

Integrated modelling to support cost-effective management of nutrient reductions to the Baltic Sea

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Abstract

Abatement and mitigation of nutrient loads to the Baltic Sea are two central aims of HELCOM's Baltic Sea Action Plan (BSAP) as well as being required by the Water Framework Directive and the Marine Strategy Framework Directive. As part of the Baltic Nest Institute and the RECOCA project (a BONUS + project), integrated cost-minimisation models have been developed to identify cost-effective methods and measures for reducing nutrient loads to the Baltic. Two separate cost-minimisation models, 'BALTCOST' and 'RECOCA', have been developed. Both of these models identify minimum cost combinations of measures to fulfill load reduction targets for the Baltic, and both models include abatement measures in the agricultural, energy and transport sectors together with wetland restoration and wastewater treatment. Emissions to both air and water are thus included in the cost-minimisation.

The BALTCOST and RECOCA models differ in their spatial resolutions. BALTCOST models 9 countries and 24 drainage basins around the Baltic, whereas RECOCA covers the same 9 countries, but at a much higher spatial resolution of 10x10 km grid cells. Special attention is paid to the retention and transport of nutrients from agricultural and wastewater sources through rivers and lakes to the sea, and also air-borne transport of emissions from energy, transportation and agriculture.

The spatially disaggregated RECOCA model has been carefully constructed to allow us to explore how spatial differences in the effect of nutrient load reductions, retention and costs influence the cost-effective distribution of measures for achieving load reduction targets. Model development required interdisciplinary cooperation between economists, hydrologists, catchment modellers and NANI-analysts. Development of the RECOCA model has been heavily dependent on the integration of detailed and consistent physical results from e.g. DAISY and NANI models with data on economic costs and returns from e.g. fertiliser application and crop yields in order to identify cost-effective abatement measures at specific spatial locations. In addition, the best available economic data from FAO, EUROSTAT and national data sources have been used to estimate cost-functions for the various measures at country or drainage basin level.

The BALTCOST model is well suited to large scale scenario modelling of cost-effective combinations of measures to meet nutrient load reduction targets for the different Baltic sea regions (7 regions in all), while the RECOCA model is well suited to address cost-effective spatial allocation of these measures within countries and regions. The two models provide the opportunity to produce well grounded implementation recommendations at different spatial resolutions to support governance and management of the Baltic Sea at different spatial scales. Preliminary results will be presented for the cost-effectiveness of load reduction scenarios, together with a brief description of the data and assumptions used in model development.

References:

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