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New scenario simulations of the Baltic Sea ecosystem to support decision making

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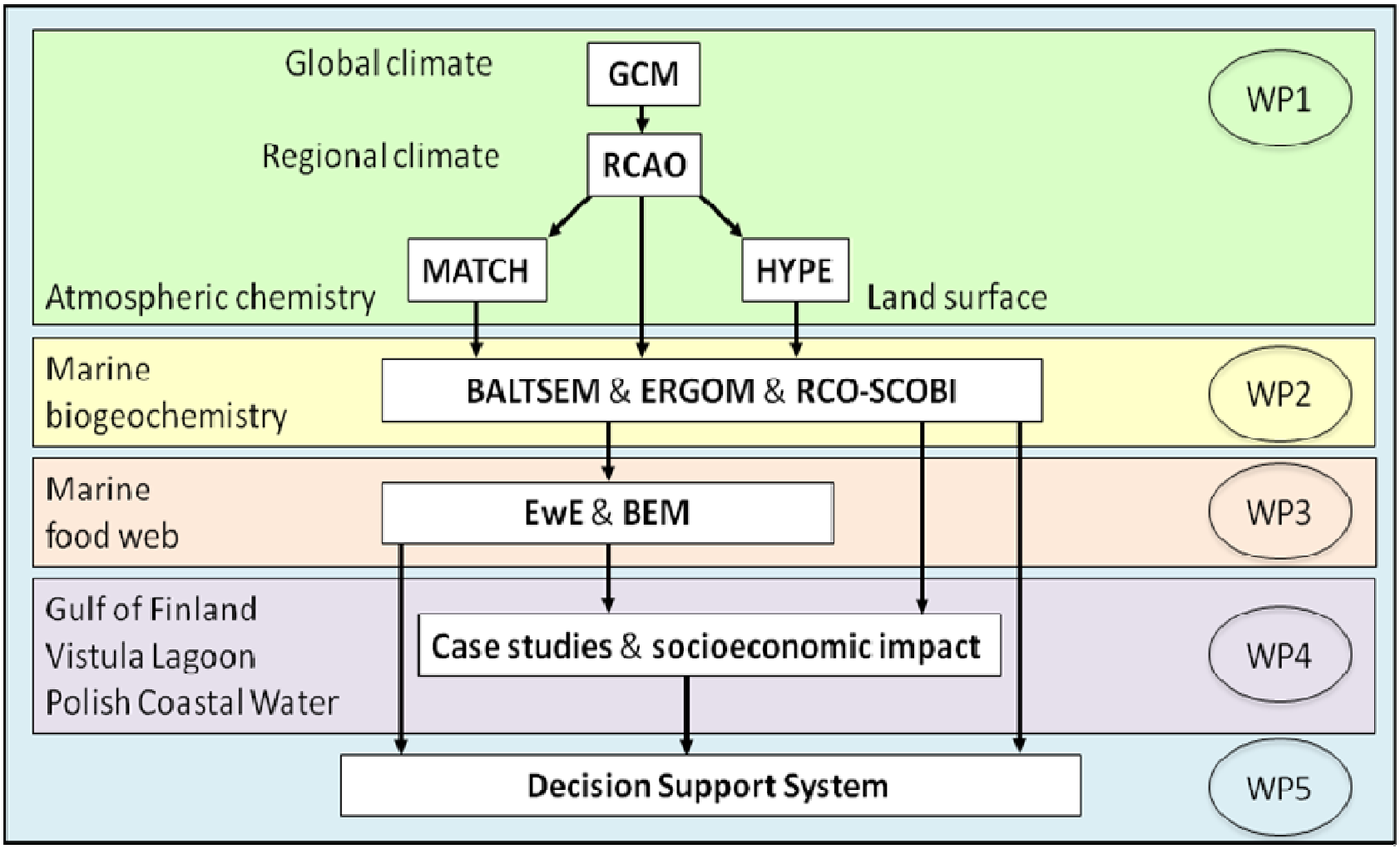
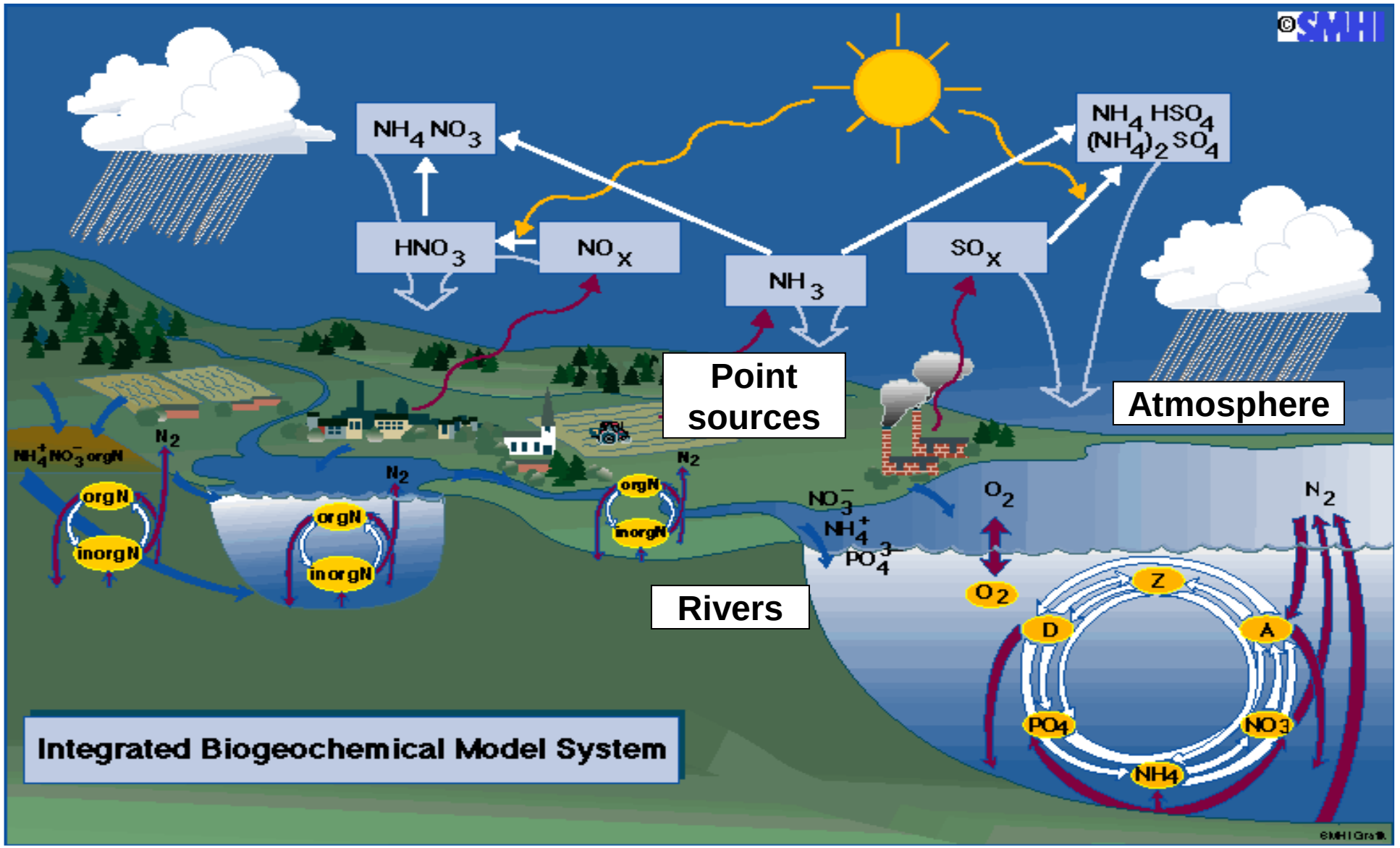

Global climate
GCM
WP1
Regional climate
RCAO
MATCH
HYPE
Atmospheric chemistry
Land surface
Marine
biogeochemistry
BALTSEM & ERGOM & RCO-SCOBI
WP2
Marine
food web
EwE & BEM
WP3
Gulf of Finland
Vistula Lagoon
Polish Coastal Water
Case studies & socioeconomic impact
WP4
Decision Support System
WP5

Coupled climate - environmental modeling



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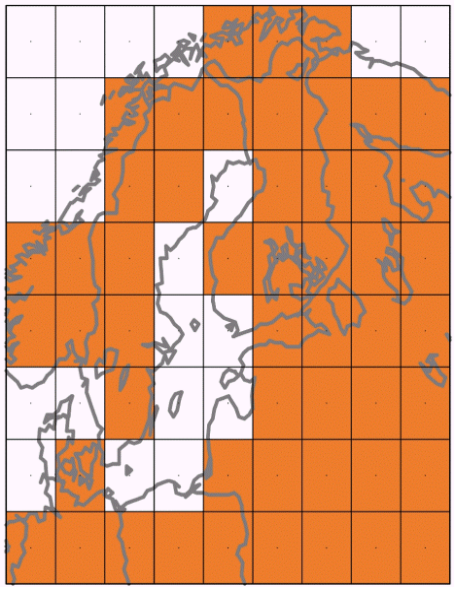
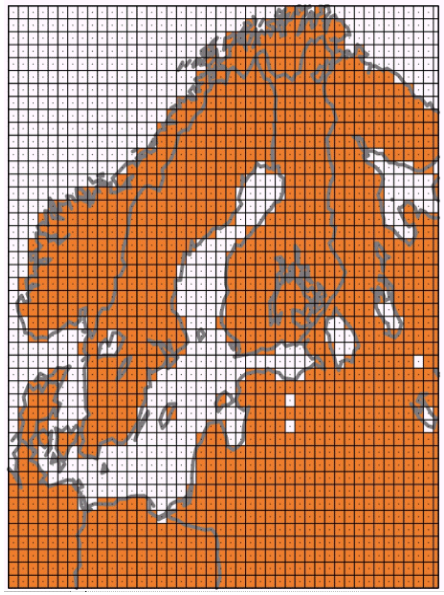
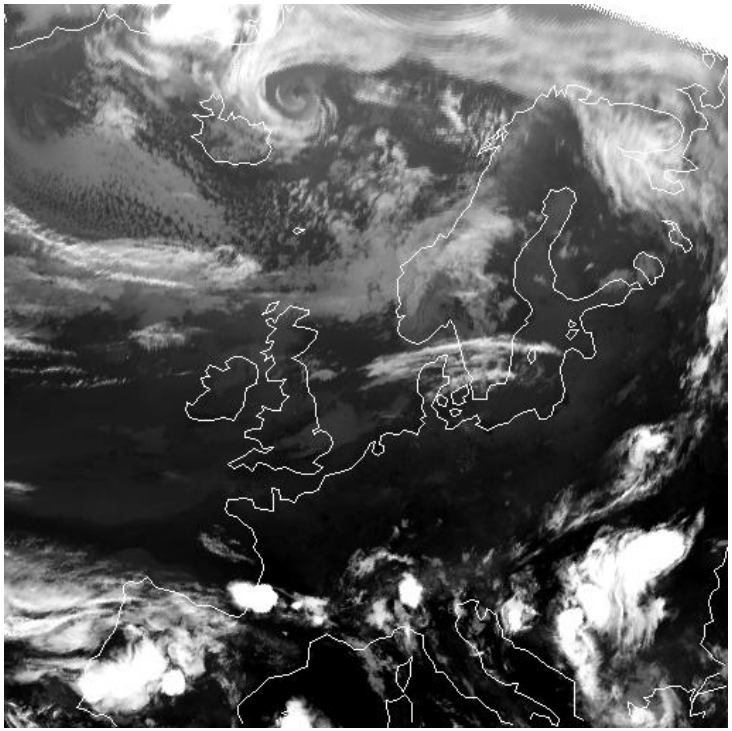
RCAO: Rossby Centre regional Atmosphere – Ocean climate model



Global



Regional



- **Increased resolution ⇒ detailed regional forcing**
- **Greater number of explicitly resolved processes**

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New simulations at SMHI :

- **Hindcast simulation**

1961-2007: RCAO/ERA-40

- **Two transient simulations**

1961-2099: RCAO/GCM A1B

(more are planned)

- **New compared to BACC (2008): no time slices, IPCC 2007, new model versions**

”The A1 scenarios are of a more integrated world with rapid economic growth, a global population that reaches 9 billion in 2050 and then gradually declines, quick spread of new and efficient technologies, a convergent world - income and way of life converge between regions. Extensive social and cultural interactions worldwide”

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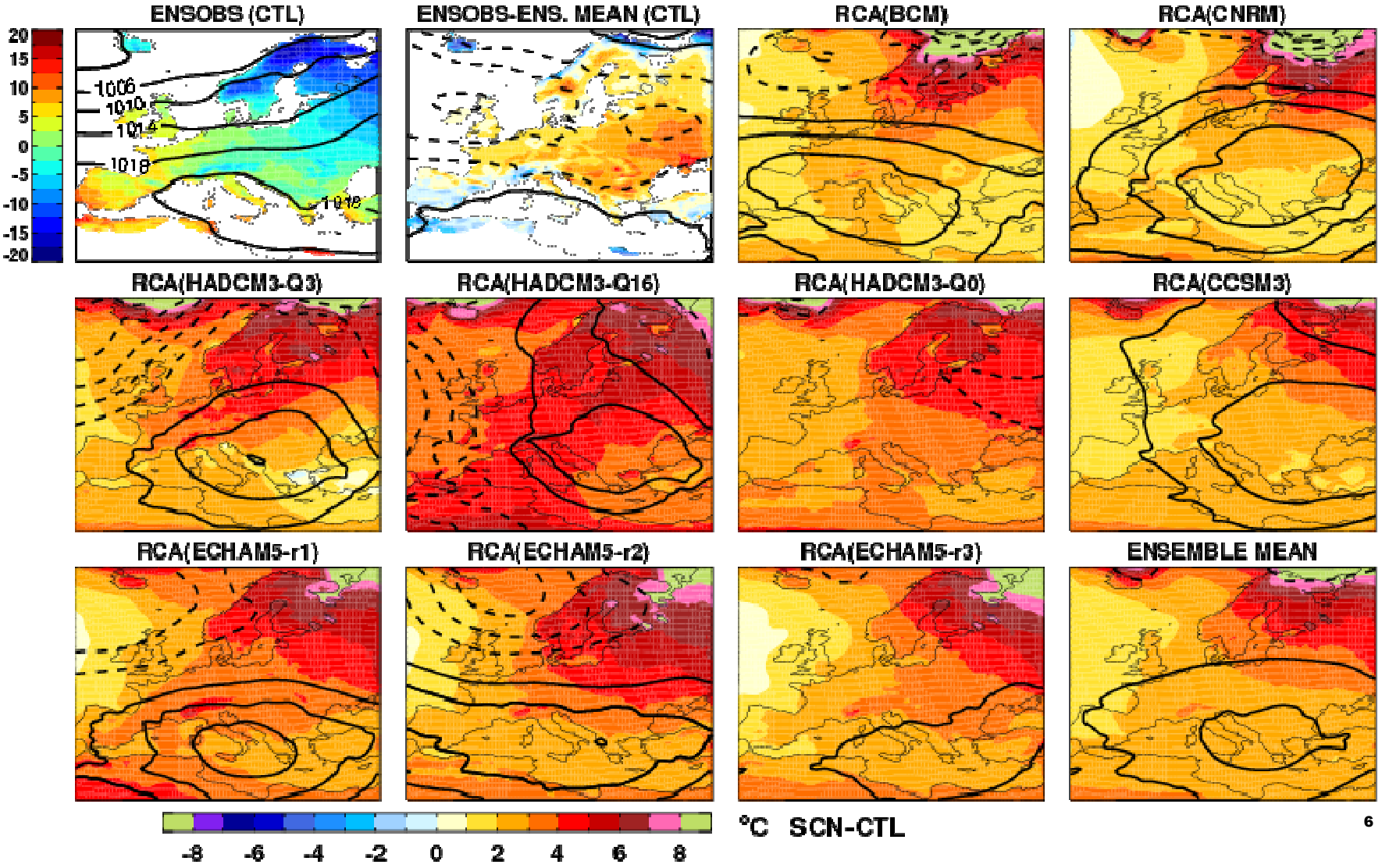
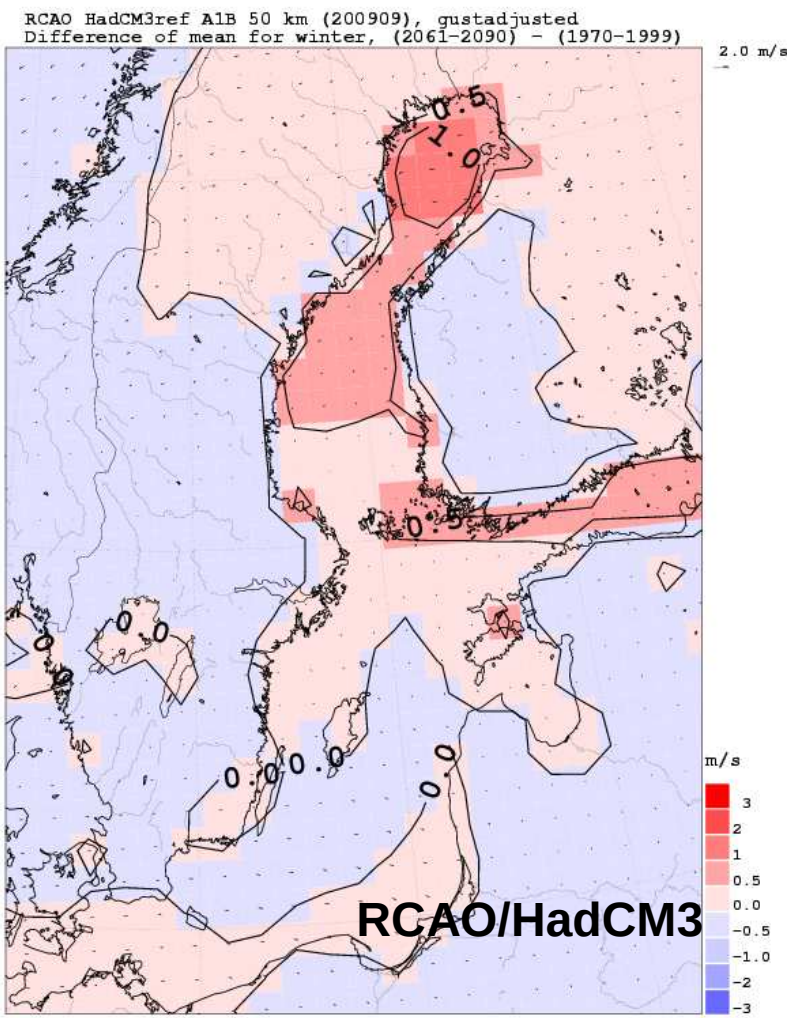
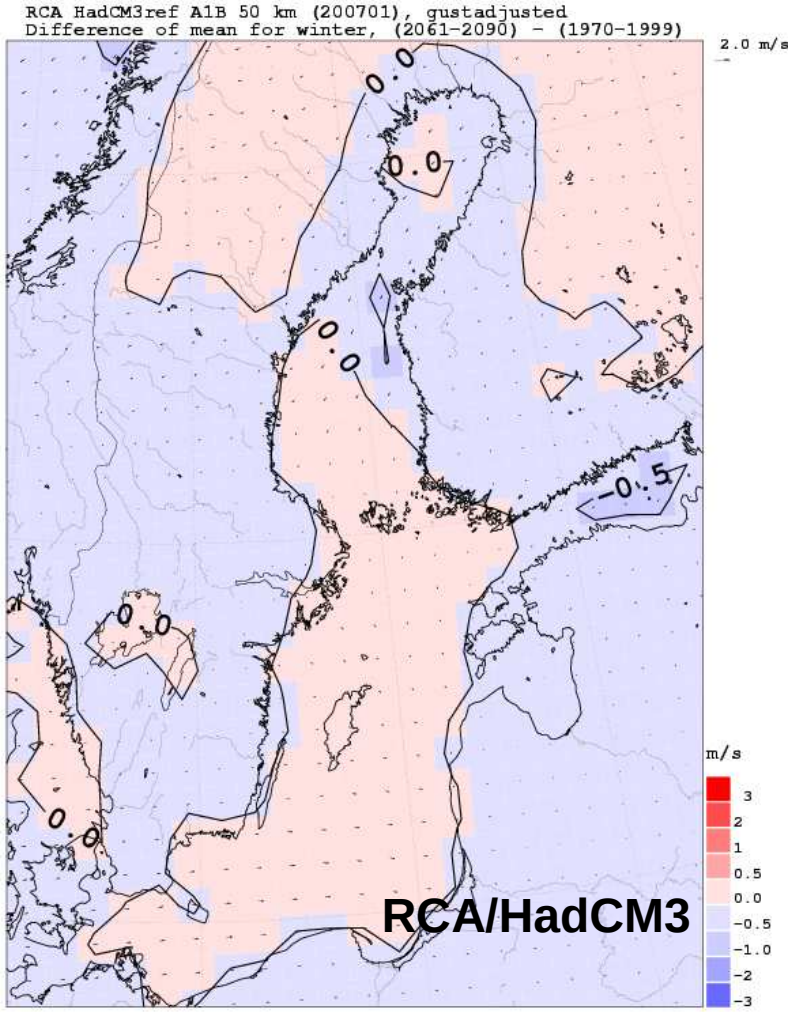
Climate change (2071-2100 vs 1961-1990): winter (DJF) mean temperature and MSLP:

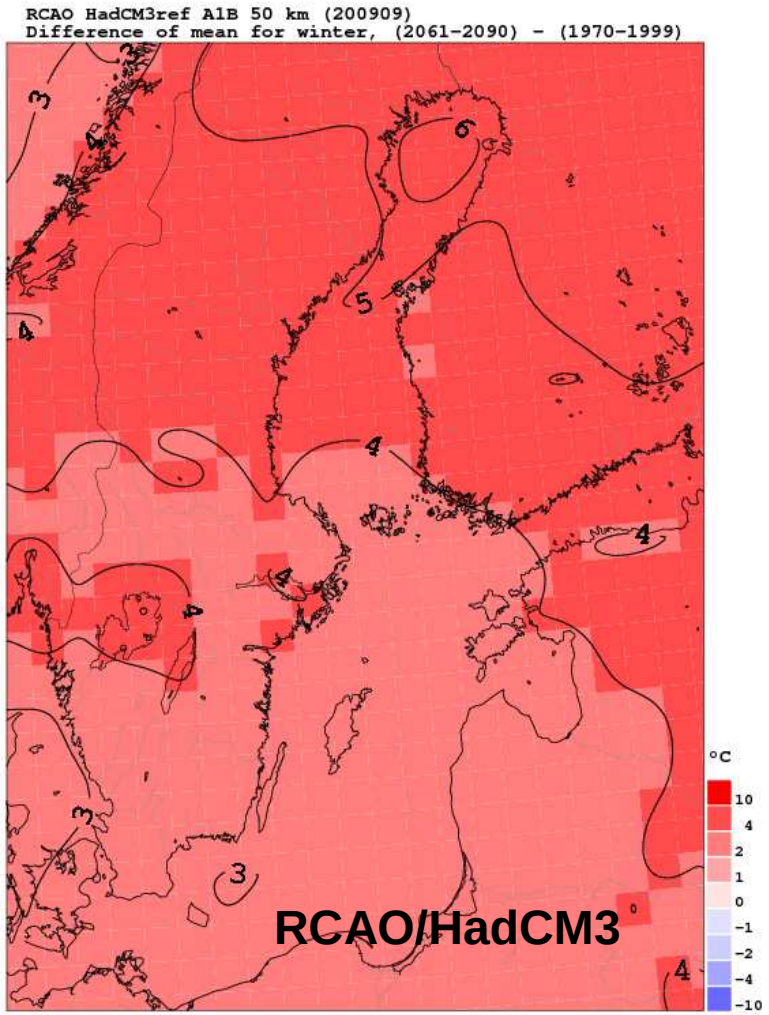


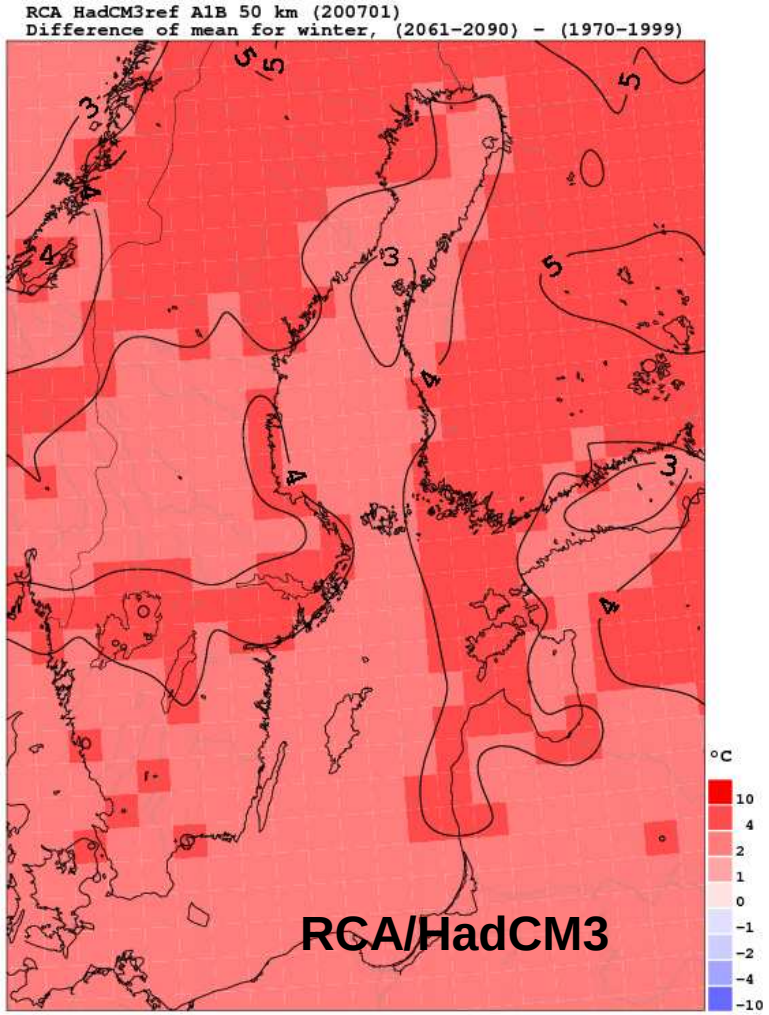
•Winter mean 10m wind speed changes (m/s) 2061-2090 minus 1970-1999



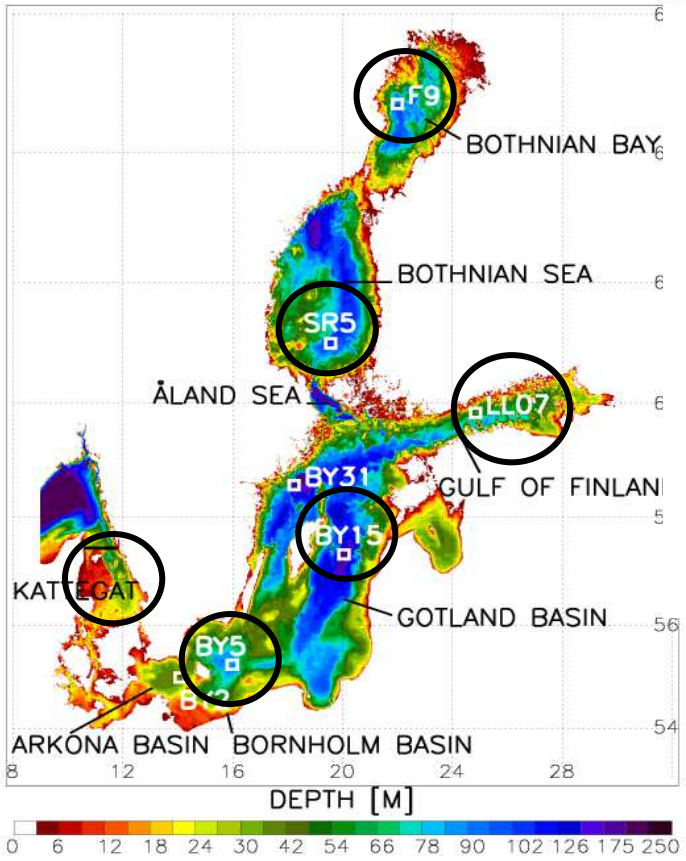


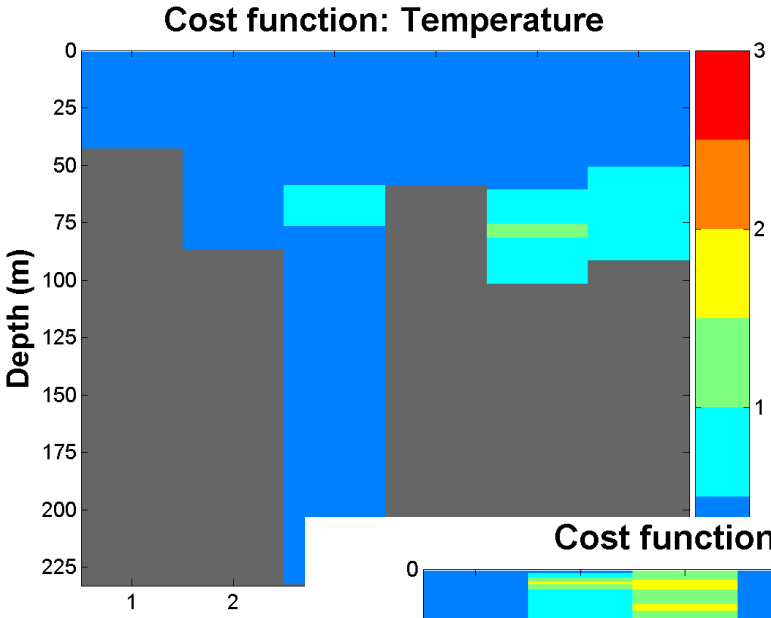
•Winter mean 2m air temperature changes (°C) 2061-2090 minus 1970-1999

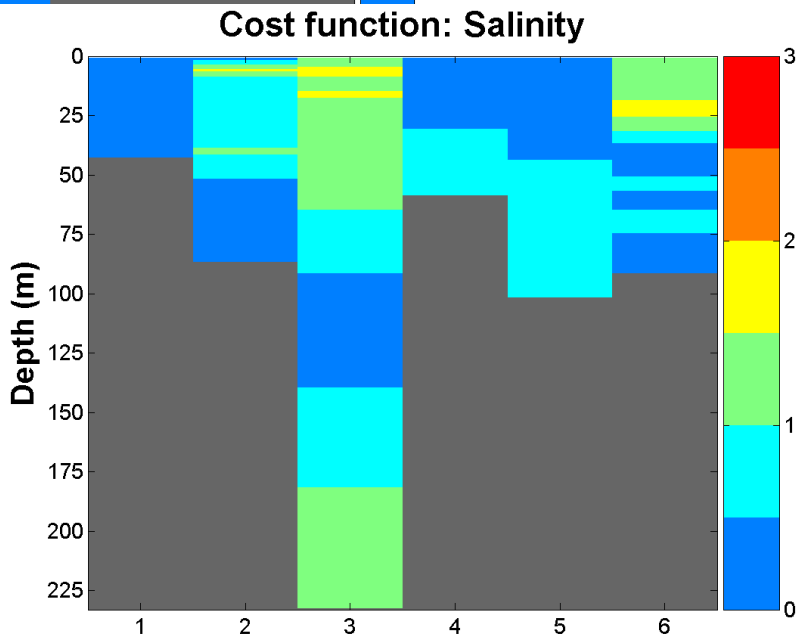




Cost function 1970-2005







Cost function 1970-2005

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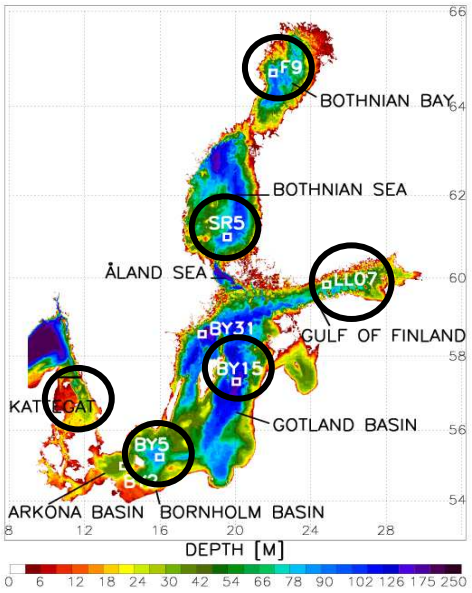
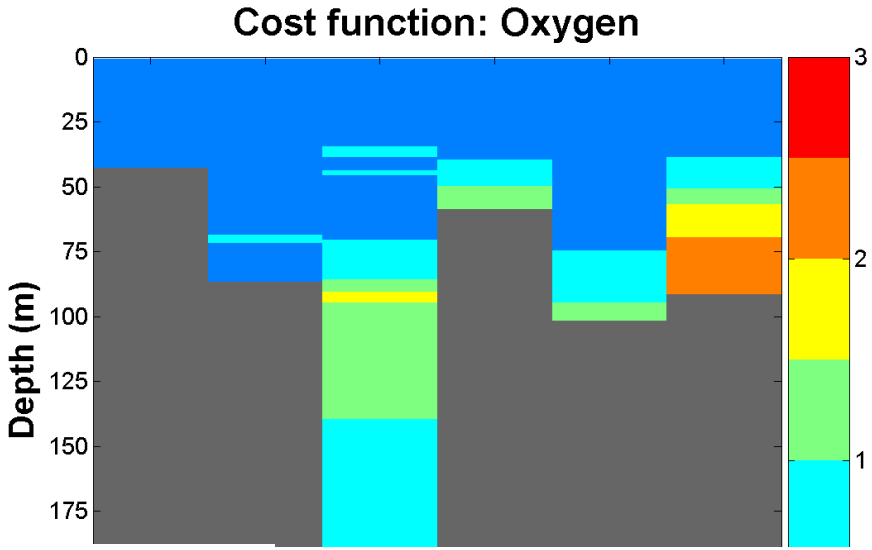
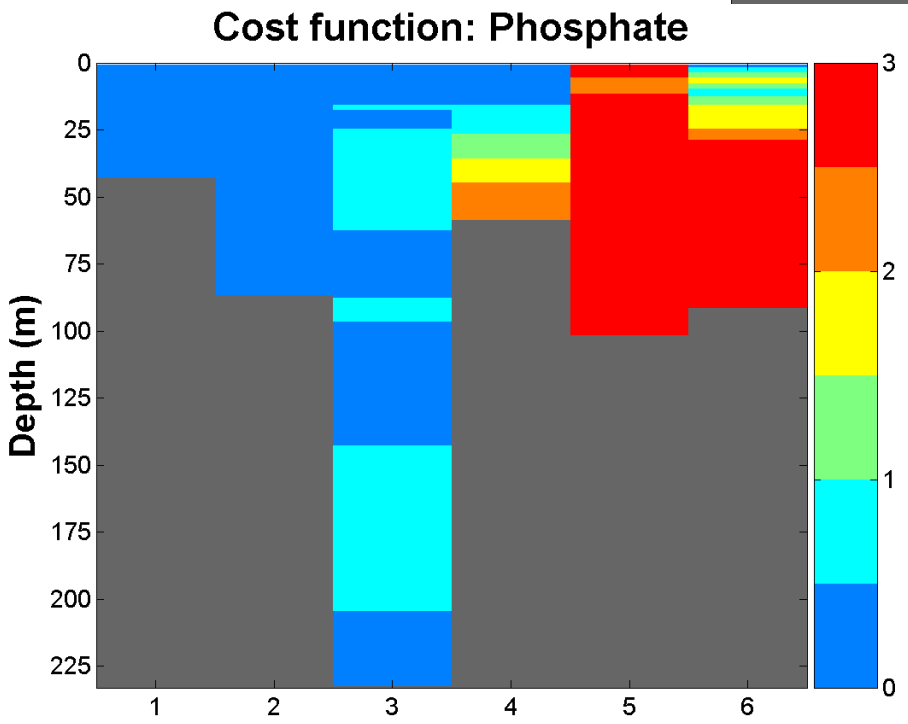
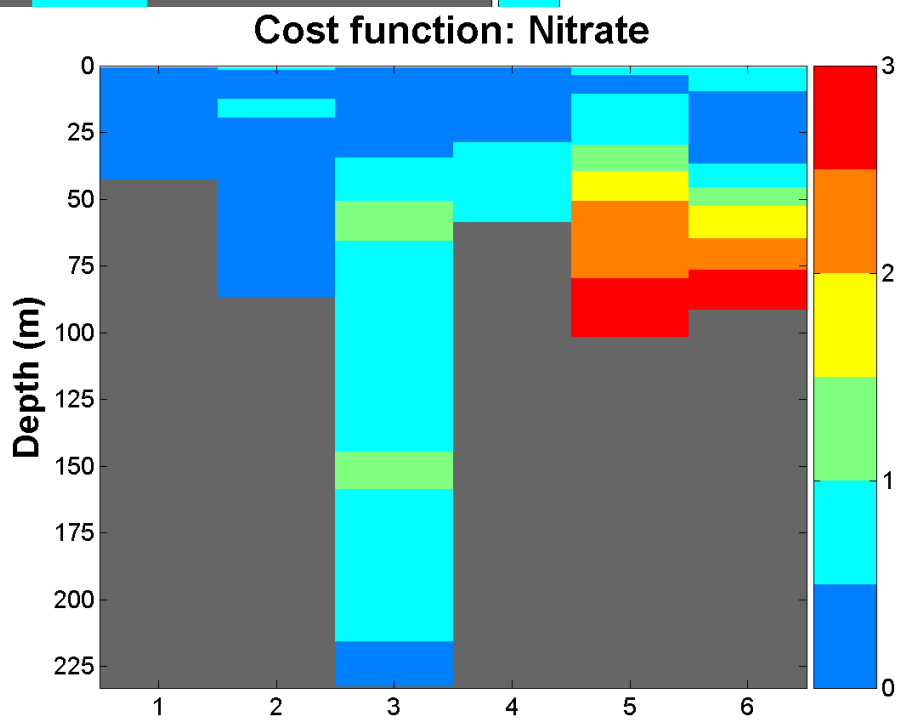


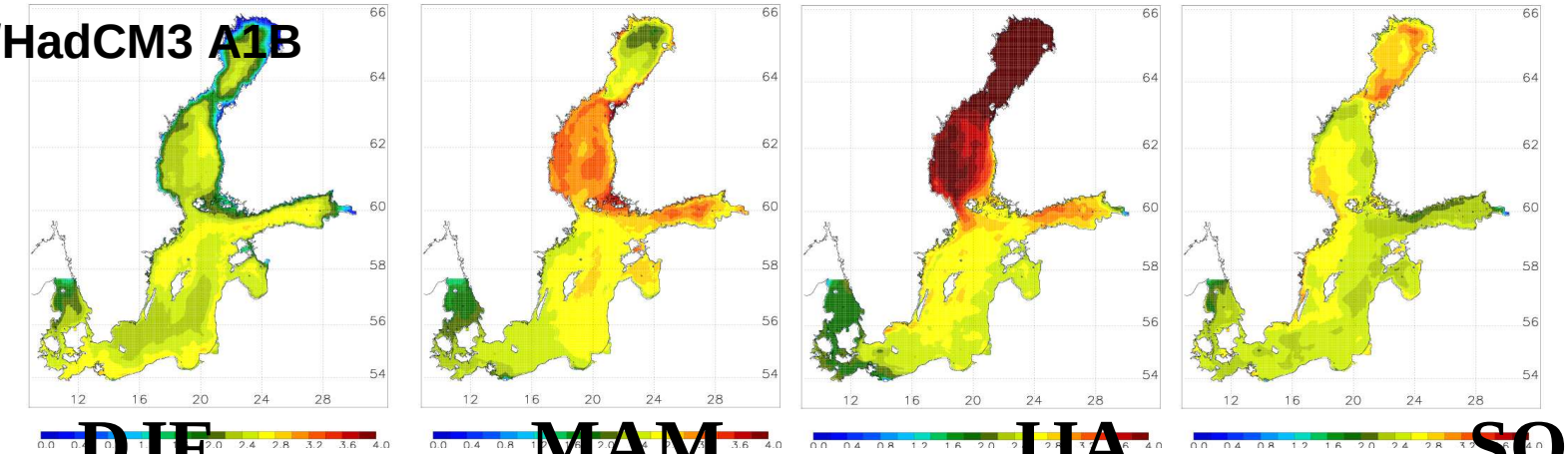




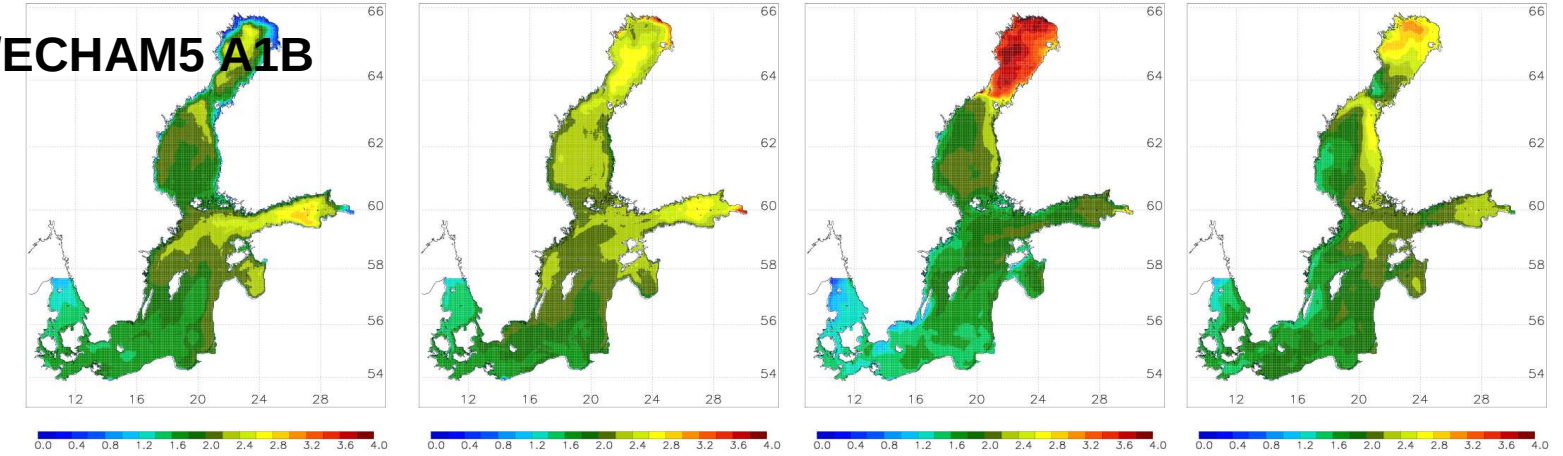


Seasonal SST changes (°C) 2089-2060 minus 1970-1999

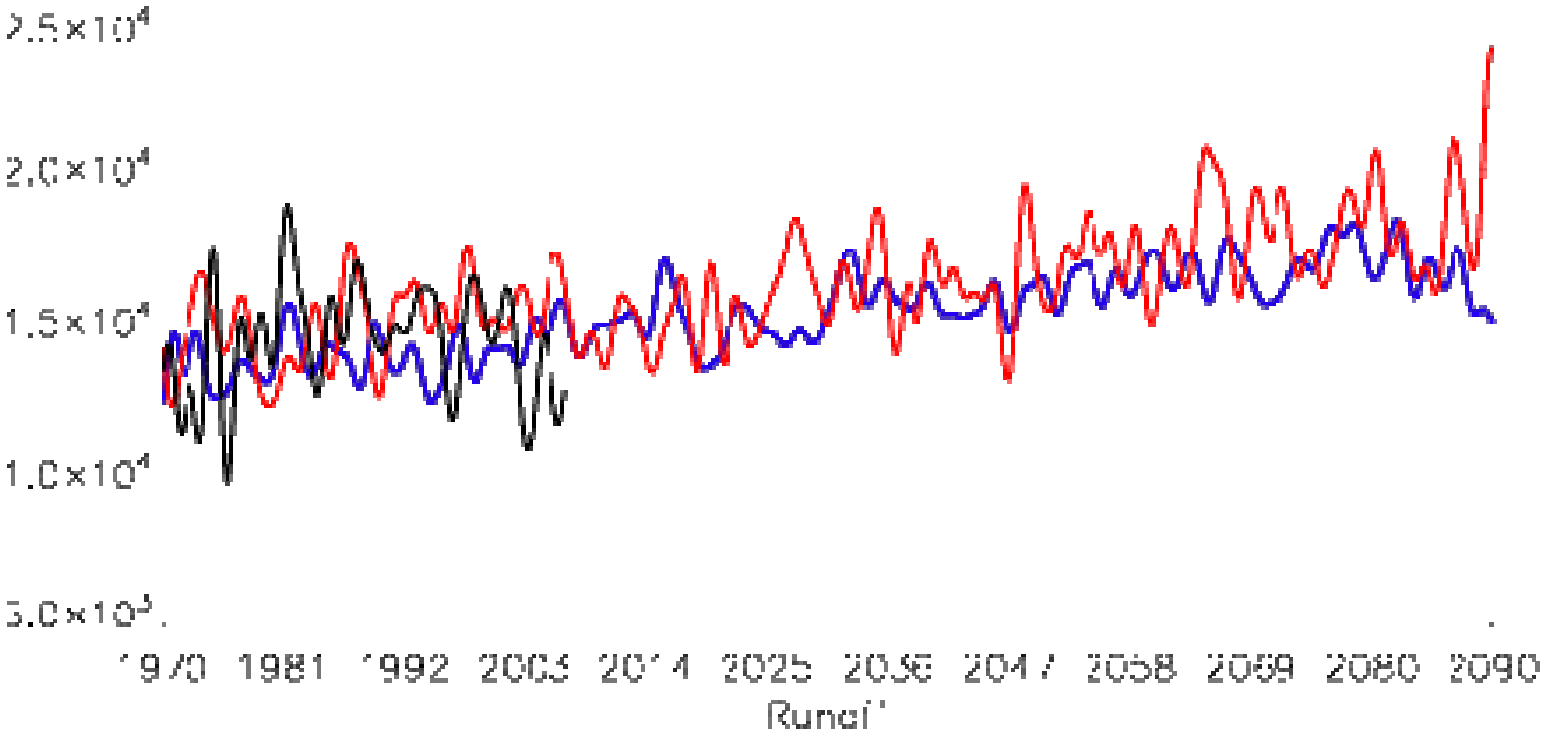
RCAO/HadCM3 A1B



RCAO/ECHAM5 A1B



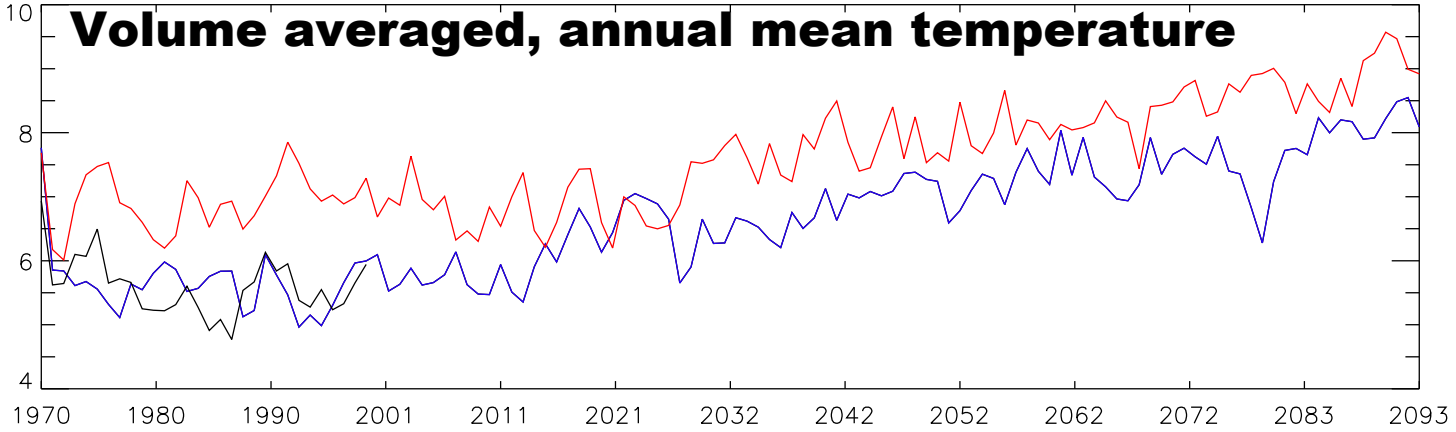
Filtered runoff 1970-2090 (m^3/s)

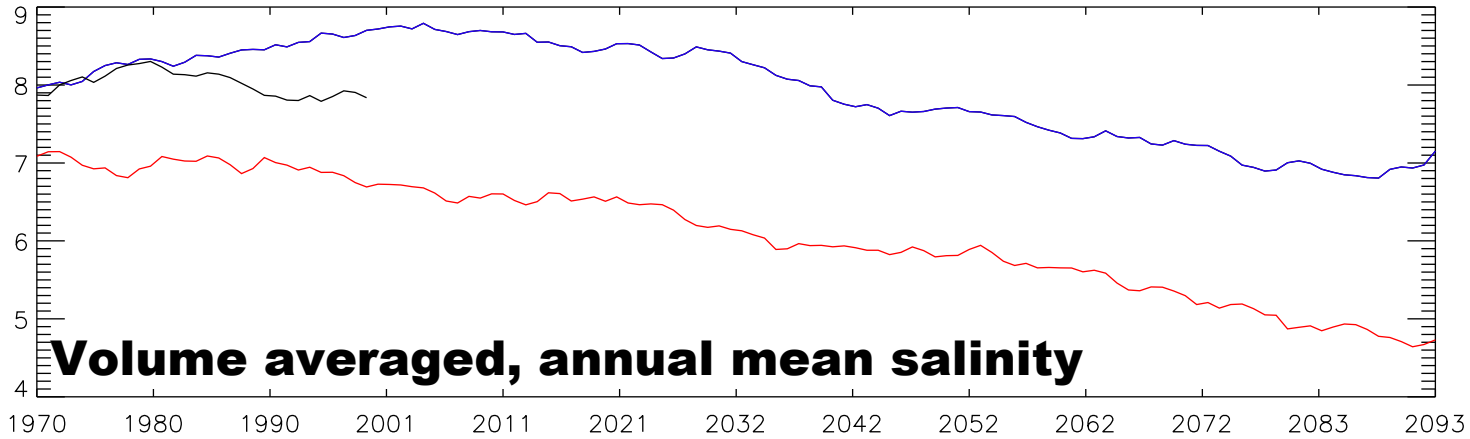


Black: Observations

Red: RCAO/ECHAM5 A1B

Blue: RCAO/HadCM3 A1B





Black: Hindcast
Red: RCAO/ECHAM5 A1B
Blue: RCAO/HadCM3 A1B

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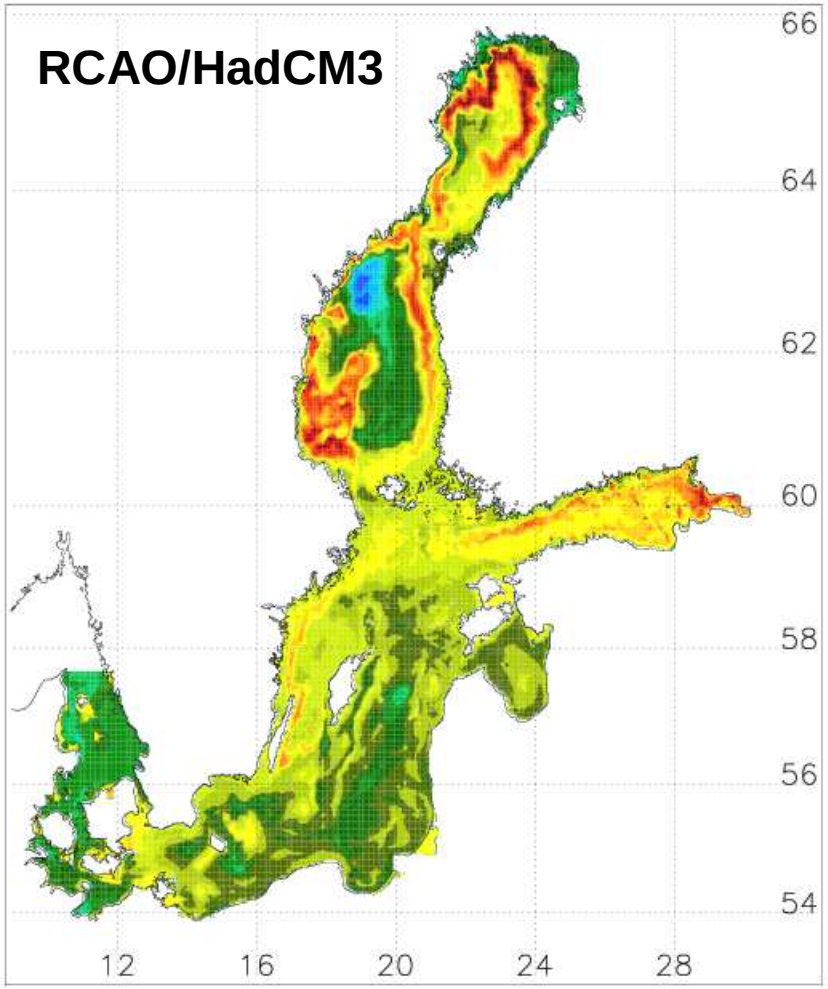
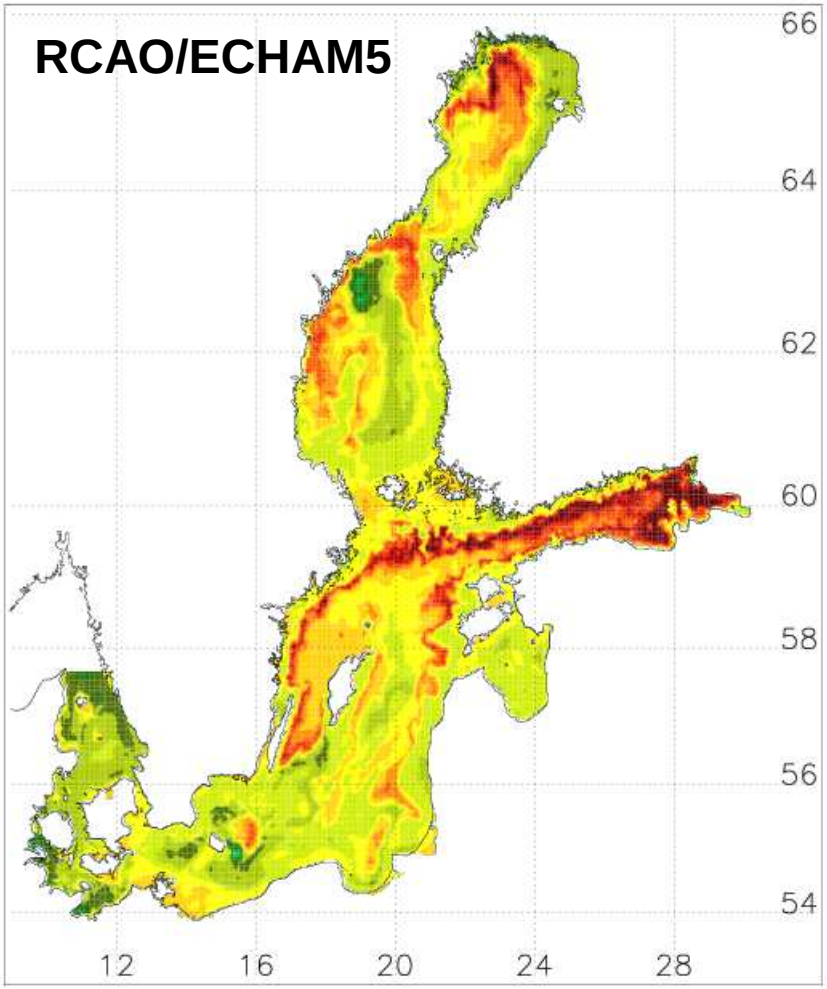
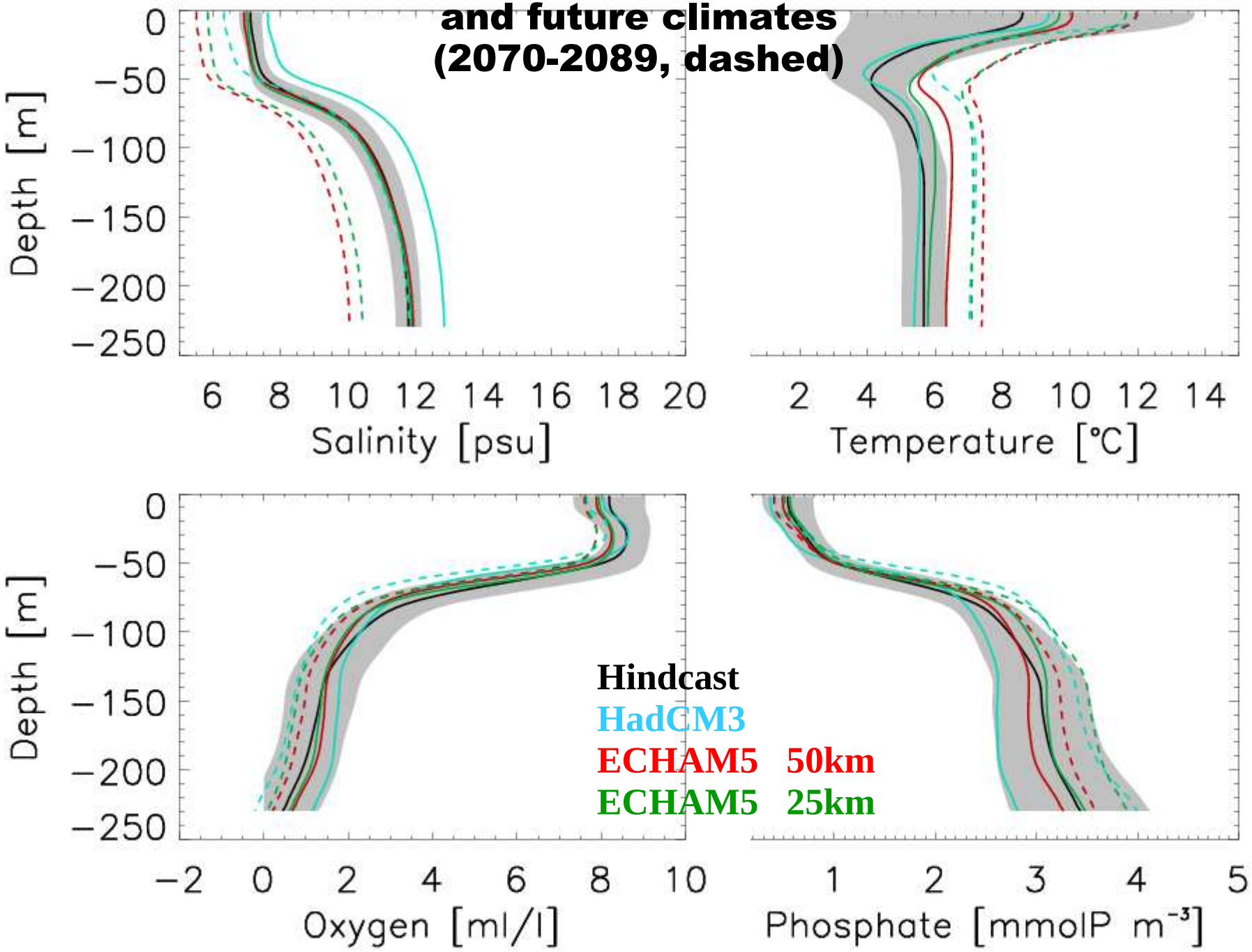
Summer bottom oxygen changes (ml/l)
2089-2060 minus 1970-1999





Profiles at Gotland Deep in control (1970-1999, solid) and future climates (2070-2089, dashed)



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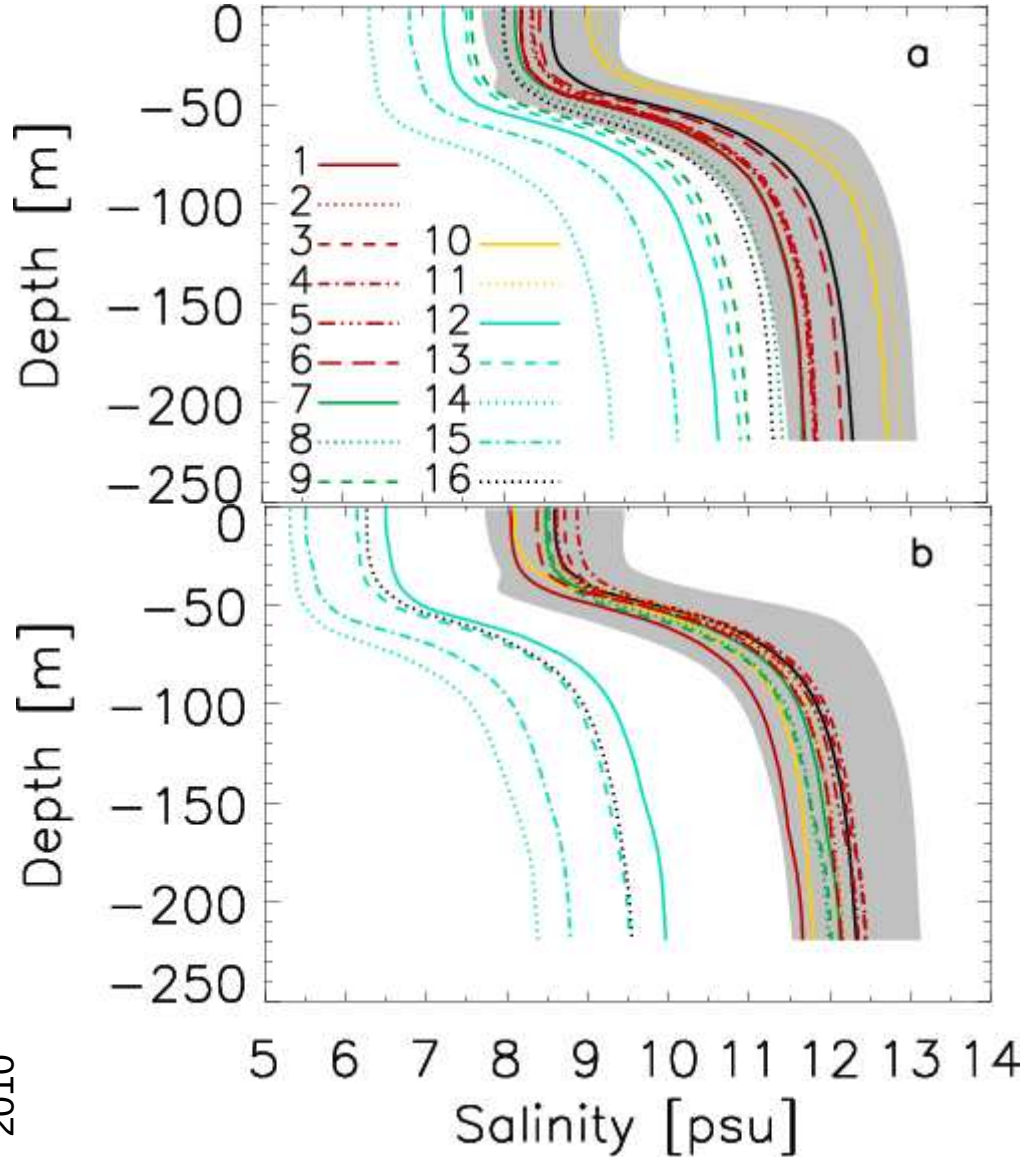
Salinity at Gotland Deep



- 1961-1990 (black solid line)
- 2071-2100 (colored lines)
- 1903-1998 +/- 2 standard deviation (shaded area)

- (a) only effects from wind changes

- (b) wind and freshwater inflow changes

(Meier et al., 2006).

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Bornholm Basin

Gotland Basin

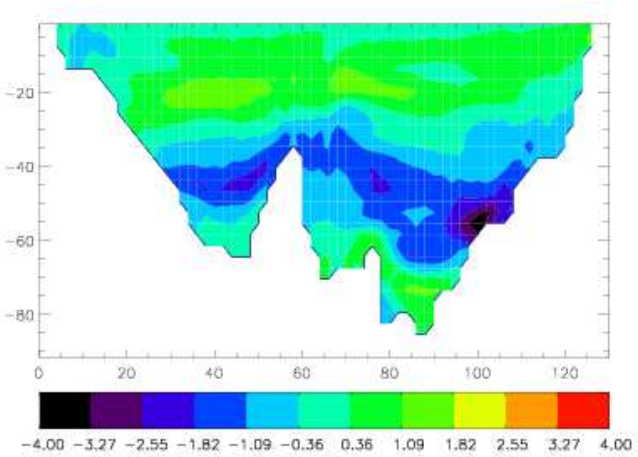
RCAO-ECHAM5 A1B

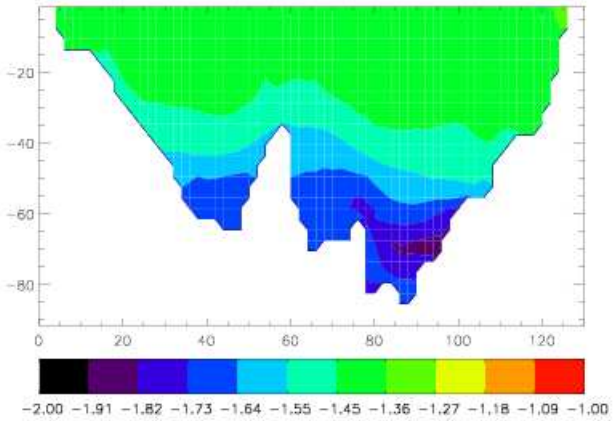
North

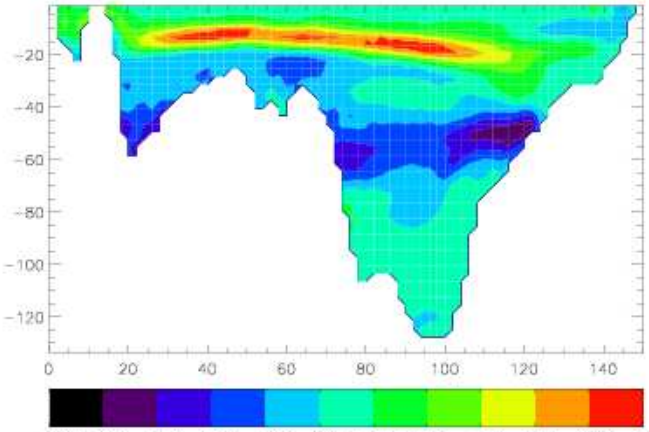
South

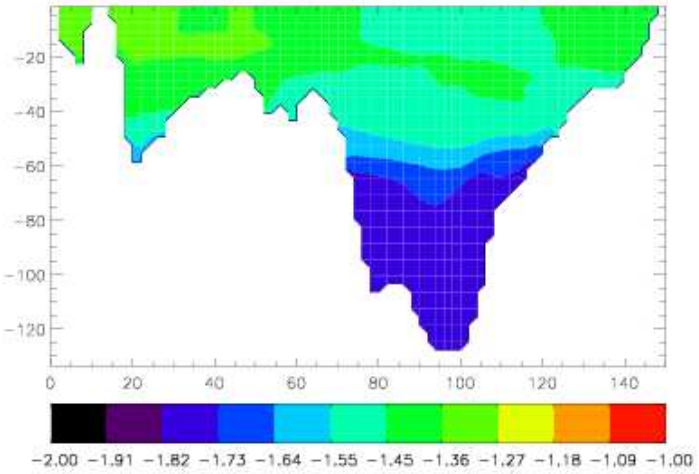
West

East









Annual mean stratification strength changes (buoyancy Frequency)

Salinity changes

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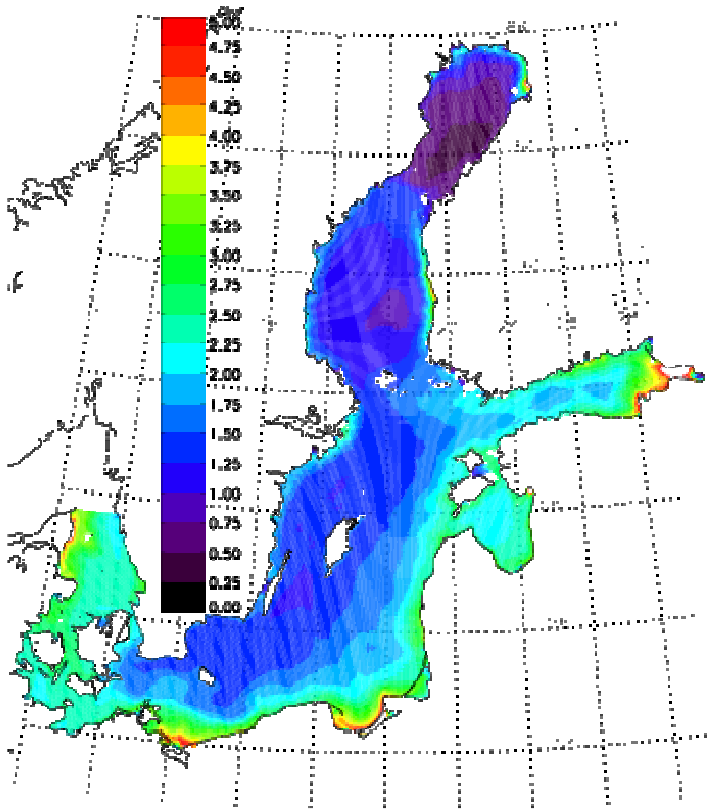
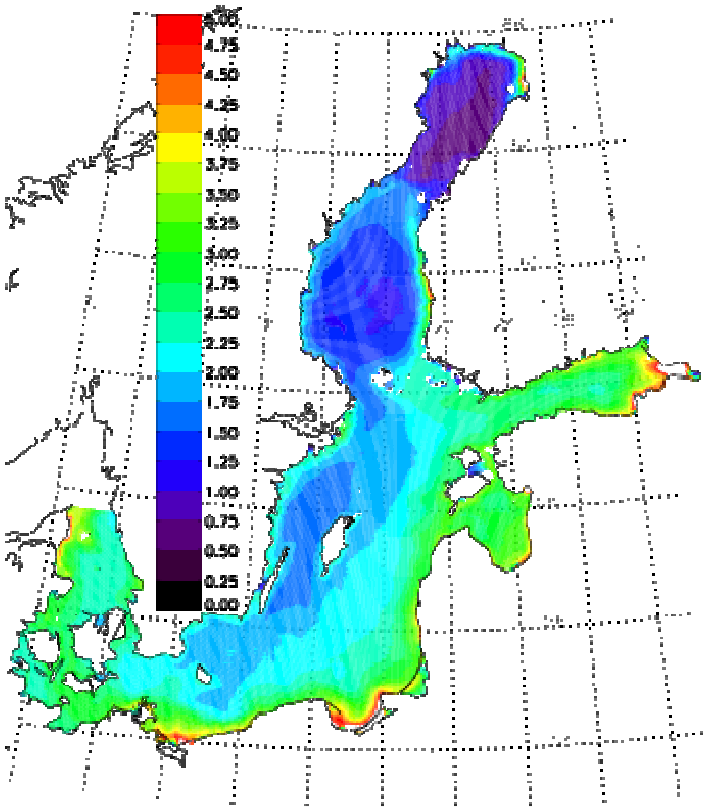
Annual mean phytoplankton concentration (mgChl m^{-3}) vertically averaged over the upper 10 m HadCM3 A1B

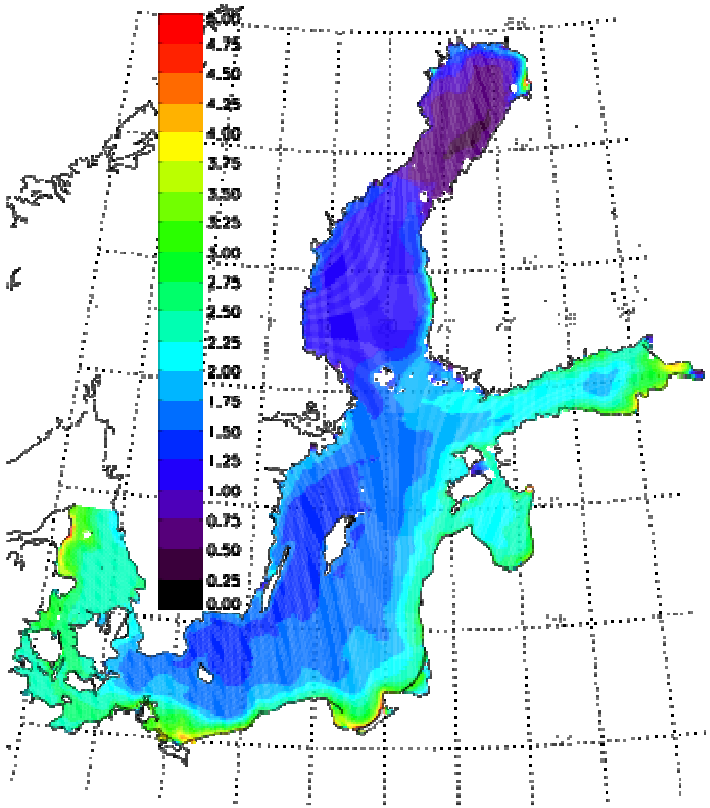


Present climate 1970-1999

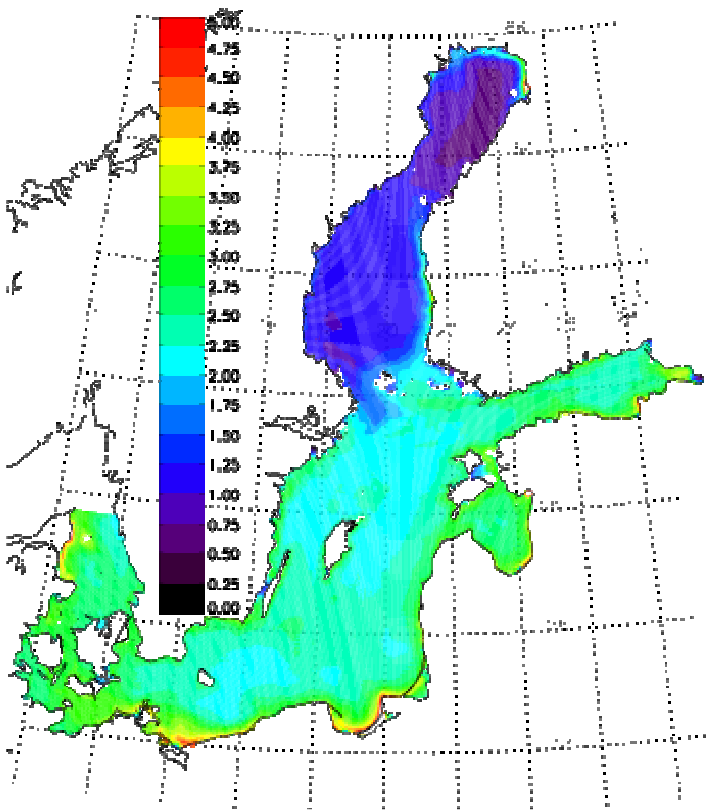


Future climate 2070-2099

Annual mean phytoplankton concentration (mgChl m^{-3}) vertically averaged over the upper 10 m ECHAM5 A1B



Present climate 1970-1999



Future climate 2070-2099

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Summary

- Improved summer SSTs using the coupled RCAO model and larger sensitivity in winter

- Indications of future increased runoff. Mean wind speed changes are statistically not significant. Hence salinity decreases are smaller than in earlier scenario simulations.

- Overall oxygen decrease but slight increases in bands across the slopes.

- Increased phytoplankton concentrations.

Next step: runoff and loads from a hydrological model HYPE