Seifert et al., 2022:
Cascading effects augment the direct impact of CO₂ on phytoplankton growth in a biogeochemical model, links to model results

This dataset provides output of model simulations with the global ocean biogeochemical model FESOM1.4-REcoM-2-M.

File "Seifert2022_mesh_FESOM_REcoM": Provides information (latitude, longitude, depth, grid cell area and volume, bottom topography) on the mesh used in all simulations. The other output files follow this mesh setup.

File "Seifert2022_Figure_8_Time_series_global_North_Atlantic": Entails a time series from 1958 to 2018 with coccolithophore biomass as well as surface $CO_{2(aq)}$ concentrations and temperature, integrated globally and over the North Atlantic. Model simulations (VARCLI_VARCO2, VARCLI_CONSTCO2, CONSTCLI_VARCO2, CTRL) are described in Table 3 of the paper.

All other files: 5-year means of phytoplankton biomass, chlorophyll, NPP, growth rates, limitations, calcification, grazing rates, calcite concentrations, zooplankton biomass, export fluxes, as well as $CO_{2(aq)}$, HCO_3^-, and nutrient concentrations. See file descriptions for depth layers and related model simulation. Model simulations (PRESENT, PRESENT_CO2, PREIND_CO2, FUTURE_CO2) are described in Table 3 of the paper.

File names refer to the Figures and Tables in the paper where the respective data are used. See below for detailed information on the individual files.

Additionally, following published datasets were used for the analysis of our model data:

- Fay & McKinley, 2014: Global Ocean Biomes: Mean and time-varying maps (NetCDF 7.8 MB). PANGAEA, https://doi.org/10.1594/PANGAEA.828650
  Used as masks for the regional representation of the FESOM-REcoM model results.
- O'Brien, 2012: Global distribution of coccolithophores abundance and biomass – Gridded data product (NetCDF) – Contribution to the MAREDAT World Ocean Atlas of Plankton Functional Types. PANGAEA, https://doi.org/10.1594/PANGAEA.785092
  Used for the evaluation of FESOM-REcoM coccolithophore biomass and distribution.
- Leblanc, Arístegui Ruiz, Armand, Assmy, Beker, Bode, Breton, Cornet, Gibson, Gosselin, Kopczynska, Marshall, Peloquin, Piontkovski, Poulton, Quéguiner, Schiebel, Shipe, Stefels, van Leeuwe, Varela, Widdicombe & Yallop, 2012: Global distribution of diatoms abundance, biovolume and biomass – Gridded data product (NetCDF) – Contribution to the MAREDAT World Ocean Atlas of Plankton Functional Types. PANGAEA, https://doi.org/10.1594/PANGAEA.777384
  Used for the evaluation of FESOM-REcoM diatom biomass and distribution.

Please contact the corresponding author for further questions (Miriam Seifert, miriam.seifert@awi.de).

List of files:
- Seifert2022_mesh_FESOM_REcoM.nc
- Seifert2022_Figures_2_S5_Biomass_mean_150m.nc
- Seifert2022_Figure_3_S4_Biomass_all_depth_layers.nc
- Seifert2022_Figure_4_5_6_S6_CO2_nutrients_biomass_chl_surface.nc
- Seifert2022_Figure_6_Limitations_productions_surface.nc
- Seifert2022_Figure_7_Cocco_dia_monthly_surface.nc
- Seifert2022_Figure_8_Time_series_global_North_Atlantic.nc
- Seifert2022_Figure_S3_Biomass_cocco_MLD.nc
- Seifert2022_Table_4_Biomass_integrated_150m.nc
- Seifert2022_Table_4_NPP_integrated_150m.nc
- Seifert2022_Table_4_Biogeochemical_fluxes.nc

Detailed information on each file:

Seifert2022_mesh_FESOM_REcoM.nc
Information on the mesh of the FESOM-REcoM setup used in this publication regarding latitude, longitude, bottom topography, cell area in m^2, cell volume in m^3, and depth levels.

Seifert2022_Figures_2_S5_Biomass_mean_150m.nc
Annual means of global coccolithophore, diatom, and small phytoplankton biomass averaged over the upper 150 m in the PRESENT, PRESENT_CO2, PREIND_CO2, and FUTURE_CO2 simulations.

Seifert2022_Figure_3_S4_Biomass_all_depth_layers.nc
Annual means of global coccolithophore and diatom biomass for all depth layers in the PRESENT and PRESENT_CO2 simulations.

Seifert2022_Figure_4_5_6_S6_CO2_nutrients_biomass_chl_surface.nc
Annual means of global surface values of $CO_{2(aq)}$ and bicarbonate concentrations, pH, biomass and chlorophyll (coccolithophores, diatoms, small phytoplankton), coccolithophore calcite concentrations, as well as dissolved inorganic nitrogen and iron concentrations in the PRESENT_CO2, PREIND_CO2, and FUTURE_CO2 simulations.

Seifert2022_Figure_6_Limitations_productions_surface.nc
Annual means of global surface values of light, nutrient, and CO_2 limitation terms, growth rates, net primary production, and calcification of coccolithophores, diatoms, and small phytoplankton in the PRESENT_CO2, PREIND_CO2, and FUTURE_CO2 simulations.

Seifert2022_Figure_7_Cocco_dia_monthly_surface.nc
Monthly means of global surfaces values of light, nutrient, and CO_2 limitation terms, growth rates, biomass, and net primary production of coccolithophores and diatoms, grazing rates on coccolithophores and diatoms, and biomass of the microzooplankton and the polar microzooplankton group in the PRESENT_CO2 and FUTURE_CO2 simulations.

Seifert2022_Figure_8_Time_series_global_North_Atlantic.nc
Annual means of globally and depth-integrated coccolithophore biomass, as well as globally integrated surface $CO_{2(aq)}$ concentrations and temperatures, and depth-integrated coccolithophore biomass as well as surface $CO_{2(aq)}$ concentrations and temperatures in the North Atlantic over the years 1958-2018 in the VARCLI_VARCO2, VARCLI_CONSTCO2, CONSTCLI_VARCO2, and CTRL simulations.

Seifert2022_Figure_S3_Biomass_cocco_MLD.nc
Monthly means of global coccolithophore biomass, averaged over the mixed layer depth in the PRESENT simulation.

Seifert2022_Table_4_Biomass_integrated_150m.nc
Annual means of global coccolithophore, diatom, and small phytoplankton biomass, integrated over the upper 150 m in the PRESENT, PRESENT_CO2, PREIND_CO2, and FUTURE_CO2 simulations.

Seifert2022_Table_4_NPP_integrated_150m.nc
Annual means of global coccolithophore, diatom, and small phytoplankton net primary production, integrated over the upper 150 m in the PRESENT, PRESENT_CO2, PREIND_CO2, and FUTURE_CO2 simulations.

Seifert2022_Table_4_Biogeochemical_fluxes.nc
Annual means of global calcite, particulate organic carbon, and silicate export as well as rain ratios (calcite export : POC export) at 100 m depth, and particulate inorganic to organic carbon ratio of coccolithophores averaged over the upper 50 m and subsampled for gridpoints with coccolithophore biomass >1 mg/m3 in the PRESENT_CO2, PREIND_CO2, and FUTURE_CO2 simulations.