Summary

International Conference

Climate Change: The environmental and socio-economic response in the southern Baltic region

25-28 May 2009 in Szczecin, Poland

The conference site had been selected thoughtfully: Regionally, Szczecin represents the Polish depression – a zone of transition between the influence of air pressure systems of the North Atlantic and Siberia. Politically, the town stands for the ongoing process of European unification – hospitably to scientist from all over Europe and beyond.

Altogether, more than 120 participants from 13 countries –participated in the conference jointly organised by the University of Szczecin and the International BALTEX Secretariat at GKSS Research Centre Geesthacht, Germany.

The participants have been joined by the aim to deliver and to discuss latest results in the investigation of a changing climate and its effects to the environment and the social life in the southern Baltic region. It was generally accepted that remarkable progress have been achieved in understanding the climate controlling system on the global scale, but, that the requirements of today consist of a spatial downscaling of global processes to the regional scale. Planning agencies and local authorities have expressed the need of future climate change projections which may be used for management and decision making on the regional and local level in order to mitigate negative effects of climate change to the environment and the society. The quality of answers to the questions depends directly on the data available – records of measurements for the past and future projections as the results of climate modelling. The two invited lectures highlighted at the beginning of the conference clearly these

dependencies. Whereas Andres Tarand (European Parliament) described possibilities and limits of the reconstruction of climate parameters for the Baltic area on the millennial scale, did Hans von Storch (GKSS Research Center Geesthacht) mainly focus on the state of the art in regional climate projections at the centennial time scale. The background of the latter presentation was the BACC report (BALTEX Assessment of Climate Change in the Baltic Sea basin) which was done by reviewing published scientific knowledge about climate change in the Baltic Sea region. This present day knowledge provided the base for the discussion within the frame of oral and poster sessions devoted to 5 topics:

Session A: Marine and terrestrial proxies for reconstructions of paleo-climate
Session B: Modeling of past climate change and future projections
Session C: Climate and anthroposphere interactions
Session D: Prehistoric communities and climate change
Session E: Climate variability and change impacts on Baltic Sea coasts

As the questions addressed by the society to the scientific community are very complex and do require complex answers, one of the goals of the conference was to foster the interdisciplinary discussion of the topics. Therefore, parallel sessions have been avoided by holding plenary sessions and poster discussions only. This strategy guaranteed a continuous productive environment of the conference. This productive atmosphere was not limited to the scientific sessions. This atmosphere did determine the social events and in particular the field excursions as well. Two groups of participants explored the Baltic Sea coast east and west of the Oder River mouth devoted to “The inner and outer coasts of Wolin Island” prepared by the scientists from the University of Szczecin and “The coasts of Rügen Island” guided by geologists from the State Authority for Environment, Nature and Geology Mecklenburg Vorpommern (LUNG). On both excursions participants have been informed about national strategies in coastal protection and defence becoming increasingly relevant in front of the background of climate change.

Results from the session’s point of view are given hereafter.

Overarching outcomes of the conference are:

- In the different fields approached by the conference evidences for a correlation between changing climate parameters and the parameters of the natural and socioeconomic systems under investigation are obvious. In order to explain statistical correlation by cause-effect relations a more intensive interdisciplinary cooperation between marine scientist, geologist, archaeologist, historians, socio-economists and climate researchers is recommended.

- The BACC report provides an appropriate data base for interdisciplinary studies of climate change effects. However, data in higher spatial resolution (for instance sea level change) are needed for coastal system studies and investigation of climate in cities. Therefore, the preparation of a BACC-II report is strongly recommended to an earliest date.

- In the southern and south-eastern Baltic countries numerous national projects are set up for studies of (in a wider sense) climate change effects. It is recommended to link these groups and to harmonize their work plans. Research networks under an EU umbrella could serve as an appropriate vehicle for international co-operation. As an example serves an anticipated network for coastal studies.

- In order to disseminate newest scientific results and skills it is recommended to organise summer schools which shall bring together in particular the academic youth for training (including field studies and modelling procedures) in interdisciplinary climate related studies.

- For the near future increasing research activities are expected regarding the cause-effect relation between green house gas emission, climate and environmental system reactions for the Baltic Sea basin. Results should be reflected by a second conference dealing with the climate change effects for the Southern Baltic region to be held at Szczecin in 2012.

A special issue of the Journal of Climate Research is planned to publish selected papers as conference proceedings.

Session A: Marine and terrestrial proxies for reconstructions of paleo-climate

In Session A on ‘Marine and terrestrial proxies for reconstructions of palaeoclimate‘ new evidence about past climate change from marine and terrestrial records has been presented and discussed. Particular emphasis was on clear hemispheric differences during major reorganization of the climate system during the last termination. This demonstrates the need for more studies on regional climate variability for providing a better mechanistic understanding even of the global climate system. An example from the Baltic region has been revealed from the Lake Hańcza sediment record in northeastern Poland showing that the first 1-2 millennia of the Holocene climate in this region was clearly influenced by the remaining part of the Scandinavian ice sheet that was responsible for a particular atmospheric circulation pattern dominated by cold and dry north easterly winds. In contrast, in the western part of the Baltic warmer Atlantic air masses influenced the climate much earlier. This lag in climatic amelioration is also reflected in the development of the vegetation. The main deciduous tree taxa invaded northeastern Poland later than other regions.

Another important benefit from this combined terrestrial and marine proxy session was the documentation that each proxy record is sensitive to different climate or environmental signals. Particularly coastal sediment records are not only sensitive climate recorders but also respond to regional hydrological changes and the transgression phases of the Baltic Sea. Using high-resolution and partly laminated records from the Gotland deep enabled to establish long time series of wind driven water circulation, thus providing the potential for a very detailed reconstruction of the North Atlantic oscillation in this region for the entire Holocene. A general lesson for future research strategies is the recognition of the importance to conduct (1) high-resolution research in order to detect even decadal-scale variability and (2) further establish a firm multi-archive approach combining proxies from different archives in order to provide a more comprehensive data set of climate and environment variability.

Session B: Modeling of past climate change and future projections

Session B covered different aspects of the efforts to analyse and model the Baltic Sea area in the last decades and possible future developments. The session was not

only focused in the Baltic Sea climate but considered also climate impacts that are already being observed and are forecast for the future. Temperatures in the Baltic Sea area have increased in the last decade in step with the global temperatures. The contributions about precipitation also identified changes, with increases in wintertime and decrease in summer time, that agree with those simulated by current climate models. These trends, together with the temperature development, will to some extent change the hydrological regime of the Baltic Sea. It could have impacts on the water mass formation in parts of the Baltic and modulate the vertical exchanges through a modified stratification. Many presentations in this session confirmed the strong influence of the North Atlantic Oscillation, and in general of surface winds, on many features of the Baltic Sea, ranging from precipitation to Baltic Sea level.

For assessing future changes, the importance of fathoming a long and wide perspective of past environmental changes becomes increasingly important. Although globally future changes will probably be brought about by different drivers than in the past, a lot can be learned from past epochs about the reaction and the variability of the Baltic Sea as a system. The estimation of the range of natural variations require a careful assessment of the available observations displaying the impacts of regional climate change, for instance in river run-off or the frequency of drought periods, and sea-level.

Future work will benefit from merging the analysis of observational data and result 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 epoch, for instance from satellites, and also from previous untapped archives, such as proxies and meteorological data. But on the other hand, this increasing model complexity requires a careful validation of the models and of the data sets themselves.

In addition, climate change and environmental change are coupled and unexpected synergies may arise between both. Modelling activities 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 by climate and anthropogenic activities than are entangled in a so far unclear way.

Session C: Climate and anthroposphere interactions

The session was devoted to the effects of climate change on: technologies for the provision of goods and services; urbanization processes; land use planning; the property market including technical and social infrastructure and capital investment effects on its maintenance and development; agriculture, fishery, forestry, and tourism; public, social, economic, technical and health safety; and the quality of life. But, here we do realize not a one-sided relation only. There are remarkable effects of those factors on climate too. The main message, which appeared in oral and poster presentation of the section refers to the diversity of interactions of anthroposphere and climate change. Participants discussed so different elements of anthroposphere, such as industry, fishery, agriculture, tourism, engineering, architecture and cultural heritage referred to climate changes in the Baltic Region. All participants pointed out the need for detailed research on climate changes interactions with these areas. Whereas some speakers did analyze various factors causing climate change, such as exhaust gas emission from fishing vessels, others presented results of their studies in anthropogenic impact of bottom sediments of the Vistula Lagoon. First of all, the future consequences of climate change in many areas have been considered. One focus was set to a central Polish city, afar from the Baltic Sea, which was as a laboratory example of climate changes. Another point of view was the broad scale effects of climate change. Here, factors such as water management and engineering work have been discussed. One example was presented as a vision of future models of water sports in the Baltic Sea region.

Session D: Prehistoric communities and climate change

The session focused on the massive climate changes after the Weichselian glaciation which had led to a variation of different environmental conditions under which hunter and gatherer societies had to adapt their subsistence strategies. Results have been 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 has been paid to late hunter-gatherer societies, coastal oriented fishing communities, and the early farming societies.

Under the title “Hunters and fishers in a changing world – preliminary results of the archaeological fieldwork 2003-2008 of the SINCOS research unit in Wismar Bay, Germany” latest results of an interdisciplinary research group have been presented. Here, the main discussion was devoted to the role of the naturally changing climate to the “Neolithic Revolution”. In general, the presentations have shown a trend in archaeological investigation: the interdisciplinary cooperation with natural scientists as geologist and biologists in order to find out driving forces for societal development. As examples served presentations of palynological data on the Late Mesolithic and the transition to the Neolithic economy in Wolin Island at the southern Baltic coast, and the Influence of geological changes on the human settlement in the region of Dziwna River (NW Poland).

Session E : Climate variability and change: impacts on Baltic Sea Coasts

The session focused on climatically controlled sea level rise and the resulting hydrographic stress 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, and the role of extreme (catastrophic) events and other risks, as well as innovative concepts for coastal protection and new coastal zone management approaches. All these topics have been presented in talks and on posters and have been discussed between geoscientists, coastal engineers, and regional authorities.

The presentations covering numerical modeling of hydrodynamic and coastal processes showed both, the actual and improved possibilities of numerical model, and the demand to further improve numerical models and numerical modeling concepts. An interesting modeling concept was shown using examples from Australia. Here, one model with different equation families (momentum, continuity, etc.) has been implemented into one model. Hence, this model can be adapted on an extremely wide variety of questions covering regional scales from several meters (e.g. in hydraulic models) to hundreds of kilometers (wide coastal stretches of Australia) and time scales from hours to years, decades and centuries. This seems to be a promising concept for further development and research projects.

Another good basis for further research is the hind-cast of the meteorological conditions during the 1872 extreme storm event in the south western part of the Baltic Sea. Based on this analysis, a wide variety of applications for meteorologists, geoscientists and also engineers seems to be possible.

Several presentations showed the vulnerability of the sandy southern Baltic Sea Coasts to changes (rising) of the mean water level and also to changes of the hydrodynamic conditions (e.g. waves and currents). The key questions for the future are:

- Do we have enough sandy material for the natural development of the sandy Southern Baltic Sea Coasts?
- Will erosion processes be accelerated?
- How will the Southern Baltic Coast most probably look like in 50 / 100 / 250 / 1000 years?
- Can we use the classical Coastal Protection measures also in the near and medium term future?

From these questions a wide variety of research projects will be derived as for example a Polish / German / Lithuanian joint research project on the Sediment Dynamics of the Southern Baltic Sea, where the Polish part of the project (COPAF - COASTLINE CHANGES OF THE SOUTHERN BALTIC SEA - PAST AND FUTURE PROJECTION) is ready to get started in November 2009.

As a summarized conclusion of session E it can be stated that the expected accelerated sea level rise within the next century / centuries will be one of the most important questions also at the Southern Baltic Sea Coasts with respect to the main areas of conflict as coastal protection, environment protection, economic development, tourism, etc.