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Modeling nitrogen and phosphorus transformations in the coastal zone at the global scale

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Human activity is leading to major increases in terrestrial nutrient inputs to the ocean and a deterioration of coastal water quality in many regions. While many detailed models are available to assess the effects of changes in nitrogen (N) and phosphorus (P) inputs to regional coastal ecosystems, the related conceptual information has not yet been transferred to spatially-explicit biogeochemical models for the global ocean. River inputs of nutrients in such models are typically either ignored or averaged inputs for larger areas are used. Since these models do not include a representation of the coastal ocean, removal or transformations of N and P in estuaries and on continental shelves are not accounted for.

Here, we take the first step in improving the model representation of coastal nutrient cycling at the global scale by developing a generic process-based model of the coupled carbon, N and P cycles for the coastal zone. Different parameterizations of the model are defined using a global coastal typology based on hydrological, lithological, morphological and biogeochemical criteria. The results of simulations performed with spatially explicit inputs and forcings are compared to data for local studies to assess the validity of the model. Ultimately, a spatially-explicit global model will be developed to quantify the role of coastal waters as a filter for terrestrial nutrient fluxes at the land-ocean interface.