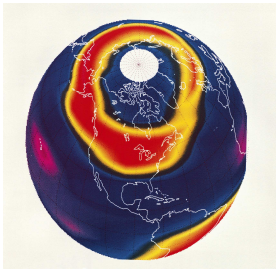
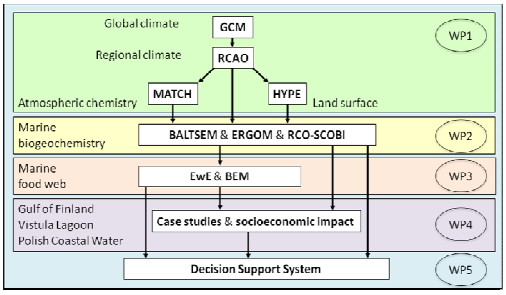
Selected highlights from the ECOSUPPORT project

The ECOSUPPORT consortium

Swedish Meteorological and Hydrological Institute, Sweden, Baltic Nest Institute, Resilience Centre, Stockholm University **Atlantic** Branch of P.P. Shirshov Institute of Oceanology, Russian Academy of Sciences, Russia, Tjärnö Marine Biological **Laboratory**, Göteborg University, Sweden, National Institute for Aquatic Resources (DTU-Aqua), Technical University of **Denmark**, Department of Marine Ecology, University of Aarhus, Denmark, Baltic Sea Research Institute Warnemünde, **Germany**, Institute of Oceanology, Polish Academy of Sciences, Gdansk, Poland, Marine Systems Institute at Tallinn **University** of Technology, Estonia, Finnish Meteorological Insitute, Helsinki, Finland, GKSS-Research Centre Geesthacht **GmbH**, Geesthacht, Germany, Center for Climate Science and Policy Research, Linköping University, Sweden

ECO SUPPORT

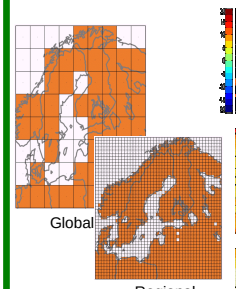


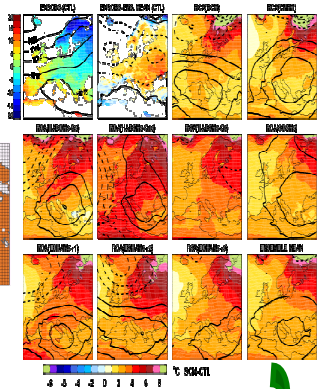


1. Project Objective

The project aims to asses the impact of different ecosystem drivers, such as nutrient supply, water temperatures and salinities in the Baltic Sea, under possible future climate conditions and different nutrient load and fishery scenarios. It will use a hierarchy of models and thereby offer an extensive tool to aid decision making regarding strategies to ensure water quality standards, biodiversity and fish stocks.

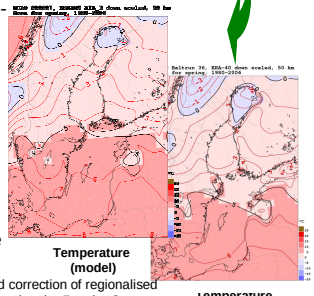
Ref: www.baltex-research.eu/ecosupport/



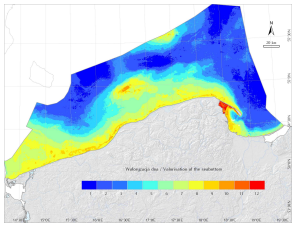


2. Climate Scenarios

Four transient GCM scenario simulations from the latest IPCC runs (1960-2100) have been selected to be used in the project. The runs are downscaled to increase the regional resolution using SMHI's coupled atmosphere-ice-ocean-land-surface model RCAO. So far 3 scenario simulations using RCAO with 50 km resolution have been completed.

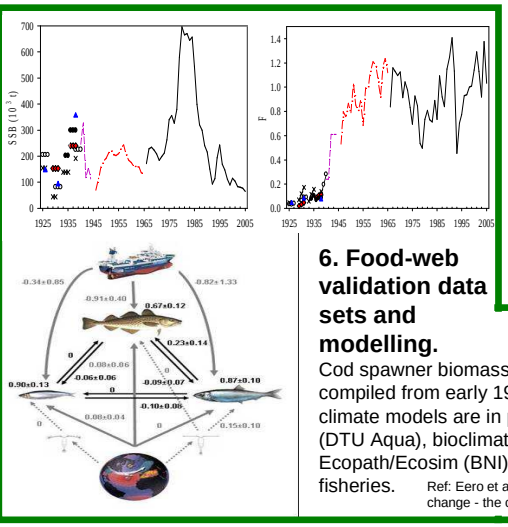


Ref: Höglund et al 2009: Validation and correction of regionalised ERA-40 wind fields over the Baltic Sea using the Rossby Centre Atmosphere model RCA3.0, SMHI Report Oceanografi No. 97, 35 pp



5. Focus study sites

The Gulf of Finland, Vistula Lagoon and the Polish coastal waters are project focus sites where assessments of the impact of climate change on the regional and local development will be made. The figure shows the biological valorization of the seabed in the southern Baltic, which can be used to demonstrate expected consequences in the value of sea-bed habitats.



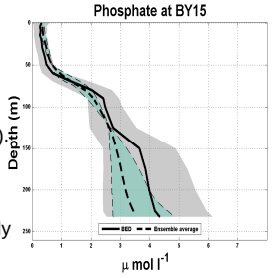
6. Food-web validation data sets and modelling.

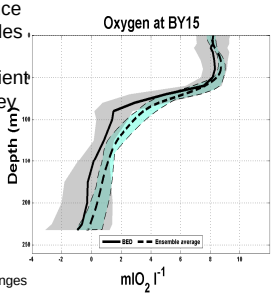
Cod spawner biomass (left) and fishing mortality (right) data sets are now compiled from early 1920s-present. Development of several types of fish-climate models are in progress, statistical single- and multispecies models (DTU Aqua), bioclimatic envelope models (GU) and food-web models using Ecopath/Ecosim (BNI), in order to evaluate the impact of climate and fisheries.

Ref: Eero et al. 2008 CJFAS. Lindegren et al 2009. Ecological forecasting under climate change - the case of Baltic cod. Proc. Roy. Soc. Lond. B (in review).

4. Marine biogeochemical modeling

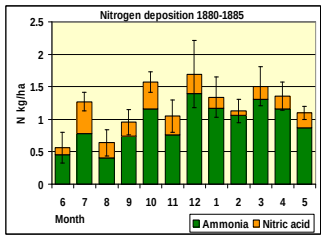
Three state-of-the-art coupled physical-biogeochemical models are used to calculate changing concentrations of nitrate, ammonium, phosphate, diatoms, flagellates, cyanobacteria, zooplankton, detritus, and oxygen: BALTSEM (BNI), ERGOM (IOW), and RCO-SCOBI (SMHI). The models are structurally different in that ERGOM and RCO-SCOBI are 3D circulation models comprising sub-basin scale processes while BALTSEM resolves the Baltic Sea spatially in 13 sub-basins. The results from hindcast simulations have been compared with observations for the period 1970-2005. It was found that all three models are able to reproduce the observed variability of biogeochemical cycles well. Uncertainties are primarily related to differences in the bioavailable fractions of nutrient loadings from land and parameterizations of key processes like sediment fluxes that are presently not well known. The figures show modeled ensemble means compared to observations.

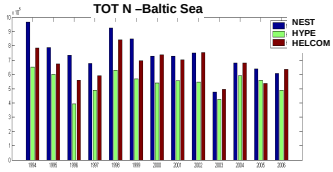


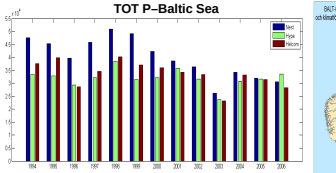


Ref: Eilola et al 2010, Quality assessment of state-of-the-art coupled physical-biogeochemical models in hind cast simulations 1970-2005, Rapport Oceanografi No.101, SMHI, Norrköping, Sweden.

Meier, H.E.M., K. Eilola, and E. Almroth, 2010: Climate-related changes in marine ecosystems simulated with a three-dimensional coupled biogeochemical-physical model of the Baltic Sea. (Clim. Res.,under rev)







3. Nutrient loads

Literature search performed by FMI revealed information about historical atmospheric load of nitrogen to the Baltic Sea drainage area. The figure to the left represents seasonal variation in atmospheric nitrogen load at an agricultural research area near Copenhagen, Denmark. To calculate future river flow and riverborne nutrient loadings the new hydrological SMHI model HYPE is used. It simulates a range of hydrological variables including phosphorus and nitrogen in soils, rivers and lakes. In addition, IOW estimated integrated loads to the Baltic Sea and also results from the BNI watershed model have been made available for ECOSUPPORT. These are compiled atmospheric load forcing on basin scales from BED and EMEP data and also taking into account the latest PLC-5 data.