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Summer climate on Bornholm - BALTEX co-organizes interdisciplinary Summer School

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At the peak of the summer, from 27 July until 5 August 2009, BALTEX, the Danish Technical University (DTU Aqua) and the University of Gothenburg co-organized a Summer School on the island of Bornholm. 20 students from across the Baltic Sea region and different scientific disciplines participated in good spirit and took the opportunity to learn both discipline-specific and interdisciplinary skills related to the topic of the course: "Climate Impacts on the Baltic Sea – From Science to Policy".

Participants in the Summer School on Bornholm, 2009

The challenge of climate change in the Baltic Sea region has different facets, and the aim of the course was to provide a true interdisciplinary approach to tackle this challenge. Scientific knowledge, assessment and advice are needed in order to make effective decisions on policy and management actions which will achieve society objectives for the marine and coastal ecosystems of the Baltic Sea.

The main purpose of this summer school was to help students develop skills in and understanding of the observation, modelling, projection and interpretation of physical and biological changes in the Baltic Sea. The course focussed on the quantitative scientific aspects of climate change impacts in the Baltic Sea, but interaction and communication between scientists and policy makers was also among the goals. An interdisciplinary view will be increasingly in demand as the societal pressures on marine ecosystems remain high or perhaps increase as climate changes. Thus, one main objective of the course was to demonstrate how discipline-specific knowledge can contribute to real management solutions at the ecosystem level, and how that knowledge can help achieve wider goals related to ecosystem-based approaches to management.

Students were assigned activities to develop their discipline-specific knowledge, learn how the knowledge could be translated to management and policy actions, and improve general scientific skills (i.e. oral and written presentation of scientific results; organisation and structuring of group work; collaboration with colleagues from different nations and disciplines). The course contained lectures, exercises, discussion tutorials and group exercises. One type of group exercise was discipline-specific (e.g. related to

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modelling oceanographic or fish population responses to climate change), while the second was course-long, interdisciplinary and oriented to societal management objectives for the Baltic Sea ecosystem. This overarching task was to develop a management plan for the Baltic Sea similar to the HELCOM Baltic Sea Action Plan, but specifically taking account of climate change. This task provided the ground for intense discussions between students and between students and lecturers, and was taken up with enthusiasm. It was impressive to see students engaged in lively discussions until late in the evenings.

The academic programme spanned a large spectrum from presentations of international conventions, committees and networks to societal and scientific aspects of climate change and modelling, and various impacts on the marine environment. On the final day, the students made 4 group presentations, in which they explained their views on a hypothetical "climate change action plan" for the Baltic Sea. Here, the students demonstrated not only a deep understanding of the course material, but also a high level of imagination.

The venue for the course was Nexø on the Danish Baltic Sea island of Bornholm. Rooms and conference facilities were booked at 'Møbelfabrikken', a former furniture factory, which proved to be a perfect place for such an event. Taking full opportunity of the summer weather, virtually all social activities (meals, breaks, discussions) took place in the green courtyard of the centre, and the nearby rocky beaches could easily be reached by bicycle for a swim during lunch break or after dinner. The facilities are close to 'Bornholms lakseklækkeri' (Bornholm Salmon Hatchery, owned by DTU-Aqua and used as an experimental cod hatchery and release facility for stock enhancement) which was also visited during the course. A bus sightseeing excursion to tourist hot spots was included in the programme as well.

The students rated the course as highly successful in their evaluations, but the organizers and lecturers were also pleased with the way the students embraced the tasks of the course in a good spirit. A new course to be offered in 2011 is already being planned, providing sufficient funding is available.

The course was co-sponsored by the Nordic Marine Academy, BONUS, DTU Aqua, GKSS, University of Gothenburg, Fishnet.dk, and EurOceans. More information including the course material, topics, lecturers and sponsors is available at

www.baltex-research.eu/baltic2009

The environmental and socio-economic response to climate change in the southern Baltic region: An international conference in Szczecin

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In May 2009, the University of Szczecin and BALTEX co-organized an international conference on climate change in the southern Baltic Sea region. More than 120 scientists, economists, engineers, politicians and managers from 13 countries participated in the 4-day conference, which was accompanied by warm, sunny weather and a good spirit of all participants.

The conference dinner took place at the Szczecin castle

The southern Baltic Sea region

The southern part of the Baltic Sea basin is of special interest to environmental and social scientists dealing with climate change impacts. Its coastlines are most vulnerable to sea level rise, which is superimposed on neotectonic land subsidence and leads to a continuous retreat of the southern Baltic coastline. This requires specific activities in coastal protection, to be co-ordinated between the neighbouring countries. In addition to that, the high population density and strong agricultural use in the southern Baltic Sea region pose a special challenge to agriculture and water management in the light of climate change.

Szczecin was thoughtfully selected as conference venue. Politically, the city stands for the ongoing process of European unification. Geographically, it is located in the Polish depression, a zone of transition between the influence of air pressure systems of the North Atlantic and Siberia. The Polish depression hosts in numerous lakes unique records of Late Pleistocene to Holocene sediments.

Together with sediments of the Baltic proper, these deposits can be used to establish complex climate proxies for a high resolution reconstruction of the regional climate.

Different disciplines and topics related to climate change

This truly interdisciplinary conference brought together scientists from different disciplines, as well as stakeholders and policy makers. Planning agencies and local authorities have expressed the need for future regional impact projections which may be used for management and decision making on the regional and local level. The quality of decisions depends directly on the quality and interpretation of the data available – both from observations of the past, and also from future projections. The conference was divided into five sessions, which are shortly summarized here.

A. Marine and terrestrial proxies for reconstructions of paleo-climate. The focus of this session was on high-resolution multi-proxy data series of past climate change in the Baltic Sea region, for the time period since the last glaciation. Key aspects were decadal to centennial climatic oscillations, the dynamics and timing of particularly abrupt changes, and the impact of the changing climate on human settlements.

New evidence on past climate change from marine and terrestrial records was presented and discussed. For example, the Lake Hańcza sediment record (northeastern Poland) showed that the climate in the first 1000-2000 years of the Holocene was clearly influenced by the remaining part of the Scandinavian ice sheet, which was responsible for a particular atmospheric circulation pattern, dominated by cold and dry north easterly winds. In contrast, warmer Atlantic air masses influenced the climate much earlier in the western part of the Baltic Sea area. This lag in warming is also reflected in the vegetation development. The main deciduous trees invaded northeastern Poland later than other regions.

Proxy records are sensitive to different climate or environmental signals, particularly coastal sediment records respond to regional hydrological changes and the transgression phases of the Baltic Sea. Using high-resolution and partly laminated records from the Gotland Deep, long time series of wind driven water circulation could be established, thus providing the potential for a very detailed reconstruction of the North Atlantic oscillation in this region for the entire Holocene.

Racze and Miedwie lakes in the Szczecin lowland

B. Modelling of past climate change and future projections. The session focused not only on modelling of the Baltic Sea regional climate but considered also impacts already observed or projected for the future. Temperatures in the Baltic Sea area have increased in the last decades, in line with the global temperatures, and precipitation has increased in winter and decrease in summer, in agreement with current climate models. These developments will to some extent change the hydrological regime of the Baltic Sea, with impacts on the water mass formation in parts of the Baltic Sea, and a modulation of vertical exchanges through a modified stratification.

In order to assess future changes, past environmental changes must be explored and assessed. Estimating the range of natural variations requires a careful assessment of available observations, for instance river runoff, the frequency of drought periods, or sea-level variations. Future work will benefit from merging the analysis of observational data and results of model simulations. On the one hand, climate and environmental models are becoming more comprehensive and complex, and larger data sets are being compiled for the present and previous untapped archives, such as proxies and meteorological data. On the other hand, this increasing model complexity requires a careful validation of models and data sets.

Climate and environmental change are coupled, and unexpected synergies may arise. Modelling and the analysis of observations will have to take into account both aspects of this ‚anthropogenic' change, even more so at small spatial and temporal scales. For instance, ice cover, algal blooms and coastal erosion are influenced both by climate change and other anthropogenic activities, which are entangled in a so far unclear way.

C. Climate and anthroposphere interactions. The session was devoted to the effects of climate change on the human environment and activities, and vice versa. Climate change impacts on the human environment and activities reported include effects on the urban climate, heating costs and insurance levels, interactions of economic development, industrial production and environmental pollution, but also historical evidence for climate related settlement patterns and agricultural techniques (e.g. the cultivation of wine), recent phenological changes of agriculturally important crops, and a vision of future water tourism in the Baltic Sea region. It was demonstrated that anthropogenic warming has an effect on bottom sediments of semi-enclosed lagoons,

and may induce ecological regime shifts, coastal erosion and lea level rise. A largely overlooked but very direct impact is the exhaust gas emission from fishing vessels. The high diversity of interactions between climate change and the anthroposphere was demonstrated in this session, and the need for more detailed research and collaboration across disciplines was stressed.

D. Prehistoric communities and climate change. The session focused on the massive climate change after the Weichselian glaciation, which led to a variation of different environmental conditions under which hunter and gatherer societies had to adapt their subsistence strategies. Results were reported based on the interpretation of new proxy-data which shed light on the interrelation between environmental change and the development of social structures, especially in the post-glacial phase. Special attention was paid to late hunter-gatherer societies, coastal oriented fishing communities, and the early farming societies. The role of the naturally changing climate in the onset of the "Neolithic Revolution" was discussed, giving an example for an interdisciplinary cooperation of archaeologists, geologist and biologists in order to find driving forces for societal development.

E. Climate variability and change: Impacts on Baltic Sea coasts. The session focused on climatically induced sea level rise and the hydrographic stress (e.g. waves and currents) on the neotectonically sinking coasts of the southern Baltic Sea. Special emphasis was put on the dynamics of coastal processes, from event-driven short periods through the decadal up to millennial time scales, with emphasis on the vulnerability of the sandy coasts of the southern Baltic Sea. It was shown that numerical modelling of hydrodynamic and coastal processes has improved considerably, and that there is a high demand to further improve models and concepts. Furthermore, innovative concepts for coastal protection and new coastal zone management approaches were discussed.

Further interdisciplinary work needed

The linkages between climate and socio-economic systems are obvious, calling for a more intensive interdisciplinary cooperation between marine scientist, geologist, archaeologist, historians, socio-economists and climate researchers. While the BACC report provides an appropriate data base for interdisciplinary studies of climate change effects, data in higher spatial resolution (for instance sea level change) are needed for coastal system studies and the investigation of urban climate.

A second conference on climate change effects in the southern Baltic Sea region to be held at Szczecin in 2012, will be a good opportunity to present and discuss the latest findings. Selected papers of the conference will be published in a special issue of "Journal of Climate Research" as conference proceedings. More information on the conference, including the complete abstract volume for download, can be found on the BALTEX website.

www.baltex-research.eu/SZC2009

The 2nd Lund Regional-scale Climate Modelling workshop: 21st century challenges in regional-scale climate modelling

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From 4-8 May 2009, about 200 climate scientists from around the world met in Lund, Sweden, for exchanging and discussing the latest developments in regional climate modelling. This 2nd Lund Regional-scale Climate Modelling Workshop was a follow-up to the first regional-scale climate modelling workshop held in Lund, Sweden in 2004. Now, five years later, it was time to take stock of the scientific progress in the wide range of topics that regional climate modelling spans. These range from the theoretical understanding and parameterisation of meso-scale and regional processes in the atmosphere/ocean/land surface/biosphere system, numerical methods and links between regional climate modelling and global climate/earth system models, as well as numerical weather prediction models, evaluation of models using various observational datasets, model intercomparison and ensemble-based methods, production and utility of regional climate scenarios, and the application of regional climate modelling output for impact studies. This 2nd Lund Regional-scale Climate Modelling Workshop summarised developments and progress achieved in the last five years, discussed open issues and focused on expected future challenges related to regional climate modelling. Thus, the overall theme for this workshop was 21st Century Challenges in Regional-scale Climate Modelling.

The response to the workshop was overwhelming. We received over 170 paper contributions from scientists from all continents, and a total of about 220 participants from 43 countries registered for the workshop. This was more than twice as many as for the first workshop in 2004, reflecting the growing interest in regional climate modelling, largely driven by the growing demand for high resolution climate projections.

Participants of the 2nd Lund Workshop on Regional-scale Climate Modelling in fron of the historical Lund University building

The workshop was structured in seven topic areas, which were represented in the oral and poster sessions. Since a prominent application of regional climate models is the provision of high resolution climate scenarios by downscaling global climate model scenarios, it was not surprising that the session on „Dynamical downscaling“ was the most frequented. In particular, the use of spectral nudging techniques (a method imposing time-variable large-scale atmospheric states on regional atmospheric models in order to improve downscaling), received much attention. Spectral nudging techniques are now used in regional “reconstructions”, i.e., downscaling of re-analyses of the last few decades, dealing with, for instance, the changing statistics of the East Asian summer monsoon, or of polar lows. Results from the next generation of regional climate models, which are applicable to very high resolution simulations (10 km grid mesh size and smaller) were shown and gave an insight on the future possibilities of regional climate models.

In recent years there has been a growing number of large projects around the world, in which regional climate modelling plays a major role. Results from several of these projects were presented at the workshop (e.g. ENSEMBLES, NARCCAP, GEWEX/CEOP, AMMA, CLARIS, CLAVIER). An outlook on the future of regional climate modelling was given in a special session. In the future, the coupling of regional systems will become more and more standard, e.g. regional atmosphere and ocean models will increasingly run in a coupled mode, rather than independently. Other modules, like ice models, aerosol chemistry, dynamic vegetation and others, may also be coupled to the atmosphere and ocean models. All this goes into the direction of regional earth system, or regional environment models. Other aspects discussed were the use of global climate models (GCMs) with regional refinement in grid mesh size, dynamic grid stretching and mosaic GCMs. The “added value” of regional climate models in comparison to global models, which had been a topic already at the Lund meeting in 2004, was again discussed. An added value has been identified with respect to the presentation of medium spatial scale variability, regions with physiographic details, such as coastlines or mountain ranges, as well as sub-synoptic dynamical phenomena such as polar lows.

Results from regional climate scenarios, or projections, are the basic input of many impact studies. Therefore, a special session was dedicated to this aspect. There was a broad range of applications, dealing with water quality, forest damage, the Sahel zone, socio-economic impacts, urban areas, and mega cities, and the impact of land use change on regional climate projections.

The workshop was co-organised by Lars Bärring from the Swedish Meteorological and Hydrological Institute (SMHI) and Lund University, Burkhardt Rockel of GKSS-Forschungszentrum Geesthacht GmbH (GKSS), the Danish Meteorological Institute (DMI), and the International BALTEX Secretariat. Regional climate modelling for the Baltic Sea region is one of the major research objectives of BALTEX.

Extended abstracts of all contributions are compiled in the Workshop Proceedings (International BALTEX Secretariat, ISSN 1681-6471, Publication No.41, April 2009), and are available online at the workshop home page at www.baltex-research.eu/RCM2009/. A special issue on the workshop will be published in a dedicated international climate research journal, to be published in 2010.

www.baltex-research.eu/RCM2009

300 scientists at the 7th Baltic Sea Science Congress in Tallinn

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Baltic marine scientists have had a long tradition of international cooperation, with several international hydrological conferences held already in the 1920s and 1930s. A new form of cooperation was created when in 1957 the "Conference of Baltic Oceanographers – CBO" was started as a non-governmental organization, holding biannual meetings with a focus on water balance and hydrography. Noting the progress achieved within the Cooperative Synoptic Investigation (1964) and the International Baltic Year (1969-1970), the famous hydrologists Falkenmark and Mikulski wrote in 1975: "The oceanographers working with the Baltic mostly focus on internal water exchange processes, such as the mixing between layers and between subregions, or between coastal waters and the open water mass". On a new level of knowledge, these topics are very important also today. Starting in those early days, significant developments have been introduced in research technology: High-resolution automatic equipment, remote sensing, data transmission and databases and advanced numerical modeling. As a result, the capability to predict conditions in the Baltic Sea on different scales has tremendously increased, be it long-term climate change projections, or short-term forecast services provided by operational oceanography.

Baltic marine biologists formed their non-governmental organization – the BMB (Baltic Marine Biologists) – in 1968, mainly to elaborate and standardize methods for marine biological investigations and facilitate Baltic Sea - wide cooperation. Since interdisciplinary problems were evident already in those early days, the biannual meetings were organized in alternative years with CBO. With sea-bed related anthropogenic impacts becoming more evident, the geologists working in the Baltic Sea founded the BSG (Baltic Sea Geologists).

In the mid-1990s, the CBO, BMB and BSG joined their efforts to organize a wider forum – the Baltic Sea Science Congress (BSSC) - where marine scientists from different disciplines can exchange the ideas and knowledge, enhance the cooperation and integrate the marine science community. The first BSSC was organized in Rønne, Denmark on 22-26 October 1996, followed by Warnemünde, Germany (23-28 November 1998), Stockholm, Sweden (25-29 November 2001), Helsinki, Finland (24-28 August 2003), Sopot, Poland (20-24 June 2005) and Rostock, Germany (19-23 March 2007). Since the tradition has been to alternate the biannual events among the Baltic Sea countries it was recommended at the last BSSC to organize the 7th BSSC, in Tallinn, Estonia.

The 7th BSSC in 2009 (www.bssc2009.org) was jointly organized by Tallinn University of Technology and University of Tartu, in cooperation with research groups from other Estonian organizations. It took place on 17-21 August 2009 at the premises of Tallinn University of Technology (www.ttu.ee), on its Campus located in the Mustamäe region.

The Scientific Steering Committee (SSC) included 35 active scientists from BMB, BSG and CBO. Based on the earlier experience of growing interdisciplinary integration of scientists (as seen in major projects), the SSC did not fix any sessions in advance, but announced an open call for session theme proposals, with the overall Congress title "Towards better understanding and improved technology for serving the society". The response on this invitation

Participants of the 7th BSSC 2009 in Tallinn

was vivid and organizers received 18 good session proposals, plus 2 attached workshops. The subsequent call for abstracts yielded 271 submitted papers which were reviewed by the SSC members and other leading scientists. The conference management system, provided by Oxford Abstracts (www.oxfordabstracts.com), allowed to collect around thousand evaluation grades (each paper was assigned to 4 reviewers). Average scores were passed to the conveners, who had written the theme proposals. They had the final word in setting up the sessions.

Eventually, the 7th Baltic Sea Science Congress brought around 300 scientists to Tallinn. The sessions "Impact of changing climate on the Baltic Sea ecosystem" and "The carbon/CO_2 cycle in semi-enclosed and shelf seas/Marine acidification" addressed open questions also highlighted in BACC (Assessment of climate change for the Baltic Sea basin). A broad range of coastal issues was treated in the sessions "Coastal and offshore exchange processes", "Coastal and offshore developments in the Baltic: impacts and assessment" and "Interplay of wave dynamics, marine ecosystem and coastal processes". Rapidly developing technological aspects of marine science were dealt with in the session "Operational oceanography and coastal observatories". More traditional sessions were "The Baltic Sea water circulation and mixing - observations and modelling", "Sedimentary systems of the Baltic Sea – function and history", and "Changes in marine communities in the Baltic and their external and internal drivers" as the most popular one. A kind of synthesis was presented by the sessions "Ecosystem health" and "Linking Ecosystem and Society". The latter was an initiative based on the just-started BONUS+ projects. The plenary talks were mainly those selected from the session talks, as evaluated. Besides that, there was also a presentation on BONUS-169 and on the EU Marine Policy (Pierre Mathy, Unit of Environment of DG Research), demonstrating further prospects of interdisciplinary marine research in the Baltic Sea area. In particular, it is expected that the European Parliament and the Council by their co-decision will give "green light" to the BONUS-169 programme. BONUS (www.bonusportal.org) was invited by BMB, BSG and CBO to jointly co-organize the next Baltic Sea Science Congresses.

In the closing, Lev Karlin, Rector of the Russian State Hydrometeorological University, invited the BSSC to hold the next Congress in 2011 in St. Petersburg, Russia, which was accepted with pleasure. The Congress also adopted a declaration, which (1) stresses the strengthening of research efforts to explore and better understand the functioning of the Baltic Sea system, including socio-economy, to obtain the knowledge base necessary for future sustainability of the Baltic Sea natural resources, and (2) calls for the creation of an independent panel of Baltic-relevant scientists, selected on the basis of scientific excellence, which can address environmental and sustainability problems, elaborate a scientific consensus and convey this to decision-makers.

www.bssc2009.org

Ecohydrology: A framework for reversing the degradation of the Baltic Sea

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The worldwide degradation of marine habitats is especially pronounced in semi-enclosed seas such as the Baltic Sea. This is due to population growth accompanied by deforestation and intensification of agricultural practices. The reduction of point-source pollution largely depends on monitoring and the enforcement of regulations, while a reduction of non-source pollution (without limiting food production) depends on the implementation of "good agricultural practices". In any case, understanding the complexity of the interplay between water and biocoenoses in the terrestrial and aquatic phases of the hydrological cycle is crucial (Fig.1).

In the anthropocene, the environment is dominated and transformed by socio-ecological processes. Therefore, reversing the degradation of the biosphere requires solutions based on an integrative science such as Ecohydrology. This is a sub-discipline of sustainability sciences and primarily deals with the ecological aspects of the hydrological cycle. Ecohydrology is based on:

- the integration of specific knowledge of various disciplines,
- the understanding of the past (e.g. paleohydrology, ecological succession patterns),

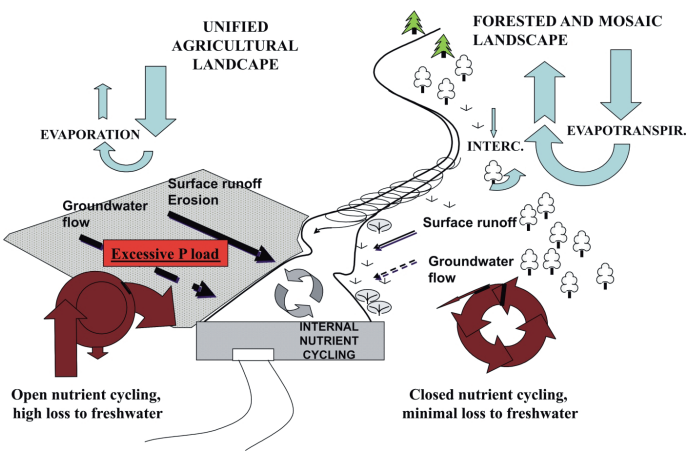

Fig. 1. Water and nutrients cycles on the basin scale (from Zalewski 2002, modified)

- considering the priorities of society vs. the carrying capacity of the ecosystem,
- the consideration of future scenarios.

The investigation of "novel ecosystems" (resulting from human interventions), and their resilience in the light of the climate and land use changes, and socio-economic and cultural processes, has become equally important as the conservation of pristine patches.

Ecohydrology as problem-solving science

According to the International Council for Science (ICSU), scientific efforts in the 21st century must be integrative, problem-solving and policy oriented, rather than solely curiosity driven. A sustainable development of the marine environment needs to take into account the fact that almost 80% of the Earth´s biological structures and fundamental ecological processes, such as the water and nutrients cycles, are suffering from deterioration.

The two major goals of Ecohydrology as a problem-solving science are

- to enhance the retention of fresh water in terrestrial and freshwater systems and to reduce freshwater losses to the sea, and
- to reduce the input and to regulate the allocation of excess nutrients and pollutants to aquatic ecosystems, towards reversing ecosystem degradation and improving human well-being.

The scientific discipline of Ecohydrology has been developed in the framework of the International Hydrological Programme of UNESCO as the major methodology to regulate aquatic ecology from the molecular to the landscape level, and from river basins and reservoirs to costal zones (Zalewski et al. 1997, Zalewski 2002, Zalewski et al. 2004).

The goal of retaining water in terrestrial and freshwater ecosystems critically depends on the restoration of habitats, which in turn maintains biodiversity. This can be done not only by conservation, but also by regulating hydrological patterns and allocating excess nutrients and pollutants to less available pools (soil, sediments, wood, biomass, fodder), or at least from dynamic and opportunistic (e.g. toxic cyanobacteria) to less dynamic organisms (zooplankton, fish, macrophytes) (Zalewski 2007, Harper et al. 2008).

The three principles of Ecohydrology as a framework for scientific investigation and problem-solving

1. The hydrological (first) principle can be described as the quantification and integration of hydrological and biological processes on the basin scale, including paleo-

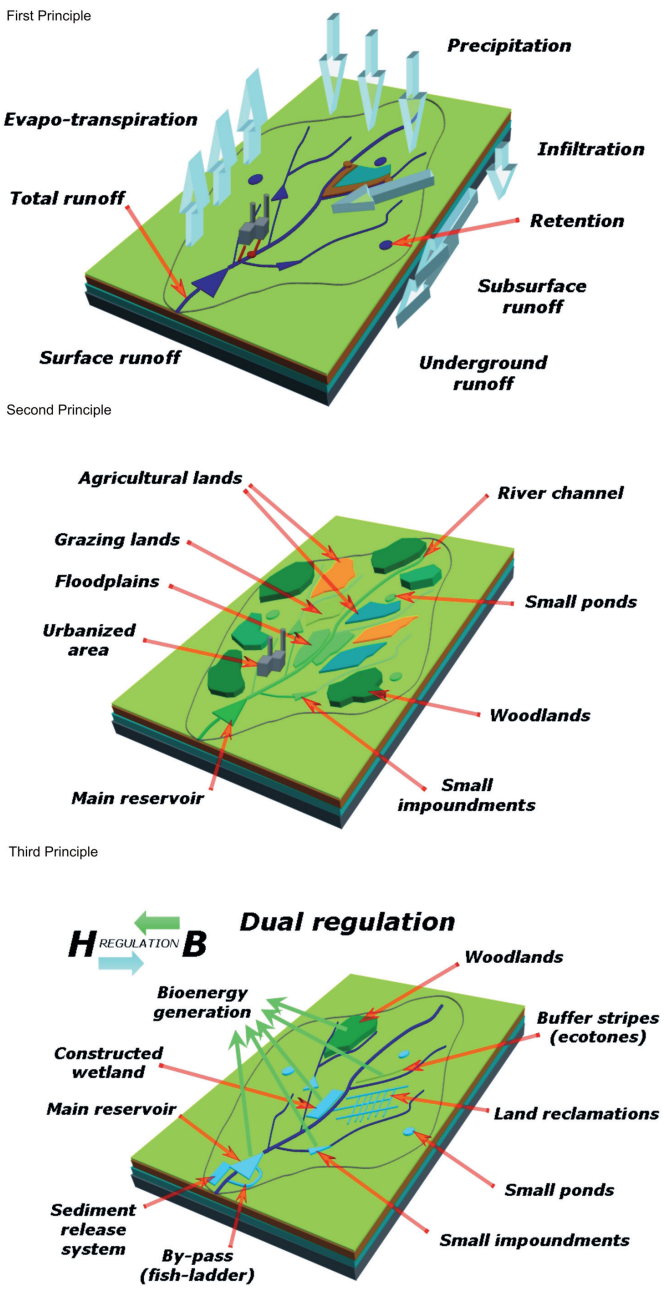

Fig. 2. The three ecohydrological principles. a. (upper): the hydrological principle, b. (middle): the ecological principle, and c. (lower): the ecotechnological principle.

hydrology, the stream geology as a basic determinant of biological productivity (Zalewski et al. 1998), and the special consideration of flow pattern changes along the river continuum (Fig. 2a).

2. The ecological (second) principle stands for enhancing the carrying capacity of the ecosystem (water quality, restoration of biodiversity, enhancing resilience and ecosystem services for society in general). This is based on the assumption that in the face of global change, i.e. an increasing population, energy consumption and growing needs at deteriorating ecosystems, it is not sufficient to protect the environment, but it is necessary to regulate ecosystem structure and processes (Fig. 2b).

3. The ecotechnological (third) principle. The use of ecosystem properties as management tools is based on the first and second principles of Ecohydrology (see above), and is related to Ecological Engineering (Mitsch 1993, Jørgensen 1996). This is expressed by three implementation steps:

- "Dual regulation" – Improving conditions for the biota by regulating hydrology and, vice versa, improving hydrological conditions by shaping biota, or controlling their interactions (Fig. 2c).
- Integration of various types of regulations on the basin scale, in order to achieve synergy effects for the improvement of water quality, biodiversity and freshwater resources.
- Harmonization of ecohydrological measures with necessary hydro-technical engineering solutions (dams, irrigation systems, sewage treatment plants, etc.)

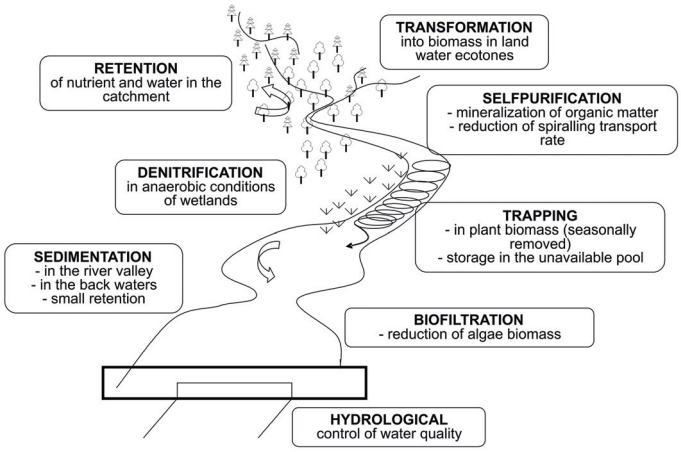

Fig. 3. The integration of different ecohydrological measures for synergistic enhancement of water quality (Zalewski 2000, modified)

The mentioned synergy effects on the basin scale, as well as other regulatory measures have helped to reduce nutrient and pollutants loads to aquatic systems significantly (Zalewski 2000, Fig. 3).

Ecohydrology for reversing Baltic Sea eutrophication

Annual precipitation in the southern Baltic Sea basin is about 600 mm, with 70% of the area being agricultural land. According to the climate scenarios presented in the BACC report (2008), summer runoff may decrease by 50%, whereas in winter it may increase by up to 70%. If such drastic changes will appear, extreme droughts and floods will pose severe threats to the area. In Poland, almost 30% of the phosphorus load from point sources to the Baltic Sea is provided by rivers, and 70% of the country is covered by agricultural areas. Thus, the reduction of loads from point sources should be combined with efforts to reduce loads from the landscape. Moreover, the role of reservoirs in nutrient transport to the sea and in regional biodiversity restoration should be reconsidered. Reducing nutrient losses from diffuse sources "is much more complicated than curbing loads from point sources due to technical and socio-economical obstacles" (HELCOM 2007). Thus, a four step strategy for reducing loads (and in particular diffused loads) should be developed, considering Ecohydrology principles:

i. The enhancement of mosaic catchments, especially for low order streams, where diffuse pollution is highest. As diversified plant communities possess the highest potential for nutrient assimilation, the lowest points of the landscape and land-water ecotone zones should be preferred areas for restoring biodiversity. The creation of ecotone zones based on native species should be recommended (Zalewski 2002).
ii. Enhancing the potential for nutrient assimilation, through biodiversity and productivity in small rivers and streams, by creating an intermediate complexity of land/water ecotones (spiraling enhancement toward self-purification, Zalewski et al. 1998; Zalewski et al. 2001).
iii. Enhancing the absorbance capacity of floodplain nutrients and pollutants. According to Kiedrzynska et al. (2008) the annual phosphorus trapping at the floodplain of Pilica River (largest left tributary of Vistula) is over 10 kg/ha, which reduces the load to the Baltic Sea by over 10%, and can still be improved by biomass/bioenergy sequentional cropping.
iv. Constructing reservoirs with an enhanced sedimentation capacity, where the organic fraction of sediments can be used for bioenergy production.

Conclusion

How can the degradation of the biogeosphere be reversed and how can the environment be sustainably managed in the future? Following the witticism by Nelson Mandela, "action without vision is wasting time and resources", we need to formulate a vision on the basis of the available methodology. It should consider the recent dynamic development of integrative, transdisciplinary scientific efforts, the necessity to change the attitude of society by participatory education, e.g. by a learning alliances methodology (Moriarty et al. 2007), and active society participation in the process of adaptive management (Olsson et al. 2006), towards achieving a harmony between the water environment and society.

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What is known about sea-level change in the Baltic Sea?

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Sea-level change is becoming an issue of increasing importance, especially in the context of anthropogenic global climate change. In addition, it is also closely linked to studies of solid earth processes and geodetic science. The possible impact of sea-level rise on the coast and the associated costs for coastal protection elicits a great interest to governmental bodies and the public. Impacts of sea-level rise can include coastal erosion and inundation, higher waves at the coast as well as salt-water intrusion and stratification with implications for the ecosystem.

The understanding of sea-level rise and variability on a global scale is nowadays the focus of many research studies worldwide, and was one of the key topics of the IPCC Fourth Assessment Report (Bindoff et al. 2007). A global average of sea-level, however, ensconces considerable regional variations that may be caused by regional and local-scale processes.

In 2008, the first Assessment of Climate Change for the Baltic Sea Basin (BACC author team, 2008) - with an overall project format similar to that of the IPCC - offered an up-to-date overview over the latest scientific findings in regional climate research on the Baltic Sea basin, including climate changes in the recent past, climate projections up until 2100 and an assessment of climate change impacts on terrestrial, freshwater and marine ecosystems.

However, the issue of sea level in the Baltic Sea appears relatively less represented in the report compared to other aspects of climate change, as it is not included in the overall summary. From our recent experience from communicating with regional stakeholders it has become very clear that this issue must be considered a major issue for stakeholders and the public at large.

Many more studies on sea level have been published since the conclusions of the BACC report. For instance, since 1993, high-quality satellite-altimeter observations of sea levels allow for more accurate estimates of globally averaged, but also regional sea-level change. Are these satellite-altimeter observations yet useful for the study of Baltic Sea level variability? Another challenge in sea-level research is the separation of the relative contributions of isostatic change, due to postglacial rebound and the eustatic sea-level change. Are there new efforts made in the development of advanced geodetic techniques for measuring vertical land movement at tide gauges? Which available input data are used up to date by coastal engineers for hydrodynamic or sediment transport models? Which

sea-level data are available for the Baltic Sea research community, and which of the data have been quality controlled by peer-reviewed scientific studies? Which climatic data were so far used for studying the climatic influence on sea level in the Baltic Sea? Has full advantage been made of existing data? Is there a need for more cross-national studies? What are the challenges for future Baltic Sea level research? What is known? What is very likely? And what is still uncertain?

In this respect, we kindly ask the BALTEX research community for help. Please inform us about publications in any language, ongoing projects and initiatives dealing with sea-level variations and change in the Baltic Sea, including coastal erosion. Helpful suggestions, comments, details and references concerning planned or ongoing research related to Baltic Sea level studies are most welcome.

These questions shall be tackled by an overview report which is currently being elaborated at the Institute for Coastal Research at GKSS Research Centre Geesthacht, summarizing the available knowledge about sea-level variability and change in the Baltic Sea region. We want to collect and assess the published knowledge about sea-level variations and change until the end of 2009.

Please contact Birgit Hünicke (birgit.huenicke@gkss.de) at GKSS.

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An introspective look at BACC: SURBACC 2009

Dennis Bray *(bray@gkss.de), Institute for Coastal Research, GKSS Research Centre Geesthacht, Germany*

An assessment report about climate change in the Baltic Sea drainage basin was published in 2008, widely known as the BACC report (BACC Author Team, 2008). A survey of BACC (SURBACC) is a proposed survey questionnaire designed to allow, among other things, the BALTEX scientific community to comment on process, content and knowledge gaps in the BACC report, as well as to identify future research priorities. This also marks the involvement of social sciences under the auspices of BALTEX. As such, a brief introduction to the application of social science as proposed here is provided for the sake of those who are curious.

Survey research and its methodology have a long history in the social science. Basically it is a systematic means of gathering information designed to elicit information directly from the population/sample of interest and then interpreting the data by means of statistical analysis. The purpose of such a survey can be twofold, resulting in description and/or causal analysis. Descriptive results are typically presented as frequencies, means, histograms, etc. An analysis of causation, of lesser importance to the BALTEX community, but of greater significance for social science, tends to lean towards multi-variate analysis or causal modelling in order to test theoretical hypothesis.

Understanding the political process and outcomes of science falls within the rubric of sociology of science. For the sociological project, the success of such a survey provides the potential for an empirical analysis of the social construction of the scientific knowledge (the voice of nature as provided by science), the means by which such knowledge is communicated by its practitioners at the micro-level, and the transfer of that knowledge at the macro level. In addition, in this particular case, the data from the survey would also enable a comparison between science generated with a regional perspective in mind to similar scientific undertakings from a global perspective. In 1996, 2003 and 2008, similar surveys were conducted by myself and Hans von Storch, involving the international scientific community dealing with global climate issues, providing a basis for a comparative analysis of regional and global science of the climate change issue.

For the BALTEX community, the survey also offers some more pragmatic opportunities. For example, it has the potential to provide a service to the members by

1. identifying areas in need of increased research and/or focus,
2. suggesting funding priorities for research, and
3. providing the opportunity for the science community to express an opinion concerning the dissemination of scientific results.

It is tentatively planned to begin the survey in autumn 2009. In the meantime, questions, comments and/or suggestions can be directed to Dennis Bray at bray@gkss.de. More information on the earlier surveys of climate scientists at:

http://coast/staff/bray/index.html

6th Study Conference on BALTEX

Międzyzdroje, Island of Wolin, Poland
14 to 18 June 2010

Scope and Themes

BALTEX is a Regional Hydroclimate Project (RHP) of the Coordinated Energy and Water Cycle Observations Project (CEOP) within the Global Energy and Water Cycle Experiment (GEWEX) of the World Climate Research Programme. In recent years, BALTEX has evolved from a metorological, hydrological and oceanographical research programme to a truly interdisciplinary research network for the Baltic Sea basin, encompassing the environmental disciplines meteorology, hydrology, oceanography, climatology and biogeochemistry, including efforts towards improving communication within the scientific community, education and outreach to stakeholders and the public. The backbone of BALTEX remains the investigation of the water, energy and matter cycles and fluxes in the regional climate system of the Baltic Sea basin (the catchment area and the sea) under changing conditions.

The 6th Study Conference on BALTEX will reflect the interdisciplinary nature of the BALTEX programme. Conference topics are aligned along the revised BALTEX Phase II objectives:

- **Improved understanding of energy and water cycles under changing conditions.** This involves the development and assessment of regional models, and the improvement of observations.
- **Analysis of past climate variability and change, and provision of regional climate projections over the Baltic Sea basin for the 21st century.** This involves detection and attribution studies as well as assessments of past, current and future climate change including its impacts on the environment.
- **Provision of improved tools for water management, with an emphasis on extreme hydrological events and long-term changes.** This includes the assessment of water resources in today's and future climate, as well as forcasting extreme events and their impacts on the environment and infrastructure.
- **Biogeochemical cycles in the Baltic Sea basin and transport processes within the regional Earth system under anthropogenic influence.** This involves the coupling of regional climate models with biogeochemical models to estimate the impact of climate change on matter fluxes.

Results related to any of the above themes are welcome, as well as contributions from other related programmes. The Conference is also envisaged as a communication platform for the research community, water resource managers and other stakeholders.

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

6th Study Conference on BALTEX

Location

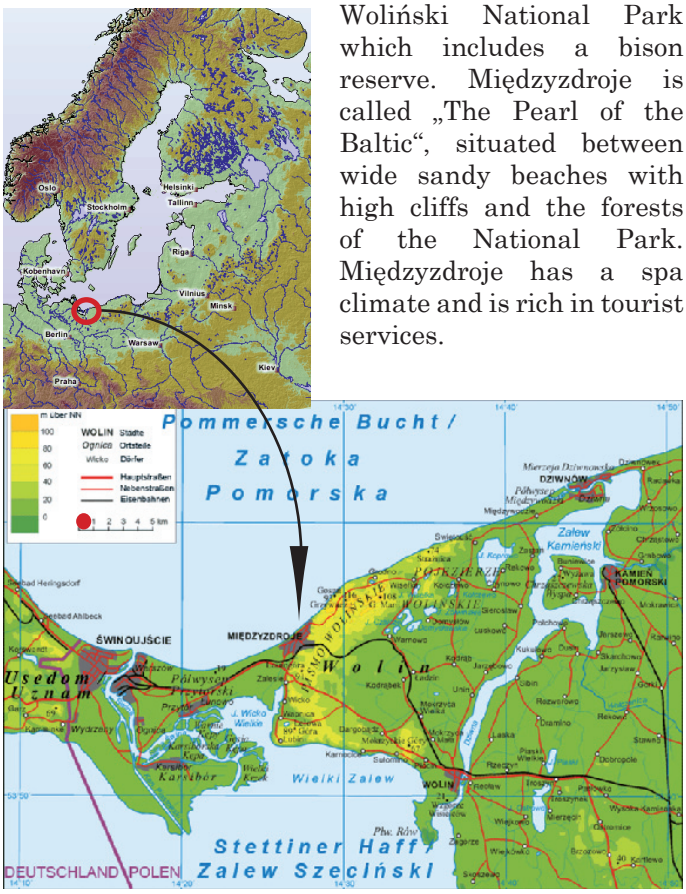
The island of Wolin is located in the Baltic Sea as part of the Oder river estuary in the Pomeranian Bay. It is separated from the island of Usedom by the Świna river, and from mainland Pomerania by the Dziwna river. Wolin covers an area of 265 km², the highest point is Mount Grzywacz with 116 m above sea level.

Most of the island consists of forests and postglacial hills. The region is geologically very young and has undergone various geological changes in the past. The Odra river estuary as we see it now was formed approximately 13,000 years ago during the last glaciation.

Wolin was first mentioned in the 10th century as the second largest Baltic marketplace of the Viking Age. Later, Wolin became notorious for its pirates.

Wolin was part of an independent Duchy of Pomerania for some 400 years, and later was incorporated in succession into Danmark, Sweden and Germany.

The island is a main tourist attraction of northwestern Poland. Located in the centre of the island is the Woliński National Park which includes a bison reserve. Międzyzdroje is called „The Pearl of the Baltic“, situated between wide sandy beaches with high cliffs and the forests of the National Park. Międzyzdroje has a spa climate and is rich in tourist services.



Organisation

Again, as for the 5th Study Conference on BALTEX, held in Estonia in 2007, 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 Conference is organised in cooperation with 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); BONUS (Baltic Organisations Network for Funding Science EEIG); and NEESPI (the Northern Eurasia Earth Science Patrnership Initiative)

Timeline

Call for papers: November 2009

Abstract submission: 15 February 2010

Registration & Hotel booking: 31 March 2010

www.baltex-research.eu/wolin2010

Co-organizers

Polish Academy of Sciences
Institute of Oceanology

HELCOM
Baltic Marine Environment
Protection Commission

NEESPI
Northern Eurasia Earth Sciences
Partnership Initiative

LOICZ
Land-Ocean Interactions in the Coastal Zone

BONUS
Baltic Organisations
Network for Funding
Science EEIG

New BALTEX Publications

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www.baltex-research.eu/publications

Announcements

Storm Surges Congress 2010

Risk and Management of current and future Storm Surges

University of Hamburg, Germany
13 - 17 September 2010

Storm surges represent a major type of natural hazard, frequently causing substantial losses of lives and economic damages.

How do we deal with the present level of risk?
How do we respond to changing future conditions?

More infos and the conference flyer at

www.loicz.org/storms2010

Deltas in Times of Climate Change Rotterdam 2010

Connecting world science and deltas

Rotterdam, The Netherlands
29 September - 1 October 2010

Deltas have a lot to offer. They are close to the sea and inland waterways. Their soils are fertile. They are therefore the base of many large and fast growing cities. But as populations grow, deltas and their cities are becoming more vulnerable. Floods, land subsidence, traffic congestion, air pollution and salt intrusion loom up as common threats. Climate change aggravates these problems.

The overall scope of the conference is planning and investments in times of climate change.

More infos at

www.climatedeltaconference.org

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.

The editor invites the scientific community to submit BALTEX-related contibutions to be published in this *Newsletter.* Submitted contributions will not be peer-reviewed and do not necessarily reflect the majority's view of the BALTEX research community. Scientific material published in this *Newsletter* should not be used without permission of the authors.

Please, send contributions to the BALTEX *Newsletter,* requests for BALTEX - related documents, suggestions or questions to the International BALTEX Secretariat via

www.baltex-research.eu

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