Provided model results

Two scenarios (REF and MTFR) are included. The subfolders contain netcdf-files with the monthly averages of the upper 10m vertical averages from the beginning of 2005 to the end of 2012. The single files contain the following variables: nitrate (mmol N m-3; NIT_for_JEODPP.scenario.nc), ammonium (mmol N m-3; AMM_for_JEODPP.scenario.nc), phosphate (mmol P m-3; DIP_for_JEODPP.scenario.nc), chlorophyll a (mg Chla m-3; CHL_for_JEODPP.scenario.nc), temperature (°C) and salinity. Further, time series of the vertically integrated net primary production (mg C m-2 day-1) is provided (NetPI_for_JEODPP.scenario.nc).

Short description of the scenario forcing and results

The model used for producing the above time series consists of a hydrodynamic module (General Estuarine Transport Model; GETM; http://www.getm.eu/) and a low trophic level ecosystem module (European Regional Seas Ecosystem Model; ERSEM; Butenschön et al., 2016; https://www.pml.ac.uk/Modelling_at_PML/Models/ERSEM) with a coupled via Framework for Aquatic Biogeochemical Model (FABM; https://github.com/fabm-model/fabm/wiki). It is applied with a horizontal resolution of 0.05 x 0.08 degrees and 25 vertical layers, which adjust their height to the vertical density gradient. The meteorological forcing from the European Centre for Medium Range Weather Forecast (ECMWF) available from http://www.ecmwf.int, based on 6-hourly records has been applied (ERA-Interim project).

River scenarios (GREEN)

The two provided simulations differ only in the riverine nutrient inputs, following the scenarios REF and MTFR developed within BLUE2. All rivers entering within the model area are considered for scenario simulations. River discharge (runoff), total nitrogen (TN) and total phosphorus loads (TP) were provided by GREEN (Grizzetti et al., 2012). As only annual river loads and freshwater fluxes were provided, the needed seasonal (monthly) loads were estimated, following longterm climatologies, computed from the output of the the catchment model HYPE (https://hypeweb.smhi.se/explore-water/historical-data/europe-time-series/). Following the needs of the ecological model, TN and TP had to be downscaled to loads of Ammonium (NH4 = 0.06 TN), Nitrate (NO3 = 0.75 TN) and Phosphate (PO4 = 0.5 TP). The conversion factors were estimated from a database of observed nutrient loads, provided by S. van Leeuwen, NIOZ within the OSPAR working ICG EMO.

Scenario results

The simulations forced with the two different riverine load scenarios were applied for 8 years (2005 – 2012) and results were evaluated with respect to the indicators used for MSFD descriptor 5 (eutrophication). While the riverine nutrient inputs were substantially lower in the MTFR scenario (on average 15.1 % of TN loads and 18.1 % of TP loads), Nitrate and Phosphate (D5C1) were reduced by 10% (8%) on average for the whole North Sea and only for approx. 1% in the Celtic Sea. Chlorophyll-a concentrations (D5C2) decreased even less.

References:

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