A generic land to sea modelling chain for fighting coastal eutrophication in France

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Water-authorities are prompt to consider coastal eutrophication in their management of water quality. Identifying admissible nutrient thresholds remains highly uncertain considering the complexity of biogeochemical processes involved in carbon and nutrient cycling that can either attenuate or exacerbate the imbalance in nutrients cascading from land to the coastal waters. A modelling chain including agricultural practices (GRAFS model), the transfer and transformations of carbon and nutrients along the hydrographic network (pyNuts-Riverstrahler model) and estuaries (C-GEM model) was designed and applied, for the first time at the scale of the entire metropolitan France, over the 2014-2019 period. Using a large database of riverine measurements (n=392,870 data from 929 stations), the results were validated for dissolved organic carbon (DOC), nitrate (NO3), dissolved phosphorus (PO4), total phosphorus (TP) and dissolved silica (DSi). This land-to-sea modelling chain allows identifying the origin of nutrient excess exported to coastal waters where it supports harmful algae blooms. Our work provides an accurate source apportionment of nutrients for 64 French sea outlets and demonstrates that efforts are still needed to reduce diffuse agricultural nutrients loads. Thanks to process-based and spatially explicit modelling tools, our approach identifies and quantifies the main processes governing the transfer of nutrients along the aquatic continuum and should ultimately sheds light on achievable levels of nutrients in marine and coastal areas.

Session SS028 Watershed-Based Nutrient Accounting: Biogeochemical Connections From Catchments to Coastal Waters

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The decade has seen significant development of relatively simple methodological approaches to relate various anthropogenic nutrient sources to their delivery to coastal waters, including watershed- and regional nutrient budgets and accounting. Advancements in our understanding of new sources, legacy sources, and spatio-temporal patterns are being achieved by using increasingly more accessible and more highly resolved data with analytical frameworks that provide a synthesis of the information to explain regional variation. One aim of such work is to improve our understanding of nutrient loading and how climate, hydrology, land use change, and other factors affect the resulting loads to coastal waters. Nutrient accounting methods, including material balances and related modelling approaches, are especially valuable for management and policy making because they relate impacts to various anthropogenic sources, and thereby facilitate development of management priorities. Presentations in this session will report on progress to date on methodologies currently in use or under development, recent applications of such approaches, and implications for environmental management and policy.

Key words: nutrient accounting, watershed, anthropogenic nutrient sources, coastal nutrient loading, biogeochemistry