BALTEX Newsletter

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WCRP GEWEX

Editorial

New Chains and New Challenges for BALTEX

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Chairman of the BALTEX Science Steering Group

At the 19th BALTEX science steering group meeting held in Gothenburg in May this year I was given the honour to take over after Prof. Hartmut Graßl as chairman for BALTEX for the coming three years. I am a meteorologist from the beginning but my background is mainly in modelling of air pollution and atmospheric chemistry, and I have been involved in the development and application of 3D air pollution models at the Swedish Meteorological and Hydrological Institute over the last 14 years.

By my side as vice-chairs I have two well known and experienced BALTEX researchers, Anders Omstedt, professor of oceanography at Gothenburg University who continues as vice-chair and Dr. Timo Vihma senior research scientist at the Finnish Meteorological Institute. Both are long standing members of the BALTEX Science Steering Group and will ensure continuity in the leadership of BALTEX. The excellent staff at the BALTEX Secretariat at GKSS Research Centre Geesthacht will also guarantee a continued smooth operation of BALTEX.

BALTEX is still in the beginning of its second phase. A new science plan is in place and we are starting to work in the direction of the Science Framework and Implementation Plan published in April 2006. The six main objectives of BALTEX Phase II all feel very relevant. They cover the physics of the land-ocean-atmosphere system of the BALTEX area but also extend to the environmental field and call for increased stakeholder interaction and educational activities.

Along with the climate issue the environmental situation in marine areas is much in focus presently. The European Commission communicated its Thematic Strategy on the Protection and Conservation of the Marine Environment in 2005, and proposed a Marine Strategy Directive. The situation in the Baltic is high on the environmental political agenda in several countries in the BALTEX area. I have always spent a fair amount of my spare time sailing on the waters around Sweden and neighbouring countries and it seems clear to me that the environmental status of the Baltic has deteriorated substantially over the last three decades. Actions to improve the situation need to be based on thorough scientific understanding of the whole system and on validated models of the relevant physical, chemical and biological processes. Here, BALTEX can play an important role in providing basic building blocks and data for integrated assessment models for the environmental status of the Baltic Sea and its entire catchment. Given the long time scales involved the link to climate is obvious in order both to understand historical variations and to provide scenarios for the future.

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First Announcement

5th Study Conference on BALTEX

Kuressaare, Saaremaa, Estonia
4-8 June 2007

For details see pages 18-22

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In pursuing its objectives BALTEX will continue to contribute to GEWEX, the Global Energy and Water Cycle Experiment, as one of its Continental-scale Experiments organized within the GEWEX Hydrometeorological Panel. I also consider BALTEX having a clearly defined commitment to contribute to the World Climate Research Programme (WCRP) and its strategies such as COPES, for example 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. At the same time, the BALTEX community needs to actively engage in discussions with other programmes and projects to build up a broad research base to meet the enlarged objectives related in particular to environmental issues of concern relevant for the BALTEX region. The recently initiated co-organisation of the forthcoming international BALTEX conference next year in Estonia together with the LOICZ programme and the Helsinki Commission, HELCOM, as well as with major EU-funded projects, is a first very promising step in this direction, with more hopefully to follow soon.

An immediate task for the new chairs will be to organise the work in BALTEX towards the six objectives for phase II. In some areas the work is well underway, the BACC initiative (see page 3) is an excellent example, while in other areas relevant working groups need to be established in order to move towards the new objectives.

Another important topic is of course funding of BALTEX research. The EU 7th framework program will soon be launched and BONUS-169 may become a reality in the coming years. It is time to start thinking about forming proposals that can put BALTEX Phase II related research into FP7.

To summarise there is a lot to do in order to move BALTEX forward in the coming years and I look forward to work together with the BALTEX community on this important task. If you have views, ideas or opinions on BALTEX issues please don't hesitate to contact me, one of my co-chairs or the BALTEX Secretariat.

Farewell and thank you Hartmut, welcome Joakim !

Hans-Jörg Isemer and Marcus Reckermann
International BALTEX Secretariat, GKSS Research Centre Geesthacht, Germany, (baltex@gkss.de)

The 19th meeting of the BALTEX Science Steering Group (BSSG), held 23 and 24 May 2006 in Göteborg, marks a turning-point for BALTEX: Following Hartmut Graßl´s wish to resign, Joakim Langner, director of the research department at SMHI, Sweden, was elected chairman of the BSSG, together with Timo Vihma (FMI, Helsinki) and Anders Omstedt (Göteborg University, Sweden) both elected vice-chair of the BSSG. During a farewell dinner given for Hartmut by SMHI, speakers stressed his outstanding leadership during the recent almost 7 years. In particular his energy to set the course for BALTEX Phase II with both the science and implementation plans being published under his chairmanship was highlighted. The benefit BALTEX has gained through Hartmut's contributions with his manifold top-class experience *e.g.* as former director of WCRP has been enormous. For us, the BALTEX Secretariat staff, it was always an inspiring experience, exciting and instructive at the same time, to support Hartmut's leadership. We anticipate, the entire BALTEX community will agree to saying: Thank you indeed, Hartmut, for sharing your time and experience with BALTEX!

Historical meeting: The "old" and new BALTEX SSG chairs met in Göteborg, 23 May 2006. From right to left: Joakim Langner, BALTEX SSG chair since May 2006, Hartmut Graßl, BALTEX SSG chair 1999-2006, Mikko Alestalo, BALTEX SSG member, Lennart Bengtsson, BALTEX SSG chair 1994-1999.

Under new leadership, the BSSG started to discuss options for future steering structures relevant for BALTEX in light of the new objectives of phase II of the programme. BSSG considered it premature to finally decide on terms and members for recently suggested BALTEX working groups already at this meeting. Instead, a revised concept of how BALTEX Phase II objectives correspond to the present and suggested working groups shall be established by the new chairs and be finally discussed at the forthcoming BSSG meeting in December 2006. This will include suggestions and discussions on BSSG membership and terms as well as additional necessary management means and structures for BALTEX Phase II. BSSG suggested seeking to officially co-organise the 5th Study Conference on BALTEX in 2007 with other programmes, which have a specific expertise profile in those areas, where BALTEX intends to co-operate more closely with, during BALTEX Phase II. The planned co-organisation of the Conference is seen as one important initial implementation measure for this envisaged scientific co-operation. Particular attention was given to options for future funding for BALTEX and both the forthcoming 7th EU framework programme as well as BONUS-169 were discussed. BSSG appreciated particularly the attendance of Kaisa Kononen, coordinator of the ERANET BONUS project, who gave an overview of the actual BONUS-169 preparations at the 19th BSSG meeting.

We are looking forward to working together with the new chairs and encourage all scientists to contact them, or us, for new ideas related to implementing BALTEX Phase II objectives. As above with Hartmut, we trust that we speak for BALTEX saying: Welcome, good speed, fun and success with BALTEX, Joakim, Anders and Timo!

BACC - BALTEX Assessment of Climate Change for the Baltic Sea Basin – International Conference in Göteborg, Sweden

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The two-day conference on 22 and 23 May 2006 in Göteborg, Sweden, co-organised by the University of Göteborg, HELCOM (the Baltic Marine Environment Protection Commission) and the BALTEX Secretariat, offered a review of published knowledge on climate change in the Baltic Sea basin and related changes in terrestrial and marine ecosystems.

The unique feature of BACC is the combination of evidence on climate change and related impacts on terrestrial, freshwater and marine ecosystems. The Conference in Göteborg was meant to, firstly, present the findings of the BACC group and to offer a discussion forum for the scientific community, this Conference thus being an element of the overall BACC assessment process. Secondly, the Conference was planned to act as mediator between science, press and politics. This was achieved by bringing together outstanding representatives of the three communities in a lively panel discussion at the end of the Conference.

The first day of the Conference was dedicated to the presentation and discussion of scientific results. Speakers were the lead authors of the BACC assessment book, which is in preparation for publication in 2007, and the structure of the presentations largely followed the chapters of the planned book: Two presentations dealt with detection of past and current, and the projection of future climate change, while two other presentations described observed and potential consequences for terrestrial and marine ecosystems, respectively, in the Baltic Sea basin. Posters summarised the main results and stimulated discussions during the coffee breaks and the poster session. The second day was dedicated to the creation of public awareness and the communication of scientific findings to help decision makers. BACC chairman Hans von Storch reviewed again the results of the BACC assessment, and Juha-Markku Leppänen and Janet Pawlak, representing the HELCOM secretariat, introduced a first draft of a “HELCOM Thematic Assessment Report on Climate Change in the Baltic Sea Area”. The HELCOM report is planned to extract information from the BACC material and to present it in a manner tailored for the purposes of HELCOM and its contracting parties, *i.e.* governmental organisations of countries bordering the Baltic Sea, and the European Commission. As such, the HELCOM report shall set an example for an efficient transfer of scientific findings from researchers to policy makers.

The participants at the BACC Conference in front of the Conference Centre Wallenberg of Göteborg University

The panel discussion, from left to right: Hans von Storch (Institute for Coastal Research at GKSS Research Centre, Germany, and BACC chairman), Sirpa Asko-Seljavaare (Member of the Finnish Parliament), Anne Christine Brusendorff (Executive Secretary of HELCOM), Maciej Zalewski (European Regional Centre for Ecohydrology under the auspices of UNESCO, Poland), Gerald Traufetter (Journalist „Der Spiegel“, Germany), Andres Tarand (Member of the European Parliament, Estonia), Lennart Bengtsson, (University of Reading, United Kingdom), and Heike Imhoff (Head of the German delegation to HELCOM). Annika Söderpalm, Sweden, chaired the panel discussion.

Sirpa Asko-Seljavaare makes a point, Hans von Storch and Anne Christine Brusendorff listen.

Finally, members of the Finnish and European parliaments, journalists from Sweden and Germany, outstanding scientists from Germany, Poland and the United Kingdom, and the executive secretary of HELCOM discussed climate change and the transfer of related knowledge within society in a vivid panel discussion. There was a general consensus that the communication between scientists and decision makers needs to be improved, while scientists shall remain independent in their scientific work and conclusions. It emerged during the discussion that expectations from both sides in terms of knowledge transfer are not clear, making communication difficult at times. Moreover, the strict scientific candour which is fundamental for researchers must not be biased by public opinion, political expectations or the zeitgeist. “Scientists who merge scientific facts with personal opinions, be it for the best, do not act in a sustainable manner”, said Hans von Storch, chairman of BACC.

The BACC project is ongoing. The Conference resulted in various suggestions for improvement of the BACC material, which are carefully considered at present by the BACC authors. HELCOM is working in parallel on a revision of its draft report, where elements of the report are expected to enter into the Baltic Sea Action Plan, see also page 16. A summary of the current BACC results as well as a copy of the draft HELCOM report as presented at the Conference are available at the BACC website at http://www.baltex-research.eu/BACC. A comprehensive textbook on BACC is planned to be published in the middle of 2007.

Main scientific messages communicated at the Conference include:

The Baltic Sea basin has become warmer in the past century. Mean surface air temperature has increased by more than 0.7 ^{o}C, which is larger than the global mean temperature increase of 0.5 ^{o}C. Other thermal variables also show changes, such as an increase in winter runoff, shorter ice seasons and a reduced ice thickness on rivers and lakes in many areas. Although a clear connection to the increased levels of greenhouse gases in the atmosphere could not be established in the Baltic area, is plausible that at least part of the recent warming in the Baltic Sea basin is related to the steadily increasing atmospheric concentrations of greenhouse gases. Projections for future climate indicate a continued increase in temperature.

For precipitation, the picture is still less clear. Although northern Europe has become wetter during the 20th century, a spatially non-uniform pattern of upward and downward trends has been observed, which can hardly be related to anthropogenic climate change. For the future, increased winter precipitation may emerge later in this century over the entire area, while summers may become drier in the southern part. For the water body of the Baltic Sea, a tendency towards lower salinity can be expected. No clear signals, neither for the past nor in future scenarios, are available with regard to wind conditions. The uncertainties concerning natural variability and the role of changes in atmospheric circulation and anthropogenic trace gas emissions in climate change stipulates the need of further research.

BACC website:
www.baltex-research.eu/BACC

The observed climate changes in the past have been associated with consistent changes in terrestrial ecosystems, such as an earlier onset of spring, a northward species shift and generally increased growth and vigour of vegetation. In lakes, higher summer algal biomasses have been found. These trends are expected to continue into the future. In the marine ecosystem of the Baltic Sea, the assessment is particularly difficult because of the presence of strong non-climatic stressors (eutrophication, fishing, release of pollutants), related to human activities. Changing temperatures have been related to various effects, in particular

Hans von Storch summarizes the BACC results

to the composition of species. A reduced sea ice cover in winter might have detrimental effects to the Baltic ringed seal, as this species is dependent on a closed ice cover for reproduction. A lower salinity is thought to have a major influence on the distribution, growth and reproduction of the Baltic Sea fauna; freshwater species are expected to enlarge their significance, and invaders from warmer seas (such as the zebra mussel *Dreissena polymorpha* or the North American jelly comb *Mnemiopsis leidyi*) may enlarge their distribution area. The expected changes in precipitation (and thus river runoff) could aggravate the problem of eutrophication in coastal areas.

The Baltic Sea Climate: Today, Yesterday and Tomorrow - Part 3

The Baltic Sea Tomorrow – A Sea of Information

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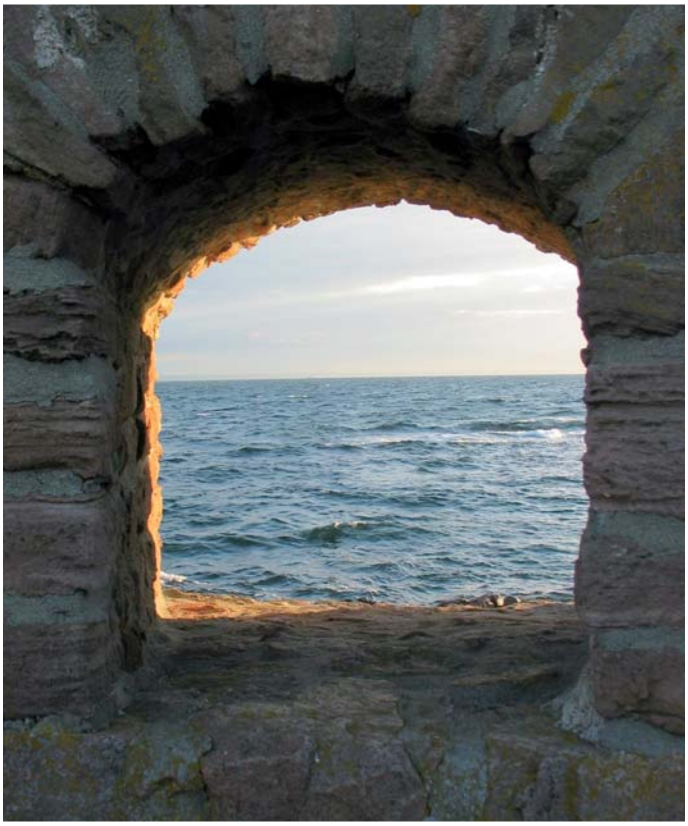
This is the third of three articles related to Baltic Sea research. The first and second parts were published in the BALTEX Newsletters No. 7 and No. 8, 2005.

It is difficult to make pronouncements about the future of the Baltic Sea. We still know too little about the processes that drive the climate. We have only just begun to understand the interplay between the geosphere, the biosphere, and the human activity. The earth is not a machine that can be easily described in computers and manuals.

We are inclined to believe that the traditional scientific disciplines have the answers, and truly there is a sea of information there. But if we are serious in our ambitions to understand climate systems, with their complex flows of air, water, chemical substances, life and human activities, many researchers from different disciplines will have to work together.



The Baltic Sea seen from Christiansø Island, spring 2004 (Photo: Karin Wesslander). People have always been fascinated by the future. Artists, writers, scientists, and visionaries perhaps sense something beyond the horizon. Mainly, we are guessing. We are prisoners of the present. But time is approaching with its invitation to attend.

No simple connections

Forecasts should be taken with a grain of salt and preferably come with a "Best Before" label. Model errors also grow with the length of the forecast.

For modelers, this is a matter of a mathematical initial problem – a matter of thoroughly understanding the conditions from which the models start their calculations. Climate researchers, on the other hand, tend to ignore the starting conditions and regard forecasts as solely a problem of boundary-value conditions. The term refers to those factors outside the actual calculation area which determine the calculation. Changes in solar radiation are one example, but volcanic eruptions and increased quantities of greenhouse gases are also often regarded as boundary-value conditions. In Figure 1 the importance of initial conditions are illustrated for the Baltic Sea salinity.

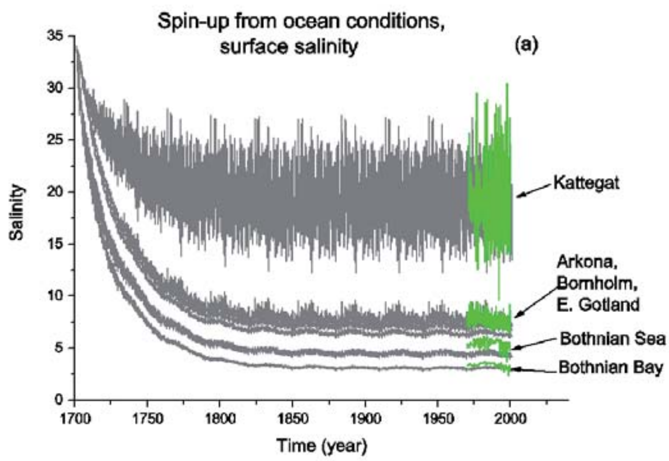


Figure 1. *A numerical model experiment with calculations (grey lines) and observations (green lines) illustrating how the Baltic Sea salinity adjusts to present climate conditions. The initial conditions in the model assume that the whole Baltic Sea is covered with ocean water. From the figure we can notice that it takes almost 100 years to reach present climate conditions, a time period when the initial conditions influence the calculation. After this spin-up period the solution is controlled by the boundary-values. The boundary-values are calculated based on observations from the atmosphere, the land and the ocean outside the Baltic Sea (from Omstedt and Hansson, 2006).*

Climate forecasts are often both an initial and a boundary-value problem. Future simulations are meaningless if we fail to take the present climate conditions and the changes into account. Land and seas undergo constant change. Greenhouse gases and volcanic eruptions affect the earth. There are no simple connections here. The dynamic biogeosphere is a complex nonlinear system that we have only begun to investigate with our mathematical models.

Linear functions and straight answers

The scare reports on air temperature and water level come one after the other: "Sweden will be four degrees warmer in a hundred years," "Göteborg transformed into the Venice of the North," "Southern Sweden ravaged by drought and Northern Sweden drowned in rain."

So, what can we say about the future? Researchers are very much inclined to work with various types of scenarios, or more accurately put, a type of sensitivity study that varies one or two factors at a time. But a scenario is not a forecast. Climate models differ from weather forecast models as the latter predicts weather a few days ahead, while climate models try to model statistics of weather. The climate models need to be improved which can be realized when studying the outcome from simulations of present climate conditions. The difference between the modelling of present climate conditions and observations provide us with a measure of the quality of the climate simulation. If the difference is large compared to the scenario change, which is often the case, the interpretation of the scenario should be done with care. The water and energy cycles are often the key processes that need improvements.

That doesn't stop less scrupulous forecasters from uncritically adding their own climate models trend to the actual observations of the day. Linear functions and straight answers, in other words, but they have nothing to do with science. The truth is that climate models need considerable improvements and that we know very little about the future. Climate forecasts are still the art of the educated guess.

Conceivable curve ?

Yet another problem with climate forecasts is that they report calculations not previously measured. The models are adapted using data from the current climate, but describe changes that have not yet been observed. Our research team has worked with models of the Baltic Sea and we have been able to show how water level, salinity, temperature, and ice vary under given conditions. We have access to direct observations from BALTEX and national data centers and are thus able to develop realistic models (Omstedt and Hansson, 2006). The danger now lies in using these models outside their validation parameter range. New important knowledge can however be gained with all the risks of model extrapolations (Müller and Storch, 2004).

As an example of model extrapolation we have studied the Baltic Sea water balance. The freshwater inflow for the last hundred years has hovered around a mean value of 16,000 m^3/s. What happens if the freshwater supply increases? The curves in the Figure 2 show that if it were tripled, the Baltic Sea would be transformed into a freshwater sea. Can we rely on that and how are we supposed to know? The calculations show that the Baltic Sea is sensitive to variations in freshwater inflow. But it is highly unrealistic to conceive of an increase of several hundred percent. Our calculations indicate that the Baltic Sea will remain a brackish sea in the future. At the same time, we are convinced that our results will be discussed and called into question when new knowledge comes to light.

The Baltic Sea tomorrow – a forecast

What is going to happen to the Baltic Sea tomorrow? The only thing we can be sure of is that the future has a surprise or two in store for us. Is there an answer to the question,

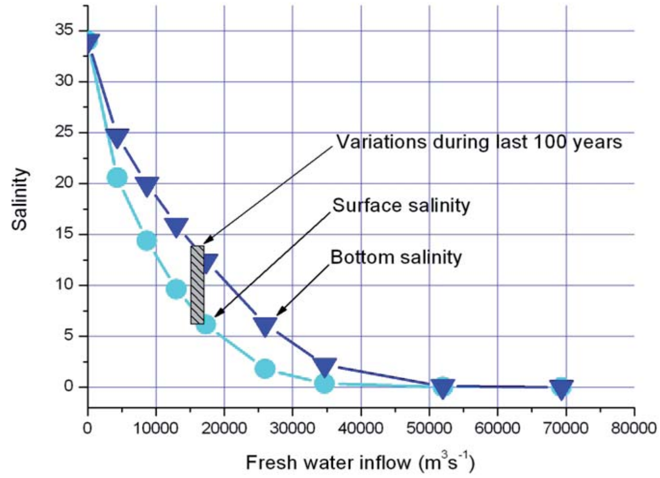


Figure 2. *Model calculations showing how salinity in the central Baltic Sea can vary with variations in freshwater inflow from rivers and precipitation. The dashed field represents typical observed variation during the last hundred years (Redrawn from Omstedt and Hansson, 2006).*

then? If we want to be able to say anything about the next hundred years, we could adopt a historical perspective. A time scale of two hundred years back in time immediately illustrates the uncertainty.

In the year 2100, the mean temperature in Stockholm will have changed by -0.1 to +0.7ºC. The Baltic Sea's water level will be 0.3 to 8.5 cm above the current mean and the maximum ice spread will have declined by 5 to 20 %. The freshwater inflow will not have changed to any significant degree and thus the salinity of the Baltic Sea will not have changed either.

Clearly, nothing spectacular. Is it a reasonable forecast? It is based on the assumption that the climate a hundred years from now will be similar to the climate today and it follows the trend in observed series. Dramatic changes in ocean circulation, particularly of the Gulf Stream, were not included. Nor were unusual effects of solar radiation, greenhouse gases, or volcanic eruptions – phenomena that can drastically change forecast conditions, but about which we know little.

Another try to make educated guesses about the future is done in the BACC project presented on page 3 in this Newsletter. This project uses the outcome from climate models that are forced by increased greenhouse gases, and the result illustrates a warming effect. As said, forecasts have a limited shelf life. As we know more, we make new and better predictions and it is clear BALTEX research is strongly needed.

The Baltic Sea - a watchful eye

With all due respect to forecasts, we need thorough knowledge of the current climate to understand what is waiting for us around the corner. We learn a great deal about the sea and the large-scale circulation of the atmosphere by tracking variations in the water level. We can use salinity to read how the water balance between precipitation and river inflow is changing throughout the Baltic Sea. Temperature and ice distribution give us an understanding of the heat balance and rapid indications of abnormal changes. The Baltic Sea is quite simply keeping a watchful eye on the climate of Northern Europe.

Measuring water level, salinity, temperature, and ice distribution is perhaps our most important task right now. We also need more in-depth research in order to geologically and historically map the climate, trace the causes of change, develop better models, and understand the consequences for life. The more we know about the Baltic Sea yesterday and today, the more we can say about the Baltic Sea tomorrow. Our job is to piece a puzzle, solve an enigma, and get to know a sea.

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Trends in Sea Surface Temperature of the Baltic Sea since 1990

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Introduction

The BACC conference (BALTEX Assessment of Climate Change for the Baltic Sea Basin) in Göteborg, Sweden in May 2006 stimulated us to analyse sea surface temperature data with respect to changes over a 16-year period from 1990-2005. The annual warming trend for the Baltic Sea basin surface air temperature has been shown to be 0.08 °C/decade which is somewhat larger than the trend for the entire globe (1861-2002), which is about 0.05 °C/decade. A marked warming in the last decades of the 20th century started around 1990 (Figure 1) in Denmark and Estonia, whereas it began around 1980 in Sweden (Draft Helcom Thematic Assessment Report, see e.g. the BACC website at www.baltex-research.eu/BACC, 2006). For the period 1980-2004, the low-pass filtered temperature time series show an increase of about 1°C for the Baltic Sea catchment area. The period coincides with the period where sea surface temperature data from NOAA satellites have been made available by the BSH (Bundesamt für Seeschifffahrt und Hydrographie Hamburg, Germany). Our analysis aims at the detection of potential sea surface temperature trends in response to the marked rising air temperature in the Baltic region. Recently, Siegel et al (2006) published an analysis on sea surface temperature development of the Baltic Sea in the period 1990-2004 based also on the NOAA AVHRR-satellite data. Here we give some additional information mainly focussed on the BACC-discussion.

BSH monthly mean SST maps

Since 1990, BSH regularly receives and processes NOAA-AVHRR satellite data. Automatically, from infrared satellite data, weekly SST (sea surface temperature) composites of the Baltic Sea and monthly SST composites are calculated and published at the BSH web site (www.bsh.de). Monthly composites for the period 1990-2005 (Figure 2) have been used to calculate long-term (16 years) monthly means. From the long-term mean, anomalies of monthly SST maps were calculated, and seasonal trends as well as trends for the total period have been determined for different basins of the Baltic Sea.

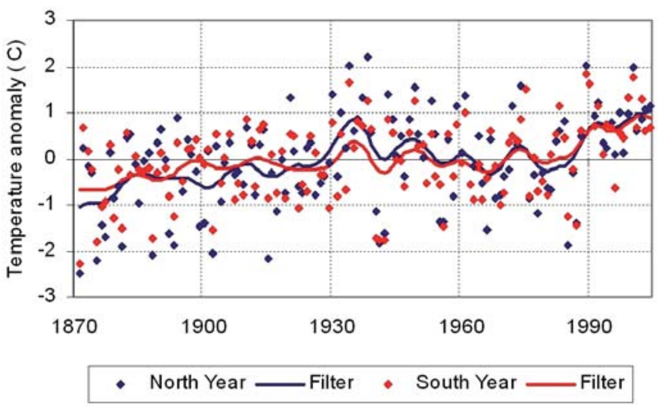

Figure 1. *Annual surface air temperature anomalies for the Baltic Sea catchment 1874-2004, calculated from 5° by 5° latitude, longitude box averages taken from the CRU dataset based on land stations. Blue (red) line and dots represent data north (south) of 60°N. The dots represent individual years, and the smoothed curves highlight variability on timescales longer than 10 years (from the BACC Poster Detection of Past and Current Climate Change 1. Atmosphere: Temperature and precipitation), see the BACC website.*

For further examination of the temperature maps and for detailed view, posters of sea surface temperature of the Baltic Sea and corresponding anomalies can be downloaded from *ftp.ifm-geomar.de/downloads/BALTEX*. Posters show monthly mean SST maps and corresponding anomalies in a time-matrix to achieve an overview of SST development and extreme situations. Especially, temperature anomalies allow an easy detection of warm and cold months compared to the mean conditions (Figure 3).

Monthly mean SST anomalies

Monthly mean SST anomalies (Figure 3) show high variability in SST development for different months and different years. Positive deviations from mean values (temperature increase) are often as high as 4-5 °C (*e.g.* June 2002, July 2003), whereas negative deviations are seldom less than -4°C (*e.g.* August 1992, November 2002). Different areas of the Baltic Sea can show different patterns of warming or cooling for the same month. Exceptional warm periods (more than 3 consecutive months) occurred for example in summer and autumn 1999, winter 2000/2001 and in summer 2002. Cool periods occurred in summer and

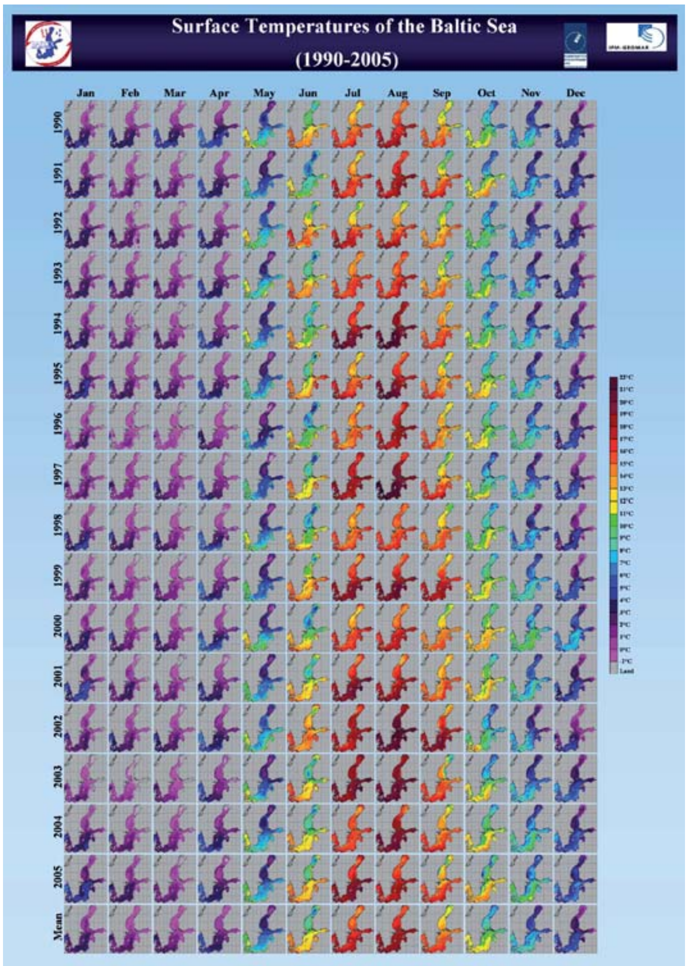

Figure 2. *Monthly mean sea surface temperature [°C] maps of the Baltic Sea (1990-2005) and 16-year averages of SST for January to December (downloadable poster).*

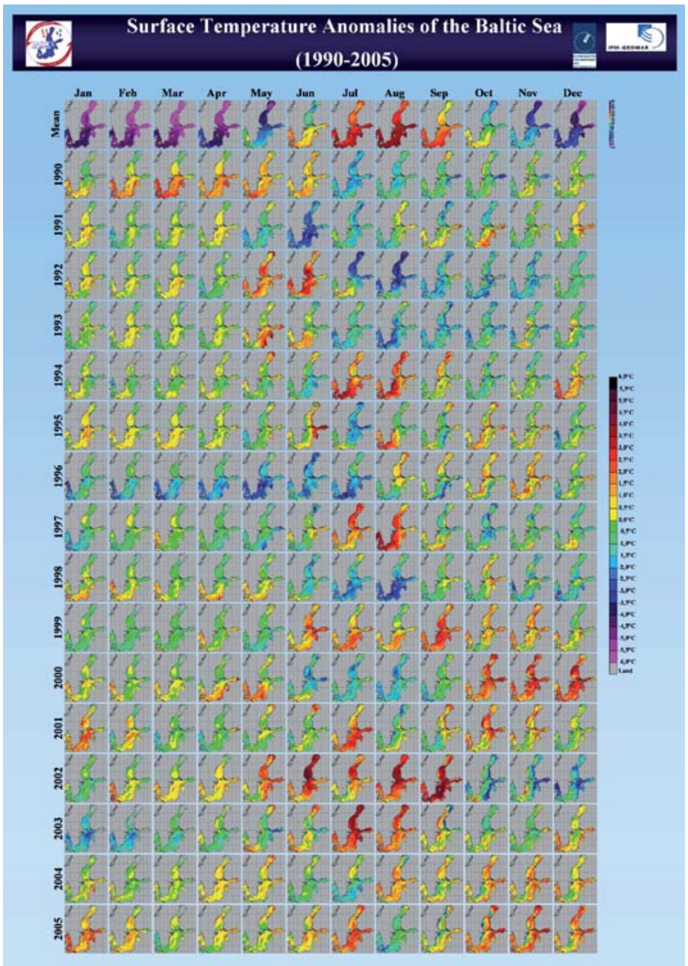

Figure 3. *16-year averages of SST for January to December, and anomalies of monthly mean sea surface temperature (1990-2005; downloadable poster).*

autumn 1992 and 1993, winter to summer 1996 and winter 2002/2003. Sometimes extreme warming or cooling (of more than 2°C) occurs for consecutive months. Extreme warming mainly happens in late spring, summer, autumn and early winter, and cooling in summer.

Trends in SST of the Baltic Sea

For the period 1990-2004, an increase in air temperature-can be determined from annual mean temperature records of the Baltic catchment and from the Stockholm record which have been presented at the BACC conference and which are available at the BACC website. For the 15 years period (1990-2004), an increase of about 0.4 °C results for the annual mean temperature of the Baltic catchment (Figure 1). There are strong differences in seasonal (3 months) mean temperature increases with the strongest increase for the seasonal mean summer (JJA) temperature of about 1.2 °C.

Ska	Kat	ArB	BoB	sGB	eGB	LaD	eGOF	GOF	BS	BB
0.60	0.50	0.40	0.20	0.40	0.40	0.50	0.90			

Table 1. *Warming trend (°C/decade) for different areas of the Baltic Sea during 1990 - 2005. For abbreviations, see legend to Figure 4.*

	Ska	Kat	ArB	BoB	sGB	eGB	LaD	eGOF	GOF	BS	BB
Jan	0.5	0.09	0.5	-0.2	-0.09	-0.13	0.07	0.4		0.09	
Feb	0.3	-0.03	-0.02	-0.3	-0.4	-0.2	-0.1	-0.2			
Mar	-0.1	-0.6	-0.4	-0.6	-0.6	-0.7	-0.4	-0.6		-0.2	
Apr	0.5	0.5	-0.3	-0.2	-0.2	-0.2	0.1	-0.1		-0.03	
May	-0.03	0.3	0.2	0	0	0.04	0.4	0.08	-0.01	-0.3	
Jun	-0.2	0.2	0.3	0	0.1	0.2	1	0.7	-0.3	0.3	2
Jul	1.1	1	0.6	1	1.2	1.6	1.7	2.7	2.3	2.7	2.1
Aug	1	0.6	0.7	0.5	1	1.2	1.6	1.3	0.8	1.7	0.8
Sep	1.1	0.8	1.4	1.2	1.4	1.5	1.2	2.4	0.7	1.7	0.7
Oct	1.2	1.3	0.9	1	0.9	1.1	0.3	1.8	1.8	1.2	1.6
Nov	1	1.2	0.6	0.2	1	0.4	0.5	1.5	2	1	1.5
Dec	0.3	0.5	0.5	0.1	0.5	0.3	0.5	0.6	0.8	0.8	1.3

Table 2. *Seasonal warming trends (°C/decade) for different areas of the Baltic Sea during 1990 - 2005.*

For the Stockholm record (not shown), an increase of about 1°C results. Thus, there are obviously seasonal and spatial differences in the warming of the Baltic area.

Can we detect a corresponding signal in the sea surface temperature evolution of the Baltic Sea?

From SST anomalies we calculated linear temperature trends for 11 positions representing different areas of the Baltic Sea (Table 1, Figure 4). The positions have been chosen to represent open sea conditions to be as far as possible off the coast to prevent coastal influences such as upwelling. Trends are given in °C/decade. For the most northern and eastern positions, sea ice coverage prevents the calculation of trends.

For the period 1990-2004, the Baltic Sea surface temperature increased in the range of 0.3-1.4 °C. The surface

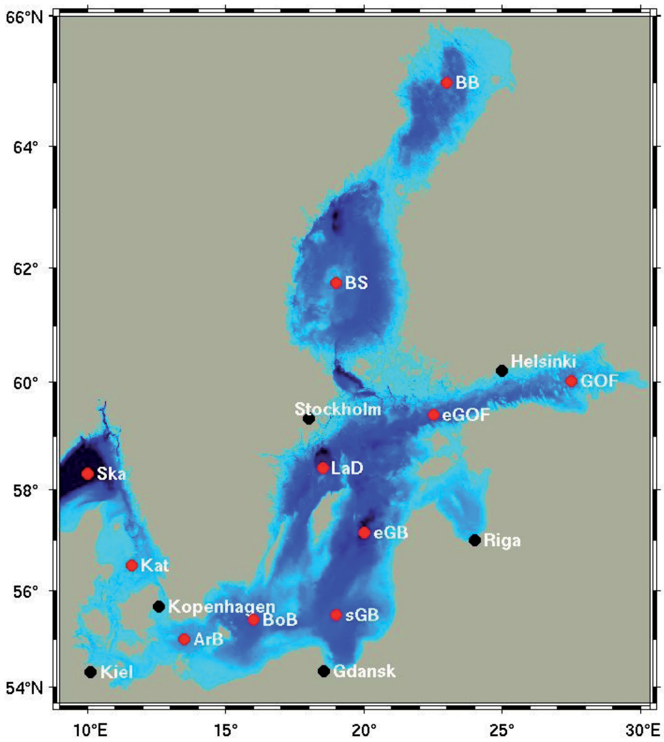

Figure 4. *Positions at which temperature trends have been calculated. Ska-Skagerrak (58.3°N, 10°E), Kat-Kattegat (56.5°N, 11.6°E), ArB-Arkona Basin (55°N, 13.5°E), BoB-Bornholm Basin (55.4°N, 16°E), sGB-southern Gotland Basin (55.5°N, 19°E), eGB-eastern Gotland Basin (57.15°N, 20°E), LaD-Landsort Deep (58.4°N, 18.5°E), eGOF-entrance Gulf of Finland (59.4°N, 22.5°E), GOF-Gulf of Finland (60°N, 27.5°E), BS-Bothnian Sea (61.75°N, 19°E), BB-Bothnian Bay (65°N, 23°E). Seasonal warming trends (°C/decade) for different areas of the Baltic Sea*

warming is rather close to the air temperature increase in the Baltic area. For the Landsort Deep station which is closest to Stockholm, a temperature increase of 0.75 °C occurred (Figure 5). We observe the tendency that trends in the south of the Baltic Sea are smaller than in the north.

Seasonal temperature trends are summarized in Table 2. Temperature trends are given in °C/decade. Again the development in the seasonal trend is similar compared to the air temperature trend (Figure 6). During winter, the temperature trend is partly negative, almost no trend in May, and extreme values for summer and autumn with more than 2°C/decade for the northern parts of the Baltic Sea in July.

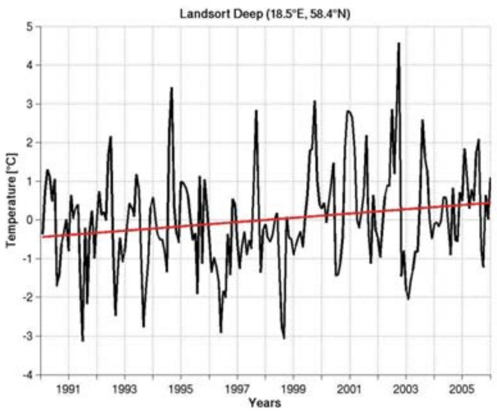

Figure 5. *Sea surface temperature [°C] evolution (1990-2005) at Landsort Deep with linear trend (red line).*

Thus the overall SST increase of the Baltic Sea is mainly caused by warming in summer and autumn, and with no pronounced contribution or even opposite trends in late winter and early spring. For the period 1990-2004 the Baltic area has become warmer and the sea surface temperature of the Baltic Sea closely follows this trend, which continues in 2005 and 2006. In 2006, again SSTs of the summer months were considerably warmer than the long-term mean. In July 2006, temperature anomalies in the Bornholm Basin were higher than 4°C, and in August anomalous warming of more than 3°C was recorded in the Bothnian Sea and Bay. It should be noted that the analysis comprises only a 16-year period, so we cannot prove whether the close relationship of the annual mean temperature for the Baltic Catchment (Figure1) and the sea surface temperature of the Baltic Sea exists for a longer period from e.g. 1870-2006. However, sea surface temperature data from NOAA-satellites can be used to monitor the recent sea surface temperature evolution of the Baltic Sea including the different sub-basins, and as such they are extremely useful in detecting current climate change.

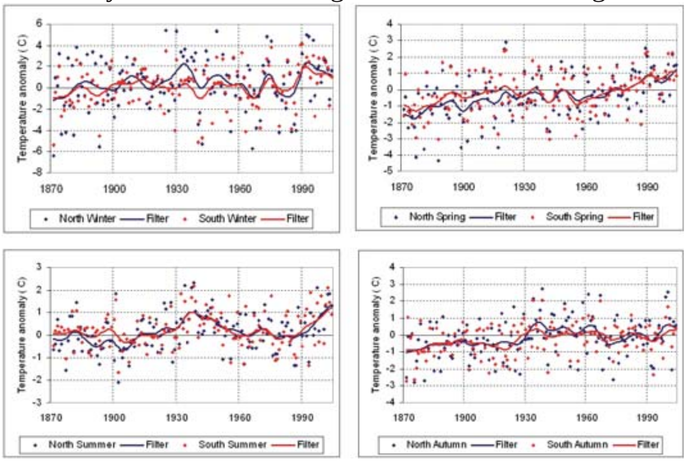

Figure 6. *Seasonal surface air temperature anomalies for the Baltic Sea catchment area 1871-2004, calculated from 5° by 5° latitude, longitude box averages taken from the CRU dataset based on land stations (winter (DJF), spring (MAM), summer (JJA), autumn (SON)). Blue (red) line and dots represent data north (south) of 60°N. The dots represent individual years, and the smoothed curves highlight variability on timescales longer than 10 years (from BACC Poster Detection of Past and Current Climate Change 1. Atmosphere: Temperature and precipitation, Fig.1.), see BACC website*

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Implementation of a high-resolution 3D ecosystem model for local and regional climate studies in the Baltic Sea

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A high-resolution 3D coupled biogeochemical-physical ocean model is implemented at the Swedish Meteorological and Hydrological Institute (SMHI). The model system can be used as a tool to investigate the Baltic Sea response to climate variations and anthropogenic activities on long timescales (100 years). It may also be used for investigations of natural events like the impact of deepwater renewal on hydrogen sulfate and oxygen conditions. The ecosystem model may for example provide information about:

- nutrient cycling and biomass production,
- budgets, transports, sources and sinks,
- water quality and sedimentation of organic matter,
- temporal and spatial development of algae blooms,
- occurrence of harmful algae blooms.

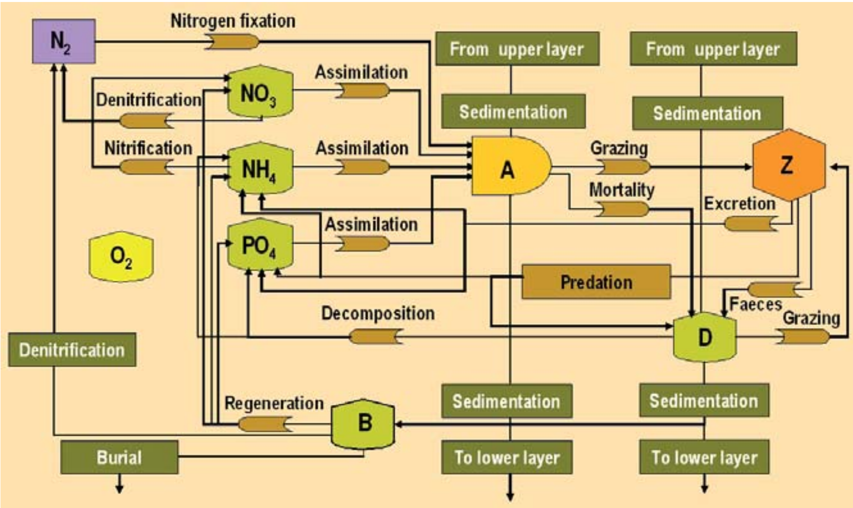

Figure 1. *The SCOBI model (Swedish Coastal and Ocean Biogeochemical Model) contains nitrate (NO_3), ammonium (NH_4), phosphate (PO_4), autotrophs (A), zooplankton (Z), detritus (D), and oxygen (O_2). Hydrogen sulfate (H_2S) is included as negative oxygen (not shown). The sediment (B) contains nutrients in the form of benthic nitrogen (NBT) and phosphorus (PBT) (not shown). The sediment module includes aggregated process descriptions for oxygen dependent nutrient regeneration, denitrification and permanent burial of organic matter. Note that the process descriptions of autotrophs, benthic nutrients, oxygen and hydrogen sulfate in the figure are much simplified for clarity.*

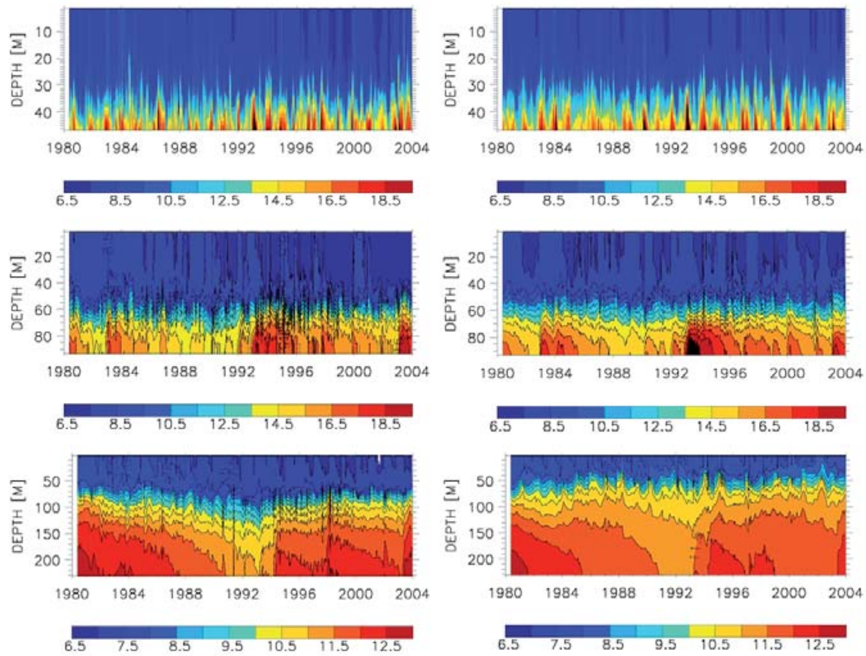

Figure 2. *Salinity (in PSU) as a function of time and depth for 1980-2003 at the monitoring stations in the Arkona Deep (BY2, upper panels), Bornholm Deep (BY5, middle panels), and Gotland Deep (BY15, lower panels): observations (left panels) and results of the Rossby Centre Ocean model, RCO right panels).*

The model system is based on the Swedish Coastal and Ocean Biogeochemical model SCOBI (Marmefelt et al., 1999, 2000, 2004; Eilola et al., 2006; Eilola and Sahlberg, 2006) see Figure 1, and the Rossby Centre ice-ocean circulation model RCO (Meier et al., 2003; Meier and Kauker, 2003; Meier, 2006; Meier et al., 2006).

The model system is validated for the period 1980-2004 with special emphasis on temperature and salinity variations (Figure 2), cyanobacterial blooms, nutrient retention in coastal areas, and effects from deepwater renewal on hydrogen sulfate and oxygen conditions.

The results show that the model may capture the major characteristics of nutrient and oxygen dynamics in the Baltic Sea. The injection of oxygen to the deep Baltic proper from a deepwater renewal is illustrated in Figure 3. Starting with a first rough guess of initial conditions in the sediment and in the water in 1980, the nutrient concentrations of the surface water approaches the natural variability after about 12 years as shown in the central Baltic proper (Figure 4).

The impact from major rivers on the spreading of nutrients in the Baltic Sea is illustrated by the modelled 10 year winter average of nitrate concentrations for the period 1993-2002 (Figure 5).

Preliminary sensitivity experiments indicate that sedimentation in coastal areas and resuspension of sediments in the model can play an important role for the long term development of the nutrient and oxygen conditions in the Baltic proper. Further sensitivity experiments are needed to investigate the model response under different environmental conditions. The forcing and the boundary conditions of the biogeochemical model are other factors that also need to be further studied during the model validation.

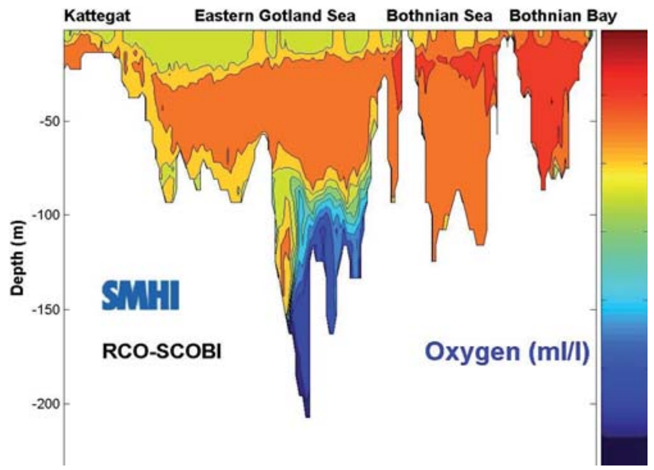

Figure 3. *Vertical section of oxygen from the Kattegat to the Bothnian Bay. The example shows preliminary model results from a period when water with higher oxygen content is injected into the deeper parts of the Baltic proper.*

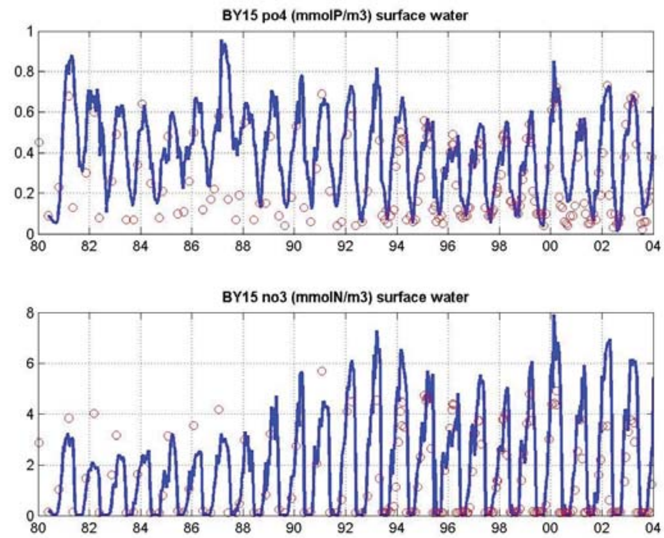

Figure 4. *Preliminary model results (blue line) and observations (red circles) of surface concentrations of phosphate and nitrate from the monitoring station BY15 in the Baltic proper during 1980-2004.*

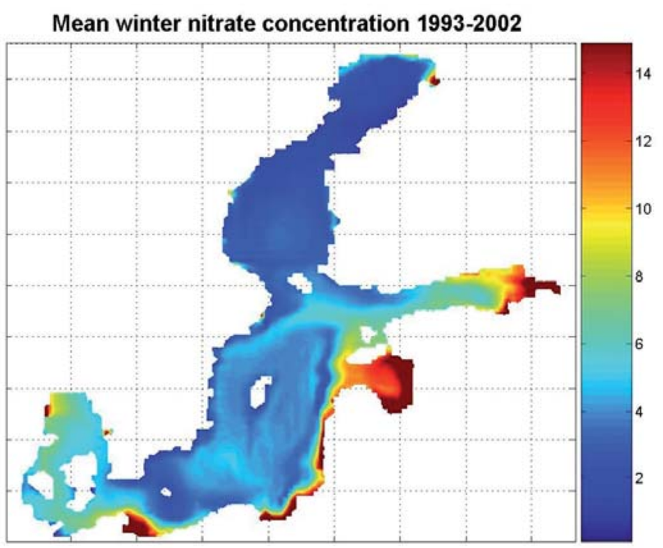

Figure 5. *Preliminary model results of average winter (Dec-Feb) surface concentrations of nitrate (mmol N/m^3) during 1993-2002.*

High horizontal resolution studies of the long-term dynamics of nutrients in the water and especially in the sediments are important to increase our understanding of the ecosystem response to changes in physical forcing and nutrient loadings. The time scales necessary for these changes to take place require that the model can simulate the conditions in the Baltic Sea for many decades. The aim is that the RCO-SCOBI model will serve as a tool for these investigations.

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BALTEX Reference Sites have completed Data Delivery for CEOP Phase 1

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Background and Objective

The Coordinated Enhanced Observing Period (CEOP) has been developed and implemented within the Global Energy and Water Cycle Experiment (GEWEX) of the World Climate Research Programme (WCRP). The fundamental issue for CEOP is to improve both our understanding of wa-

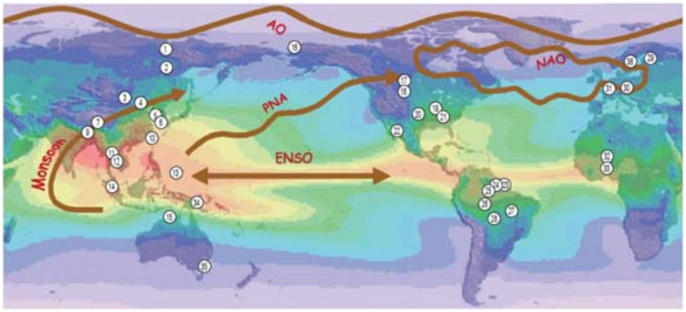

Figure 1. *Globally distributed ground-based reference sites during CEOP phase 1 (source: http://monsoon.t.u-tokyo.ac.jp/ceop/)*

ter and energy fluxes and reservoirs over land areas, as well as our ability to properly describe and predict the overall cycles and budgets of water and energy over these regions at time scales from diurnal to annual (see also http://monsoon.t.utokyo.ac.jp/ceop/).

The CEOP implementation strategy includes the collection, central archiving and management of

- data from the full spectrum of available experimental and operational satellites (e.g. NOAA-AVHRR, TRMM, LandSat, Terra, Aqua, EnviSat, ADEOS-II),
- comprehensive land surface/atmosphere data sets with high temporal resolution collected at a number of world-wide distributed reference sites, and
- model output products from leading numerical weather prediction and climate modelling centres around the world.

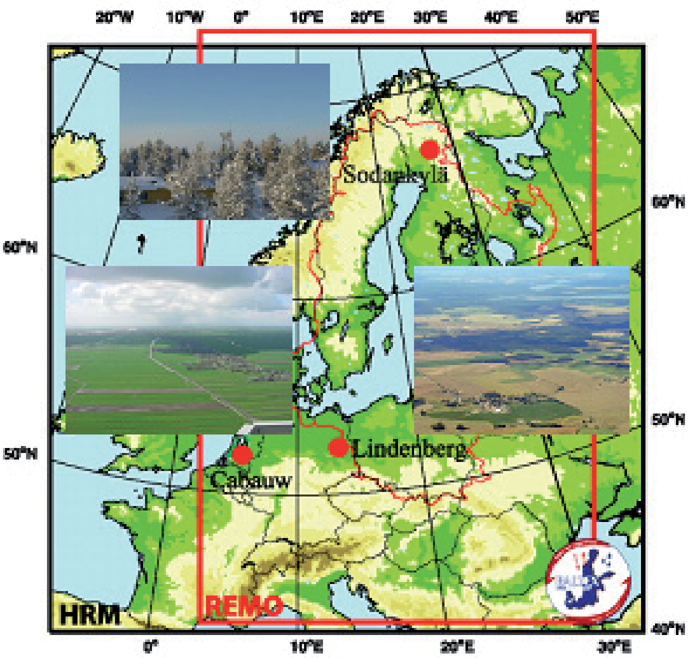

Figure 2. *Map of the BALTEX area with the position of the BALTEX CEOP reference sites and the modelling domain of the HRM and REMO models indicated, the photos show the typical land use around the reference sites (map by BALTEX Secretariat)*

By this way, CEOP seeks to establish the prototype of an integrated global observing system for the energy and water cycle which responds to both scientific and social needs of the human society. During the first phase of CEOP, data have been collected over a time period of two consecutive full-year cycles (October 2002 to December 2004).

CEOP reference sites

For CEOP phase 1, 36 sites had been nominated as ground reference sites. They represent the different geographical and climate conditions around the globe (Figure 1).

Main contributions come from the various Continental Scale Experiments (CSEs) within GEWEX (e.g. GAPP, MAGS, LBA, and BALTEX). Four European sites had initially agreed to provide data for CEOP, all of which are also reference sites in BALTEX: Sodankylä (Finland), Norunda (Sweden), Cabauw (The Netherlands), and Lindenberg (Germany). Due to funding limitations, only a reduced data set (surface and flux data for 2003) could be finally made available from Norunda. Therefore, further discussion in this note refers to Sodankylä, Cabauw, and Lindenberg only. These sites represent major climate and vegetation regions in the BALTEX study domain (see Table 1, and Figure 2).

	Sodankylä	*Cabauw*	*Lindenberg*
Site co-ordinate	67.4°N, 26.7°E	52.0°N, 4.9°E	52.2°N, 14.2°E
Elevation	179 m	-1 m	73 m
Climate	sub-arctic	temperate, dominating marine influence	temperate, transition from marine to continental influence
Vegetation	boreal forest	mainly grassland	mixed farm-land / forest

Table 1. *BALTEX in-situ reference sites for CEOP Phase 1*

While the surface characteristics are uniform around the Sodankylä and Cabauw sites, land use in the Lindenberg area is characterised by a mixture of forest and farmland (see Figure 2). Data sets from Lindenberg therefore cover two field stations, namely the Falkenberg boundary layer field site and a forest tower site about 10 km to the West of Falkenberg (see also Beyrich and Adam, 2004, Stiller et al., 2005). These two sites represent the farmland and forest parts of the region, respectively.

A standard set of measured parameters organised in five types of data tables has been defined within the CEOP Working Group on Data Management to be made available from all the reference sites. These data sets are organised as follows:

- standard surface meteorology and radiation data (data set code SFC): air temperature (T), humidity (RH), wind speed (V) / wind direction (dir), air pressure (p), up-/downward short-/longwave radiation (Rsw, Rlw), net radiation (Rnet), radiative surface temperature (Ts), precipitation (RR), snow depth (Snow),
- soil parameters (data set code STM): soil temperature (Tsoil) and soil moisture (qsoil) profiles,
- energy fluxes (data set code FLX): sensible heat flux (H), latent heat flux (LE), ground heat flux (G), CO_2 flux (CO_2),

	SFC							STM		FLX				TWR [1]			additional data [2]					
	p, T, RH	V, dir	Rsw	Rlw	Rnet	RR	Snow	Tsoil	qsoil	H	LE	G	CO_2	T, RH	V, dir	radiosonde	ceilometer	WPR / RASS	cloud radar	AOD	ozone	moment. flux
Sodankylä	X	X	X			X	X	X		X	X			X		X	X				X	X
Cabauw	X	X	X	X	X	X		X	X	X	X	X	X	X		X	X	X	X	X		X
Lindenberg	X	X	X	X	X	X	X	X	X	X	X	X		X		X	X	X	X	X	X	X

[1] *the upper tower heights are 48 m (Sodankylä), 200 m (Cabauw), and 98 m (Lindenberg), respectively*

[2] *additional data are available upon request from the data providers*

Table 2. *Parameter list from the BALTEX - CEOP reference sites*

- tower profile data (data set code TWR): profiles of temperature, humidity, wind speed and wind direction from tall towers,
- radiosonde data (data set code SONDE): high-resolution vertical profiles of pressure, air temperature, humidity, wind speed and wind direction from operational radiosoundings.

All reference site data were collected and made available to the scientific community at the CEOP Central Data Archive (CDA) managed by the Earth Observing Laboratory (EOL) of the National Center for Atmospheric Research (NCAR) (the former Joint Office for Science Support, JOSS, at the University Center for Atmospheric Research, UCAR) at Boulder, Colorado (USA). They are available at *www.eol.ucar.edu/projects/ceop/dm/*.

The data listed above had to be provided from each of the CEOP reference sites

- within a certain time frame,
- in a well-defined harmonised data format,
- with quality flags assigned to each measured value, and
- with a time resolution of 30 minutes or 1 hour (except for the radiosoundings).

The high temporal resolution of the CEOP reference site data is, a particular useful innovation for *in-situ* data sets with global coverage.

In addition to the data listed above, each site could offer to provide additional data upon users request.

A detailed overview on the parameters available from the three BALTEX reference sites for the CEOP phase 1 period is given in Table 2.

All data are quality-controlled according to procedures implemented at the institutions of the data providers, and an overall formatting and range control is again performed at the CDA. Each data value reported is accompanied by a letter-coded quality flag distinguishing six levels of data quality: Good (G) – Dubious (D) – Bad (B) – Interpolated (I) – Unchecked (U) and Missing (M).

The BALTEX reference sites have completed data delivery to the CEOP-CDA according to the proposed schedule by June 30, 2006.

Data example

The variability of some of the basic meteorological variables as well as of the energy fluxes between the three BALTEX reference sites during the year 2004 is illustrated in Figure 3. For the main surface climate variables, temperature and precipitation, differences between Cabauw and Lindenberg basically illustrate the reduced marine influence at the latter site (colder winter, reduced rain amount). The annual precipitation sum between Cabauw and Lindenberg – Falkenberg differs by about 40 % (703 mm vs. 497 mm). The temperature curve for Sodankylä is mainly governed by the high latitude and shows the most pronounced annual cycle. The same holds for the global radiation with a minimum value around zero at Sodankylä in December during the (short) polar night period. The differences between Cabauw and Lindenberg are comparably small except for the spring (April and May). Larger differences have to be noticed for the turbulent energy fluxes. The sensible heat flux during the summer is higher at Sodankylä when compared to the Lindenberg/Falkenberg and Cabauw sites. This is basically attributed to the land use characteristics. The needle-leaf forest at Sodankylä has a lower albedo than grassland/farmland resulting in higher values of net radiation, and hence energy available to force the turbulent exchange of heat and water vapour. This is confirmed by the Lindenberg/Forest energy fluxes which are of comparable magnitude as the Sodankylä fluxes during summer. The soil at Cabauw is well supplied with water throughout most of the year, resulting in the highest values of the latent heat flux. The pronounced differentiation between the winter and summer values of the latent heat flux at Sodankylä are the result of a long-lasting snow cover (roughly no evaporation between October and March) and the short vegetation period at the high-latitude site.

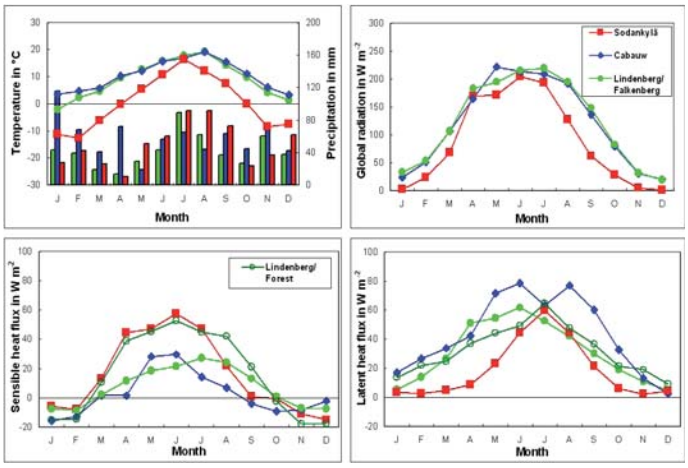

Figure 3. *Annual cycle of the monthly mean temperature, global radiation, sensible heat flux, latent heat flux and of the monthly precipitation sum at the BALTEX – CEOP reference sites Sodankylä, Cabauw, and Lindenberg for the year 2004.*

Outlook

The ground reference site data available through the CEOP CDA certainly have a wide potential for a broad use by the climate modelling and research communities. Continuous data sets over the two years are now available in a uniform format from 12 sites. Other sites were at this stage able to send in their data for part of the requested time period. Most of the 12 sites are connected to institutes who have structural funding for running long term observational programmes.

The BALTEX community is cordially invited to make use of these data and to ask the site managers for additional data and information if needed.

CEOP is currently preparing for its phase 2 which is designed to cover the period 2007-2010. Sodankylä, Cabauw, and Lindenberg have committed to continue data delivery to the CEOP-CDA during phase 2. Also, the inclusion of hydrological reference sites in CEOP is investigated. Based on the success of the first phase, CEOP will be an important integrative effort of the WCRP and has become a relevant component of the Integrated Global Observing Strategy – Partnership (IGOS-P), and a key element of the Global Earth Observation System of Systems (GEOSS).

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Volcano Dust and long-term Modes of the Baltic Sea Winter Climate

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The North Atlantic- European sector of the Arctic Oscillation (AO) also determines characteristics of the well known North Atlantic Oscillation (NAO) describing changes in the strength of mid-latitude westerlies at sea level. Andersson (2002) reported an exceptional positive correlation between the winter NAO and corresponding anomalies in the filling level of the Baltic Proper. The Baltic filling level spatially integrates the overall water budget, and temporal fluctuations in the water balance of the Baltic Proper are well depicted by anomalies in sea level recorded at central Baltic coastal stations (Svansson,1972). One of them is the Swedish station Landsort (LO: 58°45’N, 17°52’E), Figure 1. Winter (January-March) sea level anomalies of this station (LO’) are negatively correlated with anomalies of the total Baltic ice cover (BI’), peaking frequently in March (Omstedt and Chen, 2001). Due to the hemispheric nature of interannual changes in the NAO and the related Baltic winter climate, Hagen and Feistel (2005) presumed that long-term series of these three variables (NAO, LO’, BI’) involve a joint climate component represented by their first principal component. All three series started in January 1897 and ended in December 2002. The resulting first mode explains some 75% of the overall variance. Its loadings provide the Pearson correlation coefficient (R) between the input series and resulting first mode non-dimensional principal coefficients (PC) to be R=0.87 for the NAO’, R=0.88 for the LO’, but R= -0.85 for the BI’. Finally, the resulting PC series was regressively extended using the detrended ‘Manley Temperature Series’, which describes corresponding anomalies of air temperature over central England. This extended series was denoted ‘Winter Baltic Climate Index (WIBIX)’. It starts 1659 to cover 344 years, but maintains the PC for the last 106 years (1897–2002). WIBIX units of 0.5 account for NAO’= 3 hPa (Gibraltar-Reykjavik), LO’= 5 cm, and BI’= 28.000 km² (about 7% of the entire Baltic Sea area). A positive WIBIX corresponds to strengthened westerlies transporting air masses of moderate temperature towards West Europe, which results in mild winters over the Baltic Sea (maritime mode). The opposite situation is marked by a negative WIBIX (continental mode). Because the WIBIX involves the winter NAO, it strictly correlates with the winter Arctic Oscillation (AO), and the obtained coefficient of determination is R^2=0.65 (Figure 2).

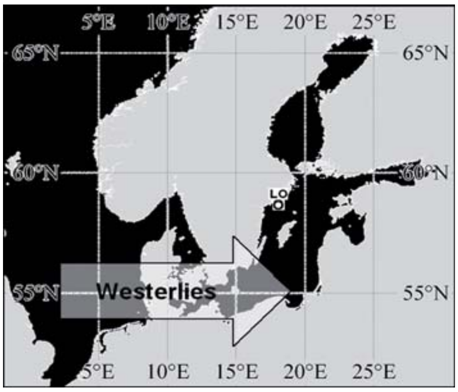

Figure 1. *The Baltic Sea area is influenced by the belt of westerlies; the Swedish coastal station Landsort (LO) is representative for sea level anomalies describing changes in the filling level of the Baltic Proper.*

The power spectrum of the WIBIX series exhibits quasi-cycles of 2.2, 3, 6–8, 14, 43, and 80–130 years. The first four of them were significant at the 95% confidence level (t-distribution). Corresponding estimates were reported from the NAO by Meincke (2002) and Tomingas (2002). Jevrejeva and Moore (2001) discussed similar cycles for the AO. The detected quasi-cycle with a length of about 14 years should be energetically linked to changes in the global radiation balance (Schönwiese et al., 1994). Comparable cycles occur worldwide in different meteorological and hydrographical variables, cf. Table 2 in Hagen et al. (2005). Concerning the WIBIX series, the energy level of associated changes fluctuates on the decadal scale with cycles between 40 and about 50 years (Figure 3). Unfortunately, such long periods are insufficiently resolved in the power spectrum and their estimates do not reach an acceptable level of statistical confidence. However, the recent literature provides some hints that they originate from so-called teleconnection processes acting on hemispheric and/or global scales due to changes in the radiation balance.

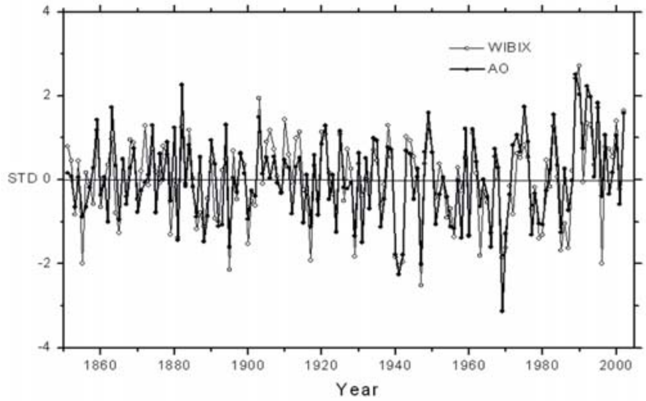

Figure 2. *Standardized (mean=0, standard deviation STD=1) winter series (January-March) of the Arctic Oscillation (AO, dots, www.cdc.noaa.gov/ClimateIndices/) and the Baltic Sea Climate Index (WIBIX) proposed by Hagen and Feistel (2005); the coefficient of determination between both series is $R^2 = 0.65$ for 152 overlapping winters (1851-2002).*

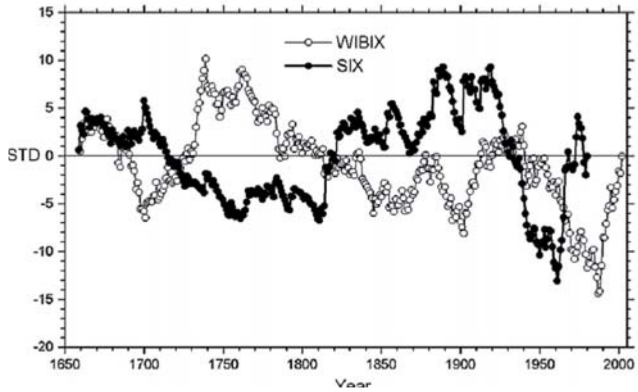

Figure 4. *Cumulative series of the standardized WIBIX (mean = 0, STD =1, open circles) and the detrended series of the corresponding 'Simkin Volcano Index (SIX)' (dots), which describes weighted frequencies of annual volcanic eruptions reaching the stratosphere between 63°S and 87°N.*

Simkin et al. (1981) compiled the worldwide volcanism. Taking into account only the time period of the WIBIX (1659-2002), an annual volcano index was created. It is based on the annual frequency of eruptions of different strength classes (C) reaching the lower stratosphere in between 63° S and 87°N. A total of four classes distinguishes between moderate (C=3) and very strong events (C=6). The annual frequency of each of them has been weighted by the factors 0.25 (C=3), 0.5 (C=4), 0.75 (C=5), and 1 (C=6). Their overall sum was detrended and standardized (mean=0, standard deviation STD = 1) to obtain the 'Simkin Volcano Index (SIX)'. Cumulatively plotted series of the SIX and the WIBIX oppress all short-term fluctuations (Figure 4). Changing signs of such cumulatively plotted series exhibit so-called turning points by relative peak values. They are given by multiples of the given standard deviation (STD). In this sense, climate regimes are embedded between neighbouring turning points and characterised through increasing (maritime mode) or decreasing curve segments (continental mode) of the WIBIX.

It is clear from Figure 4 that there was a relatively long lasting continental climate mode, which is characterised by a negative trend of the WIBIX from 1740 until 1902. This period of time was accompanied by a positive trend of the SIX. The latter points to an overall tropospheric cooling

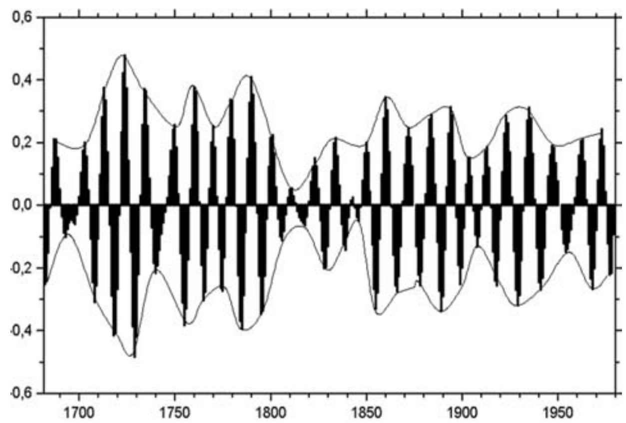

Figure 3. *Gaussian band pass filtered series of the complete WIBIX (1659-2002) describing fluctuations in the energetic level of quasi-cycles between 8 and 15 years; the applied filter is discussed in more detail by Schönwiese (2000).*

(stratospheric warming) due to increasing aerosol concentrations. Peaks in superimposed multi-year changes of the WIBIX frequently lag those of the SIX series by several years. Shorter maritime climate modes almost exhibited opposite tendencies. In summary, all findings suggests that the continental mode of the Baltic Sea winter climate preferentially reacts on globally triggered changes in atmospheric aerosols influencing the strength of westerlies at mid-latitudes on multi-decadal scales. This may be one of the reasons that the energetic level of detected shorter cycles, such as that of the 14 years quasi-cycle shown in Figure 3, fluctuates on much longer time scales, too.

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HELCOM – Creating a new Environmental Strategy for the Baltic Sea

Anne-Christine Brusendorff (anne-christine.brusendorff@helcom.fi), Executive Secretary of HELCOM, Helsinki, Finland

Today, the Helsinki Commission, or simply HELCOM, is working on an ambitious new strategy to solve major problems troubling the Baltic Sea. The HELCOM Baltic Sea Action Plan, which has already been widely heralded as a pilot project for the protection of regional seas under the newly drafted EU Marine Strategy, will provide a unique opportunity to take joint wide-scale and decisive actions to achieve the ultimate target of having a healthy marine environment with balanced ecosystems for present and future generations to enjoy.

For more than three decades, HELCOM has been acting as the main environmental policy-maker for the Baltic Sea area by developing specific measures to protect and conserve its unique marine environment. The Helsinki Commission, working through intergovernmental co-operation between all coastal countries, has produced appreciable environmental gains in the past 30 years, thus validating the conviction that the deterioration of one of the most polluted seas in the world can be halted and the state of the marine environment improved.

But despite some remarkable progress in the past years, the overall state of the Baltic Sea is still not satisfactory. In order to maintain the Baltic Sea‘s natural assets for future generations a lot more has to be done.

In view of the various environmental problems some of which are proving difficult to solve, in 2005 the Helsinki Commission decided to draw up a strategic environmental action plan to ensure that all possible measures are taken to reduce pollution in the Baltic Sea and to repair the damage done to the marine environment.

The highlight of this innovative plan is that it will be based on a clear set of Ecological Objectives defined to reflect a common vision of a healthy Baltic Sea, e.g. clear water, no excessive algal blooms and natural distribution of plants and animals. The good ecological status definition will be set based on a holistic view and by creating a balance between the health of the sea the public wants and the human influences that they will accept. With this ecosystem approach protection of the marine environment is no longer seen as an event-driven pollution reduction approach to be taken sector-by-sector. Instead, the starting point is a common understanding and definition of a sea with a good ecological balance, which is deciding the further needs for reductions of pollution loads as well as the level and extent of human activities.

Another major highlight of the HELCOM Baltic Sea Action Plan is that it will be elaborated with the active participation of all major stakeholder groups in the region – from governments, through industry and NGOs, right down to individual citizens living on the shores of the Baltic Sea, to ensure that the plan is relevant and can be effectively implemented in practice.

The consultation process behind the drafting of HELCOM’s Baltic Sea Action Plan was officially launched at a ‘kick-off’ Stakeholder Conference held on 7 March 2006 in Helsinki, Finland, where more than 200 participants, representing scientific and business communities, governments of the coastal countries, the EU, as well as major regional organisations met to discuss the objectives of the strategy and to provide input to its further development.

The HELCOM Baltic Sea Action Plan:
www.helcom.fi/BSAP/

Following the outcome of the Stakeholder Conference, at its annual meeting in March, HELCOM approved the core elements of the Baltic Sea Action Plan - a common vision of a healthy sea, and a set of Ecological Objectives to work towards so as to fulfil this vision.

The next crucial step in the development of the Baltic Sea Action Plan will be to identify and detail the kind of actions needed to achieve the agreed environmental objectives within a given timeframe for each of the four main environmental priority issues: curbing eutrophication, preventing pollution involving hazardous substances, improving safety of navigation and accident response capacity, and halting habitat destruction and the decline in biodiversity.

After a series of thematic meetings and a final Stakeholder Conference in March 2007, which will review a preliminary draft of the plan, the finalised environmental strategy will be adopted at a HELCOM Ministerial Meeting scheduled to take place on 15 November 2007 in Warsaw, Poland.

Recent BALTEX Publications

The International BALTEX Secretariat maintains a list of BALTEX publications, which is accessible via the BALTEX website at www.baltex-research.eu. Starting with this issue we will list recent BALTEX publications which have been brought to our attention also in the BALTEX Newsletter. The main requirements for papers to be qualified as "BALTEX publications" are:

1) BALTEX is explicitly referred to in the title, abstract, introduction or summary, or

2) the authors have qualified their work as a BALTEX publication.

The reader is encouraged to contact the BALTEX Secretariat in case of missing or new BALTEX publications to be included in the list maintained at the website, or to be announced at both the website and in this newsletter

Precipitation and evaporation budgets over the Baltic Proper: Observations and modelling
Smedman, Ann-Sofi, Sven-Erik Gryning, Karl Bumke, Ulf Högström, Anna Rutgersson, Ekaterina Batchvarova, Gerhard Peters, Barbara Hennemuth, Bengt Tammelin, Reijo Hyvönen, Anders Omstedt, Daniel Michelson, Tage Andersson, Marco Clemens. *Journal of Atmospheric and Ocean Science*, Vol 10, No 3, September 2005, pp. 163 – 191

The atmospheric boundary layer over the Baltic Sea ice
Brümmer, B., A. Kirchgäßner and G. Müller. *Boundary Layer Meteorology*, Vol. 117, No. 1, October 2005, pp. 91-109

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
Narapusetty, Balachandrudu and Nicole Mölders. *Journal of Applied Meteorology*: Vol. 44, No. 12, December 2005, pp. 1827–1843

The Baltic Sea ocean climate system memory and response to changes in the water and heat balance components
Omstedt, Anders and Daniel Hansson. *Continental Shelf Research*, Vol. 26, January 2006, pp. 236-251

Physical oceanography and water exchange in the Northern Kvark Strait
Green, J. A. Mattias, Bengt Liljebladh, Anders Omstedt. *Continental Shelf Research*, Vol. 26, April 2006, pp. 721-732

Ventilation of the Baltic Sea deep water: A brief review of present knowledge from observations and models
Meier, H. E. M., R. Feistel, J. Piechura, L. Arneborg, H. Burchard, V. Fiekas, N. Golenko, N. Kuzmina, V. Mohrholz, C. Nohr, V. T. Paka, J. Sellschopp, A. Stips, V. Zhurbas. *Oceanologia*, May 2006, no 48(S), pp. 133-164

Baltic Sea climate in the late twenty-first century: a dynamical downscaling approach using two global models and two emission scenarios
H.E. Markus Meier, *Climate Dynamics*, Vol. 27, No. 1, July 2006, pp. 39-68

Estimating uncertainties of projected Baltic Sea salinity in the late 21st century
Meier, H. E. M., E. Kjellström, and L. P. Graham
Geophysical Research Letters, Vol. 33, L15705, doi:10.1029/2006GL026488, August 2006.

Surface albedo measurements over sea ice in the Baltic Sea during the spring snowmelt period
Pirazzini, R., T. Vihma, M. A. Granskog, and B. Cheng. *Ann. Glaciol., 2006, 44, in press.*

Modelling of superimposed ice formation during the spring snow melt period in the Baltic Sea
Cheng, B., T. Vihma, R. Pirazzini, and M. A. Granskog, *Ann. Glaciol., 44, 2006, in press*

Superimposed ice formation and surface energy fluxes on sea ice during the spring melt–freeze period in the Baltic Sea
Granskog, M. A., T. Vihma, R. Pirazzini, and B. Cheng Granskog, M. A., T. Vihma, R. Pirazzini, and B. Cheng. *J. Glaciol., Vol 52, No. 176, January 2006, pp.119-127.*

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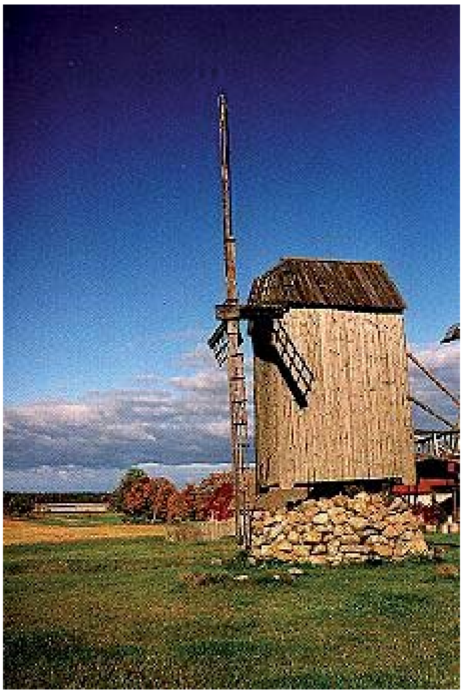
The BALTEX website:
www.baltex-research.eu

5th Study Conference on BALTEX



Kuressaare, Saaremaa, Estonia
4-8 June 2007

Scope and Themes

The Fifth BALTEX Study Conference is devoted to BALTEX Phase II objectives and will review research results related to water and energy cycles of the Baltic Sea drainage basin. It will in particular address also studies on climate variability and change, scenarios of future climate, budgets and transport of nutrients, carbon and harmful substances, improved understanding and prediction of extreme events like floods, and climate or environmental impact studies towards observing, understanding and modelling major environmental and socio-economic aspects relevant for the entire Baltic Sea basin. Results related to other GEWEX CSEs are welcome. The Conference is also envisaged as a communication platform for the research community, water resource managers and other stakeholders.

Major Conference topics will include

- Improved understanding of **energy and water cycles** of the Baltic Sea Basin focussing on closing energy and water budgets with improved accuracy for major river basins, the Baltic Sea, and at continental scale using field experiments, remote sensing applications and numerical modelling;
- Analysis of **climate variability and change** since 1800, and provision of regional climate projections over the Baltic Sea Basin for the 21st century, including impacts on ecosystems as well as studies on adaptation and mitigation strategies and policies;
- Improved **tools for water management** with emphasis on extreme events and long-term changes including an assessment of water resources in today‘s and future climate;
- **Air and water quality studies** with emphasis on nutrient and carbon cycles as well as harmful substances for the Baltic Sea Basin and integration of these cycles into regional coupled models.

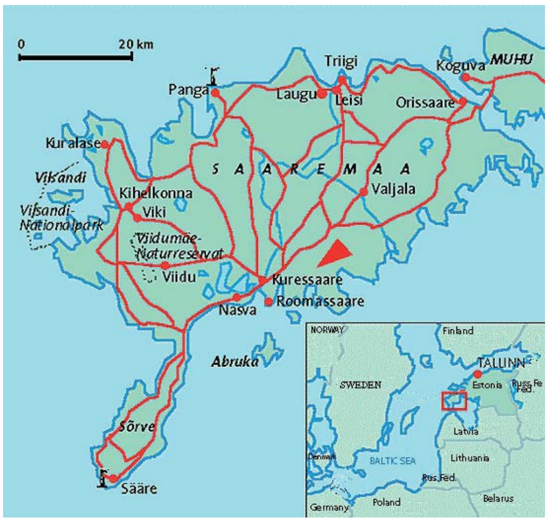
Invited and contributed papers will be presented in plenary along with parallel poster sessions. Conference language is English.

5th Study Conference on BALTEX

Location

Saaremaa is situated close to the western coast of mainland Estonia, covering an area of 2,922 km^2, or 6.5 % of the territory of Estonia. Saaremaa is among the largest islands in the entire Baltic Sea and is known as a good recreation place with unique nature and a lot of sights.

Junipers, dolomite, windmills, black bread and home-brewed beer are the symbols of Saaremaa. The island has been inhabited for about eight thousand years. The ancient fight for freedom ended in 1227 when German crusaders occupied Saaremaa. In 1559 the island was sold to Denmark. From 1645 to 1710 Saaremaa was under the rule of Sweden and from 1710 to 1917 a part of Russia. The capital of Saaremaa is Kuressaare with the bishopric castle dating from the 13th century as the most important tourist sight in town. The beautiful and well preserved old town as well as a lot of health centres offering mud and wellness treatments are among the attractions of Kuressaare.



Organisation

The enlarged objectives of BALTEX Phase II suggest initiating closer cooperation with other projects and programmes with a dedicated expertise profile in those areas BALTEX intends to contribute to in future. This is in particular true for climate variability and change as well as for air and water quality issues. The BALTEX SSG has therefore undertaken to initiate cooperation in the planning of the Conference and, for the first time, the International BALTEX Study Conference next year in Estonia is now officially being co-organised with the following five organisations or programmes:

- 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 & 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).

It is the hope that the forthcoming BALTEX Conference will help to establish a platform for discussing results and initiating new projects related to climate and environmental research focussed on the Baltic Sea and its catchment.

On the following pages, the five co-organisers elaborate in more detail on their objectives and expectations concerning the organisation of the Conference and the cooperation with BALTEX in general.

www.baltex-research.eu/conf2007

HELCOM - The Baltic Marine Environment Protection Commission (Helsinki Commission)

Juha-Markku Leppänen *(Juha-Markku.Leppanen@helcom.fi), Professional Secretary of HELCOM, Finland*

In 1974, for the first time ever, all sources of pollution around an entire sea were made subject to a single convention signed by the then seven Baltic coastal states; „Convention on the Protection of the Marine Environment of the Baltic Sea Area“. In the light of political changes, and developments in international environmental and maritime law, a new Convention was signed in 1992 by all the states bordering on the Baltic Sea, and the European Community. Overall responsibility for the implementation of the Helsinki Convention lies with the Helsinki Commission or HELCOM, which is the governing body of the Convention.

The main tasks of HELCOM are to provide timely information about environmental trends and the state of the Baltic marine ecosystem and develop common objectives and actions, which the governments of the Baltic Sea states must follow in their national environmental programmes and legislation.

HELCOM works besides as an environmental policy maker for the Baltic Sea area by developing common environmental objectives and actions also as an environmental focal point providing information about

a) the state of/trends in the marine environment
b) the efficiency of measures to protect it, and
c) common initiatives and positions which can form the basis for decision-making in other international fora.

HELCOM is fundamentally a management organisation but especially environmental monitoring and assessment activities involve broad scientific expertise. For these purposes, HELCOM has established projects to carry out defined tasks such as development of monitoring programmes, monitoring methodology, assessment products including indicator fact sheets and thematic assessments. For the assessment purposes, HELCOM also uses scientific expertise outside HELCOM. The co-operation with BALTEX/BACC to compile a HELCOM thematic assessment on climate change in the Baltic Sea area and to organise a Scientific Conference on the topic in 2006 is a perfect example of such a co-operation.

The future climate change is expected to affect the runoff from the catchment and subsequently inputs of nutrients hazardous substances into the sea. In addition, the water exchange between the Baltic Sea and North Sea is expected to be influenced affecting together with runoff the salinity levels of the sea. This all might have clear consequences in the Baltic Sea biota and its biodiversity.

Visit HELCOM at:
www.helcom.fi

In order to make sound decisions for the future, also the climate change has to be taken into account. For this purposes, HELCOM welcomes also the future co-operation with BALTEX, especially to improve the knowledge on the effects of future climate change in the Baltic Sea ecosystem. .

The new LOICZ and BALTEX Phase II

Jozef M. Pacyna, *(jp@nilu.no), Chair LOICZ Scientific Steering Committee;* ***Hartwig Kremer,*** *(loicz.ipo@loicz.org), Head International LOICZ Project Office;* ***Götz Flöser*** *(floeser@gkss.de), LOICZ European Node Officer, GKSS Research Centre Geesthacht, Germany*

Following the release of the BALTEX Phase II Science Framework and Implementation Strategy and the recent definition of the new LOICZ Science and Implementation Plan and related Research Priority Topics (www.loicz.org), it turns out that there are obvious touching points where the interests of BALTEX and LOICZ match almost exactly. The BALTEX objective “Gradual extension of BALTEX methodologies to air and water quality studies” meets with LOICZ expertise in ecosystem studies and river runoff/coastal metabolism investigations in the catchment area of the Baltic.

One example is that the recently defined Priority Topic 1 for the next phase of LOICZ “Linking social and ecological systems in the coastal zone” decidedly intends to focus on conceptual and quantitative computer models as well as decision support systems, a tool with which BALTEX scientists are well experienced concerning the Baltic Sea area.

Visit LOICZ at:
www.loicz.org

BALTEX, like LOICZ, is now moving from the purely natural scientific (hydrology, meteorology, oceanology) focus towards interactions with human society: water management, mitigation of extreme climate events, and interaction with decision makers. The impact of human induced environmental change on coastal ecosystems is, in the LOICZ priority topics, addressed as well as the climate change influence on human society.

Thus, LOICZ and BALTEX, in the Baltic Sea area, should explore establishing a mutually beneficial cooperation drawing from the findings and expertise gained during their respective first project phases: intensive cooperation with the regional and local authorities, and coupled computer models for water and energy (BALTEX), experience with biogeochemical transport and reaction processes, particularly nutrient dynamics, ecosystem assessment and modelling, and extension coastal science into the human dimension (LOICZ). Furthermore, the projects share a rather similar time horizon and finally have their project offices based in the same research institution (GKSS Research Centre, Germany).

In order to establish a close cooperation between the two programmes, the 5th BALTEX Conference 2007 seems an ideal platform to explore complementary research activities and come up with a priority list of proposed collaborative scientific objectives and activities.

Priority Topics in the LOICZ Project (Land-Ocean Interaction in the Coastal Zone)

Priority Topic 1 (Laurence Mee)
Linking social and ecological systems in the coastal zone

Priority Topic 2 (Dennis Swaney)
Assessing and predicting impact of environmental change on coastal ecosystems

Priority Topic 3 (Stephen Olsen)
Linking governance and science in coastal regions

ENSEMBLES and BALTEX

Markku Rummukainen *(markku.rummukainen@smhi.se)**,** Rossby Centre, SMHI, ENSEMBLES RT3 (regional climate models) co-coordinator,* ***Daniela Jacob,*** *Atmosphere in the Earth System, MPI-M, Ensembles RT2B (regional climate scenarios) co-coordinator,* ***Chris Hewett,*** *Hadley Centre, The Met Office, ENSEMBLES Director*

ENSEMBLES (contract number GOCE-CT-2003-505539) is a 5-year Integrated Project under the European Commission's 6th Framework Programme, Sub-Priority "Global Change and Ecosystems". The project started in September 2004 and is structured around 10 Research Themes. These are on global and regional climate model systems and climate projections, climate processes, model evaluation, impact studies, emission scenarios, user interaction, and coordination. There is an emphasis on Europe, but also on more global topics. The more than 70 participating institutes and universities aim to:

- Develop an ensemble prediction system for climate change based on global and regional Earth System models and to produce, for the first time, an objective probabilistic estimate of uncertainty in future climate at the seasonal to decadal and longer timescales
- Quantify and reduce the uncertainty in the representation of physical, chemical, biological and human-related feedbacks in the Earth System (including water resource, land use, and air quality issues, and carbon cycle feedbacks)
- Maximise the exploitation of the results by linking the outputs of the ensemble prediction system to applications such as agriculture, health, food security, energy, water resources, and insurance

Thus, ENSEMBLES shares many of the concerns in focus in the international BALTEX project, such as climate variability and climate change, prediction and projection tools, links between the physical system and environmental systems as well as impacts, and, finally, reaching out to stakeholders.

In particular, ENSEMBLES both provides BALTEX with opportunities and can benefit from contacts. The Baltic Sea region is well contained in the ENSEMBLES regional modelling domain, for which a wealth of transient, high-resolution regional climate model hindcasts (conducted in 2006-2007) and climate change projections (during 2007), as well as impact studies (2007-2008) will be conducted. ENSEMBLES would welcome BALTEX activities on these simulations that would contribute to their evaluation and application in climate and impact studies. For the ENSEMBLES pursuit on probabilistic formulations of climate change projections in Europe, the ENSEMBLES models need to be used as a system, the contribution of each model weighted in according to its respective shortcomings and advantages. BALTEX focus, data and expertise on regional energy and water cycles, including the coupled interaction of the atmosphere, the Baltic Sea and the hydrology on the surrounding land surfaces should prove useful as one means. For BALTEX, the new and extensive data created by ENSEMBLES offers a wealth of science and application opportunities.

Visit ENSEMBLES at:
www.ensembles-eu.org/

In more general terms, ENSEMBLES is interested in collaboration with WCRP activities, of which BALTEX is one.

ASTRA at the BALTEX Conference

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The Interreg IIIB (Baltic Sea) project ASTRA ("Developing Policies & Adaptation Strategies to Climate Change in the Baltic Sea Region") is a partner in next year´s BALTEX Conference.

The project ASTRA focuses on the use of scientific knowledge from climate modelling and climate impact research, as well as geomorphological and geological investigations to assess the effects of climate change impacts on both natural and socio-economic systems. In addition, the project addresses threats arising from climate change in the Baltic Sea region, such as extreme temperatures, droughts, forest fires, storm surges, winter storms and floods. As an example, the recent winter storm (January 8-9, 2005) and related national, regional and local effects and responses have been studied as a starting example of the various challenges climate change poses to the region. The project pays special attention to mitigation measures and to awareness raising, an aspect to be addressed through intensive dissemination exercises, such as regional conferences and workshops in Baltic countries.

Visit ASTRA at:
www.astra-project.org

EUR-OCEANS and BALTEX

***Friedrich Köster** (fwk@dfu.min.dk) Danish Institute for Fisheries Research; **David Turner** (davidt@chem.gu.se) Göteborg University, Department of Chemistry; **Christian Möllmann** (christian.moellmann@uni-hamburg.de), Institute for Hydrobiology and Fisheries Science, University of Hamburg, Germany*

EUR-OCEANS is an EU network of excellence (NoE) on global change and pelagic marine ecosystems with presently 160 Principal Investigators in 66 Member Organisations, located in 25 countries (*www.eur-oceans.org*). The NoE has a networking objective, i.e. to achieve lasting integration of European research organisations and the relevant scientific disciplines to put Europe in an international leadership position in this field. To reach this goal, EUR-OCEANS will favour the progressive integration of research programmes and facilities of major research institutes in Europe.

Furthermore, the overall scientific objective of EUR-OCEANS is to develop models for assessing and forecasting the impacts of climate and anthropogenic forcing on food-web dynamics (structure, functioning, diversity and stability) of pelagic ecosystems in the ocean. The jointly executed research of the NoE is organised around four broad modelling tasks (together with observations and experiments) on:

(i) pelagic ecosystems end-to-end,
(ii) biogeochemistry,
(iii) ecosystem approach to marine resources, and
(iv) within-system integration.

The work within EUR-OCEANS is further conducted in area-specific system studies. For the Baltic System Study of EUR-OCEANS, co-working with the BALTEX community is essential. This applies both to the networking objective as well as to the scientific cooperation. A first step towards the integration of Baltic Marine Science has been conducted on the 1st EUR-OCEANS Baltic System WORKSHOP which was held 31 January to 3 February 2006 in Tvärminne, Finland. An output of this workshop, which benefited much from participation of BALTEX scientists, is a draft of an EUR-OCEANS BALTIC SEA RESEARCH PROGRAMME: "Developing an integrated view on the Baltic Sea ecosystem: Challenges for modelling". The overall objective of the programme is to identify, quantify and model the major processes governing the response of the Baltic Sea system to climate and anthropogenic forcing. The ultimate goal is to enhance our predictive capabilities on the energy cycle and mass transport as well as food web dynamics and utilisation of marine living resources. To accomplish this goal, scientific challenges were defined with respect to:

(i) the physical system and climate change;
(ii) biogeochemistry - sediments and material cycles, nutrients and primary production;
(iii) remineralization and nutrient regeneration, the microbial loop and microprotists;
(iv) meso-zooplankton production and population dynamics;
(v) fish population dynamics.

Further cooperation between BALTEX and EUR-OCEANS is planned through future workshops, which will further develop the Baltic Sea Research Programme and define common research activities. Excellent opportunities to integrate Baltic Sea science are also provided by conferences and symposia. EUR-OCEANS acts as co-sponsor to the 5th Study Conference on BALTEX, with the expectation of significant scientific contributions from the EUR-OCEANS community. The scientific topics of the meeting largely overlap with the EUR-OCEANS scientific goals, and especially the impact of climate variability on the Baltic ecosystem and the development of regional coupled models are key focus areas for the future cooperation.

Visit EUR-OCEANS at:
www.eur-oceans.org

Conference Announcements

Baltic Sea and European Marine Strategy Helsinki, Finland 13 - 15 November 2006

Background

The European Commission has proposed a strategy to protect Europe‘s marine environment. It is also preparing a Green Paper on all-embracing Maritime Policy, which seeks to address the economic, environmental, social, and governance challenges relating to the oceans and the seas, in a holistic manner. The Commission‘s policy framework lays down operational guidelines on how to achieve a good environmental status for the entire marine area of the EU. The Baltic Sea is one of the marine regions, in which the common objectives and methodologies must be implemented through the development of action plans.

Scope

This conference demonstrates how research can support the protection and management of the marine environment. It addresses the Baltic Sea in terms of research, protection, environmental awareness, education, and international cooperation.

Who should attend?

Conference is targeted at decision makers, politicians, managers, media and educators as well as natural, economic, engineering and social scientists studying the Baltic Sea. The invitation covers influentials in the Baltic region and other European regional sea basins in EU Members States and Russia as well as national, regional and international organisations involved in the protection of the regional seas.

For more information and registration, please visit

www.eu2006balticsea.net

Baltic Sea Science Congress Rostock 2007

Baltic Sea Science Congress Rostock-Warnemünde, Germany 19 - 23 March 2007

From external forcing to internal responses Acclimation and regulation cascades

The coastal oceans exhibit rapid changes which are driven both by global changes and by natural and human influences on more regional scales. Natural climate variability and human activities cause numerous abiotic and biotic reactions in the coastal seas on a large variety of time and space scales. At present scales and extent of external forcing – climate variability, man-made climate change, loads and use of land and sea space – can be described quantitatively rather well. Yet, there are considerable gaps in knowledge about the temporal and spatial propagation of change through the coastal sea‘s ecosystems in many aspects: from changes of internal hydrographic and sedimentary processes to the respective changes in species composition and abundance and related energy flow and matter cycles.

Conference contributions will address state of the art and progress in the research about acclimation to changes in forcing and respective regulation cascades including new methodological approaches and model activities.

For more information and registration, please visit

www.io-warnemuende.de/bssc2007

BALTEX is the European continental-scale experiment within the Global Energy and Water Cycle Experiment (GEWEX). It constitutes a research programme focussing on water and energy cycles in the climate system of the entire Baltic Sea basin with contributions of more than 10 countries. GEWEX has been launched by the World Meteorological Organisation (WMO), the International Council for Science (ICSU) and UNESCO‘s Intergovernmental Oceanographic Commission (IOC), as part of the World Climate Research Programme (WCRP). The scientific planning of BALTEX is under the guidance of the BALTEX Science Steering Group. The BALTEX *Newsletter* is edited and printed at the International BALTEX Secretariat with financial support through the GKSS Research Centre Geesthacht, Germany. It is the hope that the BALTEX *Newsletter* is accepted as a means of reporting on plans, meetings and work in progress, which are relevant to the goals of BALTEX, as outlined in the Science and Implementation Plans for BALTEX.

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