

Year 2: Summary of BONUS+ BALTIC-C project implementation in 2010

BALTIC-C consortium for the first time constructs the organic and inorganic carbon budgets of the Baltic Sea involving C fluxes from land, and the exchange fluxes in the water bodies of the major basins. The outcome of the project will be a model framework in support of water management of the Baltic Sea and its ecosystem addressing the consequences of climate change, eutrophication, increasing atmospheric CO₂ and acid precipitation.

In 2010 BALTIC-C has continued field data on total CO₂ (CT), and total alkalinity (AT). The investigations covered all major sub-basins of the Baltic Sea between the Kattegat and the Bothnian Bay. The data together with surface water pCO₂ and O₂ measurements from VOS "FINNMAID" form a unique base for research and model validation data. River input data of river flow, alkalinity, total inorganic carbon, total organic carbon, pH, temperature, Na⁺, K⁺, Ca²⁺, Mg²⁺, Cl⁻, SO₄²⁻ have been collected into a database and form the base for model development and validation. However, the data are in many instances incomplete, especially for river monitoring data from Russia. Several sediment cores have been taken and analysed. Large efforts have also been taken to collect and analyse meteorological forcing data for present and possible future developments. The development of models for the Baltic Sea drainage basin and the Baltic Sea itself that includes the CO₂ dynamics are now in progress.

The BALTIC-C model system involves two land surface models (LPJ-GUESS, CSIM) and one Baltic Sea model (PROBE-Baltic). Meteorological forcing data and scenarios have been extracted from available sources. The terrestrial vegetation/biogeochemistry model LPJ-GUESS has been enhanced by incorporation of a sub model for Corg production in organic wetland soils. The model has been set up for application across the 50 x 50 km simulation grid on which climate atmospheric data are used. The Baltic Sea catchment model CSIM is expanded by including base cations, anions, Corg and CT (taking into account the outputs from LPJ-GUESS) and calculates now parameters such as: river runoff, nutrient load, total alkalinity, pH and pCO₂ to the Baltic Sea sub-basins. The Baltic Sea model PROBE-Baltic has been expanded by including the CO₂ dynamics and the present and past conditions have been studied extensively.

Climate scenario data have been extracted for the Baltic Sea drainage basin as well as for the Baltic Sea basins for a period representing the climate change between 1960 and 2100. Data from several emission scenarios (A1B, A2 and B1) as well as three global climate models (ECHAM 5, HadCM3 and CCSM3) are derived to be used to force the different model components within the BALTIC-C. Several contacts between the different participants have been taken to develop the program. Outside the program members of the BALTIC-C play a major role in the Baltic Sea research by contributing in several activities such as: organising the BALTEX 2010 conference and BACC II initiative (BALTEX Assessment of Climate Change). The original research plan is followed and no adaptation is necessary. Project reported on 7 research articles published and submitted and two PhD theses defended in 2010.