Fourth International Conference on Earth System Modelling
4ICESM-171, 2017

Ocean biogeochemistry response of deriving riverine nutrient and carbon fluxes from a spatio-temporal weathering model

F. Lacroix and T. Ilyina
Max Planck Institute for Meteorology

The coastal ocean is widely viewed as a hotspot for oceanic primary production, partly due to the supply of nutrients by rivers. Furthermore, river loads of C, P, N, Si and alkalinity provide a compensation for their loss through sedimentation and burial processes which occur within the global ocean. By implementing riverine nutrient and carbon fluxes into the Earth system model MPI-ESM, we aim to better represent these fluxes from land to the ocean, as well as investigate their effects on the carbon cycle of the coastal ocean, as well as of the global ocean.

We adapt a first order weathering model (Hartmann et al., 2013) to estimate fluxes of dissolved phosphate, silicate, inorganic carbon as well as alkalinity to the ocean. We thereby generate a spatial distribution of weathering yields that are dependent on temperature, runoff, lithology and soil properties. For nitrate, organic carbon and iron fluxes from land to ocean, fixed ratios are used with regard to phosphate, as these fluxes do not have their source in weathering. The fluxes are routed to the ocean through hydrological catchments from the MPI-ESM.

Our preliminary results show weathering hotspots, more specifically Southeast Asia, the Amazon, Northern Europe and Siberia, areas with large weathering yields of nutrients and carbon where large rivers also deliver these fluxes to the coastal ocean. In comparison to a model run without riverine nutrient and carbon fluxes, the nutrients and carbon from rivers provide a carbon sink in many low latitude coastal systems, but a source in high latitude systems. Furthermore, nutrient regime switches can be observed in major coastal systems due to the addition of nutrients and carbon. These could be explained due to the increase of anaerobic remineralization processes in certain regions, as well as the increase of nitrogen fixation in others.

Hartmann J. et al. (2013), Global chemical weathering and associated P-release – The role of lithology, temperature and soil properties. Chemical Geology (363): 145-163.