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Simulating riverine nutrient transport on global scale

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The currently ongoing CMIP6 simulations feature Earth System Models with interactively coupled components for atmosphere, ocean and land surface. Water, energy and momentum between these components are exchanged conservatively. This is crucial to compute climate interactions and their feedbacks consistently. Currently, the representation of biogeochemical cycles in land surface and ocean models is advancing including not only a carbon cycle but also processes based on nutrients like nitrogen or phosphorus. Some land surface models (LSM) already compute leaching of such constituents from the soil, and some ocean models (OM) consider nutrient influx from the land for a number of processes, e.g. biological activity. However, the OMs usually use observed data as input instead of the nutrient loads computed by the LSMs. This setup cannot represent the effects of climate or land use change on nutrient availability and therefore limits the applications of ESMs in respect to climate change impacts.

For this reason, we are extending our hydrological discharge model, the HDM, to not only transport water but also other constituents. The HDM is an established component of regional (GCOAST, ESM ROM, Reg-CM-ES) as well as global (MPI-ESM) climate models but also applicable as stand-alone model. In a first step, only inert transport is simulated without considering any chemical reactions or biological transformation during river flow. The transport is realized using the same linear cascade infrastructure as used for water transport. However, a successful offline validation of these new features does not only require a realistic routing scheme and consequently the representation of the most important reactions during transport, but also the generation of sensible input data either from large scale models or from observations. In our presentation, we will outline the state of this work together with the compiled input dataset.