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# Modelling nitrogen transport across compartments over northern Europe

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River discharge and the associated nutrient loads are important factors that influence the functioning of the marine ecosystem. Lateral inflows from land carrying fresh, nutrient-rich water determine coastal physical conditions and nutrient concentration and, hence, dominantly influence primary production in the system. Since this forms the basis of the trophic food web, riverine nutrient concentrations impact the variability of the whole coastal ecosystem. This process becomes even more relevant in systems like the Baltic Sea, which is almost decoupled from the open ocean and land-borne nutrients play a major role for ecosystem productivity on seasonal up to decadal time scales.

In order to represent the effects of climate or land use change on nutrient availability, a coupled system approach is required to simulate the transport of nutrients across Earth system compartments. This comprises their transport within the atmosphere, the deposition and human application at the surface, the lateral transport over the land surface into the ocean and their dynamics and transformation in the marine ecosystem. In our study, we combine these processes in a modelling chain within the GCOAST (Geesthacht Coupled cOAstal model SysTem) framework for the northern European region. This modelling chain comprises:

- Simulation of emissions, atmospheric transport and deposition with the chemistry transport model CMAQ at 36 km grid resolution using atmospheric forcing from the coastDat3 data that have been generated with the regional climate model COSMO-CLM over Europe at 0.11° resolution using ERA-Interim re-analyses as boundary conditions
- Simulation of inert processes at the land surface with the global hydrology model HydroPy (former MPI-HM), i.e. considering total nitrogen without any chemical reactions
- Riverine transport with the Hydrological Discharge (HD) model at 0.0833° spatial resolution
- Simulation of the North Sea and Baltic Sea ecosystems with 3D coupled physical-biogeochemical NPZD-model ECOSMO II at about 10 km resolution

We will present first results and their validation from this exercise.