Ecosystem Models as Support to Eutrophication Management in the North East Atlantic (EMoSEM)

Consortium

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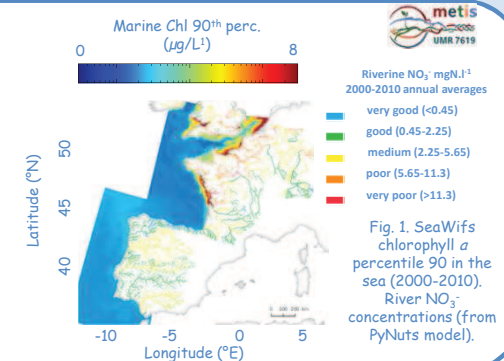
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Introduction

A major challenge in EU marine governance is to reach the "good environmental status" (GES) in the North-East Atlantic (NEA). There is a link between ecological nuisances at sea (Fig.1) and anthropogenic nutrient inputs. The land-ocean continuum hosts a complex succession of processes. Nutrient inputs in river watersheds result in problematic nutrient enrichment in the coastal zones.
It is necessary to evaluate the possibilities of nutrient reductions by adapting human activities in the watersheds.
Which scenarios of inland nutrient reduction will allow to reach the GES at sea?

Marine Chl 90th perc. (μg/L[1])

Riverine NO_3^- mgN.l[1] 2000-2010 annual averages
- very good (<0.45)
- good (0.45-2.25)
- medium (2.25-5.65)
- poor (5.65-11.3)
- very poor (>11.3)

Fig. 1. SeaWifs chlorophyll a percentile 90 in the sea (2000-2010). River NO_3^- concentrations (from PyNuts model).

Objectives

i. Scale current eutrophication status with pristine situation
ii. Identify "realistic" future scenarios of nutrient reduction in the river watersheds of NEA
iii. Assess the impact of the "realistic" scenarios in the sea
iv. Trace back the sources of nutrients (not in this poster)

Methodology

A generic watershed model applied to NEA rivers (Fig.2) calculates terrestrial nutrient exports to the sea under different scenarios:
i. A past "pristine-like" scenario, where natural nutrient exports are estimated in the absence of human influence.
ii. A series of future "realistic" scenarios, where different urban wastewater treatments and agricultural practices are combined.
Fig.3 shows results for the most promising realistic scanario LOD, which combines Local production, Organic farming and Demitarian diet.

ECO-MARS 3D
1. Seine Bight
2. Bay of Vilaine

MIRO&CO-3D
1. Belgian Continental Shelf

PCOMS
4. Douro
5. Mondego
6. Tejo

Seneque-Riverstrahler
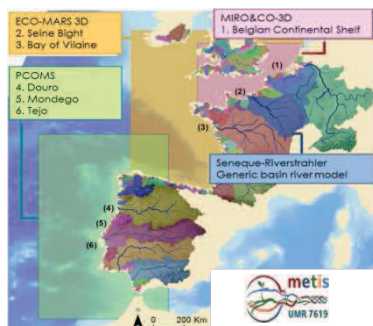Generic basin river model

Fig. 2. Map showing the domain of the basin-river SENEQUE/Riverstrahler model and the 3 coastal marine ecosystem models and their local implementation.
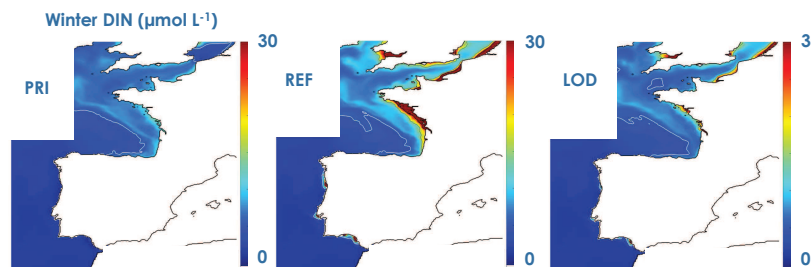
Winter DIN (μmol L^{-1})

PRI   REF   LOD

Fig. 3. Comparison of modelled winter DIN between the scenarios PRI (pristine situation), REF (current situation) and LOD (realistic future scenario) across the North East Atlantic.

Conclusions

This modelling work allowed scaling human vs natural influences on marine eutrophication, and to inform about appropriate future management choices.
i. The current status of coastal eutrophication across the NEA remains problematic
ii. The pristine situation scales the anthropogenic eutrophication in rivers and coastal zones
iii. The LOD future scenario is promising and it gives some lines of thought
iv. Mitigating eutrophication may require paradigmatic changes at different levels

EMoSEM's outcome will be transferred to Member States responsible for WFD and MSFD operations.

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