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Baltic Earth
Earth System Science for the Baltic Sea Region

Newsletter

Contents

Baltic Earth – Earth System Science for the Baltic Sea region

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After 20 years of intensive scientific and outreach activities, the Baltic Sea Experiment (BALTEX , 1993-2013), one of the original continental-scale experiments of the Global Energy and Water Cycle Experiment (GEWEX) within the World Climate Research Program (WCRP), recently came to its scheduled end. As BALTEX was among scientists regarded as a very successful research programme, the science steering group agreed to launch a successor programme with the new name “Baltic Earth”, with a revised focus on Earth system science. The programme is led by a renewed and younger steering group to continue the interdisciplinary and international collaboration in the Baltic Sea region. Although Baltic Earth will face new challenges, it inherits the BALTEX network (people and institutions), infrastructure (secretariat, study conferences, workshops, and publications) and scientific legacy, symbolized by a somewhat modified logo (compare the logos on both covers of this issue). Like BALTEX, the new programme aims to be embedded into international, global-scale programmes like GEWEX/WCRP and Future Earth.

The vision of Baltic Earth is to achieve an improved Earth system understanding of the Baltic Sea region. This means that the research disciplines of BALTEX will continue to be relevant, but with a more holistic view that encompasses processes in the atmosphere, land, and sea as well as in the anthroposphere. Specific „Grand Challenges“ are being formulated that will represent major interdisciplinary research questions to be tackled by the new programme in the coming years. Thematic assessments of particular research topics will be compiled by expert groups which shall help to identify gaps in our current knowledge and to initiate research projects. An example of such a thematic assessment with a benefit for society is the BALTEX Assessment of Climate Change for the Baltic Sea Basin (BACC). It summarizes the currently available knowledge on past, present and future climates in the Baltic Sea region, following the approach of the Intergovernmental Panel on Climate Change, but with a much more pronounced regional focus. At present, the second assessment is in its final phase and is expected to be published in spring 2014. One important activity of Baltic Earth will be to continue this series of assessments.

A science plan is being developed by the acting Interim Science Steering Group (ISSG) and will be available in summer 2014. It will be presented at the 3rd Lund Workshop on Regional Climate Modelling. Today, the ISSG consists of 22 scientists (7 females and 15 males), representing 10 Baltic Sea countries, various disciplines and key institutes of the region. The ISSG is chaired by Markus Meier (Swedish Meteorological and Hydrological Institute, Sweden) and Anna Rutgersson (Uppsala University, Sweden). After the implementation phase of Baltic Earth, a permanent Science Steering Group (SSG) will be appointed in June 2014.

Markus Meier, Marcus Reckermann and Anna Rutgersson (from left) unveil the new Baltic Earth logo at the 7th Study Conference on BALTEX.

The science plan will be updated regularly and will respond to a continuously on-going definition of core research questions that are identified as key scientific issues or Grand Challenges. These will be identified at upcoming workshops and conferences and by assessing existing knowledge in specific research fields by dedicated working groups. Research foci are planned for periods of about 3-4 years. Baltic Earth will communicate with stakeholders and national and international research funding agencies to promote funding relevant to the Grand Challenges.

Currently, a Senior Advisory Board (SAB) is being installed, consisting of members with extensive international experience in a specific scientific field of Baltic Earth and research management. The tasks of the SAB will be to provide advice to the SSG in terms of strategy and overall directions; to provide insight and contacts to relevant stakeholders, international boards and funding organizations; and to assist in acquiring financial support for specific Baltic Earth activities which require additional funding.

The provisional Baltic Earth Grand Challenges are summarized below:

1. Salinity dynamics in the Baltic Sea. This is a particularly relevant topic for the Baltic Sea, due to its unique oceanography. Salinity dynamics are directly related to the water cycle of the entire catchment area, and its understanding is a prerequisite for the understanding of ecosystem dynamics. Available projections suggest a decrease of up to 2-3 salinity units by the end of the century. The working group will investigate regional precipitation patterns (runoff), atmospheric variability (wind), saline water inflows, and the exchange between the sub-basins and turbulent mixing processes in more detail. The outcome will be a review article including also recommendations to improve coupled atmosphere-ocean models to be used for new regional climate projections (see also the article on page 3).
2. Land-sea biogeochemical feedbacks in the Baltic Sea region. The processes occurring within the drainage area greatly influence the functioning of the Baltic Sea ecosystem. This topic addresses the interaction between the land and the sea including also multiple stressors like eutrophication, acidification, overfishing and climate change. Numerous experimental data and sophisticated model tools are available, but there is a lack of process understanding and representative process parameterizations. On 13 November 2013, a first strategic international Baltic Earth Workshop on "Challenges for biogeochemistry research in the Baltic Sea Region" was held in Sopot, Poland.
3. Natural hazards and extreme events in the Baltic Sea region. Natural hazards have very complex origins, and presently the understanding as well as the capability to predict extreme events is limited. This is generally well recognized regarding infrastructure related to dam safety and urban flooding risks. However, the range of ecosystem services at risk, including biodiversity and vital societal functions such as drinking water supply, is poorly defined. Many natural hazards have hydro-meteorological origins (storms, waves, flooding, droughts) and can potentially be better described and predicted. Man-made structures can alter the impacts of extreme events like floods, e.g. through river regulation, land reclamation, dams, soil sealing, and sewage systems in urban areas, and all of these factors need to be taken into account when estimating potential impacts. A first strategic international Baltic Earth Workshop on "Natural hazards and extreme events in the Baltic Sea region" is planned for 30-31 January 2014 in Helsinki, Finland (see also the article on page 5).
4. Understanding sea level dynamics in the Baltic Sea. The global mean sea level shows large variations at regional scales, which are reflected in the heterogeneous pattern of sea-level trends in the Baltic Sea over the past 30 years. The large uncertainties in projected future global sea level rise are thus magnified when considering regional scenarios for sea level change. The complex bathymetry of the Baltic Sea and the influence of the North Sea and the Baltic Sea catchment area present challenges for sea level projections that are distinct from the global scale. The working group will utilize available long-term records of tide gauge and satellite data to assess multi-decadal variability and centennial trends. Further, global sea level scenario simulations will be regionalized for the Baltic Sea and North Sea regions. A Baltic Earth Workshop on satellite data for sea level research in the Baltic Sea is under planning.
5. Understanding regional variability of water and energy exchange in the Baltic Sea region. This topic contributes to the WCRP Grand Challenges and GEWEX Science Questions, and continues some former BALTEX research areas that still remain open. Some of those topics include efforts for an improved understanding of cloud-aerosol-feedback mechanisms, cloud processes, and atmospheric boundary layer processes for improved modeling capabilities; the diagnosis of natural variability of energy and water components including changes in extremes; the observation of atmospheric processes and characterization of uncertainties using conventional meteorological and hydrological observations; and surface and satellite based remote sensing techniques.

Within these Grand Challenges, anthropogenic changes and impacts will be treated together with the natural drivers. In addition to the scientific challenges, outreach and education are expected to be strong components of Baltic Earth. Dedicated working groups on outreach and communication as well as on education have been created. Their tentative aims are (1) to provide an arena for scientific discussion to communicate findings within the Baltic Earth research community as well as with other research

communities and society (see also the article on page 7), and (2) to communicate the importance of the Grand Challenges to funding agencies and to promote funding of relevant research. Major educational activities will be the organization of summer schools in the Baltic Sea region on specific Baltic Earth topics.

Additional working groups which are inherited from BALTEX, focus (1) on the added value of regional climate system models for the Baltic Sea catchment area and (2) on the assessment of existing scenario simulations for the Baltic Sea, investigating the combined impact of changing climate and changing nutrient loads from land and from the atmosphere. The differences in available projections assuming, for instance, the implementation of the Baltic Sea Action Plan (BSAP) for nutrient load reductions, will be explained to stakeholders like the Helsinki Commission (HELCOM). Both working groups will produce a scientific review article as outcome. For all working groups interested new members are very welcome.

www.baltic-earth.eu
www.gewex.org
www.icsu.org/future-earth
www.helcom.fi

Salinity dynamics of the Baltic Sea

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Within the new program Baltic Earth, key scientific issues or Grand Challenges (GC) for future research have been identified. One of the GC for Baltic Earth is ‚Salinity dynamics of the Baltic Sea''. The detailed understanding of the salinity dynamics is mandatory for a better knowledge of the ecosystem of the Baltic Sea. Furthermore, salinity is the key parameter for understanding the energy and water cycle of the Baltic area. Still, the present knowledge of the salinity dynamics is very limited. Thus, climate variability of atmospheric forcing, including regional precipitation patterns and runoff, water exchange with the North Sea (Major Baltic Inflows), sub-basins circulation and water exchange and vertical turbulent mixing will be of core interest. The present knowledge of the salinity dynamics are summarized in detail in Leppäranta and Myrberg (2009) and in the BACC Author Team (2008), here we will only give a very condensed view on the aims of the working group on ‚Salinity dynamics of the Baltic Sea''.

The salt budget

The salt budget of the Baltic Sea is determined by a balance between saline inflow from the Kattegat and brackish water outflow from the Baltic through the Danish Straits. River runoff and precipitation cause dilution, while evaporation acts in the opposite direction. Ice formation and melting act as evaporation and precipitation, respectively, but have no influence on an annual timescale. Generally, during dry periods the mean salinity of the Baltic Sea increases, while during wet periods it decreases. These long-term changes are superimposed by the atmospheric-driven water exchange between North Sea and Baltic Sea. The salinity and the stratification in the deep basins are linked to the occurrence of Major Baltic Inflows (MBIs; Matthäus, 2006) of higher saline water of North Sea origin, which occur sporadically and transport higher saline and oxygenated water to the deep layers. These major inflows are often followed by stagnation periods with no strong saline inflows, during which the permanent halocline weakens and even disappears in some basins. Extended areas of oxygen deficiency develop in the areas where the salinity stratification remains.

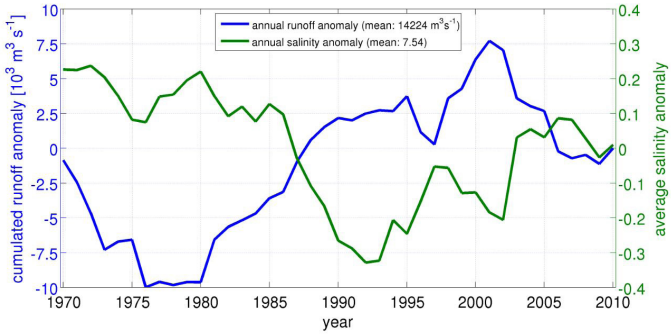

Figure 1. Accumulated anomaly of river runoff to the Baltic Sea (blue line) based on runoff data extracted from Kronsell and Andersson (2012), and volume averaged annual salinity of the Baltic Sea (green line) based on BSIOM.

Decadal variations

Salinity variations on decadal timescales are governed by the water balance. They have been small though significant over the last 100 years (Leppäranta and Myrberg, 2009). About half of the decadal variability of the average salinity of the Baltic Sea is related to the accumulated freshwater inflow (Meier and Kauker, 2003). Figure 1 displays the accumulated annual runoff anomaly and the anomaly of the averaged salinity of the Baltic Sea for the period 1970-2010. Salinity has been calculated from the Kiel Baltic Sea model BSIOM (Lehmann and Hinrichsen, 2000), and runoff data have been extracted from Kronsell and Andersson (2012). From 1970 to 1980, runoff was mainly below the average and thus the mean salinity was above the long-term mean. With the beginning of the 1980s, runoff anomalies were again mostly positive until 2002. Until 2010, runoff decreased and reached about the average value. The mean salinity of the Baltic Sea closely follows variations in accumulated total river runoff.

Thus, the freshwater inflow plays a dominant role for the development of the average salinity of the Baltic Sea.

Another significant part of the decadal variability of salinity is caused by the low-frequency variability of the zonal wind (Meier and Kauker, 2003). The wind stress anomaly is balanced by a sea-level slope anomaly between the Kattegat and the central Baltic Sea. The link between the large-scale atmospheric circulation and annual salinity revealed that roughly one half of the salinity variability is correlated to the meridional atmospheric pressure gradient over the North Atlantic, and thus to the strength of the westerly zonal winds.

Inter-annual variations

The Gotland Deep is a representative location for describing the development of the salinity stratification of the entire Baltic Sea. Indeed, changes of mean salinity match with 2% difference with the changes calculated over all sub-basins (Winsor et al. 2001). The ICES sub-division 28 represents aggregated salinity observations from the eastern Gotland Basin and the Gulf of Riga. The salinity development for the recent 60 years is displayed in Figure 2. Above the halocline, a period of low salinity started from the 1980s. The minimum level of salinity was reached around 2002/2003. Afterward, it recovered slightly until 2010. This development is closely associated with the accumulated river runoff (see Figure 1).

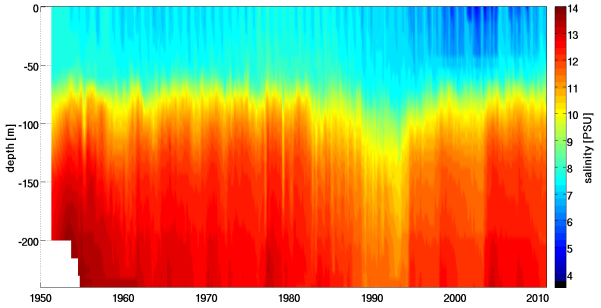

Figure 2. Time series of salinity profiles of the ICES sub-divison 28 (eastern Gotland Basin) for the period 1950 to 2010, based on ICES monthly database.

The depth of the halocline in the eastern Gotland Basin is related to salt water inflows originating from the Kattegat. Highly saline water enters the Baltic Sea by overflowing the main sill depths in the Danish Straits, further flowing as deep dense bottom current through the Arkona Basin and Bornholm Gat into the Bornholm Basin. After passing the sill to the Stolpe Channel it can reach either the Bay of Gdansk or the eastern Gotland Basin. Only stronger salt water inflows are able to substitute the bottom water. In lack of stronger inflows, from the 1980s to 1993, the depth of the halocline deepened and simultaneously weakened (Figure 2). During this low-salinity phase, the deep water in the eastern Gotland Basin was poorly ventilated, with oxygen depletion as a consequence. After the Major Baltic Inflow in 1993, deep water salinity increased again reaching similar deep water conditions in 2010 as in the 1970s. In the Gulf of Finland a reverse situation occurred: during the stagnation in 1980's the halocline gradually weakened and finally disappeared, with the consequence that the vertical mixing extended to the bottom layer, and ventilated the whole water column. After the Major Baltic Inflow in 1993, the old and stagnant deep water of the northern Gotland Basin was lifted up, and entered the Gulf of Finland as bottom water. Simultaneously, the salinity stratification strengthened again, causing occasional oxygen problems ever since.

Within and below the halocline, the salinity development in the Bornholm Basin is characterized by irregular salinity jumps and periods of a slow decrease in salinity (Figure 3). The bottom water in the deep sub-basins is renewed mainly by large perturbations, so-called major Baltic saltwater inflows (Matthäus and Franck, 1992; Fischer and Matthäus, 1996). Major salt water inflows are typically forced by a sequence of easterly winds lasting for about 20 days followed by strong to very strong westerly winds of similar duration (Lass and Matthäus, 1996). Since the mid-1970s, the frequency and intensity of major inflows have decreased (Figure 3). They were completely absent between February 1983 and January 1993.

Generally, larger water volume changes due to in- and outflows can be estimated from Landsort sea level observations. In spite of the decreasing frequency of MBIs since the mid-1970s, there is no obvious decrease in the frequency of larger volume changes (Figure 3).

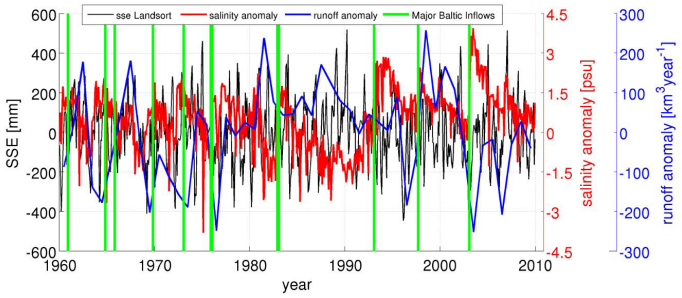

Figure 3. Time series of deep water salinity of the ICES sub-division 25 (Bornholm Basin, red line) based on ICES monthly database, annual river runoff (blue line) based on runoff extracted from Kronsell and Andersson (2012), sea surface elevation at Landsort (SMHI data base) and MBIs (green lines; Matthäus, 2006) for the period 1960 to 2009.

An explanation for the decreasing frequency of major inflows can be related to changes in meteorological patterns (Lehmann et al. 2011). Stronger westerly winds during winter are associated with a positive NAO index with intensified precipitation, lower evaporation and increased river runoff. In consequence, above-normal Baltic Sea levels occur frequently for long periods which hamper saltwater inflows. Lass and Matthäus (1996) found an anomalous west wind component at the station Kap Arkona between August and October for seasons without major Baltic Sea inflow compared to the corresponding seasons with major Baltic

Sea inflow during 1951–1990. They suggested that in years without major Baltic Sea inflow, the prevailing easterly winds emptying the Baltic Sea prior to the main inflow event were reduced.

Furthermore, an increase in river runoff could decrease the surface salinity and the salinity difference between upper and lower layer would increase. This, in turn would lead to reduced vertical mixing and as a consequence worsening of oxygen conditions in the deep layers (Leppäranta and Myrberg, 2009).

Climate projections

Variations in the salinity of the Baltic Sea are connected to regional climate conditions in the drainage basin. It has been hypothesized that increased winter time precipitation, coming as increased extent in the form of rain, would lead to an increase in freshwater outflow from the Baltic Sea. Consequently, the Kattegat water mass would become more fresh and new salt water inflows would be less likely to occur, and as a consequence the salinity level of the Baltic Sea would decrease (BACC Author Team, 2008; Leppäranta and Myrberg, 2009).

Conclusions and outlook

Salinity is an elementary factor controlling the ecosystem of the brackish Baltic Sea. Salinity dynamics is determined by net precipitation, river runoff and the compensating inflow of higher saline waters from the Kattegat, revealing higher salinity during dry periods and lower salinity during wet periods. On the short-term, the salinity level is determined by the variability in the water exchange between North Sea and Baltic Sea. Major Baltic Inflows, although occurring sporadically, carry large volumes of high saline water in to the deeper layers and change the level of deep water salinity for several years. Although MBIs ventilate deep and bottom water layers, oxygen conditions quickly turn back to hypoxic conditions due to an increased stratification strength.

Still the present understanding of salinity changes is very limited, and future projections of the salinity evolution are rather uncertain. First studies of future development indicate a 2-3 PSU decrease in salinity to the end of the century due to the expected increase in precipitation, even if the projected changes still have a high level of inaccuracy.

Since the Baltic Sea ecosystem has adapted to the present salinity regime, expected changes would exert an enormous stress on marine fauna and flora with associated negative social-economic consequences for the Baltic Sea countries.

More detailed investigations on regional precipitation patterns (runoff), atmospheric variability, highly saline water inflows (MBIs), the exchange between the sub-basins, circulation and especially vertical turbulent mixing processes are still needed. Such studies require more sophisticated measurements, especially with remote sensing techniques. Furthermore, an upgrade of the resolution of the oceanographic models which are mostly eddy-permitting, but not eddy-resolving is necessary. There is also a strong need to carry out re-analysis of meteorological model data in order to reach a high level of accuracy for atmospheric forcing used in oceanographic circulation models. There is also a need for new climate projections simulations with improved atmospheric and oceanographic (coupled) model systems.

The working group for the GC on ‚Salinity dynamics of the Baltic Sea'' will assess the current knowledge, define research gaps and stimulate research in this field. This will be accompanied by setting up specific workshops or sessions at international conferences.

References

BACC Author Team, 2008. Assessment of Climate Change for the Baltic Sea Basin. Springer Verlag Berlin, 473 pp.

Fischer, H., Matthäus, W., 1996. The importance of the Drogden Sill in the Sound for major Baltic inflows. J Mar Syst 9:137–157.

Kronsell, J., Andersson, P., 2012. Total regional runoff to the Baltic Sea. HELCOM Indicator Fact Sheets 2011, (http://www.helcom.fi/environment2/ifs).

Lass, H. U., Matthäus, W., 1996. On temporal wind variations forcing salt water inflows into the Baltic Sea. - Tellus, 48A, 663-671.

Lehmann, A., Hinrichsen, H.H., 2000. On the thermohaline variability of the Baltic Sea. J. Marine Syst., 25, 333 – 357

Lehmann, A., Getzlaff, K., Harlass, J., 2011. Detailed assessment of climate variability in the Baltic Sea area for the period 1958 to 2009. Clim Dyn 46:185-196.

Leppäranta, M., Myrberg, K., 2009. The physical oceanography of the Baltic Sea. Springer-Verlag, Berlin-Heidelberg-New York, 378 pp.

Matthäus, W., Frank, H., 1992. Characteristics of major Baltic inflows – a statistical analysis. Cont. Shelf Res. 12:1375-1400.

Matthäus, W., 2006. The history of investigationof slat water inflows into the Baltic Sea – from the early beginning to recent results. Marine Science report 6. Baltic Sea Research Institute, Warnemünde, Germany.

Meier, H.E.M., Kauker, F., 2003. Sensitivity of the Baltic Sea salinity to the freshwater supply. Clim. Res. 24:231-242.

Winsor, P., Rohde, J., Omstedt, A., 2001. Baltic Sea ocean climate: an analysis of 100 yr of hydrographic data with focus on the freshwater budget. Clim. Res. 18:5–15.

Natural hazards and extreme events as key factors in understanding and predicting natural disasters: A Grand Challenge for the Baltic Sea region

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Contemporary society is very sensitive to extreme geophysical events that have severe implications for human life, generate economic losses and influence ecosystems. Understanding the underlying causes of natural disasters (i.e. the nature of the extreme events and the links to ecosystem and society) increases the ability to predict the occurrence and severity and may save human lives as well as mitigate economic losses. Many natural hazards have hydrometeorological origin (storms, waves, flooding, droughts) and can potentially be better understood. Natural hazards are often caused by several factors (storm surge in combination with precipitation and river runoff might cause extreme flooding). Closely linked to natural hazards are extreme events, for which presently the prediction capabilities are very limited. This is generally well recognized regarding infrastructure such as dam safety and urban flooding risks, but the range of ecosystem services at risk is more poorly defined, from vital societal functions such as drinking water supply to biodiversity.

Recent changes in climate factors for the Baltic Sea region are generally well described. The uncertainty is larger when analyzing changes in extreme conditions, as they are few.The shortage of data reduces the statistical significance in the analysis (BACC II). There are indications that the storm tracks in the Northern Hemisphere have shifted slightly northward as a consequence of global warming during the last century. In addition, there are indications of additional circulation changes in the Northern Hemisphere due to the significant reduction of Arctic ice cover (BACC II). This can potentially alter wind and precipitation patterns (the origin of many natural hazards). These relations are, however, not clearly understood and described and there is a need to further investigate this with a Baltic Sea perspective. The adaptation capability of many terrestrial ecosystems, marine species and society in general depends very much on the changes in the extreme events.

Photo: Finn Majlergaard

Suggested key research areas for the Baltic Sea region with an Earth System perspective are:

- Understanding changes in atmospheric circulation in the Northern Hemisphere (due to higher global mean temperatures and reduced sea ice in the Arctic Ocean) and the impact of circulation changes on climate extremes in the Baltic Sea region in the future.
- Response and contribution of marine processes to changes in extreme and climate variability (water level, waves, ice conditions, sea surface temperature).
- Monthly to seasonal prediction systems and probabilistic estimates of the extreme events.
- How has the achievement of environmental goals influenced changes in extreme conditions (droughts, floods and heat waves)?
- How vulnerable is drinking water security to hydrometeorological extremes?
- What is the response of marine ecosystems to extreme events (coastal processes) using integrated studies (what drives what, when and how?).
- How will the carbon cycle of the Baltic Sea region respond to changes in extreme conditions (the amount, timing and quality of carbon delivered to the Baltic Sea, and the subsequent fate of that carbon).

To initiate the work focusing on extreme events in the Baltic Sea region, we are organizing a Workshop in Helsinki, 30-31 January 2014. The aim of the Baltic Earth Workshop is to review our understanding of extreme events in past, present and future and to direct research needs (see also page 11).

Workshop goals are

- to establish linkages between groups focusing on observations, statistical analysis and predictions,

- to identify gaps in knowledge and weaknesses in our ability to observe, understand and statistically calculate extreme events, and
- to review modelling capabilities to estimate the occurrence of extreme events.

Projected outcomes are

- a review of the current state-of-the-art research, gaps and advances in observations, analysis, modeling and prediction (focusing on the scientific understanding),
- action items with identified partners on how to coordinate overlapping interests, close gaps in knowledge, and enhance networking between groups; and
- plans for further research in Baltic Earth

www.baltic-earth.eu/BACC2
www.baltic-earth.eu/hazards

What do interested audiences think about climate change, the role of science and the Baltic Sea?

Hans von Storch *(hvonstorch@web.de), Helmholtz-Zentrum Geesthacht, Germany*

When discussing issues related to climate change, and in particular the process and results of BACC, I have recently used our "Turning Point" technology (for a voting pad, see Figure) to map the opinions among the audience. This system allows showing questions and different answer possibilities on the screen, and the participants respond by pressing a number of the pad – the frequency is determined by software on the laptop. When the voting is complete, the result is shown on the screen – visible for everybody. The voting itself is anonymous, as nobody can really see which number the neighbor is pressing.

The motive for doing this is two-fold, one to allow the audience to note that there are indeed different opinions in the room – the response is usually very positive – and that it may give us Baltic Earthers an extra understanding on what our stakeholders perceive and believe. Obviously, these surveys do not provide a representative estimate of opinions, but a mere snapshots of very different groups. I my case, these groups have all in common not only that they are interested in climate and the Baltic Sea, but they also have joined a presentation by Hans von Storch.

So far I have used the system three times in the Baltic Sea context, with audiences between 15 and 50 people. In one case, voting pads failed so that only about 10 people could participate. These three runs took place in December 2013 in Germany, Denmark and Latvia. The survey was done in the local languages.

The questions used so far were:

Man-made climate change

1. I am convinced that we are currently experiencing human-induced climate change.
2. I have serious doubts that we are dealing with a human induced climate change
3. No answer

Energy & climate policy

1. I support the energy transition policy that leads away from nuclear, oil and coal use
2. I find the transition premature and connected with too high costs
3. I do not believe that science legitimizes the energy transition
4. I tend to prefer a different climate policy, such as adaptation as needed or geoengineering
5. No answer

Extreme weather events

1. I perceive an increase in the strength of regional storms in the last decade
2. Our storms have always been dangerous but I cannot determine a systematic change towards more or stronger storms
3. No answer

Role of science in policymaking

1. Science should make policy recommendations to deal with problems when first indications show up that there is a serious problem
2. Science is to make policy recommendations dealing with problems when a consensus is made in science
3. Science should not issue any recommendations, but only describe the problem and possible solution strategies
4. No answer

I am seriously concerned about the state of the Baltic Sea because of

1. Eutrophication
2. Pollution (incl. dumped ammunition)
3. Overfishing
4. Climate change
5. Several causes
6. Other causes
7. No answer

The Danish, German and Latvian versions are available on the web: Go to thebaccblog.blogspot.de where this article is posted and direct links to the details of the survey are given.

	D	DK	LV
Max sample	27	12	13
A % Climate change			
Man made	48	100	38
Doubts	48	0	50
No answer	4	0	13
B % Policies			
Support of present energy policy	42	75	11
Present policy immature	31	0	33
Science insufficient to legitimize energy policy	24	0	55
Other climate policy	4	17	0
No answer	0	8	0
C %Extreme weather			
Recently more storms	28	45	55
Unchanged	60	18	46
No answer	12	36	0
D % Policy			
Recommendation based on indication	40	33	50
Recommendation based on consensus	32	42	8
No recommendation, but options	20	17	42
No answer	8	8	0
E % Baltic Sea			
Eutrophication	8	0	8
Environ. Pollution	23	0	23
Overfishing	4	8	0
Climate change	8	8	8
Several causes	42	75	54
Other causes	8	8	0
No answer	8	0	8

The frequencies of responses of our surveying of - so far - three quite different groups are given in the table above. The German group was an audience in a German University town, the Danish group were students in a regular lecture; the Latvian sample is a group of stakeholders.

Evidently, the opinions vary greatly. Among the Danish students, there are no doubts about the fact that man is the main driver behind the ongoing climate change, whereas in the other two groups from Germany and Latvia, about 50% of the participants have serious doubts about this explanation. In Germany and Denmark, the respondents favor the present energy-policy of out-phasing fossil fuels (and nuclear) from the energy mix, but in Latvia, stakeholders are more reluctant and find such a policy immature and insufficiently supported by science.

A change in storminess is perceived by a majority in the Danish and the Latvian sample, but not in the German sample. 60% to 70% in all three groups favor science to give policy recommendations, either when first signs show up or when consensus has been established. The position of an "honest broker", which provides analysis and contextualizes options, is favored by 20% in Germany and Denmark, but by 40% in Latvia.

With respect to causes of concern with respect to the Baltic Sea, most respondents see several significant factors at work; the single most significant is seen in pollution, whereas all others are only on the minds of very few members of the groups. Interestingly, the Danish students voice no concern about pollution and eutrophication as primary issues, maybe because of their chemistry curriculum is likely dealing also with water quality issues.

Help needed

I ask for comments of this exercise – are these questions precise enough, are answers to such questions informative? I am ready to change the catalog of questions accordingly. Also, I would help to get the list of questions also in other local languages of the Baltic Sea regions. Please check the compatibility of the different versions.

I would welcome very much, if others would like to use the same format with their audiences. This effort would then become a major component in the Working Group on Outreach and Communication within Baltic Earth.

PS: The internet tool (http://www.polleverywhere.com/) allows to do such surveys with a laptop, and the participants use their smart-phones.

thebaccblog.blogspot.de

Project Reports

FoMoBi (Foredune - Morphodynamics – Biodiversity) - A project to investigate dune dynamics and biodiversity on the Polish coast

Tomasz Łabuz *(labuztom@univ.szczecin.pl), Szczecin University, Poland*

Dune coasts cover more than 80% of the Polish coastline (length 500 km, mainly aligned). Nowadays, dunes and natural habitats are transformed into artificial habitats in coastal urban areas due coastal protection works. This type of habitat is also increasingly threatened due to the development of tourism and an anticipated increase in storminess.

The Polish research project „The location and morphodynamics of the foredune environment and vegetation fluctuations – The biodiverse habitat on the Polish coast" (FoMoBi) started in October 2011 and will continue until June 2014.

The FoMoBi project (1) is aimed at understanding the contemporary foredune relief, their dynamics, vegetation patterns and the emerging threats to that habitat as a part of accumulative coasts (en.fomobi.pl/), and (2) reflects the need of education and the future use of these valuable areas. The research is carried out with financial support from the National Center for Research and Development along the whole Polish coast, where there are sections of accumulation on coastal dunes.

The common European viper (Vipera berus) in Slowinski Nattional Park

The detailed aims of this project are:

1. Alignment - the ranges of the foredunes along the Polish coast and its types through their inventory space

2. Determination of foredune variability in time, under the influence of natural and anthropogenic factors (stressors)

3. Investigation of plant habitats on the foredunes: their location and biodiversity

4. Investigation of animal occurrence on the foredunes and beaches

5. Estimation of the environmental state/condition according to the guidelines for the conduct of monitoring of Natura 2000 sites.

6. Determination of threshold conditions for environmental status, type and value

7. Determination of temporal and seasonal variability of vegetation

8. Determination of the mineral basement of foredunes

9. Assessing knowledge about the dynamics, dangers and consequences of changes in this environment

10. Preparation of guidelines for action and protection or restoration of habitats

The concept is to investigate the entire Polish coastline (consisting of 500 km of open Baltic Sea coast) simultaneously, which is a pioneering operation in Poland. The results will give a detailed description of foredune dynamics and habitat characteristics, the risks they face, their variability, and indicate a sustainable human use of this environment. The investigation area covers 25% of the dune coast (that is 410 km long), where coastal dunes are developing or have been rebuilt by aeolian processes, and where pioneer plants have wide habitats.

Preliminary results show that pioneer plant habitats on dunes are under proper nature protection only in few places. Mass tourism is a main threat for the natural landscape. Heavy storms are not so dangerous due to their natural character, causing variability of coast and dune belt reconstruction. Only 15% of the Polish dune coast is accumulating (ca. 60 km, this is 10% of the whole Polish coast that is under permanent accumulation). 30 km is in a phase of annual rebuilding after erosion by storm surges. Numerous animal groups like snakes, lizards or nesting birds (as Ringed Plover, *Charadrius hiaticula*) can be found in few places. These areas are at a distance from human settlements and can be found on Świna Gate sandbar, Łebsko Lake sandbar or Vistula sandbar. A project task is to mark these areas. Almost 35 % of the dune coast length is heavily threatened due to storm surges and is in a phase of retreat.

A part of the project is educational campaigning, i.e. the organization of practical field trips, participation in ecological or other scientific events for a wider public, workshops for stakeholders and local governments, as well as the production of flyers.

We are wide open for cooperation and exchange of knowledge on dune environment management and scientific research. You are welcome at our web sites and so are your questions in our mail boxes!

References

Łabuz T.A., 2013. Polish coastal dunes – affecting factors and morphology. Landform Analysis Vol. 22, p. 33-59, doi:http://dx.doi.org/10.12657/landfana.022.001

Project Website: en.fomobi.pl
Questions and proposals: labuztom@univ.szczecin.pl

Project Reports

plan B:altic at the Baltic Sea Parliamentary Conference in Pärnu, Estonia

Sonja Deppisch *(sonja.deppisch@hcu-hamburg.de), HafenCity University Hamburg, Research Group "plan B:altic - Climate Change and Spatial Development"*

The 22nd Baltic Sea Parliamentary Conference (BSPC) was held in Pärnu, Estonia from 25 to 27 August 2013 with the overarching theme "Sustainable Innovation for a Competitive Region". The Conference was hosted by the Estonian Parliament and Ms Laine Randjärv, BSPC President 2012-2013. A broad spectrum of participants consisting mainly of parliamentarians of the Baltic Sea States but also of government officials, experts, representatives of stakeholder organizations, youth and NGOs from the entire Baltic Sea Region, attended the conference. The conference was concluded by the successful adoption of the 22 BSPC Resolution.

Dr. Sonja Deppisch, head of the research group "plan B:altic - Climate Change and Spatial Development", was invited by the Estonian Parliament to give a presentation on "plan B:altic – climate change and sustainable land-use in urban regions of the Baltic Sea coast". The presentation was of great interest to the participants and led to a lively, in-depth discussion among parliamentarians from Germany, Norway, Iceland and other states about the issue of how to deal with climate change impacts at the local level.

References

Richter, M.; Deppisch, S.; von Storch, H. (2013): Observed Changes in Long-Term Climatic Conditions and Inner-Regional Differences in Urban Regions of the Baltic Sea Coast. Atmospheric and Climate Sciences, 3 (2), pp. 165-176. Available online: http://www.scirp.org/journal/PaperDownload.aspx?paperID=30764

Presentation: www.bspc.net/file/show/682

Conference: www.bspc.net/page/show/650

22 BSPC Resolution: www.bspc.net/file/show/696

www.planbaltic.hcu-hamburg.de/en

New Publications

Send us your recent Baltic Earth publications which you would like to share with the Baltic Earth community. We will add them to our Publication database, the website and in the coming Baltic Earth Newsletter.

www.baltic-earth.eu/publications

New peer-reviewed publications

Hägg, H.E., S.W. Lyon, T. Wällstedt, C.-M. Mörth, B. Claremar, C. Humborg, 2013. Future Nutrient Load Scenarios for the Baltic Sea Due to Climate and Lifestyle Changes. AMBIO DOI 10.1007/s13280-013-0416-4.

Łabuz, T. A., 2013. Coastal Response to Climatic Changes: Discussion with Emphasis on Southern Baltic Sea. Landform Analysis, Vol. 21: 43–55.

Łabuz, T. A., 2013. Polish coastal dunes – affecting factors and morphology. Landform Analysis, Vol. 22: 33–59.

Ning, T., G. Elgered, U. Willen, J. Johansson, 2013. Evaluation of the atmospheric water vapor content in a regional climate model using ground-based GPS measurements Journal of Geophysical Research - Atmospheres, 118 p. 1-11.

Richter, M., Deppisch, S., von Storch, H., 2013. Observed Changes in Long-Term Climatic Conditions and Inner-Regional Differences in Urban Regions of the Baltic Sea Coast. Atmospheric and Climate Sciences, 3 (2), pp. 165-176.

Tian, T., F. Boberg, O.B. Christensen, J.H. Christensen, J. She, T. Vihma, 2013. Resolved complex coastlines and land-sea contrasts in a high-resolution regional climate model: a comparative study using prescribed and modelled SSTs. Tellus A 65:1-19.

Wasmund, N., G. Nausch, R. Feistel, 2013. Silicate consumption: an indicator for long-term trends in spring diatom development in the Baltic Sea J. Plankton Res. 35 (2), 393-406.

New Books

Schmidt-Thomé, P., J. Klein (Eds.) 2013. Climate Change Adaptation in Practice - from strategy development to implementation. Wiley Blackwell Book Publication, 327 p. ISBN 978-0-470-97700-2

Events

FINNISH METEOROLOGICAL INSTITUTE

Baltic Earth Workshop on

Natural hazards and extreme events in the Baltic Sea region

Finnish Meteorological Institute, Dynamicum, Helsinki, 30-31 January 2014

The overarching aim of this Baltic Earth workshop is to review our understanding of extreme events in the past, present and future, and to identify research needs. Furthermore, workshop goals are

- to establish links between research groups focusing on observations, statistical analysis and predictions,
- to identify gaps in knowledge and weaknesses in our ability to observe, understand and statistically calculate extreme events, and
- to review modeling capabilities in order to estimate the occurrence of extreme events.

Projected outcomes of the workshop are

- to establish a review of the current state-of-the-art research, gaps and advances in observations, analysis, modeling and prediction (focusing on the scientific understanding),
- to identify partners and establish action items concerning the coordination of overlapping interests, the closure of gaps in knowledge, and the enhancement of networking between groups, and
- to contribute to the planning of future Baltic Earth research in this area.

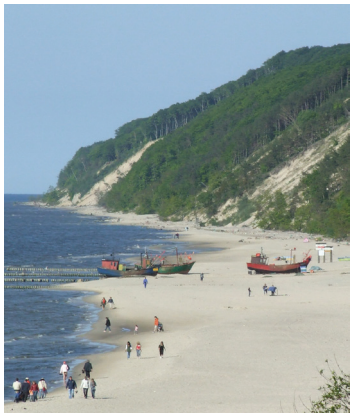
Abstract Deadline: 5 January 2014
Registration Deadline: 10 January 2014

All Infos at www.baltic-earth.eu/hazards

2nd International Conference on

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

Szczecin, Poland, 12-15 May 2014



This international conference is a follow-up on the conference on climate change in the southern Baltic region, held in Szczecin in 2009. It aims for scientists as well as planning agencies and local authorities who had expressed the need for future climate change projections suitable for management and decision making on the regional and local level, in order to help mitigate negative effects of climate change to the environment and society.

Preliminary topics of conference sessions are:

- Reconstructions of palaeo-environmental change: Geological proxies and numerical modelling
- Modelling of climate change: How reliable are future projections?
- Natural dynamics of the coastal zone and the socio-economic response from prehistoric to recent times
- Climate change and regional planning
- Changing Baltic Sea coasts and their sustainable protection
- Adaption of energy politics to climate change

In addition to these scientific topics, a one-day international "Copernicus Symposium" is planned within the frame of the conference. This symposium shall honor the 500 years anniversary of Copernicus' pioneering concept of the heliocentric system.

Abstract Deadline: 17 January 2014
Registration Deadline: 31 March 2014

All Infos at www.baltic-earth.eu/SZC2014

Events

3rd International Lund Regional-Scale Climate Modelling Workshop

21st Century Challenges in Regional Climate Modelling

16-19 June 2014

The workshop is a follow-up to the regional climate modelling workshops held in Lund, Sweden in 2004 and 2009. Research on regional climate modelling has remarkably expanded during the last few years. The aim of the Workshop is to review the overall and specific developments and progress in regional climate modelling over the last five years, to discuss pertinent open issues and challenges, and to provide input for new developments on the field. The meeting will cover a wide range of regional climate related topics, from basic modelling research on numerics, resolution and parameterisation to model evaluation and relevant observations, ensembles and applications. The workshop will also provide opportunities for working meetings for networks and projects. The workshop is jointly organised by Lund University, SMHI, DMI, HZG and the International Baltic Earth Secretariat.

Topics are:

- Regional Climate and Earth System Models
- Very-high-resolution RCMs
- Challenges for RCM Evaluation and Application
- RCM Ensembles

Abstract Deadline: 15 March 2014

Registration Deadline: 15 April 2014

All Infos at www.baltic-earth.eu/RCM2014

About

Baltic Earth is the successor to BALTEX and is dedicated to Earth system science for the Baltic Sea region in all its aspects. The scientific planning of Baltic Earth is under the guidance of the Baltic Earth Interim Science Steering Group until June 2014; thereafter, a permanent Science Steering Group shall be installed. The Baltic Earth Newsletter is edited and printed at the International Baltic Earth Secretariat with financial support through the Helmholtz-Zentrum Geesthacht, Germany.

The Baltic Earth Newsletter is intended as a means of reporting on plans, meetings and work in progress, which are relevant to the goals of Baltic Earth, as outlined in the Science and Implementation Plans for Baltic Earth.

The editor invites the scientific community to submit Baltic Earth related contibutions for publication in this Newsletter. Submitted contributions will not be peer-reviewed and do not necessarily reflect the majority's view of the Baltic Earth research community. Still, the editors reserve the right to request changes and decide on publication. Scientific material published in this Newsletter should not be used without permission of the authors.

Please, send contributions to the Baltic Earth Newsletter, requests for Baltic Earth related documents, suggestions or questions to the International Baltic Earth Secretariat via

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