Baltic Earth - Earth system science for the Baltic Sea region

Outline

- **Introduction and infrastructure**
  Marcus Reckermann,
  Intl. Baltic Earth Secretariat,
  Helmholtz-Zentrum Geesthacht, Germany

- **Grand Challenges**
  Anna Rutgersson, University of Uppsala, Sweden

- **Scientific achievements in hydrology in the Baltic Sea region**
  Irina Partatsenok, Hydromet, Belarus

- **Advances and challenges in hydrology of the Baltic sea basin: view from Russia**
  Sergei Zhuravlev, Russian State Hydrologic Institute, St. Petersburg, Russia

Baltic Earth

Earth System Science for the Baltic Sea Region

Baltic Earth -
Earth system science for the Baltic Sea region

Baltic Earth

Earth System Science for the Baltic Sea Region

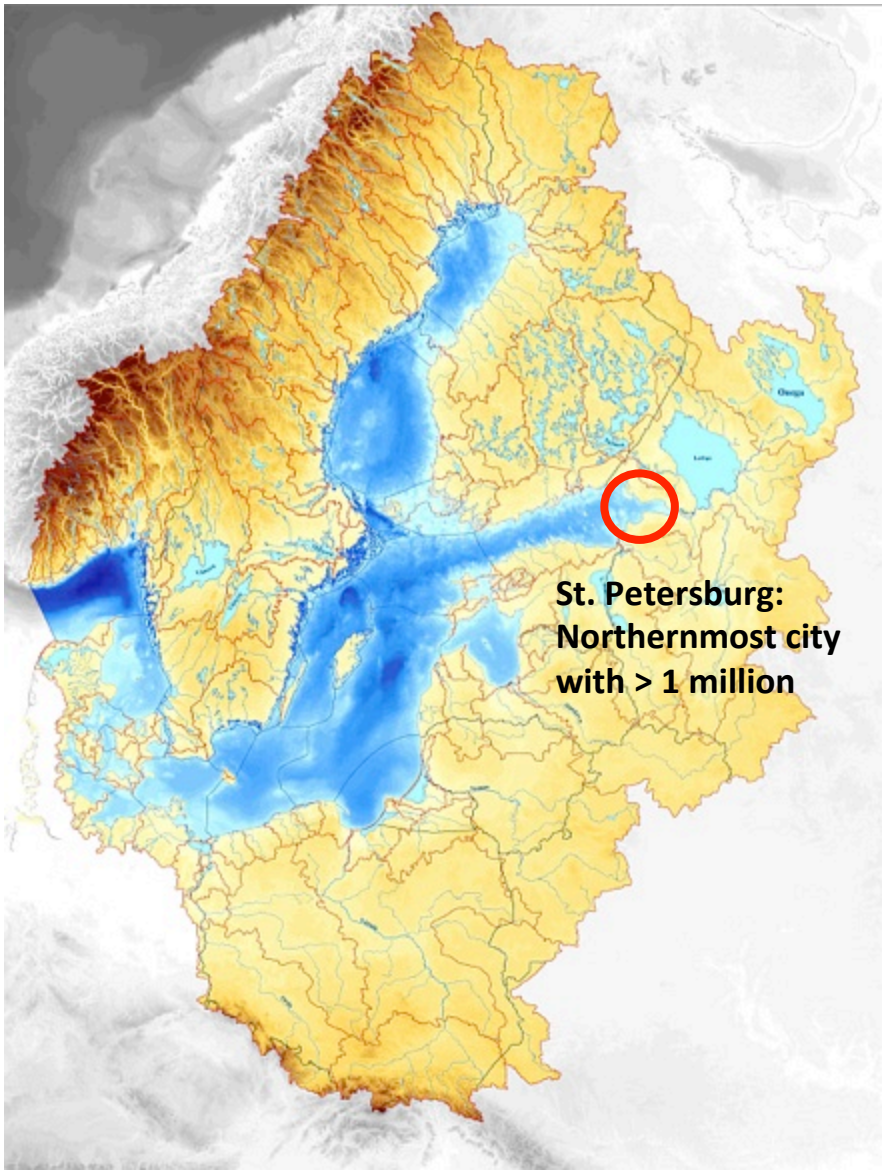
Vision of the programme

To achieve an improved Earth System understanding of the Baltic Sea region

- **Interdisciplinary** and **international** collaboration (conferences, workshops, joint projects etc.)
- **Holistic view** on the Earth system of the Baltic Sea region, encompassing processes in the **atmosphere**, on **land** and in the **sea** and also in the **anthroposphere**
- "**Service to society**" in the respect that **thematic assessments** provide an overview over knowledge gaps which need to be filled (e.g. by funded projects)
- **Education** (summer schools)
- Inherits the BALTEX network of scientists and infrastructuren
- Succeeds BALTEX since the 7th Study Conference on BALTEX, Borgholm, Öland, Sweden, 10-14 June 2013

The Baltic Sea region

The Baltic Sea region



- Drainage Basin: 2.13 Mill. km^2 (20% of the European continent)
- 85 million people in 14 countries
- Baltic Sea: 380 000 km^2

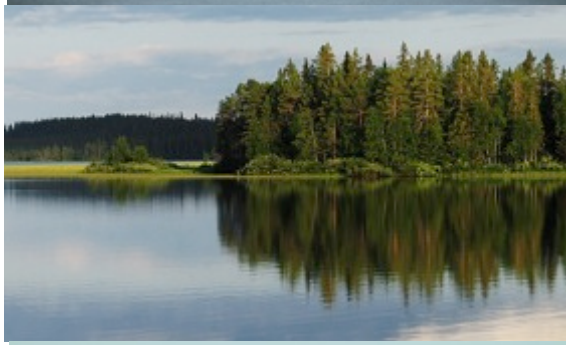
The Baltic Sea region

The North …

- → extensive forests, mostly coniferous
- → sparsely populated
- → mostly rocky coasts
- → subarctic climate in winter

The South…

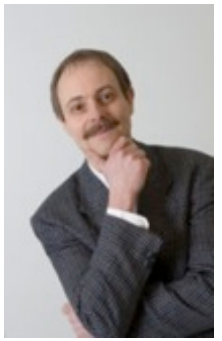
- → intense agriculture
- → densely populated
- → mostly sandy coasts
- → moderate climate in winter



Baltic Earth Infrastructure

- **International Baltic Earth Secretariat** at Helmholtz Zentrum Geesthacht
- **Baltic Earth Science Steering Group (BESSG)** Excellent, active "young" scientists; country balance, gender balance, discipline balance, institutional balance, currently 20 members; meetings biannually
- **Working Groups** installed for each GC plus
  - WG on Outreach and Communication
  - WG on Education
  - WG on the Utility of Regional Climate Models WG on the Assessment of Scenario Simulations for the Baltic Sea 1960-2100
- **Senior Advisory Board**
- **Science Plan**

BESSG chairs

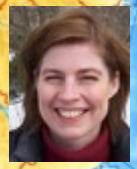


Markus Meier, Head of Physical Oceanography, Baltic Sea Research Institute, Germany

Anna Rutgersson, Professor of Meteorology, Uppsala University, Sweden.

Both have been active in BALTEX for many years

Baltic Earth SSG members



Anna Rutgersson
Sweden

Jari Haapala
Finland

Kai Myrberg
Finland

Sergey Zhuravlev
Russia

Anders Omstedt
Sweden

Piia Post
Estonia

Martin Stendel
Denmark

Ben Smith
Sweden

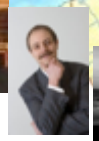
Juris Aigars
Latvia

Irina Partasenok
Belarus

Inga Dailidienė
Lithuania

Corinna Schrum
Germany

Andreas Lehmann
Germany



Markus Meier
Germany

Gregor Rehder
Germany

Karol Kulinski
Poland

Marcus Reckermann

Ralf Weisse

Franz Berger
Germany

Baltic Earth
Senior Advisory Board

Deliang Chen
Sweden

Andris Andrusailtis
BONUS

Ulla Li Zweifel
HELCOM

Valery Vuglinsky
Russia

Jüri Elken
Estonia

Fritz Köster
Denmark

Kay Emeis
Germany

Hans-Jörg Isemer
Germany

Stanislav Massel
Poland

Jan Polcher
GEWEX-GHP

Baltic Earth

Earth System Science for the Baltic Sea Region

Secretariat

Publications

Website etc.

Events

International Baltic Earth Secretariat (IBES)

Address:

International Baltic Earth Secretariat
Helmholtz-Zentrum Geesthacht
Max-Planck-Straße 1
D-21502 Geesthacht
Tel: +49-4152-87-1693
Germany
E-mail: balticearth(at)hzg.de (replace "(at)" with "@")

For details on IBES staff, click here

The International Baltic Earth Secretariat (IBES) as a focal support point for Baltic Earth is located at the Helmholtz-Zentrum Geesthacht (until 1 November 2010: GKSS Research Centre) in Geesthacht, Germany. The Baltic Earth Secretariat's tasks cover in particular:

- to support the Baltic Earth Science Steering Group, Working Groups and Panels in their activities, and to provide preliminary reviews of their work,
- to maintain connections with all participating research groups and with all operational data and numerical modelling centres for Baltic Earth,
- to prepare for international Baltic Earth meetings, workshops, seminars and conferences, and to provide assistance for reports by Baltic Earth scientists and to international research groups and the research and public community at large, and
- to inform participants about ongoing activities which may be of relevance to their work.

Since January 2002, GKSS (Helmholtz-Zentrum Geesthacht as of 1 November 2010) has been the only sponsor of the International BALTEX (now: Baltic Earth) Secretariat, covering salaries for the staff members, infrastructure and travel support.

Helmholtz-Zentrum Geesthacht

Zentrum für Material- und Küstenforschung

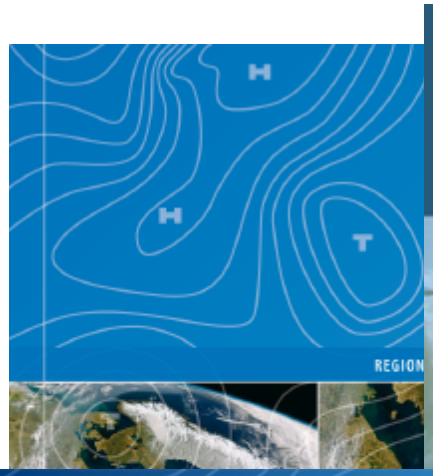
Infrastructure

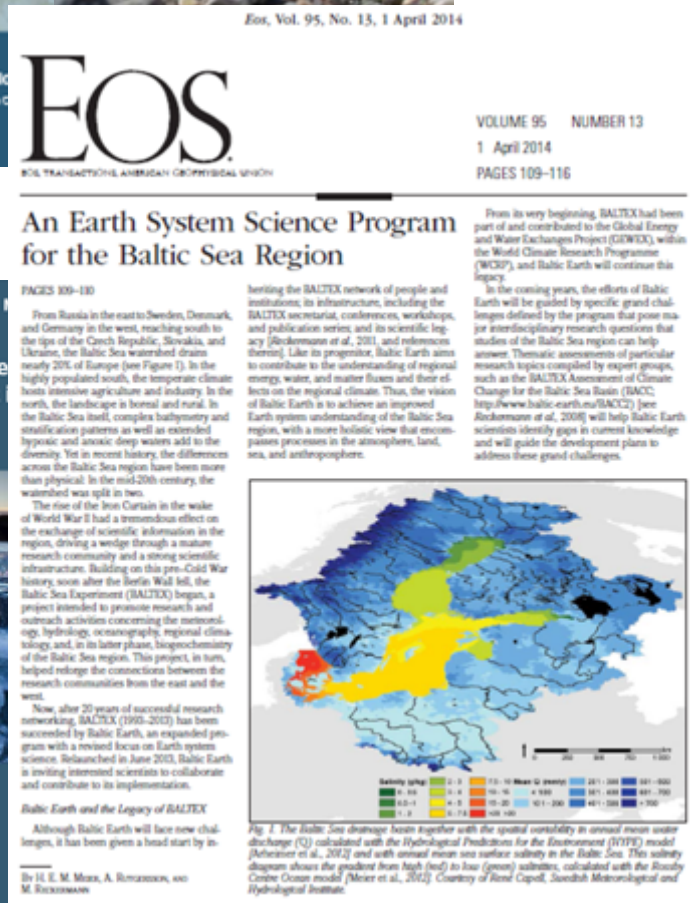
Secretariat

Publications

Website etc.

Events





Infrastructure

Secretariat

Publications

- 14 books
- 722 peer-reviewed journal articles
- 65 reports
- 876 BALTEX/Baltic Earth Conference presentations
- 55 International BALTEX Secretariat Publication Series issues
- 9 International Baltic Earth Secretariat Publication Series issues

Website

Infrastructure

Secretariat

Publications

Website etc.

Events

Baltic Earth

Earth System Science for the Baltic Sea Region

Home / News
Background
Grand Challenges
Working Groups
Projects
Publications
Organisation
International Baltic Earth Secretariat
Events
Internal
How to participate

1st Baltic Earth Conference
Multiple drivers for Earth system changes in the Baltic Sea region
Nida, Curonian Spit, Lithuania
13 - 17 June 2016

BACC II

Helmholtz-Zentrum Geesthacht
Centre for Materials and Coastal Research

Announcements

BALTEX Website...

Extending the knowledge of the regional Earth system in the Baltic Sea re

Baltic Earth stands for the vision to achieve an improved Earth system understa on. This means that the research disciplines of BALTEX continue to be relevant, but a more holi assing processes in the atmosphere, on land and in the sea as well as in the antroposphere sh e to BALTEX. Specific grand research challenges represent interdisciplinary research in the coming years. A major means will be scientific assessments of particular re approach, which shall help to identify gaps and inconsistencies in the current s, structure (secretariat, conferences, publications) and the network (people and in e logo, being very similar to the BALTEX logo, but still distinctly different.

A science plan is currentl oly to a continuously on-going definition of core research questions which are i d Challenges for research. These will be identified at conferences and by assessi by dedicated working groups (following the BACC approach). Research foci are p arth will communicate with stakeholders and research funding agencies to promote fur

NEWS

NEW! Baltic Earth Seminar at Fehmarnbelt Days 2016 **"Exchanges between the North and Baltic Seas - A scientific overview".**
Presentations online **here...**

NEW! **North Sea Climate Change Assessment now online available as Open Access! Congratulations for this tremendous effort!**

Interview with students and lecturers about the Askö Summer School...
A short note by the Baltic Sea Centre of Stockholm University ...

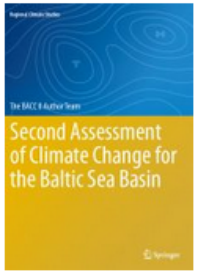
Assessment Report of the Gulf of Finland published

The Finnish Environment Institute SYKE has published an assessment of the Gulf of Finland, compiling the research results of over a hundred Finnish, Russian and Estonian researchers. The over 300-page publication includes recent information on issues such as eutrophication, hazardous substances, invasive species, noise, maritime traffic, and plastic waste. The publication is the most important result of the Gulf of Finland Year arranged by the countries. The publication includes for

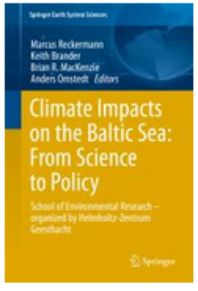
Upcoming Events

For past events look here...

The BACC Blog



BACC I (2008) download



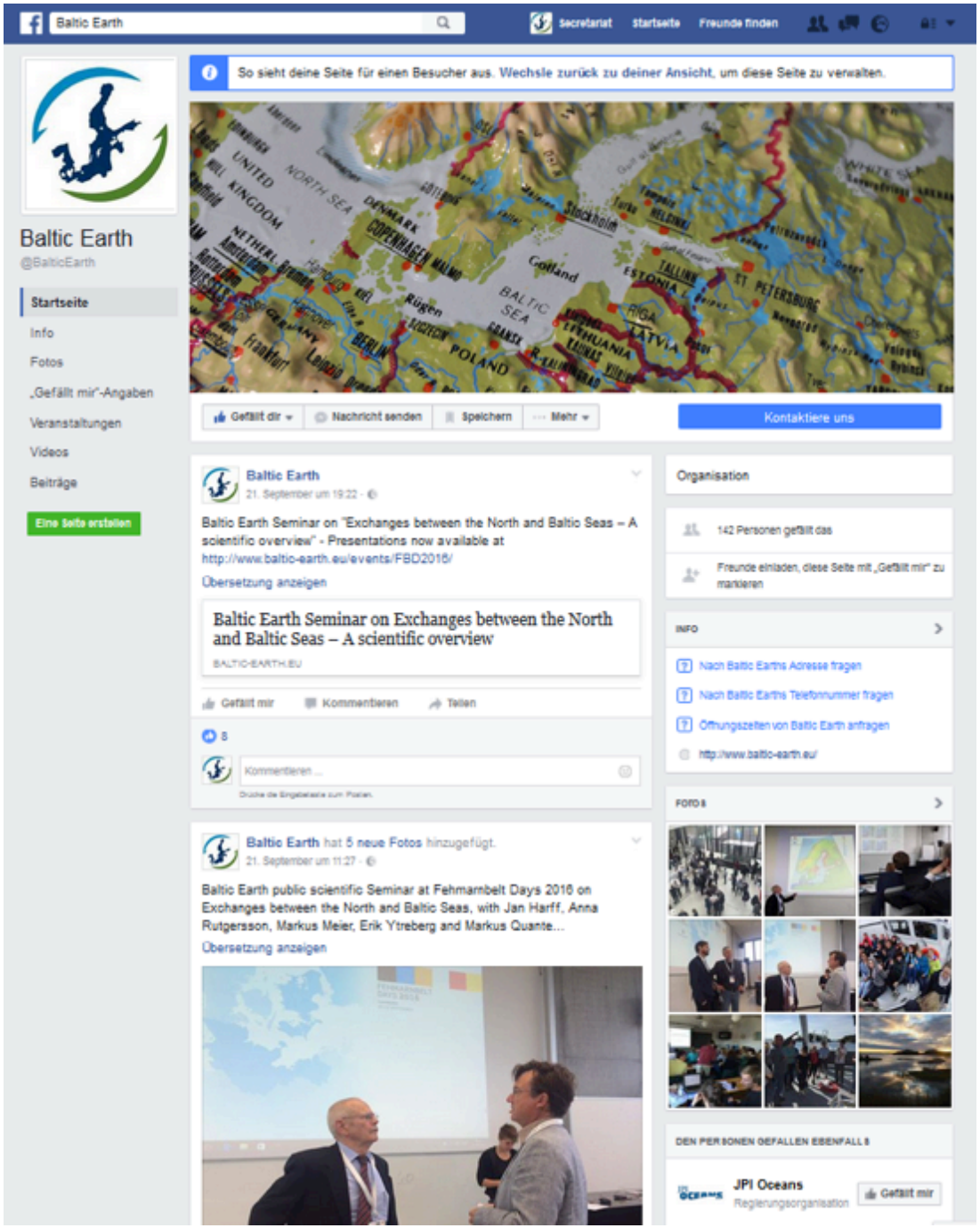
Infrastructure

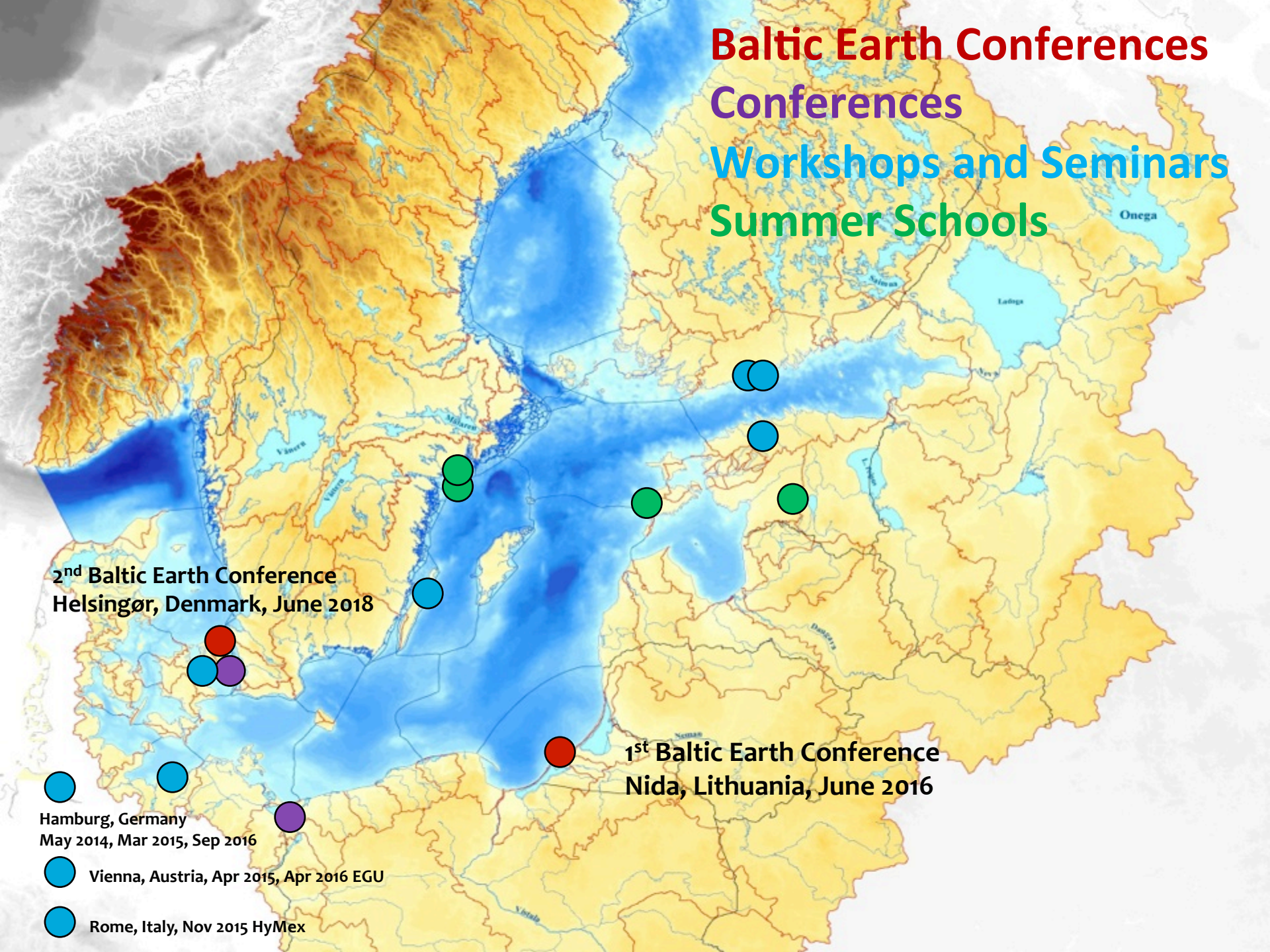
Secretariat

Publications

Website etc.

Events




Baltic Earth Conferences
Conferences
Workshops and Seminars
Summer Schools
Onega
Ladoga
2nd Baltic Earth Conference
Helsingør, Denmark, June 2018
1st Baltic Earth Conference
Nida, Lithuania, June 2016
Hamburg, Germany
May 2014, Mar 2015, Sep 2016
Vienna, Austria, Apr 2015, Apr 2016 EGU
Rome, Italy, Nov 2015 HyMex

Events

Summer Schools

Workshops and Seminars

Topical Conferences

Baltic Earth Conferences

Stockholm University

Baltic Earth

International advanced PhD course on

Impact of climate change on the marine environment with special focus on the role of changing extremes

co-organized by the "Baltic Ecosystem Adaptive Management" (BEAM) and Baltic Earth programmes and funded by BEAM

Askö Laboratory, Trosa, Sweden

24 - 30 August 2015

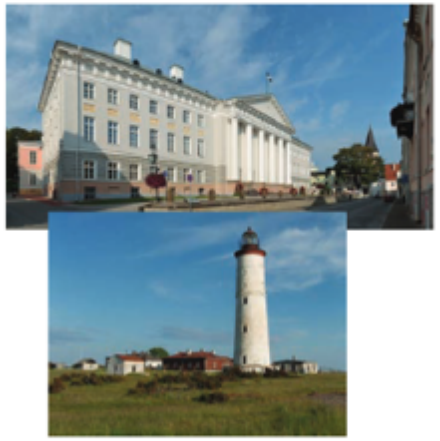
TARTU ÜLIKOOL · UNIVERSITAS TARTUENSIS · 1632

Baltic Earth

A Doctoral Students Conference

Challenges for Earth system science in the Baltic Sea region: From measurements to models

co-organized by the the University of Tartu and Baltic Earth



University of Tartu and Vilsandi Island Estonia

10 - 14 August 2015

European Union
European Social Fund

Investing in your future

Events

Summer Schools

Workshops and Seminars

Topical Conferences

Baltic Earth Conferences

International Summer School on

Climate change in the Baltic Sea region

Askö Laboratory, Trosa, Sweden, 29 August – 5 September 2016

co-organized by Baltic Earth, Stockholm University Baltic Sea Centre, Leibniz Institute for Baltic Sea Research Warnemünde and University of Rostock

Thank you to the Askö staff, lecturers and of course the students for this phantastic Summer School! We intend to be be back next year...

Interview with students and lecturers about the Askö Summer School...
A short note by the Baltic Sea Centre of Stockholm University ...

The Summer School ended with smiling faces because everybody successfully passed the exam and exercises. The spirit had been phantastic during the whole week, and the students and group exercises were just amazing. We also received a short tour around the brand new research ship "Electra" which is equipped with some of the newest technologies. A short "water crisis" was handled with ease and many buckets. A week to remember!

Events

Summer Schools

Workshops and Seminars

Topical Conferences

Baltic Earth Conferences

Events

Summer Schools

Workshops and Seminars

Topical Conferences

Baltic Earth Conferences

Baltic Earth
Earth System Science for the Baltic Sea Region

Climate modelling and impacts from the global to the regional to the urban scale

An international scientific seminar

10 March 2015

Holcim Auditorium
HafenCity Universität
Überseeallee 16, 20457 Hamburg, Germany

Scope of the seminar is to give an overview over the current state of research in the fields of global and regional climate modelling, and the impacts on the regional and urban scales.

Posters related to the seminar topic are invited to be presented. Poster abstract and registration deadline is 2 March 2015. There are no fees involved.

This open seminar is organised in connection with the 4th Baltic Earth Science Steering Group Meeting by the International Baltic Earth Secretariat at Helmholtz-Zentrum Geesthacht in cooperation with HafenCity Universität Hamburg (HCU) and the Cluster of Excellence CliSAP of Hamburg University, which stands for „Integrated Climate System Analysis and Prediction".

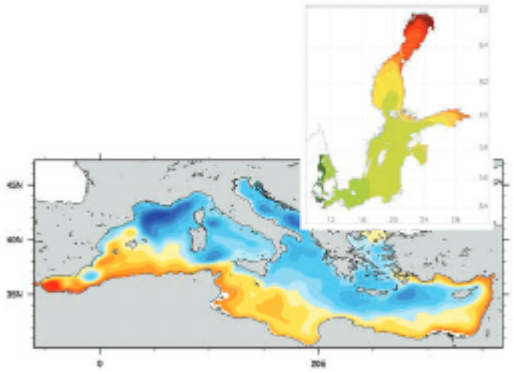
Baltic Earth is the research network for Earth system science in the Baltic Sea region. www.baltic-earth.eu

HCU HafenCity Universität Hamburg
clisap
Universität Hamburg
Max-Planck-Institut für Meteorologie
DKRZ Deutsches Klimarechenzentrum
Helmholtz-Zentrum Geesthacht
Zentrum für Material- und Küstenforschung

A joint
HyMex-Baltic Earth
Workshop

HyMeX

Joint regional climate system modelling for the European sea regions



ENEA
Rome, Italy
5-6 November 2015

Announcement and Call for Papers

Events

Summer Schools

FEHMARNBELT DAYS 2016
HAMBURG
20-22 SEPTEMBER

Workshops and Seminars

Exchanges between the North and Baltic Seas – A scientific overview

HafenCity University Hamburg, Germany
21 September, 9 – 12:30

Topical Conferences

Baltic Earth Conferences

Joint Baltic Earth-ESA Workshop on

Remote Sensing applications in the Baltic Sea region

Helsinki, Finland

29-31 March 2017

Events

Summer Schools

Workshops and Seminars

Topical Conferences

Baltic Earth Conferences

2nd International Conference

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

Szczecin, Poland
12 - 15 May 2014

Baltic Earth

First Announcement

3rd Lund Regional-scale Climate Modelling Workshop

21st Century Challenges in Regional Climate Modelling

Lund, Sweden
16 - 19 June 2014

First Announcement

Events

Summer Schools

Workshops and Seminars

Topical Conferences

Baltic Earth Conferences

1st Baltic Earth Conference

Nida, Curonian Spit, Lithuania

13 - 17 June 2016

Multiple drivers for Earth system changes in the Baltic Sea region

Second Announcement and Call for Papers

Events

Summer Schools

Workshops and Seminars

Topical Conferences

Baltic Earth Conferences

2nd Baltic Earth Conference
Helsingør, Denmark
10-15 June 2018

UPPSALA UNIVERSITET

Baltic Earth Grand Challenges

Baltic Earth

Earth System Science for the Baltic Sea Region

Anna Rutgersson

Professor of Meteorology Uppsala University

Co-chair, Baltic Earth

Baltic Earth Science Plan and Grand Challenges

- Flexible science plan with a continuously on-going definition of core research questions which are identified to be key scientific issues, so-called "**Grand Challenges**" (GCs)

- New Grand Challenges will be identified at conferences and by using **assessments of existing research** by dedicated working groups. Grand Challenges are envisaged to be research foci for periods of about 3-4 years (then terminated or updated).

- The human impact will be assessed at all levels, wherever possible and senseful

Baltic Earth Science Plan and Grand Challenges

- GC1: Salinity dynamics
- GC2: Land-Sea biogeochemical linkages
- GC3: Natural hazards and extreme events
- GC4: Sea level and coastal dynamics of the Baltic Sea
- GC5: Regional variability of water and energy exchanges
- GC6: Multiple drivers of regional Earth system changes

Baltic Earth Science Plan and Grand Challenges

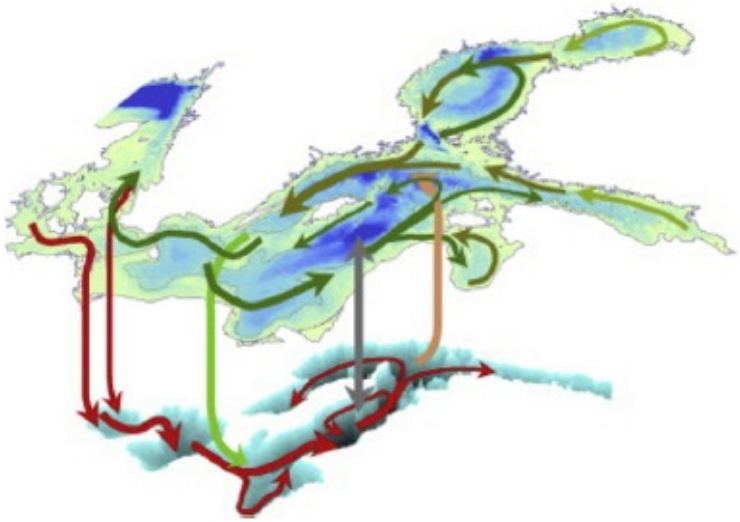
- GC1: Salinity dynamics GEWEX
- GC2: Land-Sea biogeochemical linkages
- GC3: Natural hazards and extreme events GEWEX
- GC4: Sea level and coastal dynamics of the Baltic Sea
- GC5: Regional variability of water and energy exchanges GEWEX
- GC6: Multiple drivers of regional Earth system changes

GC1: Salinity dynamics in the Baltic Sea

GC chairs: Andreas Lehman, GEOMAR, Kai Myrberg, FMI; Piia Post, University of Tarttu

Suggested key research themes

- Interrelation between decadal/climate variability and salinity.
- Water mass exchange and major Baltic inflows
- Regional salinity distribution/variability and associated circulation patterns (including salinity fluxes between the coastal areas and the open sea and within the sub-basins).



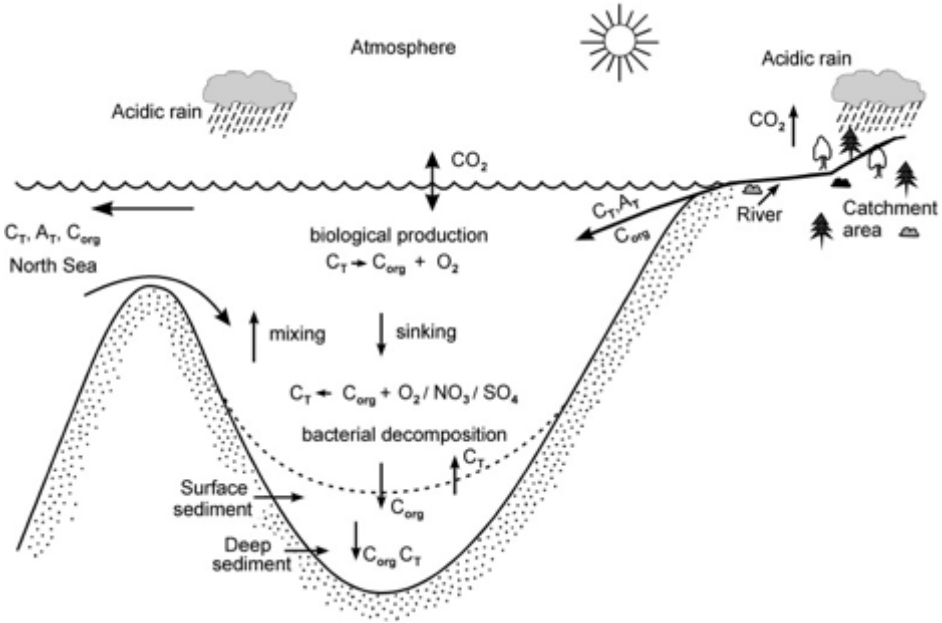
Elken and Matthäus (2008)

GC2: Land-Sea biogeochemical linkages

GC chairs: Gergor Rehder, IOW, Karol Kulinski, IO-PAN, Benjamin Smith, Lund University

Suggested key research themes

- C, N, P cycles studies for the understanding primary production mechanism and organic matter transformations in the Baltic Sea
- Transformations and pathways of terrestrial organic matter, influence of the terrestrial input on the carbonate system
- extension of the databases with the missing terrestrial loads data of the key chemical substances (e.g. Neva River).



Omstedt et al

GC3: Natural hazards and extreme events in the Baltic Sea region

GC chairs: Jaari Haapala, FMI; Anna Rutgersson, Uppsala University; Martin Stendel, DMI,

Background:

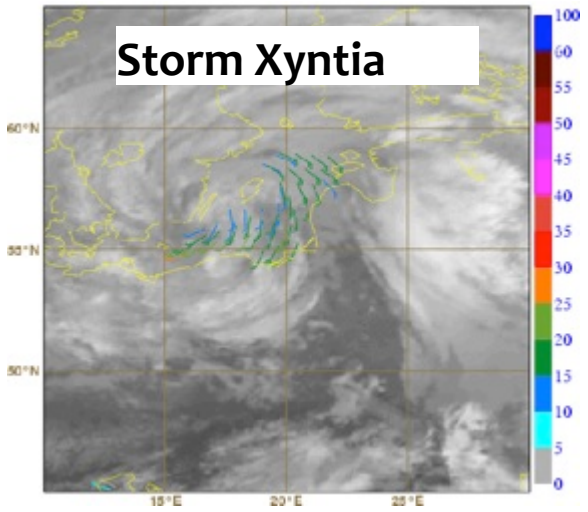
- Society is very sensitive to extreme geophysical events that have severe implications for human life, generate economic losses and influence ecosystems.
- A natural disaster links extreme geophysical events to ecosystems and society (in particular weaknesses in ecosystems and society)
- Understanding the underlying causes of natural disasters increases the ability to predict the occurrence and severity and may save human lives as well as mitigate economic losses.

Photos: Martin Stendel and Finn Majlergaard

GC3: Natural hazards and extreme events in the Baltic Sea region

Background:

- Many natural hazards have hydrometeorological origin (storms, waves, flooding, droughts).
- Natural hazards are often caused by several factors (storm surge in combination with precipitation and river runoff might cause extreme flooding).
- Prediction capabilities are very limited. This is generally well recognized regarding infrastructure such as dam safety and urban flooding risks.
- The range of ecosystem services at risk is more poorly defined, from vital societal functions such as drinking water supply to biodiversity.



From: http://www.eumetrain.org/data/2/227/navmenu.php?tab=2&page=8.0.0
FMI

GC3: Natural hazards and extreme events in the Baltic Sea region

Suggested key research themes

- Changes in atmospheric circulation in the Northern Hemisphere, 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?
- How will the carbon cycle of the Baltic Sea region respond to changes in extreme conditions ?

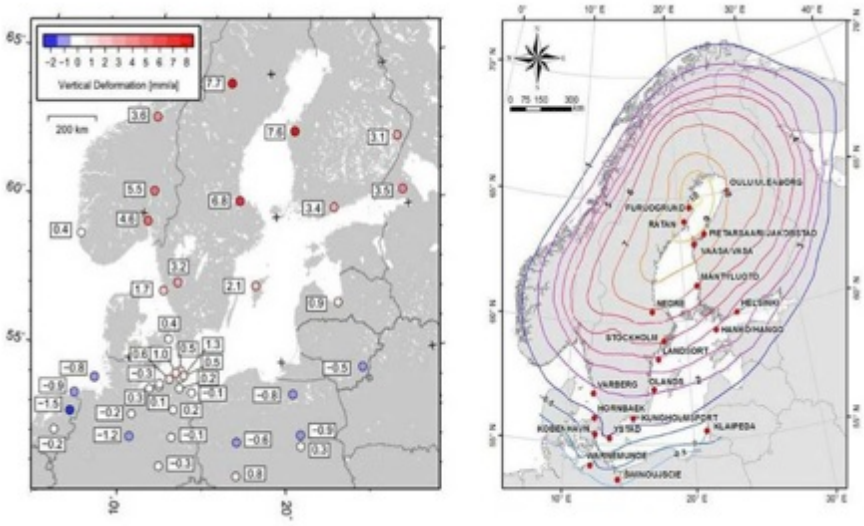
Gudrun Storm

GC4: Sea Level and Coastal Dynamics

GC chairs: Ralf Weisse, HZG, Anders Omstedt University of Gothenburg, Birgit Hunicke, HZG

Suggested key research themes

- Future sea level changes on time scales from seasons to decades (mean and extreme sea levels)
- A systematic comparison of tide-gauges and high resolution satellite products. more high-resolution ocean and atmosphere-ocean regional simulations of the Baltic Sea are becoming available.
- Consistent analysis of all data sets is needed.



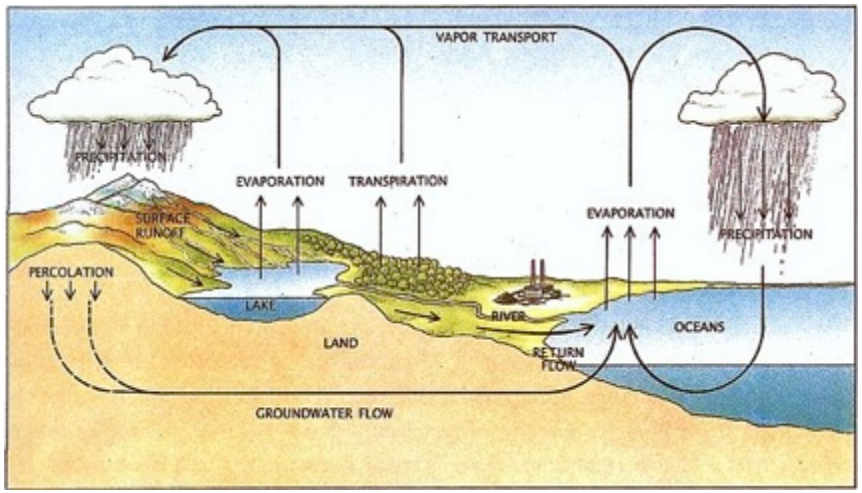
Estimations of crustal deformation rates in the Baltic Sea Region derived by different methods. From Richter et al. (2011) and Harff et al. (2010).

GC5: Regional variability of water and energy exchanges in the Baltic Sea region

GC chairs: Sergej Zhuravlev, Saint-Petersburg State University, Irina Partasenok, Centre for Hydrometeorology

Suggested key research themes

- The observation of atmospheric processes
- The diagnosis of natural variability of energy and water components.
- The improved description and modelling of atmospheric processes
- The extended and continuous evaluation of atmospheric processes with conventional meteorological/hydrological observations.
- The modelling/prediction of short- and long-term water and energy exchanges.

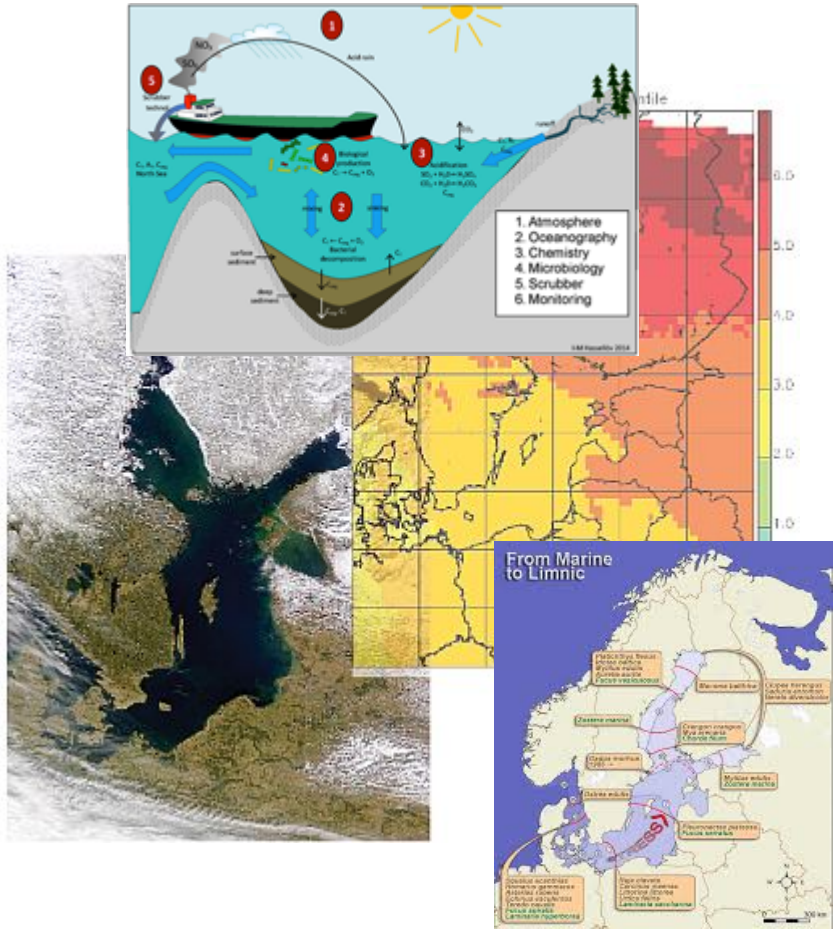


GC6: Multiple drivers of regional Earth system changes

GC chairs: Benjamin Smith, Lund University; Juris Aigars, University of Latvia
Marcus Reckermann, HZG

Suggested key research themes

- A mixture of interwoven factors, such as regional climate change, eutrophication, pollution, fisheries, hydrographic engineering, agricultural and forestry practices and land cover change are responsible for the current situation and of potential importance as drivers of future changes.
- There is a need for increased cooperation among researchers having specialised knowledge of different components of the coupled biophysical-societal system.
- Key disciplines include meteorology and climate science, oceanography, hydrology, marine, terrestrial and freshwater ecology, microbiology and biogeochemistry, economists, human geographers, political scientists and engineers.



Joint Baltic Earth/ESA Workshop

Remote sensing applications to address regional challenges

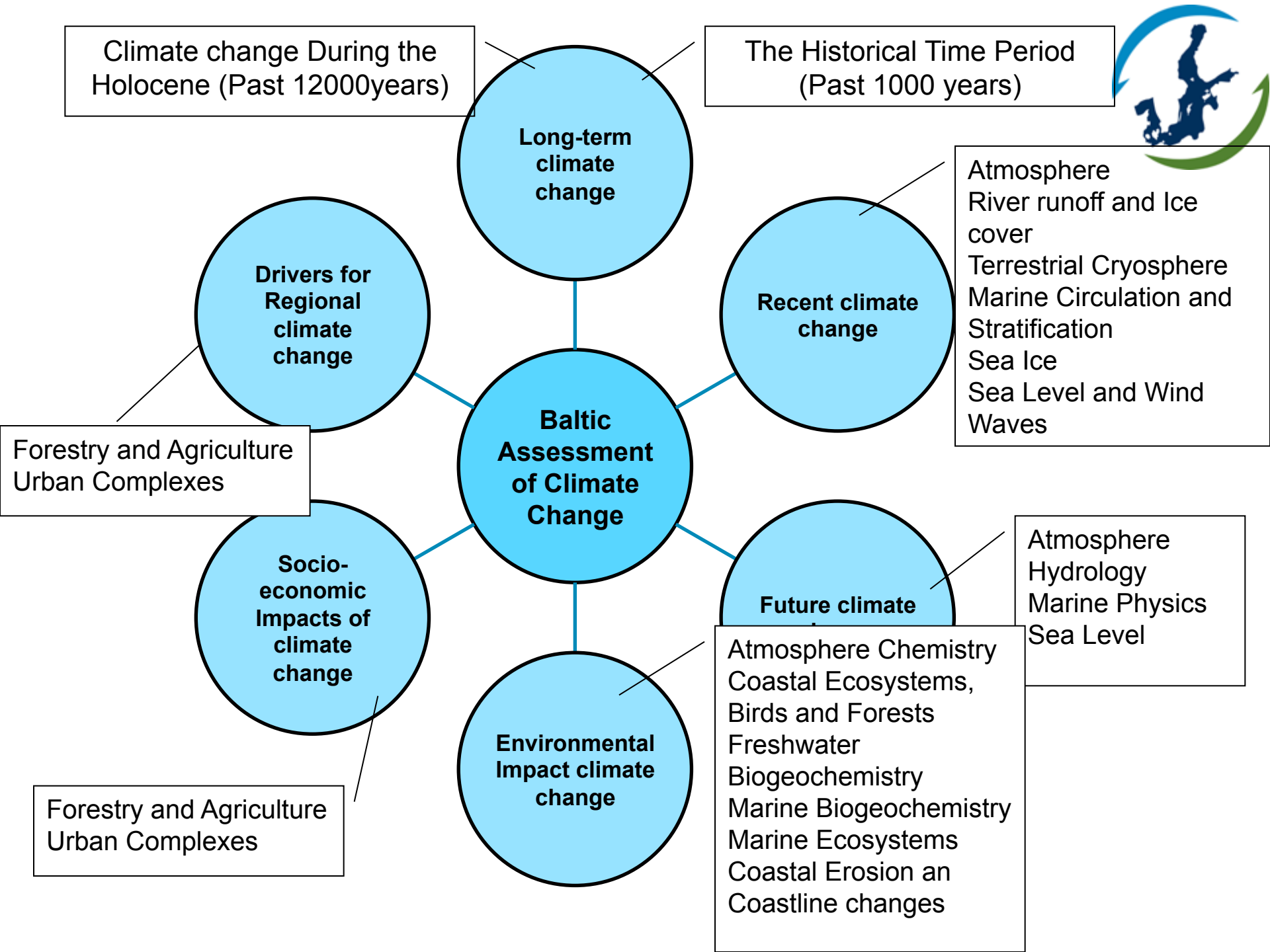
29-31 March, Helsinki, Finland

Scientific topics:

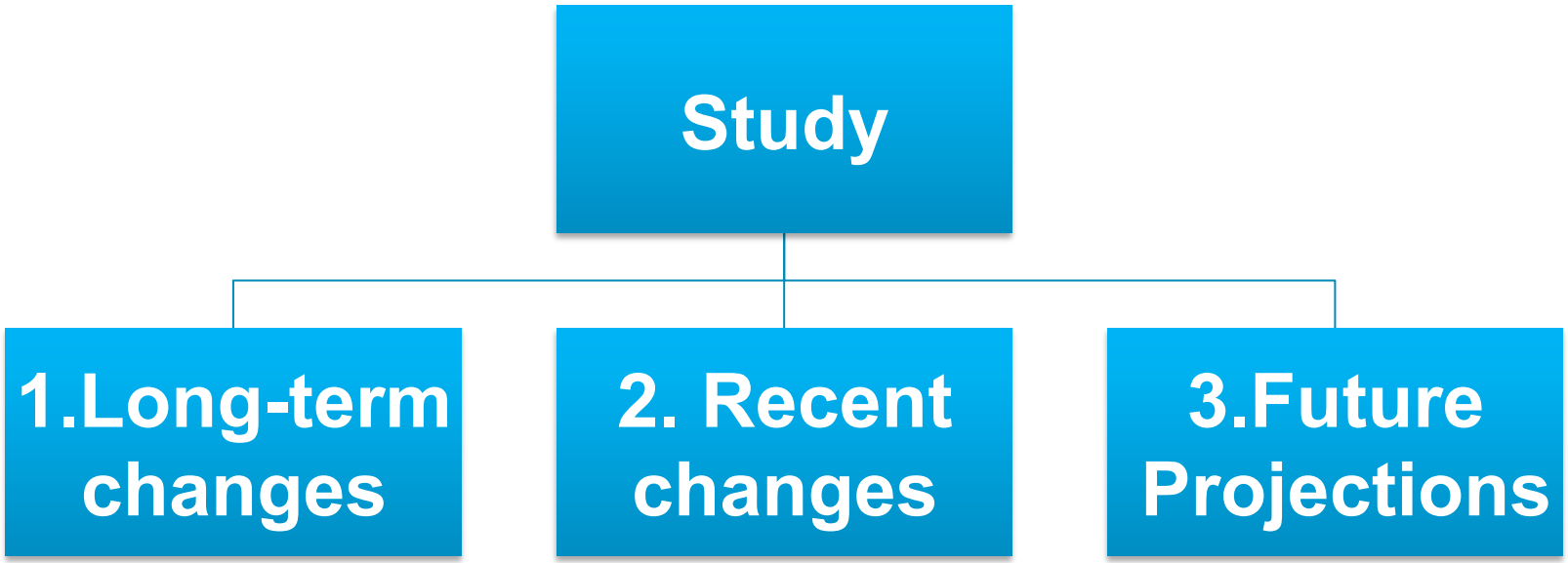
- Salinity dynamics in the Baltic Sea
- Land-Sea biogeochemical feedbacks in the Baltic Sea region
- Natural hazards and regional variability of water and energy exchanges
- Understanding sea level dynamics
- General topics

Scientific Achievments of Baltic Earth with Focus on the Hydroclimatology

Irina Partasenok, Hydromet,
Belarus
And Baltic Earth team


Climate change During the Holocene (Past 12000years)
The Historical Time Period (Past 1000 years)
Long-term climate change
Drivers for Regional climate change
Recent climate change
Atmosphere
River runoff and Ice cover
Terrestrial Cryosphere
Marine Circulation and Stratification
Sea Ice
Sea Level and Wind Waves
Forestry and Agriculture
Urban Complexes
Baltic Assessment of Climate Change
Socio-economic Impacts of climate change
Future climate
Atmosphere
Hydrology
Marine Physics
Sea Level
Environmental Impact climate change
Atmosphere Chemistry
Coastal Ecosystems, Birds and Forests
Freshwater Biogeochemistry
Marine Biogeochemistry
Marine Ecosystems
Coastal Erosion an Coastline changes
Forestry and Agriculture
Urban Complexes

Baltic Earth achievments

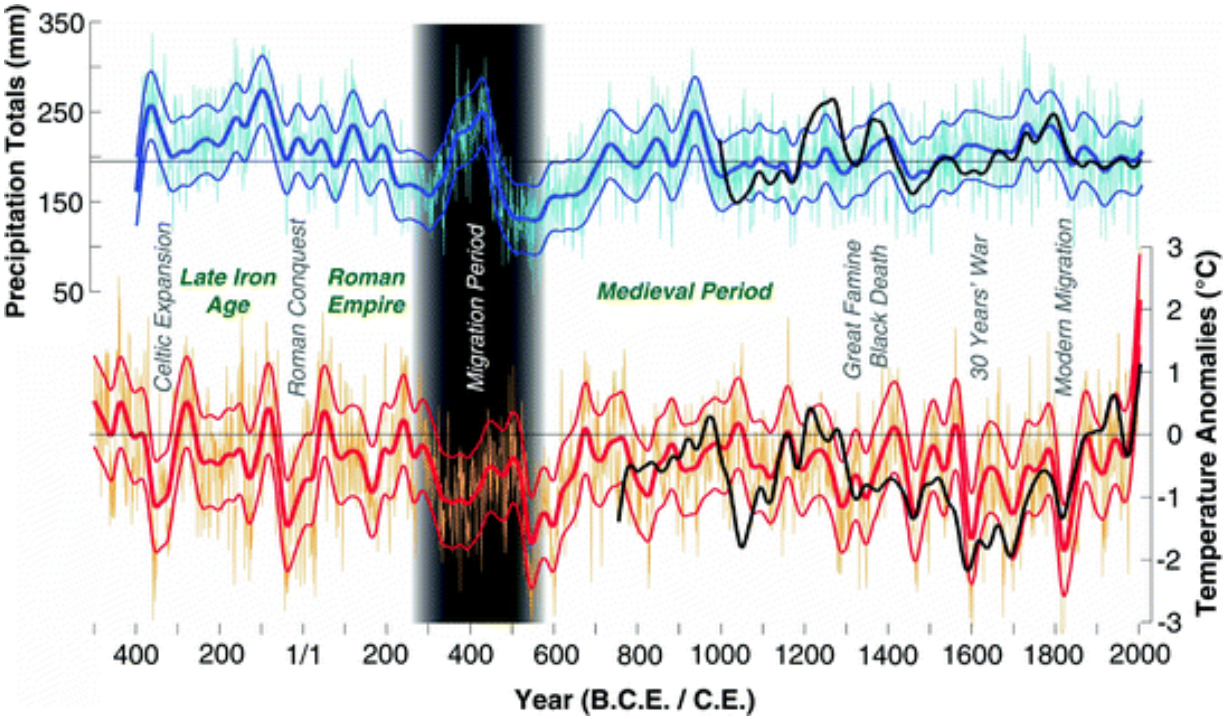


1. Long-term Climate Change (12000 years BP)

Climate change during the Holocene

For main stages of the Baltic Sea

1) Baltic Ice Lakestage (before 11500 years BP)
2) Yoldia sea Stage (11700-10700 years BP)
3) Ancylus Lake Stage (10700-9500 years BP)
4) Littorina Sea Stage (9500 years to present).



Reconstructed April–June (AMJ) precipitation totals (*top*) and summer (June–August) temperature anomalies (*bottom*) for central Europe with respect to 1901–2000. *Error bars* are ±1 RMSE (Root-Mean Square Error) for the calibration periods. *Black lines* show independent precipitation and temperature reconstructions from Germany (Büntgen et al. 2010) and Switzerland (Büntgen et al. 2006). *Bold lines* are 60-year low-pass filters. Periods of demographic expansion, economic prosperity and societal stability are noted, as are periods of political turmoil, cultural change and population instability. Büntgen et al. (2011b)

1. Long-term Climate Change (1000 years BP)

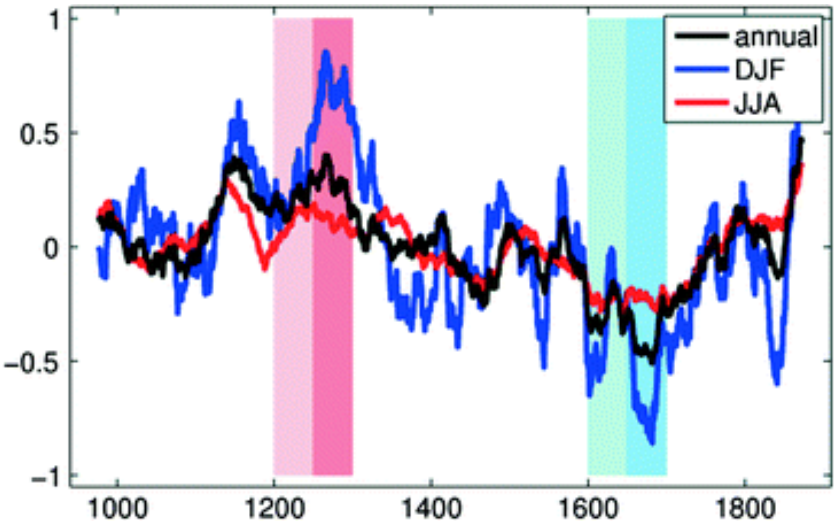
Millenial Climate

Medieval Warm Period (900-1350)

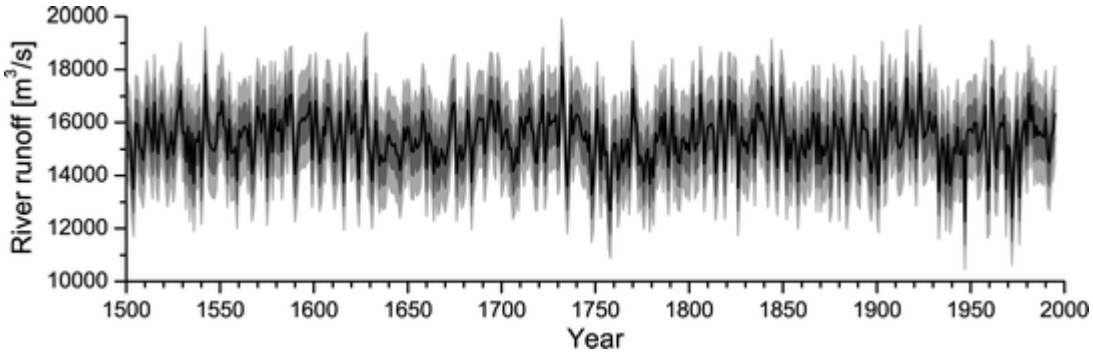
Transitional Period (13580-1550)

Little Ice Period (1550-1850)

Conterporary Warm Period (after 1850)

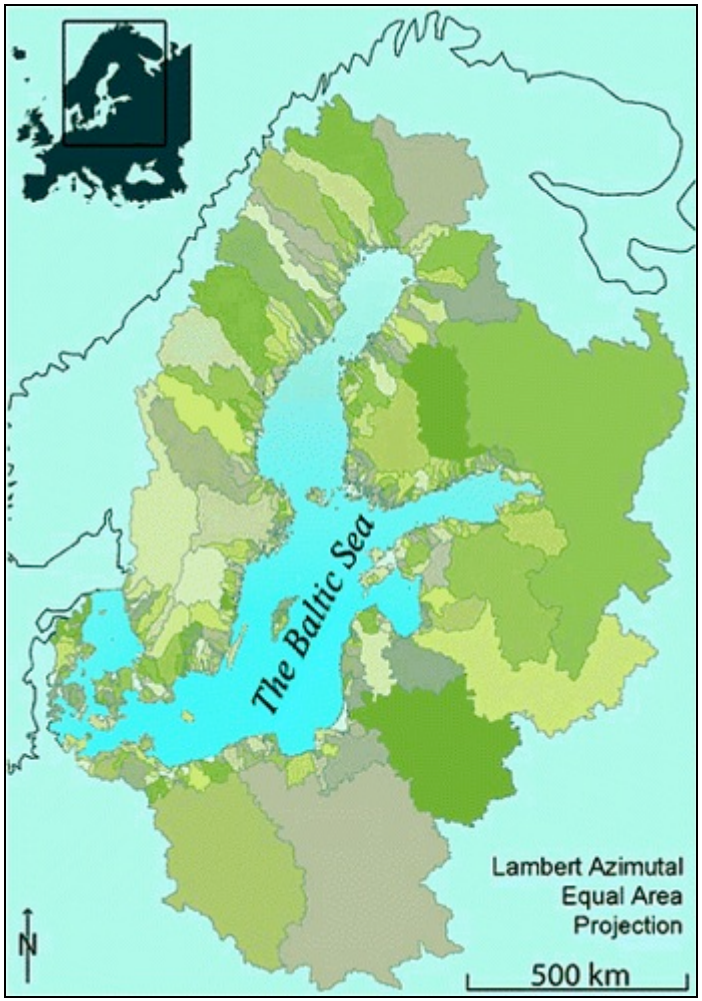


The 2-m temperature anomaly with regard to the preindustrial mean (950–1900) for the winter (*DJF*), summer (*JJA*) and annual mean averaged over the Baltic Sea region. The coloured sections highlight the periods that are defined as MWP (*red*) and LIA (*blue*). The darker colours reflect the 50-year periods which are considered for the analysis of the Baltic Sea. After Schimanke et al. (2012)



Reconstructed annual river discharge to the Baltic Sea for the past 500 years. The *grey shading* indicates 1 and 2 standard errors of the reconstructed river discharge (Hansson et al. 2011)

2. Recent Changes - study object



Sub-basins of the Baltic Sea drainage basin greater than 6 km² in size (Hannerz and Destouni 2006)

River	Country	Area (km²)	Percentage of Baltic Sea drainage basin	Mean annual discharge ($m^3 s^{-1}$)	Percentage of total river inflow to the Baltic Sea	Run-off ($l km^{-2} s^{-1}$)
Neva	Russia/ Finland	281,000	16.1	2460	17.6	8.8
Vistula	Poland/ Ukraine/ Belarus/ Slovakia	194,400	11.2	1065	7.6	5.5
Odra	Poland/ Germany/ Czech Republic	118,900	6.8	573	4.1	4.8
Nemunas (Lithuanian	Belarus/ Lithuania/ Russia	98,200	5.6	632	4.5	6.4
Daugava	Belarus/ Latvia/ Lithuania/ Estonia/ Russia	87,900	5.1	659	4.7	7.5
Narva	Estonia/ Russia	56,200	3.2	403	2.9	7.2
Kemi	Finland	51,400	3.0	562	4.0	11.0
Göta	Sweden	50,100	2.9	574	4.1	11.5
Torne	Sweden/ Finland	40,100	2.3	392	2.8	9.8
Kymi	Finland	37,200	2.1	338	2.4	9.1
Total		1,015,400	58	7658	55	

Climate forcing the streamflow and floods

Floods wave coherence in the large river basins

Water supply in the snow cover before melting

Precipitation

Moistening in the autumn and winter season

Ice cover on the snow pack

Depth of ground freezing before snow melting

Snow melting intensity

Atmospheric Circulation

Air temperature **Precipitation**

2. Recent Changes

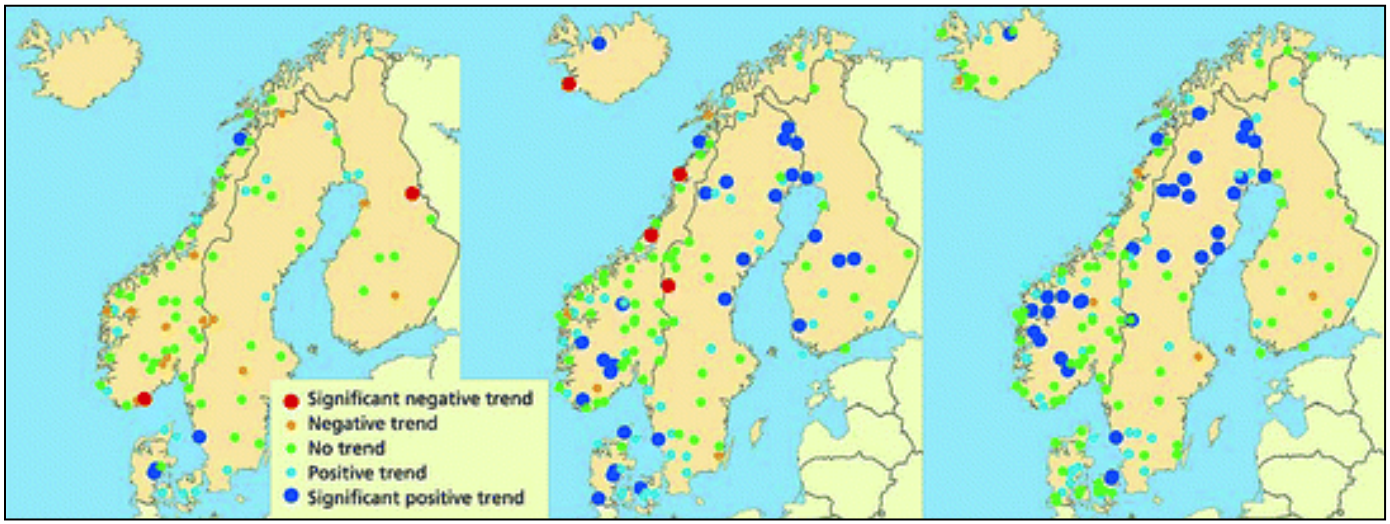
Atmosphere – north shift of the cyclones and increase of westerly.

Wind – increase of wind speed in the North.

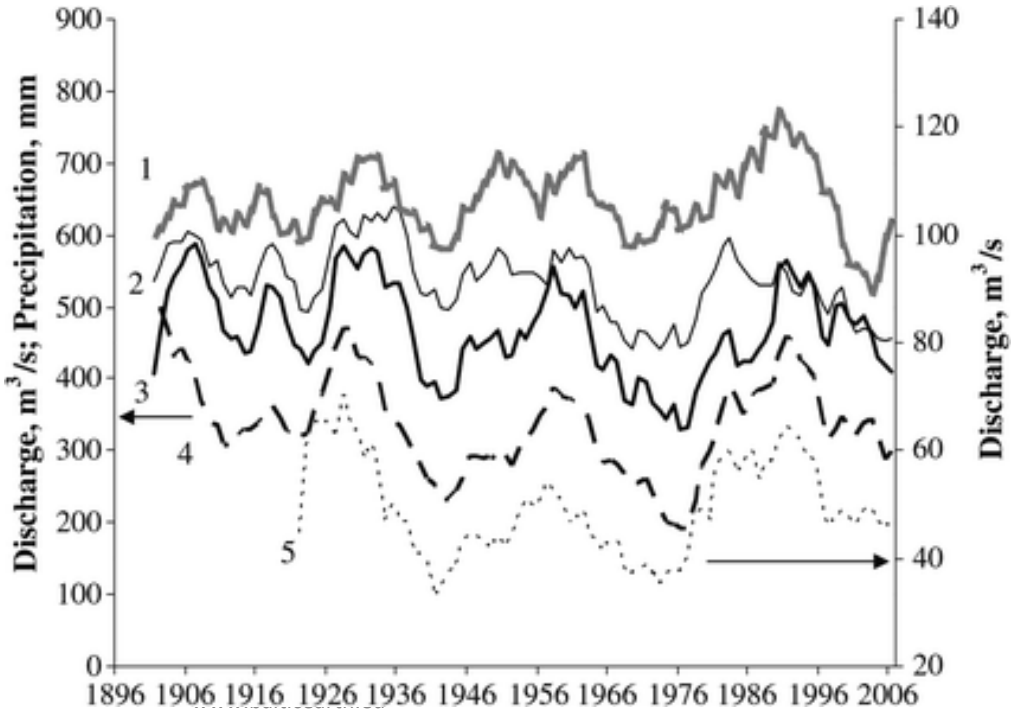
Precipitation – no sign.change for entire region, more in the North. Falling is longer and more extremes.

Air temperature – increase, especially in cold part of the year.

2. Recent Changes - Hydrology



Trends in annual streamflow within the Nordic countries for 1920–2002 (*left*), 1941–2002 (*middle*) and 1961–2000 (*right*) (Hisdal et al. 2010)



Long-term change in precipitation and mean annual discharge for rivers in the Baltic Sea basin: *1* precipitation (Station Rīga University); *2* Nemunas; *3* Daugava; *4* Narva; *5* Pärnu. Curves 1–4: left axis, curve 5: right axis. Data were smoothed using a 6-year moving average

3. Future Projections - Hydrology

Country	Model combinations	Scenario	Results	
Denmark	1)HIRHAM 2)NAM+ECHAM4-HIRHAM	SRES A2	Annual discharge increase up to 11-14% Annual discharge increase up to 9-34%	Sediment up to 24-27% Phosphor up to 3.3-16.5%
Finland	1) WSFS 2)TUFLOW+2GCM +RCA3 RCM 3) TUFLOW +3GCM +4RCM	SRES A2, A1B B1	1)North –no change, West and Centre – floods increase 2) Floods decrease 3)Floods decrease up to 8-22%	
Latvia	HBV+HadAM3H-RCAO	SRES A2 B2	Annual discharges decrease up to 2-24%	
Lithuania	HBV+ECHAM5 and HadCM3	SRES A1B	Annual discharges decrease up to 41%	
Norway	HBV+2GCM+RCM	SRES A2 B2	Winter and autumn discharge decrease	
Poland	ECHAM5-MPI-M-REMO		Water decrease in the median value from −32 to −50 mm	
Sweden	HBV+GCM/RCM ECHAM5/RCA3	SRES A1B	Uncertainness in the projections	

Advances and challenges in hydrology of the Baltic sea basin: view from Russia

Russian State Hydrological Institute

Saint-Petersburg State University

Sergei Zhuravlev,
Associate Professor, Chair of Hydrology, Inst. of Earth Sciences, SPbSU
Leading researcher, head of the Hydrologic Modelling Lab, Russian State Hydrologic Institute
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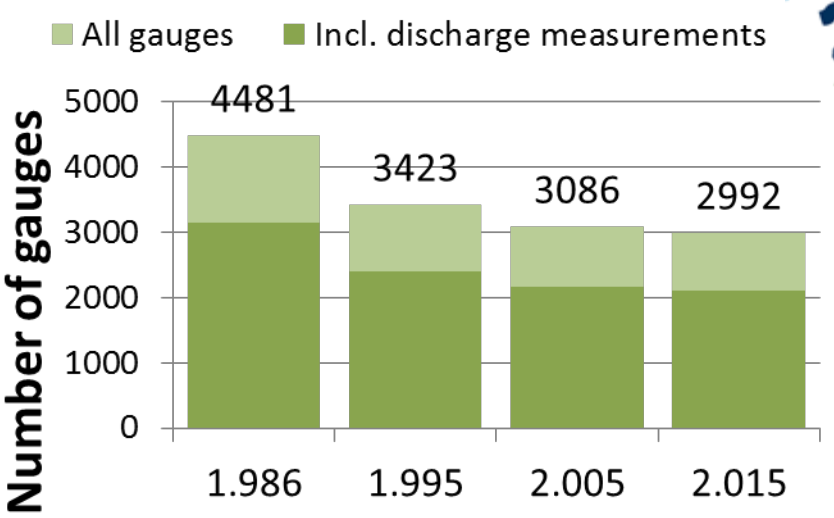
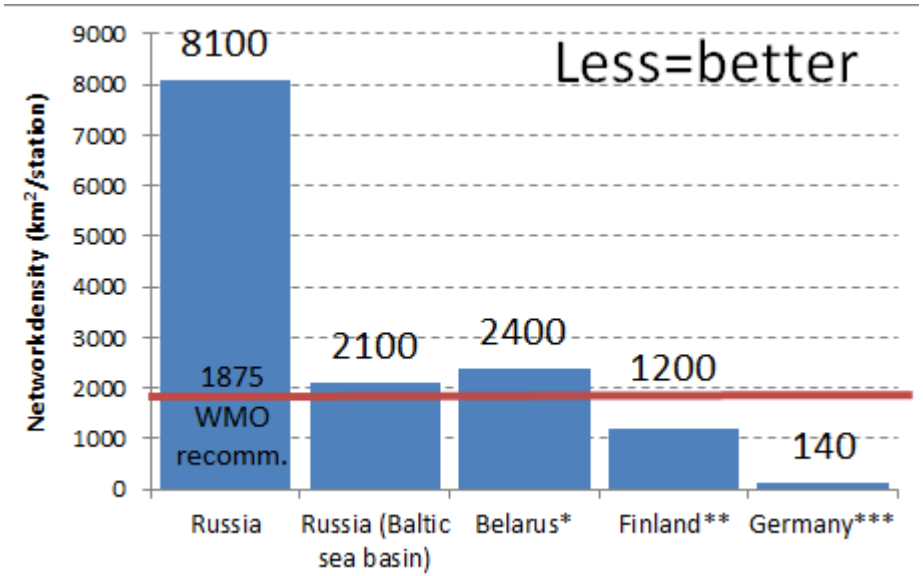
Hydrological network in Russia and Russian part of the Baltic Sea basin

- **Total number of hydrological stations is about 3000.**
- **It is slowly decreasing during last years**
- **Russian part of the Baltic sea basin has the highest density of hydrological network**





*HMC.BY 2014
**WMO INFOHYDRO 2014
***Fresh surface water, 2009

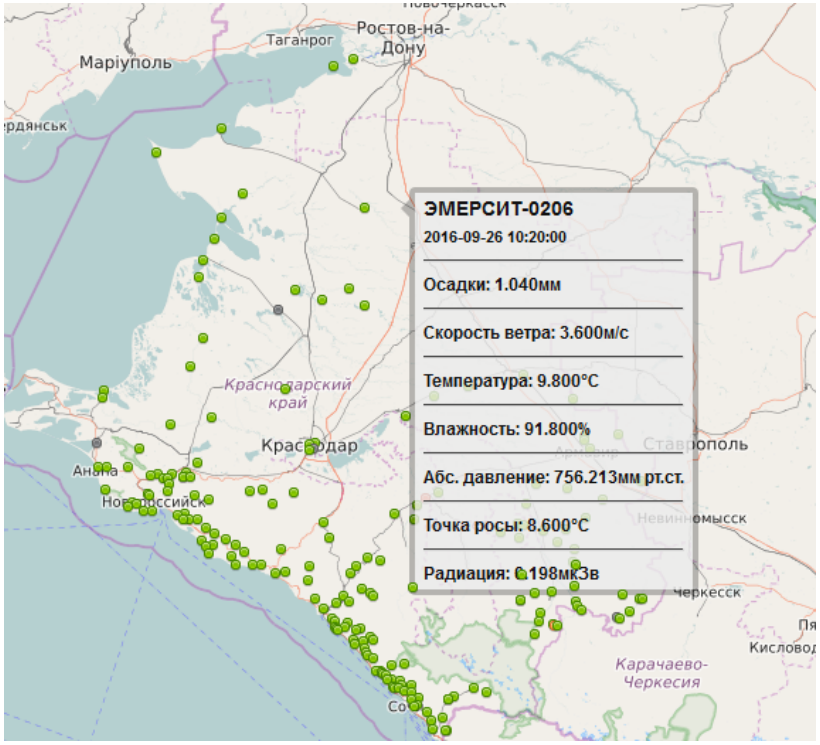
Hydrological datasets and new data services in Russia

- automated information system of the state monitoring of water objects (gmvo.skniivh.ru)

  Daily discharges (1950 stations) from 2008 up to date
  Daily water levels (2650 stations)
  Hydrochemical data, water turbidity, ice regime etc

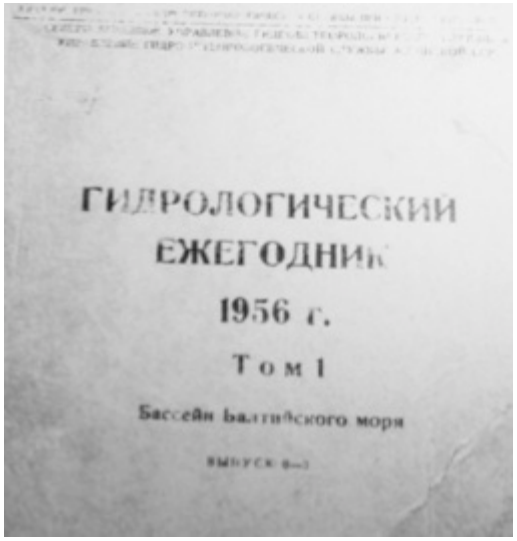
But only in Russian☹

- regional systems
  i.e. http://emercit.com/map/



- local datasets

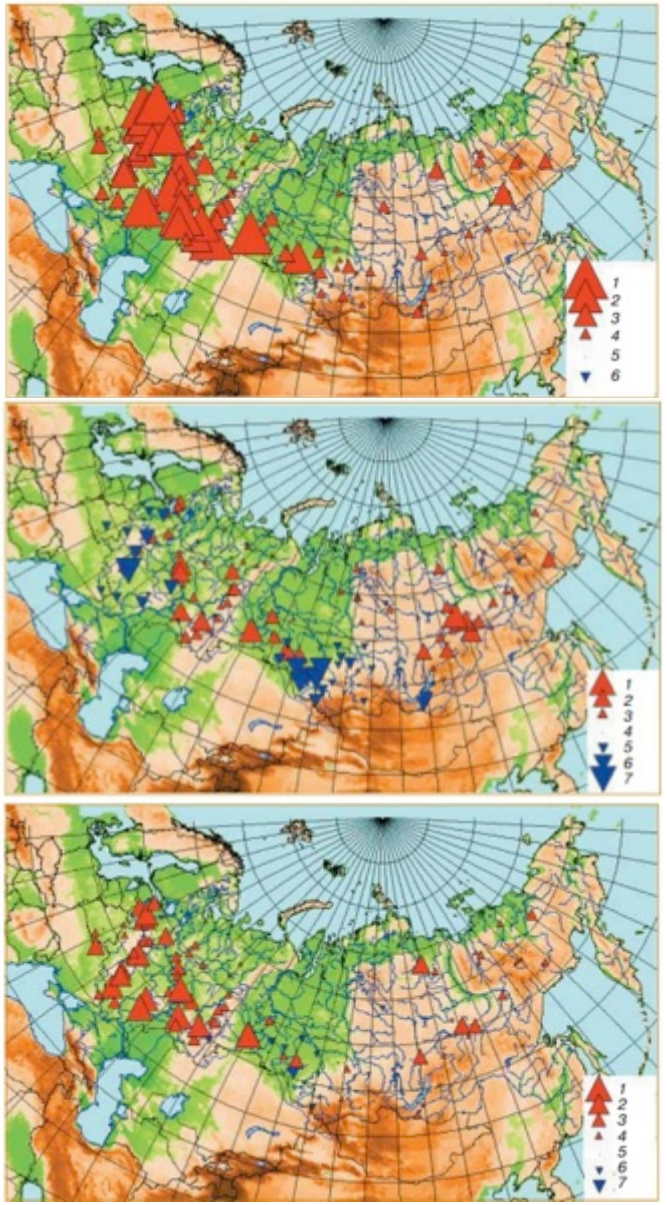
  Daily runoff data for the Russian part of the Baltic sea basin (1946 - 1992)



Runoff studies: runoff trends in Russia

- Winter and summer low flows are increasing
- Different spatial patterns for spring floods
- Strong need for regional studies

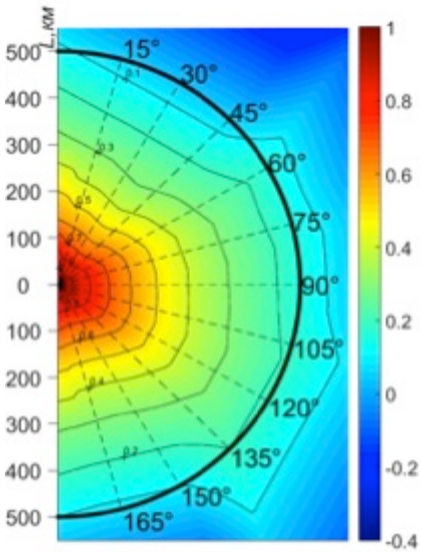
Anomalies of winter, spring and summer–fall runoff



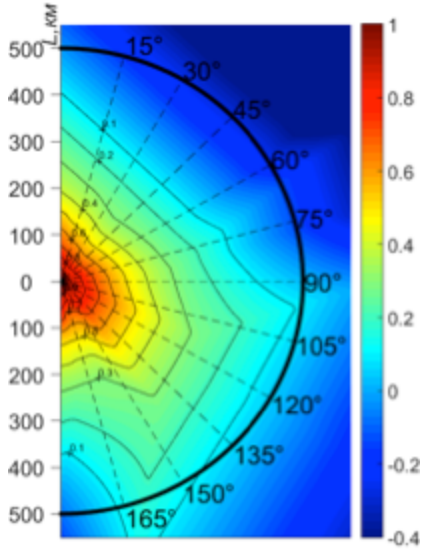
(Shiklomanov, Georgievskiy, 2008)

Runoff trends in the Russian part of the Baltic sea basin

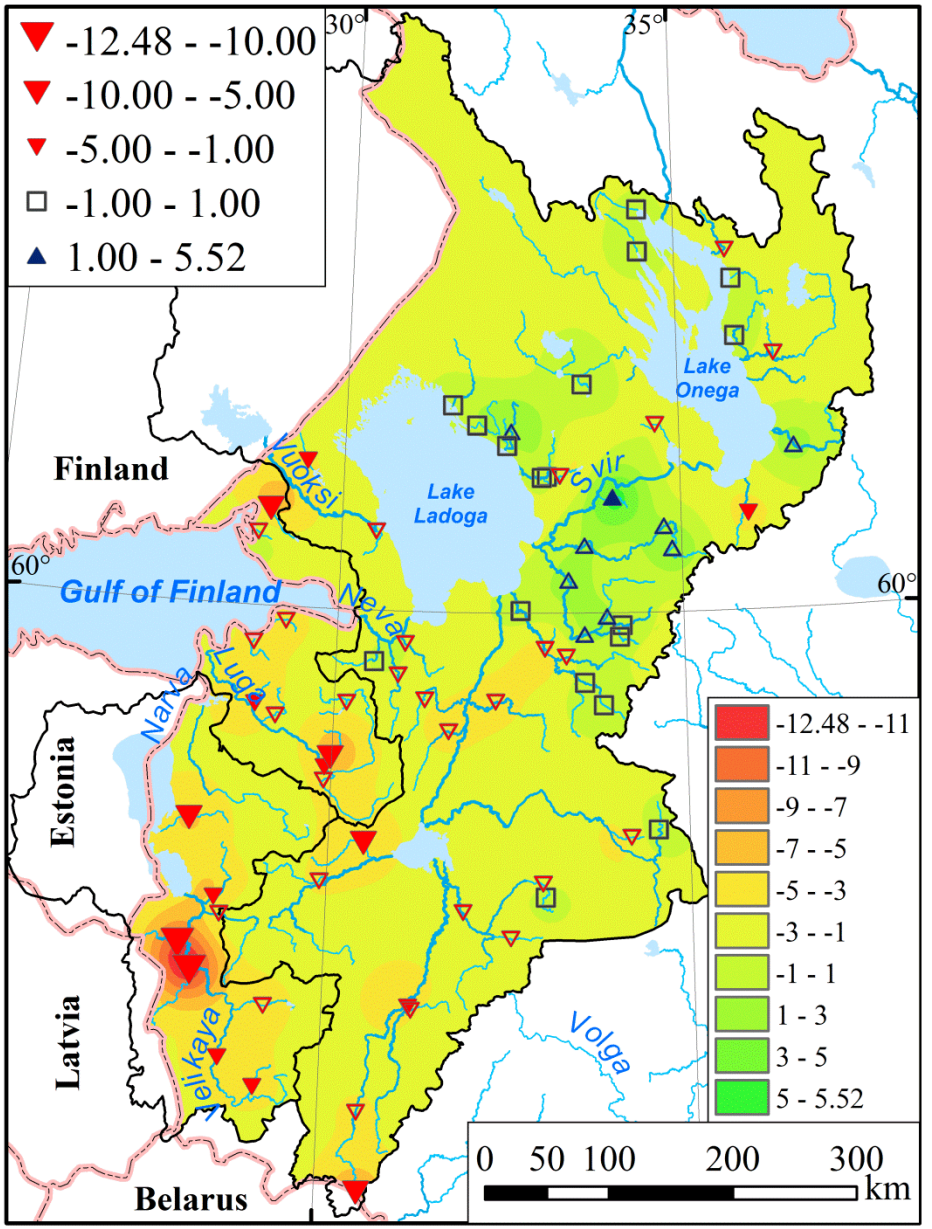
- Peak runoff of spring floods over the east of GoF basins tends to decrease in the south and to increase in the north
- The major factor of peak flow reducing is increasing of thaws during the winter period
- Spatial correlation of peak runoff is decreasing (Red – perfect correlation; blue – weak)



(1946-1978)



(1979-2013)



Peak flow trends for the period 1946-2013
(Zhuravlev, 2016)

Hydrologic modeling

A number of hydrological models were adapted to Baltic Sea region:

- HYPE (SMHI, Sweden)
- HBV (SMHI, Sweden)
- Hydrograph (SHI, Russia)
- WetSPA (Belgium, adapted to Poland)
- SWAT (USA, adapted to different countries of Baltic Sea region)

and many others

Objectives:

To share information about different models adapted for Baltic Sea basin
To review numerous hydrological studies for the different sub-basins of the Baltic Sea

What should be done (acc. to BE Science Plan, GC 5 Understanding regional variability of water and energy exchanges)

- Data description and translation. Guideline preparation.
- Review article & participation in assessment reports
- New “sub”-regional projects (e.g. Western Dvina project, Russia and Belarus)

Thank You!

Baltic Earth

Earth System Science for the Baltic Sea Region