```

cumulative_surface_net_downward_shortwave_flux_for_coupling_multiplied_by_timestep

```
long_name      cumulative net downward sw flux multiplied by timestep
units          W m-2 s
rank           1
type           real
kind           kind_phys
source         MODULE gmtb_scm_type_defs TYPE physics_type
local_name     physics%Coupling(i)%nswsfc_cpl
requested      GFS_surface_generic_post_run
physics set    physics
```

cumulative_surface_snow_area_fraction_multiplied_by_timestep
```
     long_name    cumulative surface snow area fraction multiplied by timestep
     units        s
     rank         1
     type         real
     kind         kind_phys
     source       MODULE gmtb_scm_type_defs TYPE physics_type
     local_name   physics%Diag(i)%snowca
     requested    GFS_surface_generic_post_run
     physics set  physics
```

cumulative_surface_upward_latent_heat_flux_for_coupling_multiplied_by_timestep
```
     long_name    cumulative sfc latent heat flux multiplied by timestep
     units        W m-2 s
     rank         1
     type         real
     kind         kind_phys
     source       MODULE gmtb_scm_type_defs TYPE physics_type
     local_name   physics%Coupling(i)%dqsfc_cpl
     requested    GFS_PBL_generic_post_run
     physics set  physics
```

cumulative_surface_upward_latent_heat_flux_for_diag_multiplied_by_timestep
```
     long_name    cumulative sfc latent heat flux multiplied by timestep
     units        W m-2 s
     rank         1
     type         real
     kind         kind_phys
     source       MODULE gmtb_scm_type_defs TYPE physics_type
     local_name   physics%Diag(i)%dqsfc
     requested    GFS_PBL_generic_post_run
     physics set  physics
```

cumulative_surface_upward_potential_latent_heat_flux_multiplied_by_timestep

long_name	cumulative surface upward potential latent heat flux multiplied by timestep
units	W m-2 s
rank	1
type	real
kind	kind_phys
source	MODULE gmtb_scm_type_defs TYPE physics_type
local_name	physics%Diag(i)%ep
requested	GFS_surface_generic_post_run
physics set	physics

cumulative_surface_upward_sensible_heat_flux_for_coupling_multiplied_by_timestep

long_name	cumulative sfc sensible heat flux multiplied by timestep
units	W m-2 s
rank	1
type	real
kind	kind_phys
source	MODULE gmtb_scm_type_defs TYPE physics_type
local_name	physics%Coupling(i)%dtsfc_cpl
requested	GFS_PBL_generic_post_run
physics set	physics

cumulative_surface_upward_sensible_heat_flux_for_diag_multiplied_by_timestep

long_name	cumulative sfc sensible heat flux multiplied by timestep
units	W m-2 s
rank	1
type	real
kind	kind_phys
source	MODULE gmtb_scm_type_defs TYPE physics_type
local_name	physics%Diag(i)%dtsfc
requested	GFS_PBL_generic_post_run
physics set	physics

cumulative_surface_x_momentum_flux_for_coupling_multiplied_by_timestep

```
long_name     cumulative sfc x momentum flux multiplied by timestep
units         Pa s
rank          1
type          real
kind          kind_phys
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Coupling(i)%dusfc_cpl
requested     GFS_PBL_generic_post_run
physics set   physics
```

cumulative_surface_x_momentum_flux_for_diag_multiplied_by_timestep

```
long_name     cumulative sfc x momentum flux multiplied by timestep
units         Pa s
rank          1
type          real
kind          kind_phys
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Diag(i)%dusfc
requested     GFS_PBL_generic_post_run
physics set   physics
```

cumulative_surface_y_momentum_flux_for_coupling_multiplied_by_timestep

```
long_name     cumulative sfc y momentum flux multiplied by timestep
units         Pa s
rank          1
type          real
kind          kind_phys
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Coupling(i)%dvsfc_cpl
requested     GFS_PBL_generic_post_run
physics set   physics
```

cumulative_surface_y_momentum_flux_for_diag_multiplied_by_timestep
```
long_name      cumulative sfc y momentum flux multiplied by timestep
units          Pa s
rank           1
type           real
kind           kind_phys
source         MODULE gmtb_scm_type_defs TYPE physics_type
local_name     physics%Diag(i)%dvsfc
requested      GFS_PBL_generic_post_run
physics set    physics
```

cumulative_transpiration_flux_multiplied_by_timestep
```
long_name      cumulative total plant transpiration rate multiplied by timestep
units          kg m-2
rank           1
type           real
kind           kind_phys
source         MODULE gmtb_scm_type_defs TYPE physics_type
local_name     physics%Diag(i)%transa
requested      GFS_surface_generic_post_run
physics set    physics
```

date_and_time_at_model_initialization
```
long_name      initialization date and time
units          none
rank           1
type           integer
kind
source         MODULE gmtb_scm_type_defs TYPE physics_type
local_name     physics%Model(i)%idat
requested      GFS_rrtmg_setup_run
physics set    physics
```

date_and_time_at_model_initialization_reordered

```
long_name     initial date with different size and ordering
units         none
rank          1
type          integer
kind
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Model(i)%idate
requested     GFS_rrtmg_setup_init
physics set   physics
```

daytime_points

```
long_name     daytime points
units         index
rank          1
type          integer
kind
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Interstitial(i)%idxday
requested     rrtmg_sw_pre_run
              rrtmg_sw_run
physics set   physics
```

daytime_points_dimension

long_name	daytime points dimension
units	count
rank	0
type	integer
kind	
source	MODULE gmtb_scm_type_defs TYPE physics_type
local_name	physics%Interstitial(i)%nday
requested	rrtmg_sw_post_run
	rrtmg_sw_pre_run
	rrtmg_sw_run
physics set	physics

deep_soil_temperature

long_name	deep soil temperature
units	K
rank	1
type	real
kind	kind_phys
source	MODULE gmtb_scm_type_defs TYPE physics_type
local_name	physics%Sfcprop(i)%tg3
requested	lsm_noah_run
physics set	physics

density_of_frozen_precipitation

```
long_name      density of frozen precipitation
units          kg m-3
rank           1
type           real
kind           kind_phys
source         MODULE gmtb_scm_type_defs TYPE physics_type
local_name     physics%Sfcprop(i)%rhofr
requested      NOT REQUESTED
physics set
```

depth_of_soil_levels_for_land_surface_model

```
long_name      depth of soil levels for land surface model
units          m
rank           1
type           real
kind           kind_phys
source         MODULE gmtb_scm_type_defs TYPE physics_type
local_name     physics%Sfcprop(i)%zs
requested      NOT REQUESTED
physics set
```

detrainment_conversion_parameter_deep_convection

```
long_name      convective detrainment conversion parameter for deep conv.
units          m-1
rank           0
type           real
kind           kind_phys
source         MODULE gmtb_scm_type_defs TYPE physics_type
local_name     physics%Model(i)%c1_deep
requested      samfdeepcnv_run
physics set    physics
```

detrainment_conversion_parameter_shallow_convection
```
long_name    convective detrainment conversion parameter for shal conv.
units        m-1
rank         0
type         real
kind         kind_phys
source       MODULE gmtb_scm_type_defs TYPE physics_type
local_name   physics%Model(i)%c1_shal
requested    samfshalcnv_run
physics set  physics
```

dewpoint_temperature_at_2m
```
long_name    2 meter dewpoint temperature
units        K
rank         1
type         real
kind         kind_phys
source       MODULE gmtb_scm_type_defs TYPE physics_type
local_name   physics%Diag(i)%dpt2m
requested    sfc_diag_post_run
physics set  physics
```

diffusivity_background_sigma_level
```
long_name    sigma threshold for background mom.  diffusion
units        none
rank         0
type         real
kind         kind_phys
source       MODULE gmtb_scm_type_defs TYPE physics_type
local_name   physics%Model(i)%xkzm_s
requested    hedmf_run
physics set  physics
```

dimensionless_exner_function_at_lowest_model_interface

```
long_name    dimensionless Exner function at lowest model interface
units        none
rank         1
type         real
kind         kind_phys
source       MODULE gmtb_scm_type_defs TYPE physics_type
local_name   physics%Statein(i)%prsik(:,1)
requested    GFS_surface_generic_pre_run
             hedmf_run
physics set  physics
```

dimensionless_exner_function_at_lowest_model_layer

```
long_name    dimensionless Exner function at lowest model layer
units        none
rank         1
type         real
kind         kind_phys
source       MODULE gmtb_scm_type_defs TYPE physics_type
local_name   physics%Statein(i)%prslk(:,1)
requested    GFS_surface_generic_pre_run
physics set  physics
```

dimensionless_exner_function_at_model_interfaces

```
long_name    dimensionless Exner function at model layer interfaces
units        none
rank         2
type         real
kind         kind_phys
source       MODULE gmtb_scm_type_defs TYPE physics_type
local_name   physics%Statein(i)%prsik
requested    NOT REQUESTED
physics set
```

dimensionless_exner_function_at_model_layers

```
long_name      dimensionless Exner function at model layer centers
units          none
rank           2
type           real
kind           kind_phys
source         MODULE gmtb_scm_type_defs TYPE physics_type
local_name     physics%Statein(i)%prslk
requested      GFS_suite_interstitial_3_run
               gwdps_run
               hedmf_run
physics set    physics
```

dissipation_estimate_of_air_temperature_at_model_layers

```
long_name      dissipation estimate model layer mean temperature
units          K
rank           2
type           real
kind           kind_phys
source         MODULE gmtb_scm_type_defs TYPE physics_type
local_name     physics%Statein(i)%diss_est
requested      NOT REQUESTED
physics set
```

diurnal_thermocline_layer_heat_content

```
long_name      heat content in diurnal thermocline layer
units          K m
rank           1
type           real
kind           kind_phys
source         MODULE gmtb_scm_type_defs TYPE physics_type
local_name     physics%Sfcprop(i)%xt
requested      sfc_nst_post_run
               sfc_nst_run
physics set    physics
```

diurnal_thermocline_layer_thickness

```
long_name      diurnal thermocline layer thickness
units          m
rank           1
type           real
kind           kind_phys
source         MODULE gmtb_scm_type_defs TYPE physics_type
local_name     physics%Sfcprop(i)%xz
requested      sfc_nst_post_run
               sfc_nst_run
physics set    physics
```

diurnal_thermocline_layer_x_current

```
long_name      u-current content in diurnal thermocline layer
units          m2 s-1
rank           1
type           real
kind           kind_phys
source         MODULE gmtb_scm_type_defs TYPE physics_type
local_name     physics%Sfcprop(i)%xu
requested      sfc_nst_run
physics set    physics
```

diurnal_thermocline_layer_y_current

```
long_name      v-current content in diurnal thermocline layer
units          m2 s-1
rank           1
type           real
kind           kind_phys
source         MODULE gmtb_scm_type_defs TYPE physics_type
local_name     physics%Sfcprop(i)%xv
requested      sfc_nst_run
physics set    physics
```

dominant_freezing_rain_type

```
long_name      dominant freezing rain type
units          none
rank           1
type           real
kind           kind_phys
source         MODULE gmtb_scm_type_defs TYPE physics_type
local_name     physics%Diag(i)%tdomzr
requested      GFS_MP_generic_post_run
physics set    physics
```

dominant_rain_type

```
long_name      dominant rain type
units          none
rank           1
type           real
kind           kind_phys
source         MODULE gmtb_scm_type_defs TYPE physics_type
local_name     physics%Diag(i)%tdomr
requested      GFS_MP_generic_post_run
physics set    physics
```

dominant_sleet_type

```
long_name      dominant sleet type
units          none
rank           1
type           real
kind           kind_phys
source         MODULE gmtb_scm_type_defs TYPE physics_type
local_name     physics%Diag(i)%tdomip
requested      GFS_MP_generic_post_run
physics set    physics
```

dominant_snow_type

```
long_name      dominant snow type
units          none
rank           1
type           real
kind           kind_phys
source         MODULE gmtb_scm_type_defs TYPE physics_type
local_name     physics%Diag(i)%tdoms
requested      GFS_MP_generic_post_run
physics set    physics
```

downdraft_fraction_reaching_surface_over_land_deep_convection

```
long_name      downdraft fraction reaching surface over land for deep conv.
units          frac
rank           0
type           real
kind           kind_phys
source         MODULE gmtb_scm_type_defs TYPE physics_type
local_name     physics%Model(i)%betal_deep
requested      samfdeepcnv_run
physics set    physics
```

downdraft_fraction_reaching_surface_over_ocean_deep_convection

```
long_name      downdraft fraction reaching surface over ocean for deep conv.
units          frac
rank           0
type           real
kind           kind_phys
source         MODULE gmtb_scm_type_defs TYPE physics_type
local_name     physics%Model(i)%betas_deep
requested      samfdeepcnv_run
physics set    physics
```

dynamics_to_physics_timestep_ratio

```
long_name      ratio of dynamics timestep to physics timestep
units          none
rank           0
type           real
kind           kind_phys
source         MODULE gmtb_scm_type_defs TYPE physics_type
local_name     physics%Interstitial(i)%frain
requested      GFS_DCNV_generic_post_run
               GFS_MP_generic_post_run
               GFS_SCNV_generic_post_run
               GFS_suite_interstitial_1_run
               samfshalcnv_post_run
physics set    physics
```

entrainment_rate_coefficient_deep_convection

```
long_name      entrainment rate coefficient for deep convection
units          none
rank           0
type           real
kind           kind_phys
source         MODULE gmtb_scm_type_defs TYPE physics_type
local_name     physics%Model(i)%clam_deep
requested      samfdeepcnv_run
physics set    physics
```

entrainment_rate_coefficient_shallow_convection

```
long_name      entrainment rate coefficient for shal conv.
units          none
rank           0
type           real
kind           kind_phys
source         MODULE gmtb_scm_type_defs TYPE physics_type
local_name     physics%Model(i)%clam_shal
requested      samfshalcnv_run
physics set    physics
```

equation_of_time

```
long_name      equation of time (radian)
units          radians
rank           0
type           real
kind           kind_phys
source         MODULE gmtb_scm_type_defs TYPE physics_type
local_name     physics%Model(i)%slag
requested      GFS_rrtmg_setup_run
               dcyc2t3_run
physics set    physics
```

extra_top_layer

long_name	extra top layer for radiation
units	none
rank	0
type	integer
kind	
source	MODULE gmtb_scm_type_defs
local_name	LTP
requested	GFS_rrtmg_post_run
	rrtmg_lw_post_run
	rrtmg_sw_post_run
physics set	physics

flag_TKE_dissipation_heating

long_name	flag for tke dissipative heating
units	flag
rank	0
type	logical
kind	
source	MODULE gmtb_scm_type_defs TYPE physics_type
local_name	physics%Model(i)%dspheat
requested	hedmf_run
physics set	physics

flag_convective_gravity_wave_drag

long_name	flag for conv gravity wave drag
units	flag
rank	0
type	logical
kind	
source	MODULE gmtb_scm_type_defs TYPE physics_type
local_name	physics%Model(i)%cnvgwd
requested	GFS_DCNV_generic_pre_run
physics set	physics

flag_deep_convection

long_name	flag indicating whether convection occurs in column (0 or 1)
units	flag
rank	1
type	integer
kind	
source	MODULE gmtb_scm_type_defs TYPE physics_type
local_name	physics%Interstitial(i)%kcnv
requested	gwdc_run
	samfdeepcnv_run
	samfshalcnv_run
physics set	physics

flag_diagnostics

long_name	logical flag for storing diagnostics
units	flag
rank	0
type	logical
kind	
source	MODULE gmtb_scm_type_defs TYPE physics_type
local_name	physics%Model(i)%lssav
requested	GFS_DCNV_generic_post_run
	GFS_MP_generic_post_run
	GFS_PBL_generic_post_run
	GFS_SCNV_generic_post_run
	GFS_surface_generic_post_run
	gwdc_post_run
	gwdps_post_run
	lsm_noah_post_run
	samfshalcnv_post_run
	sfc_diag_post_run
physics set	physics

flag_diagnostics_3D

long_name	flag for 3d diagnostic fields
units	flag
rank	0
type	logical
kind	
source	MODULE gmtb_scm_type_defs TYPE physics_type
local_name	physics%Model(i)%ldiag3d
requested	GFS_DCNV_generic_post_run
	GFS_DCNV_generic_pre_run
	GFS_MP_generic_post_run
	GFS_MP_generic_pre_run
	GFS_PBL_generic_post_run
	GFS_SCNV_generic_post_run
	GFS_SCNV_generic_pre_run
	gwdc_post_run
	gwdps_post_run
	h2ophys_run
	ozphys_run
physics set	physics

flag_for_Arakawa_Wu_adjustment

long_name	flag for Arakawa Wu scale-aware adjustment
units	flag
rank	0
type	logical
kind	
source	MODULE gmtb_scm_type_defs TYPE physics_type
local_name	physics%Model(i)%do_aw
requested	GFS_MP_generic_pre_run
physics set	physics

flag_for_CRICK-proof_cloud_water

```
long_name     flag for CRICK-Proof cloud water
units         flag
rank          0
type          logical
kind
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Model(i)%crick_proof
requested     GFS_rrtmg_setup_init
physics set   physics
```

flag_for_Chikira_Sugiyama_deep_convection

```
long_name     flag for Chikira-Sugiyama convection
units         flag
rank          0
type          logical
kind
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Model(i)%cscnv
requested     GFS_suite_interstitial_3_run
physics set   physics
```

flag_for_aerosol_physics

```
long_name     flag for aerosol physics
units         flag
rank          0
type          logical
kind
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Model(i)%ltaerosol
requested     GFS_PBL_generic_post_run
              GFS_PBL_generic_pre_run
              GFS_suite_interstitial_3_run
              GFS_suite_interstitial_4_run
physics set   physics
```

flag_for_chemistry_coupling

```
long_name     flag controlling cplchm collection (default off)
units         flag
rank          0
type          logical
kind
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Model(i)%cplchm
requested     GFS_MP_generic_post_run
physics set   physics
```

flag_for_cloud_condensate_normalized_by_cloud_cover

```
long_name      flag for cloud condensate normalized by cloud cover
units          flag
rank           0
type           logical
kind
source         MODULE gmtb_scm_type_defs TYPE physics_type
local_name     physics%Model(i)%ccnorm
requested      GFS_rrtmg_setup_init
physics set    physics
```

flag_for_convective_transport_of_tracers

```
long_name      flag for convective transport of tracers
units          flag
rank           0
type           logical
kind
source         MODULE gmtb_scm_type_defs TYPE physics_type
local_name     physics%Model(i)%trans_trac
requested      GFS_suite_interstitial_3_run
physics set    physics
```

flag_for_default_aerosol_effect_in_shortwave_radiation

```
long_name      default aerosol effect in sw only
units          flag
rank           0
type           integer
kind
source         MODULE gmtb_scm_type_defs TYPE physics_type
local_name     physics%Model(i)%iaer
requested      GFS_rrtmg_setup_init
physics set    physics
```

flag_for_flux_coupling

long_name	flag controlling cplflx collection (default off)
units	flag
rank	0
type	logical
kind	
source	MODULE gmtb_scm_type_defs TYPE physics_type
local_name	physics%Model(i)%cplflx
requested	GFS_MP_generic_post_run
	GFS_PBL_generic_post_run
	GFS_surface_generic_post_run
physics set	physics

flag_for_frozen_soil_physics

long_name	flag for frozen soil physics (RUC)
units	flag
rank	2
type	real
kind	kind_phys
source	MODULE gmtb_scm_type_defs TYPE physics_type
local_name	physics%Sfcprop(i)%flag_frsoil
requested	NOT REQUESTED
physics set	

flag_for_gfdl_microphysics_scheme

```
long_name      choice of GFDL microphysics scheme
units          flag
rank           0
type           integer
kind
source         MODULE gmtb_scm_type_defs TYPE physics_type
local_name     physics%Model(i)%imp_physics_gfdl
requested      GFS_MP_generic_post_run
               GFS_PBL_generic_post_run
               GFS_PBL_generic_pre_run
               GFS_suite_interstitial_3_run
               GFS_suite_interstitial_4_run
               gfdl_cloud_microphys_init
physics set    physics
```

flag_for_guess_run

```
long_name      flag for guess run
units          flag
rank           1
type           logical
kind
source         MODULE gmtb_scm_type_defs TYPE physics_type
local_name     physics%Interstitial(i)%flag_guess
requested      GFS_surface_loop_control_part1_run
               GFS_surface_loop_control_part2_run
               lsm_noah_run
               sfc_nst_run
physics set    physics
```

flag_for_hedmf

```
long_name     flag for hybrid edmf pbl scheme (moninedmf)
units         flag
rank          0
type          logical
kind
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Model(i)%hybedmf
requested     GFS_PBL_generic_post_run
physics set   physics
```

flag_for_hydrostatic_heating_from_physics

```
long_name     flag for use of hydrostatic heating in physics
units         flag
rank          0
type          logical
kind
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%phys_hydrostatic
requested     gfdl_cloud_microphys_run
physics set   physics
```

flag_for_hydrostatic_solver

```
long_name     flag for use the hydrostatic or nonhydrostatic solver
units         flag
rank          0
type          logical
kind
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%hydrostatic
requested     gfdl_cloud_microphys_run
physics set   physics
```

flag_for_initial_time-date_control

```
long_name     flag for initial conditions and forcing
units         flag
rank          0
type          integer
kind
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Model(i)%ictm
requested     GFS_rrtmg_setup_init
physics set   physics
```

flag_for_iteration

```
long_name     flag for iteration
units         flag
rank          1
type          logical
kind
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Interstitial(i)%flag_iter
requested     GFS_surface_loop_control_part2_run
              lsm_noah_run
              sfc_ex_coef_run
              sfc_nst_run
              sfc_sice_run
physics set   physics
```

flag_for_land_surface_scheme

```
long_name     flag for land surface model lsm=1 for noah lsm
units         flag
rank          0
type          integer
kind
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Model(i)%lsm
requested     sfc_sice_run
physics set   physics
```

flag_for_lw_clouds_without_sub-grid_approximation

```
long_name     flag for lw clouds without sub-grid approximation
units         flag
rank          0
type          integer
kind
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Model(i)%isubc_lw
requested     GFS_rrtmg_setup_init
physics set   physics
```

flag_for_mass_flux_deep_convection_scheme

```
long_name     flag for mass-flux deep convection scheme
units         flag
rank          0
type          integer
kind
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Model(i)%imfdeepcnv
requested     NOT REQUESTED
physics set
```

flag_for_mass_flux_shallow_convection_scheme

```
long_name     flag for mass-flux shallow convection scheme
units         flag
rank          0
type          integer
kind
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Model(i)%imfshalcnv
requested     NOT REQUESTED
physics set
```

flag_for_max-random_overlap_clouds_for_longwave_radiation

```
long_name     lw:  max-random overlap clouds
units         flag
rank          0
type          integer
kind
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Model(i)%iovr_lw
requested     GFS_rrtmg_setup_init
physics set   physics
```

flag_for_max-random_overlap_clouds_for_shortwave_radiation

```
long_name     sw:  max-random overlap clouds
units         flag
rank          0
type          integer
kind
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Model(i)%iovr_sw
requested     GFS_rrtmg_setup_init
physics set   physics
```

flag_for_microphysics_scheme

```
long_name      choice of microphysics scheme
units          flag
rank           0
type           integer
kind
source         MODULE gmtb_scm_type_defs TYPE physics_type
local_name     physics%Model(i)%imp_physics
requested      GFS_MP_generic_post_run
               GFS_PBL_generic_post_run
               GFS_PBL_generic_pre_run
               GFS_rrtmg_setup_init
               GFS_suite_interstitial_3_run
               GFS_suite_interstitial_4_run
               gfdl_cloud_microphys_init
physics set    physics
```

flag_for_mom4_coupling

```
long_name      flag controls mom4 sea ice
units          flag
rank           0
type           logical
kind
source         MODULE gmtb_scm_type_defs TYPE physics_type
local_name     physics%Model(i)%mom4ice
requested      sfc_sice_run
physics set    physics
```

flag_for_morrison_gettelman_microphysics_scheme

```
long_name      choice of Morrison-Gettelman rmicrophysics scheme
units          flag
rank           0
type           integer
kind
source         MODULE gmtb_scm_type_defs TYPE physics_type
local_name     physics%Model(i)%imp_physics_mg
requested      GFS_suite_interstitial_3_run
physics set    physics
```

flag_for_mountain_blocking

```
long_name      flag for mountain blocking
units          flag
rank           0
type           logical
kind
source         MODULE gmtb_scm_type_defs TYPE physics_type
local_name     physics%Model(i)%use_zmtnblck
requested      NOT REQUESTED
physics set
```

flag_for_nsstm_run

```
long_name      NSSTM flag:  off/uncoupled/coupled=0/1/2
units          flag
rank           0
type           integer
kind
source         MODULE gmtb_scm_type_defs TYPE physics_type
local_name     physics%Model(i)%nstf_name(1)
requested      GFS_surface_loop_control_part2_run
               sfc_nst_post_run
               sfc_nst_run
physics set    physics
```

flag_for_output_of_longwave_heating_rate

```
long_name     flag to output lw heating rate (Radtend%lwhc)
units         flag
rank          0
type          logical
kind
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Model(i)%lwhtr
requested     NOT REQUESTED
physics set
```

flag_for_output_of_shortwave_heating_rate

```
long_name     flag to output sw heating rate (Radtend%swhc)
units         flag
rank          0
type          logical
kind
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Model(i)%swhtr
requested     NOT REQUESTED
physics set
```

flag_for_precipitation_effect_on_radiation

```
long_name     radiation precip flag for Ferrier/Moorthi
units         flag
rank          0
type          logical
kind
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Model(i)%norad_precip
requested     GFS_rrtmg_setup_init
physics set   physics
```

flag_for_precipitation_type

```
long_name      snow/rain flag for precipitation
units          flag
rank           1
type           real
kind           kind_phys
source         MODULE gmtb_scm_type_defs TYPE physics_type
local_name     physics%Sfcprop(i)%srflag
requested      GFS_MP_generic_post_run
               lsm_noah_run
               sfc_sice_run
physics set    physics
```

flag_for_precipitation_type_algorithm

```
long_name      flag controls precip type algorithm
units          flag
rank           0
type           logical
kind
source         MODULE gmtb_scm_type_defs TYPE physics_type
local_name     physics%Model(i)%cal_pre
requested      GFS_MP_generic_post_run
physics set    physics
```

flag_for_radar_reflectivity

```
long_name      flag for radar reflectivity
units          flag
rank           0
type           logical
kind
source         MODULE gmtb_scm_type_defs TYPE physics_type
local_name     physics%Model(i)%lradar
requested      NOT REQUESTED
physics set
```

flag_for_reduced_drag_coefficient_over_sea

```
long_name     flag for reduced drag coeff.  over sea
units         flag
rank          0
type          logical
kind
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Model(i)%redrag
requested     sfc_ex_coef_run
physics set   physics
```

flag_for_ruc_land_surface_scheme

```
long_name     flag for RUC land surface model
units         flag
rank          0
type          integer
kind
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Model(i)%lsm_ruc
requested     NOT REQUESTED
physics set
```

flag_for_scale_aware_TKE_moist_EDMF_PBL

```
long_name     flag for scale-aware TKE moist EDMF PBL scheme
units         flag
rank          0
type          logical
kind
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Model(i)%satmedmf
requested     GFS_suite_interstitial_3_run
physics set   physics
```

flag_for_shoc
```
     long_name    flag for SHOC
     units        flag
     rank         0
     type         logical
     kind
     source       MODULE gmtb_scm_type_defs TYPE physics_type
     local_name   physics%Model(i)%do_shoc
     requested    GFS_suite_interstitial_3_run
                  gfdl_cloud_microphys_init
     physics set  physics
```

flag_for_solar_constant
```
     long_name    use prescribed solar constant
     units        flag
     rank         0
     type         integer
     kind
     source       MODULE gmtb_scm_type_defs TYPE physics_type
     local_name   physics%Model(i)%isol
     requested    GFS_rrtmg_setup_init
     physics set  physics
```

flag_for_stochastic_shum_option
```
     long_name    flag for stochastic shum option
     units        flag
     rank         0
     type         logical
     kind
     source       MODULE gmtb_scm_type_defs TYPE physics_type
     local_name   physics%Model(i)%do_shum
     requested    NOT REQUESTED
     physics set
```

flag_for_stochastic_skeb_option

```
long_name     flag for stochastic skeb option
units         flag
rank          0
type          logical
kind
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Model(i)%do_skeb
requested     NOT REQUESTED
physics set
```

flag_for_stochastic_surface_perturbations

```
long_name     flag for stochastic surface perturbations option
units         flag
rank          0
type          logical
kind
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Model(i)%do_sfcperts
requested     GFS_surface_generic_pre_run
physics set   physics
```

flag_for_stochastic_surface_physics_perturbations

```
long_name     flag for stochastic surface physics perturbations
units         flag
rank          0
type          logical
kind
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Model(i)%do_sppt
requested     GFS_MP_generic_post_run
              GFS_surface_generic_pre_run
physics set   physics
```

flag_for_surface_emissivity_control

```
long_name     surface emissivity control flag, use fixed value of 1
units         flag
rank          0
type          integer
kind
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Model(i)%iems
requested     GFS_rrtmg_setup_init
physics set   physics
```

flag_for_sw_clouds_without_sub-grid_approximation

```
long_name     flag for sw clouds without sub-grid approximation
units         flag
rank          0
type          integer
kind
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Model(i)%isubc_sw
requested     GFS_rrtmg_setup_init
physics set   physics
```

flag_for_thompson_microphysics_scheme

```
long_name      choice of Thompson microphysics scheme
units          flag
rank           0
type           integer
kind
source         MODULE gmtb_scm_type_defs TYPE physics_type
local_name     physics%Model(i)%imp_physics_thompson
requested      GFS_PBL_generic_post_run
               GFS_PBL_generic_pre_run
               GFS_suite_interstitial_3_run
               GFS_suite_interstitial_4_run
physics set    physics
```

flag_for_using_climatology_albedo

```
long_name      flag for using climatology alb, based on sfc type
units          flag
rank           0
type           integer
kind
source         MODULE gmtb_scm_type_defs TYPE physics_type
local_name     physics%Model(i)%ialb
requested      GFS_rrtmg_setup_init
physics set    physics
```

flag_for_using_prescribed_global_mean_co2_value

```
long_name      prescribed global mean value (old opernl)
units          flag
rank           0
type           integer
kind
source         MODULE gmtb_scm_type_defs TYPE physics_type
local_name     physics%Model(i)%ico2
requested      GFS_rrtmg_setup_init
physics set    physics
```

flag_for_vertical_index_direction_control

```
long_name      iflip - is not the same as flipv
units          flag
rank           0
type           integer
kind
source         MODULE gmtb_scm_type_defs TYPE physics_type
local_name     physics%Model(i)%iflip
requested      GFS_rrtmg_setup_init
physics set    physics
```

flag_for_wsm6_microphysics_scheme

```
long_name      choice of WSM6 microphysics scheme
units          flag
rank           0
type           integer
kind
source         MODULE gmtb_scm_type_defs TYPE physics_type
local_name     physics%Model(i)%imp_physics_wsm6
requested      GFS_PBL_generic_post_run
               GFS_PBL_generic_pre_run
               GFS_suite_interstitial_3_run
physics set    physics
```

flag_for_zhao_carr_microphysics_scheme
```
long_name    choice of Zhao-Carr microphysics scheme
units        flag
rank         0
type         integer
kind
source       MODULE gmtb_scm_type_defs TYPE physics_type
local_name   physics%Model(i)%imp_physics_zhao_carr
requested    GFS_suite_interstitial_3_run
             GFS_suite_interstitial_4_run
physics set  physics
```

flag_for_zhao_carr_pdf_microphysics_scheme
```
long_name    choice of Zhao-Carr microphysics scheme with PDF clouds
units        flag
rank         0
type         integer
kind
source       MODULE gmtb_scm_type_defs TYPE physics_type
local_name   physics%Model(i)%imp_physics_zhao_carr_pdf
requested    GFS_suite_interstitial_3_run
             GFS_suite_interstitial_4_run
physics set  physics
```

flag_gocart
```
long_name     flag for 3d diagnostic fields for gocart 1
units         flag
rank          0
type          logical
kind
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Model(i)%lgocart
requested     GFS_DCNV_generic_post_run
              GFS_DCNV_generic_pre_run
              GFS_SCNV_generic_post_run
              GFS_SCNV_generic_pre_run
              GFS_suite_interstitial_4_run
physics set   physics
```

flag_idealized_physics
```
long_name     flag for idealized physics
units         flag
rank          0
type          logical
kind
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Model(i)%lsidea
requested     GFS_PBL_generic_post_run
              rayleigh_damp_run
physics set   physics
```

flag_mg3_as_mg2

long_name	flag for controlling prep for Morrison-Gettelman microphysics
units	flag
rank	0
type	logical
kind	
source	MODULE gmtb_scm_type_defs TYPE physics_type
local_name	physics%Interstitial(i)%mg3_as_mg2
requested	NOT REQUESTED
physics set	

flag_print

long_name	control flag for diagnostic print out
units	flag
rank	0
type	logical
kind	
source	MODULE gmtb_scm_type_defs TYPE physics_type
local_name	physics%Model(i)%lprnt
requested	gwdc_run
	gwdps_run
	hedmf_run
	rrtmg_lw_run
	rrtmg_sw_run
	sfc_nst_run
	sfc_sice_run
	zhaocarr_gscond_run
	zhaocarr_precpd_run
physics set	physics

flag_shallow_convective_cloud

```
long_name    flag for shallow convective cloud
units
rank         0
type         logical
kind
source       MODULE gmtb_scm_type_defs TYPE physics_type
local_name   physics%Model(i)%shcnvcw
requested    samfshalcnv_post_run
physics set  physics
```

flag_skip_macro

```
long_name    flag to skip cloud macrophysics in Morrison scheme
units        flag
rank         1
type         logical
kind
source       MODULE gmtb_scm_type_defs TYPE physics_type
local_name   physics%Interstitial(i)%skip_macro
requested    NOT REQUESTED
physics set
```

flag_to_calc_lw

```
long_name    logical flags for lw radiation calls
units        flag
rank         0
type         logical
kind
source       MODULE gmtb_scm_type_defs TYPE physics_type
local_name   physics%Model(i)%lslwr
requested    rrtmg_lw_run
physics set  physics
```

flag_to_calc_sw

```
long_name      logical flags for sw radiation calls
units          flag
rank           0
type           logical
kind
source         MODULE gmtb_scm_type_defs TYPE physics_type
local_name     physics%Model(i)%lsswr
requested      GFS_rrtmg_setup_run
               rrtmg_sw_run
physics set    physics
```

forecast_date_and_time

```
long_name      current forecast date and time
units          none
rank           1
type           integer
kind
source         MODULE gmtb_scm_type_defs TYPE physics_type
local_name     physics%Model(i)%jdat
requested      GFS_rrtmg_setup_run
physics set    physics
```

forecast_hour

```
long_name      hour time after 00z at the t-step
units          h
rank           0
type           real
kind           kind_phys
source         MODULE gmtb_scm_type_defs TYPE physics_type
local_name     physics%Model(i)%solhr
requested      dcyc2t3_run
               sfc_nst_run
physics set    physics
```

forecast_time

```
long_name     curent forecast time
units         h
rank          0
type          real
kind          kind_phys
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Model(i)%fhour
requested     gwdc_run
physics set   physics
```

fraction_of_convective_cloud

```
long_name     fraction of convective cloud
units         frac
rank          1
type          real
kind          kind_phys
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Cldprop(i)%cv
requested     cnvc90_run
physics set   physics
```

fraction_of_grid_box_with_subgrid_orography_higher_than_critical_height

```
long_name     frac.  of grid box with by subgrid orography higher than critical height
units         frac
rank          2
type          real
kind          kind_phys
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Interstitial(i)%clx
requested     gwdps_pre_run
              gwdps_run
physics set   physics
```

free_convection_layer_thickness

long_name	thickness of free convection layer (FCL)
units	m
rank	1
type	real
kind	kind_phys
source	MODULE gmtb_scm_type_defs TYPE physics_type
local_name	physics%Sfcprop(i)%d_conv
requested	sfc_nst_run
physics set	physics

frequency_for_longwave_radiation

long_name	frequency for longwave radiation
units	s
rank	0
type	real
kind	kind_phys
source	MODULE gmtb_scm_type_defs TYPE physics_type
local_name	physics%Model(i)%fhlwr
requested	NOT REQUESTED
physics set	

frequency_for_shortwave_radiation

long_name	frequency for shortwave radiation
units	s
rank	0
type	real
kind	kind_phys
source	MODULE gmtb_scm_type_defs TYPE physics_type
local_name	physics%Model(i)%fhswr
requested	GFS_rrtmg_setup_run
physics set	physics

gas_constant_dry_air

```
long_name    ideal gas constant for dry air
units        J kg-1 K-1
rank         0
type         real
kind         kind_phys
source       MODULE gmtb_scm_physical_constants
local_name   con_rd
requested    gfdl_cloud_microphys_run
             gmtb_scm_sfc_flux_spec_run
             gwdc_run
             gwdps_run
             samfdeepcnv_run
             samfshalcnv_run
physics set  physics
```

gas_constant_water_vapor

```
long_name    ideal gas constant for water vapor
units        J kg-1 K-1
rank         0
type         real
kind         kind_phys
source       MODULE gmtb_scm_physical_constants
local_name   con_rv
requested    gwdps_run
             samfdeepcnv_run
             samfshalcnv_run
physics set  physics
```

geopotential

```
long_name     geopotential at model layer centers
units         m2 s-2
rank          2
type          real
kind          kind_phys
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Statein(i)%phil
requested     GFS_surface_generic_pre_run
              get_phi_fv3_run
              gwdps_run
              hedmf_run
              samfdeepcnv_run
              samfshalcnv_run
physics set   physics
```

geopotential_at_interface

```
long_name     geopotential at model layer interfaces
units         m2 s-2
rank          2
type          real
kind          kind_phys
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Statein(i)%phii
requested     GFS_MP_generic_post_run
              get_phi_fv3_run
              get_prs_fv3_run
              gfdl_cloud_microphys_run
              gwdps_run
              hedmf_run
physics set   physics
```

geopotential_difference_between_midlayers_divided_by_midlayer_virtual_temperature

```
    long_name    difference between mid-layer geopotentials divided by mid-layer virtual temperature
    units        m2 s-2 K-1
    rank         2
    type         real
    kind         kind_phys
    source       MODULE gmtb_scm_type_defs TYPE physics_type
    local_name   physics%Interstitial(i)%del_gz
    requested    get_phi_fv3_run
                 get_prs_fv3_run
    physics set  physics
```

graupel_mixing_ratio

```
    long_name    moist (dry+vapor, no condensates) mixing ratio of graupel
    units        kg kg-1
    rank         2
    type         real
    kind         kind_phys
    source       MODULE gmtb_scm_type_defs TYPE physics_type
    local_name   physics%Statein(i)%qgrs(:,:,scm_state%graupel_index)
    requested    GFS_PBL_generic_pre_run
    physics set  physics
```

graupel_mixing_ratio_updated_by_physics

```
    long_name    moist (dry+vapor, no condensates) mixing ratio of graupel updated by physics
    units        kg kg-1
    rank         2
    type         real
    kind         kind_phys
    source       MODULE gmtb_scm_type_defs TYPE physics_type
    local_name   physics%Stateout(i)%gq0(:,:,scm_state%graupel_index)
    requested    gfdl_cloud_microphys_run
    physics set  physics
```

graupel_number_concentration

```
long_name     number concentration of graupel
units         kg-1
rank          2
type          real
kind          kind_phys
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Statein(i)%qgrs(:,:,physics%Model(i)%ntgnc)
requested     NOT REQUESTED
physics set
```

graupel_number_concentration_updated_by_physics

```
long_name     number concentration of graupel updated by physics
units         kg-1
rank          2
type          real
kind          kind_phys
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Stateout(i)%gq0(:,:,physics%Model(i)%ntgnc)
requested     NOT REQUESTED
physics set
```

gravitational_acceleration

long_name	gravitational acceleration
units	m s-2
rank	0
type	real
kind	kind_phys
source	MODULE gmtb_scm_physical_constants
local_name	con_g
requested	GFS_DCNV_generic_post_run
	GFS_MP_generic_post_run
	GFS_surface_generic_pre_run
	gfdl_cloud_microphys_run
	gmtb_scm_sfc_flux_spec_run
	gwdc_run
	gwdps_run
	samfdeepcnv_run
	samfshalcnv_run
	sfc_diag_run
physics set	physics

grid_size_related_coefficient_used_in_scale-sensitive_schemes

long_name	grid size related coefficient used in scale-sensitive schemes
units	none
rank	1
type	real
kind	kind_phys
source	MODULE gmtb_scm_type_defs TYPE physics_type
local_name	physics%Interstitial(i)%work1
requested	GFS_suite_interstitial_1_run
	GFS_suite_interstitial_3_run
	gwdc_pre_run
	zhaocarr_precpd_run
physics set	physics

grid_size_related_coefficient_used_in_scale-sensitive_schemes_complement

```
long_name      complement to work1
units          none
rank           1
type           real
kind           kind_phys
source         MODULE gmtb_scm_type_defs TYPE physics_type
local_name     physics%Interstitial(i)%work2
requested      GFS_suite_interstitial_1_run
               GFS_suite_interstitial_3_run
               gwdc_pre_run
physics set    physics
```

h2o_forcing

```
long_name      water forcing data
units          various
rank           3
type           real
kind           kind_phys
source         MODULE gmtb_scm_type_defs TYPE physics_type
local_name     physics%Tbd(i)%h2opl
requested      h2ophys_run
physics set    physics
```

h2o_forcing_from_host

```
long_name      h2o forcing data from host
units          various
rank           4
type           real
kind           kind_phys
source         MODULE gmtb_scm_type_defs TYPE physics_type
local_name     physics%h2o_forcing_in
requested      NOT REQUESTED
physics set
```

height_above_ground_at_lowest_model_layer

```
long_name      layer 1 height
units          m
rank           1
type           real
kind           kind_phys
source         MODULE gmtb_scm_type_defs TYPE physics_type
local_name     physics%Diag(i)%zlvl
requested      GFS_surface_generic_pre_run
               gmtb_scm_sfc_flux_spec_run
               lsm_noah_run
               sfc_ex_coef_run
physics set    physics
```

horizontal_block_size

```
long_name    for explicit data blocking:  block sizes of all blocks
units        count
rank         1
type         integer
kind
source       MODULE gmtb_scm_type_defs TYPE physics_type
local_name   physics%Model(i)%blksz
requested    NOT REQUESTED
physics set
```

horizontal_dimension

long_name	horizontal dimension
units	count
rank	0
type	integer
kind	
source	MODULE gmtb_scm_type_defs TYPE physics_type
local_name	physics%Interstitial(i)%ix
requested	GFS_MP_generic_post_run
	cnvc90_run
	dcyc2t3_run
	get_phi_fv3_run
	get_prs_fv3_run
	gwdc_run
	gwdps_run
	h2ophys_run
	hedmf_run
	ozphys_run
	rayleigh_damp_run
	samfdeepcnv_run
	samfshalcnv_run
	zhaocarr_gscond_run
	zhaocarr_precpd_run
physics set	physics

horizontal_index_of_printed_column

long_name	horizontal index of printed column
units	index
rank	0
type	integer
kind	
source	MODULE gmtb_scm_type_defs TYPE physics_type
local_name	physics%Interstitial(i)%ipr
requested	gwdc_run
	gwdps_run
	hedmf_run
	sfc_nst_run
	sfc_sice_run
	zhaocarr_gscond_run
	zhaocarr_precpd_run
physics set	physics

horizontal_loop_extent

long_name	horizontal loop extent
units	count
rank	0
type	integer
kind	
source	MODULE gmtb_scm_type_defs TYPE physics_type
local_name	physics%Interstitial(i)%im
requested	GFS_DCNV_generic_post_run
	GFS_DCNV_generic_pre_run
	GFS_MP_generic_post_run
	GFS_MP_generic_pre_run
	GFS_PBL_generic_post_run
	GFS_PBL_generic_pre_run
	GFS_SCNV_generic_post_run
	GFS_SCNV_generic_pre_run
	GFS_rrtmg_post_run
	GFS_rrtmg_pre_run
	GFS_rrtmg_setup_init
	GFS_suite_interstitial_3_run
	GFS_suite_interstitial_4_run
	GFS_suite_stateout_reset_run
	GFS_suite_stateout_update_run
	GFS_surface_generic_post_run
	GFS_surface_generic_pre_run
	GFS_surface_loop_control_part1_run
	GFS_surface_loop_control_part2_run
	cnvc90_run
	dcyc2t3_post_run
	dcyc2t3_run
	gfdl_cloud_microphys_run
	gwdc_post_run
	gwdc_pre_run
	gwdc_run
	gwdps_pre_run
	gwdps_run
	h2ophys_run
	hedmf_run
	lsm_noah_post_run

ice_friendly_aerosol_number_concentration

```
long_name     number concentration of ice-friendly aerosols
units         kg-1
rank          2
type          real
kind          kind_phys
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Statein(i)%qgrs(:,:,physics%Model(i)%ntia)
requested     GFS_PBL_generic_pre_run
physics set   physics
```

ice_friendly_aerosol_number_concentration_updated_by_physics

```
long_name     number concentration of ice-friendly aerosols updated by physics
units         kg-1
rank          2
type          real
kind          kind_phys
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Stateout(i)%gq0(:,:,physics%Model(i)%ntia)
requested     NOT REQUESTED
physics set
```

ice_number_concentration

```
long_name     number concentration of ice
units         kg-1
rank          2
type          real
kind          kind_phys
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Statein(i)%qgrs(:,:,physics%Model(i)%ntinc)
requested     GFS_PBL_generic_pre_run
physics set   physics
```

ice_number_concentration_updated_by_physics

    long_name   number concentration of ice updated by physics
    units   kg-1
    rank   2
    type   real
    kind   kind_phys
    source   MODULE gmtb_scm_type_defs TYPE physics_type
    local_name   physics%Stateout(i)%gq0(:,:,physics%Model(i)%ntinc)
    requested   NOT REQUESTED
    physics set

ice_water_mixing_ratio

    long_name   moist (dry+vapor, no condensates) mixing ratio of ice water
    units   kg kg-1
    rank   2
    type   real
    kind   kind_phys
    source   MODULE gmtb_scm_type_defs TYPE physics_type
    local_name   physics%Statein(i)%qgrs(:,:,scm_state%cloud_ice_index)
    requested   GFS_PBL_generic_pre_run
    physics set physics

ice_water_mixing_ratio_updated_by_physics

    long_name   moist (dry+vapor, no condensates) mixing ratio of ice water updated by physics
    units   kg kg-1
    rank   2
    type   real
    kind   kind_phys
    source   MODULE gmtb_scm_type_defs TYPE physics_type
    local_name   physics%Stateout(i)%gq0(:,:,scm_state%cloud_ice_index)
    requested   gfdl_cloud_microphys_run
    physics set physics

index_for_cloud_amount

```
long_name    tracer index for cloud amount integer
units        index
rank         0
type         integer
kind
source       MODULE gmtb_scm_type_defs TYPE physics_type
local_name   physics%Model(i)%ntclamt
requested    GFS_suite_interstitial_3_run
             GFS_suite_interstitial_4_run
physics set  physics
```

index_for_graupel

```
long_name    tracer index for graupel
units        index
rank         0
type         integer
kind
source       MODULE gmtb_scm_type_defs TYPE physics_type
local_name   physics%Model(i)%ntgl
requested    GFS_suite_interstitial_3_run
             GFS_suite_interstitial_4_run
physics set  physics
```

index_for_graupel_number_concentration

```
long_name    tracer index for graupel number concentration
units        index
rank         0
type         integer
kind
source       MODULE gmtb_scm_type_defs TYPE physics_type
local_name   physics%Model(i)%ntgnc
requested    GFS_suite_interstitial_3_run
             GFS_suite_interstitial_4_run
physics set  physics
```

index_for_ice_cloud_condensate

```
long_name    tracer index for ice water
units        index
rank         0
type         integer
kind
source       MODULE gmtb_scm_type_defs TYPE physics_type
local_name   physics%Model(i)%ntiw
requested    GFS_suite_interstitial_3_run
             GFS_suite_interstitial_4_run
physics set  physics
```

index_for_ice_cloud_number_concentration

```
long_name    tracer index for ice number concentration
units        index
rank         0
type         integer
kind
source       MODULE gmtb_scm_type_defs TYPE physics_type
local_name   physics%Model(i)%ntinc
requested    GFS_suite_interstitial_4_run
physics set  physics
```

index_for_liquid_cloud_condensate

```
long_name     tracer index for cloud condensate (or liquid water)
units         index
rank          0
type          integer
kind
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Model(i)%ntcw
requested     GFS_MP_generic_post_run
              GFS_MP_generic_pre_run
              GFS_rrtmg_setup_init
              GFS_suite_interstitial_3_run
              GFS_suite_interstitial_4_run
              hedmf_run
physics set   physics
```

index_for_liquid_cloud_number_concentration

```
long_name     tracer index for liquid number concentration
units         index
rank          0
type          integer
kind
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Model(i)%ntlnc
requested     GFS_suite_interstitial_4_run
physics set   physics
```

index_for_ozone

```
long_name     tracer index for ozone mixing ratio
units         index
rank          0
type          integer
kind
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Model(i)%ntoz
requested     GFS_PBL_generic_post_run
              GFS_rrtmg_setup_init
physics set   physics
```

index_for_rain_number_concentration

```
long_name     tracer index for rain number concentration
units         index
rank          0
type          integer
kind
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Model(i)%ntrnc
requested     GFS_suite_interstitial_3_run
              GFS_suite_interstitial_4_run
physics set   physics
```

index_for_rain_water

```
long_name     tracer index for rain water
units         index
rank          0
type          integer
kind
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Model(i)%ntrw
requested     GFS_suite_interstitial_3_run
              GFS_suite_interstitial_4_run
physics set   physics
```

index_for_snow_number_concentration

```
long_name     tracer index for snow number concentration
units         index
rank          0
type          integer
kind
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Model(i)%ntsnc
requested     GFS_suite_interstitial_3_run
              GFS_suite_interstitial_4_run
physics set   physics
```

index_for_snow_water

long_name	tracer index for snow water
units	index
rank	0
type	integer
kind	
source	MODULE gmtb_scm_type_defs TYPE physics_type
local_name	physics%Model(i)%ntsw
requested	GFS_suite_interstitial_3_run
	GFS_suite_interstitial_4_run
physics set	physics

index_of_TKE_convective_transport_tracer

long_name	index of TKE in the convectively transported tracer array
units	index
rank	0
type	integer
kind	
source	MODULE gmtb_scm_type_defs TYPE physics_type
local_name	physics%Interstitial(i)%ntk
requested	samfdeepcnv_run
	samfshalcnv_run
physics set	physics

index_of_dtlm_start

long_name	index to start dtlm run or not
units	index
rank	1
type	real
kind	kind_phys
source	MODULE gmtb_scm_type_defs TYPE physics_type
local_name	physics%Sfcprop(i)%ifd
requested	sfc_nst_run
physics set	physics

index_of_highest_temperature_inversion
```
long_name     index of highest temperature inversion
units         index
rank          1
type          integer
kind
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Interstitial(i)%kinver
requested     hedmf_run
physics set   physics
```

index_of_time_step
```
long_name     current forecast iteration
units         index
rank          0
type          integer
kind
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Model(i)%kdt
requested     GFS_MP_generic_post_run
              gwdps_run
              sfc_nst_run
physics set   physics
```

instantaneous_atmosphere_detrainment_convective_mass_flux
```
    long_name    (detrainment mass flux) * delt
    units        kg m-2
    rank         2
    type         real
    kind         kind_phys
    source       MODULE gmtb_scm_type_defs TYPE physics_type
    local_name   physics%Interstitial(i)%dt_mf
    requested    GFS_DCNV_generic_post_run
                 samfdeepcnv_run
                 samfshalcnv_run
    physics set  physics
```

instantaneous_atmosphere_detrainment_convective_mass_flux_on_dynamics_timestep
```
    long_name    (detrainment mass flux) * delt
    units        kg m-2
    rank         2
    type         real
    kind         kind_phys
    source       MODULE gmtb_scm_type_defs TYPE physics_type
    local_name   physics%Coupling(i)%det_mfi
    requested    GFS_DCNV_generic_post_run
    physics set  physics
```

instantaneous_atmosphere_downdraft_convective_mass_flux

```
    long_name      (downdraft mass flux) * delt
    units          kg m-2
    rank           2
    type           real
    kind           kind_phys
    source         MODULE gmtb_scm_type_defs TYPE physics_type
    local_name     physics%Interstitial(i)%dd_mf
    requested      GFS_DCNV_generic_post_run
                   samfdeepcnv_run
    physics set    physics
```

instantaneous_atmosphere_downdraft_convective_mass_flux_on_dynamics_timestep

```
    long_name      (downdraft mass flux) * delt
    units          kg m-2
    rank           2
    type           real
    kind           kind_phys
    source         MODULE gmtb_scm_type_defs TYPE physics_type
    local_name     physics%Coupling(i)%dwn_mfi
    requested      GFS_DCNV_generic_post_run
    physics set    physics
```

instantaneous_atmosphere_heat_diffusivity

```
    long_name      instantaneous atmospheric heat diffusivity
    units          m2 s-1
    rank           2
    type           real
    kind           kind_phys
    source         MODULE gmtb_scm_type_defs TYPE physics_type
    local_name     physics%Coupling(i)%dkt
    requested      NOT REQUESTED
    physics set
```

instantaneous_atmosphere_updraft_convective_mass_flux

```
long_name     (updraft mass flux) * delt
units         kg m-2
rank          2
type          real
kind          kind_phys
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Interstitial(i)%ud_mf
requested     GFS_DCNV_generic_post_run
              samfdeepcnv_run
              samfshalcnv_run
physics set   physics
```

instantaneous_atmosphere_updraft_convective_mass_flux_on_dynamics_timestep

```
long_name     (updraft mass flux) * delt
units         kg m-2
rank          2
type          real
kind          kind_phys
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Coupling(i)%upd_mfi
requested     GFS_DCNV_generic_post_run
physics set   physics
```

instantaneous_cosine_of_zenith_angle

long_name	cosine of zenith angle at current time
units	none
rank	1
type	real
kind	kind_phys
source	MODULE gmtb_scm_type_defs TYPE physics_type
local_name	physics%Interstitial(i)%xcosz
requested	GFS_suite_interstitial_2_run
	GFS_surface_generic_post_run
	dcyc2t3_run
	sfc_nst_run
physics set	physics

instantaneous_deep_convective_cloud_condensate_mixing_ratio_on_dynamics_time_step

long_name	instantaneous total convective condensate mixing ratio
units	kg kg-1
rank	2
type	real
kind	kind_phys
source	MODULE gmtb_scm_type_defs TYPE physics_type
local_name	physics%Coupling(i)%cnvqci
requested	GFS_DCNV_generic_post_run
physics set	physics

instantaneous_specific_humidity_at_2m_for_coupling

```
long_name      instantaneous Q2m
units          kg kg-1
rank           1
type           real
kind           kind_phys
source         MODULE gmtb_scm_type_defs TYPE physics_type
local_name     physics%Coupling(i)%q2mi_cpl
requested      GFS_surface_generic_post_run
physics set    physics
```

instantaneous_surface_air_pressure_for_coupling

```
long_name      instantaneous sfc pressure
units          Pa
rank           1
type           real
kind           kind_phys
source         MODULE gmtb_scm_type_defs TYPE physics_type
local_name     physics%Coupling(i)%psurfi_cpl
requested      GFS_surface_generic_post_run
physics set    physics
```

instantaneous_surface_downwelling_diffuse_near_infrared_shortwave_flux_for_coupling

```
long_name      instantaneous sfc nir diff downward sw flux
units          W m-2
rank           1
type           real
kind           kind_phys
source         MODULE gmtb_scm_type_defs TYPE physics_type
local_name     physics%Coupling(i)%dnirdfi_cpl
requested      GFS_surface_generic_post_run
physics set    physics
```

instantaneous_surface_downwelling_diffuse_ultraviolet_and_visible_shortwave_flux_for_coupling

```
long_name      instantaneous sfc uv+vis diff downward sw flux
units          W m-2
rank           1
type           real
kind           kind_phys
source         MODULE gmtb_scm_type_defs TYPE physics_type
local_name     physics%Coupling(i)%dvisdfi_cpl
requested      GFS_surface_generic_post_run
physics set    physics
```

instantaneous_surface_downwelling_direct_near_infrared_shortwave_flux_for_coupling

```
long_name      instantaneous sfc nir beam downward sw flux
units          W m-2
rank           1
type           real
kind           kind_phys
source         MODULE gmtb_scm_type_defs TYPE physics_type
local_name     physics%Coupling(i)%dnirbmi_cpl
requested      GFS_surface_generic_post_run
physics set    physics
```

instantaneous_surface_downwelling_direct_ultraviolet_and_visible_shortwave_flux_for_coupling

```
long_name      instantaneous sfc uv+vis beam downward sw flux
units          W m-2
rank           1
type           real
kind           kind_phys
source         MODULE gmtb_scm_type_defs TYPE physics_type
local_name     physics%Coupling(i)%dvisbmi_cpl
requested      GFS_surface_generic_post_run
physics set    physics
```

instantaneous_surface_downwelling_longwave_flux_for_coupling

```
long_name      instantaneous sfc downward lw flux
units          W m-2
rank           1
type           real
kind           kind_phys
source         MODULE gmtb_scm_type_defs TYPE physics_type
local_name     physics%Coupling(i)%dlwsfci_cpl
requested      GFS_surface_generic_post_run
physics set    physics
```

instantaneous_surface_downwelling_shortwave_flux_for_coupling

```
long_name      instantaneous sfc downward sw flux
units          W m-2
rank           1
type           real
kind           kind_phys
source         MODULE gmtb_scm_type_defs TYPE physics_type
local_name     physics%Coupling(i)%dswsfci_cpl
requested      GFS_surface_generic_post_run
physics set    physics
```

instantaneous_surface_ground_heat_flux

```
long_name      instantaneous sfc ground heat flux
units          W m-2
rank           1
type           real
kind           kind_phys
source         MODULE gmtb_scm_type_defs TYPE physics_type
local_name     physics%Diag(i)%gfluxi
requested      GFS_surface_generic_post_run
physics set    physics
```

instantaneous_surface_net_downward_diffuse_near_infrared_shortwave_flux_for_coupling

```
long_name     instantaneous net nir diff sfc downward sw flux
units         W m-2
rank          1
type          real
kind          kind_phys
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Coupling(i)%nnirdfi_cpl
requested     GFS_surface_generic_post_run
physics set   physics
```

instantaneous_surface_net_downward_diffuse_ultraviolet_and_visible_shortwave_flux_for_coupling

```
long_name     instantaneous net uv+vis diff downward sw flux
units         W m-2
rank          1
type          real
kind          kind_phys
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Coupling(i)%nvisdfi_cpl
requested     GFS_surface_generic_post_run
physics set   physics
```

instantaneous_surface_net_downward_direct_near_infrared_shortwave_flux_for_coupling

```
long_name     instantaneous net nir beam sfc downward sw flux
units         W m-2
rank          1
type          real
kind          kind_phys
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Coupling(i)%nnirbmi_cpl
requested     GFS_surface_generic_post_run
physics set   physics
```

instantaneous_surface_net_downward_direct_ultraviolet_and_visible_shortwave_flux_for_coupling

```
long_name      instantaneous net uv+vis beam downward sw flux
units          W m-2
rank           1
type           real
kind           kind_phys
source         MODULE gmtb_scm_type_defs TYPE physics_type
local_name     physics%Coupling(i)%nvisbmi_cpl
requested      GFS_surface_generic_post_run
physics set    physics
```

instantaneous_surface_net_downward_longwave_flux_for_coupling

```
long_name      instantaneous net sfc downward lw flux
units          W m-2
rank           1
type           real
kind           kind_phys
source         MODULE gmtb_scm_type_defs TYPE physics_type
local_name     physics%Coupling(i)%nlwsfci_cpl
requested      GFS_surface_generic_post_run
physics set    physics
```

instantaneous_surface_net_downward_shortwave_flux_for_coupling

```
long_name      instantaneous net sfc downward sw flux
units          W m-2
rank           1
type           real
kind           kind_phys
source         MODULE gmtb_scm_type_defs TYPE physics_type
local_name     physics%Coupling(i)%nswsfci_cpl
requested      GFS_surface_generic_post_run
physics set    physics
```

instantaneous_surface_potential_evaporation

long_name	instantaneous sfc potential evaporation
units	W m-2
rank	1
type	real
kind	kind_phys
source	MODULE gmtb_scm_type_defs TYPE physics_type
local_name	physics%Diag(i)%epi
requested	GFS_surface_generic_post_run
physics set	physics

instantaneous_surface_skin_temperature_for_coupling

long_name	instantaneous sfc temperature
units	K
rank	1
type	real
kind	kind_phys
source	MODULE gmtb_scm_type_defs TYPE physics_type
local_name	physics%Coupling(i)%tsfci_cpl
requested	GFS_surface_generic_post_run
physics set	physics

instantaneous_surface_upward_latent_heat_flux

long_name	surface upward latent heat flux
units	W m-2
rank	1
type	real
kind	kind_phys
source	MODULE gmtb_scm_type_defs TYPE physics_type
local_name	physics%Interstitial(i)%dqsfc1
requested	GFS_PBL_generic_post_run
	hedmf_run
physics set	physics

instantaneous_surface_upward_latent_heat_flux_for_coupling

```
long_name     instantaneous sfc latent heat flux
units         W m-2
rank          1
type          real
kind          kind_phys
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Coupling(i)%dqsfci_cpl
requested     GFS_PBL_generic_post_run
physics set   physics
```

instantaneous_surface_upward_latent_heat_flux_for_diag

```
long_name     instantaneous sfc latent heat flux multiplied by timestep
units         W m-2
rank          1
type          real
kind          kind_phys
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Diag(i)%dqsfci
requested     GFS_PBL_generic_post_run
physics set   physics
```

instantaneous_surface_upward_sensible_heat_flux

```
long_name     surface upward sensible heat flux
units         W m-2
rank          1
type          real
kind          kind_phys
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Interstitial(i)%dtsfc1
requested     GFS_PBL_generic_post_run
              hedmf_run
physics set   physics
```

instantaneous_surface_upward_sensible_heat_flux_for_coupling

```
long_name      instantaneous sfc sensible heat flux
units          W m-2
rank           1
type           real
kind           kind_phys
source         MODULE gmtb_scm_type_defs TYPE physics_type
local_name     physics%Coupling(i)%dtsfci_cpl
requested      GFS_PBL_generic_post_run
physics set  physics
```

instantaneous_surface_upward_sensible_heat_flux_for_diag

```
long_name      instantaneous sfc sensible heat flux multiplied by timestep
units          W m-2
rank           1
type           real
kind           kind_phys
source         MODULE gmtb_scm_type_defs TYPE physics_type
local_name     physics%Diag(i)%dtsfci
requested      GFS_PBL_generic_post_run
physics set  physics
```

instantaneous_surface_x_momentum_flux

```
long_name      x momentum flux
units          Pa
rank           1
type           real
kind           kind_phys
source         MODULE gmtb_scm_type_defs TYPE physics_type
local_name     physics%Interstitial(i)%dusfc1
requested      GFS_PBL_generic_post_run
               hedmf_run
physics set  physics
```

instantaneous_surface_x_momentum_flux_for_coupling
```
    long_name    instantaneous sfc x momentum flux
    units        Pa
    rank         1
    type         real
    kind         kind_phys
    source       MODULE gmtb_scm_type_defs TYPE physics_type
    local_name   physics%Coupling(i)%dusfci_cpl
    requested    GFS_PBL_generic_post_run
    physics set  physics
```

instantaneous_surface_x_momentum_flux_for_diag
```
    long_name    instantaneous sfc x momentum flux multiplied by timestep
    units        Pa
    rank         1
    type         real
    kind         kind_phys
    source       MODULE gmtb_scm_type_defs TYPE physics_type
    local_name   physics%Diag(i)%dusfci
    requested    GFS_PBL_generic_post_run
    physics set  physics
```

instantaneous_surface_y_momentum_flux
```
    long_name    y momentum flux
    units        Pa
    rank         1
    type         real
    kind         kind_phys
    source       MODULE gmtb_scm_type_defs TYPE physics_type
    local_name   physics%Interstitial(i)%dvsfc1
    requested    GFS_PBL_generic_post_run
                 hedmf_run
    physics set  physics
```

instantaneous_surface_y_momentum_flux_for_coupling

```
    long_name     instantaneous sfc y momentum flux
    units         Pa
    rank          1
    type          real
    kind          kind_phys
    source        MODULE gmtb_scm_type_defs TYPE physics_type
    local_name    physics%Coupling(i)%dvsfci_cpl
    requested     GFS_PBL_generic_post_run
    physics set   physics
```

instantaneous_surface_y_momentum_flux_for_diag

```
    long_name     instantaneous sfc y momentum flux multiplied by timestep
    units         Pa
    rank          1
    type          real
    kind          kind_phys
    source        MODULE gmtb_scm_type_defs TYPE physics_type
    local_name    physics%Diag(i)%dvsfci
    requested     GFS_PBL_generic_post_run
    physics set   physics
```

instantaneous_temperature_at_2m_for_coupling

```
    long_name     instantaneous T2m
    units         K
    rank          1
    type          real
    kind          kind_phys
    source        MODULE gmtb_scm_type_defs TYPE physics_type
    local_name    physics%Coupling(i)%t2mi_cpl
    requested     GFS_surface_generic_post_run
    physics set   physics
```

instantaneous_upward_sensible_heat_flux
```
long_name      instantaneous upward sensible heat flux
units          W m-2
rank           1
type           real
kind           kind_phys
source         MODULE gmtb_scm_type_defs TYPE physics_type
local_name     physics%Coupling(i)%ushfsfci
requested      NOT REQUESTED
physics set
```

instantaneous_water_vapor_specific_humidity_tendency_due_to_convection
```
long_name      instantaneous moisture tendency due to convection
units          kg kg-1 s-1
rank           2
type           real
kind           kind_phys
source         MODULE gmtb_scm_type_defs TYPE physics_type
local_name     physics%Coupling(i)%dqdti
requested      GFS_DCNV_generic_post_run
               GFS_SCNV_generic_post_run
               GFS_suite_interstitial_4_run
physics set    physics
```

instantaneous_x_stress_due_to_gravity_wave_drag

```
long_name      zonal surface stress due to orographic gravity wave drag
units          Pa
rank           1
type           real
kind           kind_phys
source         MODULE gmtb_scm_type_defs TYPE physics_type
local_name     physics%Interstitial(i)%dusfcg
requested      gwdc_post_run
               gwdc_run
               gwdps_post_run
               gwdps_run
physics set    physics
```

instantaneous_x_wind_at_10m_for_coupling

```
long_name      instantaneous U10m
units          m s-1
rank           1
type           real
kind           kind_phys
source         MODULE gmtb_scm_type_defs TYPE physics_type
local_name     physics%Coupling(i)%u10mi_cpl
requested      GFS_surface_generic_post_run
physics set    physics
```

instantaneous_y_stress_due_to_gravity_wave_drag

      long_name   meridional surface stress due to orographic gravity wave drag
      units   Pa
      rank   1
      type   real
      kind   kind_phys
      source   MODULE gmtb_scm_type_defs TYPE physics_type
      local_name   physics%Interstitial(i)%dvsfcg
      requested   gwdc_post_run
                     gwdc_run
                     gwdps_post_run
                     gwdps_run
      physics set physics

instantaneous_y_wind_at_10m_for_coupling

      long_name   instantaneous V10m
      units   m s-1
      rank   1
      type   real
      kind   kind_phys
      source   MODULE gmtb_scm_type_defs TYPE physics_type
      local_name   physics%Coupling(i)%v10mi_cpl
      requested   GFS_surface_generic_post_run
      physics set physics

inverse_scaling_factor_for_critical_relative_humidity

    long_name   inverse scaling factor for critical relative humidity
    units   rad2 m-2
    rank   0
    type   real
    kind   kind_phys
    source   MODULE gmtb_scm_type_defs TYPE physics_type
    local_name   physics%Model(i)%dxinv
    requested   GFS_suite_interstitial_1_run
    physics set   physics

iounit_log

    long_name   fortran unit number for logfile
    units   none
    rank   0
    type   integer
    kind
    source   MODULE gmtb_scm_type_defs TYPE physics_type
    local_name   physics%Model(i)%logunit
    requested   gfdl_cloud_microphys_init
    physics set   physics

iounit_namelist

    long_name   fortran unit number for file opens
    units   none
    rank   0
    type   integer
    kind
    source   MODULE gmtb_scm_type_defs TYPE physics_type
    local_name   physics%Model(i)%nlunit
    requested   gfdl_cloud_microphys_init
                  lsm_noah_init
    physics set   physics

iteration_number
```
    long_name    number of iteration
    units        index
    rank         0
    type         integer
    kind
    source       MODULE gmtb_scm_type_defs TYPE physics_type
    local_name   physics%Interstitial(i)%iter
    requested    NOT REQUESTED
    physics set
```

kinematic_surface_upward_latent_heat_flux
```
    long_name    kinematic surface upward latent heat flux
    units        kg kg-1 m s-1
    rank         1
    type         real
    kind         kind_phys
    source       MODULE gmtb_scm_type_defs TYPE physics_type
    local_name   physics%Interstitial(i)%evap
    requested    gmtb_scm_sfc_flux_spec_run
                 hedmf_run
                 lsm_noah_run
                 sfc_diag_run
                 sfc_nst_run
                 sfc_sice_run
    physics set  physics
```

kinematic_surface_upward_sensible_heat_flux

```
long_name      kinematic surface upward sensible heat flux
units          K m s-1
rank           1
type           real
kind           kind_phys
source         MODULE gmtb_scm_type_defs TYPE physics_type
local_name     physics%Interstitial(i)%hflx
requested      gmtb_scm_sfc_flux_spec_run
               hedmf_run
               lsm_noah_run
               sfc_nst_run
               sfc_sice_run
physics set    physics
```

lake_mask_real

```
long_name      lake mask:  non-lake/lake=0/1
units          flag
rank           1
type           real
kind           kind_phys
source         MODULE gmtb_scm_type_defs TYPE physics_type
local_name     physics%Sfcprop(i)%lakemsk
requested      NOT REQUESTED
physics set
```

land_area_fraction

long_name	land area fraction
units	frac
rank	1
type	real
kind	kind_phys
source	MODULE gmtb_scm_type_defs TYPE physics_type
local_name	physics%Interstitial(i)%frland
requested	GFS_suite_interstitial_1_run
	gfdl_cloud_microphys_run
physics set	physics

largest_cloud_top_vertical_index_encountered_thus_far

long_name	largest cloud top vertical index encountered thus far
units	index
rank	1
type	real
kind	kind_phys
source	MODULE gmtb_scm_type_defs TYPE physics_type
local_name	physics%Tbd(i)%acvt
requested	cnvc90_run
physics set	physics

latent_heat_of_vaporization_of_water_at_0C

long_name	latent heat of evaporation/sublimation
units	J kg-1
rank	0
type	real
kind	kind_phys
source	MODULE gmtb_scm_physical_constants
local_name	con_hvap
requested	gmtb_scm_sfc_flux_spec_run
	samfdeepcnv_run
	samfshalcnv_run
physics set	physics

latitude

long_name	grid latitude in radians
units	radians
rank	1
type	real
kind	kind_phys
source	MODULE gmtb_scm_type_defs TYPE physics_type
local_name	physics%Grid(i)%xlat
requested	GFS_MP_generic_post_run
physics set	physics

latitude_index_in_debug_printouts

long_name	latitude index in debug printouts
units	index
rank	0
type	integer
kind	
source	MODULE gmtb_scm_type_defs TYPE physics_type
local_name	physics%Interstitial(i)%latidxprnt
requested	gwdc_run
physics set	physics

latitude_of_h2o_forcing_data_from_host

```
long_name     latitude value of the h2o forcing data coming from host
units         degree
rank          1
type          real
kind          kind_phys
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%h2o_lat
requested     NOT REQUESTED
physics set
```

latitude_of_ozone_forcing_data_from_host

```
long_name     latitude value of the ozone forcing data coming from host
units         degree
rank          1
type          real
kind          kind_phys
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%ozone_lat
requested     NOT REQUESTED
physics set
```

level_of_dividing_streamline

```
long_name     level of the dividing streamline
units         none
rank          1
type          real
kind          kind_phys
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Diag(i)%zmtnblck
requested     gwdps_run
physics set   physics
```

longitude

long_name	grid longitude in radians
units	radians
rank	1
type	real
kind	kind_phys
source	MODULE gmtb_scm_type_defs TYPE physics_type
local_name	physics%Grid(i)%xlon
requested	GFS_MP_generic_post_run
	dcyc2t3_run
	sfc_nst_post_run
	sfc_nst_run
physics set	physics

lw_fluxes_sfc

long_name	lw radiation fluxes at sfc
units	W m-2
rank	1
type	sfcflw_type
kind	
source	MODULE gmtb_scm_type_defs TYPE physics_type
local_name	physics%Radtend(i)%sfcflw
requested	rrtmg_lw_run
physics set	physics

lw_fluxes_top_atmosphere

```
long_name     lw radiation fluxes at top
units         W m-2
rank          1
type          topflw_type
kind
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Diag(i)%topflw
requested     rrtmg_lw_run
physics set   physics
```

lwe_thickness_of_convective_precipitation_amount_for_coupling

```
long_name     total convective precipitation
units         m
rank          1
type          real
kind          kind_phys
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Coupling(i)%rainc_cpl
requested     GFS_MP_generic_post_run
physics set   physics
```

lwe_thickness_of_convective_precipitation_amount_on_dynamics_timestep

```
long_name     convective rain at this time step
units         m
rank          1
type          real
kind          kind_phys
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Diag(i)%rainc
requested     GFS_DCNV_generic_post_run
              GFS_MP_generic_post_run
              cnvc90_run
              samfshalcnv_post_run
physics set   physics
```

lwe_thickness_of_deep_convective_precipitation_amount

```
long_name     deep convective rainfall amount on physics timestep
units         m
rank          1
type          real
kind          kind_phys
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Interstitial(i)%raincd
requested     GFS_DCNV_generic_post_run
              samfdeepcnv_run
physics set   physics
```

lwe_thickness_of_explicit_precipitation_amount

long_name	explicit precipitation (rain, ice, snow, graupel, ...) on physics timestep
units	m
rank	1
type	real
kind	kind_phys
source	MODULE gmtb_scm_type_defs TYPE physics_type
local_name	physics%Interstitial(i)%prcpmp
requested	GFS_MP_generic_post_run
	gfdl_cloud_microphys_run
	zhaocarr_precpd_run
physics set	physics

lwe_thickness_of_explicit_rain_amount

long_name	explicit rain on physics timestep
units	m
rank	1
type	real
kind	kind_phys
source	MODULE gmtb_scm_type_defs TYPE physics_type
local_name	physics%Interstitial(i)%rainmp
requested	gfdl_cloud_microphys_run
physics set	physics

lwe_thickness_of_graupel_amount
```
    long_name      explicit graupel fall on physics timestep
    units          m
    rank           1
    type           real
    kind           kind_phys
    source         MODULE gmtb_scm_type_defs TYPE physics_type
    local_name     physics%Interstitial(i)%graupelmp
    requested      GFS_MP_generic_post_run
                   gfdl_cloud_microphys_run
    physics set    physics
```

lwe_thickness_of_graupel_amount_on_dynamics_timestep
```
    long_name      graupel fall at this time step
    units          m
    rank           1
    type           real
    kind           kind_phys
    source         MODULE gmtb_scm_type_defs TYPE physics_type
    local_name     physics%Diag(i)%graupel
    requested      GFS_MP_generic_post_run
    physics set    physics
```

lwe_thickness_of_ice_amount
```
    long_name      explicit ice fall on physics timestep
    units          m
    rank           1
    type           real
    kind           kind_phys
    source         MODULE gmtb_scm_type_defs TYPE physics_type
    local_name     physics%Interstitial(i)%icemp
    requested      GFS_MP_generic_post_run
                   gfdl_cloud_microphys_run
    physics set    physics
```

lwe_thickness_of_ice_amount_on_dynamics_timestep

```
long_name     ice fall at this time step
units         m
rank          1
type          real
kind          kind_phys
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Diag(i)%ice
requested     GFS_MP_generic_post_run
physics set   physics
```

lwe_thickness_of_moist_convective_adj_precipitation_amount

```
long_name     adjusted moist convective rainfall amount on physics timestep
units         m
rank          1
type          real
kind          kind_phys
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Interstitial(i)%rainmcadj
requested     NOT REQUESTED
physics set
```

lwe_thickness_of_precipitation_amount_for_coupling

```
long_name     total rain precipitation
units         m
rank          1
type          real
kind          kind_phys
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Coupling(i)%rain_cpl
requested     GFS_MP_generic_post_run
              GFS_surface_generic_pre_run
physics set   physics
```

lwe_thickness_of_precipitation_amount_on_dynamics_timestep

```
long_name     total rain at this time step
units         m
rank          1
type          real
kind          kind_phys
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Diag(i)%rain
requested     GFS_MP_generic_post_run
physics set   physics
```

lwe_thickness_of_shallow_convective_precipitation_amount

```
long_name     shallow convective rainfall amount on physics timestep
units         m
rank          1
type          real
kind          kind_phys
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Interstitial(i)%raincs
requested     samfshalcnv_post_run
              samfshalcnv_run
physics set   physics
```

lwe_thickness_of_snow_amount

```
long_name     explicit snow fall on physics timestep
units         m
rank          1
type          real
kind          kind_phys
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Interstitial(i)%snowmp
requested     GFS_MP_generic_post_run
              gfdl_cloud_microphys_run
physics set   physics
```

lwe_thickness_of_snow_amount_for_coupling

```
long_name     total snow precipitation
units         m
rank          1
type          real
kind          kind_phys
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Coupling(i)%snow_cpl
requested     GFS_MP_generic_post_run
              GFS_surface_generic_pre_run
physics set   physics
```

lwe_thickness_of_snow_amount_on_dynamics_timestep

```
long_name     snow fall at this time step
units         m
rank          1
type          real
kind          kind_phys
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Diag(i)%snow
requested     GFS_MP_generic_post_run
physics set   physics
```

magnitude_of_perturbation_of_heat_to_momentum_roughness_length_ratio

```
long_name     magnitude of perturbation of heat to momentum roughness length ratio
units         frac
rank          1
type          real
kind          kind_phys
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Model(i)%pertzt
requested     GFS_surface_generic_pre_run
physics set   physics
```

magnitude_of_perturbation_of_leaf_area_index

```
long_name     magnitude of perturbation of leaf area index
units         frac
rank          1
type          real
kind          kind_phys
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Model(i)%pertlai
requested     GFS_surface_generic_pre_run
physics set   physics
```

magnitude_of_perturbation_of_momentum_roughness_length

```
long_name     magnitude of perturbation of momentum roughness length
units         frac
rank          1
type          real
kind          kind_phys
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Model(i)%pertz0
requested     GFS_surface_generic_pre_run
physics set   physics
```

magnitude_of_perturbation_of_soil_type_b_parameter

```
long_name     magnitude of perturbation of soil type b parameter
units         frac
rank          1
type          real
kind          kind_phys
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Model(i)%pertshc
requested     GFS_surface_generic_pre_run
physics set   physics
```

magnitude_of_perturbation_of_vegetation_fraction

```
long_name    magnitude of perturbation of vegetation fraction
units        frac
rank         1
type         real
kind         kind_phys
source       MODULE gmtb_scm_type_defs TYPE physics_type
local_name   physics%Model(i)%pertvegf
requested    GFS_surface_generic_pre_run
             lsm_noah_run
physics set  physics
```

magnitude_of_surface_albedo_perturbation

```
long_name    magnitude of surface albedo perturbation
units        frac
rank         1
type         real
kind         kind_phys
source       MODULE gmtb_scm_type_defs TYPE physics_type
local_name   physics%Model(i)%pertalb
requested    NOT REQUESTED
physics set
```

maximum_column_heating_rate

```
long_name    maximum heating rate in column
units        K s-1
rank         1
type         real
kind         kind_phys
source       MODULE gmtb_scm_type_defs TYPE physics_type
local_name   physics%Interstitial(i)%cumabs
requested    gwdc_pre_run
             gwdc_run
physics set  physics
```

maximum_critical_relative_humidity

```
long_name     maximum critical relative humidity
units         frac
rank          0
type          real
kind          kind_phys
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Model(i)%rhcmax
requested     GFS_suite_interstitial_3_run
physics set   physics
```

maximum_scaling_factor_for_critical_relative_humidity

```
long_name     maximum scaling factor for critical relative humidity
units         m2 rad-2
rank          0
type          real
kind          kind_phys
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Model(i)%dxmax
requested     NOT REQUESTED
physics set
```

maximum_specific_humidity_at_2m

```
long_name     maximum specific humidity at 2m height
units         kg kg-1
rank          1
type          real
kind          kind_phys
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Diag(i)%spfhmax
requested     sfc_diag_post_run
physics set   physics
```

maximum_subgrid_orography

long_name	maximum of subgrid orography
units	m
rank	1
type	real
kind	kind_phys
source	MODULE gmtb_scm_type_defs TYPE physics_type
local_name	physics%Interstitial(i)%elvmax
requested	gwdps_pre_run
	gwdps_run
physics set	physics

maximum_temperature_at_2m

long_name	max temperature at 2m height
units	K
rank	1
type	real
kind	kind_phys
source	MODULE gmtb_scm_type_defs TYPE physics_type
local_name	physics%Diag(i)%tmpmax
requested	sfc_diag_post_run
physics set	physics

maximum_vegetation_area_fraction

long_name	max fractional coverage of green vegetation
units	frac
rank	1
type	real
kind	kind_phys
source	MODULE gmtb_scm_type_defs TYPE physics_type
local_name	physics%Sfcprop(i)%shdmax
requested	lsm_noah_run
	sfc_ex_coef_run
physics set	physics

maximum_wind_at_10m

long_name	maximum wind speed at 10 m
units	m s-1
rank	1
type	real
kind	kind_phys
source	MODULE gmtb_scm_type_defs TYPE physics_type
local_name	physics%Diag(i)%wind10mmax
requested	sfc_diag_post_run
physics set	physics

maximum_x_wind_at_10m

long_name	maximum x wind at 10 m
units	m s-1
rank	1
type	real
kind	kind_phys
source	MODULE gmtb_scm_type_defs TYPE physics_type
local_name	physics%Diag(i)%u10mmax
requested	sfc_diag_post_run
physics set	physics

maximum_y_wind_at_10m

long_name	maximum y wind at 10 m
units	m s-1
rank	1
type	real
kind	kind_phys
source	MODULE gmtb_scm_type_defs TYPE physics_type
local_name	physics%Diag(i)%v10mmax
requested	sfc_diag_post_run
physics set	physics

mean_change_over_depth_in_sea_water_temperature

```
long_name    mean of dT(z) (zsea1 to zsea2)
units        K
rank         1
type         real
kind         kind_phys
source       MODULE gmtb_scm_type_defs TYPE physics_type
local_name   physics%Interstitial(i)%dtzm
requested    sfc_nst_post_run
physics set  physics
```

mean_effective_radius_for_ice_cloud

```
long_name    mean effective radius for ice cloud
units        micron
rank         2
type         real
kind         kind_phys
source       MODULE gmtb_scm_type_defs TYPE physics_type
local_name   physics%Interstitial(i)%clouds(:,:,5)
requested    GFS_rrtmg_pre_run
             rrtmg_lw_run
             rrtmg_sw_run
physics set  physics
```

mean_effective_radius_for_liquid_cloud

long_name	mean effective radius for liquid cloud
units	micron
rank	2
type	real
kind	kind_phys
source	MODULE gmtb_scm_type_defs TYPE physics_type
local_name	physics%Interstitial(i)%clouds(:,:,3)
requested	GFS_rrtmg_pre_run
	rrtmg_lw_run
	rrtmg_sw_run
physics set	physics

mean_effective_radius_for_rain_drop

long_name	mean effective radius for rain drop
units	micron
rank	2
type	real
kind	kind_phys
source	MODULE gmtb_scm_type_defs TYPE physics_type
local_name	physics%Interstitial(i)%clouds(:,:,7)
requested	GFS_rrtmg_pre_run
	rrtmg_lw_run
	rrtmg_sw_run
physics set	physics

mean_effective_radius_for_snow_flake

```
long_name     mean effective radius for snow flake
units         micron
rank          2
type          real
kind          kind_phys
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Interstitial(i)%clouds(:,:,9)
requested     GFS_rrtmg_pre_run
              rrtmg_lw_run
              rrtmg_sw_run
physics set   physics
```

minimum_scaling_factor_for_critical_relative_humidity

```
long_name     minimum scaling factor for critical relative humidity
units         m2 rad-2
rank          0
type          real
kind          kind_phys
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Model(i)%dxmin
requested     GFS_suite_interstitial_1_run
physics set   physics
```

minimum_specific_humidity_at_2m

```
long_name     minimum specific humidity at 2m height
units         kg kg-1
rank          1
type          real
kind          kind_phys
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Diag(i)%spfhmin
requested     sfc_diag_post_run
physics set   physics
```

minimum_temperature_at_2m

```
long_name     min temperature at 2m height
units         K
rank          1
type          real
kind          kind_phys
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Diag(i)%tmpmin
requested     sfc_diag_post_run
physics set   physics
```

minimum_vegetation_area_fraction

```
long_name     min fractional coverage of green vegetation
units         frac
rank          1
type          real
kind          kind_phys
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Sfcprop(i)%shdmin
requested     lsm_noah_run
physics set   physics
```

model_layer_number_at_cloud_base

```
long_name     vertical indices for low, middle and high cloud bases
units         index
rank          2
type          integer
kind
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Interstitial(i)%mbota
requested     GFS_rrtmg_post_run
              GFS_rrtmg_pre_run
physics set   physics
```

model_layer_number_at_cloud_top

```
long_name      vertical indices for low, middle and high cloud tops
units          index
rank           2
type           integer
kind
source         MODULE gmtb_scm_type_defs TYPE physics_type
local_name     physics%Interstitial(i)%mtopa
requested      GFS_rrtmg_post_run
               GFS_rrtmg_pre_run
physics set    physics
```

momentum_transport_reduction_factor_pgf_deep_convection

```
long_name      reduction factor in momentum transport due to deep conv.  induced pressure gradient force
units          frac
rank           0
type           real
kind           kind_phys
source         MODULE gmtb_scm_type_defs TYPE physics_type
local_name     physics%Model(i)%pgcon_deep
requested      samfdeepcnv_run
physics set    physics
```

momentum_transport_reduction_factor_pgf_shallow_convection

```
long_name      reduction factor in momentum transport due to shal conv.  induced pressure gradient force
units          frac
rank           0
type           real
kind           kind_phys
source         MODULE gmtb_scm_type_defs TYPE physics_type
local_name     physics%Model(i)%pgcon_shal
requested      samfshalcnv_run
physics set    physics
```

mpi_comm
```
    long_name     MPI communicator
    units         index
    rank          0
    type          integer
    kind
    source        MODULE gmtb_scm_type_defs TYPE physics_type
    local_name    physics%Model(i)%communicator
    requested     NOT REQUESTED
    physics set
```

mpi_rank
```
    long_name     current MPI-rank
    units         index
    rank          0
    type          integer
    kind
    source        MODULE gmtb_scm_type_defs TYPE physics_type
    local_name    physics%Model(i)%me
    requested     GFS_rrtmg_setup_init
                  GFS_rrtmg_setup_run
                  gfdl_cloud_microphys_init
                  gwdps_run
                  h2ophys_run
                  lsm_noah_init
                  ozphys_run
    physics set   physics
```

mpi_root

long_name	master MPI-rank
units	index
rank	0
type	integer
kind	
source	MODULE gmtb_scm_type_defs TYPE physics_type
local_name	physics%Model(i)%master
requested	gfdl_cloud_microphys_init
physics set	physics

mpi_size

long_name	number of MPI tasks in communicator
units	count
rank	0
type	integer
kind	
source	MODULE gmtb_scm_type_defs TYPE physics_type
local_name	physics%Model(i)%ntasks
requested	NOT REQUESTED
physics set	

multiplication_factors_for_convective_gravity_wave_drag

long_name	multiplication factor for convective GWD
units	none
rank	1
type	real
kind	kind_phys
source	MODULE gmtb_scm_type_defs TYPE physics_type
local_name	physics%Model(i)%cgwf
requested	gwdc_pre_run
physics set	physics

multiplication_factors_for_mountain_blocking_and_orographic_gravity_wave_drag

```
long_name      multiplication factors for cdmb and gwd
units          none
rank           1
type           real
kind           kind_phys
source         MODULE gmtb_scm_type_defs TYPE physics_type
local_name     physics%Model(i)%cdmbgwd
requested      gwdps_run
physics set    physics
```

namelist_filename

```
long_name      namelist filename
units          none
rank           0
type           character
kind           len=64
source         MODULE gmtb_scm_type_defs TYPE physics_type
local_name     physics%Model(i)%fn_nml
requested      gfdl_cloud_microphys_init
physics set    physics
```

namelist_filename_for_internal_file_reads

```
long_name      namelist filename for internal file reads
units          none
rank           1
type           character
kind           len=256
source         MODULE gmtb_scm_type_defs TYPE physics_type
local_name     physics%Model(i)%input_nml_file
requested      gfdl_cloud_microphys_init
physics set    physics
```

natural_log_of_h2o_forcing_data_pressure_levels

```
long_name     natural log of h2o forcing data pressure levels
units         log(Pa)
rank          1
type          real
kind          kind_phys
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Interstitial(i)%h2o_pres
requested     h2ophys_run
physics set   physics
```

natural_log_of_h2o_forcing_data_pressure_levels_from_host

```
long_name     natural logarithm of the pressure levels of the h2o forcing data
units         Pa
rank          1
type          real
kind          kind_phys
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%h2o_pres
requested     NOT REQUESTED
physics set
```

natural_log_of_ozone_forcing_data_pressure_levels

```
long_name     natural log of ozone forcing data pressure levels
units         log(Pa)
rank          1
type          real
kind          kind_phys
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Interstitial(i)%oz_pres
requested     ozphys_run
physics set   physics
```

natural_log_of_ozone_forcing_data_pressure_levels_from_host

```
long_name     natural logarithm of the pressure levels of the ozone forcing data
units         Pa
rank          1
type          real
kind          kind_phys
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%ozone_pres
requested     NOT REQUESTED
physics set
```

nonnegative_lwe_thickness_of_precipitation_amount_on_dynamics_timestep

```
long_name     total precipitation amount in each time step
units         m
rank          1
type          real
kind          kind_phys
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Sfcprop(i)%tprcp
requested     GFS_MP_generic_post_run
              lsm_noah_run
              sfc_nst_run
              sfc_sice_run
physics set   physics
```

normalized_soil_wetness

long_name	normalized soil wetness
units	frac
rank	1
type	real
kind	kind_phys
source	MODULE gmtb_scm_type_defs TYPE physics_type
local_name	physics%Diag(i)%wet1
requested	lsm_noah_run
physics set	physics

number_of_3d_arrays_associated_with_pdf-based_clouds

long_name	number of 3d arrays associated with pdf based clouds/mp
units	count
rank	0
type	integer
kind	
source	MODULE gmtb_scm_type_defs TYPE physics_type
local_name	physics%Model(i)%npdf3d
requested	GFS_DCNV_generic_post_run
	GFS_rrtmg_setup_init
	samfshalcnv_post_run
physics set	physics

number_of_cloud_condensate_types

long_name	number of cloud condensate types
units	count
rank	0
type	integer
kind	
source	MODULE gmtb_scm_type_defs TYPE physics_type
local_name	physics%Model(i)%ncnd
requested	NOT REQUESTED
physics set	

number_of_coefficients_in_h2o_forcing_data

long_name	number of coefficients in h2o forcing data
units	index
rank	0
type	integer
kind	
source	MODULE gmtb_scm_type_defs TYPE physics_type
local_name	physics%Interstitial(i)%h2o_coeff
requested	h2ophys_run
physics set	physics

number_of_coefficients_in_h2o_forcing_data_from_host

long_name	number of coeffcients in h2o forcing data coming from host
units	count
rank	0
type	integer
kind	
source	MODULE gmtb_scm_type_defs TYPE physics_type
local_name	physics%n_h2o_coefficients
requested	NOT REQUESTED
physics set	

number_of_coefficients_in_ozone_forcing_data

long_name	number of coefficients in ozone forcing data
units	index
rank	0
type	integer
kind	
source	MODULE gmtb_scm_type_defs TYPE physics_type
local_name	physics%Interstitial(i)%oz_coeff
requested	ozphys_run
physics set	physics

number_of_coefficients_in_ozone_forcing_data_from_host
```
long_name      number of coeffcients in ozone forcing data coming from host
units          count
rank           0
type           integer
kind
source         MODULE gmtb_scm_type_defs TYPE physics_type
local_name     physics%n_ozone_coefficients
requested      NOT REQUESTED
physics set
```

number_of_convective_3d_cloud_fields
```
long_name      number of convective 3d clouds fields
units          count
rank           0
type           integer
kind
source         MODULE gmtb_scm_type_defs TYPE physics_type
local_name     physics%Model(i)%ncnvcld3d
requested      GFS_DCNV_generic_post_run
               samfshalcnv_post_run
physics set   physics
```

number_of_equatorial_longitude_points
```
long_name      number of global points in x-dir (i) along the equator
units          count
rank           0
type           integer
kind
source         MODULE gmtb_scm_type_defs TYPE physics_type
local_name     physics%Model(i)%lonr
requested      gwdps_run
physics set   physics
```

number_of_hydrometeors

    long_name   choice of cloud scheme / number of hydrometeors
    units   count
    rank   0
    type   integer
    kind
    source   MODULE gmtb_scm_type_defs TYPE physics_type
    local_name   physics%Model(i)%ncld
    requested   GFS_MP_generic_post_run
                  samfdeepcnv_run
                  samfshalcnv_run
    physics set   physics

number_of_latitutde_points_in_h2o_forcing_data_from_host

    long_name   number of latitude points in h2o forcing data coming from host
    units   count
    rank   0
    type   integer
    kind
    source   MODULE gmtb_scm_type_defs TYPE physics_type
    local_name   physics%n_h2o_lats
    requested   NOT REQUESTED
    physics set

number_of_latitutde_points_in_ozone_forcing_data_from_host

    long_name   number of latitude points in ozone forcing data coming from host
    units   count
    rank   0
    type   integer
    kind
    source   MODULE gmtb_scm_type_defs TYPE physics_type
    local_name   physics%n_ozone_lats
    requested   NOT REQUESTED
    physics set

number_of_statistical_measures_of_subgrid_orography

long_name	number of topographic variables in GWD
units	count
rank	0
type	integer
kind	
source	MODULE gmtb_scm_type_defs TYPE physics_type
local_name	physics%Model(i)%nmtvr
requested	gwdps_pre_run
	gwdps_run
physics set	physics

number_of_surface_perturbations

long_name	number of surface perturbations
units	count
rank	0
type	integer
kind	
source	MODULE gmtb_scm_type_defs TYPE physics_type
local_name	physics%Model(i)%nsfcpert
requested	GFS_surface_generic_pre_run
physics set	physics

number_of_time_levels_in_h2o_forcing_data_from_host

long_name	number of time levels in h2o forcing data coming from host
units	count
rank	0
type	integer
kind	
source	MODULE gmtb_scm_type_defs TYPE physics_type
local_name	physics%n_h2o_times
requested	NOT REQUESTED
physics set	

number_of_time_levels_in_ozone_forcing_data_from_host

```
long_name     number of time levels in ozone forcing data coming from host
units         count
rank          0
type          integer
kind
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%n_ozone_times
requested     NOT REQUESTED
physics set
```

number_of_total_tracers

```
long_name     total number of tracers
units         count
rank          0
type          integer
kind
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Interstitial(i)%tracers_total
requested     GFS_suite_interstitial_4_run
physics set   physics
```

number_of_tracers

    long_name   number of tracers
    units   count
    rank   0
    type   integer
    kind
    source   MODULE gmtb_scm_type_defs TYPE physics_type
    local_name   physics%Model(i)%ntrac
    requested   GFS_MP_generic_post_run
                 GFS_MP_generic_pre_run
                 GFS_PBL_generic_post_run
                 GFS_PBL_generic_pre_run
                 GFS_suite_interstitial_3_run
                 GFS_suite_interstitial_4_run
                 GFS_suite_stateout_reset_run
                 GFS_suite_stateout_update_run
    physics set physics

number_of_tracers_for_CS

    long_name   number of convectively transported tracers in Chikira-Sugiyama deep conv. scheme
    units   count
    rank   0
    type   integer
    kind
    source   MODULE gmtb_scm_type_defs TYPE physics_type
    local_name   physics%Interstitial(i)%ncstrac
    requested   NOT REQUESTED
    physics set

number_of_tracers_for_cloud_condensate

```
long_name    number of tracers for cloud condensate
units        count
rank         0
type         integer
kind
source       MODULE gmtb_scm_type_defs TYPE physics_type
local_name   physics%Interstitial(i)%nncl
requested    GFS_MP_generic_post_run
             GFS_MP_generic_pre_run
physics set  physics
```

number_of_tracers_for_convective_transport

```
long_name    number of tracers for convective transport
units        count
rank         0
type         integer
kind
source       MODULE gmtb_scm_type_defs TYPE physics_type
local_name   physics%Interstitial(i)%nn
requested    GFS_SCNV_generic_post_run
             GFS_suite_interstitial_3_run
             GFS_suite_interstitial_4_run
physics set  physics
```

number_of_tracers_for_samf

```
long_name     number of tracers for scale-aware mass flux schemes
units         count
rank          0
type          integer
kind
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Interstitial(i)%nsamftrac
requested     samfdeepcnv_run
              samfshalcnv_run
physics set   physics
```

number_of_vertical_diffusion_tracers

```
long_name     number of tracers to diffuse vertically
units         count
rank          0
type          integer
kind
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Interstitial(i)%nvdiff
requested     GFS_PBL_generic_post_run
              GFS_PBL_generic_pre_run
              hedmf_run
physics set   physics
```

number_of_vertical_layers_for_radiation_calculations

```
long_name      number of vertical levels for radiation calculations
units          count
rank           0
type           integer
kind
source         MODULE gmtb_scm_type_defs TYPE physics_type
local_name     physics%Model(i)%levr
requested      GFS_rrtmg_setup_init
               rayleigh_damp_run
physics set    physics
```

number_of_water_tracers

```
long_name      number of water-related tracers
units          count
rank           0
type           integer
kind
source         MODULE gmtb_scm_type_defs TYPE physics_type
local_name     physics%Interstitial(i)%tracers_water
requested      NOT REQUESTED
physics set
```

ocean_mixed_layer_thickness

```
long_name      mixed layer thickness
units          m
rank           1
type           real
kind           kind_phys
source         MODULE gmtb_scm_type_defs TYPE physics_type
local_name     physics%Sfcprop(i)%zm
requested      sfc_nst_run
physics set    physics
```

omega

long_name	layer mean vertical velocity
units	Pa s-1
rank	2
type	real
kind	kind_phys
source	MODULE gmtb_scm_type_defs TYPE physics_type
local_name	physics%Statein(i)%vvl
requested	gfdl_cloud_microphys_run
	samfdeepcnv_run
	samfshalcnv_run
physics set	physics

orography

long_name	orography
units	m
rank	1
type	real
kind	kind_phys
source	MODULE gmtb_scm_type_defs TYPE physics_type
local_name	physics%Sfcprop(i)%oro
requested	sfc_nst_post_run
	sfc_nst_pre_run
physics set	physics

orography_unfiltered

```
long_name      unfiltered orography
units          m
rank           1
type           real
kind           kind_phys
source         MODULE gmtb_scm_type_defs TYPE physics_type
local_name     physics%Sfcprop(i)%oro_uf
requested      sfc_nst_post_run
               sfc_nst_pre_run
physics set    physics
```

ozone_concentration_at_layer_for_radiation

```
long_name      ozone concentration layer
units          kg kg-1
rank           2
type           real
kind           kind_phys
source         MODULE gmtb_scm_type_defs TYPE physics_type
local_name     physics%Interstitial(i)%olyr
requested      GFS_rrtmg_pre_run
               rrtmg_lw_run
               rrtmg_sw_run
physics set    physics
```

ozone_concentration_updated_by_physics

long_name	ozone concentration updated by physics
units	kg kg-1
rank	2
type	real
kind	kind_phys
source	MODULE gmtb_scm_type_defs TYPE physics_type
local_name	physics%Stateout(i)%gq0(:,:,scm_state%ozone_index)
requested	ozphys_run
physics set	physics

ozone_forcing

long_name	ozone forcing data
units	various
rank	3
type	real
kind	kind_phys
source	MODULE gmtb_scm_type_defs TYPE physics_type
local_name	physics%Tbd(i)%ozpl
requested	ozphys_run
physics set	physics

ozone_forcing_from_host

long_name	ozone forcing data from host
units	various
rank	4
type	real
kind	kind_phys
source	MODULE gmtb_scm_type_defs TYPE physics_type
local_name	physics%ozone_forcing_in
requested	NOT REQUESTED
physics set	

ozone_mixing_ratio

```
long_name     ozone mixing ratio
units         kg kg-1
rank          2
type          real
kind          kind_phys
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Statein(i)%qgrs(:,:,scm_state%ozone_index)
requested     GFS_PBL_generic_pre_run
physics set   physics
```

perturbation_of_heat_to_momentum_roughness_length_ratio

```
long_name     perturbation of heat to momentum roughness length ratio
units         frac
rank          1
type          real
kind          kind_phys
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Interstitial(i)%zt1d
requested     GFS_surface_generic_pre_run
              sfc_ex_coef_run
physics set   physics
```

perturbation_of_leaf_area_index

```
long_name     perturbation of leaf area index
units         frac
rank          1
type          real
kind          kind_phys
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Interstitial(i)%xlai1d
requested     GFS_surface_generic_pre_run
              lsm_noah_run
physics set   physics
```

perturbation_of_momentum_roughness_length

```
long_name      perturbation of momentum roughness length
units          frac
rank           1
type           real
kind           kind_phys
source         MODULE gmtb_scm_type_defs TYPE physics_type
local_name     physics%Interstitial(i)%z01d
requested      GFS_surface_generic_pre_run
               sfc_ex_coef_run
physics set    physics
```

perturbation_of_soil_type_b_parameter

```
long_name      perturbation of soil type "b" parameter
units          frac
rank           1
type           real
kind           kind_phys
source         MODULE gmtb_scm_type_defs TYPE physics_type
local_name     physics%Interstitial(i)%bexp1d
requested      GFS_surface_generic_pre_run
               lsm_noah_run
physics set    physics
```

perturbation_of_vegetation_fraction

```
long_name     perturbation of vegetation fraction
units         frac
rank          1
type          real
kind          kind_phys
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Interstitial(i)%vegf1d
requested     GFS_surface_generic_pre_run
              lsm_noah_run
physics set   physics
```

pi

```
long_name     ratio of a circle's circumference to its diameter
units         radians
rank          0
type          real
kind          kind_phys
source        MODULE gmtb_scm_physical_constants
local_name    con_pi
requested     GFS_suite_interstitial_4_run
              gwdc_run
physics set   physics
```

pressure_at_bottom_of_convective_cloud

```
long_name     convective cloud bottom pressure
units         Pa
rank          1
type          real
kind          kind_phys
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Cldprop(i)%cvb
requested     cnvc90_run
physics set   physics
```

pressure_at_top_of_convective_cloud

long_name	convective cloud top pressure
units	Pa
rank	1
type	real
kind	kind_phys
source	MODULE gmtb_scm_type_defs TYPE physics_type
local_name	physics%Cldprop(i)%cvt
requested	cnvc90_run
physics set	physics

pressure_cutoff_for_rayleigh_damping

long_name	pressure level from which Rayleigh Damping is applied
units	Pa
rank	0
type	real
kind	kind_phys
source	MODULE gmtb_scm_type_defs TYPE physics_type
local_name	physics%Model(i)%prslrd0
requested	rayleigh_damp_run
physics set	physics

radar_reflectivity_10cm

long_name	instantaneous refl_10cm
units	dBZ
rank	2
type	real
kind	kind_phys
source	MODULE gmtb_scm_type_defs TYPE physics_type
local_name	physics%Diag(i)%refl_10cm
requested	NOT REQUESTED
physics set	

rain_conversion_parameter_deep_convection

```
long_name    convective rain conversion parameter for deep conv.
units        m-1
rank         0
type         real
kind         kind_phys
source       MODULE gmtb_scm_type_defs TYPE physics_type
local_name   physics%Model(i)%c0s_deep
requested    samfdeepcnv_run
physics set  physics
```

rain_conversion_parameter_shallow_convection

```
long_name    convective rain conversion parameter for shal conv.
units        m-1
rank         0
type         real
kind         kind_phys
source       MODULE gmtb_scm_type_defs TYPE physics_type
local_name   physics%Model(i)%c0s_shal
requested    samfshalcnv_run
physics set  physics
```

rain_evaporation_coefficient_deep_convection

```
long_name    convective rain evaporation coefficient for deep conv.
units        frac
rank         0
type         real
kind         kind_phys
source       MODULE gmtb_scm_type_defs TYPE physics_type
local_name   physics%Model(i)%evfact_deep
requested    samfdeepcnv_run
physics set  physics
```

rain_evaporation_coefficient_over_land_deep_convection

```
long_name      convective rain evaporation coefficient over land for deep conv.
units          frac
rank           0
type           real
kind           kind_phys
source         MODULE gmtb_scm_type_defs TYPE physics_type
local_name     physics%Model(i)%evfactl_deep
requested      samfdeepcnv_run
physics set    physics
```

rain_number_concentration

```
long_name      number concentration of rain
units          kg-1
rank           2
type           real
kind           kind_phys
source         MODULE gmtb_scm_type_defs TYPE physics_type
local_name     physics%Statein(i)%qgrs(:,:,physics%Model(i)%ntrnc)
requested      NOT REQUESTED
physics set
```

rain_number_concentration_updated_by_physics

```
long_name      number concentration of rain updated by physics
units          kg-1
rank           2
type           real
kind           kind_phys
source         MODULE gmtb_scm_type_defs TYPE physics_type
local_name     physics%Stateout(i)%gq0(:,:,physics%Model(i)%ntrnc)
requested      NOT REQUESTED
physics set
```

rain_water_mixing_ratio

```
long_name      moist (dry+vapor, no condensates) mixing ratio of rain water
units          kg kg-1
rank           2
type           real
kind           kind_phys
source         MODULE gmtb_scm_type_defs TYPE physics_type
local_name     physics%Statein(i)%qgrs(:,:,scm_state%rain_index)
requested      GFS_PBL_generic_pre_run
physics set    physics
```

rain_water_mixing_ratio_updated_by_physics

```
long_name      moist (dry+vapor, no condensates) mixing ratio of rain water updated by physics
units          kg kg-1
rank           2
type           real
kind           kind_phys
source         MODULE gmtb_scm_type_defs TYPE physics_type
local_name     physics%Stateout(i)%gq0(:,:,scm_state%rain_index)
requested      gfdl_cloud_microphys_run
physics set    physics
```

random_number_array

```
long_name      random number array (0-1)
units          none
rank           2
type           real
kind           kind_phys
source         MODULE gmtb_scm_type_defs TYPE physics_type
local_name     physics%Tbd(i)%rann
requested      GFS_MP_generic_post_run
physics set    physics
```

ratio_of_dry_air_to_water_vapor_gas_constants

```
long_name      rd/rv
units          none
rank           0
type           real
kind           kind_phys
source         MODULE gmtb_scm_physical_constants
local_name     con_eps
requested      samfdeepcnv_run
               samfshalcnv_run
               sfc_diag_post_run
               sfc_diag_run
physics set    physics
```

ratio_of_dry_air_to_water_vapor_gas_constants_minus_one

```
long_name      (rd/rv) - 1
units          none
rank           0
type           real
kind           kind_phys
source         MODULE gmtb_scm_physical_constants
local_name     con_epsm1
requested      samfdeepcnv_run
               samfshalcnv_run
               sfc_diag_post_run
               sfc_diag_run
physics set    physics
```

ratio_of_exner_function_between_midlayer_and_interface_at_lowest_model_layer

long_name	Exner function ratio bt midlayer and interface at 1st layer
units	ratio
rank	1
type	real
kind	kind_phys
source	MODULE gmtb_scm_type_defs TYPE physics_type
local_name	physics%Interstitial(i)%work3
requested	GFS_surface_generic_pre_run
	gmtb_scm_sfc_flux_spec_run
	lsm_noah_run
	sfc_diag_run
	sfc_ex_coef_run
	sfc_nst_run
	sfc_sice_run
physics set	physics

ratio_of_snowfall_to_rainfall

long_name	snow ratio: ratio of snow to total precipitation
units	frac
rank	1
type	real
kind	kind_phys
source	MODULE gmtb_scm_type_defs TYPE physics_type
local_name	physics%Diag(i)%sr
requested	gfdl_cloud_microphys_run
	zhaocarr_precpd_run
physics set	physics

ratio_of_vapor_to_dry_air_gas_constants_minus_one

```
long_name     (rv/rd) - 1 (rv = ideal gas constant for water vapor)
units         none
rank          0
type          real
kind          kind_phys
source        MODULE gmtb_scm_physical_constants
local_name    con_fvirt
requested     gfdl_cloud_microphys_run
              gmtb_scm_sfc_flux_spec_run
              gwdc_run
              samfdeepcnv_run
              samfshalcnv_run
physics set   physics
```

ratio_of_wind_at_lowest_model_layer_and_wind_at_10m

```
long_name     ratio of sigma level 1 wind and 10m wind
units         ratio
rank          1
type          real
kind          kind_phys
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Sfcprop(i)%f10m
requested     sfc_diag_run
physics set   physics
```

sea_ice_concentration

```
long_name     ice fraction over open water
units         frac
rank          1
type          real
kind          kind_phys
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Sfcprop(i)%fice
requested     sfc_sice_post_run
              sfc_sice_run
physics set   physics
```

sea_ice_temperature

```
long_name     sea uce surface skin temperature
units         K
rank          1
type          real
kind          kind_phys
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Sfcprop(i)%tisfc
requested     sfc_sice_post_run
              sfc_sice_run
physics set   physics
```

sea_ice_thickness

long_name	sea ice thickness
units	m
rank	1
type	real
kind	kind_phys
source	MODULE gmtb_scm_type_defs TYPE physics_type
local_name	physics%Sfcprop(i)%hice
requested	sfc_sice_post_run
	sfc_sice_run
physics set	physics

sea_land_ice_mask

```
long_name     sea/land/ice mask (=0/1/2)
units         flag
rank          1
type          integer
kind
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Interstitial(i)%islmsk
requested     GFS_suite_interstitial_1_run
              GFS_suite_interstitial_3_run
              GFS_surface_generic_post_run
              GFS_surface_generic_pre_run
              GFS_surface_loop_control_part2_run
              lsm_noah_run
              samfdeepcnv_run
              samfshalcnv_run
              sfc_ex_coef_run
              sfc_nst_post_run
              sfc_nst_pre_run
              sfc_nst_run
              sfc_sice_post_run
              sfc_sice_run
physics set   physics
```

sea_land_ice_mask_real

```
long_name     landmask:  sea/land/ice=0/1/2
units         flag
rank          1
type          real
kind          kind_phys
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Sfcprop(i)%slmsk
requested     sfc_nst_post_run
physics set   physics
```

sea_surface_reference_temperature

```
long_name     sea surface reference temperature
units         K
rank          1
type          real
kind          kind_phys
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Sfcprop(i)%tref
requested     sfc_nst_post_run
              sfc_nst_run
physics set   physics
```

sea_water_salinity

```
long_name     salinity content in diurnal thermocline layer
units         ppt m
rank          1
type          real
kind          kind_phys
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Sfcprop(i)%xs
requested     sfc_nst_run
physics set   physics
```

seconds_elapsed_since_model_initialization

```
long_name     seconds elapsed since model initialization
units         s
rank          0
type          real
kind          kind_phys
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Model(i)%sec
requested     NOT REQUESTED
physics set
```

seed_random_numbers_lw

```
long_name     random seeds for sub-column cloud generators lw
units         none
rank          1
type          integer
kind
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Tbd(i)%icsdlw
requested     rrtmg_lw_run
physics set   physics
```

seed_random_numbers_sw

```
long_name     random seeds for sub-column cloud generators sw
units         none
rank          1
type          integer
kind
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Tbd(i)%icsdsw
requested     rrtmg_sw_run
physics set   physics
```

sensible_heat_flux_due_to_rainfall

```
long_name      sensible heat flux due to rainfall
units          W
rank           1
type           real
kind           kind_phys
source         MODULE gmtb_scm_type_defs TYPE physics_type
local_name     physics%Sfcprop(i)%qrain
requested      sfc_nst_run
physics set    physics
```

sensitivity_of_dtl_heat_content_to_surface_temperature

```
long_name      d(xt)/d(ts)
units          m
rank           1
type           real
kind           kind_phys
source         MODULE gmtb_scm_type_defs TYPE physics_type
local_name     physics%Sfcprop(i)%xtts
requested      sfc_nst_run
physics set    physics
```

sensitivity_of_dtl_thickness_to_surface_temperature

```
long_name      d(xz)/d(ts)
units          m K-1
rank           1
type           real
kind           kind_phys
source         MODULE gmtb_scm_type_defs TYPE physics_type
local_name     physics%Sfcprop(i)%xzts
requested      sfc_nst_run
physics set    physics
```

sine_of_latitude

long_name	sine of the grid latitude
units	none
rank	1
type	real
kind	kind_phys
source	MODULE gmtb_scm_type_defs TYPE physics_type
local_name	physics%Grid(i)%sinlat
requested	dcyc2t3_run
	sfc_nst_run
physics set	physics

sine_of_solar_declination_angle

long_name	sin of the solar declination angle
units	none
rank	0
type	real
kind	kind_phys
source	MODULE gmtb_scm_type_defs TYPE physics_type
local_name	physics%Model(i)%sdec
requested	GFS_rrtmg_setup_run
	dcyc2t3_run
physics set	physics

slope_of_subgrid_orography

long_name	slope of subgrid orography
units	none
rank	1
type	real
kind	kind_phys
source	MODULE gmtb_scm_type_defs TYPE physics_type
local_name	physics%Interstitial(i)%sigma
requested	gwdps_pre_run
	gwdps_run
physics set	physics

smallest_cloud_base_vertical_index_encountered_thus_far

long_name	smallest cloud base vertical index encountered thus far
units	index
rank	1
type	real
kind	kind_phys
source	MODULE gmtb_scm_type_defs TYPE physics_type
local_name	physics%Tbd(i)%acvb
requested	cnvc90_run
physics set	physics

snow_deposition_sublimation_upward_latent_heat_flux

long_name	latent heat flux from snow depo/subl
units	W m-2
rank	1
type	real
kind	kind_phys
source	MODULE gmtb_scm_type_defs TYPE physics_type
local_name	physics%Interstitial(i)%sbsno
requested	GFS_surface_generic_post_run
	lsm_noah_pre_run
	lsm_noah_run
physics set	physics

snow_freezing_rain_upward_latent_heat_flux

long_name	latent heat flux due to snow and frz rain
units	W m-2
rank	1
type	real
kind	kind_phys
source	MODULE gmtb_scm_type_defs TYPE physics_type
local_name	physics%Interstitial(i)%snohf
requested	GFS_surface_generic_post_run
	lsm_noah_pre_run
	lsm_noah_run
physics set	physics

snow_number_concentration

```
long_name      number concentration of snow
units          kg-1
rank           2
type           real
kind           kind_phys
source         MODULE gmtb_scm_type_defs TYPE physics_type
local_name     physics%Statein(i)%qgrs(:,:,physics%Model(i)%ntsnc)
requested      NOT REQUESTED
physics set
```

snow_number_concentration_updated_by_physics

```
long_name      number concentration of snow updated by physics
units          kg-1
rank           2
type           real
kind           kind_phys
source         MODULE gmtb_scm_type_defs TYPE physics_type
local_name     physics%Stateout(i)%gq0(:,:,physics%Model(i)%ntsnc)
requested      NOT REQUESTED
physics set
```

snow_temperature_bottom_first_layer

```
long_name      snow temperature at the bottom of the first soil layer
units          K
rank           1
type           real
kind           kind_phys
source         MODULE gmtb_scm_type_defs TYPE physics_type
local_name     physics%Sfcprop(i)%tsnow
requested      NOT REQUESTED
physics set
```

snow_water_mixing_ratio

```
long_name    moist (dry+vapor, no condensates) mixing ratio of snow water
units        kg kg-1
rank         2
type         real
kind         kind_phys
source       MODULE gmtb_scm_type_defs TYPE physics_type
local_name   physics%Statein(i)%qgrs(:,:,scm_state%snow_index)
requested    GFS_PBL_generic_pre_run
physics set  physics
```

snow_water_mixing_ratio_updated_by_physics

```
long_name    moist (dry+vapor, no condensates) mixing ratio of snow water updated by physics
units        kg kg-1
rank         2
type         real
kind         kind_phys
source       MODULE gmtb_scm_type_defs TYPE physics_type
local_name   physics%Stateout(i)%gq0(:,:,scm_state%snow_index)
requested    gfdl_cloud_microphys_run
physics set  physics
```

soil_moisture_content

```
long_name    soil moisture
units        kg m-2
rank         1
type         real
kind         kind_phys
source       MODULE gmtb_scm_type_defs TYPE physics_type
local_name   physics%Diag(i)%soilm
requested    lsm_noah_run
physics set  physics
```

soil_temperature
```
long_name     soil temperature
units         K
rank          2
type          real
kind          kind_phys
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Sfcprop(i)%stc
requested     lsm_noah_run
              sfc_sice_run
physics set   physics
```

soil_temperature_for_land_surface_model
```
long_name     soil temperature for land surface model
units         K
rank          2
type          real
kind          kind_phys
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Sfcprop(i)%tslb
requested     NOT REQUESTED
physics set
```

soil_type_classification
```
long_name     soil type at each grid cell
units         index
rank          1
type          integer
kind
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Interstitial(i)%soiltype
requested     GFS_surface_generic_pre_run
              lsm_noah_run
physics set   physics
```

soil_type_classification_real

long_name	soil type for lsm
units	index
rank	1
type	real
kind	kind_phys
source	MODULE gmtb_scm_type_defs TYPE physics_type
local_name	physics%Sfcprop(i)%stype
requested	GFS_surface_generic_pre_run
physics set	physics

soil_type_dataset_choice

long_name	soil type dataset choice
units	index
rank	0
type	integer
kind	
source	MODULE gmtb_scm_type_defs TYPE physics_type
local_name	physics%Model(i)%isot
requested	GFS_surface_generic_pre_run
	lsm_noah_init
	lsm_noah_run
physics set	physics

soil_upward_latent_heat_flux

long_name	soil upward latent heat flux
units	W m-2
rank	1
type	real
kind	kind_phys
source	MODULE gmtb_scm_type_defs TYPE physics_type
local_name	physics%Interstitial(i)%evbs
requested	GFS_surface_generic_post_run
	lsm_noah_pre_run
	lsm_noah_run
physics set	physics

soil_vertical_dimension

long_name	number of soil layers
units	count
rank	0
type	integer
kind	
source	MODULE gmtb_scm_type_defs TYPE physics_type
local_name	physics%Model(i)%lsoil
requested	lsm_noah_post_run
	lsm_noah_pre_run
	lsm_noah_run
	sfc_nst_run
	sfc_sice_run
physics set	physics

soil_vertical_dimension_for_land_surface_model

long_name	number of soil layers internal to land surface model
units	count
rank	0
type	integer
kind	
source	MODULE gmtb_scm_type_defs TYPE physics_type
local_name	physics%Model(i)%lsoil_lsm
requested	NOT REQUESTED
physics set	

solar_constant

long_name	solar constant (sun-earth distant adjusted)
units	W m-2
rank	0
type	real
kind	kind_phys
source	MODULE gmtb_scm_type_defs TYPE physics_type
local_name	physics%Model(i)%solcon
requested	GFS_rrtmg_setup_run
	rrtmg_sw_run
physics set	physics

specific_heat_of_dry_air_at_constant_pressure

```
long_name     specific heat of dry air at constant pressure
units         J kg-1 K-1
rank          0
type          real
kind          kind_phys
source        MODULE gmtb_scm_physical_constants
local_name    con_cp
requested     gmtb_scm_sfc_flux_spec_run
              gwdc_post_run
              gwdc_run
              gwdps_run
              rayleigh_damp_run
              samfdeepcnv_run
              samfshalcnv_run
              sfc_diag_run
physics set   physics
```

specific_heat_of_liquid_water_at_constant_pressure

```
long_name     specific heat of liquid water at constant pressure
units         J kg-1 K-1
rank          0
type          real
kind          kind_phys
source        MODULE gmtb_scm_physical_constants
local_name    con_cliq
requested     samfdeepcnv_run
              samfshalcnv_run
physics set   physics
```

specific_heat_of_water_vapor_at_constant_pressure

```
long_name     specific heat of water vapor at constant pressure
units         J kg-1 K-1
rank          0
type          real
kind          kind_phys
source        MODULE gmtb_scm_physical_constants
local_name    con_cvap
requested     samfdeepcnv_run
              samfshalcnv_run
physics set   physics
```

specific_humidity_at_2m

```
long_name     2 meter specific humidity
units         kg kg-1
rank          1
type          real
kind          kind_phys
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Sfcprop(i)%q2m
requested     GFS_surface_generic_post_run
              gmtb_scm_sfc_flux_spec_run
              sfc_diag_post_run
              sfc_diag_run
physics set   physics
```

specified_kinematic_surface_upward_latent_heat_flux

```
long_name      specified kinematic surface upward latent heat flux
units          kg kg-1 m s-1
rank           1
type           real
kind           kind_phys
source         MODULE gmtb_scm_type_defs TYPE physics_type
local_name     physics%Sfcprop(i)%spec_lh_flux
requested      gmtb_scm_sfc_flux_spec_run
physics set    physics
```

specified_kinematic_surface_upward_sensible_heat_flux

```
long_name      specified kinematic surface upward sensible heat flux
units          K m s-1
rank           1
type           real
kind           kind_phys
source         MODULE gmtb_scm_type_defs TYPE physics_type
local_name     physics%Sfcprop(i)%spec_sh_flux
requested      gmtb_scm_sfc_flux_spec_run
physics set    physics
```

standard_deviation_of_subgrid_orography

```
long_name      standard deviation of subgrid orography
units          m
rank           1
type           real
kind           kind_phys
source         MODULE gmtb_scm_type_defs TYPE physics_type
local_name     physics%Interstitial(i)%hprime1
requested      gwdps_pre_run
               gwdps_run
physics set    physics
```

start_index_of_other_tracers

```
long_name    beginning index of the non-water tracer species
units        index
rank         0
type         integer
kind
source       MODULE gmtb_scm_type_defs TYPE physics_type
local_name   physics%Interstitial(i)%tracers_start_index
requested    NOT REQUESTED
physics set
```

statistical_measures_of_subgrid_orography

```
long_name    orographic metrics
units        various
rank         2
type         real
kind         kind_phys
source       MODULE gmtb_scm_type_defs TYPE physics_type
local_name   physics%Sfcprop(i)%hprime
requested    gwdps_pre_run
physics set  physics
```

sub-layer_cooling_amount

```
long_name    sub-layer cooling amount
units        K
rank         1
type         real
kind         kind_phys
source       MODULE gmtb_scm_type_defs TYPE physics_type
local_name   physics%Sfcprop(i)%dt_cool
requested    sfc_nst_post_run
             sfc_nst_run
physics set  physics
```

sub-layer_cooling_thickness

```
long_name      sub-layer cooling thickness
units          m
rank           1
type           real
kind           kind_phys
source         MODULE gmtb_scm_type_defs TYPE physics_type
local_name     physics%Sfcprop(i)%z_c
requested      sfc_nst_post_run
               sfc_nst_run
physics set    physics
```

subsurface_runoff_flux

```
long_name      subsurface runoff flux
units          g m-2 s-1
rank           1
type           real
kind           kind_phys
source         MODULE gmtb_scm_type_defs TYPE physics_type
local_name     physics%Interstitial(i)%drain
requested      GFS_surface_generic_post_run
               lsm_noah_post_run
               lsm_noah_pre_run
               lsm_noah_run
physics set    physics
```

surface_air_pressure

long_name	surface pressure
units	Pa
rank	1
type	real
kind	kind_phys
source	MODULE gmtb_scm_type_defs TYPE physics_type
local_name	physics%Statein(i)%pgr
requested	GFS_surface_generic_post_run
	lsm_noah_run
	rayleigh_damp_run
	samfdeepcnv_run
	samfshalcnv_run
	sfc_diag_post_run
	sfc_diag_run
	sfc_ex_coef_run
	sfc_nst_run
	sfc_sice_run
	zhaocarr_gscond_run
physics set	physics

surface_air_pressure_at_previous_time_step

long_name	surface air pressure at previous time step
units	Pa
rank	1
type	real
kind	kind_phys
source	MODULE gmtb_scm_type_defs TYPE physics_type
local_name	physics%Tbd(i)%phy_f2d(:,2)
requested	zhaocarr_gscond_run
physics set	physics

surface_air_pressure_two_time_steps_back

long_name	surface air pressure two time steps back
units	Pa
rank	1
type	real
kind	kind_phys
source	MODULE gmtb_scm_type_defs TYPE physics_type
local_name	physics%Tbd(i)%phy_f2d(:,1)
requested	zhaocarr_gscond_run
physics set	physics

surface_air_temperature_for_radiation

long_name	lowest model layer air temperature for radiation
units	K
rank	1
type	real
kind	kind_phys
source	MODULE gmtb_scm_type_defs TYPE physics_type
local_name	physics%Interstitial(i)%tsfa
requested	GFS_rrtmg_pre_run
	rrtmg_lw_post_run
	rrtmg_lw_pre_run
	rrtmg_sw_pre_run
physics set	physics

surface_albedo_due_to_UV_and_VIS_diffused

```
long_name      surface albedo due to UV+VIS diffused beam
units          frac
rank           1
type           real
kind           kind_phys
source         MODULE gmtb_scm_type_defs TYPE physics_type
local_name     physics%Interstitial(i)%sfcalb(:,4)
requested      rrtmg_sw_post_run
               rrtmg_sw_pre_run
               rrtmg_sw_run
physics set    physics
```

surface_albedo_due_to_UV_and_VIS_direct

```
long_name      surface albedo due to UV+VIS direct beam
units          frac
rank           1
type           real
kind           kind_phys
source         MODULE gmtb_scm_type_defs TYPE physics_type
local_name     physics%Interstitial(i)%sfcalb(:,3)
requested      rrtmg_sw_post_run
               rrtmg_sw_pre_run
               rrtmg_sw_run
physics set    physics
```

surface_albedo_due_to_near_IR_diffused

```
long_name     surface albedo due to near IR diffused beam
units         frac
rank          1
type          real
kind          kind_phys
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Interstitial(i)%sfcalb(:,2)
requested     rrtmg_sw_post_run
              rrtmg_sw_pre_run
              rrtmg_sw_run
physics set   physics
```

surface_albedo_due_to_near_IR_direct

```
long_name     surface albedo due to near IR direct beam
units         frac
rank          1
type          real
kind          kind_phys
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Interstitial(i)%sfcalb(:,1)
requested     rrtmg_sw_post_run
              rrtmg_sw_pre_run
              rrtmg_sw_run
physics set   physics
```

surface_albedo_perturbation

long_name	surface albedo perturbation
units	frac
rank	1
type	real
kind	kind_phys
source	MODULE gmtb_scm_type_defs TYPE physics_type
local_name	physics%Interstitial(i)%alb1d
requested	GFS_rrtmg_pre_run
	rrtmg_sw_pre_run
physics set	physics

surface_condensation_mass

long_name	surface condensation mass
units	kg m-2
rank	1
type	real
kind	kind_phys
source	MODULE gmtb_scm_type_defs TYPE physics_type
local_name	physics%Sfcprop(i)%cndm_surf
requested	NOT REQUESTED
physics set	

surface_diffused_shortwave_albedo

long_name	mean surface diffused sw albedo
units	frac
rank	1
type	real
kind	kind_phys
source	MODULE gmtb_scm_type_defs TYPE physics_type
local_name	physics%Radtend(i)%sfalb
requested	lsm_noah_run
physics set	physics

surface_downwelling_diffuse_near_infrared_shortwave_flux
```
     long_name    surface downwelling diffuse near-infrared shortwave flux at current time
     units        W m-2
     rank         1
     type         real
     kind         kind_phys
     source       MODULE gmtb_scm_type_defs TYPE physics_type
     local_name   physics%Interstitial(i)%adjnirdfd
     requested    GFS_surface_generic_post_run
                  dcyc2t3_run
     physics set  physics
```

surface_downwelling_diffuse_near_infrared_shortwave_flux_on_radiation_time_step
```
     long_name    sfc nir diff sw downward flux
     units        W m-2
     rank         1
     type         real
     kind         kind_phys
     source       MODULE gmtb_scm_type_defs TYPE physics_type
     local_name   physics%Coupling(i)%nirdfdi
     requested    dcyc2t3_run
     physics set  physics
```

surface_downwelling_diffuse_ultraviolet_and_visible_shortwave_flux
```
     long_name    surface downwelling diffuse ultraviolet plus visible shortwave flux at current time
     units        W m-2
     rank         1
     type         real
     kind         kind_phys
     source       MODULE gmtb_scm_type_defs TYPE physics_type
     local_name   physics%Interstitial(i)%adjvisdfd
     requested    GFS_surface_generic_post_run
                  dcyc2t3_run
     physics set  physics
```

surface_downwelling_diffuse_ultraviolet_and_visible_shortwave_flux_on_radiation_time_step

```
long_name      sfc uv+vis diff sw downward flux
units          W m-2
rank           1
type           real
kind           kind_phys
source         MODULE gmtb_scm_type_defs TYPE physics_type
local_name     physics%Coupling(i)%visdfdi
requested      dcyc2t3_run
physics set    physics
```

surface_downwelling_direct_near_infrared_shortwave_flux

```
long_name      surface downwelling beam near-infrared shortwave flux at current time
units          W m-2
rank           1
type           real
kind           kind_phys
source         MODULE gmtb_scm_type_defs TYPE physics_type
local_name     physics%Interstitial(i)%adjnirbmd
requested      GFS_surface_generic_post_run
               dcyc2t3_run
physics set    physics
```

surface_downwelling_direct_near_infrared_shortwave_flux_on_radiation_time_step

```
long_name      sfc nir beam sw downward flux
units          W m-2
rank           1
type           real
kind           kind_phys
source         MODULE gmtb_scm_type_defs TYPE physics_type
local_name     physics%Coupling(i)%nirbmdi
requested      dcyc2t3_run
physics set    physics
```

surface_downwelling_direct_ultraviolet_and_visible_shortwave_flux

```
long_name     surface downwelling beam ultraviolet plus visible shortwave flux at current time
units         W m-2
rank          1
type          real
kind          kind_phys
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Interstitial(i)%adjvisbmd
requested     GFS_surface_generic_post_run
              dcyc2t3_run
physics set   physics
```

surface_downwelling_direct_ultraviolet_and_visible_shortwave_flux_on_radiation_time_step

```
long_name     sfc uv+vis beam sw downward flux
units         W m-2
rank          1
type          real
kind          kind_phys
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Coupling(i)%visbmdi
requested     dcyc2t3_run
physics set   physics
```

surface_downwelling_longwave_flux
```
     long_name      surface downwelling longwave flux at current time
     units          W m-2
     rank           1
     type           real
     kind           kind_phys
     source         MODULE gmtb_scm_type_defs TYPE physics_type
     local_name     physics%Diag(i)%dlwsfci
     requested      GFS_suite_interstitial_2_run
                    GFS_surface_generic_post_run
                    GFS_surface_generic_pre_run
                    dcyc2t3_run
     physics set  physics
```

surface_downwelling_longwave_flux_absorbed_by_ground
```
     long_name      total sky surface downward longwave flux absorbed by the ground
     units          W m-2
     rank           1
     type           real
     kind           kind_phys
     source         MODULE gmtb_scm_type_defs TYPE physics_type
     local_name     physics%Interstitial(i)%gabsbdlw
     requested      GFS_surface_generic_pre_run
                    lsm_noah_run
                    sfc_nst_run
                    sfc_sice_run
     physics set  physics
```

surface_downwelling_longwave_flux_on_radiation_time_step

```
long_name     total sky sfc downward lw flux
units         W m-2
rank          1
type          real
kind          kind_phys
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Coupling(i)%sfcdlw
requested     dcyc2t3_run
physics set   physics
```

surface_downwelling_shortwave_flux

```
long_name     surface downwelling shortwave flux at current time
units         W m-2
rank          1
type          real
kind          kind_phys
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Diag(i)%dswsfci
requested     GFS_suite_interstitial_2_run
              GFS_surface_generic_post_run
              dcyc2t3_post_run
              dcyc2t3_run
              lsm_noah_run
              sfc_sice_run
physics set   physics
```

surface_downwelling_shortwave_flux_on_radiation_time_step
```
long_name      total sky sfc downward sw flux
units          W m-2
rank           1
type           real
kind           kind_phys
source         MODULE gmtb_scm_type_defs TYPE physics_type
local_name     physics%Coupling(i)%sfcdsw
requested      dcyc2t3_run
physics set    physics
```

surface_drag_coefficient_for_heat_and_moisture_in_air
```
long_name      surface exchange coeff heat moisture
units          none
rank           1
type           real
kind           kind_phys
source         MODULE gmtb_scm_type_defs TYPE physics_type
local_name     physics%Interstitial(i)%cdq
requested      gmtb_scm_sfc_flux_spec_run
               lsm_noah_run
               sfc_ex_coef_run
               sfc_nst_run
               sfc_sice_run
physics set    physics
```

surface_drag_coefficient_for_momentum_in_air
```
    long_name      surface exchange coeff for momentum
    units          none
    rank           1
    type           real
    kind           kind_phys
    source         MODULE gmtb_scm_type_defs TYPE physics_type
    local_name     physics%Interstitial(i)%cd
    requested      gmtb_scm_sfc_flux_spec_run
                   lsm_noah_run
                   sfc_ex_coef_run
                   sfc_nst_run
                   sfc_sice_run
    physics set    physics
```

surface_drag_mass_flux_for_heat_and_moisture_in_air
```
    long_name      thermal exchange coefficient
    units          kg m-2 s-1
    rank           1
    type           real
    kind           kind_phys
    source         MODULE gmtb_scm_type_defs TYPE physics_type
    local_name     physics%Diag(i)%chh
    requested      lsm_noah_run
                   sfc_nst_run
                   sfc_sice_run
    physics set    physics
```

surface_drag_wind_speed_for_momentum_in_air

long_name	momentum exchange coefficient
units	m s-1
rank	1
type	real
kind	kind_phys
source	MODULE gmtb_scm_type_defs TYPE physics_type
local_name	physics%Diag(i)%cmm
requested	lsm_noah_run
	sfc_nst_run
	sfc_sice_run
physics set	physics

surface_friction_velocity

long_name	boundary layer parameter
units	m s-1
rank	1
type	real
kind	kind_phys
source	MODULE gmtb_scm_type_defs TYPE physics_type
local_name	physics%Sfcprop(i)%uustar
requested	gmtb_scm_sfc_flux_spec_run
	sfc_ex_coef_run
physics set	physics

surface_ground_temperature_for_radiation

long_name	surface ground temperature for radiation
units	K
rank	1
type	real
kind	kind_phys
source	MODULE gmtb_scm_type_defs TYPE physics_type
local_name	physics%Interstitial(i)%tsfg
requested	GFS_rrtmg_pre_run
	rrtmg_lw_pre_run
	rrtmg_lw_run
	rrtmg_sw_pre_run
physics set	physics

surface_longwave_emissivity

long_name	surface lw emissivity in fraction
units	frac
rank	1
type	real
kind	kind_phys
source	MODULE gmtb_scm_type_defs TYPE physics_type
local_name	physics%Radtend(i)%semis
requested	GFS_surface_generic_pre_run
	dcyc2t3_run
	lsm_noah_run
	rrtmg_lw_run
	sfc_nst_run
	sfc_sice_run
physics set	physics

surface_midlayer_air_temperature_in_longwave_radiation

```
long_name    surface air temp during lw calculation
units        K
rank         1
type         real
kind         kind_phys
source       MODULE gmtb_scm_type_defs TYPE physics_type
local_name   physics%Radtend(i)%tsflw
requested    dcyc2t3_run
physics set  physics
```

surface_net_downwelling_shortwave_flux

```
long_name    surface net downwelling shortwave flux at current time
units        W m-2
rank         1
type         real
kind         kind_phys
source       MODULE gmtb_scm_type_defs TYPE physics_type
local_name   physics%Diag(i)%nswsfci
requested    dcyc2t3_post_run
             dcyc2t3_run
             lsm_noah_run
             sfc_nst_run
             sfc_sice_run
physics set  physics
```

surface_net_downwelling_shortwave_flux_on_radiation_time_step

```
long_name    total sky sfc netsw flx into ground
units        W m-2
rank         1
type         real
kind         kind_phys
source       MODULE gmtb_scm_type_defs TYPE physics_type
local_name   physics%Coupling(i)%sfcnsw
requested    dcyc2t3_run
physics set  physics
```

surface_roughness_length

```
long_name    surface roughness length
units        cm
rank         1
type         real
kind         kind_phys
source       MODULE gmtb_scm_type_defs TYPE physics_type
local_name   physics%Sfcprop(i)%zorl
requested    gmtb_scm_sfc_flux_spec_run
             hedmf_run
             lsm_noah_run
             sfc_ex_coef_run
physics set  physics
```

surface_runoff

long_name	surface water runoff (from lsm)
units	kg m-2
rank	1
type	real
kind	kind_phys
source	MODULE gmtb_scm_type_defs TYPE physics_type
local_name	physics%Diag(i)%srunoff
requested	GFS_surface_generic_post_run
	lsm_noah_post_run
physics set	physics

surface_runoff_flux

long_name	surface runoff flux
units	g m-2 s-1
rank	1
type	real
kind	kind_phys
source	MODULE gmtb_scm_type_defs TYPE physics_type
local_name	physics%Interstitial(i)%runoff
requested	GFS_surface_generic_post_run
	lsm_noah_post_run
	lsm_noah_pre_run
	lsm_noah_run
physics set	physics

surface_skin_temperature

```
long_name    surface skin temperature
units        K
rank         1
type         real
kind         kind_phys
source       MODULE gmtb_scm_type_defs TYPE physics_type
local_name   physics%Sfcprop(i)%tsfc
requested    GFS_MP_generic_post_run
             GFS_surface_generic_post_run
             GFS_surface_generic_pre_run
             dcyc2t3_run
             gmtb_scm_sfc_flux_spec_run
             hedmf_run
             lsm_noah_run
             sfc_diag_run
             sfc_ex_coef_run
             sfc_nst_post_run
             sfc_nst_pre_run
             sfc_sice_post_run
             sfc_sice_run
physics set  physics
```

surface_skin_temperature_after_iteration

```
long_name      surface skin temperature after iteration
units          K
rank           1
type           real
kind           kind_phys
source         MODULE gmtb_scm_type_defs TYPE physics_type
local_name     physics%Interstitial(i)%tsurf
requested      GFS_surface_generic_pre_run
               lsm_noah_run
               sfc_ex_coef_run
               sfc_nst_post_run
               sfc_nst_pre_run
               sfc_nst_run
physics set    physics
```

surface_skin_temperature_for_nsst

```
long_name      ocean surface skin temperature
units          K
rank           1
type           real
kind           kind_phys
source         MODULE gmtb_scm_type_defs TYPE physics_type
local_name     physics%Interstitial(i)%tseal
requested      sfc_nst_pre_run
               sfc_nst_run
physics set    physics
```

surface_slope_classification

```
long_name     surface slope type at each grid cell
units         index
rank          1
type          integer
kind
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Interstitial(i)%slopetype
requested     GFS_surface_generic_pre_run
              lsm_noah_run
physics set   physics
```

surface_slope_classification_real

```
long_name     sfc slope type for lsm
units         index
rank          1
type          real
kind          kind_phys
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Sfcprop(i)%slope
requested     GFS_surface_generic_pre_run
physics set   physics
```

surface_snow_area_fraction

```
long_name      surface snow area fraction
units          frac
rank           1
type           real
kind           kind_phys
source         MODULE gmtb_scm_type_defs TYPE physics_type
local_name     physics%Interstitial(i)%snowc
requested      GFS_surface_generic_post_run
               lsm_noah_pre_run
               lsm_noah_run
physics set    physics
```

surface_snow_area_fraction_for_diagnostics

```
long_name      surface snow area fraction
units          frac
rank           1
type           real
kind           kind_phys
source         MODULE gmtb_scm_type_defs TYPE physics_type
local_name     physics%Sfcprop(i)%sncovr
requested      lsm_noah_run
physics set    physics
```

surface_snow_melt

```
long_name      snow melt during timestep
units          m
rank           1
type           real
kind           kind_phys
source         MODULE gmtb_scm_type_defs TYPE physics_type
local_name     physics%Interstitial(i)%snowmt
requested      sfc_sice_run
physics set    physics
```

surface_snow_thickness_water_equivalent

long_name	water equivalent snow depth over land
units	mm
rank	1
type	real
kind	kind_phys
source	MODULE gmtb_scm_type_defs TYPE physics_type
local_name	physics%Sfcprop(i)%snowd
requested	lsm_noah_run
	sfc_ex_coef_run
	sfc_sice_run
physics set	physics

surface_specific_humidity

long_name	surface air saturation specific humidity
units	kg kg-1
rank	1
type	real
kind	kind_phys
source	MODULE gmtb_scm_type_defs TYPE physics_type
local_name	physics%Interstitial(i)%qss
requested	gmtb_scm_sfc_flux_spec_run
	lsm_noah_run
	sfc_diag_run
	sfc_nst_run
	sfc_sice_run
physics set	physics

surface_upward_potential_latent_heat_flux

```
long_name     surface upward potential latent heat flux
units         W m-2
rank          1
type          real
kind          kind_phys
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Interstitial(i)%ep1d
requested     GFS_surface_generic_post_run
              lsm_noah_run
              sfc_nst_run
              sfc_sice_run
physics set   physics
```

surface_upwelling_diffuse_near_infrared_shortwave_flux

```
long_name     surface upwelling diffuse near-infrared shortwave flux at current time
units         W m-2
rank          1
type          real
kind          kind_phys
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Interstitial(i)%adjnirdfu
requested     GFS_surface_generic_post_run
              dcyc2t3_run
physics set   physics
```

surface_upwelling_diffuse_near_infrared_shortwave_flux_on_radiation_time_step

```
    long_name    sfc nir diff sw upward flux
    units        W m-2
    rank         1
    type         real
    kind         kind_phys
    source       MODULE gmtb_scm_type_defs TYPE physics_type
    local_name   physics%Coupling(i)%nirdfui
    requested    dcyc2t3_run
    physics set  physics
```

surface_upwelling_diffuse_ultraviolet_and_visible_shortwave_flux

```
    long_name    surface upwelling diffuse ultraviolet plus visible shortwave flux at current time
    units        W m-2
    rank         1
    type         real
    kind         kind_phys
    source       MODULE gmtb_scm_type_defs TYPE physics_type
    local_name   physics%Interstitial(i)%adjvisdfu
    requested    GFS_surface_generic_post_run
                 dcyc2t3_run
    physics set  physics
```

surface_upwelling_diffuse_ultraviolet_and_visible_shortwave_flux_on_radiation_time_step

```
    long_name    sfc uv+vis diff sw upward flux
    units        W m-2
    rank         1
    type         real
    kind         kind_phys
    source       MODULE gmtb_scm_type_defs TYPE physics_type
    local_name   physics%Coupling(i)%visdfui
    requested    dcyc2t3_run
    physics set  physics
```

surface_upwelling_direct_near_infrared_shortwave_flux

long_name	surface upwelling beam near-infrared shortwave flux at current time
units	W m-2
rank	1
type	real
kind	kind_phys
source	MODULE gmtb_scm_type_defs TYPE physics_type
local_name	physics%Interstitial(i)%adjnirbmu
requested	GFS_surface_generic_post_run
	dcyc2t3_run
physics set	physics

surface_upwelling_direct_near_infrared_shortwave_flux_on_radiation_time_step

long_name	sfc nir beam sw upward flux
units	W m-2
rank	1
type	real
kind	kind_phys
source	MODULE gmtb_scm_type_defs TYPE physics_type
local_name	physics%Coupling(i)%nirbmui
requested	dcyc2t3_run
physics set	physics

surface_upwelling_direct_ultraviolet_and_visible_shortwave_flux

long_name	surface upwelling beam ultraviolet plus visible shortwave flux at current time
units	W m-2
rank	1
type	real
kind	kind_phys
source	MODULE gmtb_scm_type_defs TYPE physics_type
local_name	physics%Interstitial(i)%adjvisbmu
requested	GFS_surface_generic_post_run
	dcyc2t3_run
physics set	physics

surface_upwelling_direct_ultraviolet_and_visible_shortwave_flux_on_radiation_time_step

```
      long_name      sfc uv+vis beam sw upward flux
      units          W m-2
      rank           1
      type           real
      kind           kind_phys
      source         MODULE gmtb_scm_type_defs TYPE physics_type
      local_name     physics%Coupling(i)%visbmui
      requested      dcyc2t3_run
      physics set    physics
```

surface_upwelling_longwave_flux

```
      long_name      surface upwelling longwave flux at current time
      units          W m-2
      rank           1
      type           real
      kind           kind_phys
      source         MODULE gmtb_scm_type_defs TYPE physics_type
      local_name     physics%Diag(i)%ulwsfci
      requested      GFS_suite_interstitial_2_run
                     GFS_surface_generic_post_run
                     dcyc2t3_run
      physics set    physics
```

surface_upwelling_shortwave_flux

```
long_name     surface upwelling shortwave flux at current time
units         W m-2
rank          1
type          real
kind          kind_phys
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Diag(i)%uswsfci
requested     dcyc2t3_post_run
physics set   physics
```

surface_wind_enhancement_due_to_convection

```
long_name     surface wind enhancement due to convection
units         m s-1
rank          1
type          real
kind          kind_phys
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Tbd(i)%phy_f2d(:,physics%Model(i)%num_p2d)
requested     lsm_noah_run
              sfc_ex_coef_run
              sfc_nst_run
              sfc_sice_run
physics set   physics
```

surface_wind_stress
```
long_name     surface wind stress
units         m2 s-2
rank          1
type          real
kind          kind_phys
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Interstitial(i)%stress
requested     gmtb_scm_sfc_flux_spec_run
              hedmf_run
              sfc_ex_coef_run
              sfc_nst_run
physics set   physics
```

sw_fluxes_sfc
```
long_name     sw radiation fluxes at sfc
units         W m-2
rank          1
type          sfcfsw_type
kind
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Radtend(i)%sfcfsw
requested     rrtmg_sw_run
physics set   physics
```

sw_fluxes_top_atmosphere

```
long_name      sw radiation fluxes at toa
units          W m-2
rank           1
type           topfsw_type
kind
source         MODULE gmtb_scm_type_defs TYPE physics_type
local_name     physics%Diag(i)%topfsw
requested      rrtmg_sw_run
physics set    physics
```

temperature_at_2m

```
long_name      2 meter temperature
units          K
rank           1
type           real
kind           kind_phys
source         MODULE gmtb_scm_type_defs TYPE physics_type
local_name     physics%Sfcprop(i)%t2m
requested      GFS_surface_generic_post_run
               gmtb_scm_sfc_flux_spec_run
               sfc_diag_post_run
               sfc_diag_run
physics set    physics
```

temperature_at_zero_celsius

```
long_name     temperature at 0 degrees Celsius
units         K
rank          0
type          real
kind          kind_phys
source        MODULE gmtb_scm_physical_constants
local_name    con_t0c
requested     samfdeepcnv_run
              samfshalcnv_run
physics set   physics
```

tendency_of_air_temperature_due_to_longwave_heating_assuming_clear_sky_on_radiation_time_step

```
long_name     clear sky heating rate due to longwave radiation
units         K s-1
rank          2
type          real
kind          kind_phys
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Tbd(i)%htlw0
requested     dcyc2t3_run
              rrtmg_lw_post_run
              rrtmg_lw_run
physics set   physics
```

tendency_of_air_temperature_due_to_longwave_heating_assuming_clear_sky_on_radiation_timestep

```
long_name      clear sky lw heating rates
units          K s-1
rank           2
type           real
kind           kind_phys
source         MODULE gmtb_scm_type_defs TYPE physics_type
local_name     physics%Radtend(i)%lwhc
requested      NOT REQUESTED
physics set
```

tendency_of_air_temperature_due_to_longwave_heating_on_radiation_time_step

```
long_name      total sky heating rate due to longwave radiation
units          K s-1
rank           2
type           real
kind           kind_phys
source         MODULE gmtb_scm_type_defs TYPE physics_type
local_name     physics%Tbd(i)%htlwc
requested      dcyc2t3_run
               hedmf_run
               rrtmg_lw_post_run
               rrtmg_lw_run
physics set    physics
```

tendency_of_air_temperature_due_to_longwave_heating_on_radiation_timestep

```
long_name      total sky lw heating rate
units          K s-1
rank           2
type           real
kind           kind_phys
source         MODULE gmtb_scm_type_defs TYPE physics_type
local_name     physics%Radtend(i)%htrlw
requested      GFS_PBL_generic_post_run
physics set    physics
```

tendency_of_air_temperature_due_to_model_physics

```
long_name      air temperature tendency due to model physics
units          K s-1
rank           2
type           real
kind           kind_phys
source         MODULE gmtb_scm_type_defs TYPE physics_type
local_name     physics%Interstitial(i)%dtdt
requested      GFS_PBL_generic_post_run
               GFS_suite_interstitial_1_run
               GFS_suite_stateout_update_run
               dcyc2t3_run
               gwdps_post_run
               gwdps_run
               hedmf_run
               rayleigh_damp_run
physics set    physics
```

tendency_of_air_temperature_due_to_radiative_heating_assuming_clear_sky

```
long_name    clear sky radiative (shortwave + longwave) heating rate at current time
units        K s-1
rank         2
type         real
kind         kind_phys
source       MODULE gmtb_scm_type_defs TYPE physics_type
local_name   physics%Interstitial(i)%dtdtc
requested    GFS_MP_generic_post_run
             GFS_suite_interstitial_1_run
             dcyc2t3_run
physics set  physics
```

tendency_of_air_temperature_due_to_radiative_heating_on_physics_time_step

```
long_name    temp.  change due to radiative heating per time step
units        K
rank         2
type         real
kind         kind_phys
source       MODULE gmtb_scm_type_defs TYPE physics_type
local_name   physics%Tbd(i)%dtdtr
requested    GFS_MP_generic_post_run
             GFS_surface_generic_pre_run
physics set  physics
```

tendency_of_air_temperature_due_to_shortwave_heating_assuming_clear_sky_on_radiation_time_step

```
long_name     clear sky heating rates due to shortwave radiation
units         K s-1
rank          2
type          real
kind          kind_phys
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Tbd(i)%htsw0
requested     dcyc2t3_run
              rrtmg_sw_post_run
              rrtmg_sw_run
physics set   physics
```

tendency_of_air_temperature_due_to_shortwave_heating_assuming_clear_sky_on_radiation_timestep

```
long_name     clear sky sw heating rates
units         K s-1
rank          2
type          real
kind          kind_phys
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Radtend(i)%swhc
requested     NOT REQUESTED
physics set
```

tendency_of_air_temperature_due_to_shortwave_heating_on_radiation_time_step

```
    long_name     total sky heating rate due to shortwave radiation
    units         K s-1
    rank          2
    type          real
    kind          kind_phys
    source        MODULE gmtb_scm_type_defs TYPE physics_type
    local_name    physics%Tbd(i)%htswc
    requested     dcyc2t3_run
                  hedmf_run
                  rrtmg_sw_post_run
                  rrtmg_sw_run
    physics set   physics
```

tendency_of_air_temperature_due_to_shortwave_heating_on_radiation_timestep

```
    long_name     total sky sw heating rate
    units         K s-1
    rank          2
    type          real
    kind          kind_phys
    source        MODULE gmtb_scm_type_defs TYPE physics_type
    local_name    physics%Radtend(i)%htrsw
    requested     GFS_PBL_generic_post_run
    physics set   physics
```

tendency_of_cloud_droplet_number_concentration_due_to_model_physics

long_name	number concentration of cloud droplets (liquid) tendency due to model physics
units	kg-1 s-1
rank	2
type	real
kind	kind_phys
source	MODULE gmtb_scm_type_defs TYPE physics_type
local_name	physics%Interstitial(i)%dqdt(:,:,physics%Model(i)%ntlnc)
requested	GFS_PBL_generic_post_run
physics set	physics

tendency_of_graupel_mixing_ratio_due_to_model_physics

long_name	moist (dry+vapor, no condensates) mixing ratio of graupel tendency due to model physics
units	kg kg-1 s-1
rank	2
type	real
kind	kind_phys
source	MODULE gmtb_scm_type_defs TYPE physics_type
local_name	physics%Interstitial(i)%dqdt(:,:,physics%Model(i)%ntgl)
requested	GFS_PBL_generic_post_run
physics set	physics

tendency_of_ice_cloud_water_mixing_ratio_due_to_model_physics

long_name	cloud condensed water mixing ratio tendency due to model physics
units	kg kg-1 s-1
rank	2
type	real
kind	kind_phys
source	MODULE gmtb_scm_type_defs TYPE physics_type
local_name	physics%Interstitial(i)%dqdt(:,:,physics%Model(i)%ntiw)
requested	GFS_PBL_generic_post_run
physics set	physics

tendency_of_ice_friendly_aerosol_number_concentration_due_to_model_physics

```
long_name      number concentration of ice-friendly aerosols tendency due to model physics
units          kg-1 s-1
rank           2
type           real
kind           kind_phys
source         MODULE gmtb_scm_type_defs TYPE physics_type
local_name     physics%Interstitial(i)%dqdt(:,:,physics%Model(i)%ntia)
requested      GFS_PBL_generic_post_run
physics set    physics
```

tendency_of_ice_number_concentration_due_to_model_physics

```
long_name      number concentration of ice tendency due to model physics
units          kg-1 s-1
rank           2
type           real
kind           kind_phys
source         MODULE gmtb_scm_type_defs TYPE physics_type
local_name     physics%Interstitial(i)%dqdt(:,:,physics%Model(i)%ntinc)
requested      GFS_PBL_generic_post_run
physics set    physics
```

tendency_of_liquid_cloud_water_mixing_ratio_due_to_model_physics

```
long_name      cloud condensed water mixing ratio tendency due to model physics
units          kg kg-1 s-1
rank           2
type           real
kind           kind_phys
source         MODULE gmtb_scm_type_defs TYPE physics_type
local_name     physics%Interstitial(i)%dqdt(:,:,physics%Model(i)%ntcw)
requested      GFS_PBL_generic_post_run
physics set    physics
```

tendency_of_lwe_thickness_of_precipitation_amount_for_coupling

long_name	change in rain_cpl (coupling_type)
units	m
rank	1
type	real
kind	kind_phys
source	MODULE gmtb_scm_type_defs TYPE physics_type
local_name	physics%Tbd(i)%drain_cpl
requested	GFS_MP_generic_post_run
	GFS_surface_generic_pre_run
physics set	physics

tendency_of_lwe_thickness_of_snow_amount_for_coupling

long_name	change in show_cpl (coupling_type)
units	m
rank	1
type	real
kind	kind_phys
source	MODULE gmtb_scm_type_defs TYPE physics_type
local_name	physics%Tbd(i)%dsnow_cpl
requested	GFS_MP_generic_post_run
	GFS_surface_generic_pre_run
physics set	physics

tendency_of_ozone_mixing_ratio_due_to_model_physics

long_name	ozone mixing ratio tendency due to model physics
units	kg kg-1 s-1
rank	2
type	real
kind	kind_phys
source	MODULE gmtb_scm_type_defs TYPE physics_type
local_name	physics%Interstitial(i)%dqdt(:,:,physics%Model(i)%ntoz)
requested	GFS_PBL_generic_post_run
physics set	physics

tendency_of_rain_water_mixing_ratio_due_to_microphysics

long_name	tendency of rain water mixing ratio due to microphysics
units	kg kg-1 s-1
rank	2
type	real
kind	kind_phys
source	MODULE gmtb_scm_type_defs TYPE physics_type
local_name	physics%Interstitial(i)%rainp
requested	zhaocarr_precpd_run
physics set	physics

tendency_of_rain_water_mixing_ratio_due_to_model_physics

long_name	moist (dry+vapor, no condensates) mixing ratio of rain water tendency due to model physics
units	kg kg-1 s-1
rank	2
type	real
kind	kind_phys
source	MODULE gmtb_scm_type_defs TYPE physics_type
local_name	physics%Interstitial(i)%dqdt(:,:,physics%Model(i)%ntrw)
requested	GFS_PBL_generic_post_run
physics set	physics

tendency_of_snow_water_mixing_ratio_due_to_model_physics

long_name	moist (dry+vapor, no condensates) mixing ratio of snow water tendency due to model physics
units	kg kg-1 s-1
rank	2
type	real
kind	kind_phys
source	MODULE gmtb_scm_type_defs TYPE physics_type
local_name	physics%Interstitial(i)%dqdt(:,:,physics%Model(i)%ntsw)
requested	GFS_PBL_generic_post_run
physics set	physics

tendency_of_tracers_due_to_model_physics

```
long_name      updated tendency of the tracers
units          kg kg-1 s-1
rank           3
type           real
kind           kind_phys
source         MODULE gmtb_scm_type_defs TYPE physics_type
local_name     physics%Interstitial(i)%dqdt
requested      GFS_PBL_generic_post_run
               GFS_suite_interstitial_1_run
               GFS_suite_stateout_update_run
physics set    physics
```

tendency_of_vertically_diffused_tracer_concentration

```
long_name      updated tendency of the tracers due to vertical diffusion in PBL scheme
units          kg kg-1 s-1
rank           3
type           real
kind           kind_phys
source         MODULE gmtb_scm_type_defs TYPE physics_type
local_name     physics%Interstitial(i)%dvdftra
requested      GFS_PBL_generic_post_run
               hedmf_run
physics set    physics
```

tendency_of_water_friendly_aerosol_number_concentration_due_to_model_physics

long_name	number concentration of water-friendly aerosols tendency due to model physics
units	kg-1 s-1
rank	2
type	real
kind	kind_phys
source	MODULE gmtb_scm_type_defs TYPE physics_type
local_name	physics%Interstitial(i)%dqdt(:,:,physics%Model(i)%ntwa)
requested	GFS_PBL_generic_post_run
physics set	physics

tendency_of_water_friendly_surface_aerosols_at_surface

long_name	instantaneous sfc aerosol source
units	kg-1 s-1
rank	1
type	real
kind	kind_phys
source	MODULE gmtb_scm_type_defs TYPE physics_type
local_name	physics%Coupling(i)%nwfa2d
requested	NOT REQUESTED
physics set	

tendency_of_water_vapor_specific_humidity_due_to_model_physics

long_name	water vapor specific humidity tendency due to model physics
units	kg kg-1 s-1
rank	2
type	real
kind	kind_phys
source	MODULE gmtb_scm_type_defs TYPE physics_type
local_name	physics%Interstitial(i)%dqdt(:,:,1)
requested	GFS_PBL_generic_post_run
physics set	physics

tendency_of_x_wind_due_to_convective_gravity_wave_drag

long_name	zonal wind tendency due to convective gravity wave drag
units	m s-2
rank	2
type	real
kind	kind_phys
source	MODULE gmtb_scm_type_defs TYPE physics_type
local_name	physics%Interstitial(i)%gwdcu
requested	gwdc_post_run
	gwdc_run
physics set	physics

tendency_of_x_wind_due_to_model_physics

long_name	zonal wind tendency due to model physics
units	m s-2
rank	2
type	real
kind	kind_phys
source	MODULE gmtb_scm_type_defs TYPE physics_type
local_name	physics%Interstitial(i)%dudt
requested	GFS_PBL_generic_post_run
	GFS_suite_interstitial_1_run
	GFS_suite_stateout_update_run
	gwdps_post_run
	gwdps_run
	hedmf_run
	rayleigh_damp_run
physics set	physics

tendency_of_y_wind_due_to_convective_gravity_wave_drag

long_name	meridional wind tendency due to convective gravity wave drag
units	m s-2
rank	2
type	real
kind	kind_phys
source	MODULE gmtb_scm_type_defs TYPE physics_type
local_name	physics%Interstitial(i)%gwdcv
requested	gwdc_post_run
	gwdc_run
physics set	physics

tendency_of_y_wind_due_to_model_physics

long_name	meridional wind tendency due to model physics
units	m s-2
rank	2
type	real
kind	kind_phys
source	MODULE gmtb_scm_type_defs TYPE physics_type
local_name	physics%Interstitial(i)%dvdt
requested	GFS_PBL_generic_post_run
	GFS_suite_interstitial_1_run
	GFS_suite_stateout_update_run
	gwdps_post_run
	gwdps_run
	hedmf_run
	rayleigh_damp_run
physics set	physics

threshold_volume_fraction_of_condensed_water_in_soil

```
long_name     soil moisture threshold (volumetric)
units         frac
rank          1
type          real
kind          kind_phys
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Diag(i)%smcref2
requested     lsm_noah_pre_run
              lsm_noah_run
physics set   physics
```

time_integral_of_x_stress_due_to_gravity_wave_drag

```
long_name     vertically integrated u change by OGWD
units         Pa s
rank          1
type          real
kind          kind_phys
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Diag(i)%dugwd
requested     gwdc_post_run
              gwdps_post_run
physics set   physics
```

time_integral_of_y_stress_due_to_gravity_wave_drag

```
long_name     vertically integrated v change by OGWD
units         Pa s
rank          1
type          real
kind          kind_phys
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Diag(i)%dvgwd
requested     gwdc_post_run
              gwdps_post_run
physics set   physics
```

time_levels_in_h2o_forcing_data_from_host

```
long_name     time values of the h2o forcing data coming from host
units         day
rank          1
type          real
kind          kind_phys
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%h2o_time
requested     NOT REQUESTED
physics set
```

time_levels_in_ozone_forcing_data_from_host

```
long_name     time values of the ozone forcing data coming from host
units         day
rank          1
type          real
kind          kind_phys
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%ozone_time
requested     NOT REQUESTED
physics set
```

time_scale_for_rayleigh_damping

long_name	time scale for Rayleigh damping in days
units	d
rank	0
type	real
kind	kind_phys
source	MODULE gmtb_scm_type_defs TYPE physics_type
local_name	physics%Model(i)%ral_ts
requested	rayleigh_damp_run
physics set	physics

time_step_for_dynamics

long_name	dynamics timestep
units	s
rank	0
type	real
kind	kind_phys
source	MODULE gmtb_scm_type_defs TYPE physics_type
local_name	physics%Model(i)%dtf
requested	GFS_DCNV_generic_post_run
	GFS_MP_generic_post_run
	GFS_PBL_generic_post_run
	GFS_rrtmg_setup_run
	GFS_suite_interstitial_4_run
	GFS_surface_generic_post_run
	gwdc_post_run
	gwdps_post_run
	lsm_noah_post_run
	lsm_noah_run
	sfc_diag_post_run
	sfc_nst_run
	sfc_sice_run
	zhaocarr_gscond_run
physics set	physics

time_step_for_physics

long_name	physics timestep
units	s
rank	0
type	real
kind	kind_phys
source	MODULE gmtb_scm_type_defs TYPE physics_type
local_name	physics%Model(i)%dtp
requested	GFS_suite_stateout_update_run
	gfdl_cloud_microphys_run
	gwdc_post_run
	gwdc_pre_run
	gwdc_run
	gwdps_run
	h2ophys_run
	hedmf_run
	ozphys_run
	rayleigh_damp_run
	samfdeepcnv_run
	samfshalcnv_run
	zhaocarr_gscond_run
	zhaocarr_precpd_run
physics set	physics

time_step_for_radiation

long_name	radiation time step
units	s
rank	0
type	real
kind	kind_phys
source	MODULE gmtb_scm_type_defs TYPE physics_type
local_name	physics%Interstitial(i)%raddt
requested	GFS_rrtmg_post_run
	GFS_rrtmg_pre_run
physics set	physics

total_cloud_fraction

long_name	layer total cloud fraction
units	frac
rank	2
type	real
kind	kind_phys
source	MODULE gmtb_scm_type_defs TYPE physics_type
local_name	physics%Interstitial(i)%clouds(:,:,1)
requested	GFS_rrtmg_post_run
	GFS_rrtmg_pre_run
	rrtmg_lw_run
	rrtmg_sw_run
physics set	physics

total_runoff

```
long_name      total water runoff
units          kg m-2
rank           1
type           real
kind           kind_phys
source         MODULE gmtb_scm_type_defs TYPE physics_type
local_name     physics%Diag(i)%runoff
requested      GFS_surface_generic_post_run
               lsm_noah_post_run
physics set    physics
```

tracer_concentration

```
long_name      model layer mean tracer concentration
units          kg kg-1
rank           3
type           real
kind           kind_phys
source         MODULE gmtb_scm_type_defs TYPE physics_type
local_name     physics%Statein(i)%qgrs
requested      GFS_PBL_generic_pre_run
               GFS_suite_stateout_reset_run
               GFS_suite_stateout_update_run
physics set    physics
```

tracer_concentration_save

long_name	tracer concentration before entering a physics scheme
units	kg kg-1
rank	3
type	real
kind	kind_phys
source	MODULE gmtb_scm_type_defs TYPE physics_type
local_name	physics%Interstitial(i)%save_q
requested	GFS_MP_generic_pre_run
physics set	physics

tracer_concentration_updated_by_physics

long_name	tracer concentration updated by physics
units	kg kg-1
rank	3
type	real
kind	kind_phys
source	MODULE gmtb_scm_type_defs TYPE physics_type
local_name	physics%Stateout(i)%gq0
requested	GFS_MP_generic_post_run
	GFS_MP_generic_pre_run
	GFS_suite_interstitial_3_run
	GFS_suite_interstitial_4_run
	GFS_suite_stateout_reset_run
	GFS_suite_stateout_update_run
physics set	physics

transpiration_flux

```
long_name    total plant transpiration rate
units        kg m-2 s-1
rank         1
type         real
kind         kind_phys
source       MODULE gmtb_scm_type_defs TYPE physics_type
local_name   physics%Interstitial(i)%trans
requested    GFS_surface_generic_post_run
             lsm_noah_pre_run
             lsm_noah_run
physics set  physics
```

upper_bound_on_max_albedo_over_deep_snow

```
long_name    maximum snow albedo
units        frac
rank         1
type         real
kind         kind_phys
source       MODULE gmtb_scm_type_defs TYPE physics_type
local_name   physics%Sfcprop(i)%snoalb
requested    lsm_noah_run
physics set  physics
```

upward_heat_flux_in_soil

long_name	soil heat flux
units	W m-2
rank	1
type	real
kind	kind_phys
source	MODULE gmtb_scm_type_defs TYPE physics_type
local_name	physics%Interstitial(i)%gflx
requested	GFS_surface_generic_post_run
	lsm_noah_run
	sfc_nst_run
	sfc_sice_run
physics set	physics

vegetation_area_fraction

long_name	areal fractional cover of green vegetation
units	frac
rank	1
type	real
kind	kind_phys
source	MODULE gmtb_scm_type_defs TYPE physics_type
local_name	physics%Sfcprop(i)%vfrac
requested	GFS_surface_generic_pre_run
physics set	physics

vegetation_type_classification

long_name	vegetation type at each grid cell
units	index
rank	1
type	integer
kind	
source	MODULE gmtb_scm_type_defs TYPE physics_type
local_name	physics%Interstitial(i)%vegtype
requested	GFS_surface_generic_pre_run
	lsm_noah_run
	sfc_ex_coef_run
physics set	physics

vegetation_type_classification_real

long_name	vegetation type for lsm
units	index
rank	1
type	real
kind	kind_phys
source	MODULE gmtb_scm_type_defs TYPE physics_type
local_name	physics%Sfcprop(i)%vtype
requested	GFS_surface_generic_pre_run
physics set	physics

vegetation_type_dataset_choice

long_name	land use dataset choice
units	index
rank	0
type	integer
kind	
source	MODULE gmtb_scm_type_defs TYPE physics_type
local_name	physics%Model(i)%ivegsrc
requested	GFS_surface_generic_pre_run
	lsm_noah_init
	lsm_noah_run
	sfc_ex_coef_run
physics set	physics

vertical_dimension

```
long_name    number of vertical levels
units        count
rank         0
type         integer
kind
source       MODULE gmtb_scm_type_defs TYPE physics_type
local_name   physics%Model(i)%levs
requested    GFS_DCNV_generic_post_run
             GFS_DCNV_generic_pre_run
             GFS_MP_generic_post_run
             GFS_MP_generic_pre_run
             GFS_PBL_generic_post_run
             GFS_PBL_generic_pre_run
             GFS_SCNV_generic_post_run
             GFS_SCNV_generic_pre_run
             GFS_suite_interstitial_3_run
             GFS_suite_interstitial_4_run
             GFS_suite_stateout_reset_run
             GFS_suite_stateout_update_run
             GFS_surface_generic_pre_run
             cnvc90_run
             dcyc2t3_run
             get_phi_fv3_run
             get_prs_fv3_run
             gfdl_cloud_microphys_run
             gwdc_post_run
             gwdc_pre_run
             gwdc_run
             gwdps_run
             h2ophys_run
             hedmf_run
             ozphys_run
             rayleigh_damp_run
             samfdeepcnv_run
             samfshalcnv_post_run
             samfshalcnv_run
             zhaocarr_gscond_run
             zhaocarr_precpd_run
```

vertical_dimension_of_h2o_forcing_data

long_name	number of vertical layers in h2o forcing data
units	count
rank	0
type	integer
kind	
source	MODULE gmtb_scm_type_defs TYPE physics_type
local_name	physics%Interstitial(i)%levh2o
requested	h2ophys_run
physics set	physics

vertical_dimension_of_h2o_forcing_data_from_host

long_name	number of vertical layers in h2o forcing data coming from host
units	count
rank	0
type	integer
kind	
source	MODULE gmtb_scm_type_defs TYPE physics_type
local_name	physics%n_h2o_layers
requested	NOT REQUESTED
physics set	

vertical_dimension_of_ozone_forcing_data

long_name	number of vertical layers in ozone forcing data
units	count
rank	0
type	integer
kind	
source	MODULE gmtb_scm_type_defs TYPE physics_type
local_name	physics%Interstitial(i)%levozp
requested	ozphys_run
physics set	physics

vertical_dimension_of_ozone_forcing_data_from_host

```
long_name     number of vertical layers in ozone forcing data coming from host
units         count
rank          0
type          integer
kind
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%n_ozone_layers
requested     NOT REQUESTED
physics set
```

vertical_index_at_cloud_base

```
long_name     vertical index at cloud base
units         index
rank          1
type          integer
kind
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Interstitial(i)%kbot
requested     cnvc90_run
              gwdc_pre_run
              gwdc_run
              samfdeepcnv_run
              samfshalcnv_run
physics set   physics
```

vertical_index_at_cloud_top

```
long_name      vertical index at cloud top
units          index
rank           1
type           integer
kind
source         MODULE gmtb_scm_type_defs TYPE physics_type
local_name     physics%Interstitial(i)%ktop
requested      cnvc90_run
               gwdc_pre_run
               gwdc_run
               samfdeepcnv_run
               samfshalcnv_run
physics set    physics
```

vertical_index_at_top_of_atmosphere_boundary_layer

```
long_name      vertical index at top atmospheric boundary layer
units          index
rank           1
type           integer
kind
source         MODULE gmtb_scm_type_defs TYPE physics_type
local_name     physics%Interstitial(i)%kpbl
requested      GFS_suite_interstitial_3_run
               gwdps_run
               hedmf_run
physics set    physics
```

vertical_index_difference_between_inout_and_local

long_name	vertical index difference between in/out and local
units	index
rank	0
type	integer
kind	
source	MODULE gmtb_scm_type_defs TYPE physics_type
local_name	physics%Interstitial(i)%kd
requested	GFS_rrtmg_post_run
	GFS_rrtmg_pre_run
	rrtmg_lw_post_run
	rrtmg_sw_post_run
physics set	physics

vertical_index_difference_between_layer_and_lower_bound

long_name	vertical index difference between layer and lower bound
units	index
rank	0
type	integer
kind	
source	MODULE gmtb_scm_type_defs TYPE physics_type
local_name	physics%Interstitial(i)%kb
requested	GFS_rrtmg_post_run
	GFS_rrtmg_pre_run
physics set	physics

vertical_index_difference_between_layer_and_upper_bound

long_name	vertical index difference between layer and upper bound
units	index
rank	0
type	integer
kind	
source	MODULE gmtb_scm_type_defs TYPE physics_type
local_name	physics%Interstitial(i)%kt
requested	GFS_rrtmg_post_run
	GFS_rrtmg_pre_run
physics set	physics

vertical_interface_dimension

long_name	vertical interface dimension
units	count
rank	0
type	integer
kind	
source	MODULE gmtb_scm_type_defs TYPE physics_type
local_name	physics%Interstitial(i)%levi
requested	NOT REQUESTED
physics set	

vertical_layer_dimension_for_radiation

long_name	number of vertical layers for radiation
units	count
rank	0
type	integer
kind	
source	MODULE gmtb_scm_type_defs TYPE physics_type
local_name	physics%Interstitial(i)%lm
requested	GFS_rrtmg_post_run
	GFS_rrtmg_pre_run
	rrtmg_lw_post_run
	rrtmg_sw_post_run
physics set	physics

vertical_sigma_coordinate_for_radiation_initialization

long_name	vertical sigma coordinate for radiation initialization
units	none
rank	1
type	real
kind	kind_phys
source	MODULE gmtb_scm_type_defs TYPE physics_type
local_name	physics%Model(i)%si
requested	GFS_rrtmg_setup_init
physics set	physics

vertical_temperature_average_range_lower_bound
```
long_name     zsea1 in mm
units         mm
rank          0
type          integer
kind
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Model(i)%nstf_name(4)
requested     sfc_nst_post_run
              sfc_nst_run
physics set   physics
```

vertical_temperature_average_range_upper_bound
```
long_name     zsea2 in mm
units         mm
rank          0
type          integer
kind
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Model(i)%nstf_name(5)
requested     sfc_nst_post_run
              sfc_nst_run
physics set   physics
```

vertically_diffused_tracer_concentration

```
long_name      tracer concentration diffused by PBL scheme
units          kg kg-1
rank           3
type           real
kind           kind_phys
source         MODULE gmtb_scm_type_defs TYPE physics_type
local_name     physics%Interstitial(i)%vdftra
requested      GFS_PBL_generic_pre_run
               hedmf_run
physics set    physics
```

volume_fraction_of_condensed_water_in_soil_at_wilting_point

```
long_name      wilting point (volumetric)
units          frac
rank           1
type           real
kind           kind_phys
source         MODULE gmtb_scm_type_defs TYPE physics_type
local_name     physics%Diag(i)%smcwlt2
requested      lsm_noah_pre_run
               lsm_noah_run
physics set    physics
```

volume_fraction_of_soil_moisture

```
long_name      total soil moisture
units          frac
rank           2
type           real
kind           kind_phys
source         MODULE gmtb_scm_type_defs TYPE physics_type
local_name     physics%Sfcprop(i)%smc
requested      lsm_noah_run
physics set    physics
```

volume_fraction_of_soil_moisture_for_land_surface_model
```
long_name     volumetric fraction of soil moisture for lsm
units         frac
rank          2
type          real
kind          kind_phys
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Sfcprop(i)%smois
requested     NOT REQUESTED
physics set
```

volume_fraction_of_unfrozen_soil_moisture
```
long_name     liquid soil moisture
units         frac
rank          2
type          real
kind          kind_phys
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Sfcprop(i)%slc
requested     lsm_noah_run
physics set   physics
```

volume_fraction_of_unfrozen_soil_moisture_for_land_surface_model
```
long_name     volume fraction of unfrozen soil moisture for lsm
units         frac
rank          2
type          real
kind          kind_phys
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Sfcprop(i)%sh2o
requested     NOT REQUESTED
physics set
```

volume_mixing_ratio_ccl4

long_name	volume mixing ratio ccl4
units	kg kg-1
rank	2
type	real
kind	kind_phys
source	MODULE gmtb_scm_type_defs TYPE physics_type
local_name	physics%Interstitial(i)%gasvmr(:,:,9)
requested	GFS_rrtmg_pre_run
	rrtmg_lw_run
	rrtmg_sw_run
physics set	physics

volume_mixing_ratio_cfc11

long_name	volume mixing ratio cfc11
units	kg kg-1
rank	2
type	real
kind	kind_phys
source	MODULE gmtb_scm_type_defs TYPE physics_type
local_name	physics%Interstitial(i)%gasvmr(:,:,6)
requested	GFS_rrtmg_pre_run
	rrtmg_lw_run
	rrtmg_sw_run
physics set	physics

volume_mixing_ratio_cfc113

```
long_name     volume mixing ratio cfc113
units         kg kg-1
rank          2
type          real
kind          kind_phys
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Interstitial(i)%gasvmr(:,:,10)
requested     GFS_rrtmg_pre_run
physics set   physics
```

volume_mixing_ratio_cfc12

```
long_name     volume mixing ratio cfc12
units         kg kg-1
rank          2
type          real
kind          kind_phys
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Interstitial(i)%gasvmr(:,:,7)
requested     GFS_rrtmg_pre_run
              rrtmg_lw_run
              rrtmg_sw_run
physics set   physics
```

volume_mixing_ratio_cfc22

```
long_name      volume mixing ratio cfc22
units          kg kg-1
rank           2
type           real
kind           kind_phys
source         MODULE gmtb_scm_type_defs TYPE physics_type
local_name     physics%Interstitial(i)%gasvmr(:,:,8)
requested      GFS_rrtmg_pre_run
               rrtmg_lw_run
               rrtmg_sw_run
physics set    physics
```

volume_mixing_ratio_ch4

```
long_name      volume mixing ratio ch4
units          kg kg-1
rank           2
type           real
kind           kind_phys
source         MODULE gmtb_scm_type_defs TYPE physics_type
local_name     physics%Interstitial(i)%gasvmr(:,:,3)
requested      GFS_rrtmg_pre_run
               rrtmg_lw_run
               rrtmg_sw_run
physics set    physics
```

volume_mixing_ratio_co

```
long_name      volume mixing ratio co
units          kg kg-1
rank           2
type           real
kind           kind_phys
source         MODULE gmtb_scm_type_defs TYPE physics_type
local_name     physics%Interstitial(i)%gasvmr(:,:,5)
requested      GFS_rrtmg_pre_run
               rrtmg_lw_run
               rrtmg_sw_run
physics set    physics
```

volume_mixing_ratio_co2

```
long_name      volume mixing ratio co2
units          kg kg-1
rank           2
type           real
kind           kind_phys
source         MODULE gmtb_scm_type_defs TYPE physics_type
local_name     physics%Interstitial(i)%gasvmr(:,:,1)
requested      GFS_rrtmg_pre_run
               rrtmg_lw_run
               rrtmg_sw_run
physics set    physics
```

volume_mixing_ratio_n2o

```
long_name     volume mixing ratio no2
units         kg kg-1
rank          2
type          real
kind          kind_phys
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Interstitial(i)%gasvmr(:,:,2)
requested     GFS_rrtmg_pre_run
              rrtmg_lw_run
              rrtmg_sw_run
physics set   physics
```

volume_mixing_ratio_o2

```
long_name     volume mixing ratio o2
units         kg kg-1
rank          2
type          real
kind          kind_phys
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Interstitial(i)%gasvmr(:,:,4)
requested     GFS_rrtmg_pre_run
              rrtmg_lw_run
              rrtmg_sw_run
physics set   physics
```

vonKarman_constant

```
long_name      vonKarman constant
units          none
rank           0
type           real
kind           kind_phys
source         MODULE gmtb_scm_physical_constants
local_name     con_vonKarman
requested      gmtb_scm_sfc_flux_spec_run
physics set    physics
```

water_equivalent_accumulated_snow_depth

```
long_name      water equiv of acc snow depth over land and sea ice
units          mm
rank           1
type           real
kind           kind_phys
source         MODULE gmtb_scm_type_defs TYPE physics_type
local_name     physics%Sfcprop(i)%weasd
requested      lsm_noah_run
               sfc_sice_run
physics set    physics
```

water_friendly_aerosol_number_concentration

```
long_name      number concentration of water-friendly aerosols
units          kg-1
rank           2
type           real
kind           kind_phys
source         MODULE gmtb_scm_type_defs TYPE physics_type
local_name     physics%Statein(i)%qgrs(:,:,physics%Model(i)%ntwa)
requested      GFS_PBL_generic_pre_run
physics set    physics
```

water_friendly_aerosol_number_concentration_updated_by_physics

```
long_name     number concentration of water-friendly aerosols updated by physics
units         kg-1
rank          2
type          real
kind          kind_phys
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Stateout(i)%gq0(:,:,physics%Model(i)%ntwa)
requested     NOT REQUESTED
physics set
```

water_vapor_specific_humidity

```
long_name     water vapor specific humidity
units         kg kg-1
rank          2
type          real
kind          kind_phys
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Statein(i)%qgrs(:,:,scm_state%water_vapor_index)
requested     GFS_PBL_generic_pre_run
              get_prs_fv3_run
              gwdc_run
              gwdps_run
physics set   physics
```

water_vapor_specific_humidity_at_layer_for_radiation

```
long_name      specific humidity layer
units          kg kg-1
rank           2
type           real
kind           kind_phys
source         MODULE gmtb_scm_type_defs TYPE physics_type
local_name     physics%Interstitial(i)%qlyr
requested      GFS_rrtmg_pre_run
               rrtmg_lw_run
               rrtmg_sw_run
physics set    physics
```

water_vapor_specific_humidity_at_lowest_model_layer

```
long_name      water vapor specific humidity at lowest model layer
units          kg kg-1
rank           1
type           real
kind           kind_phys
source         MODULE gmtb_scm_type_defs TYPE physics_type
local_name     physics%Statein(i)%qgrs(:,1,scm_state%water_vapor_index)
requested      GFS_surface_generic_post_run
               gmtb_scm_sfc_flux_spec_run
               lsm_noah_run
               sfc_ex_coef_run
               sfc_nst_run
               sfc_sice_run
physics set    physics
```

water_vapor_specific_humidity_at_lowest_model_layer_for_diag
```
    long_name      layer 1 specific humidity for diag
    units          kg kg-1
    rank           1
    type           real
    kind           kind_phys
    source         MODULE gmtb_scm_type_defs TYPE physics_type
    local_name     physics%Diag(i)%q1
    requested      GFS_surface_generic_post_run
    physics set    physics
```

water_vapor_specific_humidity_at_lowest_model_layer_updated_by_physics
```
    long_name      water vapor specific humidity at lowest model layer updated by physics
    units          kg kg-1
    rank           1
    type           real
    kind           kind_phys
    source         MODULE gmtb_scm_type_defs TYPE physics_type
    local_name     physics%Stateout(i)%gq0(:,1,scm_state%water_vapor_index)
    requested      sfc_diag_run
    physics set    physics
```

water_vapor_specific_humidity_at_previous_time_step
```
    long_name      water vapor specific humidity at previous time step
    units          kg kg-1
    rank           2
    type           real
    kind           kind_phys
    source         MODULE gmtb_scm_type_defs TYPE physics_type
    local_name     physics%Tbd(i)%phy_f3d(:,:,4)
    requested      zhaocarr_gscond_run
    physics set    physics
```

water_vapor_specific_humidity_save

    long_name   water vapor specific humidity before entering a physics scheme
    units   kg kg-1
    rank   2
    type   real
    kind   kind_phys
    source   MODULE gmtb_scm_type_defs TYPE physics_type
    local_name   physics%Interstitial(i)%save_q(:,:,scm_state%water_vapor_index)
    requested   GFS_DCNV_generic_post_run
                  GFS_DCNV_generic_pre_run
                  GFS_MP_generic_post_run
                  GFS_SCNV_generic_post_run
                  GFS_SCNV_generic_pre_run
    physics set   physics

water_vapor_specific_humidity_two_time_steps_back

    long_name   water vapor specific humidity two time steps back
    units   kg kg-1
    rank   2
    type   real
    kind   kind_phys
    source   MODULE gmtb_scm_type_defs TYPE physics_type
    local_name   physics%Tbd(i)%phy_f3d(:,:,2)
    requested   zhaocarr_gscond_run
    physics set   physics

water_vapor_specific_humidity_updated_by_physics

```
     long_name      water vapor specific humidity updated by physics
     units          kg kg-1
     rank           2
     type           real
     kind           kind_phys
     source         MODULE gmtb_scm_type_defs TYPE physics_type
     local_name     physics%Stateout(i)%gq0(:,:,scm_state%water_vapor_index)
     requested      GFS_DCNV_generic_post_run
                    GFS_DCNV_generic_pre_run
                    GFS_SCNV_generic_post_run
                    GFS_SCNV_generic_pre_run
                    get_phi_fv3_run
                    gfdl_cloud_microphys_run
                    h2ophys_run
                    samfdeepcnv_run
                    samfshalcnv_run
                    zhaocarr_gscond_run
                    zhaocarr_precpd_run
     physics set    physics
```

weights_for_stochastic_shum_perturbation

```
     long_name      weights for stochastic shum perturbation
     units          none
     rank           2
     type           real
     kind           kind_phys
     source         MODULE gmtb_scm_type_defs TYPE physics_type
     local_name     physics%Coupling(i)shum_wts
     requested      NOT REQUESTED
     physics set
```

weights_for_stochastic_shum_perturbation_flipped

```
long_name     weights for stochastic shum perturbation, flipped
units         none
rank          2
type          real
kind          kind_phys
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Diag(i)%shum_wts
requested     NOT REQUESTED
physics set
```

weights_for_stochastic_skeb_perturbation_of_x_wind

```
long_name     weights for stochastic skeb perturbation of x wind
units         none
rank          2
type          real
kind          kind_phys
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Coupling(i)%skebu_wts
requested     NOT REQUESTED
physics set
```

weights_for_stochastic_skeb_perturbation_of_x_wind_flipped

```
long_name     weights for stochastic skeb perturbation of x wind, flipped
units         none
rank          2
type          real
kind          kind_phys
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Diag(i)%skebu_wts
requested     NOT REQUESTED
physics set
```

weights_for_stochastic_skeb_perturbation_of_y_wind

```
long_name     weights for stochastic skeb perturbation of y wind
units         none
rank          2
type          real
kind          kind_phys
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Coupling(i)%skebv_wts
requested     NOT REQUESTED
physics set
```

weights_for_stochastic_skeb_perturbation_of_y_wind_flipped

```
long_name     weights for stochastic skeb perturbation of y wind, flipped
units         none
rank          2
type          real
kind          kind_phys
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Diag(i)%skebv_wts
requested     NOT REQUESTED
physics set
```

weights_for_stochastic_sppt_perturbation

```
long_name     weights for stochastic sppt perturbation
units         none
rank          2
type          real
kind          kind_phys
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Coupling(i)%sppt_wts
requested     NOT REQUESTED
physics set
```

weights_for_stochastic_sppt_perturbation_flipped

```
long_name     weights for stochastic sppt perturbation, flipped
units         none
rank          2
type          real
kind          kind_phys
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Diag(i)%sppt_wts
requested     NOT REQUESTED
physics set
```

weights_for_stochastic_surface_physics_perturbation

```
long_name     weights for stochastic surface physics perturbation
units         none
rank          2
type          real
kind          kind_phys
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Coupling(i)%sfc_wts
requested     GFS_surface_generic_pre_run
physics set   physics
```

wind_speed_at_lowest_model_layer

```
long_name      wind speed at lowest model level
units          m s-1
rank           1
type           real
kind           kind_phys
source         MODULE gmtb_scm_type_defs TYPE physics_type
local_name     physics%Interstitial(i)%wind
requested      GFS_surface_loop_control_part1_run
               GFS_surface_loop_control_part2_run
               gmtb_scm_sfc_flux_spec_run
               hedmf_run
               sfc_ex_coef_run
physics set  physics
```

x_wind

```
long_name      zonal wind
units          m s-1
rank           2
type           real
kind           kind_phys
source         MODULE gmtb_scm_type_defs TYPE physics_type
local_name     physics%Statein(i)%ugrs
requested      GFS_suite_stateout_reset_run
               GFS_suite_stateout_update_run
               gwdc_run
               gwdps_run
               hedmf_run
               rayleigh_damp_run
physics set  physics
```

x_wind_at_10m

long_name	10 meter u wind speed
units	m s-1
rank	1
type	real
kind	kind_phys
source	MODULE gmtb_scm_type_defs TYPE physics_type
local_name	physics%Diag(i)%u10m
requested	GFS_surface_generic_post_run
	gmtb_scm_sfc_flux_spec_run
	hedmf_run
	sfc_diag_post_run
	sfc_diag_run
physics set	physics

x_wind_at_lowest_model_layer

long_name	zonal wind at lowest model layer
units	m s-1
rank	1
type	real
kind	kind_phys
source	MODULE gmtb_scm_type_defs TYPE physics_type
local_name	physics%Statein(i)%ugrs(:,1)
requested	GFS_surface_generic_post_run
	gmtb_scm_sfc_flux_spec_run
	lsm_noah_run
	sfc_ex_coef_run
	sfc_nst_run
	sfc_sice_run
physics set	physics

x_wind_at_lowest_model_layer_for_diag

    long_name   layer 1 x wind for diag
    units   m s-1
    rank   1
    type   real
    kind   kind_phys
    source   MODULE gmtb_scm_type_defs TYPE physics_type
    local_name   physics%Diag(i)%u1
    requested   GFS_surface_generic_post_run
    physics set   physics

x_wind_at_lowest_model_layer_updated_by_physics

    long_name   zonal wind at lowest model layer updated by physics
    units   m s-1
    rank   1
    type   real
    kind   kind_phys
    source   MODULE gmtb_scm_type_defs TYPE physics_type
    local_name   physics%Stateout(i)%gu0(:,1)
    requested   sfc_diag_run
    physics set   physics

x_wind_save

    long_name   x-wind before entering a physics scheme
    units   m s-1
    rank   2
    type   real
    kind   kind_phys
    source   MODULE gmtb_scm_type_defs TYPE physics_type
    local_name   physics%Interstitial(i)%save_u
    requested   GFS_DCNV_generic_post_run
                  GFS_DCNV_generic_pre_run
    physics set   physics

x_wind_updated_by_physics

long_name	zonal wind updated by physics
units	m s-1
rank	2
type	real
kind	kind_phys
source	MODULE gmtb_scm_type_defs TYPE physics_type
local_name	physics%Stateout(i)%gu0
requested	GFS_DCNV_generic_post_run
	GFS_DCNV_generic_pre_run
	GFS_suite_stateout_reset_run
	GFS_suite_stateout_update_run
	gfdl_cloud_microphys_run
	gwdc_post_run
	samfdeepcnv_run
	samfshalcnv_run
physics set	physics

y_wind

long_name	meridional wind
units	m s-1
rank	2
type	real
kind	kind_phys
source	MODULE gmtb_scm_type_defs TYPE physics_type
local_name	physics%Statein(i)%vgrs
requested	GFS_suite_stateout_reset_run
	GFS_suite_stateout_update_run
	gwdc_run
	gwdps_run
	hedmf_run
	rayleigh_damp_run
physics set	physics

y_wind_at_10m

```
long_name      10 meter v wind speed
units          m s-1
rank           1
type           real
kind           kind_phys
source         MODULE gmtb_scm_type_defs TYPE physics_type
local_name     physics%Diag(i)%v10m
requested      GFS_surface_generic_post_run
               gmtb_scm_sfc_flux_spec_run
               hedmf_run
               sfc_diag_post_run
               sfc_diag_run
physics set    physics
```

y_wind_at_lowest_model_layer

```
long_name      meridional wind at lowest model layer
units          m s-1
rank           1
type           real
kind           kind_phys
source         MODULE gmtb_scm_type_defs TYPE physics_type
local_name     physics%Statein(i)%vgrs(:,1)
requested      GFS_surface_generic_post_run
               gmtb_scm_sfc_flux_spec_run
               lsm_noah_run
               sfc_ex_coef_run
               sfc_nst_run
               sfc_sice_run
physics set    physics
```

y_wind_at_lowest_model_layer_for_diag

```
long_name     layer 1 y wind for diag
units         m s-1
rank          1
type          real
kind          kind_phys
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Diag(i)%v1
requested     GFS_surface_generic_post_run
physics set   physics
```

y_wind_at_lowest_model_layer_updated_by_physics

```
long_name     meridional wind at lowest model layer updated by physics
units         m s-1
rank          1
type          real
kind          kind_phys
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Stateout(i)%gv0(:,1)
requested     sfc_diag_run
physics set   physics
```

y_wind_save

```
long_name     y-wind before entering a physics scheme
units         m s-1
rank          2
type          real
kind          kind_phys
source        MODULE gmtb_scm_type_defs TYPE physics_type
local_name    physics%Interstitial(i)%save_v
requested     GFS_DCNV_generic_post_run
              GFS_DCNV_generic_pre_run
physics set   physics
```

y_wind_updated_by_physics

long_name	meridional wind updated by physics
units	m s-1
rank	2
type	real
kind	kind_phys
source	MODULE gmtb_scm_type_defs TYPE physics_type
local_name	physics%Stateout(i)%gv0
requested	GFS_DCNV_generic_post_run
	GFS_DCNV_generic_pre_run
	GFS_suite_stateout_reset_run
	GFS_suite_stateout_update_run
	gfdl_cloud_microphys_run
	gwdc_post_run
	samfdeepcnv_run
	samfshalcnv_run
physics set	physics

zenith_angle_temporal_adjustment_factor_for_shortwave_fluxes

long_name	zenith angle temporal adjustment factor for shortwave
units	none
rank	1
type	real
kind	kind_phys
source	MODULE gmtb_scm_type_defs TYPE physics_type
local_name	physics%Interstitial(i)%xmu
requested	GFS_PBL_generic_post_run
	GFS_suite_interstitial_2_run
	dcyc2t3_run
	hedmf_run
physics set	physics