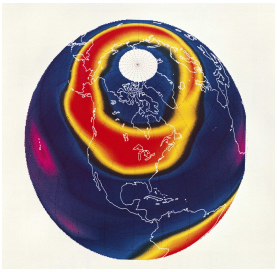
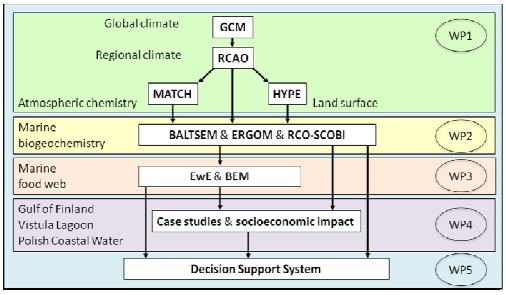
ECOSUPPORT: project approach and selected results

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

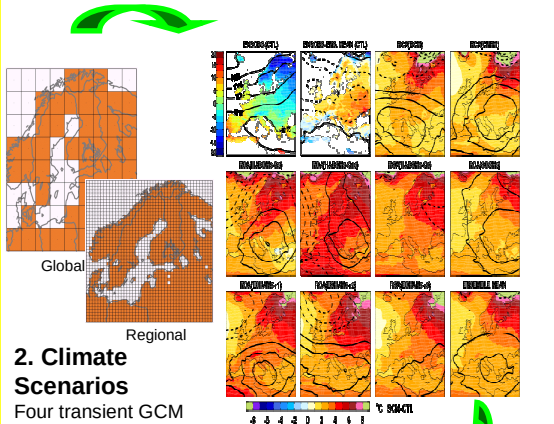




1. Project Objective

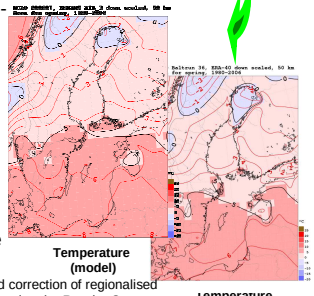
The project aims to asses the impact of different ecosystem drivers, such as nutrient supply, water temperatures and salinities in the Baltic Sea, under possible future climate conditions and different nutrient load and fishery scenarios. It will use a hierarchy of models and thereby offer an extensive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

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

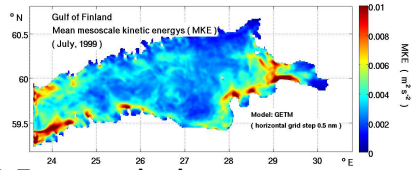


2. Climate Scenarios

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

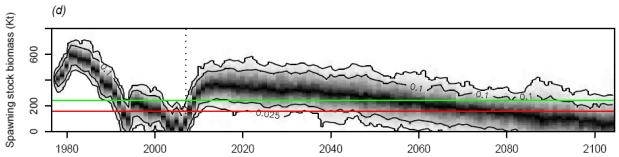


5. Focus study sites

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 a map of mesoscale kinetic energy in the surface layer. High kinetic energy in the coastal zone reveal effect of baroclinic jets of coupled upwelling /downwelling events in the western Gulf. Relatively high values of MKE in the open western part reflect coastal offshore exchange caused by squirts and eddies formed due to instability of jets. Meandering of Neva River inflow and wind driven coastal jets result in high MKE in the eastern GOF.

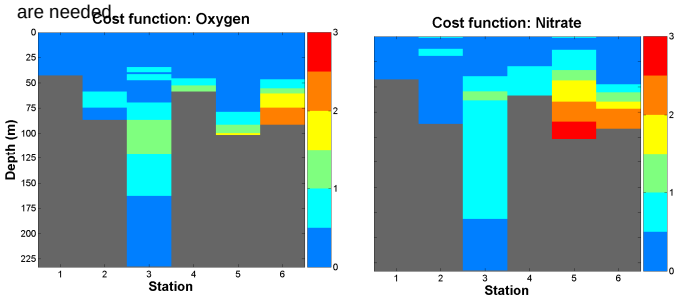
6. Food-web modelling.

Development of several types models are in progress to investigate the impact of a future climate on fisheries and food-web structures (DTU Aqua, GU and BNI). As an example a scenario projection of cod spawner biomass in the Eastern Baltic Sea under assumption of a reduction of salinity by 0.8 PSU is shown. Exploitation is at a precautionary level (Fpa = 0.3). The scenario includes effects of climate change on cod reproductive success, herring and sprat recruitment, and the zooplankton community. See Lindegren et al. 2010 Proc. Roy. Soc. B. for details.



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). As a way to evaluate the models' ability to simulate processes the cost functions were calculated for the ensemble averages (1970-2005) of salinity, temperature, oxygen, phosphate, nitrate at 6 stations in the Baltic Sea, ranging from the Kattegat in the west to the Bothnian Bay in the north. Light and dark blue colors (0-1) indicate good results, green and yellow colors indicate reasonable (1-2), while orange and red colors indicate poor results (>2). The cost function is a quick tool to assess the quality of model results compared to data and they give good indications to where more efforts are needed.



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 & river runoff

FMI has compiled a data set of the published historical atmospheric nutrient load measurements within the influence area of the Baltic Sea between 1850 and 1960 (see Poster 2b-10, Ruoho-Airola et al). A literature search revealed over 40 articles with results of air and precipitation measurements. Some of the articles presented a review of a large quantity of older measurements, others published results for a few months of monitoring in a network. Articles about monitoring at individual stations covered often experimental work for some years. The map shows the stations where data are available. The watershed model HYPE (SMHI) has been used to produce runoff data to the Baltic Sea for a control period and for a future scenario. The total runoff to the different basins are shown below, compared to data from a statistical method.