Chapter 4.3 Projections of future climate change

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4.3.1 Atmospheric change in the Baltic Sea region

4.3.2 Hydrological changes in the Baltic Region

4.3.3 Marine physical changes

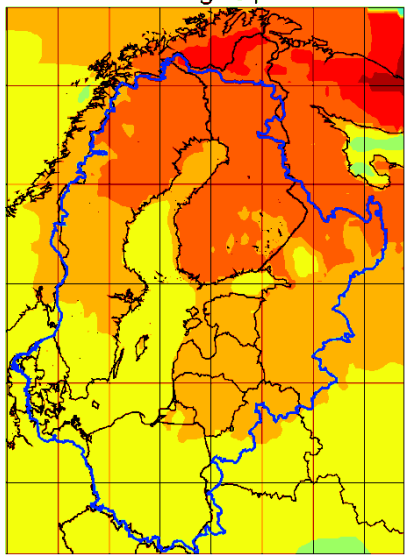
4.3.4 Changes in the Baltic Sea level

Atmospheric change: Spans of projections from an ensemble

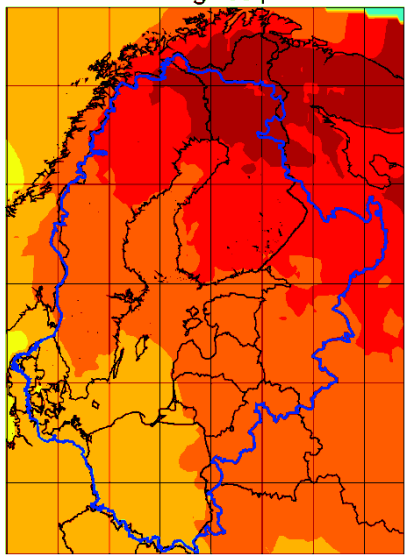
- 13 RCM simulations from the ENSEMBLES project change between 1961-1990 and 2070-2099
- The 13 numbers are sorted, resulting in an approximate 5th percentile corresponding to the lowest value, a median, and an approximate 95th percentile.
- http://ensemblesrt3.dmi.dk/

Span of projected warming

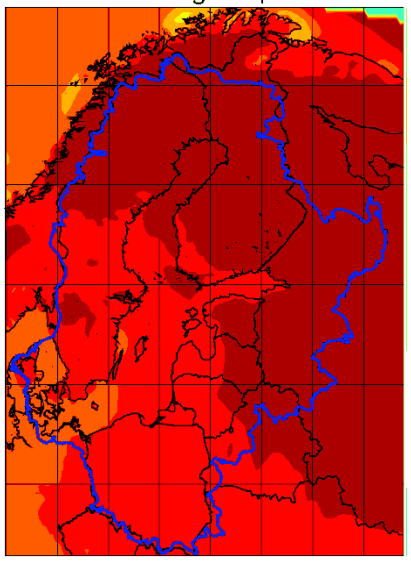
Winter T change 5 percentile



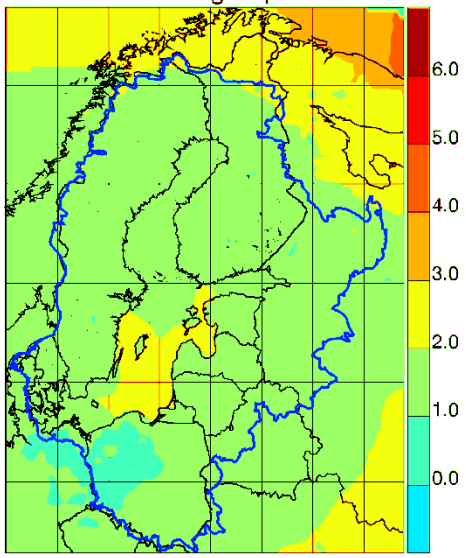
Winter T change 50 percentile



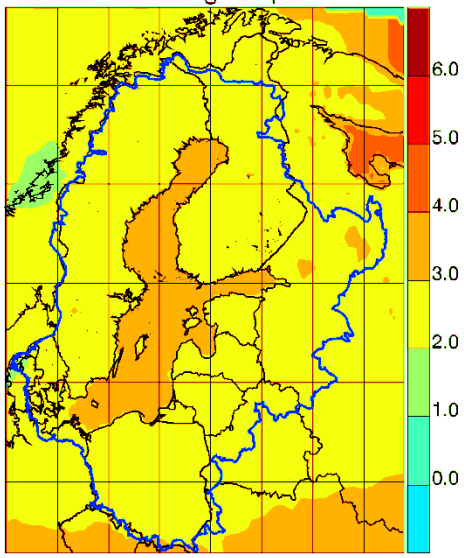
Winter T change 95 percentile



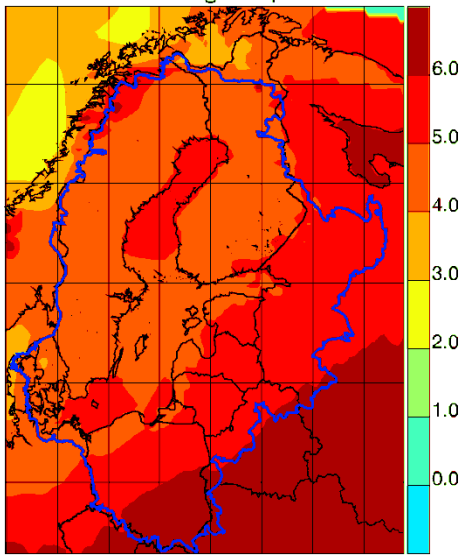
Summer T change 5 percentile



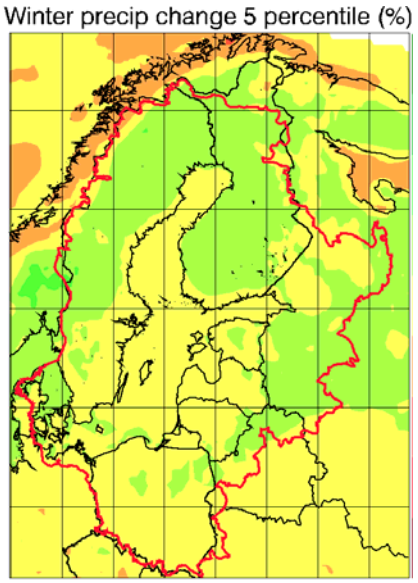
Summer T change 50 percentile

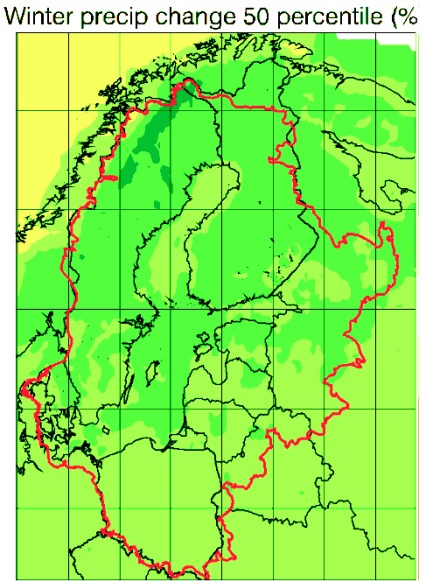


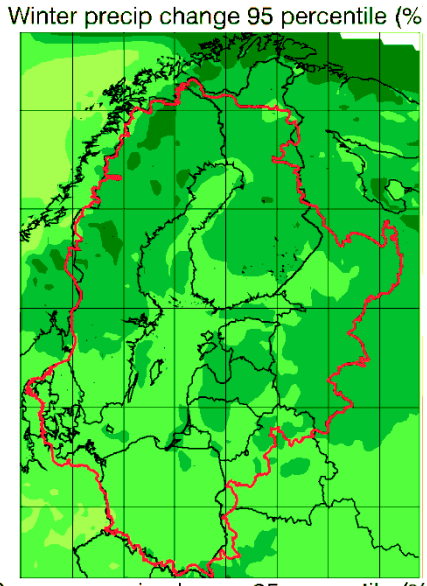
Summer T change 95 percentile

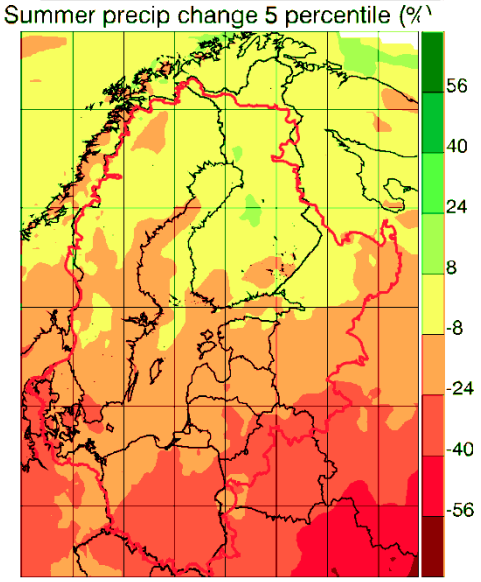


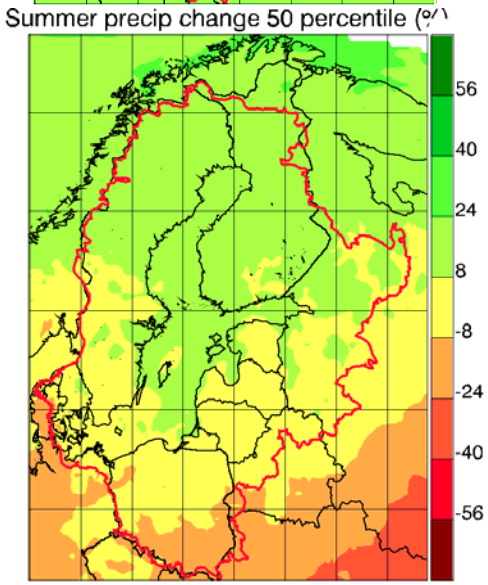
Span of precipitation change

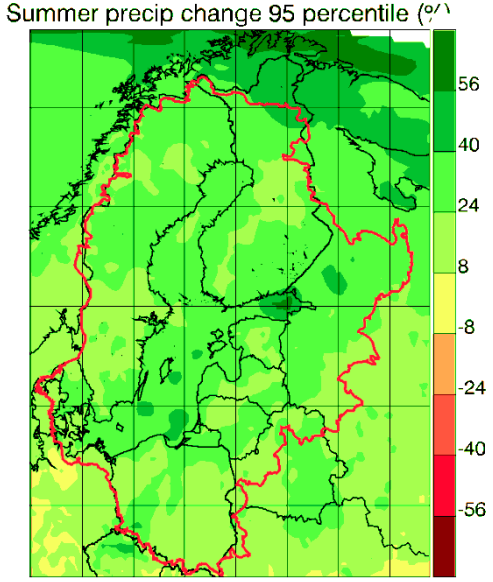






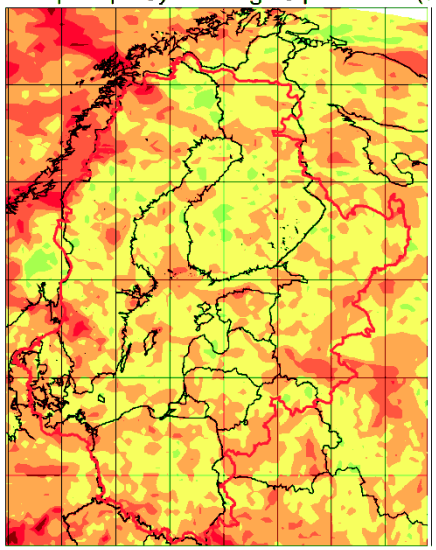




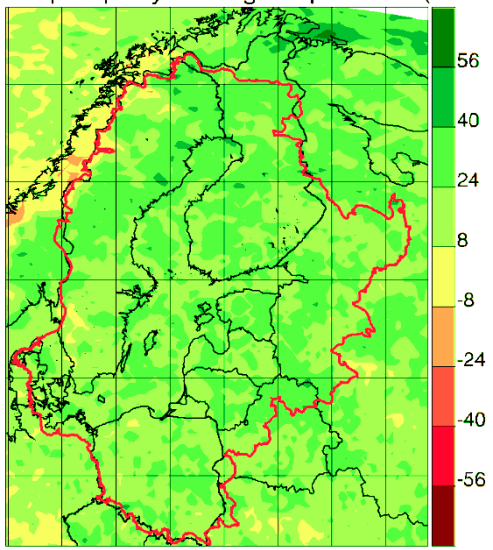


Span of 10y return value precip.

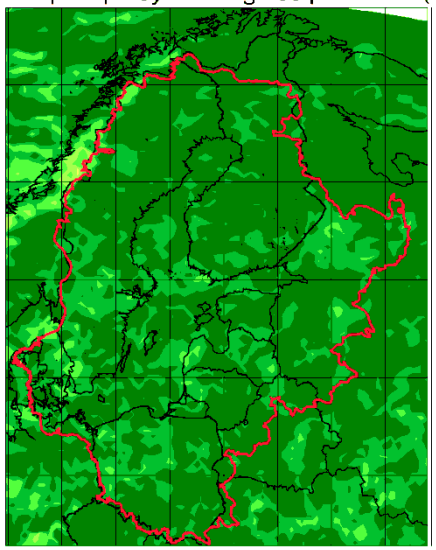
Winter precip 10yrv change 5 percentile (



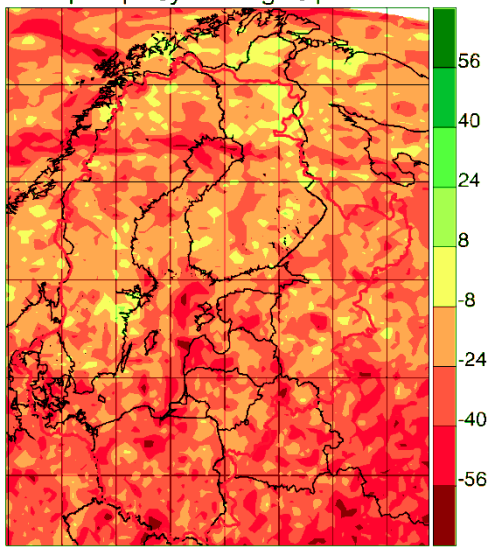
Winter precip 10yrv change 50 percentile (



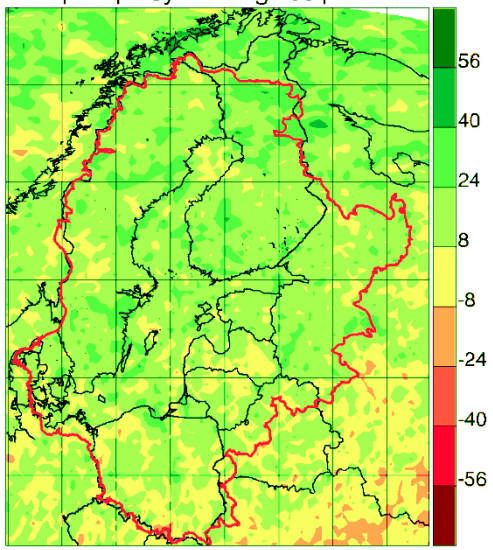
Winter precip 10yrv change 95 percentile (



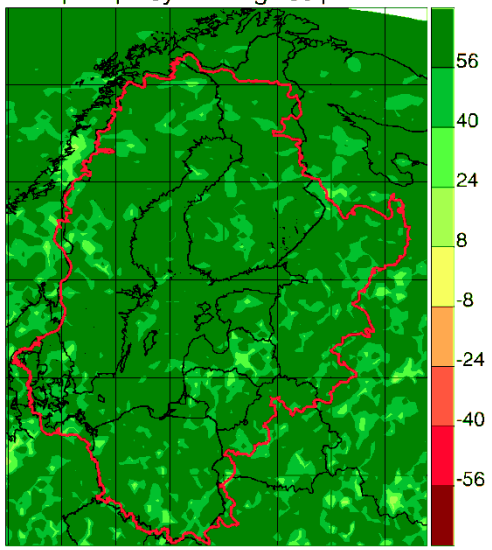
Summer precip 10yrv change 5 percentile



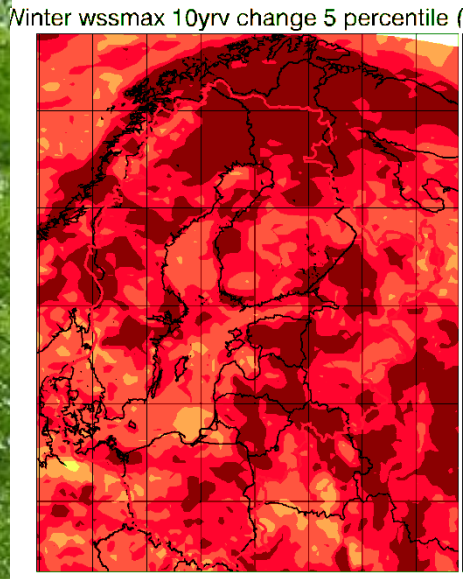
ummer precip 10yrv change 50 percentile

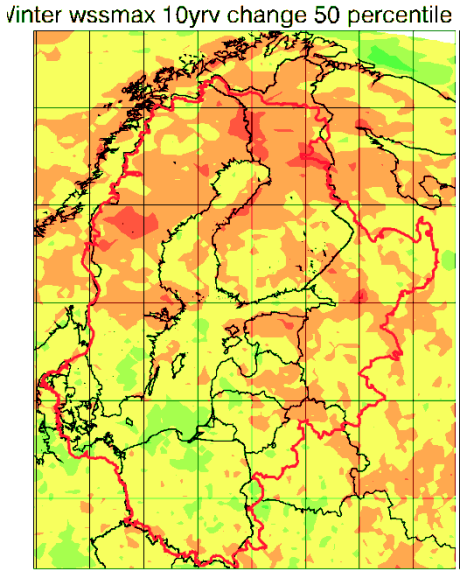


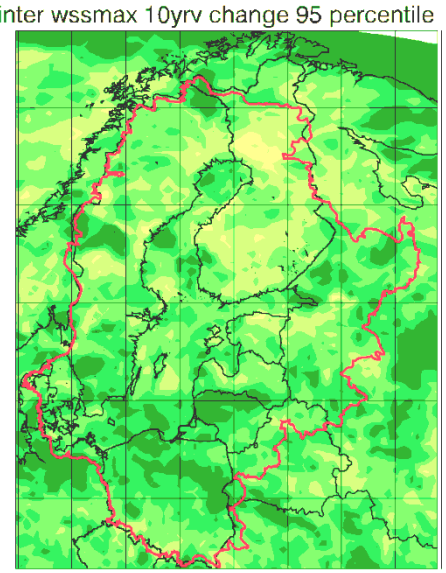
ummer precip 10yrv change 95 percentile

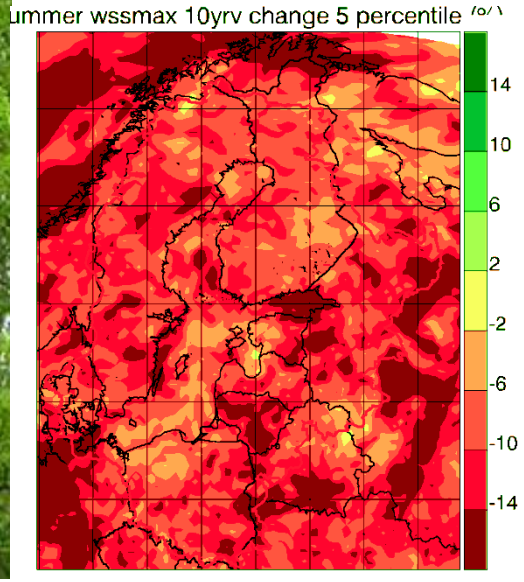


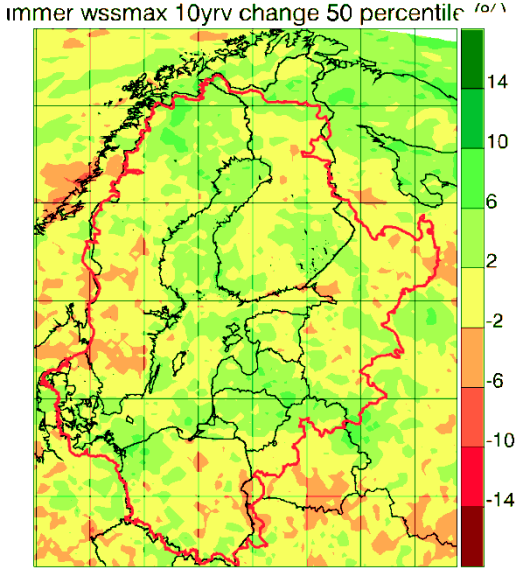
Wind extremes 10yrv

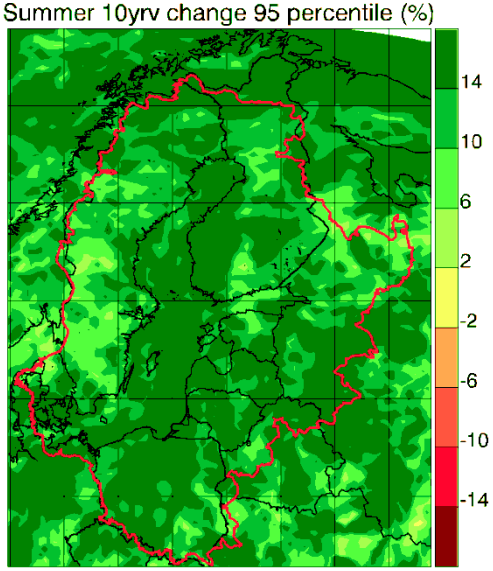




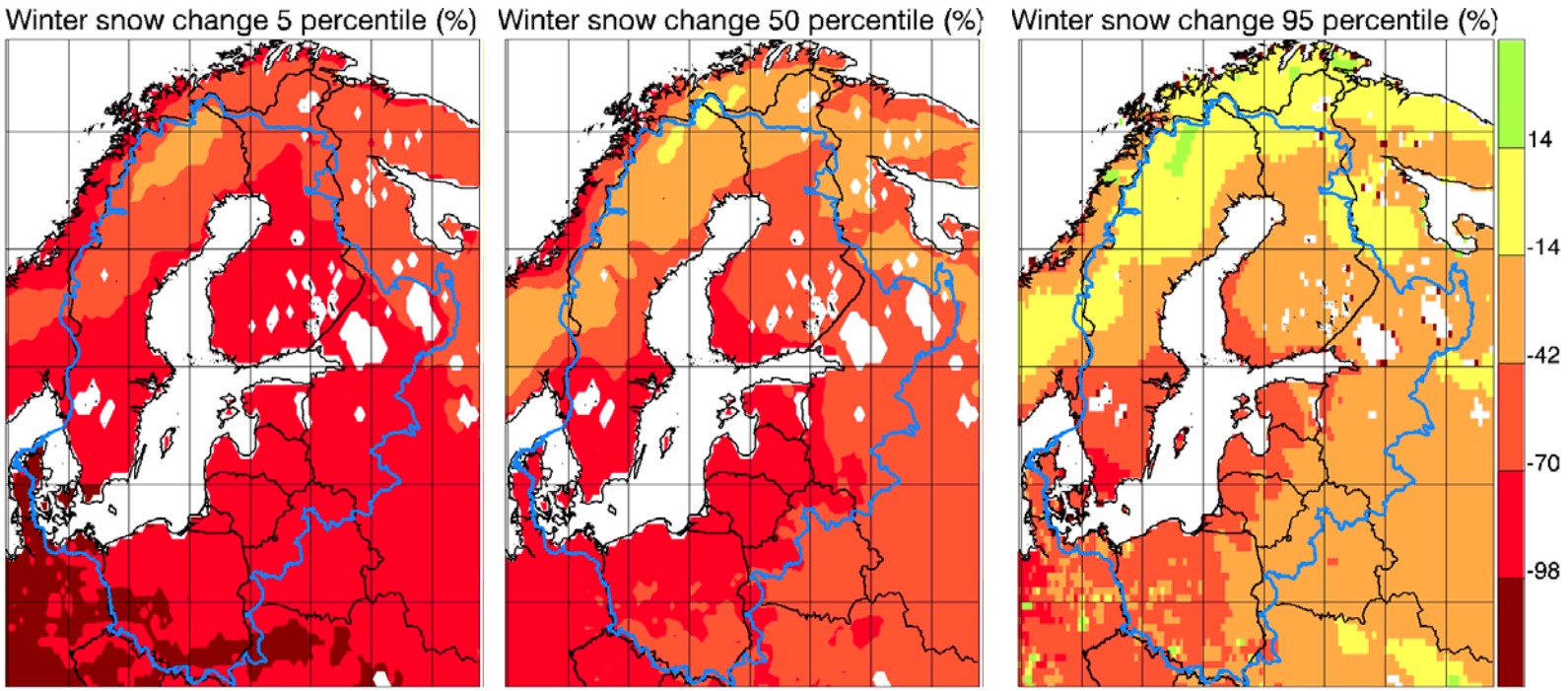








Snow change


Winter snow change 5 percentile (%)
Winter snow change 50 percentile (%)
Winter snow change 95 percentile (%)
14
-14
-42
-70
-98

General conclusions

- Same general expectations as before
- More quantitative information (*e.g.* estimates of cc span)
- Winter warming, mostly in the North
- Summer warming less than winter
- More winter precipitation
- Summer precipitation grows in the North, decreases in the South
- Insignificant changes in winds
- Increase in warm and wet extremes, also in summer
- Snow decrease 75% in 100 years

Hydrology

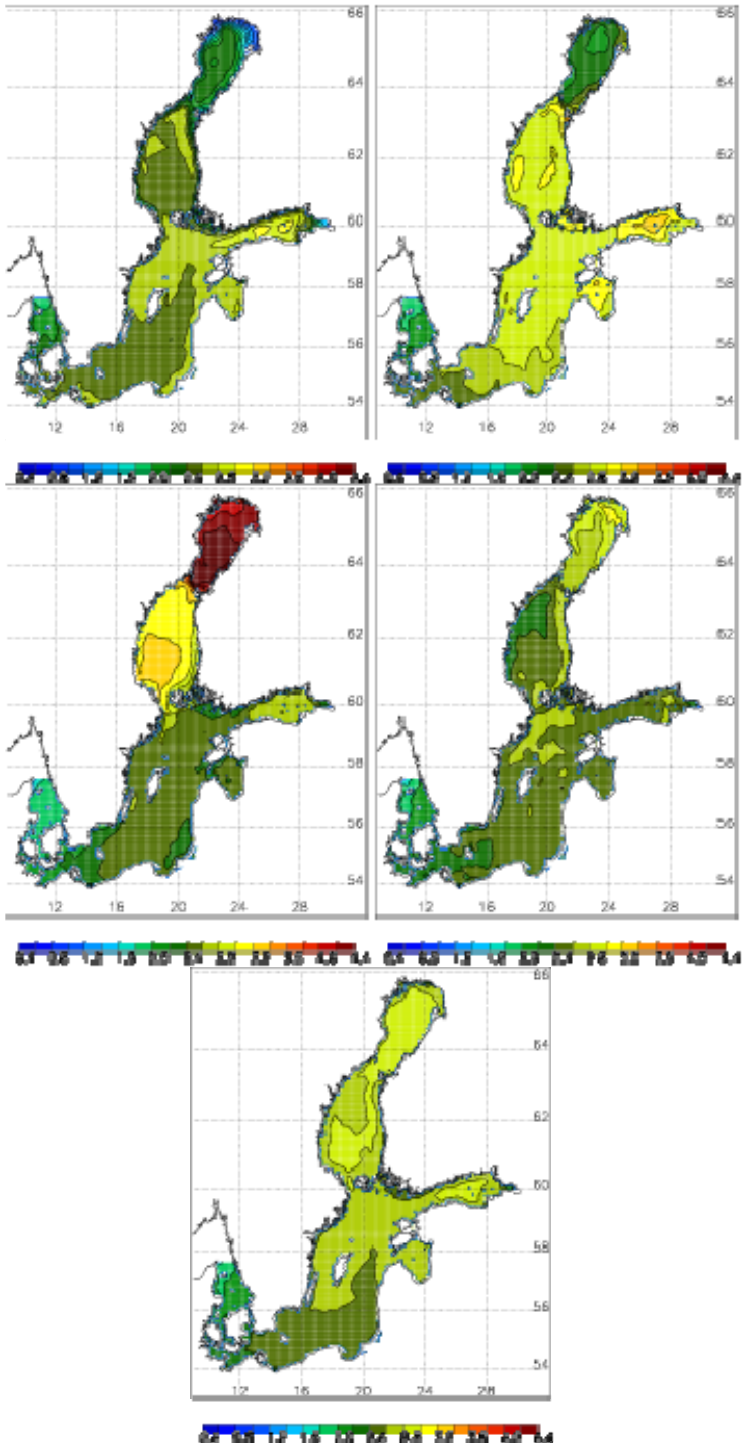
- Confirmation of the conclusions from BACC (2008)
- Areas presently characterized by spring floods due to snow melting, floods will occur earlier; the magnitude is expected to decrease because of less snowfall and shorter snow accumulation period
- Hence, sediment transport and the risk of inundation are expected to decrease
- In the southern part of the Baltic Sea area, more winter precipitation result in an increased river discharge during winter
- Groundwater recharge will increase in areas where the infiltration capacity is not exceeded presently, resulting in increasing groundwater levels
- Decreasing precipitation and increasing temperature and evapotranspiration during summer result in drying of the root zone and increasing irrigation demands in the southern part of the BSC
- The southern half of the BSC shows significant reductions in snow cover of around 75 %

Features of new simulations compared to the first assessment

- The horizontal resolution of atmosphere and ocean components were increased to typically less than 25 and 3.6 km, respectively
- New model versions of GCMs and RCMs were used
- The results and assumptions of AR4 (IPCC, 2007) were considered instead of the results of AR3 (IPCC, 2001)
- Multi-model ensemble modelling was introduced to estimate the uncertainties due to biases
- Instead of time slices often combined with the „delta" approach, transient simulations (1960-2100) were performed
- Coupled physical-biogeochemical models were used

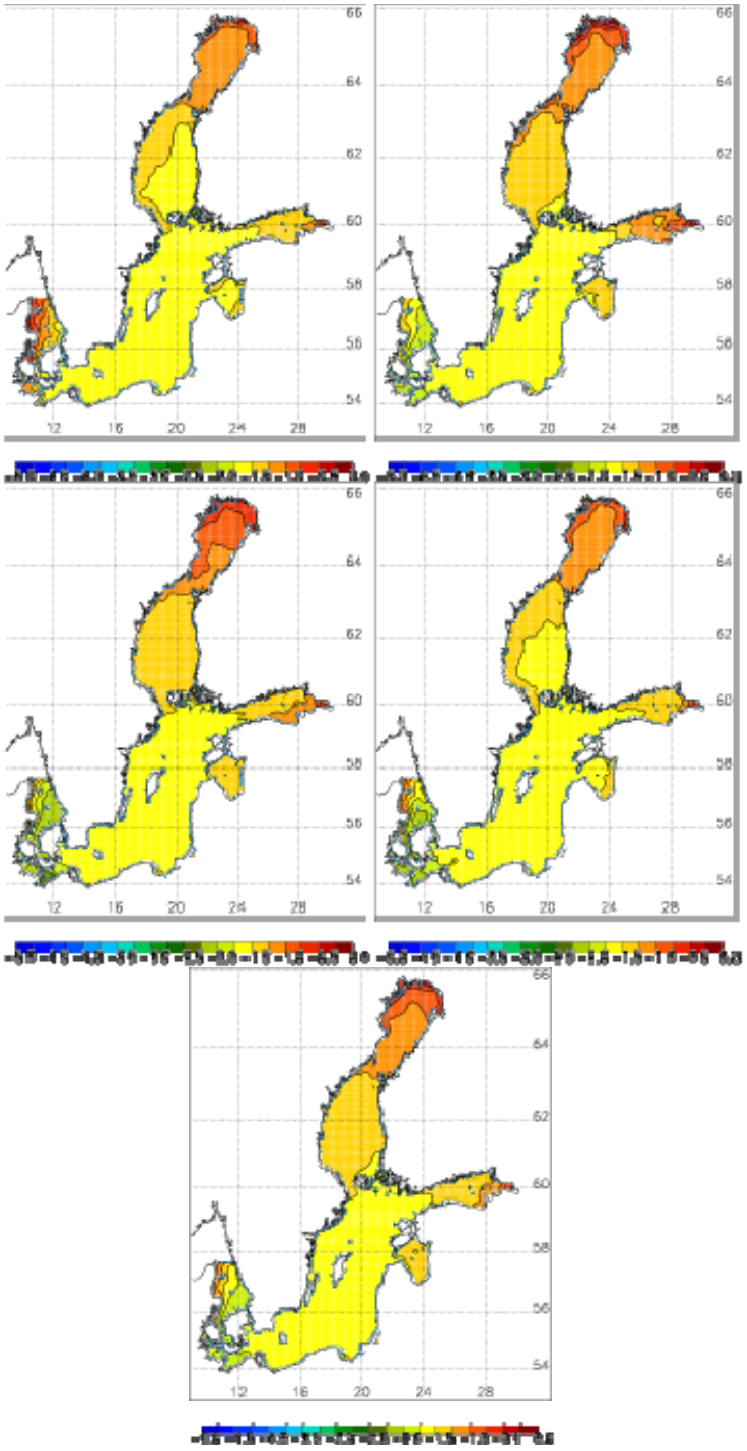
SST change

Meier *et al.*, 2012



Salinity change

Meier *et al.*, 2012

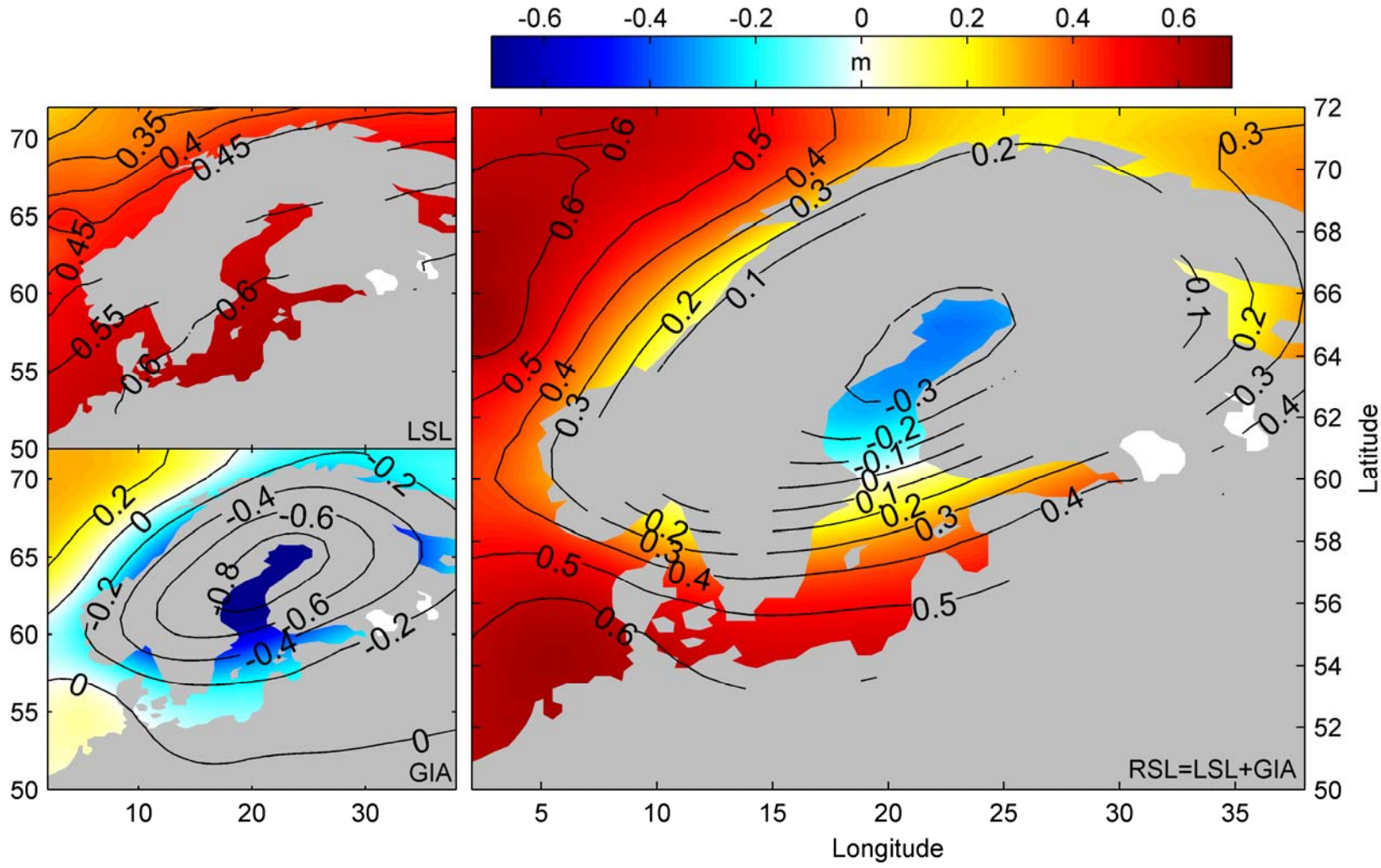


General conclusions

- Sea surface temperature increase up to 4°C and deep water temperature increase up to 2°C
- Sea ice decrease around 50-80%
- Sea salinity decrease 8-50%
- Frequency of westerly wave directions increase by 3.5% compared to actual conditions

A1B sea level change

Grinsted 2012; Hill *et al.* 2010



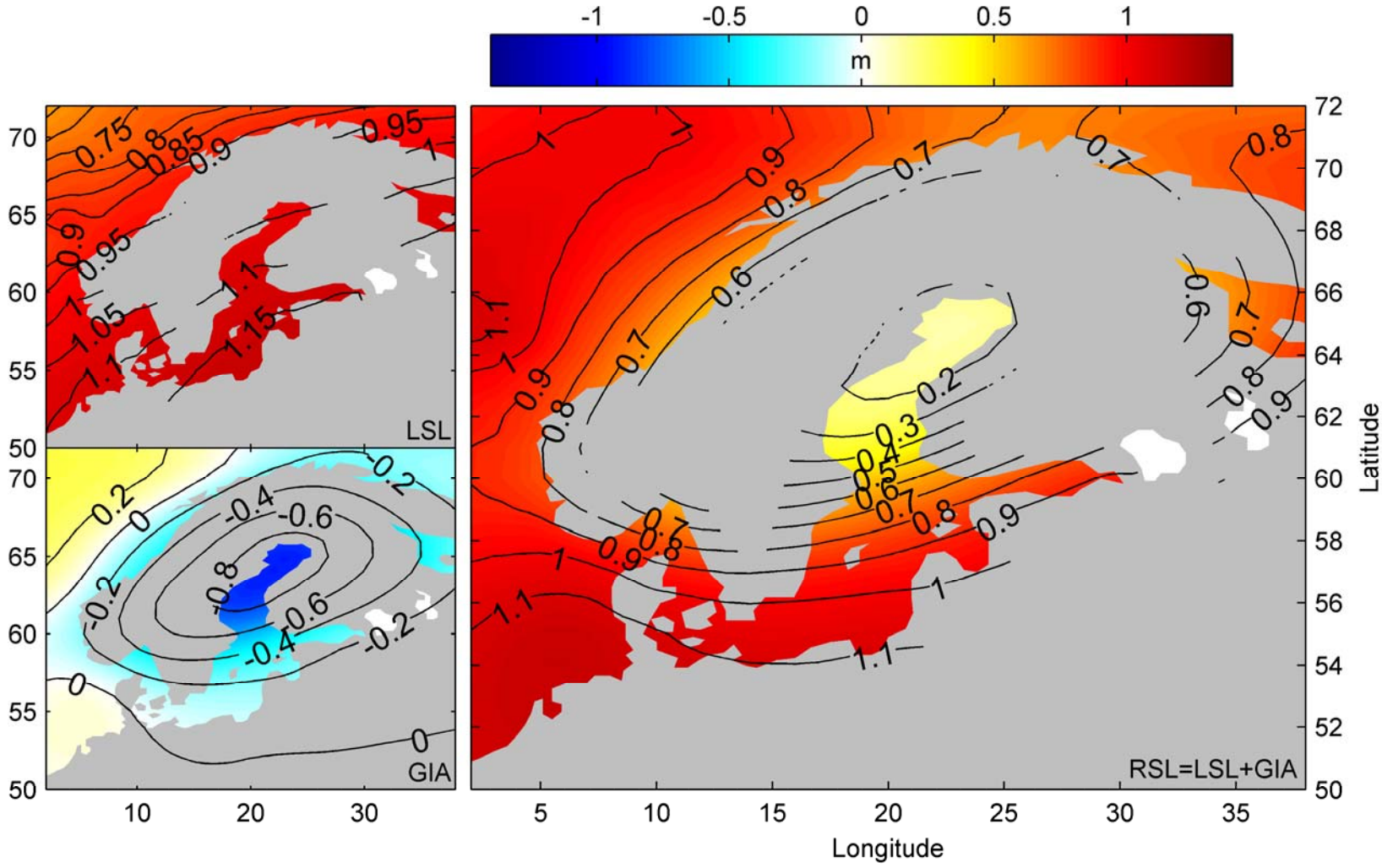
A1B sea level change

Grinsted 2012; Hill *et al.* 2010

- Local sea level change plus isostatic adjustment (rebound after last ice age) plus geoid deformation related to the removal of ice

”Worst case” sea level change

Grinsted 2012; Hill *et al.* 2010



General conclusions

- Local sea level change around -0.3m to +0.7m, largest to the South

To be continued ……

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