



# BALTEX

## The Baltic Sea Experiment

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GKSS, Germany

**CEOP#6, Washington, D.C.  
12 - 14 March 2007**

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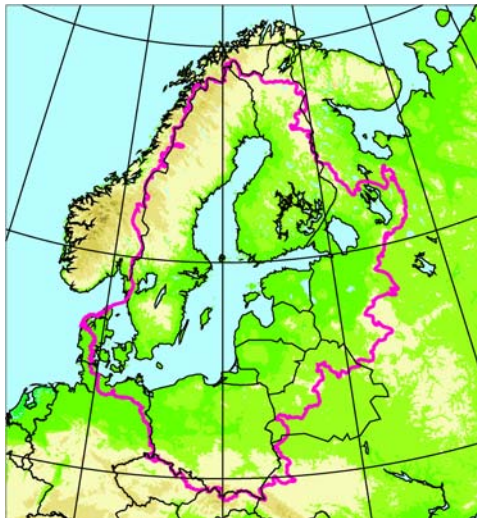
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## BALTEX Phase II



BALTEX Phase I 1993-2003

BALTEX Phase II 2003-2012



## BALTEX Phase II

Science Plan

February 2004

Science Framework and  
Implementation Strategy

April 2006

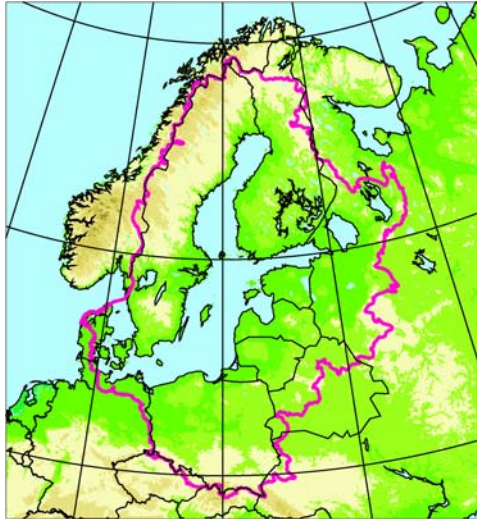
BALTEX Leadership Changes

May 2006

see [www.baltex-research.eu](http://www.baltex-research.eu)

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### BALTEX Features

- International Inter-disciplinary Partner Network across more than 10 countries with variable and project-dependent geometry and size
- No central funding
- At present, funding is largely based on institutional resources
- Functioning management structure: SSG, Secretariat, WGs
- Regular International Conferences
- Science and Strategy plans established
- Bottom-up vs. Top-down management approach is a sensible issue



### Framework considerations for BALTEX Phase II:

- 1 Gaps from BALTEX Phase 1**
- 2 GEWEX Phase 2 objectives (as of 2004/5)**
- 3 WCRP COPES framework (*Earth system modelling*)**
- 4 Environmental aspects relevant for the Baltic Sea, in particular air and water quality**
- 5 Stronger contribution to stakeholders' needs**



1. Better understanding of the **energy and water cycles** over the Baltic Sea basin
2. Analysis of **climate variability and change** since 1800, and provision of regional climate projections over the Baltic Sea basin for the 21<sup>st</sup> century
3. Provision of improved tools for **water management**, with an emphasis on more accurate **forecasts of extreme events** and long-term changes
4. Gradual extension of BALTEX methodologies to **air and water quality** studies
5. Strengthened **interaction with decision makers**, with emphasis on global change impact assessments
6. **Education and outreach** at the international level



Objectives 2 and 1

1. Better understanding of the **energy and water cycles** over the Baltic Sea basin

Objectives 1 and 3

2. Analysis of **climate variability and change** since 1800, and provision of regional climate projections over the Baltic Sea basin for the 21<sup>st</sup> century

Objective 3 and 4

3. Provision of improved tools for **water management**, with an emphasis on more accurate **forecasts of extreme events** and long-term changes

Beyond GEWEX

4. Gradual extension of BALTEX methodologies to **air and water quality** studies

Objective 4

5. Strengthened **interaction with decision makers**, with emphasis on global change impact assessments

Objective 4

6. **Education and outreach** at the international level

## BALTEX Phase II Objectives: Number of Conference Papers



5<sup>th</sup> Study Conference  
on BALTEX  
First Announcement



Kuressaare, Saaremaa  
Estonia  
4-8 June 2007

32

1. Better understanding of the **energy and water cycles** over the Baltic Sea basin

42

2. Analysis of **climate variability and change** since 1800, and provision of regional climate projections over the Baltic Sea basin for the 21<sup>st</sup> century

20

3. Provision of improved tools for **water management**, with an emphasis on more accurate **forecasts of extreme events** and long-term changes

26

4. Gradual extension of BALTEX methodologies to **air and water quality** studies

Conference  
2007:

Phase I: 27 %

Phase II: 73 %

Conference  
2004:

Phase I: 70 %

Phase II: 30 %

## GEWEX Phase II Objectives (December 2006)



GEWEX Objective 1:

Produce consistent research quality data sets complete with error descriptions of the Earth's energy budget and water cycle and their variability and trends on interannual to decadal time scales, for use in climate system analysis and model development and evaluation.

GEWEX Objective 2:

Enhance the understanding of and quantify how energy and water cycle processes contribute to climate feedbacks.

GEWEX Objective 3:

Improve the predictive capability for key water and energy cycle variables and feedbacks through improved parameterizations to better represent hydrometeorological processes, and determine the geographical and seasonal characteristics of their predictability over land areas

GEWEX Objective #4:

Undertake joint activities with operational hydrometeorological services, related ESSP projects like the GWSP, and hydrological research programs to demonstrate the value of GEWEX research, data sets and tools for assessing the consequences of climate predictions and global change for water resources.

## GEWEX Phase II Objectives (Frascati, Oct 2006)



### GEWEX Objective 1:

Produce consistent research quality data sets complete with error descriptions of the Earth's energy budget and water cycle and their variability and trends on interannual to decadal time scales, for use in climate system analysis and model development and validation.

### GEWEX Objective 2:

Enhance the understanding of how energy and water cycle processes function and quantify their contribution to climate feedbacks.

### GEWEX Objective 3:

Determine the geographical and seasonal characteristics of the predictability of key water and energy cycle variables over land areas and through collaborations with the wider WCRP community and determine the predictability of energy and water cycles on a global basis.

### GEWEX Objective 4:

Develop better seasonal predictions of water and energy cycle variability through improved parameterizations encapsulating hydrometeorological processes and feedbacks for atmospheric circulation models.

### GEWEX Objective 5:

Undertake joint activities with operational hydro-meteorological services and hydrological research programmes to demonstrate the value of new GEWEX prediction capabilities, data sets and tools for assessing the consequences of climate predictions and global change.



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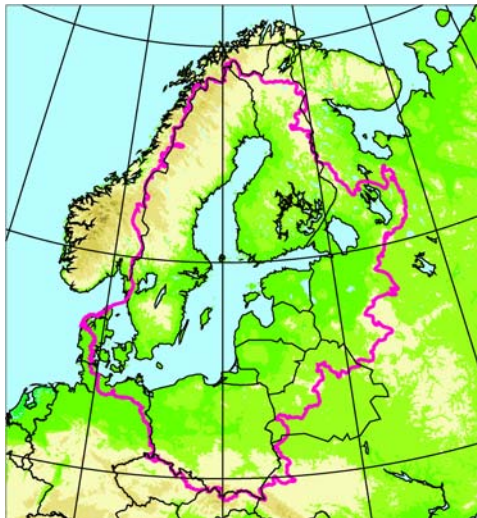
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## BALTEX Phase II 2003-2012



### BALTEX Interaction with Users

- BSSG chair and vice-chair represent 2 major national Hydromet Services in Scandinavia
- 8 national Hydromet Services in northern and central Europe have representatives in the BSSG
- Successful cooperation with HELCOM (Helsinki Commission) as an intergovernmental body related to *Assessment of past and future climate variability and change and ecosystem impact in the Baltic Sea basin*



BSSG = BALTEX Science Steering Group

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**7 March 2007:** HELCOM Report on Climate Change in the Baltic Sea basin, which is based on the BALTEX assessment, officially adopted by the HELCOM general assembly of national heads of delegations.

*The assessment will be submitted as a background document to the upcoming **HELCOM Ministerial Meeting** in November, which is slated to adopt the strategic **Baltic Sea Action Plan** to further reduce pollution in the sea and restore the good ecological status of the marine environment.*

## BALTEX Phase II: Objective 1

### 1 Better understanding of the energy and water cycles over the Baltic Sea basin



#### Major Goals

- Evaluation of regional models
- Better and more comprehensive observations from the Baltic Sea basin
- Development of a complete numerical regional climate model system
- “Closing” the energy and water budgets at higher levels of confidence

... *i.e.* largely a selective continuation of Phase I ...

## BALTEX Phase II: Objective 1 (2)



### 1 Better understanding of the energy and water cycles over the Baltic Sea basin



#### Specific observational gaps:

- Solid precipitation, snow
- Impact of water vapour, clouds and aerosols on regional radiation balance components
- Soil water and ice
- Baltic Sea bottom currents

#### Major Goals

- Evaluation of regional models
- Better and more comprehensive observations from the Baltic Sea basin
- Development of a complete numerical regional climate model system
- “Closing” the energy and water budgets at higher levels of confidence

## BALTEX Phase II: Objective 2



### 2 Analysis of climate variability and change since 1800, and provision of regional climate projections over the Baltic Sea basin for the 21<sup>st</sup> century



#### Major Goals

- Mechanisms of regional climate variability and change
- Detection and attribution of regional climate change
- Projections of future climate variability and change

**BACC**  
**BALTEX ASSESSMENT OF CLIMATE CHANGE**  
**for the Baltic Sea Basin**

### BALTEX Phase II: Objective 3



3 Provision of improved tools for water management, with an emphasis on more accurate forecasts of extreme events and long-term changes



- To assess how both present and future climate variability impacts on water resources
- To develop methods/tools to quantify and reduce associated risks from climate extremes

- Development and validation of coupled hydrological-atmospheric models
- Improvement of flood forecasting



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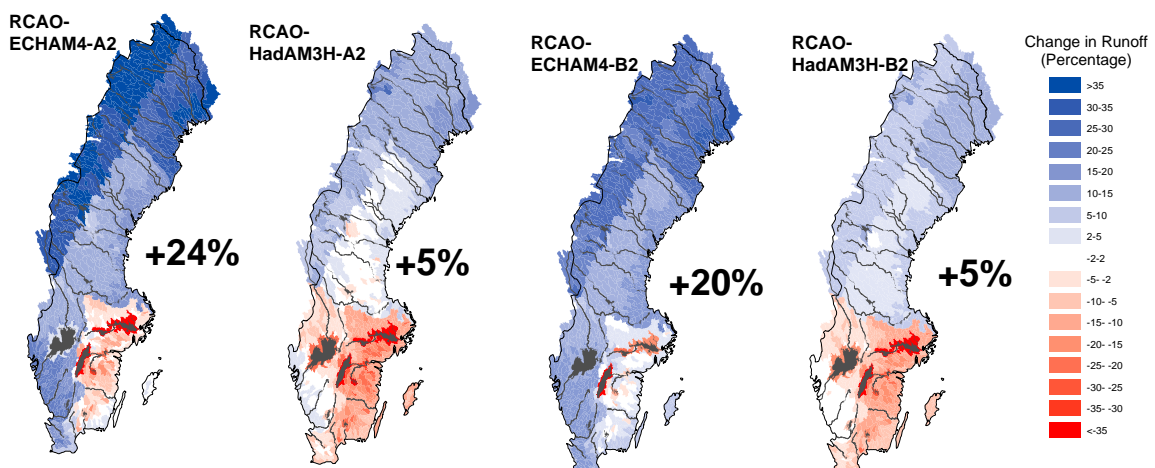
### BALTEX Phase II: Objective 3 (2)



3 Provision of improved tools for water management, with an emphasis on more accurate forecasts of extreme events and long-term changes

#### Percent difference in mean annual runoff

2071-2100 compared to 1961-1990



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4 Gradual extension of BALTEX methodologies to air and water quality studies

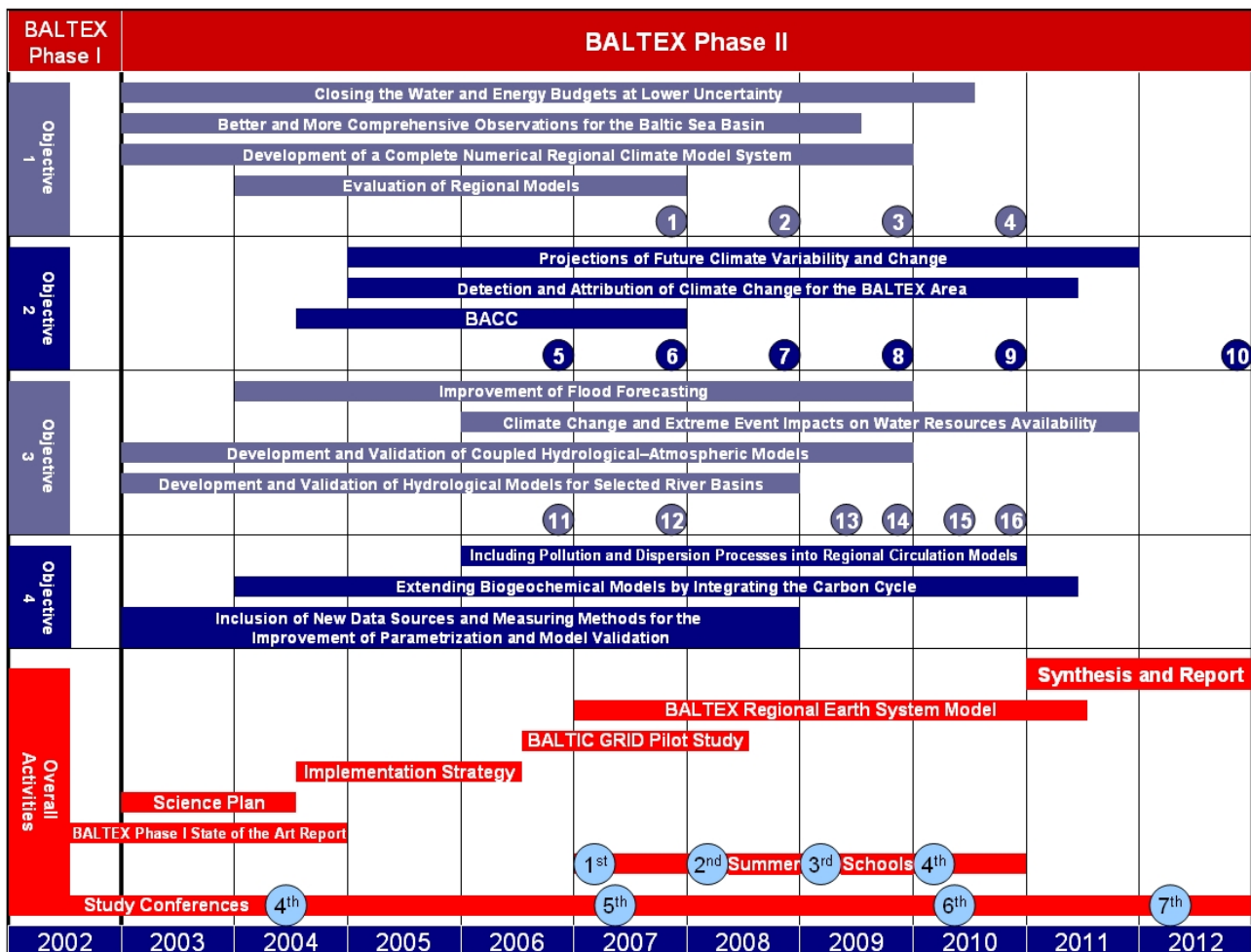


Major Goals

- Modelling nutrient and pollutant budgets and fluxes in the Baltic Sea basin
- Coupling of regional climate models with biogeochemical models
- Harmonisation of modelling tools
- Inclusion of nutrient and carbon cycles into climate models
- New data sources and measurement techniques
- Dedicated field experiments

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Reference sites Cabauw, Lindenberg, Sodankylä  
Model output data archive, DKRZ Hamburg

### GEWEX Objective 1

Establish and discuss independent estimates of the water and energy budgets over land and sea in the Baltic Sea basin, based on observations, re-analysis products such as ERA-40, and model results (2007).

Complete independent estimates of the water and energy budgets over land and sea in the Baltic Sea basin for the period 1980 to 2005 as input to the GEWEX RHP-related activities (2008).

A BALTEX “state-of-the-art” Baltic Sea basin energy and water cycle product complete with error bars will be produced and discussed. This product will provide the best estimates of the water cycle variables and analysis of the ability to close the Baltic Sea basin (and sub-basins) water budget for the period 1980 to 2010 (2012).



### GEWEX Objective 2

Assess existing knowledge on past and projected regional climate variability and changes and related impacts on ecosystems in the Baltic Sea basin, identify related research needs (2007).

Initiate climate change detection, attribution and vulnerability studies at the regional scale for the Baltic Sea basin (2007).

Establish and discuss climate projections for the 21st century using coupled regional models for the Baltic Sea basin (2008).

Establish ensemble climate projection products including error estimates for the Baltic Sea basin (2009).

Assess climate change detection, attribution and vulnerability at the regional scale for the Baltic Sea basin (2010).

Update the assessment of climate change and variability for the Baltic Sea basin as a final document originating from BALTEX (2012).



### GEWEX Objectives 3 and 4

Identify specific river basins with the potential for a close cooperation between researchers and management authorities with the aim to jointly improve and develop flood forecast model tools. Implement related projects at the international level (2007).

Assess the present performance of flood forecasting models in different regions of the Baltic Sea basin and identify future cooperation for projects dedicated to flood forecasting improvement. Implement related projects at the international level (2007).

Establish and discuss assessments of the availability of water resources based on ensemble climate projections for the 21st century in cooperation with water management authorities in selected river basins and for the entire Baltic Sea basin (2009).

Provide an assessment of the role of land-atmosphere interactions during major wet and dry (drought) periods, specifically for the 1995 to 2004 period, as a contribution to pan-GEWEX activities (2009).

Provide assessments of water resources including ground water based on ensemble climate projections for the 21st century for the entire Baltic Sea basin. Establish long-lasting cooperation or joint-ventures with river basin management authorities for selected river basins with the view to continuously update water resources assessments (2010).

Assess improvements in flood forecasting models in different river catchments in the Baltic Sea basin (2010).

### BALTEX view of (and expectation to) the new CEOP (as a follow-up to GHP)

Added value through

A platform (or panel) for exchanging ideas, views, regional results concerning common scientific topics and aims defined in the frame of GEWEX / WCRP

Options for co-operation (i) within CEOP and (ii) beyond (but within GEWEX and WCRP)

WEBS, ICTS (ongoing)

Extremes, Cold region study, NEESPI, CLIVAR (tbd)

Are the revised RHP criteria adequate and ready for approval ?

See next slide



**Draft RHP TECHNICAL CRITERIA (To be proposed for 2007)**

- Cooperation of an NWP center for provision of atmospheric and land surface data assimilation.
- Atmospheric-hydrologic models for studying transferability and climate variability.
- Mechanism for collecting and managing adequate hydrometeorological data sets.
- Participation in the open international exchange of scientific information and data.
- Interactions with hydrologic services and related groups
- Commitment of adequate resources and personnel. ??
- Evaluation of GEWEX global data products
- Contributions to CEOP in situ, remote sensing, and model output databases.

**Draft RHP SCIENTIFIC CRITERIA (To be proposed for 2007)**

- Observe, simulate, and predict the diurnal, seasonal, annual and interannual cycles.
- Determine climate system variability and critical feedbacks. ??
- Demonstrate improvements in predictions of water-related climate parameters.
- Demonstrate the applicability of techniques and models for other regions. ??
- Assess the human impact on hydroclimate variations, including vulnerability to climate change. ??

## BALTEX Phase II 2003-2012

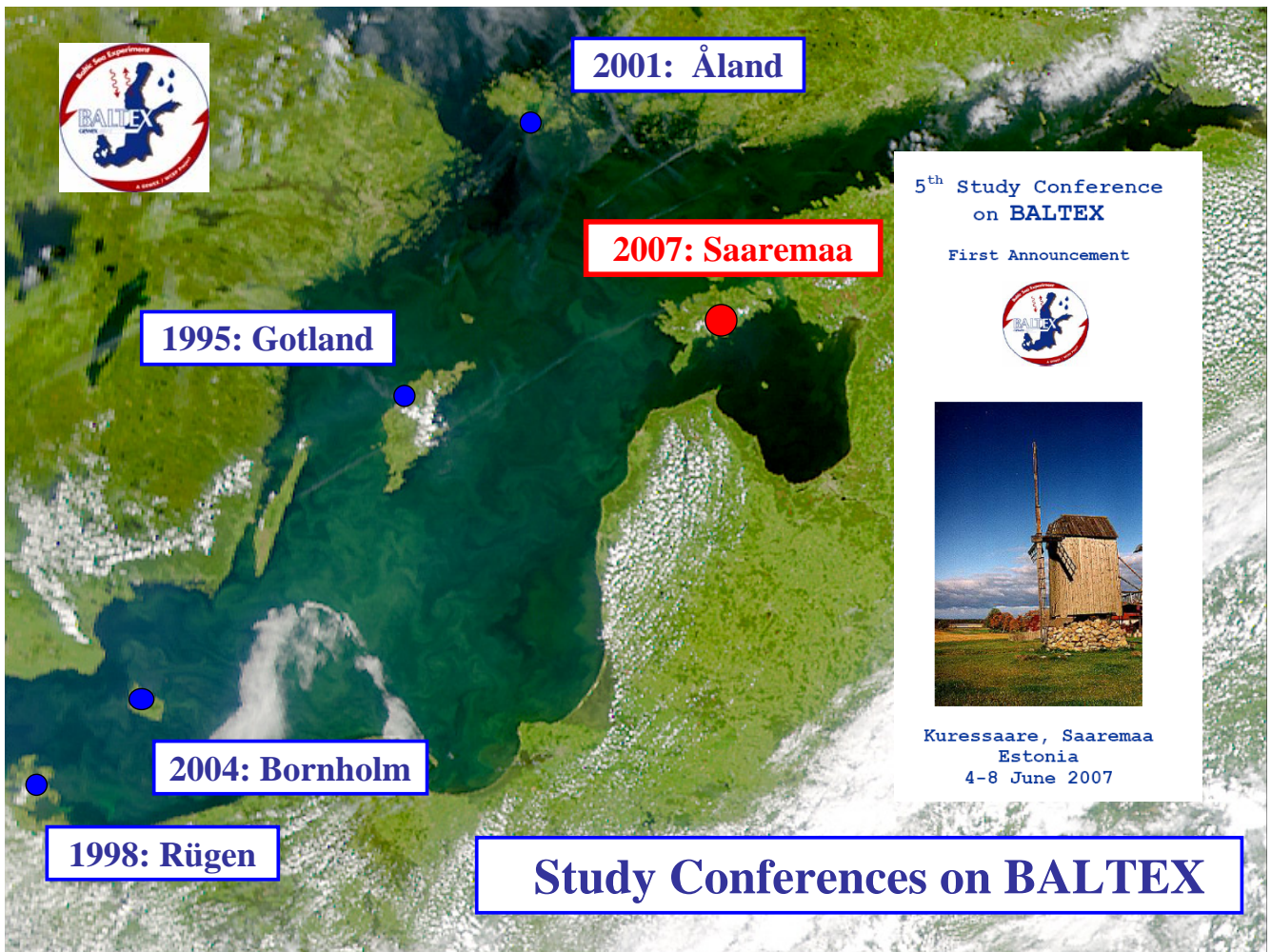


**Draft RHP SCIENTIFIC CRITERIA (To be proposed for 2007)**

- Observe, simulate, and predict the diurnal, seasonal, annual and interannual cycles.
- Determine climate system variability and critical feedbacks.
- Demonstrate improvements in predictions of water-related climate parameters. (??)
- Demonstrate the applicability of techniques and models for other regions.
- Assess the human impact on hydroclimate variations, including vulnerability to climate change (??)

Contribute to providing climate projections for water cycle-relevant parameters at the regional scale and at appropriate time scales (during 21st century)

Contribute to assessing past and present hydroclimate variability and change and contribute to detection, attribution and vulnerability studies at the regional scale



**BALTEX Phase II: 5<sup>th</sup> Study Conference 2007**

in co-operation with

**HELCOM**

(the Baltic Marine Environment Protection Commission)

**LOICZ “Land-Ocean Interactions in the Coastal Zone”**  
a core-project of IGBP

**ASTRA “Developing Policies & Adaptation Strategies to  
Climate Change in the Baltic Sea Region”**  
EU INTERREG IIIB Project

**ENSEMBLES “Ensemble-based predictions of climate changes  
and their impacts”,** FP6 Integrated Project

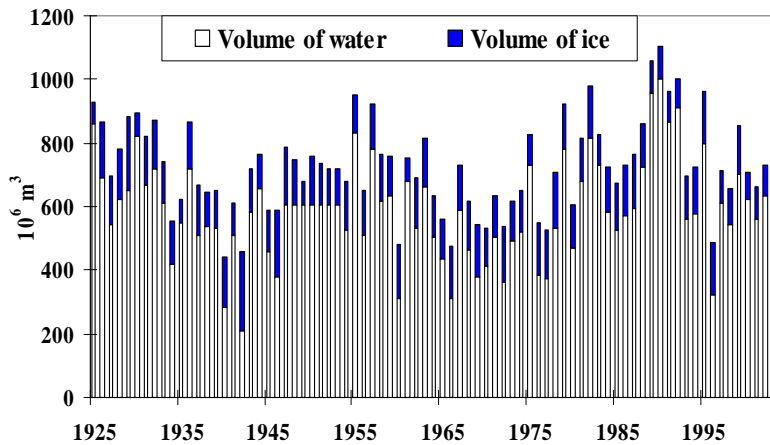
**EUR-OCEANS “Excellence for Ocean Ecosystem Analysis”,**  
FP6 Network of Excellence



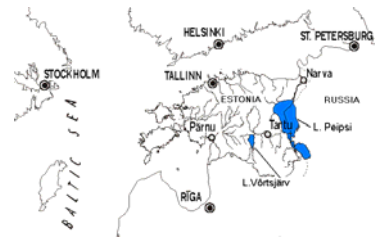


## Exploration of long-term observational records

*We suggest to strengthen the collection and exploration of long-term (decades to centuries) observational data records to document past and present climate. Focus should be on water cycle relevant parameters.*



### Lake Võrtsjärv Estonia



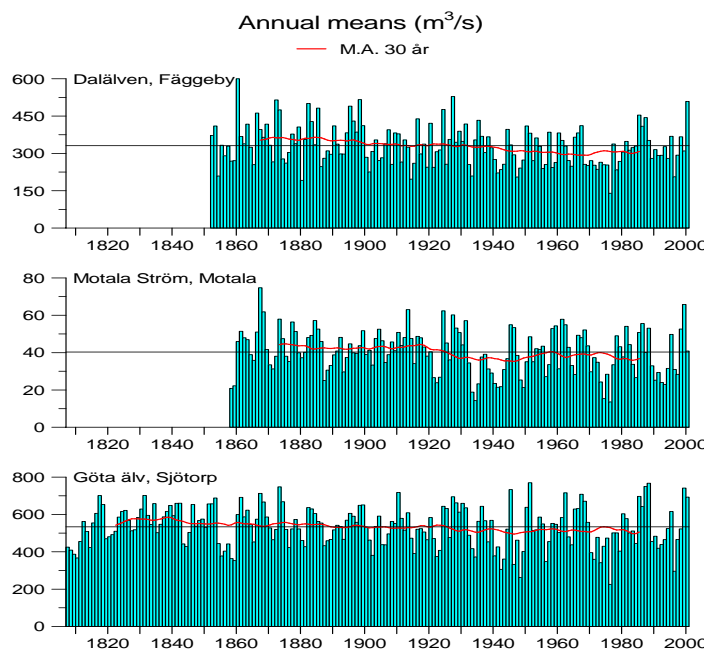
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## Sweden's longest records

### Annual mean runoff



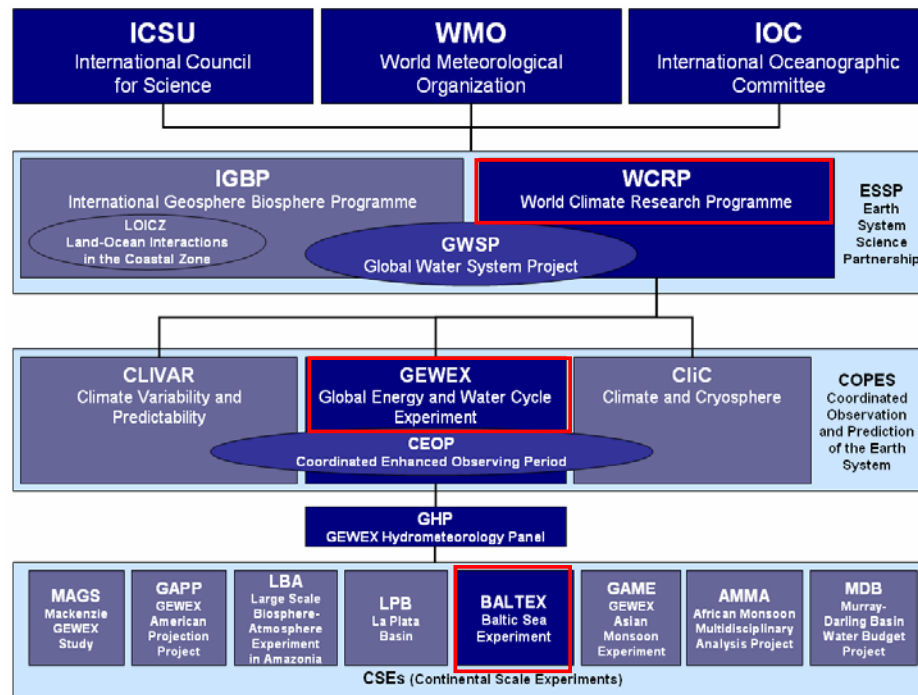
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## Issues and Recommendations (2)



Global and regional research programmes and projects relevant for BALTEX. *BALTEX Phase II Science and Implementation Strategy, 2006, page 72.*

## The Roots of BALTEX





## CEOP-RHP plenary session 8

1. Data needs: **Satellite data and products**
2. Data infrastructure needs:  
**One-stop shop (Unidart) presently planned to re-place the traditional BALTEX data centre structure, share experiences with CEOP beneficial, concrete support essential with satellite data.**
3. Climate region commonality: **Common climate regimes with CPPA and NEESPI, cold-region studies**
4. Needs for up- and downscaling ??
5. Needs for pilot demonstrations ??
6. Clarification of limitations

**What are the implications of a „project of projects“ for a RHP such as BALTEX ?**



***Thank you !***





