!---

Text S01.

! Input file for precursor run that returns a 3.5°C stratified water column. An ! explanation of the input parameters and of the set-up of the file can be ! found in https://palm.muk.uni-hannover.de/trac.

!---

```
&inipar nx = 127, ny = 511, nz = 32,
        dx = 1, dy = 1, dz = 1,

        ocean = .T.,

        fft_method = 'temperton-algorithm',   ! fast, but restrictions apply

        momentum_advec = 'ws-scheme',        ! default advection scheme
    scalar_advec   = 'ws-scheme',

        phi = 54,

        initializing_actions = 'set_constant_profiles',

        ug_surface = 0.4, vg_surface = 0.0,

        bc_pt_b = 'neumann',
    bc_uv_t = 'neumann',
    bc_p_t = 'neumann'
        bc_p_b = 'dirichlet',
    bc_pt_t = 'neumann',
    bc_s_t = 'neumann',
    bc_s_b = 'neumann',

        random_heatflux = .F.,
    use_top_fluxes = .T.,
    top_heatflux = 0.0,
    top_momentumflux_u = 0.0,
    top_momentumflux_v = 0.0,
    top_salinityflux = 0.0,
```

```
   surface_heatflux = 0.0,

        topography = 'flat',

        sa_surface = 33.,

        pt_surface = 288.15,
   pt_vertical_gradient = 40.0, 0.0,
        pt_vertical_gradient_level = -0.5, -10.5,

        passive_scalar = .T.,
        s_surface = 0.006,
        s_vertical_gradient = -60.0, 0.0,
        s_vertical_gradient_level = -30 -32,/


&d3par  end_time = 60000.0,
        restart_time = 60000,
        dt_restart = 60000,

        create_disturbances = .T.,
        disturbance_level_t = -28.5,
        disturbance_level_b = -29.5,
        disturbance_amplitude = 0.0001,

        dt_run_control = 0.0,
        dt_dots = 0.0,

        dt_data_output = 200.0,
        dt_data_output_av  = 200.0,
        averaging_interval = 200.0,
        dt_averaging_input = 0.0,

        section_xz =  64,
        section_xy =  30, 2

        data_output = 'u_xz', 'pt_xz', 's_xz',
                'u_xy', 'pt_xy', 's_xy',
```

```
dt_dopr = 2000.0,
averaging_interval_pr = 2000.0,
dt_averaging_input_pr = 0.0,
data_output_pr = '#u', '#v', '#pt', 'w', 'e',
         'w"u"', 'w*u*','wu', 'e*',
         'w"v"', 'w*v*','wv',
         'w"vpt"', 'w*vpt*','wvpt',
         'w"pt"', 'w*pt*','wpt',
         'u*2','v*2', 'w*u*u*:dz',
         '#km', '#l',

data_output_2d_on_each_pe = .F.,

npey = 32,
npex = 8,/
```

!---

Text S02.

! Input file for precursor run that returns a 2.5°C stratified water column. An ! explanation of the input parameters and of the set-up of the file can be ! found in https://palm.muk.uni-hannover.de/trac.

!---

```
&inipar nx = 127, ny = 511, nz = 32,
        dx = 1, dy = 1, dz = 1,

        ocean = .T.,

        fft_method = 'temperton-algorithm',   ! fast, but restrictions apply

        momentum_advec = 'ws-scheme',      ! default advection scheme
        scalar_advec   = 'ws-scheme',

        phi = 54,

        initializing_actions = 'set_constant_profiles',

        ug_surface = 0.4, vg_surface = 0.0,

        bc_pt_b = 'neumann',
        bc_uv_t = 'neumann',
        bc_p_t = 'neumann'
        bc_p_b = 'dirichlet',
        bc_pt_t = 'neumann',
        bc_s_t = 'neumann',
        bc_s_b = 'neumann',

        random_heatflux = .F.,
        use_top_fluxes = .T.,
        top_heatflux = 0.0,
        top_momentumflux_u = 0.0,
        top_momentumflux_v = 0.0,
        top_salinityflux = 0.0,
        surface_heatflux = 0.0,
```

```
        topography = 'flat',

        sa_surface = 33.,

        pt_surface = 288.15,
        pt_vertical_gradient = 30.0, 0.0,
        pt_vertical_gradient_level = -0.5, -10.5,

        passive_scalar = .T.,
        s_surface = 0.006,
        s_vertical_gradient = -60.0, 0.0,
        s_vertical_gradient_level = -30 -32,/


&d3par  end_time = 60000.0,
        restart_time = 60000,
        dt_restart = 60000,

        create_disturbances = .T.,
        disturbance_level_t = -28.5,
        disturbance_level_b = -29.5,
        disturbance_amplitude = 0.0001,

        dt_run_control = 0.0,
        dt_dots = 0.0,

        dt_data_output = 200.0,
        dt_data_output_av  = 200.0,
        averaging_interval = 200.0,
        dt_averaging_input = 0.0,

        section_xz =  64,
        section_xy =  30, 2

        data_output = 'u_xz', 'pt_xz', 's_xz',
                      'u_xy', 'pt_xy', 's_xy',

        dt_dopr = 2000.0,
```

```
    averaging_interval_pr = 2000.0,
    dt_averaging_input_pr = 0.0,
    data_output_pr = '#u', '#v', '#pt', 'w', 'e',
             'w"u"', 'w*u*','wu', 'e*',
             'w"v"', 'w*v*','wv',
             'w"vpt"', 'w*vpt*','wvpt',
             'w"pt"', 'w*pt*','wpt',
             'u*2','v*2', 'w*u*u*:dz',
             '#km', '#l',

    data_output_2d_on_each_pe = .F.,

    npey = 32,
    npex = 8,/

!-------------------------------------------------------------------------------------------------
```

Text S03.

! Input file for precursor run that returns a 1.5°C stratified water column. An ! explanation of the input parameters and of the set-up of the file can be ! found in https://palm.muk.uni-hannover.de/trac.

```
!-------------------------------------------------------------------------------------------------
&inipar nx = 127, ny = 511, nz = 32,
       dx = 1, dy = 1, dz = 1,

       ocean = .T.,

       fft_method = 'temperton-algorithm',   ! fast, but restrictions apply

       momentum_advec = 'ws-scheme',        ! default advection scheme
         scalar_advec   = 'ws-scheme',

       phi = 54,

       initializing_actions = 'set_constant_profiles',

       ug_surface = 0.4, vg_surface = 0.0,
```

```
      bc_pt_b = 'neumann',
         bc_uv_t = 'neumann',
         bc_p_t = 'neumann'
      bc_p_b = 'dirichlet',
         bc_pt_t = 'neumann',
         bc_s_t = 'neumann',
         bc_s_b = 'neumann',

      random_heatflux = .F.,
         use_top_fluxes = .T.,
         top_heatflux = 0.0,
         top_momentumflux_u = 0.0,
         top_momentumflux_v = 0.0,
         top_salinityflux = 0.0,
         surface_heatflux = 0.0,

      topography = 'flat',

      sa_surface = 33.,

      pt_surface = 288.15,
         pt_vertical_gradient = 20.0, 0.0,
      pt_vertical_gradient_level = -0.5, -10.5,

      passive_scalar = .T.,
      s_surface = 0.006,
      s_vertical_gradient = -60.0, 0.0,
      s_vertical_gradient_level = -30 -32,/


&d3par  end_time = 40000.0,
      restart_time = 40000,
      dt_restart = 40000,

      create_disturbances = .T.,
      disturbance_level_t = -28.5,
      disturbance_level_b = -29.5,
      disturbance_amplitude = 0.0001,
```

```
dt_run_control = 0.0,
dt_dots = 0.0,

dt_data_output = 200.0,
dt_data_output_av  = 200.0,
averaging_interval = 200.0,
dt_averaging_input = 0.0,

section_xz =  64,
section_xy =  30, 2

data_output = 'u_xz', 'pt_xz', 's_xz',
              'u_xy', 'pt_xy', 's_xy',

dt_dopr = 2000.0,
averaging_interval_pr = 2000.0,
dt_averaging_input_pr = 0.0,
data_output_pr = '#u', '#v', '#pt', 'w', 'e',
                 'w"u"', 'w*u*','wu', 'e*',
                 'w"v"', 'w*v*','wv',
                 'w"vpt"', 'w*vpt*','wvpt',
                 'w"pt"', 'w*pt*','wpt',
                 'u*2','v*2', 'w*u*u*:dz',
                 '#km', '#l',

data_output_2d_on_each_pe = .F.,

npey = 32,
npex = 8,/
```

!----------

Text S04.

! Input file for precursor run that returns a 0.5°C stratified water column. An ! explanation of the input parameters and of the set-up of the file can be ! found in https://palm.muk.uni-hannover.de/trac.

```
!-------------------------------------------------------------------------------------------------
&inipar nx = 127, ny = 511, nz = 32,
        dx = 1, dy = 1, dz = 1,

        ocean = .T.,

        fft_method = 'temperton-algorithm',   ! fast, but restrictions apply

        momentum_advec = 'ws-scheme',         ! default advection scheme
    scalar_advec   = 'ws-scheme',

        phi = 54,

        initializing_actions = 'set_constant_profiles',

        ug_surface = 0.4, vg_surface = 0.0,

        bc_pt_b = 'neumann',
    bc_uv_t = 'neumann',
    bc_p_t = 'neumann'
        bc_p_b = 'dirichlet',
    bc_pt_t = 'neumann',
    bc_s_t = 'neumann',
    bc_s_b = 'neumann',

        random_heatflux = .F.,
    use_top_fluxes = .T.,
    top_heatflux = 0.0,
    top_momentumflux_u = 0.0,
    top_momentumflux_v = 0.0,
    top_salinityflux = 0.0,
    surface_heatflux = 0.0,

        topography = 'flat',

        sa_surface = 33.,

        pt_surface = 288.15,
    pt_vertical_gradient = 12.0, 0.0,
```

```
        pt_vertical_gradient_level = -0.5, -10.5,

        passive_scalar = .T.,
        s_surface = 0.006,
        s_vertical_gradient = -60.0, 0.0,
        s_vertical_gradient_level = -30 -32,/


&d3par  end_time = 15000.0,
        restart_time = 15000,
        dt_restart = 15000,

        create_disturbances = .T.,
        disturbance_level_t = -28.5,
        disturbance_level_b = -29.5,
        disturbance_amplitude = 0.0001,

        dt_run_control = 0.0,
        dt_dots = 0.0,

        dt_data_output = 200.0,
        dt_data_output_av  = 200.0,
        averaging_interval = 200.0,
        dt_averaging_input = 0.0,

        section_xz =  64,
        section_xy =  30, 2

        data_output = 'u_xz', 'pt_xz', 's_xz',
                'u_xy', 'pt_xy', 's_xy',

        dt_dopr = 2000.0,
        averaging_interval_pr = 2000.0,
        dt_averaging_input_pr = 0.0,
        data_output_pr = '#u', '#v', '#pt', 'w', 'e',
                'w"u"', 'w*u*','wu', 'e*',
                'w"v"', 'w*v*','wv',
                'w"vpt"', 'w*vpt*','wvpt',
                'w"pt"', 'w*pt*','wpt',
```

```
            'u*2','v*2', 'w*u*u*:dz',
            '#km', '#l',

        data_output_2d_on_each_pe = .F.,

        npey = 32,
        npex = 8,/


!-------------------------------------------------------------------------------------------------
```

Text S05.

! Input file for main run that simulates the wake past a monopile and bottom !boundary layer mixing in a 3.5°C stratified water column. An explanation of !the input parameters and of the set-up of the file can be found in !https://palm.muk.uni-hannover.de/trac.

```
!-------------------------------------------------------------------------------------------------
&inipar  nx = 1023, ny = 1023, nz = 32,
        dx = 1, dy = 1, dz = 1,

        ocean = .T.,

        fft_method =  'temperton-algorithm',   ! fast, but restrictions apply
        psolver = 'multigrid',
        mg_cycles = 4,
        residual_limit = 0.0001,

        momentum_advec = 'ws-scheme',        ! default advection scheme
        scalar_advec   = 'ws-scheme',

        phi = 54,

        initializing_actions = 'read_restart_data', !'cyclic_fill',

        bc_pt_b = 'neumann',
        bc_uv_t = 'neumann',
        bc_p_t = 'neumann',
```

```
        bc_p_b = 'dirichlet',
        bc_pt_t = 'neumann',
        bc_lr = 'dirichlet/radiation',
    bc_s_t = 'neumann',
    bc_s_b = 'neumann',

        random_heatflux = .F.,
        use_top_fluxes = .T.,
        top_heatflux = 0.0,
        top_momentumflux_u = 0.0,
        top_momentumflux_v = 0.0,
        top_salinityflux = 0.0,
        surface_heatflux = 0.0,

        topography = 'read_from_file',

        turbulent_inflow = .T.,
        recycling_width = 128,
        recycling_yshift = .T.,

        passive_scalar = .T.,/

&d3par  end_time = 50000.0,
        restart_time = 30000,
        dt_restart = 20000,
        create_disturbances = .F.,

        dt_run_control = 0.0,
        dt_dots = 0.0,

        dt_data_output = 200.0,
        skip_time_data_output_av = 10000,
        dt_data_output_av  = 5000.0,
        averaging_interval = 5000.0,
        dt_averaging_input = 0.0,

        section_xz =  512,
        section_xy =  30, 15, 4,
```

```
        data_output = 'u_xz', 'pt_xz', 's_xz',
                'u_xy', 'pt_xy', 's_xy',
                'u_av', 'pt_av', 'v_av', 'w_av', 'e_av', 's_av',
                'u', 'pt', 'v', 'w', 's',

        dt_dopr = 2000.0,
        averaging_interval_pr = 2000.0,
        dt_averaging_input_pr = 0.0,
        data_output_pr = '#u', '#v', '#pt', 'w', 'e',
                'w"u"', 'w*u*','wu', 'e*',
                'w"v"', 'w*v*','wv',
                'w"vpt"', 'w*vpt*','wvpt',
                'w"pt"', 'w*pt*','wpt',
                'u*2','v*2', 'w*u*u*:dz',
                '#km', '#l',
                'w"s"', 'w*s*','ws',


        skip_time_domask = 10000.0,

        dt_domask             = 0.0,

        data_output_masks(1,:) = 'u',

        mask_x_loop(1,:) = 20.0, 1020.0, 20.0,
        mask_y_loop(1,:) = 0.0, 1020.0, 25.0,
        mask_z_loop(1,:) = -1.0, -30.0, 2,

        data_output_2d_on_each_pe = .F.,/

!-------------------------------------------------------------------------------------------------
```

Text S06.

```
! Input file for main run that simulates bottom boundary layer mixing in a !
3.5°C stratified water column. An explanation of the input parameters and !of
the set-up of the file can be found in !https://palm.muk.uni-hannover.de/trac.

!-------------------------------------------------------------------------------------------------
&inipar  nx = 1023, ny = 1023, nz = 32,
```

```
    dx = 1, dy = 1, dz = 1,

    ocean = .T.,

    fft_method =  'temperton-algorithm',   ! fast, but restrictions apply
    psolver = 'multigrid',
    mg_cycles = 4,
    residual_limit = 0.0001,

    momentum_advec = 'ws-scheme',         ! default advection scheme
    scalar_advec   = 'ws-scheme',

    phi = 54,

    initializing_actions = 'read_restart_data', !'cyclic_fill',

    bc_pt_b = 'neumann',
    bc_uv_t = 'neumann',
    bc_p_t = 'neumann',
    bc_p_b = 'dirichlet',
    bc_pt_t = 'neumann',
    bc_lr = 'dirichlet/radiation',
bc_s_t = 'neumann',
bc_s_b = 'neumann',

    random_heatflux = .F.,
    use_top_fluxes = .T.,
    top_heatflux = 0.0,
    top_momentumflux_u = 0.0,
    top_momentumflux_v = 0.0,
    top_salinityflux = 0.0,
    surface_heatflux = 0.0,

    topography = 'flat',

    turbulent_inflow = .T.,
    recycling_width = 128,
    recycling_yshift = .T.,
```

```
        passive_scalar = .T.,/

&d3par  end_time = 35000.0,
        restart_time = 15000,
        dt_restart = 15000,
        create_disturbances = .F.,

        dt_run_control = 0.0,
        dt_dots = 0.0,

        dt_data_output = 200.0,
        skip_time_data_output_av = 10000,
        dt_data_output_av  = 5000.0,
        averaging_interval = 5000.0,
        dt_averaging_input = 0.0,

        section_xz =  512,
        section_xy =  30, 15, 4,

        data_output = 'u_xz', 'pt_xz', 's_xz',
                'u_xy', 'pt_xy', 's_xy',
                'u_av', 'pt_av', 'v_av', 'w_av', 'e_av', 's_av',
                'u', 'pt', 'v', 'w', 's',

        dt_dopr = 2000.0,
        averaging_interval_pr = 2000.0,
        dt_averaging_input_pr = 0.0,
        data_output_pr = '#u', '#v', '#pt', 'w', 'e',
                'w"u"', 'w*u*','wu', 'e*',
                'w"v"', 'w*v*','wv',
                'w"vpt"', 'w*vpt*','wvpt',
                'w"pt"', 'w*pt*','wpt',
                'u*2','v*2', 'w*u*u*:dz',
                '#km', '#l',
                'w"s"', 'w*s*','ws',


        skip_time_domask = 10000.0,
```

```
        dt_domask               = 0.0,

        data_output_masks(1,:) = 'u',

        mask_x_loop(1,:) = 20.0, 1020.0, 20.0,
        mask_y_loop(1,:) = 0.0, 1020.0, 25.0,
        mask_z_loop(1,:) = -1.0, -30.0, 2,

        data_output_2d_on_each_pe = .F.,/


!-----------------------------------------------------------------------------------------------
```

Text S07.

! Input file for main run that simulates the wake past a monopile and bottom !boundary layer mixing in a 2.5°C stratified water column. An explanation of !the input parameters and of the set-up of the file can be found in !https://palm.muk.uni-hannover.de/trac.

```
!-----------------------------------------------------------------------------------------------
&inipar  nx = 1023, ny = 1023, nz = 32,
        dx = 1, dy = 1, dz = 1,

        ocean = .T.,

        fft_method =  'temperton-algorithm',   ! fast, but restrictions apply
        psolver = 'multigrid',
        mg_cycles = 4,
        residual_limit = 0.0001,

        momentum_advec = 'ws-scheme',        ! default advection scheme
        scalar_advec   = 'ws-scheme',

        phi = 54,

        initializing_actions = 'read_restart_data', !'cyclic_fill',

        bc_pt_b = 'neumann',
```

```
        bc_uv_t = 'neumann',
        bc_p_t = 'neumann',
        bc_p_b = 'dirichlet',
        bc_pt_t = 'neumann',
        bc_lr = 'dirichlet/radiation',
    bc_s_t = 'neumann',
    bc_s_b = 'neumann',

        random_heatflux = .F.,
        use_top_fluxes = .T.,
        top_heatflux = 0.0,
        top_momentumflux_u = 0.0,
        top_momentumflux_v = 0.0,
        top_salinityflux = 0.0,
        surface_heatflux = 0.0,

        topography = 'read_from_file',

        turbulent_inflow = .T.,
        recycling_width = 128,
        recycling_yshift = .T.,

        passive_scalar = .T.,/

&d3par  end_time = 35000.0,
        restart_time = 15000,
        dt_restart = 20000,
        create_disturbances = .F.,

        dt_run_control = 0.0,
        dt_dots = 0.0,

        dt_data_output = 200.0,
        skip_time_data_output_av = 10000,
        dt_data_output_av  = 5000.0,
        averaging_interval = 5000.0,
        dt_averaging_input = 0.0,

        section_xz =  512,
```

```
section_xy =  30, 15, 4,

data_output = 'u_xz', 'pt_xz', 's_xz',
         'u_xy', 'pt_xy', 's_xy',
         'u_av', 'pt_av', 'v_av', 'w_av', 'e_av', 's_av',
         'u', 'pt', 'v', 'w', 's',

dt_dopr = 2000.0,
averaging_interval_pr = 2000.0,
dt_averaging_input_pr = 0.0,
data_output_pr = '#u', '#v', '#pt', 'w', 'e',
         'w"u"', 'w*u*','wu', 'e*',
         'w"v"', 'w*v*','wv',
         'w"vpt"', 'w*vpt*','wvpt',
         'w"pt"', 'w*pt*','wpt',
         'u*2','v*2', 'w*u*u*:dz',
         '#km', '#l',
         'w"s"', 'w*s*','ws',


skip_time_domask = 10000.0,

dt_domask             = 0.0,

data_output_masks(1,:) = 'u',

mask_x_loop(1,:) = 20.0, 1020.0, 20.0,
mask_y_loop(1,:) = 0.0, 1020.0, 25.0,
mask_z_loop(1,:) = -1.0, -30.0, 2,

data_output_2d_on_each_pe = .F.,/
```

!---

Text S08.

```
! Input file for main run that simulates bottom boundary layer mixing in a !
2.5°C stratified water column. An explanation of the input parameters and !of
the set-up of the file can be found in !https://palm.muk.uni-hannover.de/trac.

!-----------------------------------------------------------------------------------------------
&inipar  nx = 1023, ny = 1023, nz = 32,
         dx = 1, dy = 1, dz = 1,

         ocean = .T.,

         fft_method =  'temperton-algorithm',   ! fast, but restrictions apply
         psolver = 'multigrid',
         mg_cycles = 4,
         residual_limit = 0.0001,

         momentum_advec = 'ws-scheme',        ! default advection scheme
         scalar_advec   = 'ws-scheme',

         phi = 54,

         initializing_actions = 'read_restart_data', !'cyclic_fill',

         bc_pt_b = 'neumann',
         bc_uv_t = 'neumann',
         bc_p_t = 'neumann',
         bc_p_b = 'dirichlet',
         bc_pt_t = 'neumann',
         bc_lr = 'dirichlet/radiation',
    bc_s_t = 'neumann',
    bc_s_b = 'neumann',

         random_heatflux = .F.,
         use_top_fluxes = .T.,
         top_heatflux = 0.0,
         top_momentumflux_u = 0.0,
         top_momentumflux_v = 0.0,
         top_salinityflux = 0.0,
         surface_heatflux = 0.0,
```

```
        topography = 'flat',

        turbulent_inflow = .T.,
        recycling_width = 128,
        recycling_yshift = .T.,

        passive_scalar = .T.,/

&d3par  end_time = 30000.0,
        restart_time = 15000,
        dt_restart = 15000,
        create_disturbances = .F.,

        dt_run_control = 0.0,
        dt_dots = 0.0,

        dt_data_output = 200.0,
        skip_time_data_output_av = 10000,
        dt_data_output_av  = 5000.0,
        averaging_interval = 5000.0,
        dt_averaging_input = 0.0,

        section_xz =  512,
        section_xy =  30, 15, 4,

        data_output = 'u_xz', 'pt_xz', 's_xz',
                'u_xy', 'pt_xy', 's_xy',
                'u_av', 'pt_av', 'v_av', 'w_av', 'e_av', 's_av',
                'u', 'pt', 'v', 'w', 's',

        dt_dopr = 2000.0,
        averaging_interval_pr = 2000.0,
        dt_averaging_input_pr = 0.0,
        data_output_pr = '#u', '#v', '#pt', 'w', 'e',
                'w"u"', 'w*u*','wu', 'e*',
                'w"v"', 'w*v*','wv',
                'w"vpt"', 'w*vpt*','wvpt',
                'w"pt"', 'w*pt*','wpt',
                'u*2','v*2', 'w*u*u*:dz',
```

```
            '#km', '#l',
            'w"s"', 'w*s*','ws',


        skip_time_domask = 10000.0,

        dt_domask             = 0.0,

        data_output_masks(1,:) = 'u',

        mask_x_loop(1,:) = 20.0, 1020.0, 20.0,
        mask_y_loop(1,:) = 0.0, 1020.0, 25.0,
        mask_z_loop(1,:) = -1.0, -30.0, 2,

        data_output_2d_on_each_pe = .F.,/
```

!---

Text S09.

! Input file for main run that simulates the wake past a monopile and bottom !boundary layer mixing in a 1.5°C stratified water column. An explanation of !the input parameters and of the set-up of the file can be found in !https://palm.muk.uni-hannover.de/trac.

!---

```
&inipar  nx = 1023, ny = 1023, nz = 32,
        dx = 1, dy = 1, dz = 1,

        ocean = .T.,

        fft_method =  'temperton-algorithm',   ! fast, but restrictions apply
        psolver = 'multigrid',
        mg_cycles = 4,
        residual_limit = 0.0001,

        momentum_advec = 'ws-scheme',        ! default advection scheme
        scalar_advec   = 'ws-scheme',
```

```
        phi = 54,

        initializing_actions = 'read_restart_data', !'cyclic_fill',

        bc_pt_b = 'neumann',
        bc_uv_t = 'neumann',
        bc_p_t = 'neumann',
        bc_p_b = 'dirichlet',
        bc_pt_t = 'neumann',
        bc_lr = 'dirichlet/radiation',
    bc_s_t = 'neumann',
    bc_s_b = 'neumann',

        random_heatflux = .F.,
        use_top_fluxes = .T.,
        top_heatflux = 0.0,
        top_momentumflux_u = 0.0,
        top_momentumflux_v = 0.0,
        top_salinityflux = 0.0,
        surface_heatflux = 0.0,

        topography = 'read_from_file',

        turbulent_inflow = .T.,
        recycling_width = 128,
        recycling_yshift = .T.,

        passive_scalar = .T.,/

&d3par  end_time = 35000.0,
        restart_time = 15000,
        dt_restart = 15000,
        create_disturbances = .F.,

        dt_run_control = 0.0,
        dt_dots = 0.0,

        dt_data_output = 200.0,
```

```
       skip_time_data_output_av = 10000,
       dt_data_output_av  = 5000.0,
       averaging_interval = 5000.0,
       dt_averaging_input = 0.0,

       section_xz =  512,
       section_xy =  30, 15, 4,

       data_output = 'u_xz', 'pt_xz', 's_xz',
             'u_xy', 'pt_xy', 's_xy',
             'u_av', 'pt_av', 'v_av', 'w_av', 'e_av', 's_av',
             'u', 'pt', 'v', 'w', 's',

       dt_dopr = 2000.0,
       averaging_interval_pr = 2000.0,
       dt_averaging_input_pr = 0.0,
       data_output_pr = '#u', '#v', '#pt', 'w', 'e',
             'w"u"', 'w*u*','wu', 'e*',
             'w"v"', 'w*v*','wv',
             'w"vpt"', 'w*vpt*','wvpt',
             'w"pt"', 'w*pt*','wpt',
             'u*2','v*2', 'w*u*u*:dz',
             '#km', '#l',
             'w"s"', 'w*s*','ws',


       skip_time_domask = 10000.0,

       dt_domask              = 0.0,

       data_output_masks(1,:) = 'u',

       mask_x_loop(1,:) = 20.0, 1020.0, 20.0,
       mask_y_loop(1,:) = 0.0, 1020.0, 25.0,
       mask_z_loop(1,:) = -1.0, -30.0, 2,

       data_output_2d_on_each_pe = .F.,/

!-------------------------------------------------------------------------------------------------
```

Text S10.

```
! Input file for main run that simulates bottom boundary layer mixing in a !
1.5°C stratified water column. An explanation of the input parameters and !of
the set-up of the file can be found in !https://palm.muk.uni-hannover.de/trac.

!-----------------------------------------------------------------------------------------------
&inipar  nx = 1023, ny = 1023, nz = 32,
         dx = 1, dy = 1, dz = 1,

         ocean = .T.,

         fft_method =  'temperton-algorithm',   ! fast, but restrictions apply
         psolver = 'multigrid',
         mg_cycles = 4,
         residual_limit = 0.0001,

         momentum_advec = 'ws-scheme',        ! default advection scheme
         scalar_advec   = 'ws-scheme',

         phi = 54,

         initializing_actions = 'read_restart_data', !'cyclic_fill',

         bc_pt_b = 'neumann',
         bc_uv_t = 'neumann',
         bc_p_t = 'neumann',
         bc_p_b = 'dirichlet',
         bc_pt_t = 'neumann',
         bc_lr = 'dirichlet/radiation',
    bc_s_t = 'neumann',
    bc_s_b = 'neumann',

         random_heatflux = .F.,
         use_top_fluxes = .T.,
         top_heatflux = 0.0,
         top_momentumflux_u = 0.0,
         top_momentumflux_v = 0.0,
         top_salinityflux = 0.0,
```

```
        surface_heatflux = 0.0,

        topography = 'flat',

        turbulent_inflow = .T.,
        recycling_width = 128,
        recycling_yshift = .T.,

        passive_scalar = .T.,/

&d3par  end_time = 35000.0,
        restart_time = 15000,
        dt_restart = 15000,
        create_disturbances = .F.,

        dt_run_control = 0.0,
        dt_dots = 0.0,

        dt_data_output = 200.0,
        skip_time_data_output_av = 10000,
        dt_data_output_av  = 5000.0,
        averaging_interval = 5000.0,
        dt_averaging_input = 0.0,

        section_xz =  512,
        section_xy =  30, 15, 4,

        data_output = 'u_xz', 'pt_xz', 's_xz',
                'u_xy', 'pt_xy', 's_xy',
                'u_av', 'pt_av', 'v_av', 'w_av', 'e_av', 's_av',
                'u', 'pt', 'v', 'w', 's',

        dt_dopr = 2000.0,
        averaging_interval_pr = 2000.0,
        dt_averaging_input_pr = 0.0,
        data_output_pr = '#u', '#v', '#pt', 'w', 'e',
                'w''u''', 'w*u*','wu', 'e*',
                'w''v''', 'w*v*','wv',
                'w''vpt''', 'w*vpt*','wvpt',
```

```
            'w"pt"', 'w*pt*','wpt',
            'u*2','v*2', 'w*u*u*:dz',
            '#km', '#l',
            'w"s"', 'w*s*','ws',


      skip_time_domask = 10000.0,

      dt_domask             = 0.0,

      data_output_masks(1,:) = 'u',

      mask_x_loop(1,:) = 20.0, 1020.0, 20.0,
      mask_y_loop(1,:) = 0.0, 1020.0, 25.0,
      mask_z_loop(1,:) = -1.0, -30.0, 2,

      data_output_2d_on_each_pe = .F.,/


!-------------------------------------------------------------------------------------------------
```

Text S11.

! Input file for main run that simulates the wake past a monopile and bottom !boundary layer mixing in a 0.5°C stratified water column. An explanation of !the input parameters and of the set-up of the file can be found in !https://palm.muk.uni-hannover.de/trac.

```
!-------------------------------------------------------------------------------------------------
&inipar  nx = 1023, ny = 1023, nz = 32,
      dx = 1, dy = 1, dz = 1,

      ocean = .T.,

      fft_method =  'temperton-algorithm',   ! fast, but restrictions apply
      psolver = 'multigrid',
      mg_cycles = 4,
      residual_limit = 0.0001,
```

```
        momentum_advec = 'ws-scheme',        ! default advection scheme
        scalar_advec   = 'ws-scheme',

        phi = 54,

        initializing_actions = 'read_restart_data', !'cyclic_fill',

        bc_pt_b = 'neumann',
        bc_uv_t = 'neumann',
        bc_p_t = 'neumann',
        bc_p_b = 'dirichlet',
        bc_pt_t = 'neumann',
        bc_lr = 'dirichlet/radiation',
    bc_s_t = 'neumann',
    bc_s_b = 'neumann',

        random_heatflux = .F.,
        use_top_fluxes = .T.,
        top_heatflux = 0.0,
        top_momentumflux_u = 0.0,
        top_momentumflux_v = 0.0,
        top_salinityflux = 0.0,
        surface_heatflux = 0.0,

        topography = 'read_from_file',

        turbulent_inflow = .T.,
        recycling_width = 128,
        recycling_yshift = .T.,

        passive_scalar = .T.,/

&d3par  end_time = 35000.0,
        restart_time = 15000,
        dt_restart = 15000,
        create_disturbances = .F.,

        dt_run_control = 0.0,
        dt_dots = 0.0,
```

```
dt_data_output = 200.0,
skip_time_data_output_av = 10000,
dt_data_output_av  = 5000.0,
averaging_interval = 5000.0,
dt_averaging_input = 0.0,

section_xz =  512,
section_xy =  30, 15, 4,

data_output = 'u_xz', 'pt_xz', 's_xz',
         'u_xy', 'pt_xy', 's_xy',
         'u_av', 'pt_av', 'v_av', 'w_av', 'e_av', 's_av',
         'u', 'pt', 'v', 'w', 's',

dt_dopr = 2000.0,
averaging_interval_pr = 2000.0,
dt_averaging_input_pr = 0.0,
data_output_pr = '#u', '#v', '#pt', 'w', 'e',
         'w"u"', 'w*u*','wu', 'e*',
         'w"v"', 'w*v*','wv',
         'w"vpt"', 'w*vpt*','wvpt',
         'w"pt"', 'w*pt*','wpt',
         'u*2','v*2', 'w*u*u*:dz',
         '#km', '#l',
         'w"s"', 'w*s*','ws',


skip_time_domask = 10000.0,

dt_domask              = 0.0,

data_output_masks(1,:) = 'u',

mask_x_loop(1,:) = 20.0, 1020.0, 20.0,
mask_y_loop(1,:) = 0.0, 1020.0, 25.0,
mask_z_loop(1,:) = -1.0, -30.0, 2,

data_output_2d_on_each_pe = .F.,/
```

!---

Text S12.

! Input file for main run that simulates bottom boundary layer mixing in a ! 0.5°C stratified water column. An explanation of the input parameters and !of the set-up of the file can be found in !https://palm.muk.uni-hannover.de/trac.

!---

```
&inipar  nx = 1023, ny = 1023, nz = 32,
         dx = 1, dy = 1, dz = 1,

         ocean = .T.,

         fft_method =  'temperton-algorithm',   ! fast, but restrictions apply
         psolver = 'multigrid',
         mg_cycles = 4,
         residual_limit = 0.0001,

         momentum_advec = 'ws-scheme',        ! default advection scheme
         scalar_advec   = 'ws-scheme',

         phi = 54,

         initializing_actions = 'read_restart_data', !'cyclic_fill',

         bc_pt_b = 'neumann',
         bc_uv_t = 'neumann',
         bc_p_t = 'neumann',
         bc_p_b = 'dirichlet',
         bc_pt_t = 'neumann',
         bc_lr = 'dirichlet/radiation',
    bc_s_t = 'neumann',
    bc_s_b = 'neumann',

         random_heatflux = .F.,
         use_top_fluxes = .T.,
         top_heatflux = 0.0,
```

```
        top_momentumflux_u = 0.0,
        top_momentumflux_v = 0.0,
        top_salinityflux = 0.0,
        surface_heatflux = 0.0,

        topography = 'flat',

        turbulent_inflow = .T.,
        recycling_width = 128,
        recycling_yshift = .T.,

        passive_scalar = .T.,/

&d3par  end_time = 35000.0,
        restart_time = 15000,
        dt_restart = 15000,
        create_disturbances = .F.,

        dt_run_control = 0.0,
        dt_dots = 0.0,

        dt_data_output = 200.0,
        skip_time_data_output_av = 10000,
        dt_data_output_av  = 5000.0,
        averaging_interval = 5000.0,
        dt_averaging_input = 0.0,

        section_xz =  512,
        section_xy =  30, 15, 4,

        data_output = 'u_xz', 'pt_xz', 's_xz',
                'u_xy', 'pt_xy', 's_xy',
                'u_av', 'pt_av', 'v_av', 'w_av', 'e_av', 's_av',
                'u', 'pt', 'v', 'w', 's',

        dt_dopr = 2000.0,
        averaging_interval_pr = 2000.0,
        dt_averaging_input_pr = 0.0,
        data_output_pr = '#u', '#v', '#pt', 'w', 'e',
```

```
                'w"u"', 'w*u*','wu', 'e*',
                'w"v"', 'w*v*','wv',
                'w"vpt"', 'w*vpt*','wvpt',
                'w"pt"', 'w*pt*','wpt',
                'u*2','v*2', 'w*u*u*:dz',
                '#km', '#l',
                'w"s"', 'w*s*','ws',


        skip_time_domask = 10000.0,

        dt_domask             = 0.0,

        data_output_masks(1,:) = 'u',

        mask_x_loop(1,:) = 20.0, 1020.0, 20.0,
        mask_y_loop(1,:) = 0.0, 1020.0, 25.0,
        mask_z_loop(1,:) = -1.0, -30.0, 2,

        data_output_2d_on_each_pe = .F.,/

!-------------------------------------------------------------------------------------------------
```

Text S13

Topography file (NETCDF-file) for simulations with a monopile. An explanation of the input parameters and of the set-up of the file can be found in https://palm.muk.uni-hannover.de/trac.

Data sets ds01 to ds06

NETCDF-file of the temperature, depth and salinity data collected in 2015 using the "towed chain" and the Sea & Sun Technology's Standard Data Acquisition software package in the German Bight of the North Sea. Measurements in these file correspond to those collected by each of the CTD sensors of the chain, which measured at a mean depths of:

File name (Schultzeetal_ds{x})	mean depth (m)
01	1.3
02	2.5
03	3.7
04	4.8
05	6.5
06	8.1

Data sets ds07 to ds14

NETCDF-file of the temperature, depth and salinity data collected in 2017 using the "towed chain" and the Sea & Sun Technology's Standard Data Acquisition software package in the German Bight of the North Sea. Measurements in these file correspond to those collected by each of the CTD sensors of the chain, which measured at a mean depths:

File name (Schultzeetal_ds{x})	mean depth (m)
07	3.5
08	6.0
09	7.4
10	8.6
11	10.0
12	11.4

13	12.7
14	13.9

Data sets ds15 to ds16

NETCDF-file of the GPS track of the "towed chain" measurements in the North Sea in 2015 (Schultzeetal_ds15) and 2017 (Schultzeetal_ds16).