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

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Objectives

- Suggest innovative ecological indicators to account for Harmful Algal Blooms (HABs) in the Good Environmental Status (GES) definition.
- Estimate the GES targets for each coastal zone of the North-East Atlantic (NEA).
- Identify "realistic" scenarios of nutrient reduction in the river watersheds of NEA.
- Assess the impact of the "realistic" scenarios in the sea, and compare to GES requirements.

Context

A major challenge in EU marine governance is to reach the GES in the NEA (Fig. 1). This area is facing several eutrophication problems linked to the human pressure in the watershed. Human activity delivers, to the river system, nitrogen (N) and phosphorus (P) in excess to silica naturally issued from rock weathering, that reach the coastal zone after having been processed along the land-ocean aquatic continuum.

Mitigating coastal eutrophication problems needs to identify the major anthropogenic N and P nutrient sources, their transformation paths along their transfer to the coastal sea and the ecological response of the coastal ecosystem to these nutrient alterations.

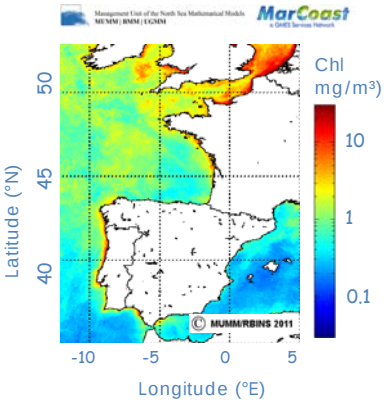

Fig. 1. Meris chlorophyll a concentration (percentile 90) in 2011

Methodology

Marine ecological models (Fig. 2) will be used to track the nutrients in the sea, and trace back their riverine or oceanic sources with the transboundary nutrient transport method (TBNT [1]).

A generic watershed model will be constructed for the NEA rivers (Fig. 2) and will be coupled to existing ecological models of specific coastal areas to describe present-day coastal bloom developments.

A pristine-like scenario will be run to scale current coastal eutrophication problems in each coastal zone and identify specific GES targets.

Specific 'tracking methods' (TBNT, distance-to-target requirement (DTTR) estimates) will be used to trace the natural vs anthropogenic origin of excess nutrients in specific area [1, 2].

Diverse "realistic" nutrient reduction scenarios (where different urban wastewater treatments and agricultural practices are combined) will be run and their ecological efficiency will be estimated by comparison with the GES targets.

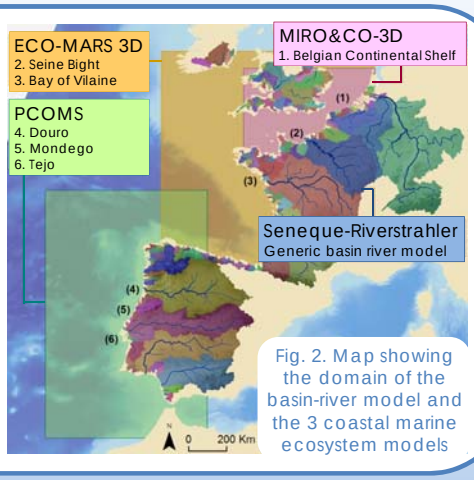

Fig. 2. Map showing the domain of the basin-river model and the 3 coastal marine ecosystem models

Expected results

This modelling work will allow to scale human vs natural influences in marine eutrophication, and to inform about appropriate future management choices with:

- Innovative ecological indicators
- Description of eutrophication problems in the NEA and their causes
- Comparison of the current eutrophication status with a "pristine-like" status
- "Realistic" future scenarios for watershed management, and impacts at sea

EMoSEM's outcome will be transferred to Member States responsible for Water Framework Directive (WFD) and Marine Strategy Framework Directive (MSFD) operations, and to the OSPAR Commission.

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