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Past, present and future eutrophication levels in the North East Atlantic

Anthropogenic eutrophication remains a considerable stressor to marine ecosystems worldwide. In the North East Atlantic waters (NEA), most countries sustain coastal eutrophication with toxic algal blooms and ecological nuisances. Marine eutrophication in the NEA directly relies on nutrient enrichment at the river outlets, which is linked to human activities and land use in the watersheds. The question rises of whether the human society can reduce its nutrient emissions by changing its land use without compromising its food security. A new generic river model (PyNuts-Riverstrahler) was designed to estimate the point and diffuse nutrient emissions (N,P) to the rivers depending on land use in the watersheds across Western Europe (agro-food systems, urban structures, wastewater treatment plants). The resulting loads from the river model have been used as inputs to three marine ecological models (BioPComs, EcoMars3d, Miro&Co) covering together a large part of the NEA from the Iberian shelf to the Southern North Sea. The modelling of the land-ocean continuum allowed quantifying the impact of changes in land use on marine eutrophication in the NEA. A "pristine-like" scenario was tested to scale the current level of eutrophication with respect to an absolute "natural" level. "Future" scenarios were also tested to appraise the impact of the actual EU recommendations (WFD, MSFD), and to propose a more radical but still realistic scenario. It is shown that a paradigmatic change in agricultural practices combined with a large-scale demitarian diet might sensibly reduce both riverine and marine eutrophication.

Keywords: Eutrophication, model scenarios, land-ocean continuum, North East Atlantic