BACC2 Chapter 4.3: Projections of future climate change

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Markus Meier, SMHI
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Aslak Grinsted, KU

General remarks

- Roughly on time, except for the marine part (Markus M), which has been delayed until mid March due to work overload
- 41 pages, 7 pages of references
- One (anonymous) review has been received; somewhat harsh, in particular wrt. sea level: *a consensus is indicated, which does not exist*
- Our chapter is somewhat inhomogeneous: A mix of pure literature overview (”review style”; sds and hydrology) and a more result-oriented descriptive writing (”paper style”; dds and sea level); what do we want?

Contents

DMI

What is inside

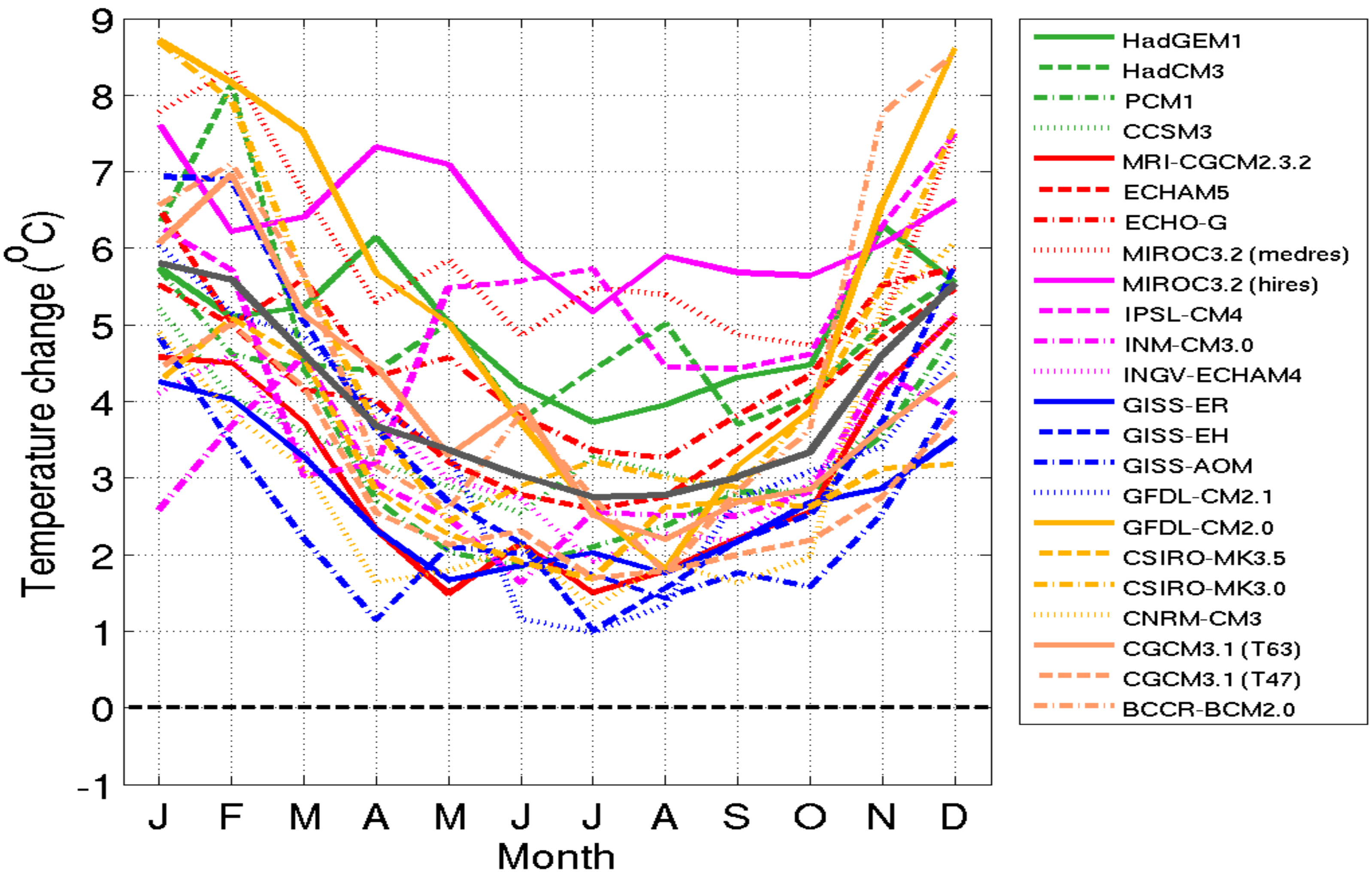
- **4.3 Projections of future climate change**
- *Ole B. Christensen, Erik Kjellström*

- Table 4.3.1 Selection of ENSEMBLES RCM simulation used in this section. All simulations follow the SRES A1B scenario. For documentation on the individual models, see http://ensemblesrt3.dmi.dk/
- **Preparing this talk I discovered that the models used for extremes analysis are not exactly this set. I am sure the conclusions hold, and I will of course correct the figures and the text**

Acronym	**GCM**	**RCM**
ICTP-REGCM3_ECHAM5	ECHAM5	RegCM3
MPI-M-REMO_ECHAM5	ECHAM5	REMO
SMHIRCA_ECHAM5-r3	ECHAM5	RCA
KNMI-RACMO2_ECHAM5	ECHAM5	RACMO2
DMI-HIRHAM5_ECHAM5	ECHAM5	HIRHAM5
SMHIRCA_BCM	BCM	RCA
DMI-HIRHAM5_BCM	BCM	HIRHAM5
DMI-HIRHAM5_ARPEGE	ARPEGE	HIRHAM5
CNRM-RM5.1_ARPEGE	ARPEGE	Aladin
ETHZ-CLM_HadCM3Q0	HadCM3	CLM
METO-HC_HadRM3Q0_HadCM3Q0	HadCM3	HadRM3

What is inside

- GCM results for the region



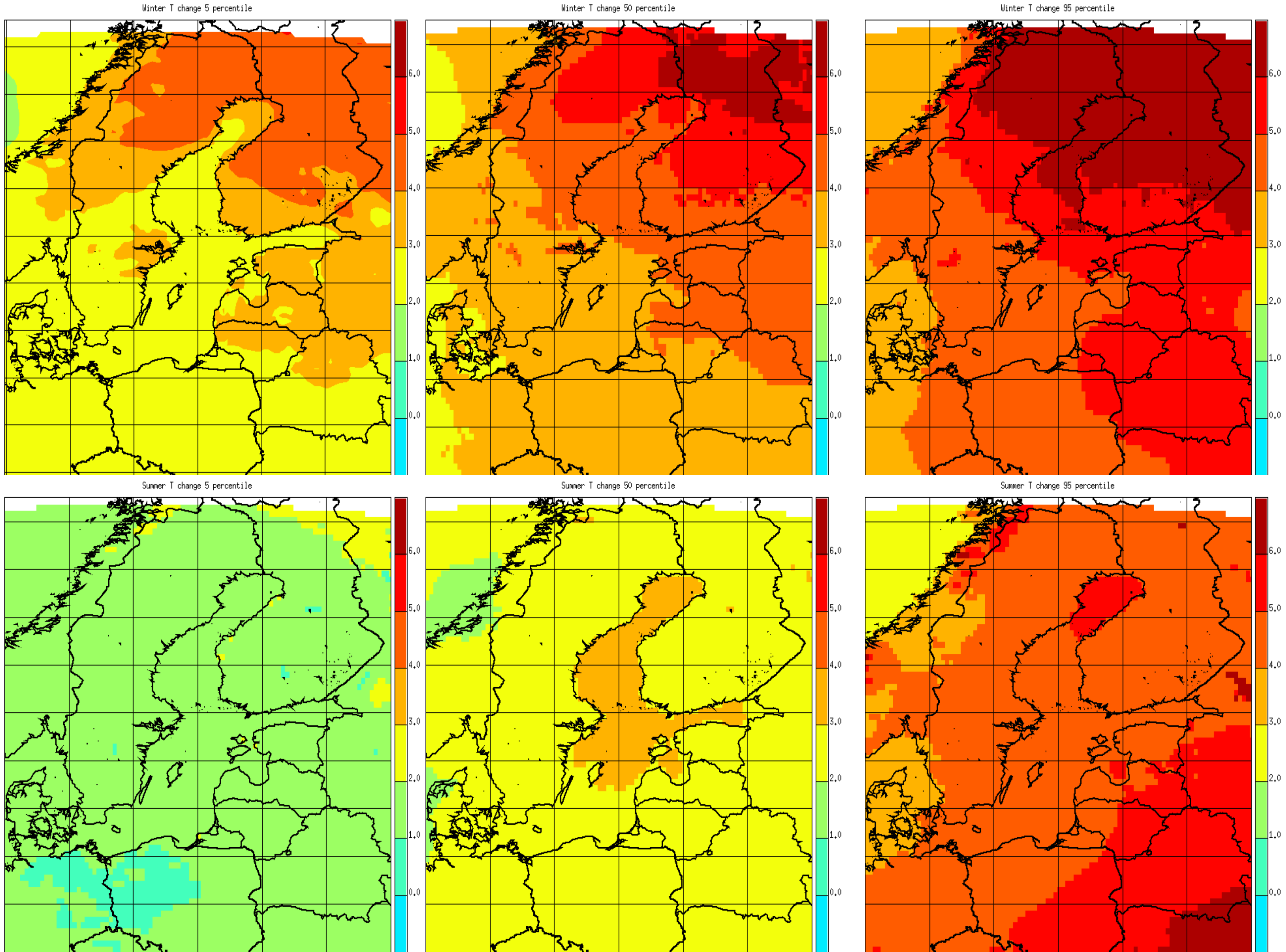
What is inside

- RCM results
- Temperature
- Precipitation
- Wind speed
- Extremes of precipitation and wind speed

- All with model spread!!

What is inside

- RCM-based maps: Temperature



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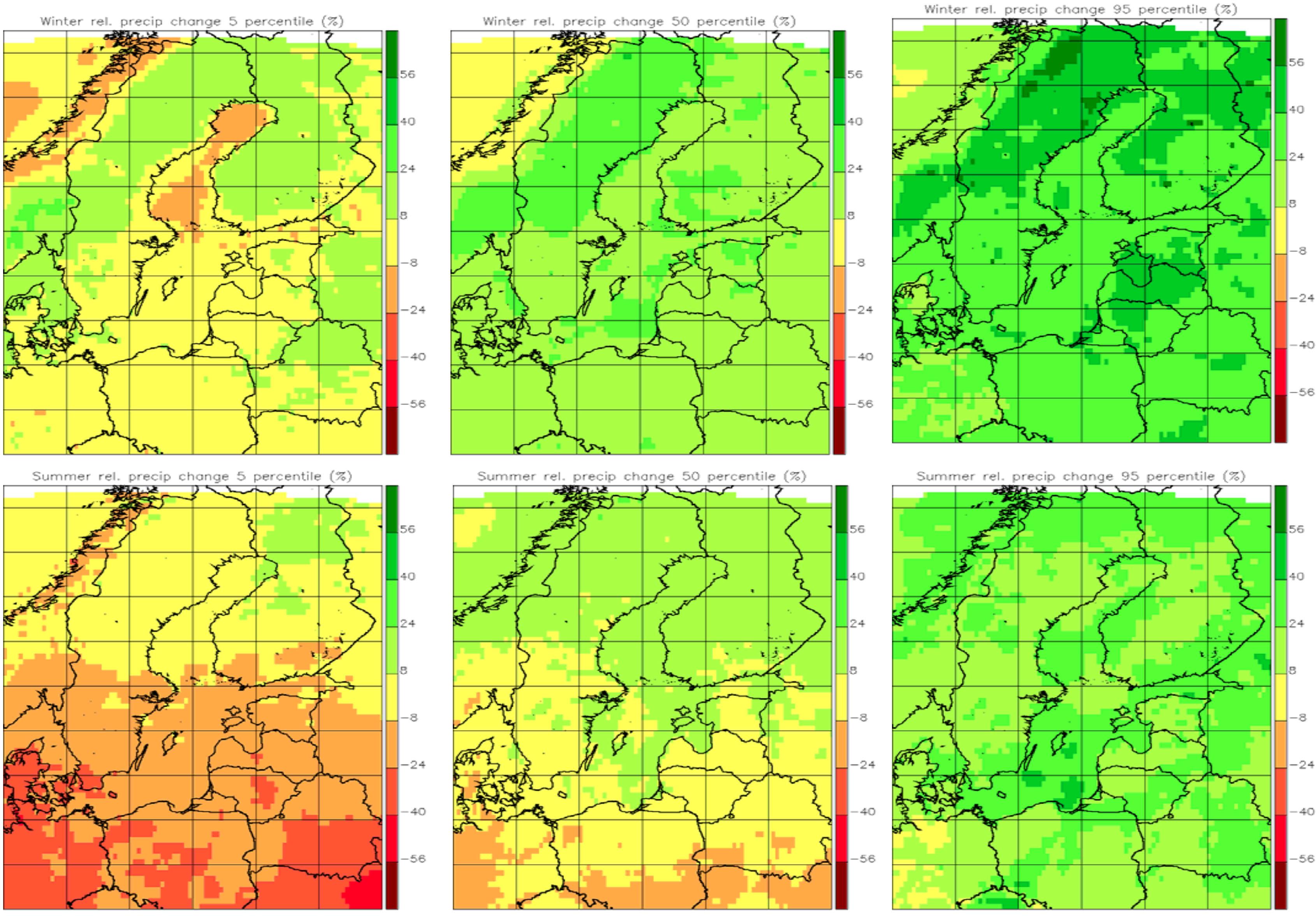
- RCM-based maps: Precipitation



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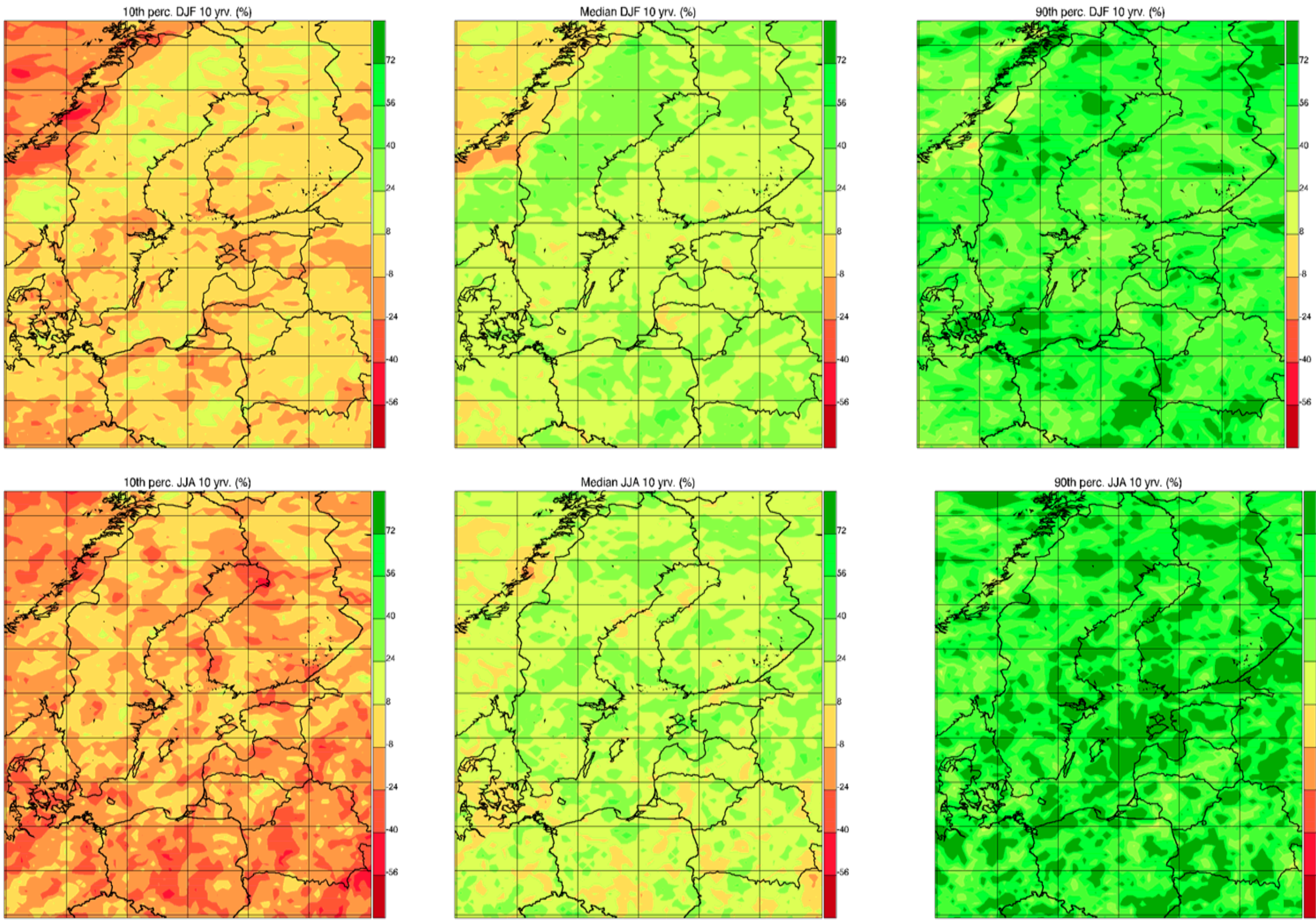
- RCM-based maps: Extremes



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- **4.3.1.9 Statistical Downscaling**
- *Eduardo Zorita*

- Statistical downscaling literature review
- For the Baltic Sea area, SD methods have been mostly applied to estimate future changes in hydrological variables like precipitation and run-off, and of storm-related variables like wind. The usual large-scale predictors are SLP and geopotential height. Linear regression methods have generally been more frequently found in the literature. The applications for the Baltic Sea area have rather made use of non-linear methods, such as weather typing, fuzzy networks and clustering algorithms

What is inside

- **4.3.2 Hydrological Changes in the Baltic Region**
- *Torben Sonnenborg*

- The majority of studies of expected changes in the hydrology of the Baltic Sea Basin have been performed at a national level. We have therefore structured the following description according to countries.
- ***4.3.2.2 Synthesis of Projected Future Hydrological Changes***
- The studies cited above generally confirm the conclusions from BACC (2008). For areas presently characterized by spring floods due to snow melting, the floods will generally occur earlier and the magnitude will decrease in the future because of less snowfall and shorter snow accumulation period. As a consequence, sediment transport and the risk of inundation are expected to decrease.
- Decreasing precipitation combined with increasing temperature and evapotranspiration during summer are projected to result in drying of the root zone and increasing irrigation demands in the southern part of the Baltic Sea area.
- The uncertainty issue has received increasing attention during the last period. Results indicate that especially the GCM is important for the projected changes in climate
- In only one study the effect of impact model uncertainty has been investigated. Several uncertainties are associated with impact modelling including parameter uncertainty and model structure uncertainty.

What is inside

- **4.3.4 Changes in the Baltic Sea Level**
- *Aslak Grinsted*

- Global warming is causing sea levels to rise, primarily due to loss of land-based ice masses and thermal (steric) expansion of the world oceans. The projected changes in Relative Sea Level (RSL) will deviate markedly from the global mean for a variety of reasons. A practical approach to projecting regional sea level rise is to project the individual major contributions to global mean sea level rise, and combine this budget with the corresponding spatial fingerprints of each contributor.
- Based on [our] estimates, we project 0.78 m ± 0.4 m of global mean sea level rise under SRES scenario A1B by 2090-2099.

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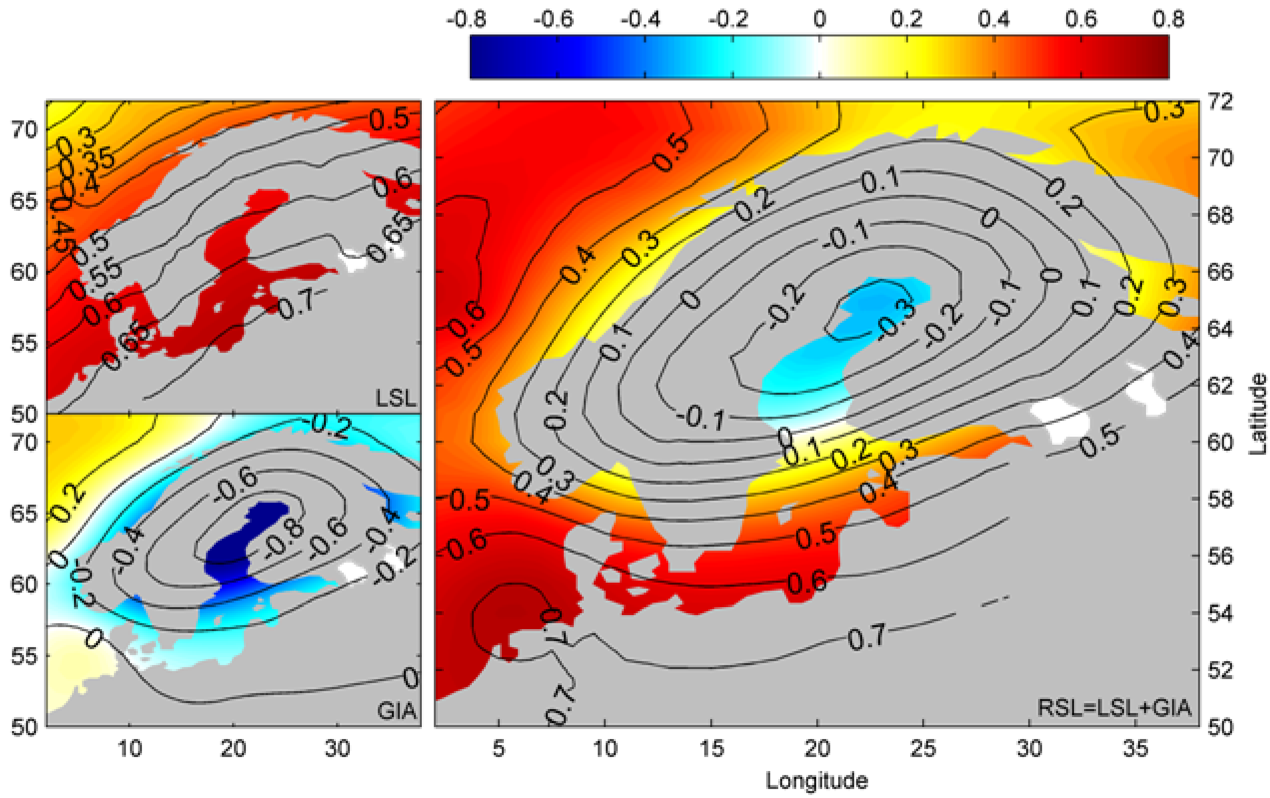

Figure 4.3.14. Right panel shows the **projected** Regional Sea Level rise from 1990-1999 to 2090-2099 under SRES scenario A1B, decomposed into local sea level rise (left top) and glacial isostatic adjustment (left bottom).

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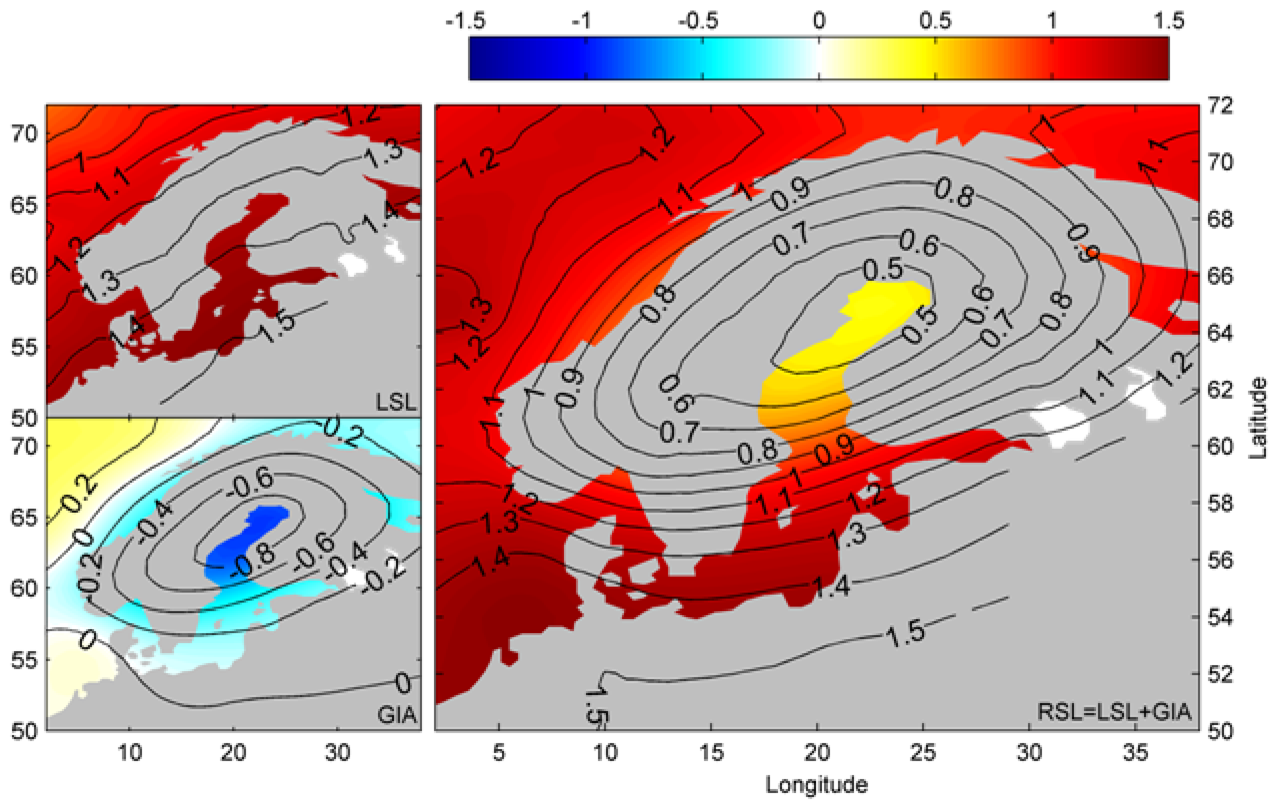

Figure 4.3.15. A **high-end estimate** of sea level rise in the Baltic. Right panel shows the projected Regional Sea Level rise from 1990-1999 to 2090-2099, decomposed into local sea level rise (left top) and glacial isostatic adjustment (left bottom).