

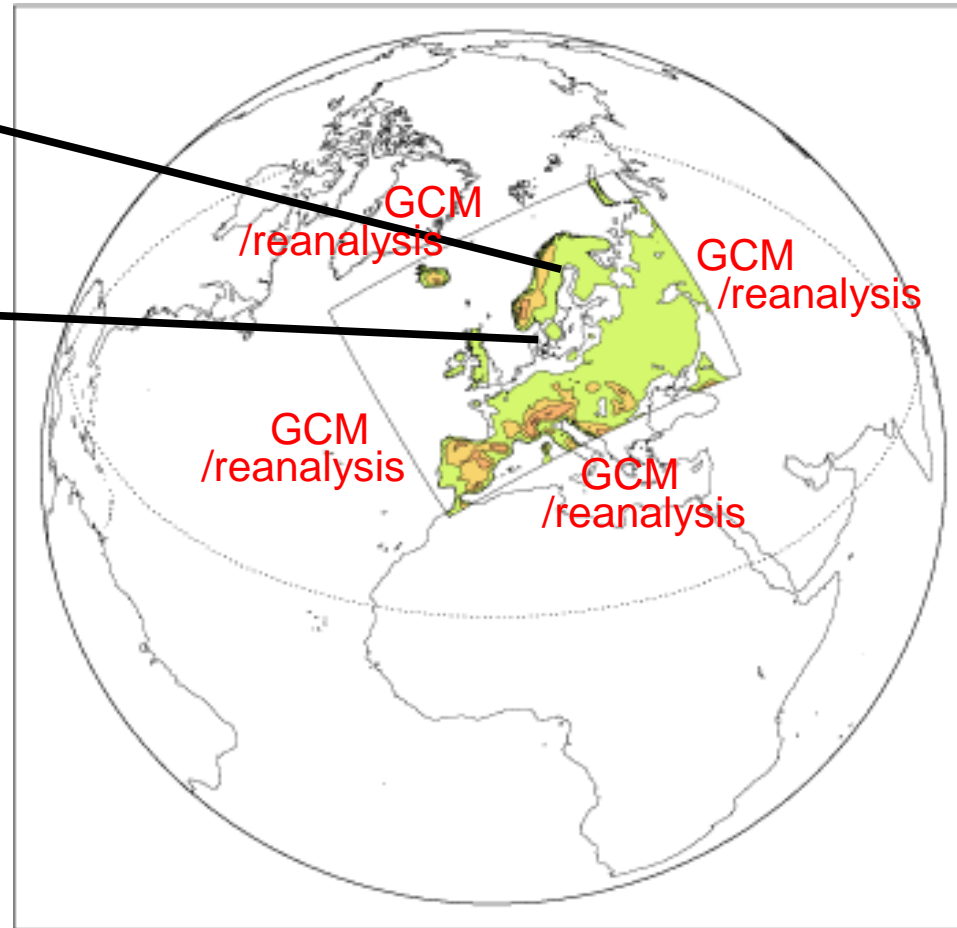
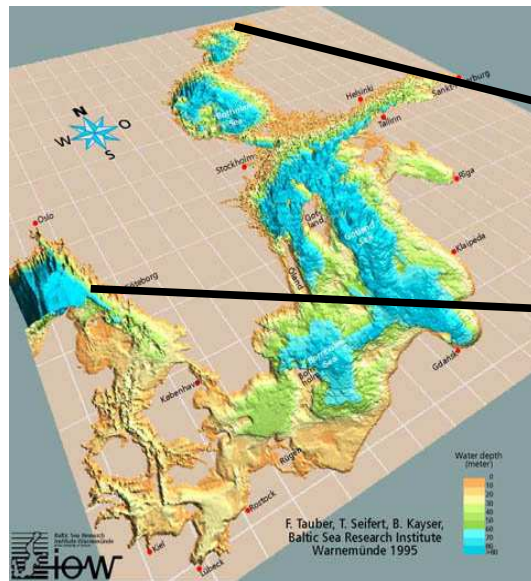
# Coupled climate modelling for Northern Europe

Ralf Döscher\*, Ulf Hansson\*, Anders Höglund\*\*, Ulrika Willén\*

\* SMHI/Rossby Centre, \*\* SMHI/ocean research

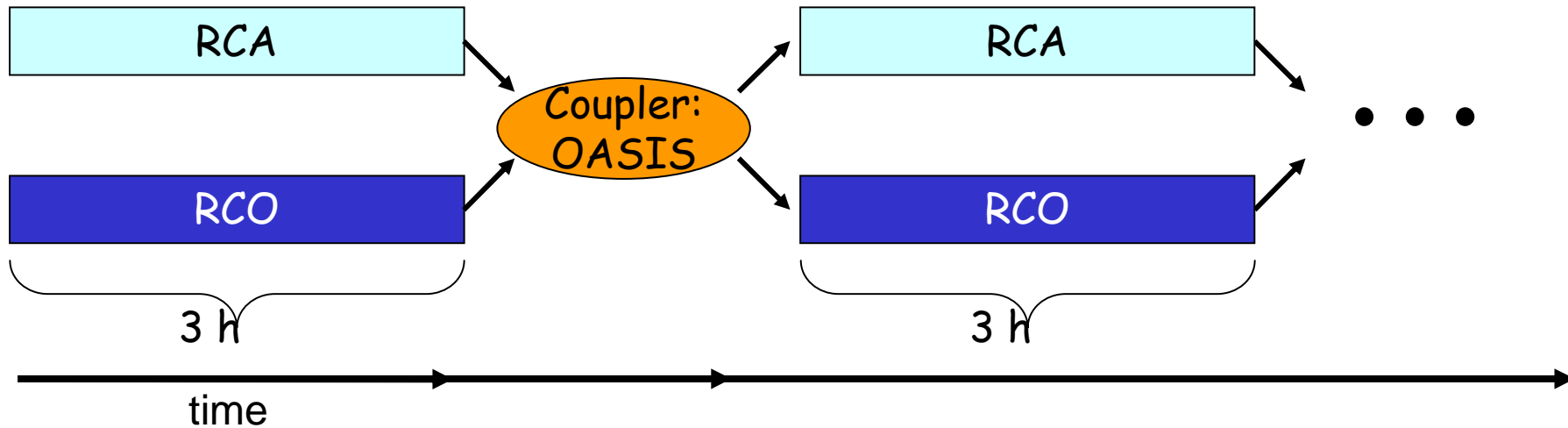
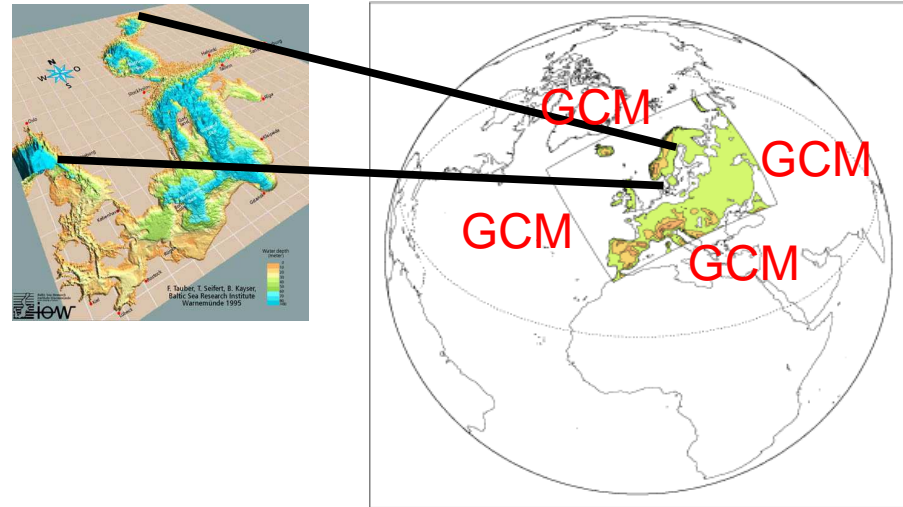


# Coupled climate model setup

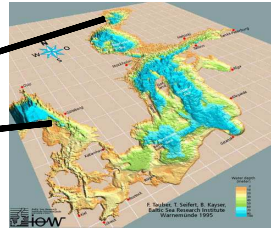
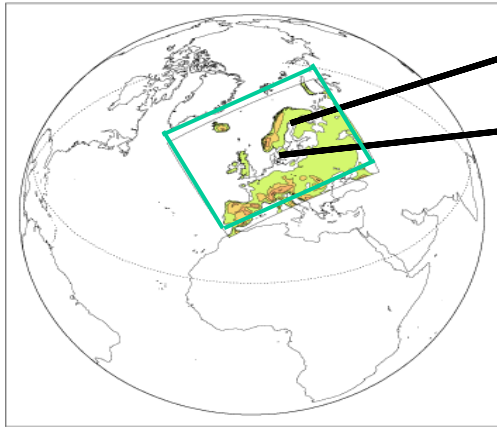


- Better representation of SST and sea ice conditions
- Coupled interaction
- Regional scenarios

# Coupled climate model setup

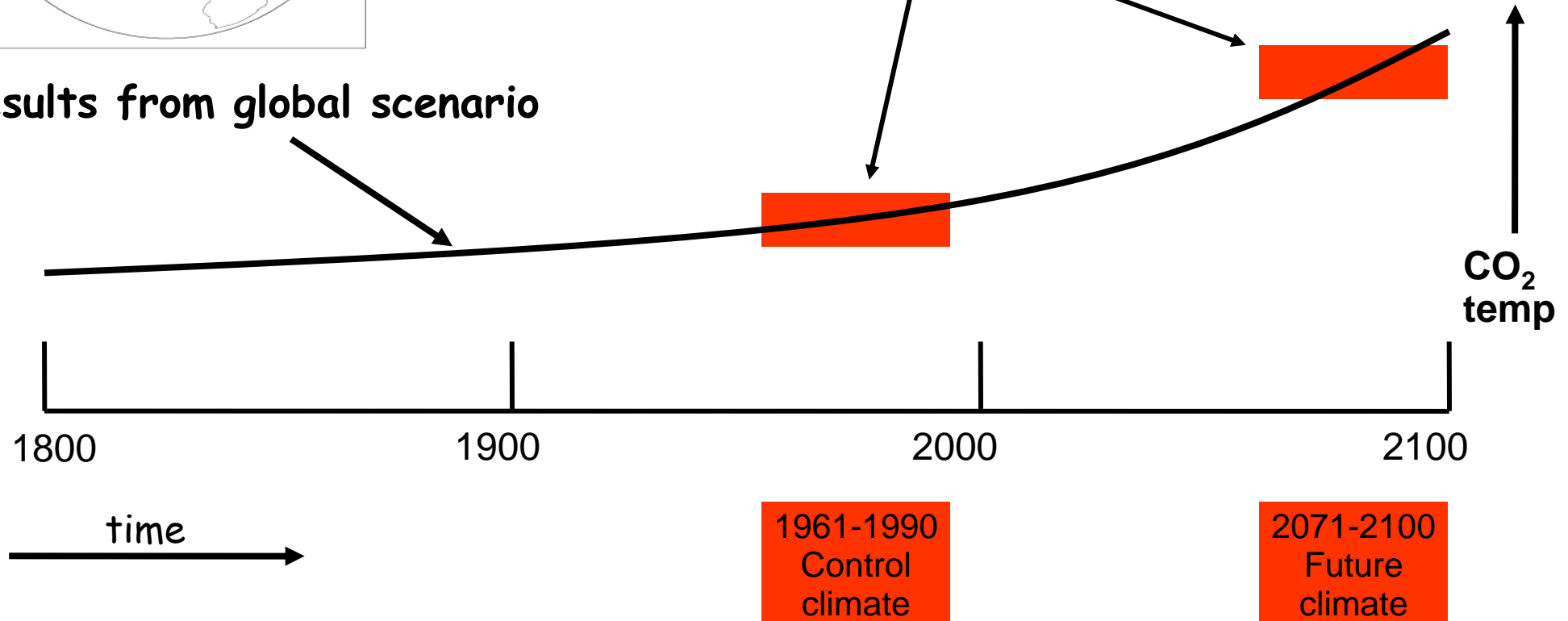


# Regional downscaling 2003

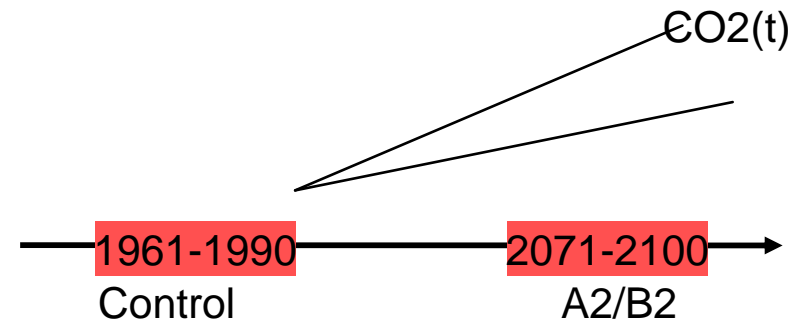
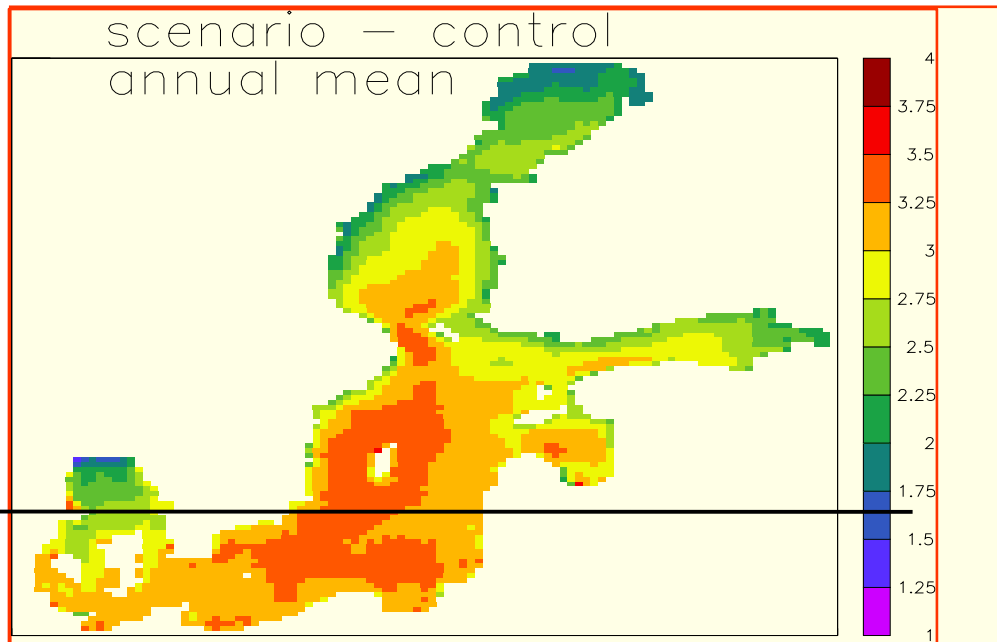


Regional simulations

Results from global scenario



# Earlier climate scenarios for the Baltic Sea: SST

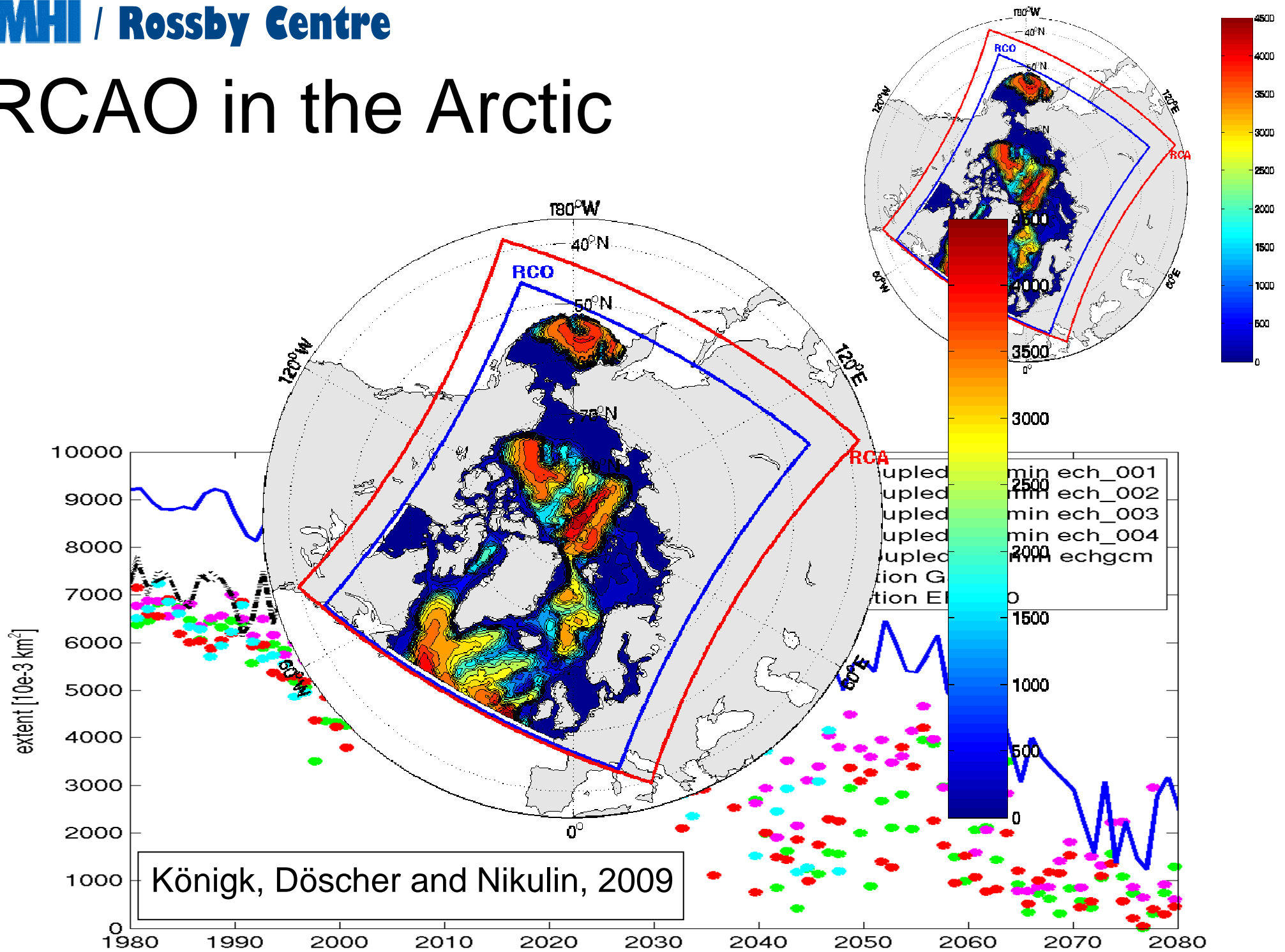


- SST increased all over the Baltic Sea
- Strongest signal in the central and southern Baltic Sea, where ice does not occur in the scenarios

Döscher and Meier, 2004

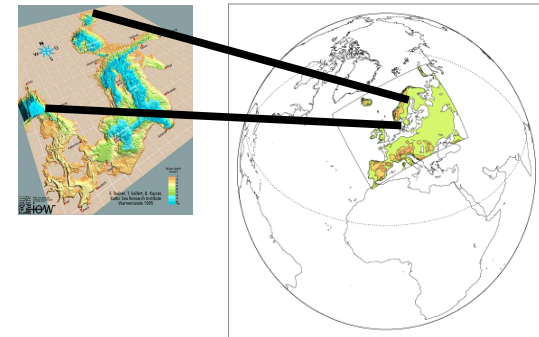
- Baltic sea scenarios from 2003, based on IPCC 2001 global scenarios
- 30-year time slices
- Older versions of RCA and RCO

# RCAO in the Arctic



# RCAO for the Baltic-Northern Europe domain

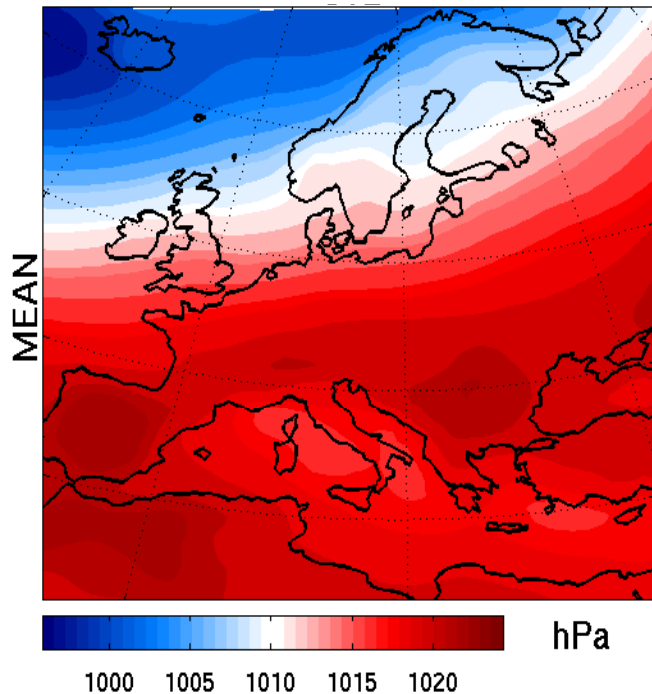
- Improved versions of RCA and RCO, updated coupling technology
- New global scenarios (IPCC 2007)
- Revised domain compatible to “ENSEMBLES”
- Transient runs (1960-2100) instead of time slices



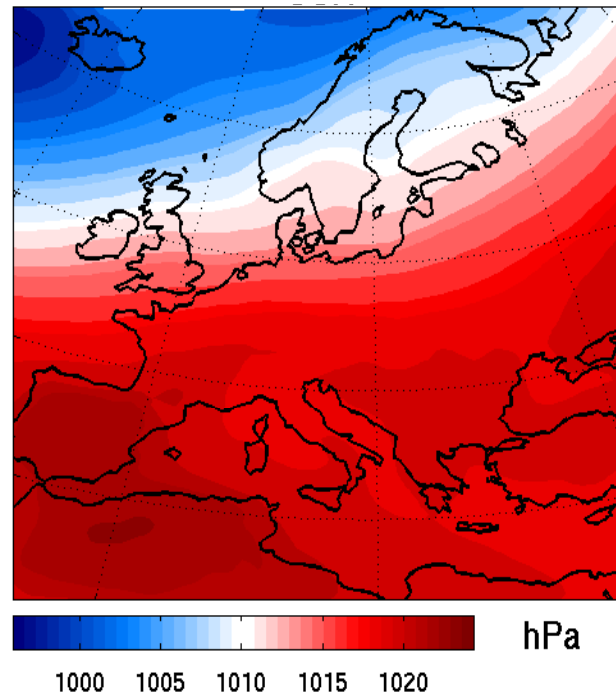
# RCAO validation: Sea Level Pressure

Mean sea level pressure (psl), WINTER (DJF), 50km

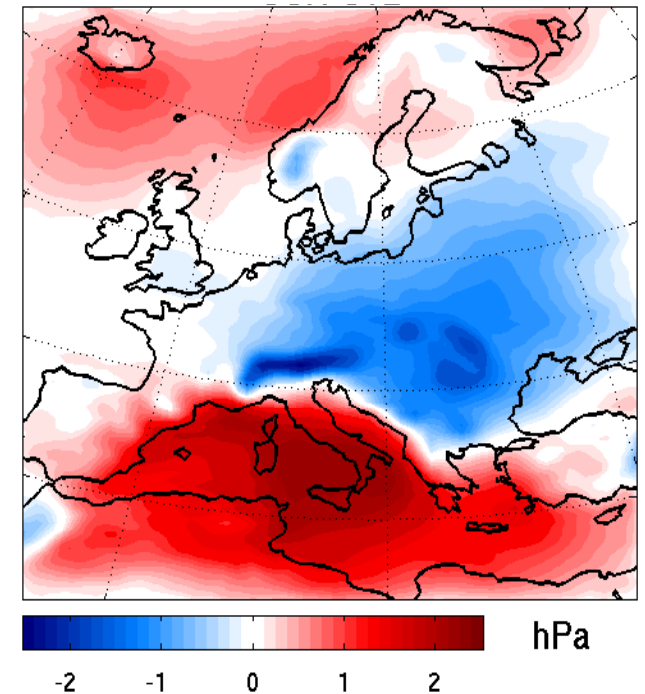
SCN: SMHIRCAO ERA40 CTL 1970-2000 | CTL: ECMWF ERA40 CTL 1970-2000



ERA



RCAO  
forced by ERA



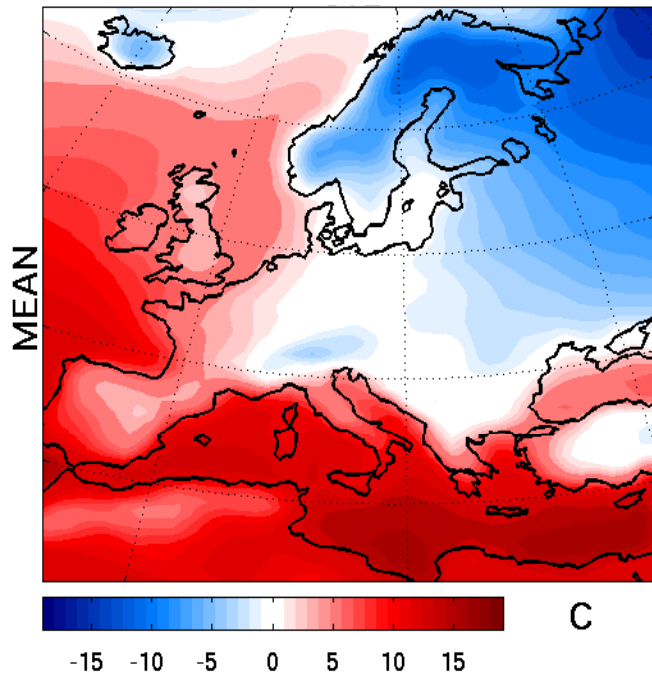
RCAO - ERA



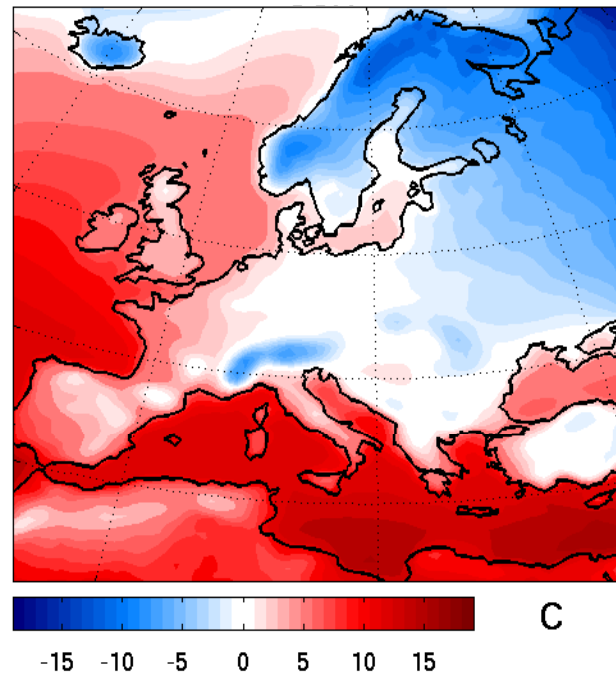
# RCAO validation: 2-m-air temperature

2-meter temperature (tas), WINTER (DJF), 50km

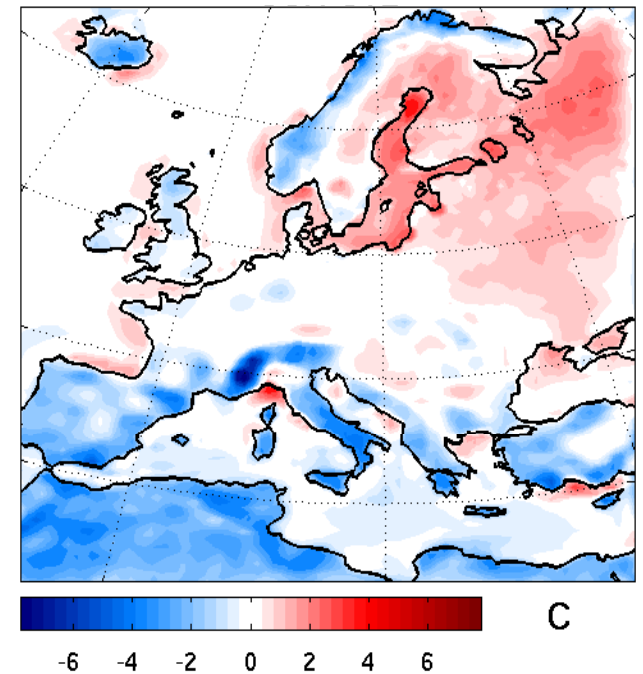
SCN: SMHIRCAO ERA40 CTL 1970-2000 | CTL: ECMWF ERA40 CTL 1970-2000



ERA



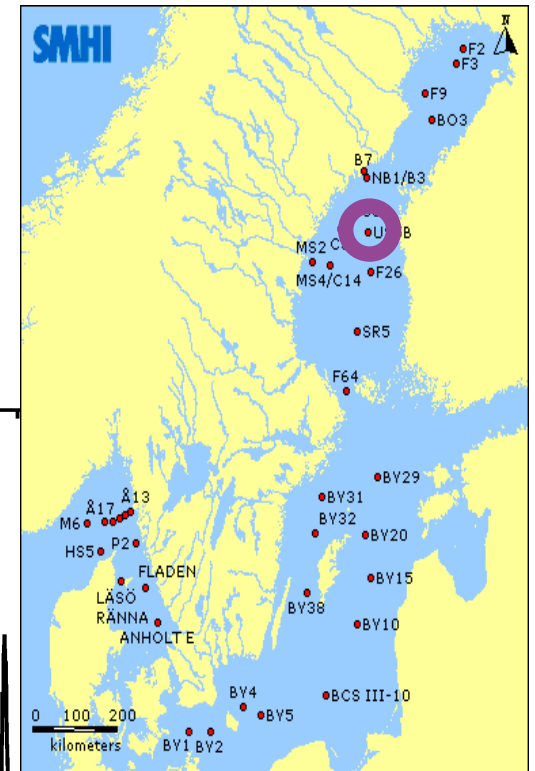
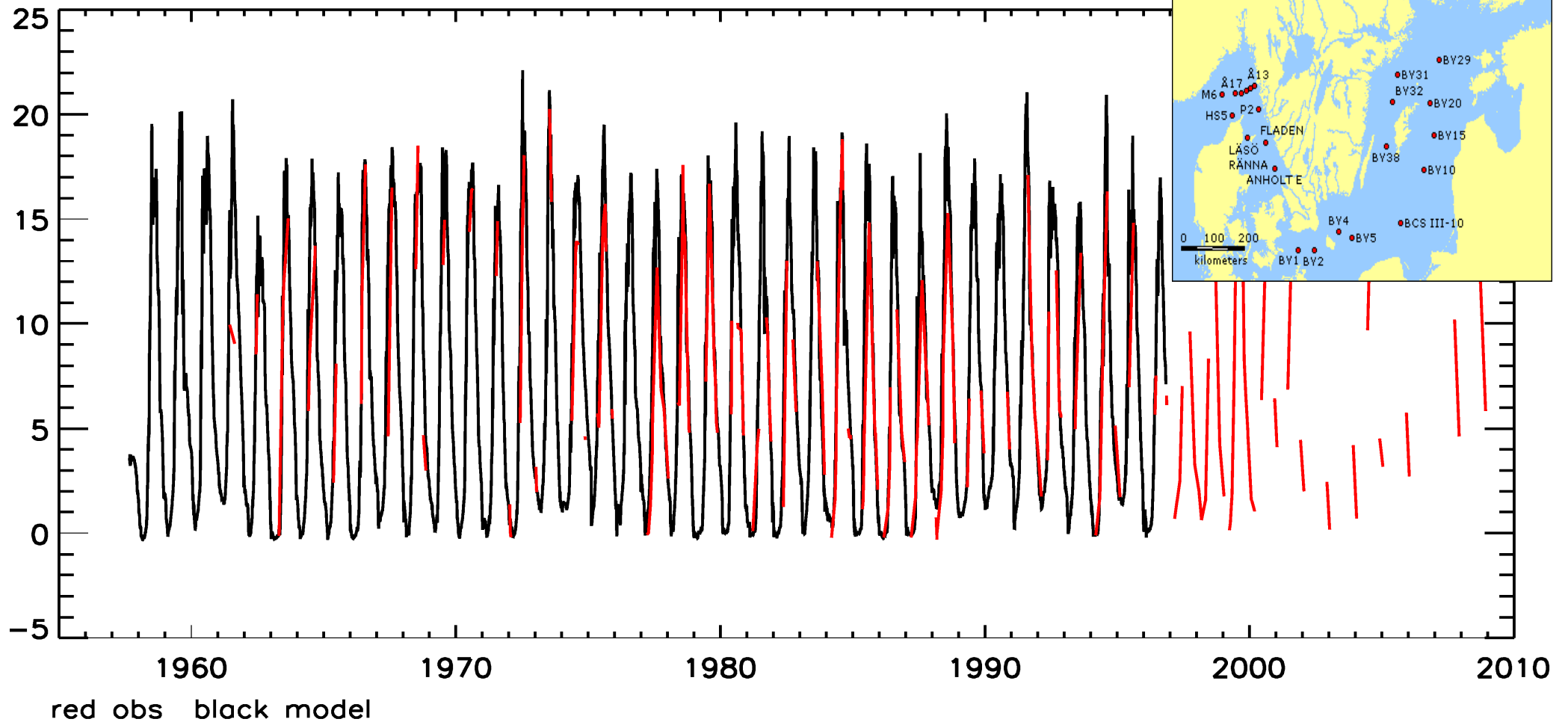
RCAO  
forced by ERA



RCAO - ERA

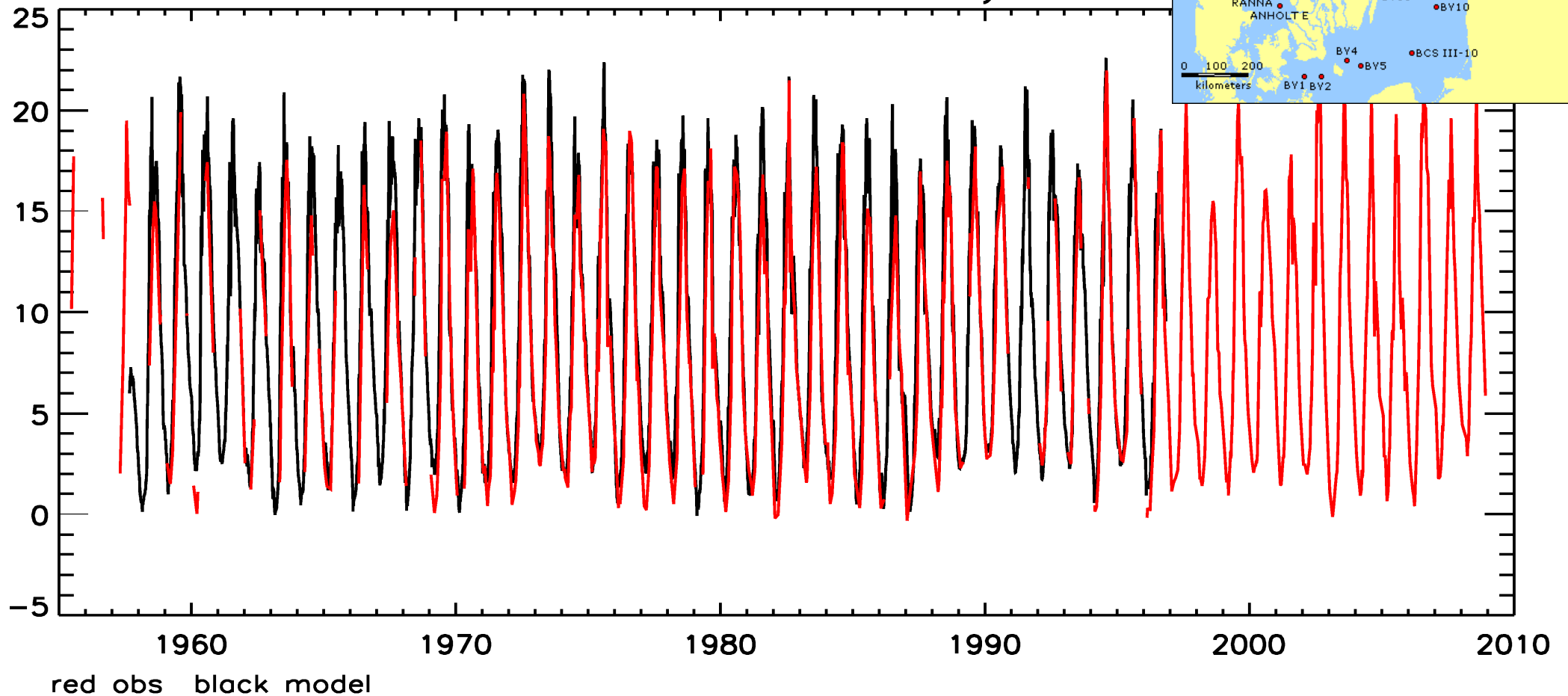
# Sea surface temperature

rcao-ERAbaltrun32 SST us5b



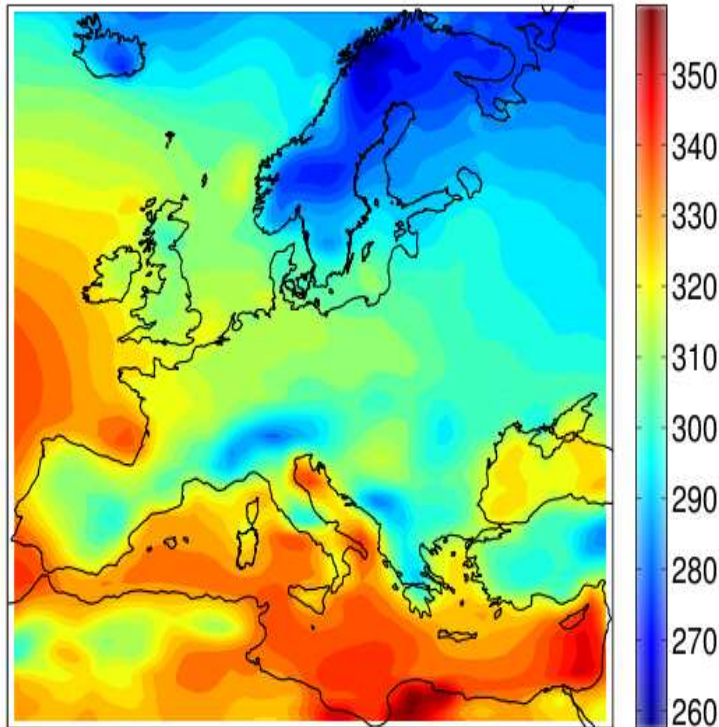
# Sea surface temperature

rcao-ERAbaltrun32 SST by31



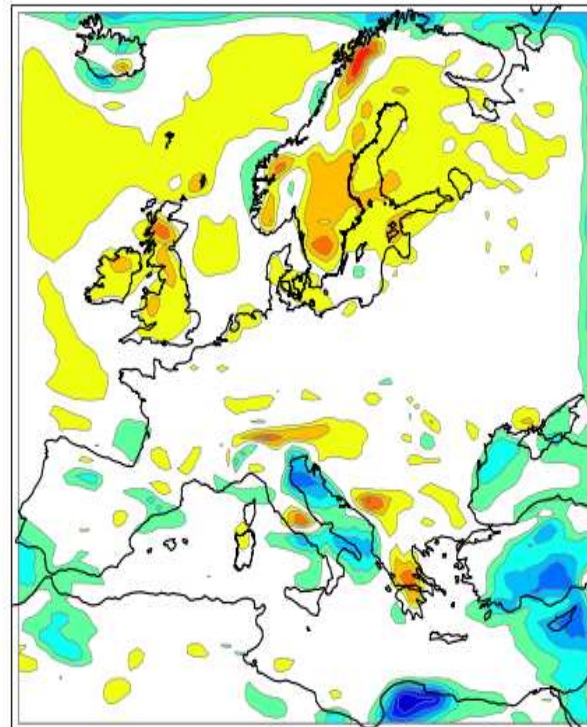
# Heat fluxes: Annual mean LWD radiation

ERA40 lwdnsrf



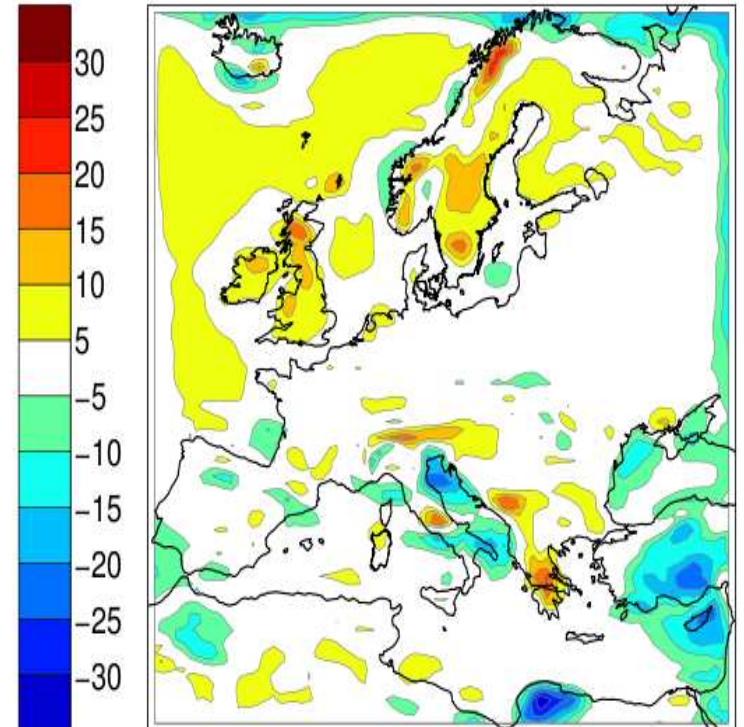
ERA

RCAO\_ERA lwdnsrf - ERA40 lwdnsrf



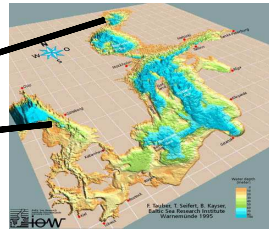
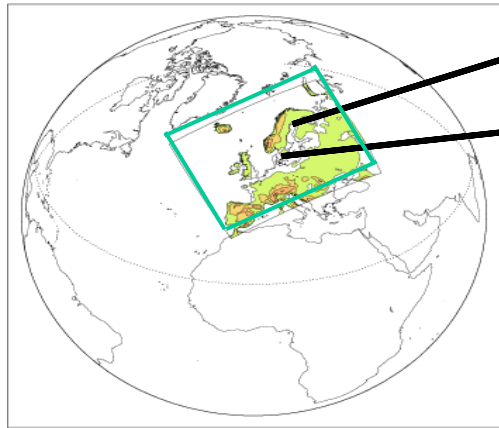
RCAO, forced by ERA

RCA3\_ERA40 lwdnsrf - ERA40 lwdnsrf



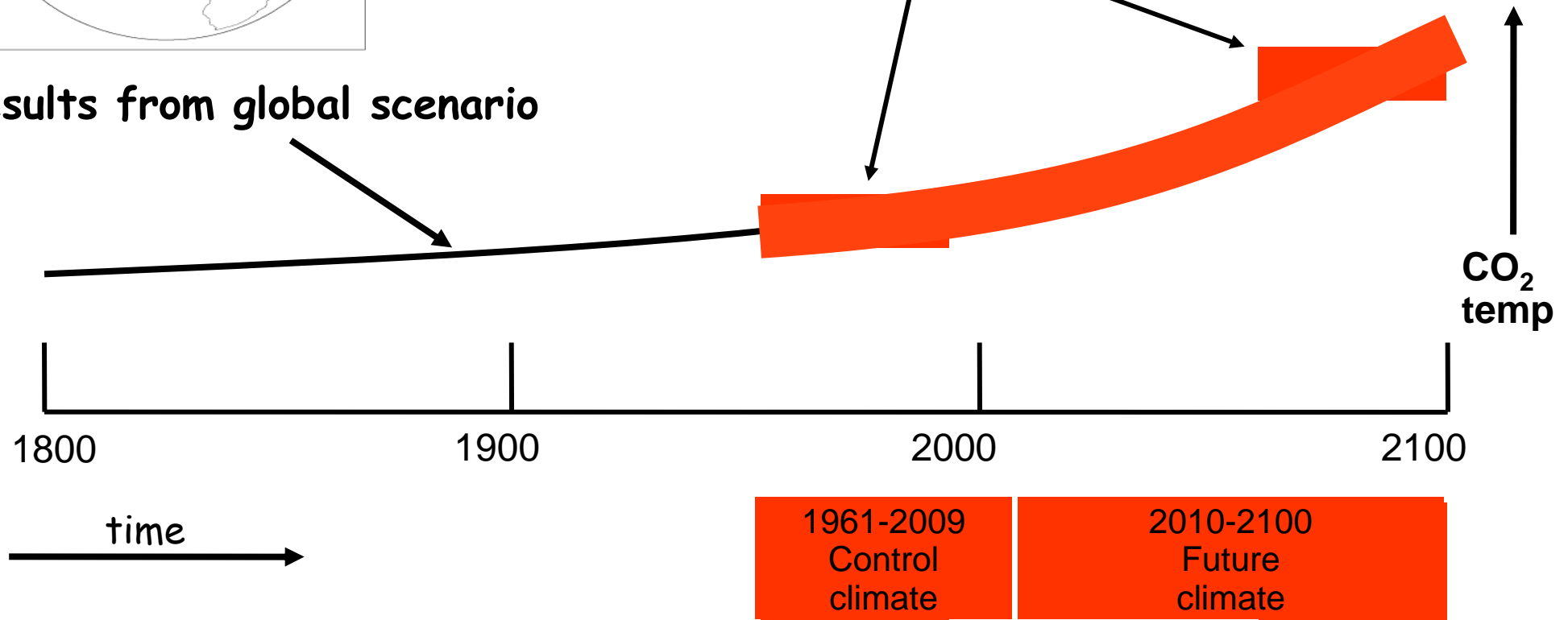
RCA, forced by ERA

# Regional downscaling



Regional simulations

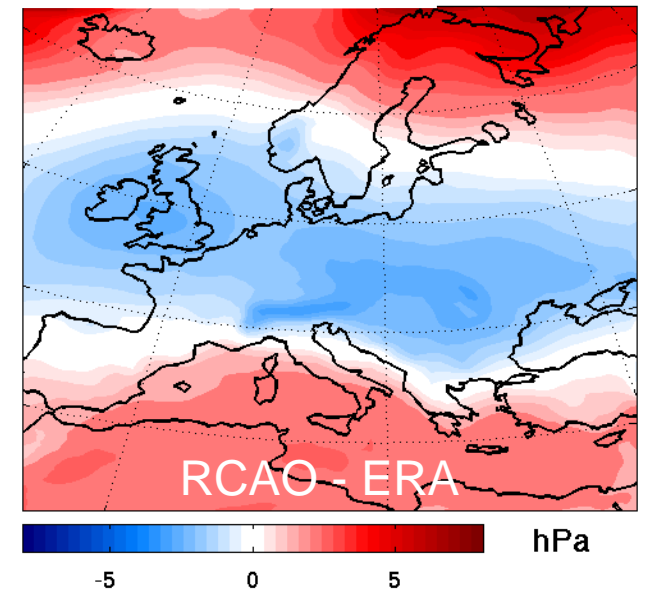
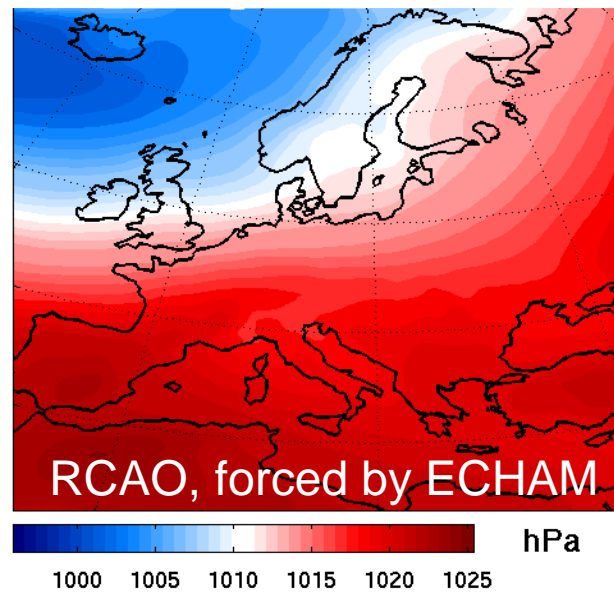
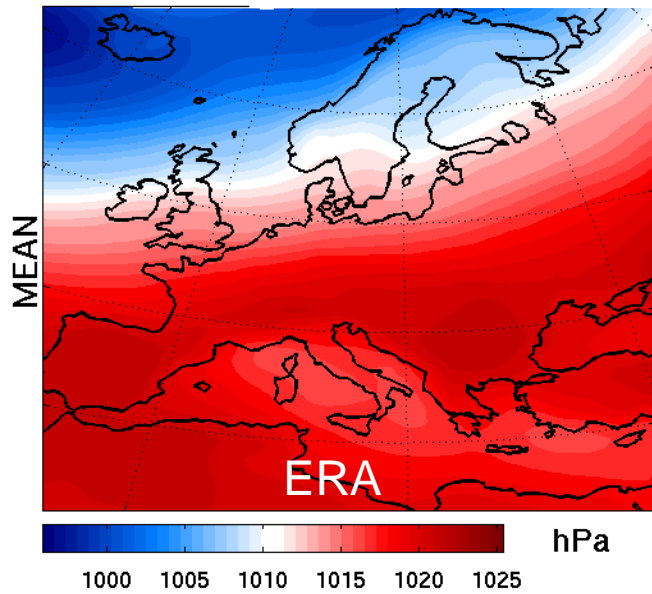
Results from global scenario





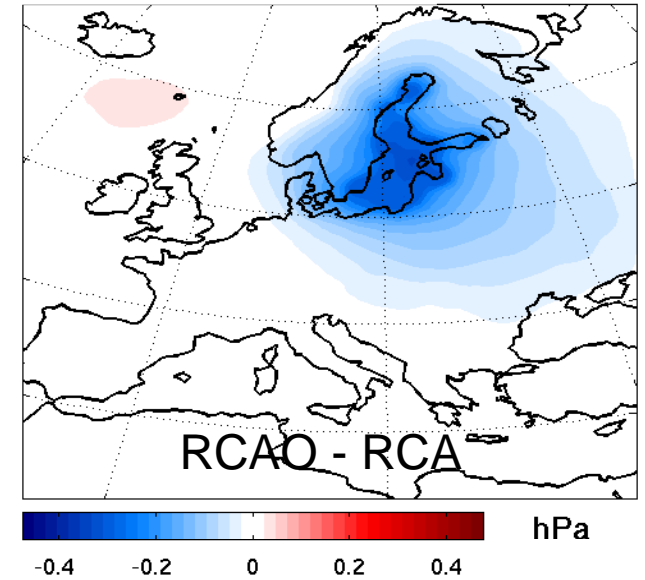
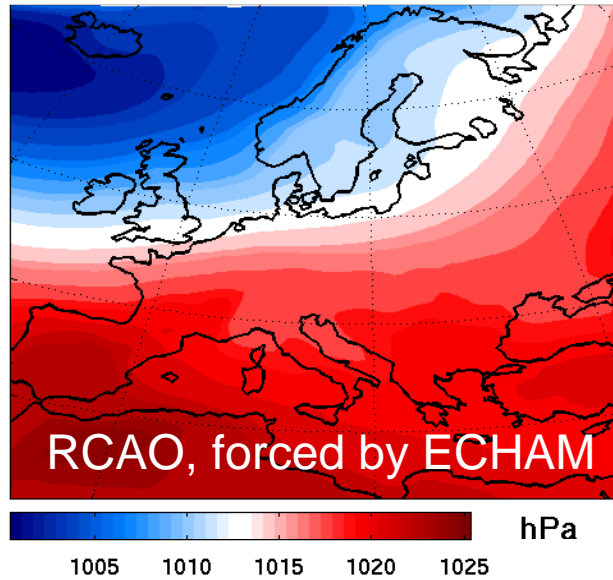
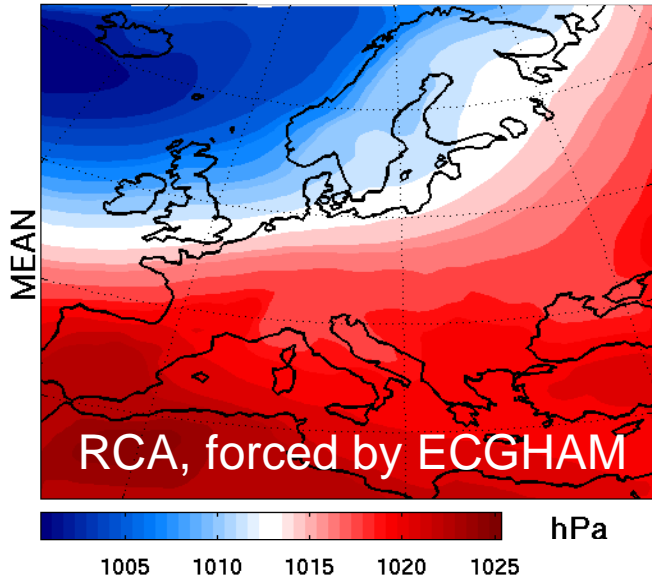
Mean sea level pressure (psl), **WINTER** (DJF), 50km

SCN: SMHIRCAO ECHAM5-r3 A1B 1970-2000 | CTL: ECMWF ERA40 CTL 1970-2000



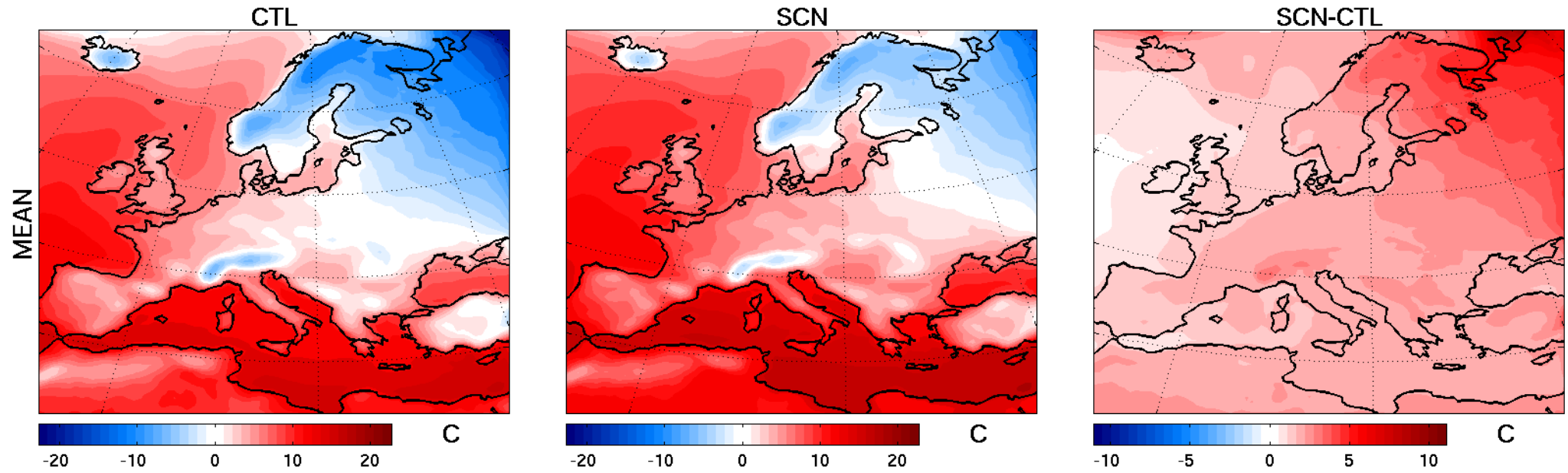
Mean sea level pressure (psl), **WINTER** (DJF), 50km

SCN: SMHIRCAO ECHAM5-r3 A1B 1970-2000 | CTL: SMHIRCA30 ECHAM5-r3 A1B 1970-2000



2-meter temperature (tas), WINTER (DJF), 50km

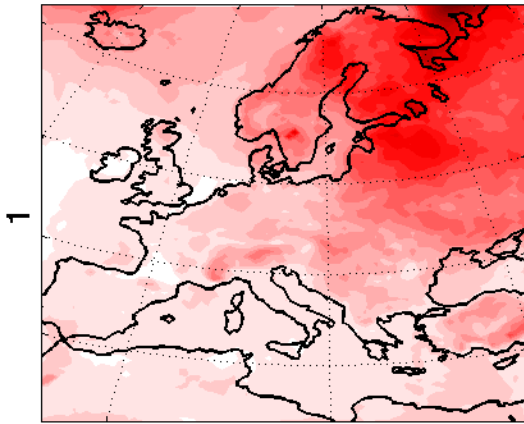
SCN: SMHIRCAO ECHAM5-r3 A1B 2050-2080 | CTL: SMHIRCAO ECHAM5-r3 A1B 1970-2000



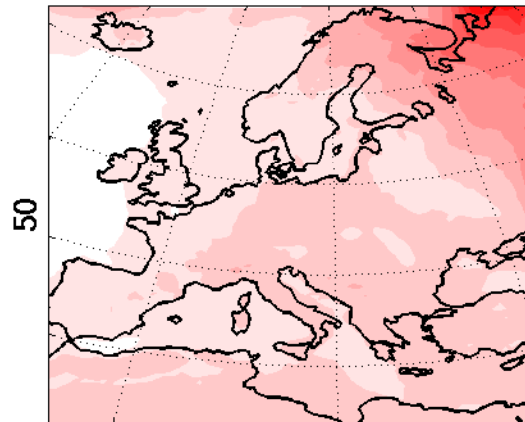


2-meter temperature (tas), WINTER (DJF), 50km

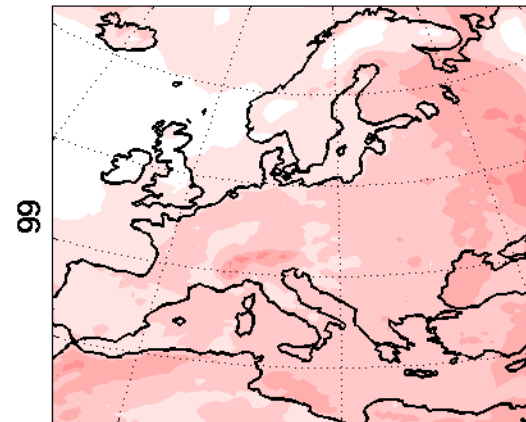
SCN: SMHIRCAO ECHAM5-r3 A1B 2050-2080 | CTL: SMHIRCAO ECHAM5-r3 A1B 1970-2000



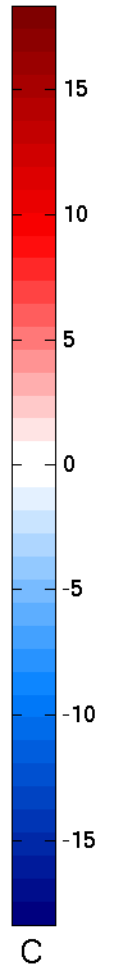
1% coldest days get much warmer



1% warmest days get little warmer

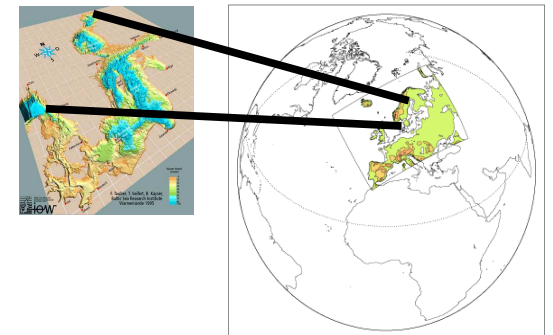


Percentiles  
(total)  
SCN-CTL



# Coming soon

- 4 coupled scenarios
  - ECHAM A1B *finished*
  - Hadley A1B
  - ECHAM A2
  - Hadley A2
- In deep climate change analysis
- Better representation of deep ocean salinity
- Scenarios in 25 km resolution



# The End



Linux clusters  
at NSC, Linköping



# 2-m-air temperature increase

2-meter temperature (tas), WINTER (DJF), 50km

SCN: SMHIRCAO ECHAM5-r3 A1B 2050-2080 | CTL: SMHIRCAO ECHAM5-r3 A1B 1970-2000

2-meter temperature (tas), SUMMER (JJA), 50km

SCN: SMHIRCAO ECHAM5-r3 A1B 2050-2080 | CTL: SMHIRCAO ECHAM5-r3 A1B 1970-2000

