Phosphorus transport within the land-sea margin - from molecular mechanisms to global models

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In this study, our goal is to develop a universal model to predict P transport within the land-sea margin in a global scope through the lens of biogeochemical mechanisms in a molecular level. While field-scale research identified phenomena and gauges the magnitude of the P transport, a mechanistic study derived from the spectroscopic analysis provides the explanation and a basis for further application. We will first determine the transformation and transport of P across the land-sea margin in terms of quantifying and qualifying the variation in P species as functions of biogeochemical parameters. Both sequential extraction and spectroscopic analysis - X-ray absorption near edge structure (XANES) spectroscopy – will be conducted to decipher the spatial and temporal distribution of P species in the case study that locates in the Gaomei wetland area. Secondarily, a batch study will be conducted to determine the sequestration, mobilization, and exchange of P at the fresh-sea water interfaces as functions environmental parameters such as pH, Eh, salinity, and total organic carbon. The conclusive results from the first and secondary experiments are supposed to provide the definitive relationship between the P mobilization in relation to its species and biogeochemical characteristics. Under the prerequisite that P release across the land-sea continuum may share common features in a global scale, biogeochemical parameters that dominate P transport derived from the case study will be applied to develop a global P transport model. Wherein proposed mobilization mechanisms driven by hydro-chemical responses and biogeochemical reactions will be integrated with the site-specific data such as biota-nutrient variables, soil characteristics, and environmental features using the approach with the combination of Bayesian belief network (BBN) and geographic information system (GIS) to determine the probability of P release as functions of areas that share common environmental features. The model is expected to shed light on effective mitigation/adaptation strategies for environmental conservation and to provide new insight for P management in environmental risk assessment for anthropogenic activities.