

Status of dynamical downscaling at the Rossby Centre and future plans

Erik Kjellström

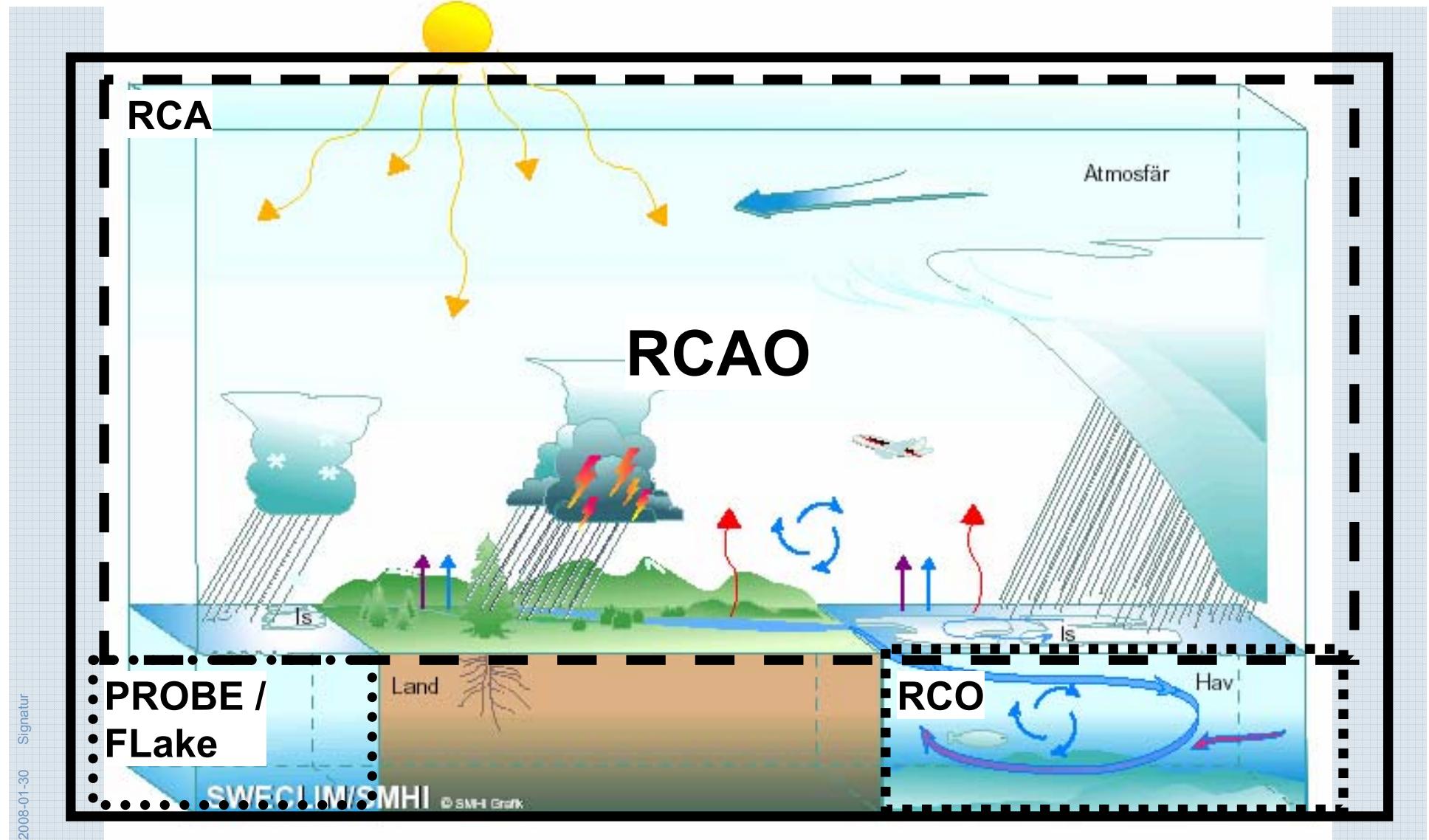
Presentation given at the BALTEX Workshop on Utility of Regional Climate Models

at SMHI, Norrköping, Sweden. 23 January 2008

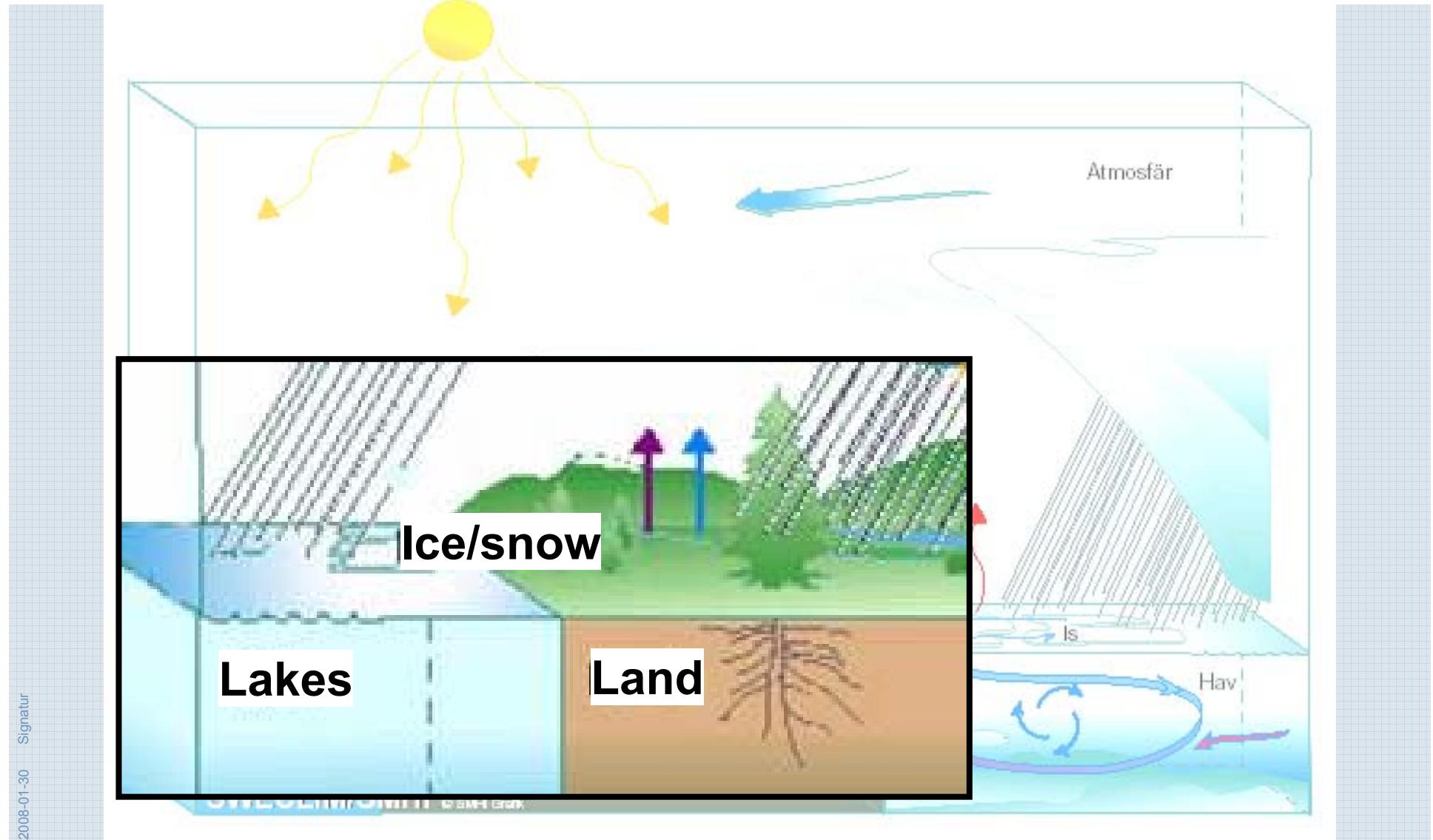
Outline

- ✓ Recent, ongoing and future model development
 - RCA2 → RCA3 → RCA3.1 → RCA4
PRUDENCE ENSEMBLES 2008 2009
 - RCO
 - RCAO (Baltic Sea, Arctic)
- ✓ Preliminary results from the new version of RCAO
- ✓ Climate scenario simulation plans

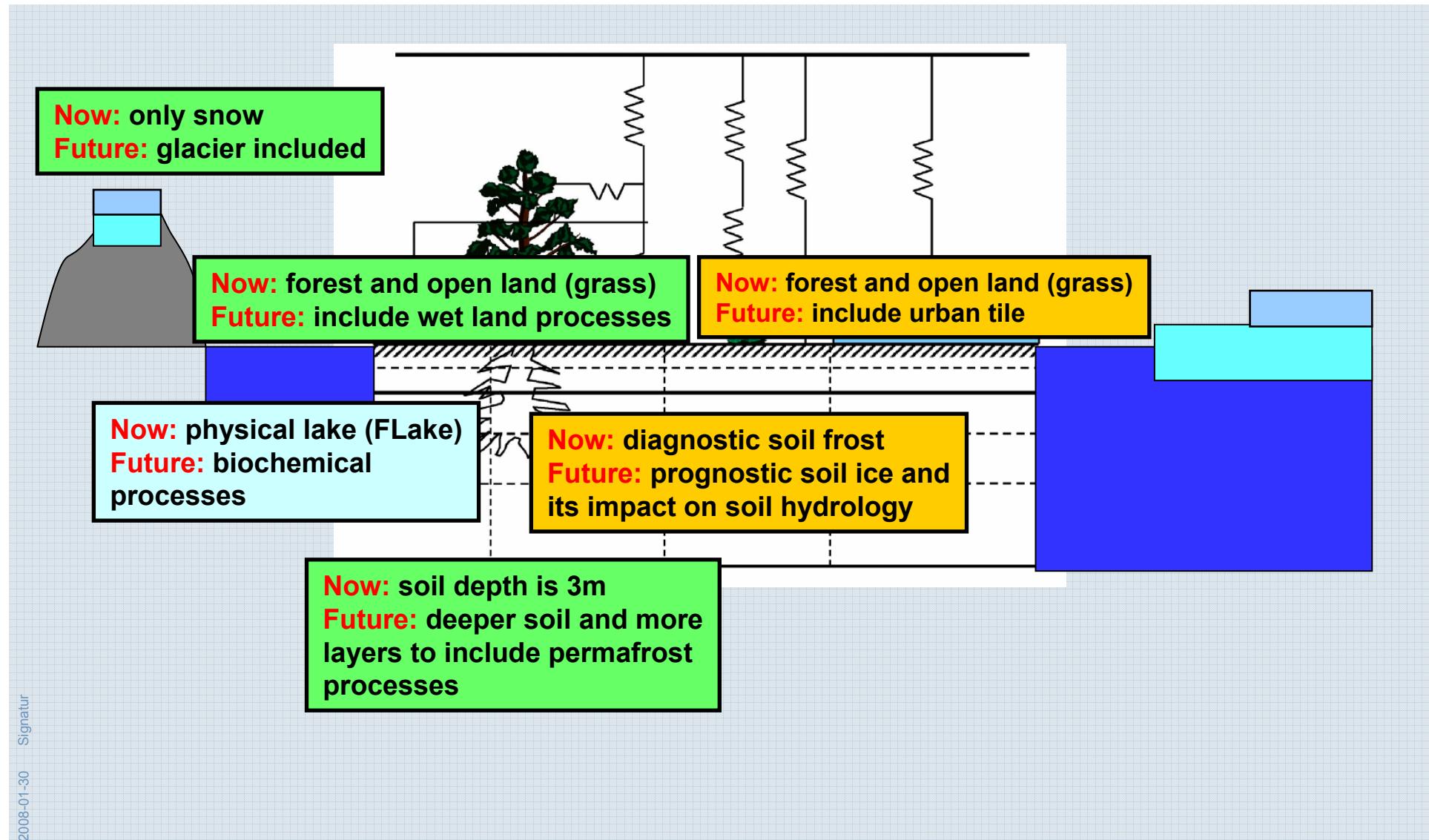
Recent, ongoing and future model development



The land surface scheme



The land surface scheme in RCA3 and possible future development



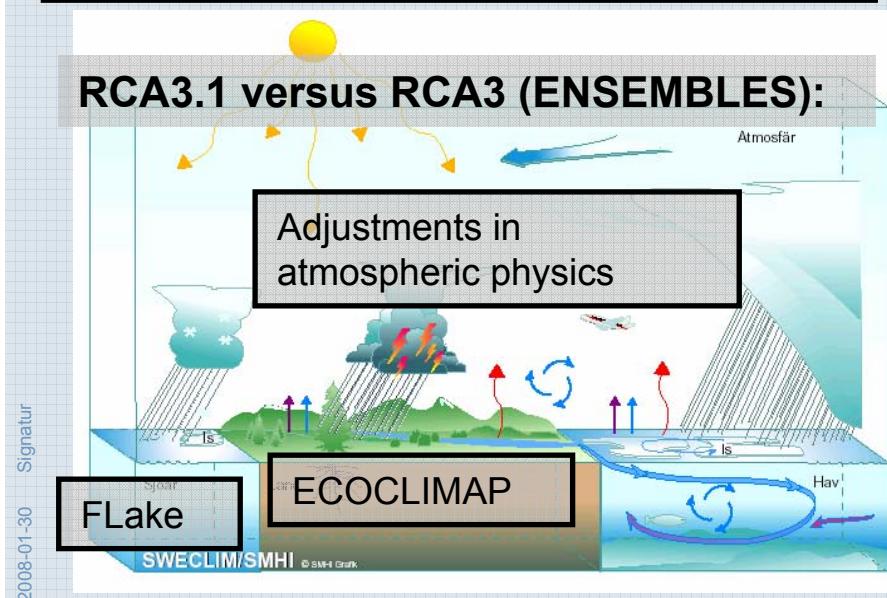
Do we need to account for lakes in climate and NWP modelling?

To answer that question two sets of RCM simulations have been done:

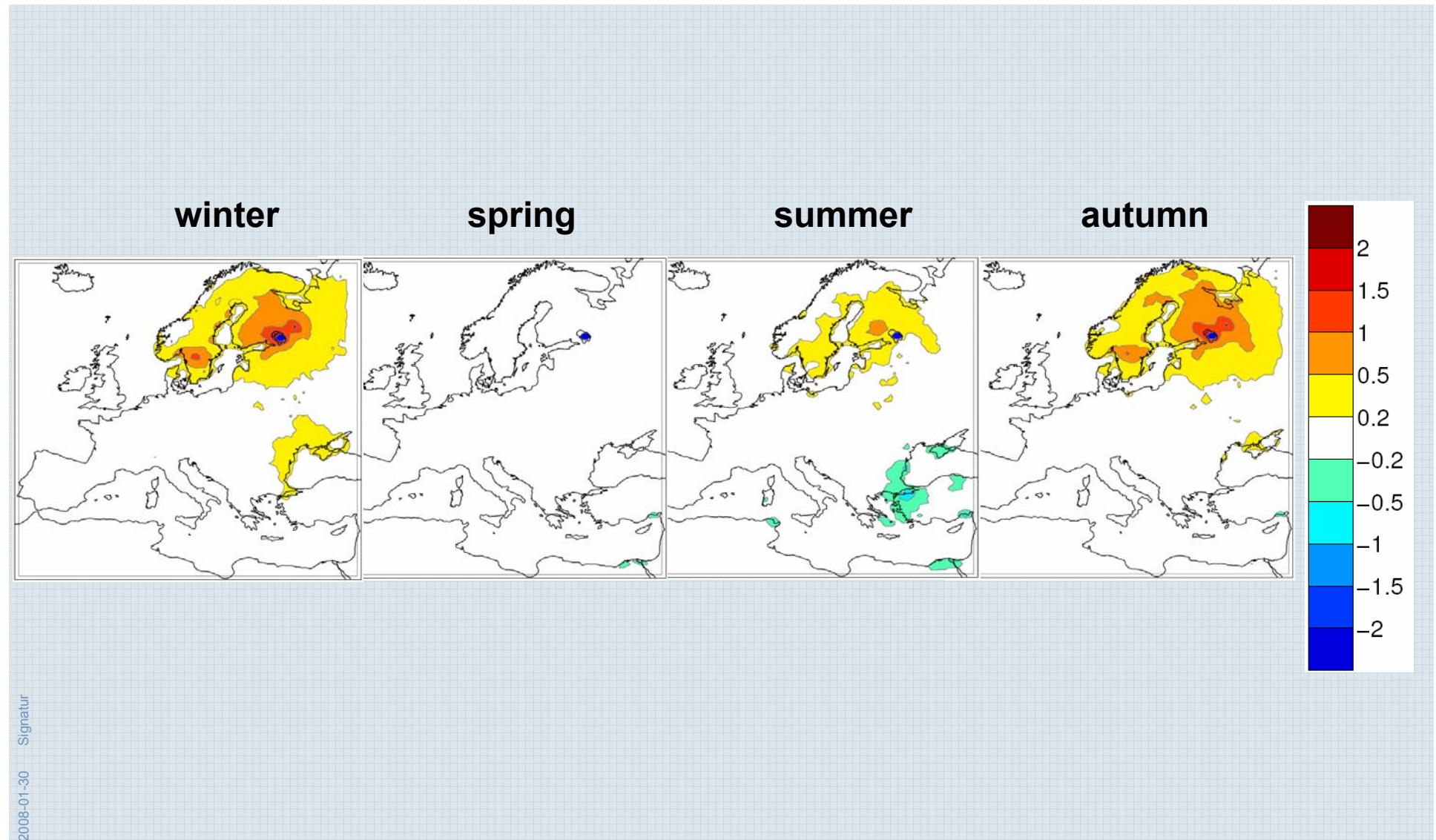
- **RCM:**
the Rossby Centre Regional Climate Model (RCA3.1)
- **Time period:**
1961-1990
- **Lateral BC and SST:**
from ERA40 (ECMWF Reanalysis)

Lake model
FLake used
for all inland
water

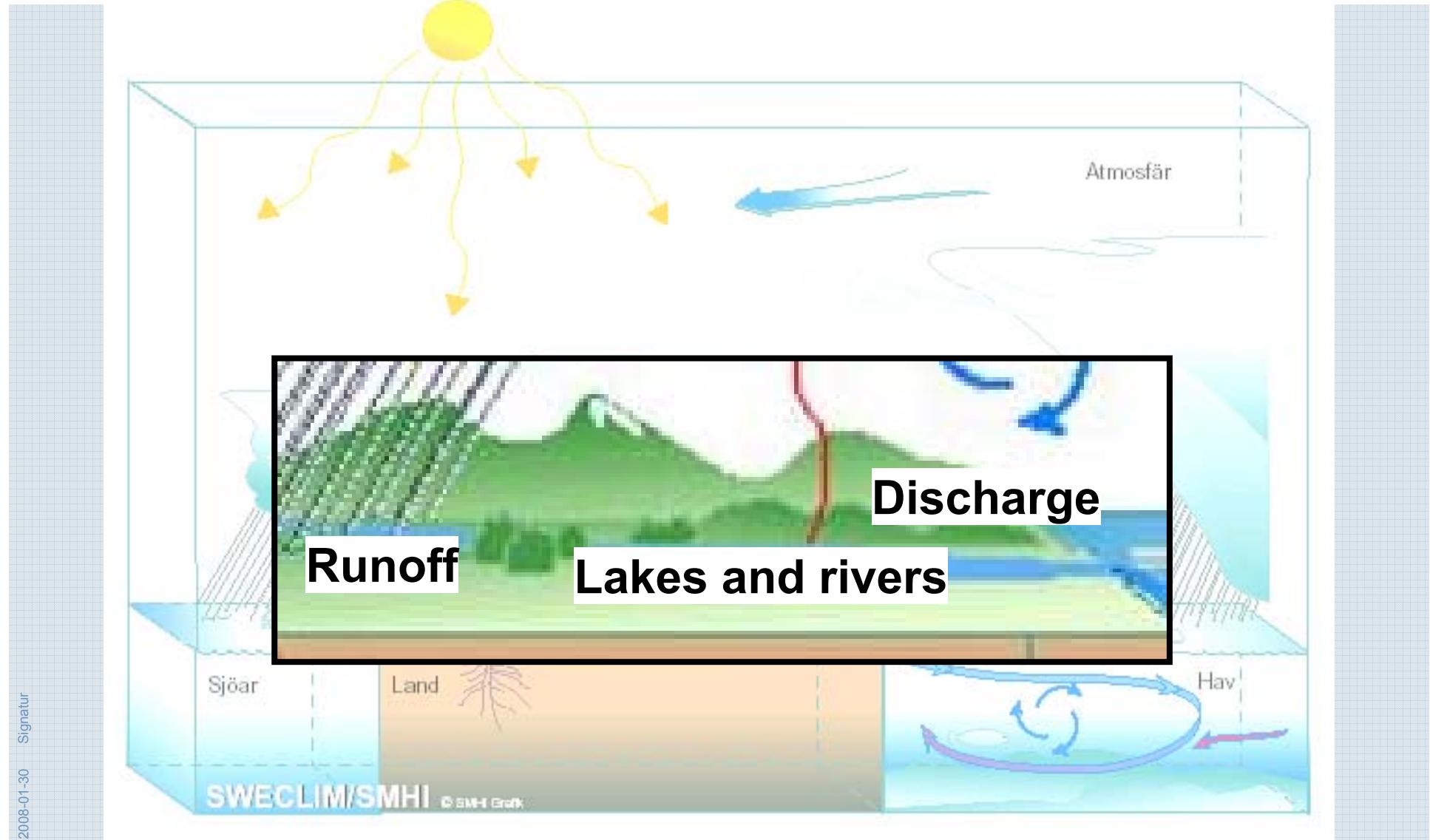
All inland
water
replaced by
land



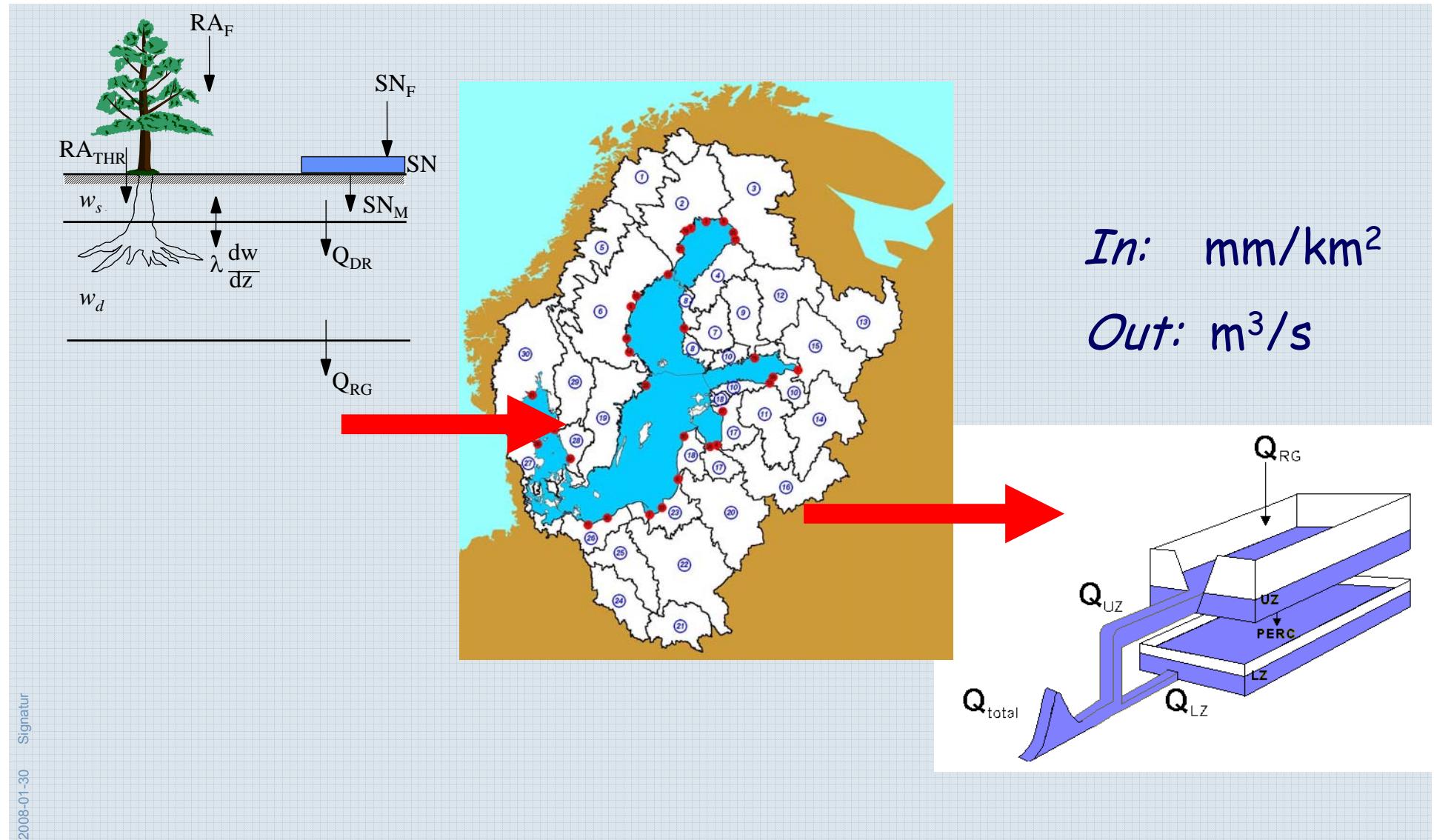
Lake influence on seasonal mean open land T2m



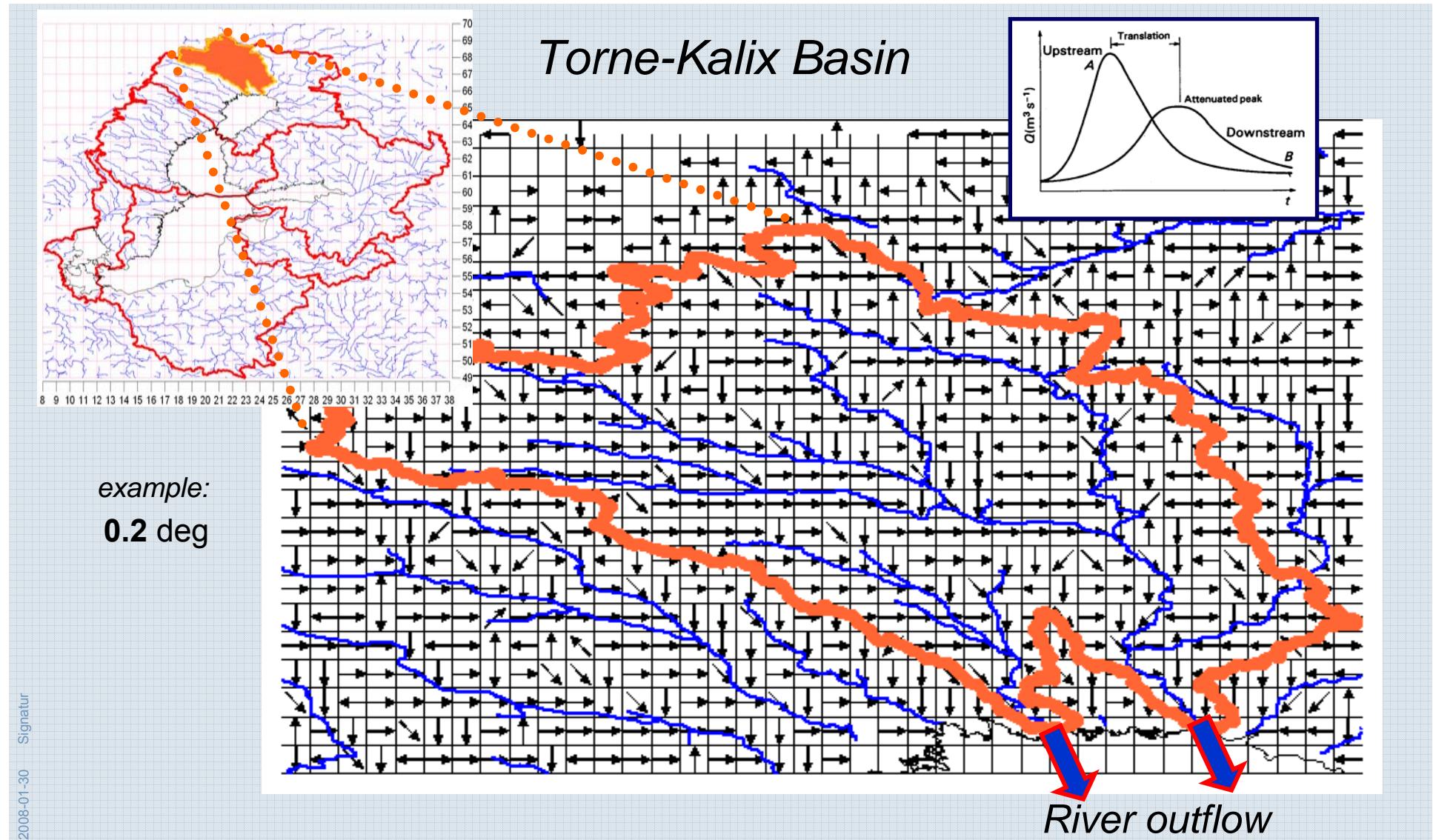
Model development: Hydrology



Runoff Routing in RCA2 and RCA3 ...

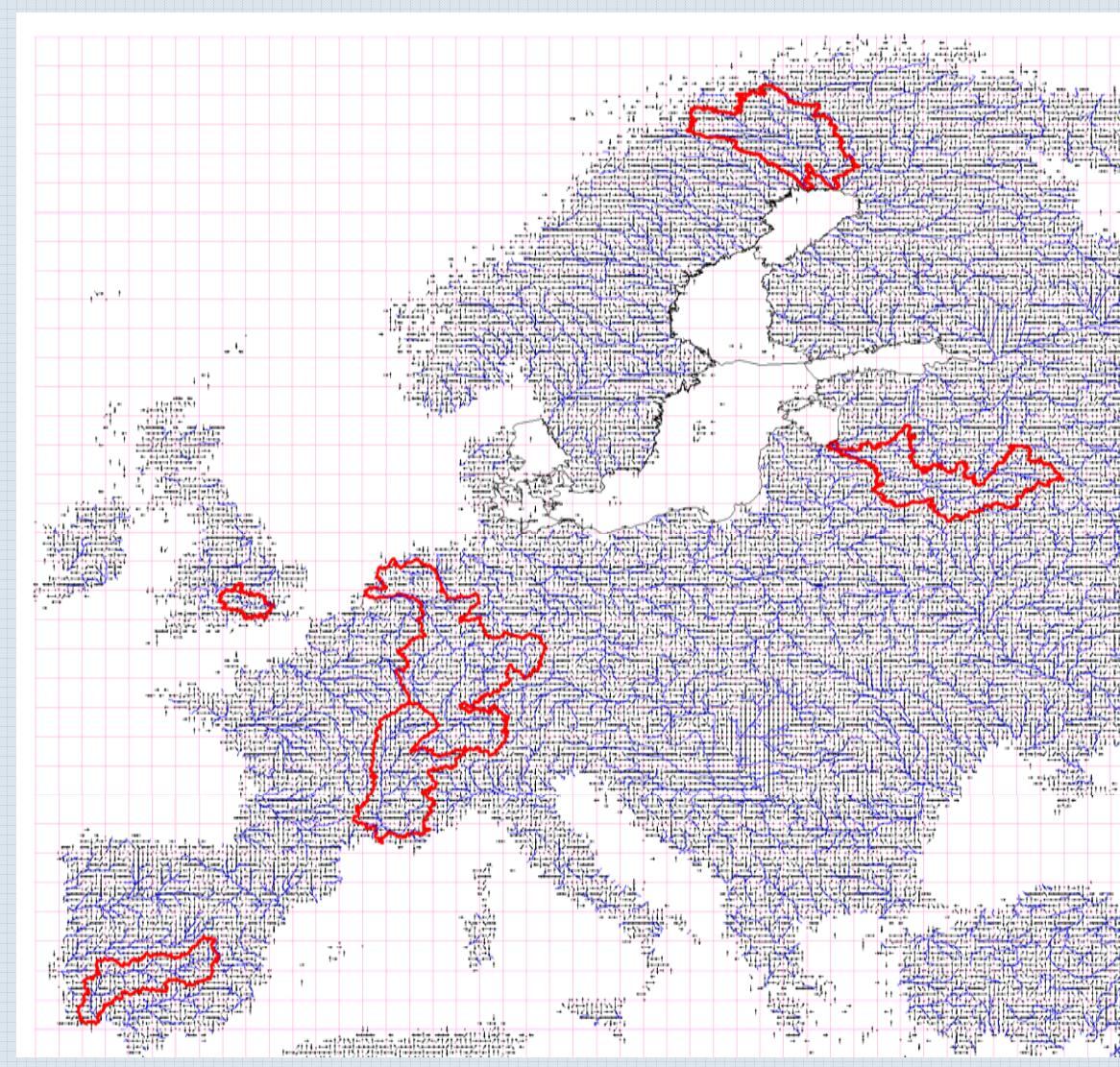


Runoff Routing in RCA3.1 ...



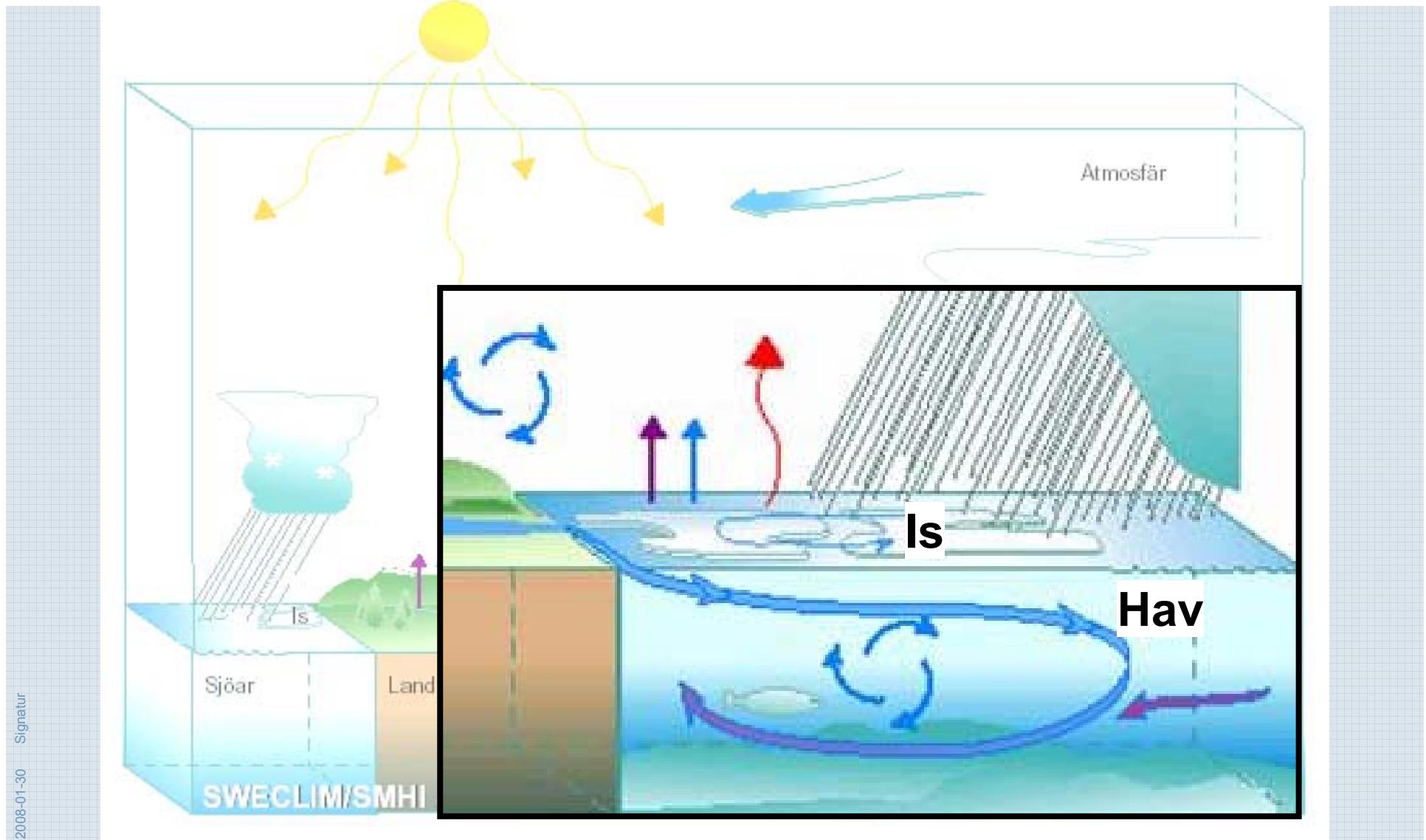
Runoff Routing in RCA3.1 ... a more universal approach with added detail

example:
0.2 deg

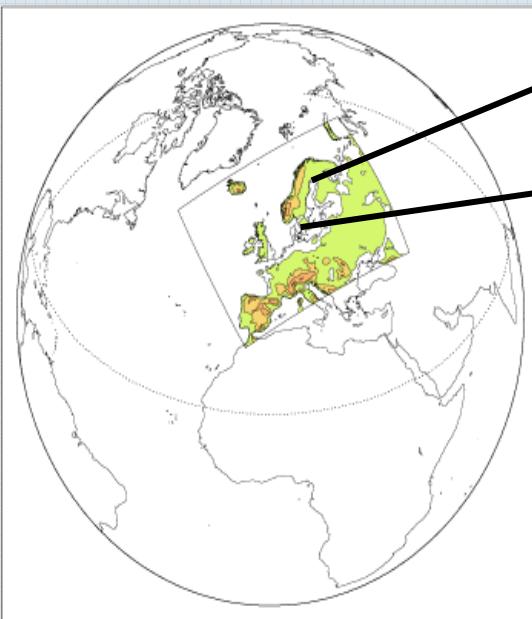


*choose
any
basin!*

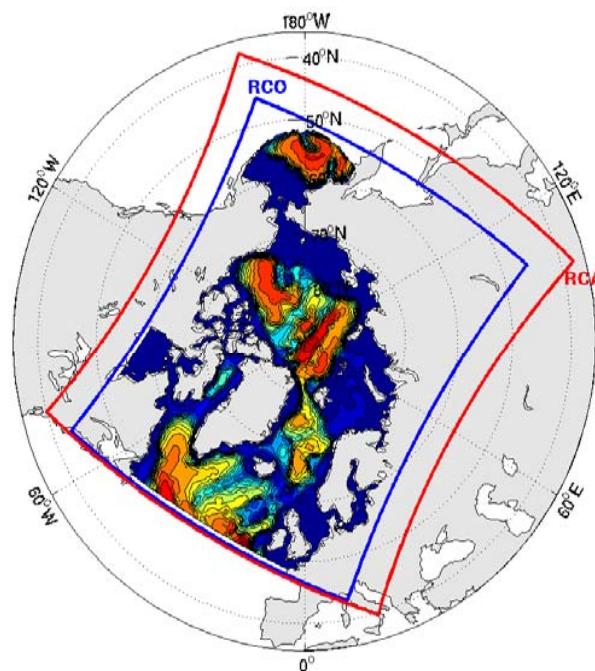
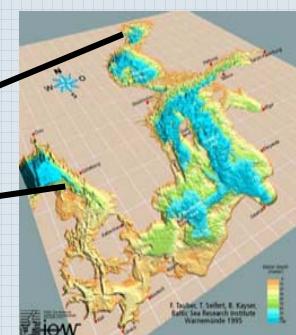
Model development: Atmosphere-ocean coupling



Work in two regions

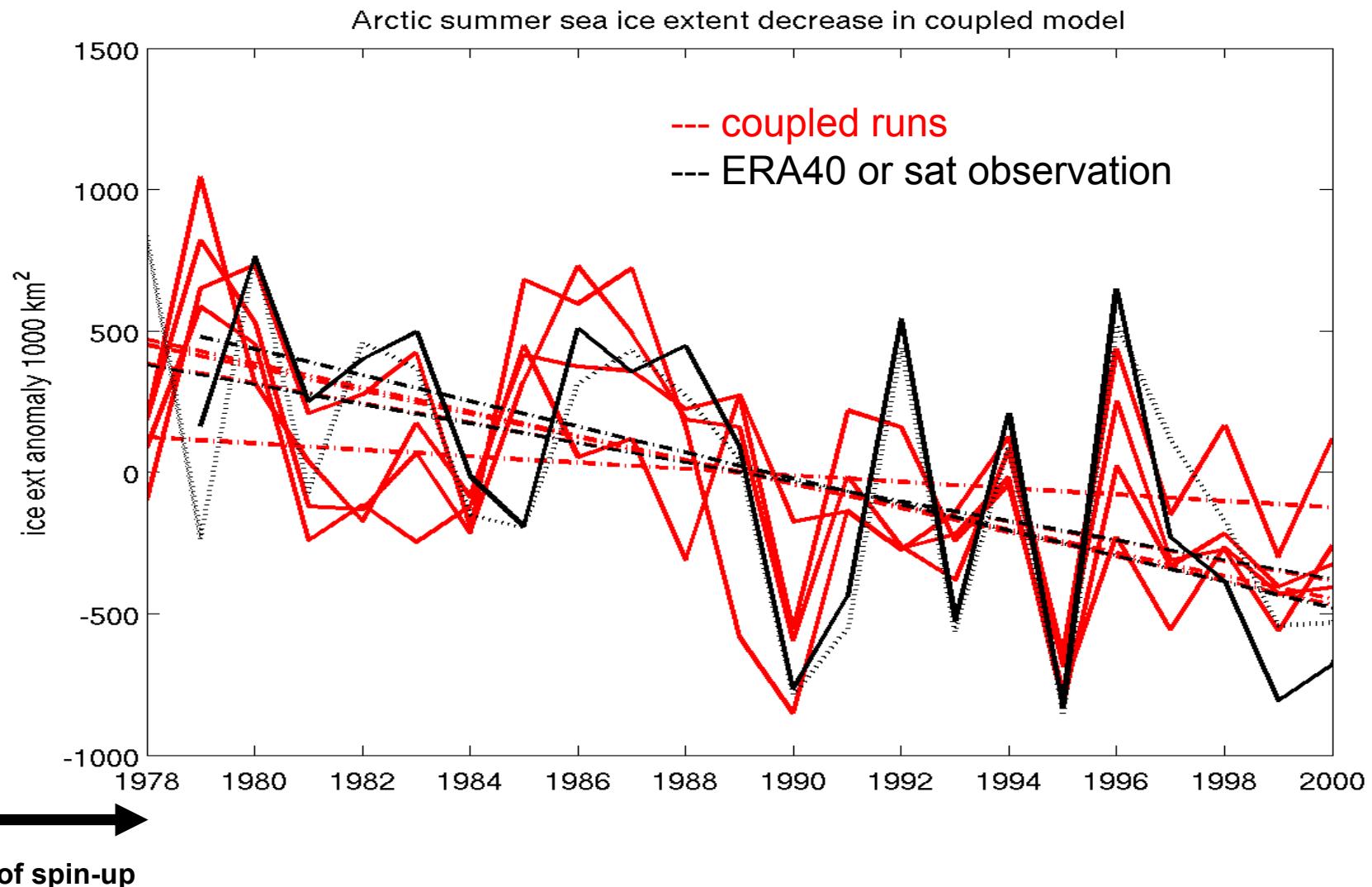


The Baltic region

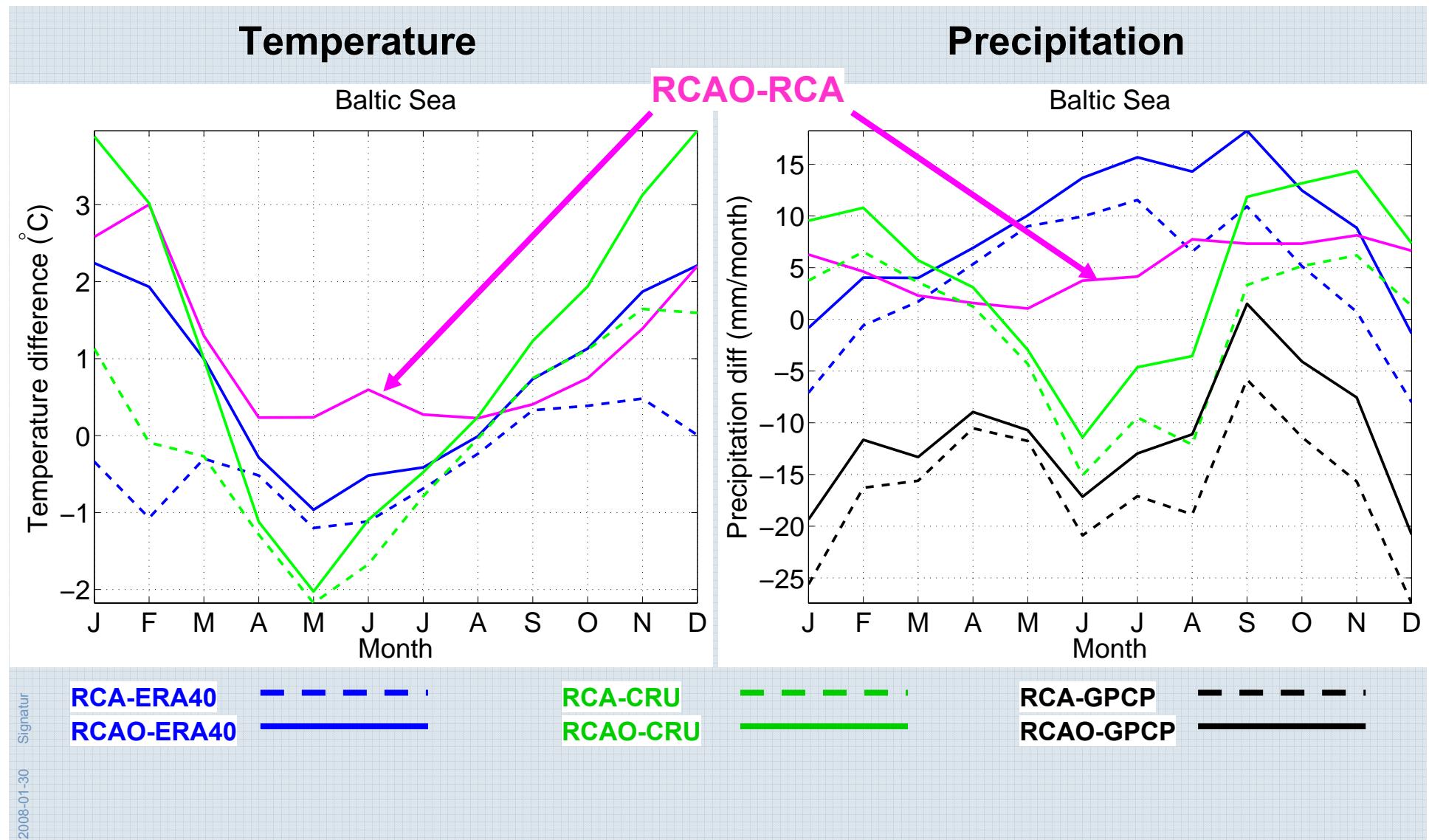


The Arctic region

Arctic summer sea ice extent anomaly in four ensemble runs

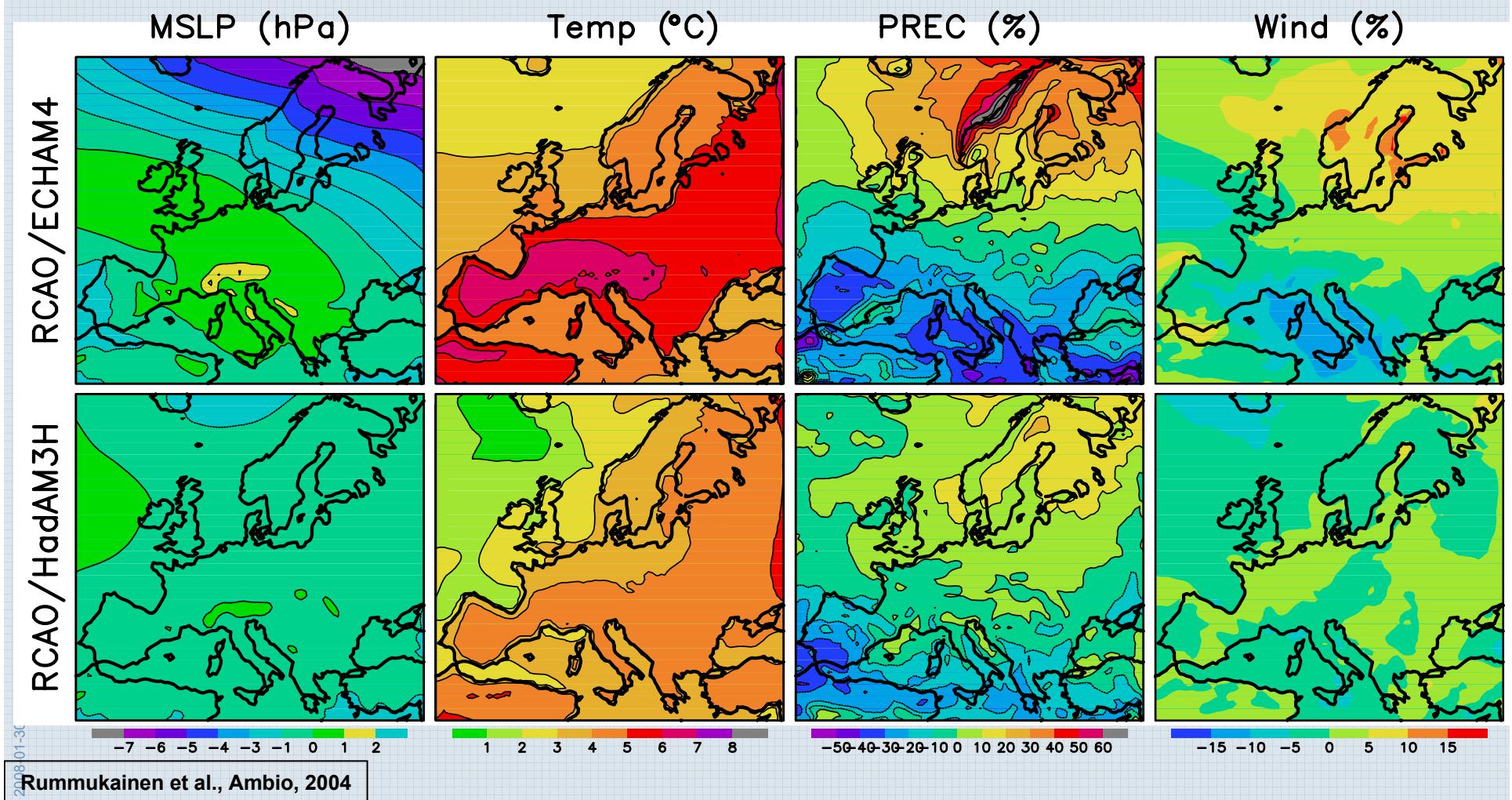


Preliminary results for the Baltic Sea: lateral boundary conditions from ERA40 (1978-1998)



Climate scenarios at the Rossby Centre

Change in annual means: SRES A2 (2071-2100) minus control (1961-1990)



Climate change experiments in ENSEMBLES: combination of GCMs and RCMs (@25km), SRES A1B



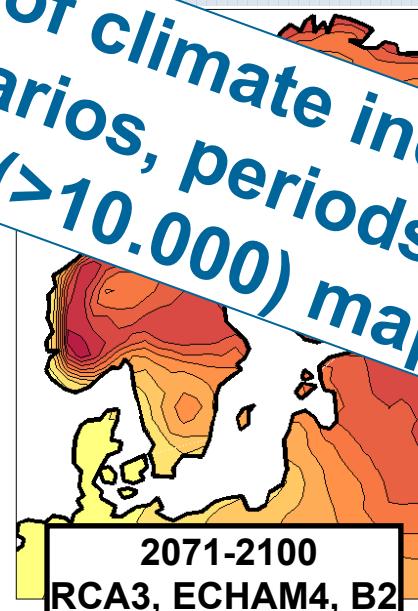
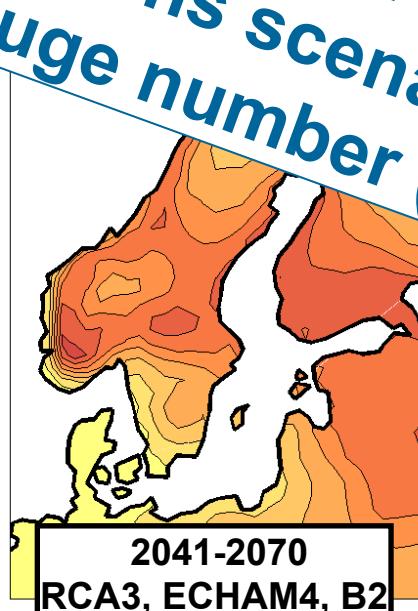
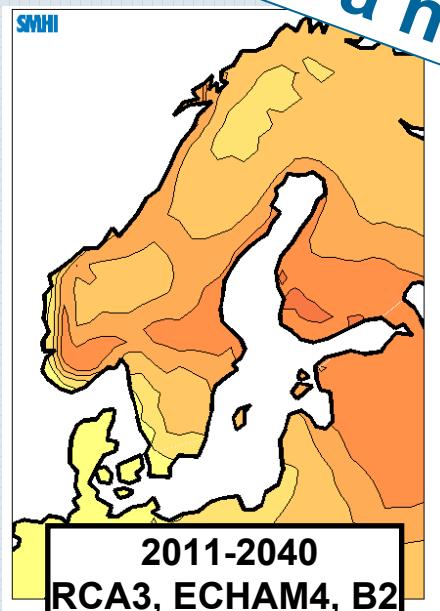
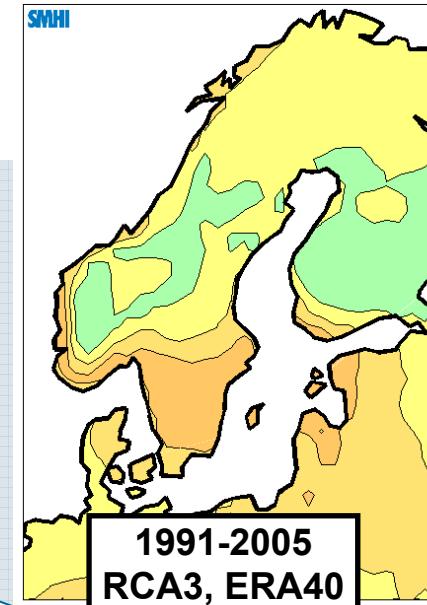
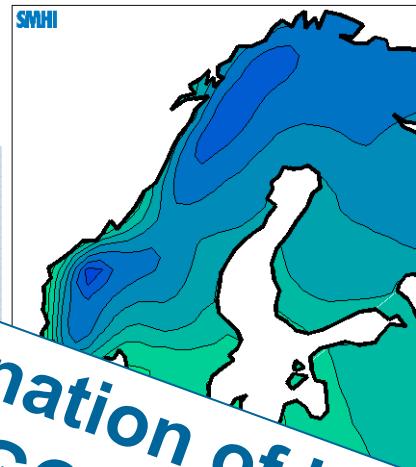
	METO-HC	MPIMET	CNRM	DMI	ETH	KNMI	ICTP	SMHI	UCLM	C4I	GKSS	MetNo	CHMI	
METO-HC	1950-2100				1950-2050			1950-2050	1950-2050				1950-2050	
MPIMET	1950-2100	1950-2100		1950-2050		1950-2050	1950-2050			1950-2050				
IPSL		1950-2050									1950-2050			
CNRM			1950-2050	1950-2050										
NERSC								1950-2050				1950-2050		

Signature

2008-01-30

<http://www.ensembles-eu.org/>

Combination of large number of climate indices, periods and seasons yields a huge number (>10.000) maps



Climate change experiments in ENSEMBLES: combination of GCMs and RCMs (@25km), SRES A1B



Will run all these @50km

	METO-HC	MPIMET	CNRM	DMI	ETH	KNMI	ICTP	SMHI	UCLM	C4I	GKSS	MetNo	CHMI
METO-HC	1950-2100				1950-2050			1950-2100	1950-2050	1950-2050			1950-2050
MPIMET	1950-2100	1950-2100		1950-2050		1950-2050	1950-2050	1950-2100		1950-2050			
IPSL		1950-2050						1950-2100			1950-2050		
CNRM			1950-2050	1950-2050				1950-2100					
NERSC								1950-2100				1950-2050	

Climate scenarios at the Rossby Centre

Existing, in production/being analysed and planned/started:

RCAO ECHAM4/HadAM3H A2&B2	(RMK102,111, ...)
RCA3 ECHAM4 A2&B2	(RMK108,111)
RCA3 CCSM3 Stab. 450 ppm	(RMK110)
RCA3 ECHAM5 A1B	(RMK111)
RCA3 CCSM3 A1B	
RCA3 ECHAM5 A1B	
RCA3 BCM A1B	
RCA3 HadCM3(perturbed phys. low) A1B	
RCA3-GUESS ECHAM5 A1B (1961-2100)	

runs at 25 km

Europe

with RCA3.1

Plans to run RCA3 with boundary conditions from all GCMs in ENSEMBLES (≥ 5)

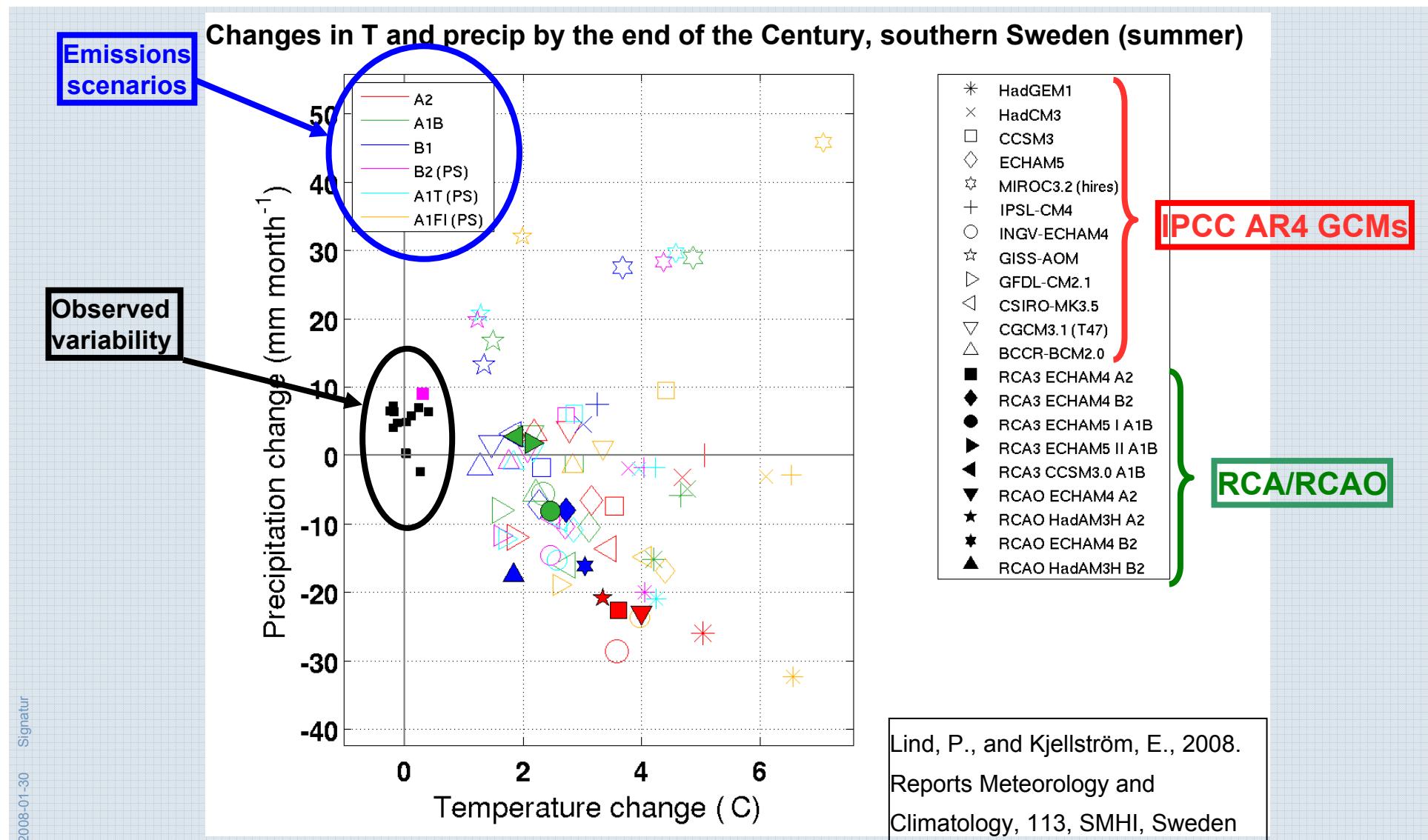
- RCAO Baltic ERA-40 hindcast
- RCAO Baltic scenario (during 2008)
- RCAO Arctic ERA-40 hindcast
- RCAO Arctic scenarios
- Scenarios for western Africa (ENSEMBLES-AMMA) & South America (CLARIS-LPB)

RCA3 ECHAM4/CCSM3 South Africa (PUNGWE-/PAMO)

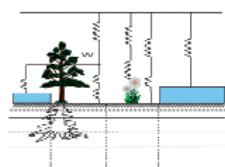
RCA3 CCSM3 Paleo-climate (35kyrBP, 21kyrBP, 5kyrAP)

RCA3-FLake ECHO-G Baltic 600 of the last 1000 years

Ongoing activity: Put SMHI-Rossby Centres climate change scenarios in a broader context



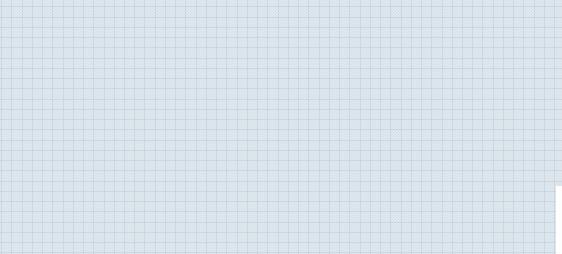
Thanks for your attention!



The land-surface scheme of the Rossby Centre regional atmospheric climate model (RCA3)

No 122, 2006

SMHI
Reports Meteorology and Climatology



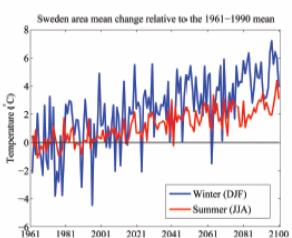
No 12

SMHI
Reports Meteorology and Climatology



No 109, I

SMHI
Reports Meteorology and Climatology



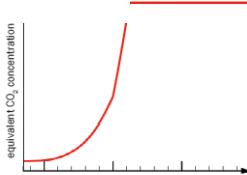
Sweden area mean change relative to the 1961–1990 mean

Temperature (°C)

Winter (DIF) Summer (JJA)

No 109, Dec 20

SMHI
Reports Meteorology and Climatology



Nordic regionalisation of a greenhouse-gas stabilisation scenario

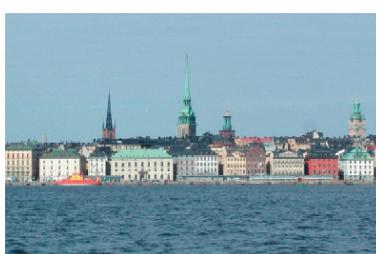
equivalent CO₂ concentration

Year

Patrick Samuelsson, Stefan Gottsch, Anders Ullerstig
Rossby Centre

No 11

SMHI
Reports Meteorology and Climatology



Climate change scenario simulation of wind, sea level, and river discharge in the Baltic Sea and Lake Mälaren region – a dynamical downscaling approach from global to local scale

H.E. Martin Meier¹, Julian Andréasson², Barry Bonsuoni¹,
L. Phil Graham³, Erik Kjellström¹, Gunn Persson⁴ and
Michael Vieli^{1,5}

¹Swedish Meteorological and Hydrological Institute
²Iuregia AB

No 111, Aug 2

SMHI
Reports Meteorology and Climatology

Reports are available at www.smhi.se

Signatur

2008-01-30

Gunn Persson, Lars Bärring, Erik Kjellström,
Gustav Strandberg and Markku Rummukainen

Erik Kjellström, Lars Bärring, Stefan Gottsch, Ulf Hansson,
Colin Jones, Patrick Samuelsson, Markku Rummukainen,
Anders Ullerstig, Ulrika Wikén and Klaus Wyser