

Baltic Sea Experiment (BALTEX)

Reporting Period: October 2005 to September 2006

Starting date: 1993

End date: 2012

URL: <http://www.baltex-research.eu>

Chairs and term dates:

Joakim Langner, Chair of the BALTEX Science Steering Group

Swedish Meteorological and Hydrological Institute, Norrköping, Sweden (since 2006)

Vice-chairs of the BALTEX Science Steering Group:

Anders Omstedt, Göteborg University, Göteborg, Sweden (since 2001)

Timo Vihma, Finnish Meteorological Institute, Helsinki, Finland (since 2006).

The term for all three positions is for three years starting May 2006.

Overview

BALTEX Phase II (2003-2012) objectives are:

1. Better understanding of the energy and water cycles over the Baltic Sea basin.
2. Analysis of climate variability and change since 1800, and provision of regional climate projections over the Baltic Sea basin for the 21st century.
3. Provision of improved tools for water management, with an emphasis on more accurate forecasts of extreme events and long-term changes.
4. Gradual extension of BALTEX methodologies to air and water quality studies.
5. Strengthened interaction with decision-makers, with emphasis on global change impact assessments.
6. Education and outreach at the international level.

Status

Major past year activities:

- BALTEX Phase II implementation document
- BACC Conference
- BALTIC GRID Pilot Study
- BALTEX leadership changes

BALTEX PHASE II IMPLEMENTATION DOCUMENT FINALIZED AND PUBLISHED

Based on the Science Plan, a *Science Framework and Implementation Strategy Document for BALTEX Phase II, 2003-2012* has been established and published in April 2006. The structure of this document follows the six major objectives as defined in the Science Plan for BALTEX Phase II, see above. While the Science Plan for BALTEX Phase II (published in 2004) explains the scientific objectives in terms of several related major goals, the recent implementation document suggests how to achieve these goals and describes potential activities and more concrete implementation measures. It also specifies additional data needs and highlights the desired involvement of stakeholders.

BACC CONFERENCE

The *BALTEX Assessment of Climate Change for the Baltic Sea Basin* (BACC) is an initiative contributing to objective 2 of BALTEX Phase II, see 7.1 above. The BACC project undertook to organize the First International Conference on the Assessment of Climate Change for the Baltic Sea Basin (BACC) on 22-23 May 2006 in Göteborg Sweden, where leading scientist, politicians, journalists and interested stakeholders from the Baltic Sea countries took part. The BACC Project, chaired by Hans von Storch, GKSS Research Centre Geesthacht, Germany, is a joint venture of BALTEX and HELCOM (Baltic Marine Environment Protection Commission) as an example of a dialogue between the scientific community and environmental policy makers. The unique feature of BACC is the combination of evidence on past, current and future climate change and related impacts on marine, freshwater and terrestrial ecosystems in the Baltic Sea basin. It is the first systematic scientific effort for assessing climate change in a European region, and for a GEWEX CSE as well. The BACC material is currently being edited for publication as a

comprehensive climate assessment book for the Baltic Sea basin, to be published in 2007. See <http://www.baltex-research/BACC> for more details.

BALTIC GRID PILOT STUDY BEING SET UP

BALTIC GRID is being planned as one major implementation means for BALTEX Phase II. A BALTIC GRID Pilot Study is therefore currently being set up to explore and demonstrate the potential of such a grid. The grid idea within the pilot study is mainly to share resources (model data, observations and expertise) within the existing BALTEX communication and cooperation network. A free-as-possible information and data exchange with respect to the BALTEX data policy is expected. Additionally to the planned simulations, re-initialisations (nudging) and data assimilation will be performed. Thus, data from the BALTEX Data Centres as well as additional observations (hydrographical and satellite data) will be needed. Furthermore, these data are important for process studies and model validation. The following objectives are planned to be dealt with in the BALTIC GRID Pilot Project:

- Quantification of the energy and water cycle including precipitation and evaporation for the BRIDGE period 1999-2004, including quantification of corresponding uncertainties;
- Detailed investigation of coastal regions of the Baltic area (coastal ocean and atmospheric boundary layer);
- Analysis of extreme events and “Großwetterlagen” (forcing and response);
- Analysis of sea ice evolution, comparison with new satellite data and observations;
- Detailed investigation of atmosphere-ocean and atmosphere-sea ice-ocean fluxes;
- Detailed analysis of water mass exchange between the deep basins of the Baltic Sea.

The BALTIC GRID Pilot Study is chaired by Andreas Lehmann, GEOMAR Institute for Marine Research, Kiel, Germany. See <http://www.baltex-research.eu/grid> for more details.

BALTEX LEADERSHIP CHANGES

The BALTEX Science Steering Group (SSG) at its 19th meeting in Göteborg, Sweden, 24 May 2006, elected Dr Joakim Langner as new chair of the BALTEX SSG. Dr Langner is director of the research department at the Swedish Meteorological and Hydrological Institute (SMHI) in Norrköping, Sweden. He is associated professor in meteorology and his key interest and specialisation include atmospheric dispersion modelling, development and application of various chemistry-transport models from local to global scales, and atmospheric chemistry. Further, the BALTEX SSG elected and confirmed two vice-chairs: Dr Timo Vihma, senior research scientist at the Finnish Meteorological Institute (FMI) and docent in meteorology at the University of Helsinki, Helsinki, Finland; and Prof Anders Omstedt, Professor for Oceanography at Göteborg University, Earth Science Centre, Göteborg, Sweden. The BALTEX SSG approved a three-years term for their chair and vice-chairs with the possibility of one prolongation.

Future: Next year foreseen activities

- Reorganize the steering structure, membership and terms considering the revised objectives of BALTEX Phase II.
- Reorganize the BALTEX data centre structure and function: The possibility for a ONE-STOP SHOP approach is currently being explored by the BALTEX WG Data Management taking into consideration the UNIDART protocol of EUMETNET, WIS of WMO, IODE of IOC and the EUROGRID project.
- Publication of the BACC results as a comprehensive climate assessment book for the Baltic Sea basin.
- Conduct the 5th Study Conference on BALTEX, 4-8 June 2007 in Kuressaare, Estonia: The novel and important aspect will be the co-organisation of the Conference together with projects and programmes which are considered relevant in particular for the new science areas and objectives of BALTEX Phase II, namely HELCOM (the Baltic Marine Environment Protection Commission); LOICZ (Land-Ocean Interactions in the Coastal Zone), a core-project of the International Geosphere-Biosphere Programme (IGBP); ASTRA (Developing Policies and Adaptation Strategies to Climate Change in the Baltic Sea Region, an INTERREG IIIB Project); the FP6

Integrated Project ENSEMBLES (Ensemble-based predictions of climate changes and their impacts); and the FP6 Network of Excellence EUR-OCEANS (Excellence for Ocean Ecosystem Analysis). The Conference is seen as an important implementation measure for in particular the new objectives related to air and water quality as well as climate change issues and is hoped to result in new interdisciplinary projects.

- International funding applications in particular for both the 7th EU framework programme and the article-169 funding programme BONUS-169 (if in place already in 2007).

Key results

Findings from the BALTEX Assessment of Climate Change for the Baltic Sea Basin (BACC) include the following:

- A marked increase of mean surface air temperature of more than 0.7°C in the region during the recent century;
- Consistent changes in other variables such as extreme temperatures, increase of winter runoff, shorter ice seasons and reduced ice thickness on rivers and lakes in many areas;
- Assessment of indications that at least part of the recent warming in the Baltic Sea basin is related to the steadily increasing atmospheric concentrations of greenhouse gases;
- A spatially non-uniform pattern of upward and downward trends in precipitation, which can hardly be related to anthropogenic climate change;
- For the future, projections indicate that increased winter precipitation may emerge later in this century over the entire area, while summers may become drier in the southern part – but this expectation is uncertain for the time being; for the Baltic Sea, a tendency towards lower salinity could be expected; no clear signals, whether for the past or for future scenarios, are available with regard to wind conditions;
- Observed changes in past temperature have been associated with consistent changes in terrestrial ecosystems, such as earlier spring phenological phases, northward species shifts and increased growth and vigour of vegetation, these changes are expected to continue in the future;
- An assessment for the marine ecosystem of the Baltic Sea is particularly difficult because of the presence of strong non-climatic stressors such as eutrophication, fishing, release of pollutants, related to human activities.
- The Baltic Sea climate system memory and response to changes in the water and heat balance components explored through data analysis and modelling;
- Projection of the Baltic Sea climate in the late 21st century established using a dynamical downscaling approach with two global models and two emission scenarios;
- Improved understanding of the formation of superimposed ice and factors affecting the albedo of melting snow over the Baltic Sea ice cover;
- New observational evidence on the temporal and spatial variability of the atmospheric boundary layer over Baltic Sea ice;
- Precipitation and evaporation budgets over the Baltic Sea established through combination of observations and modelling;
- Physics of snowmelt episodes at the land surface in the Baltic region explored and model deficiencies identified and quantified.

Issues and recommendations

Enhanced exploration of long-term observational records: For GHP, in particular CSEs, we suggest to strengthen the collection and exploration of long-term (decades to centuries) observational data records to document past and present climate variability and change. Focus should be on water cycle relevant parameters. This is a contribution to meeting the revised objective #1 of GEWEX Phase II.

Contributions to WCRP strategic framework

Through the envisaged contribution to develop a regional component of an Earth System model for the Baltic Sea Basin, and also through its climate change and variability research components, BALTEX Phase II has a clearly defined commitment to contribute to WCRP/COPES. The extended BALTEX Phase II objectives cover aspects of both CLIVAR (Climate Variability and Predictability) and CliC (Climate and Cryosphere), two other major WCRP global projects. In addition, the gradual extension of BALTEX

research activities to air and water quality studies opens the option for a closer cooperation with projects of the International Geosphere-Biosphere Programme (IGBP) such as LOICZ (Land-Ocean Interactions in the Coastal Zone). The Baltic Sea basin is currently proposed to become an IGBP Integrated Regional Study Area, where closer links to regional LOICZ studies in the Baltic Sea coastal regions are desirable. The Earth System Science Partnership (ESSP), a joint initiative of all four coordinated global change programmes, including WCRP and IGBP, has the major objective to conduct integrated studies of the Earth system to explore the changes occurring in the system and implications for global sustainability. One of the joint ESSP projects already established is the Global Water System Project (GWSP), where BALTEX intends to contribute to, in cooperation with other in particular IGBP projects. The closer link between BALTEX and LOICZ is seen as a regional cooperation in the global frame of both ESSP and GWSP.

Contributions to society and to WCRP/GEWEX visibility

BALTEX will maintain a broad programme component with the overall objective to strengthen the education and outreach of BALTEX at all relevant levels, ranging from local to international and global. This component of the programme shall promote and facilitate the dissemination, transfer, exploitation, assessment and broad take-up of past and future programme results. The character of the individual measures include in particular i) the creation of awareness, ii) dissemination of results of the programme, and, iii) dedicated education and training measures. The target groups to be addressed in society can be largely divided into 1) stakeholders and users, 2) scientists, 3) students, and 4) the general public.

Concrete current examples include the conduction of the first conference on *Assessment of Climate Change for the Baltic Sea Basin (BACC)* (see also 7.1 above) and the close cooperation with HELCOM¹ within the BACC project, where BALTEX and HELCOM officially agreed to establish a joint venture in the sense, that the BACC material will be used for a HELCOM Thematic Assessment Report to be published in 2007.

Governmental organisations, in particular, the national Hydromet Services, are considered important stakeholders from the point of view of research programs, such as BALTEX. They provide services for society and thus establish the link between research programs and society. It is noteworthy in this context, that the new chair and vice chair of the BALTEX SSG (see above) represent two major national Services (of Sweden in Finland), a fact which is expected to facilitate and strengthen the direct interaction of the BALTEX research community and relevant Services, and thus society, in the Baltic region.

Summary

Extension of BALTEX research within Phase II will in particular include areas such as climate variability and climate change studies, scenarios of future climate, budgets and transport of harmful substances, improved understanding and prediction of extreme events like floods, and climate or environmental impact studies that respond to social needs and support decision makers in the broader context of Global Climate Change issues. An important aspect of BALTEX Phase II will be a more holistic approach towards observing, understanding and modelling major environmental and socio-economic aspects relevant for the entire Baltic Sea basin. Parts of the BALTEX Phase II research activities will thus contribute to the build-up of a high resolution integrated modelling capability for Northern Europe, embedded in an Earth System Model. In the recent year major contributions were made in particular to objective 2 related to climate, climate change and variability covering the past up to 200 years and projections for the 21st century. Under new leadership, BALTEX has started to reorganize its steering and organisational structure and membership of steering panels in order to more closely reflect the complex structure and contents of phase II of the programme.

¹HELCOM (the Helsinki Commission, see www.helcom.fi) has the status of an intergovernmental international organisation with all countries bordering the Baltic Sea, and the European Union being Contracting Parties to HELCOM.

List of selected key publications

BALTEX, 2006 a: Assessment of Climate Change for the Baltic Sea Basin - The BACC Project. Editors: The BACC Lead Author Group. International BALTEX Secretariat Publication No. 35, June 2006, 26 pages. (Available at the BALTEX Secretariat)

BALTEX, 2006 b: BALTEX Phase II (2003 - 2012): Science Framework and Implementation Strategy. International BALTEX Secretariat Publication No. 34, April 2006, 92 pages (available at the BALTEX Secretariat)

Brümmer, B., A. Kirchgäßner and G. Müller, 2005: The atmospheric boundary layer over the Baltic Sea ice. *Bound. Layer Met.*, 117 (1), 91-109.

Granskog, M. A., T. Vihma, R. Pirazzini, and B. Cheng, 2006: Superimposed ice formation and surface energy fluxes on sea ice during the spring melt-freeze period in the Baltic Sea. *J. Glaciol.*, 52, 119-127.

Meier, H.E.M., 2006: Baltic Sea climate in the late twenty-first century: A dynamical downscaling approach using two global models and two emission scenarios. *Climate Dynamics*, 27(1), 39-68, doi: 10.1007 / s00382-006-0124-x.

Narapusetty, B. and N. Mölders, 2005: Evaluation of snow depth and soil temperatures predicted by the hydro-thermodynamic soil-vegetation scheme coupled with the fifth-generation Pennsylvania State University-NCAR Mesoscale Model. *J.Appl.Met.*, 44 (12), 1827-1843.

Omstedt, A., and D., Hansson, 2006: The Baltic Sea ocean climate system memory and response to changes in the water and heat balance components. *Continental Shelf Research*, 26, 236-251.

Smedman, A.-S. and co-authors, 2005: Precipitation and evaporation budgets over the Baltic Proper: Observations and modelling. *J. Atm.Ocean Sci.*, 10 (3), 163-191.

For announcements of recent BALTEX publications and an updated comprehensive list of BALTEX publications and reports visit <http://www.baltex-research.eu>

List of meetings, workshops

- BALTEX SSG meeting #18: 18 to 20 October 2005, Lindenberg, Germany
- 2nd BACC workshop, 8 / 9 December 2005, Warsaw, Poland
- International BACC Conference, 22 / 23 May 2006, Gothenburg, Sweden
- BALTEX WG Data Management Meeting, 23 May 2006, Gothenburg, Sweden
- BALTEX SSG meeting #19, 24 May 2006, Gothenburg, Sweden
- BALTEX WG Radar Meeting, 7 / 8 June 2006, Tallinn, Estonia
- Meeting of BALTEX SSG chairs and Secretariat, 19 September 2006, Geesthacht, Germany

Planned meetings, workshops

- BALTEX SSG meeting #20, 7-8 December 2006, St. Petersburg, Russia
- Meeting of the BALTEX WG Data Management, December 2006, St. Petersburg, Russia
- 5th Study Conference on BALTEX, 4-8 June 2007, Island of Saaremaa, Estonia

List of members and their term dates

Members of the BALTEX SSG:

Mikko Alestalo, Finnish Meteorological Institute, Finland

Franz Berger, German Weather Service DWD, Germany
Ole Bøssing Christensen, Danish Meteorological Institute, Denmark
Sven-Erik Gryning, Risø National Laboratory, Denmark
Daniela Jacob, Max-Planck-Institute for Meteorology, Germany
Sirje Keevallik, Estonian Maritime Academy, Estonia
Piotr Kowalczak, Institute of Meteorology and Water Management, Poland
Zbigniew W. Kundzewicz, Research Centre of Agriculture and Forest Envir., Poland
Joakim Langner (chair), Swedish Meteorological and Hydrological Institute, Sweden
Andreas Lehmann, IFM-GEOMAR, Germany
Andris Leitass, Latvian Hydrometeorological Agency, Latvia
Jörgen Nilsson, Swedish Meteorological and Hydrological Institute, Sweden
Anders Omstedt (vice chair), Göteborg University, Sweden
Jan Piechura, Institute of Oceanology, Poland
Dan Rosbjerg, Technical University of Denmark, Denmark
Markku Rummukainen, Swedish Meteorological and Hydrological Institute, Sweden
Ivan M. Skouratovitch, State Committee for Hydrometeorology, Belarus
Aad P. van Ulden, The Royal Netherlands Meteorological Institute, The Netherlands
Timo Vihma (vice chair), Finnish Meteorological Institute, Finland
Hans von Storch, GKSS Research Centre Geesthacht, Germany
Valeri S. Vuglinsky, State Hydrological Institute, Russia