FINNISH METEOROLOGICAL INSTITUTE

Baltic Earth

Baltic Earth Workshop on

Natural hazards and extreme events in the Baltic Sea region

Finnish Meteorological Institute, Dynamicum, Helsinki

30-31 January 2014

Outbreak Group and Plenary Discussions
Summary

Three groups were formed to discuss the topics of temperature and precipitation extreme events as well as sea level and storm surges. The groups had been given some questions as guidelines for the discussion. Please find the detailed outbreak working group notes including the names of participating colleagues below.

In the following plenary discussion, several topics were highlighted with direct relevance for the future processing of this topic under Baltic Earth:

- The term “extreme events” is suggested to be substituted by the more concrete “high impact events”
- The topics of high impact events of temperature and precipitation should be dealt with together as the phenomena and impacts are strongly interrelated
- One or more review papers on something like “Meteorological high impact events in the Baltic Sea region” is a desirable output of this community and should be followed. The concrete scope of the work will need to be specified.
- Databases on high impact events should be identified and analyzed, monthly means are not sufficient; e.g. a list/inventory of the “50 strongest high impact events in the Baltic Sea region”
- joint effort of different countries to produce such a data base; also digitization and availability of data
- Existing data bases of this type to be checked
- Interdisciplinarity to be extended, involve scientists of different fields but also the impact, adaptation, planning communities

The next steps would be the identification of a writing team for the suggested review paper(s). This group could, based on the brainstorming effort of this workshop, also formulate the contribution to the Baltic Earth Science Plan which is due in June 2014.

Draft Summary: Marcus Reckermann, 14 Feb 2014

Baltic Earth Workshop on Extreme Events / Outbreak Working Group Discussion 31 Jan 2014		
Theme		
Temperature Extremes	Precipitation Extremes	Sea level and Storm Surges
Chair		
Deliang Chen	Joanna Wibig	Ralf Weisse
Rapporteur		
Anna Rutgersson	Marcus Reckermann	Jari Haapala
Participants		
Bin Cheng, Arna Männik, Trin Sirtu, Timo Vihma, Deliang, Anna, Byoung, Ilkka Ljuga	Irina Partasenok, Elena Saltikoff, Piia Post, Tija Sile, Erik Gregow, Antti Mäkelä, Martin Stendel, Velle Toll, Sven-Erik Enno, Juri Kamenik	Dörte Salecker, Norman Dreier, Gustaf Klinga, Reijo Hyvönen, Vladimir Ryabchenko, Jüri Elken, Halina Kowalewska-Kalkowska, Jaak Jaagus, Helve Meitern, Maarika Org, Katri Pindsoo, Maris Eelsalu, Svenja Bierstedt
What kind of extreme events are observed in the Baltic Sea catchment area? What is the present understanding of their generation mechanisms and occurrence?		
Not only temperature – problematic in combination with other parameters (temp drought problematic for agriculture) icing (cold and humidity). Low temperature in winter and lack of snow (bad for agriculture). Risk of forest fires. Low temp much ice less snow can cause problems. In this region the low temperatures can be considered a larger problem then high temperature presently, this might change. In northern Europe we might be less tolerant to high temperature extremes. Different timescales relevant for different types of extremes. Timing, duration of relevance for society (for example dry springs for agriculture).	Large-scale: Spring flooding***, summer flooding (with special attention to 5b cyclones)***, snow storms***, cyclonic storms***, droughts** Small scale: Urban flooding*, thunderstorms*, hail events*, Föhn effect***, heavy fog* **, freezing rain (black ice, clear ice, glaze, supercooled rain) * ** Other: Lake effect on snow** Generation of phenomena mostly largely understood, but observation forecast of small-scale events often problematic (*** well understood, ** moderate understanding, * weak understanding, * ** weak to moderate understanding)	• Sea level, coastal flooding • Storm surge generated extreme events • High water levels due to wind generated waves • Rouge waves • Meteo-tsunamis • Relative mean sea level change • Prefilling (anomalies in water volume of the Baltic Sea) • Seiches • Interaction with river flooding In general good basic understanding of generation mechanism, not for occurrence Other marine hazards • Severe sea ice conditions, sea ice ridging in the coast, compression, freezing • Massive algae blooms • Fog • Temperature, salinity, anoxic conditions, mixing, internal waves, current extremes

What are the implications for society, e.g. impacts on infrastructure and social systems, but also effects of infrastructure on vulnerability?		
What kind of sectors should be targets? Ecosystems, transportation, agriculture, industry, energy, human wellbeing (thermal comfort)	Flooding, snow, freezing rain: strong impacts on traffic (all), electricity transmission networks (freezing rain), agriculture (flooding, freezing rain), wind power (freezing rain), supply and contamination of drinking water (flooding) Drought: agriculture, atomic power plants, hydropower, water supply, health, forest fires, forest damage Annual spring flooding can be well forecast, so there is a time to prepare, but it needs a costly infrastructure. Damage is wide spreading. Flashfloods cannot be anticipated enough early, damages are local, but could be serious Increasing vulnerability: settlement on historical flood plains, regulation of rivers, sealing of the ground in the urban area, land use changes – changes in retention and infiltration, pollution increasing resilience (decreasing vulnerability): dams, protection dykes, removing settlements from flood plains,	• Coastal flooding in cities • Problems in off-shore operations • User need forecast and statistics of extremes, design guidelines: coastal management, shipping and navigation, coastal and offshore engineering • Erosion, accumulation of sediments • Water pollution due to the coastal flooding, leak of harmful substances
Is the data availability sufficient to explain past extreme events? Which kind of data is needed to sufficiently describe and explain extreme events in the past?		
• Temp extremes – extremely low temperatures, data not available (very local phenomena) also extreme modelling challenge (thermal decoupling). • Ice mass balance buoy – new system for snow and ice equipment. • Old data – need to collect more long term data, check existing projects/data bases? • Reanalysis – is the best type of data set for looking at combination of data. • Quality of Precipitation data not good enough. • Extremely local phenomena – we do not have the measurements (precip, low temps).	There is a lack of past soil moisture data and data on changes in land cover, There are problems with continuous and homogenous time series of precipitation because of too low temporal and spatial resolution and river hydrographical series, because of river regulations. It is necessary to continue digitalization of historical data (together with metadata), and protect existing stations against all kinds of inhomogeneity (changes in location, changes in surrounding, changes in instrumentation, other changes). Continue remote sensing re-analysis. Checking homogeneity of remote data.	• First measurement of sea level have begun more than 200 years ago. • PSMSL center don't provide sufficient data for an analysis for extreme events • Data is available in national level • Quality depends on stations (problems in leveling, locations changes, changes in measurement techniques, temporal resolution, etc) • Hindcast simulations available (1948 →) • Several compilations of atmospheric data available • Proxy records on historical events

What is a common practice to calculate return periods of extreme events? What are the problems here?		
At the moment this is not a prioritized problem (standard methods work well enough)	Not calculated by Estonian weather service. What are the problems here? Looking for the best theoretical distribution, fitting parameters and calculation of return period. On the basis of empirical distribution (only lower return periods). Special methods for rare and frequent events needed. Statistically challenging, especially when return period is of the same length or longer than the observation record. More complicated for precipitation than for temperature.	No common practice
How much is known about changes of extreme events, are they more common now or different than 50 years ago?		
Some good studies exist concerning what happens to the extremes (focusing only temperature), probably the same thing should be done for combinations of parameters	Public awareness has changed; the quality of assessment of changes is related to rarity of extreme events; more robust for large scale events than for small scale; in the case of precipitation the natural variability is still stronger than observed changes; to attribute changes to reasons the changes in weather and infrastructure must be accounted for. Impacts are different than 50 years ago; strong changes in vulnerability (not related to weather), some indication of less snow, but depending on location, and less fog in urban areas	• When periods of about 50 years are considered there are changes dependent on region • When longer time scales are considered there is substantial decadal variability but no clear long-term trend apart from changes in mean sea level
Which changes in frequency and intensity of extreme events are to be expected in a warmer climate? Will there be new type of extreme events? Which tools are available, which tools are needed?		
New types of extremes (warm autumns now ice in GF)	In theory, more precipitation is expected; changes in seasonal distribution: less in summer, more in winter. Longer droughts, more heavy precipitation events, indications already observed, possible movement of storm tracks (not 5b?), increasing lake effect snow, changes in soil moisture (longer droughts – drier soils cannot take up water – stronger water erosion, landslides)	• Relative high confidence of mean sea change and corresponding changes in extremes • Less confidence in wind induced changes • Some indications of coastal flooding in river mouths, duration of extreme events are expected to be longer • Sea ice reduction will enhance seiche-oscillation in winter time

	New types of extreme events? Erosion, landslides, insect pests and other ecological impacts, more often changes through zero causing cyclic freezing and melting of the surface layer (mostly in southern part), seasonal soil frost, ice accumulation, avalanches Tools? Available: increasing number of data sources: remote sensing data on precipitation, water content in the atmosphere, temperature, SLP and geopotential heights; radar data; satelite images of clouds, more dense in time and space data on precipitation allowing for analysis of shower intensities. Needed: more soil moisture measurements, higher temporal resolution, cooperation between data holders, make use of social media data, new tools for quality controls, interdisciplinary communication (land architects, urban planning) criteria for classification of extreme events	
What are knowledge gaps and what should be priorities of research?		
Remote controls of the circulation (like Less ice in arctic and linkages to changes in circulation in the Baltic Sea region understanding is not complete).	• relation of extreme precipitation and soil moisture • for- and nowcasting and validation methods for small-scale extreme precip events • Climatology of precipitation with high temporal and spatial resolution (10 min, 1 km) • Urban flooding*, thunderstorms*, hail events* - driving factors, mechanisms, circulation • detection and attribution of extremes and their changes • methodology of projections and their validation of extreme precipitation events in all time scales	• Detection and attribution, climate change vs. natural variability • Emphasis so far has been in the amplitudes of the extreme water level events, not much on duration of the events • Joint probabilities of several factors to contribute extreme sea level • Uncertainty has not address in systematic way • Climate change vs. other drivers (coastal management) • ???

Miscellaneous		
Modelling capacity of extreme events? How they should be validated – if they reproduce previous events. Ensembles important for forecasts and scenarios. Models should be used for reproducing specific events. Some types of model can – others not (ocean models more sensitive when run for extreme events?) Precipitation snow/ice accuracy a problem What timescales are we looking into? (not operational, but climate change timescale, hindcast for really short and long time scales). Action item: • Identification of high impact events, clear identification of timing, duration in combination with other variables and the impact to certain sectors (not temperature by itself that is the relevant feature). Identification has to be linked to agriculture, ecosystem services industry, transportation and human wellbeing. • This identification could be the basis for analysis of the past and future, look into if data are good enough, do the models reproduce the variability for these events enough? • Review paper on the temperature (precipitation and snow/low temperature and wind) extremes and the impact on ecosystem services. • Base for applications to Bonus/Horizon2020/Nordforsk. • Reanalysis of extreme events would be a very valuable thing to have. • Suggest the workshop participants to form small group to identify possible funding possibilities.	Which common activities can we recommend? • developing and promoting for- and nowcasting and validation methods for small-scale extreme precip events • cooperation between data holders • interdisciplinary communication (land architects, urban planning) • filling the above mentioned knowledge gaps	