



Combined Effects of Nutrient Load Reduction and Climate Scenarios for the Baltic Sea Basin

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A Baltic Sea Action Plan was approved in 2007 by the countries surrounding the Baltic Sea to improve the ecological status of this sea. An important part of this plan is reduction of nutrient inflows from the Baltic Sea basin into the sea. Required nutrient reductions have been apportioned to the countries within the basin and these countries are now planning the remedial measures required to meet the plan's requirements. An important factor that remains to be considered, however, is how well the planned nutrient reductions improve nutrient inflows into the Baltic Sea in a changed future climate.

A high resolution, process based hydrological and nutrient flux model was set up for the entire Baltic Sea catchment area using the HYPE (Hydrological Predictions for the Environment) model. The HYPE model introduces the ability to model detailed hydrological processes at high resolution simultaneously and homogeneously across many river basins. When using a modelling tool to assess water resources and their quality for a basin entailing several political entities, it is an advantage that the methods and data used are homogenous across such political boundaries.

Readily available, regional and global databases were used to set up the model inputs including topography, precipitation, temperature, land use, soil-type, and nutrients from atmospheric, agricultural, industrial and urban wastewater sources, over the entire model domain. Daily river runoff data from the Baltex and GRDC databases was used to calibrate and validate the parameters describing runoff processes, while monthly and seasonal data from the European Environment Agency's WISE database were used to calibrate and validate the water quality parameters in the model.

The model application is able to reproduce measured daily flow variations and magnitude in both large and small waterways across the model domain, and measured seasonal variation and overall magnitude of nutrient fluxes to the Baltic Sea. Total yearly volumes of discharge, total nitrogen and total phosphorus also compare well to published figures for total fluxes to the Baltic Sea (Helcom PLC-group, 2008). The validated model is used as a tool to examine the effects of different climate and remedial measure scenarios for both the land regions of the model domain, and influxes to the Baltic Sea. Generally, results show a lessened effect of the remedial scenarios tested for future climate scenarios at the end of this century.