“The marine ecosystem in changing climate – on the added value of coupled climate-environmental modeling for the Baltic Sea”, 16 October, 10:00-17:00

10:00 Welcome

10:05-12:25 Presentations (max 15 min plus 5 min for questions), chair: Brian MacKenzie

10:05-10:25 Markus Meier, SMHI: Impact of changing climate on biogeochemical cycles in the Baltic Sea – An introduction

10:25-10:45 Bo Gustafsson, Baltic Nest Institute: First results from coupled physical-biogeochemical modelling within the BONUS+ project ECOSUPPORT (An advanced modeling tool for scenarios of the Baltic Sea ECOsystem to SUPPORT decision making)

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13:55-14:15 Inari Helle, Helsinki University: IBAM - Integrated Bayesian risk analysis of ecosystem management in the Gulf of Finland

14:15-14:35 Anna Gårdmark, Swedish Board of Fisheries: Biological Ensemble Modelling to improve fisheries science and management

14:35-15:00 Coffee + Poster

15:00-17:00 Discussion of collaboration and data exchange, chair: Brian MacKenzie

Impact of changing climate on biogeochemical cycles in the Baltic Sea – An

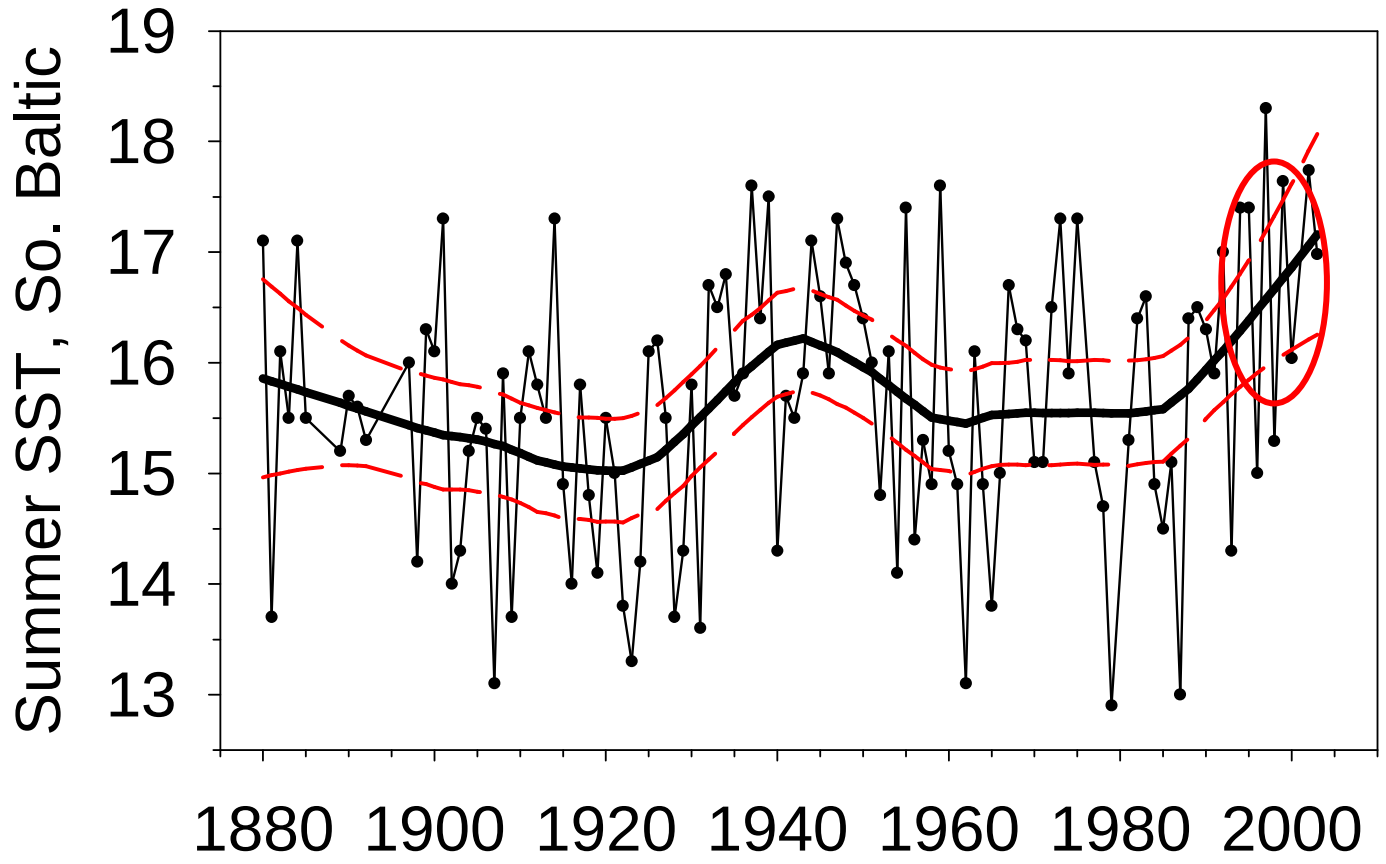
H.E. Markus Meier, Kari Eilola, Anders Höglund, Erik Kjellström and ECOSUPPORT collaborators

Swedish Meteorological and Hydrological Institute and Stockholm University

Markus.Meier@smhi.se

Observed climate is changing

Summer (JAS) SST 1880-2003



warm conditions during 1990s-2000s

(Source: MacKenzie & Schiedek 2007)

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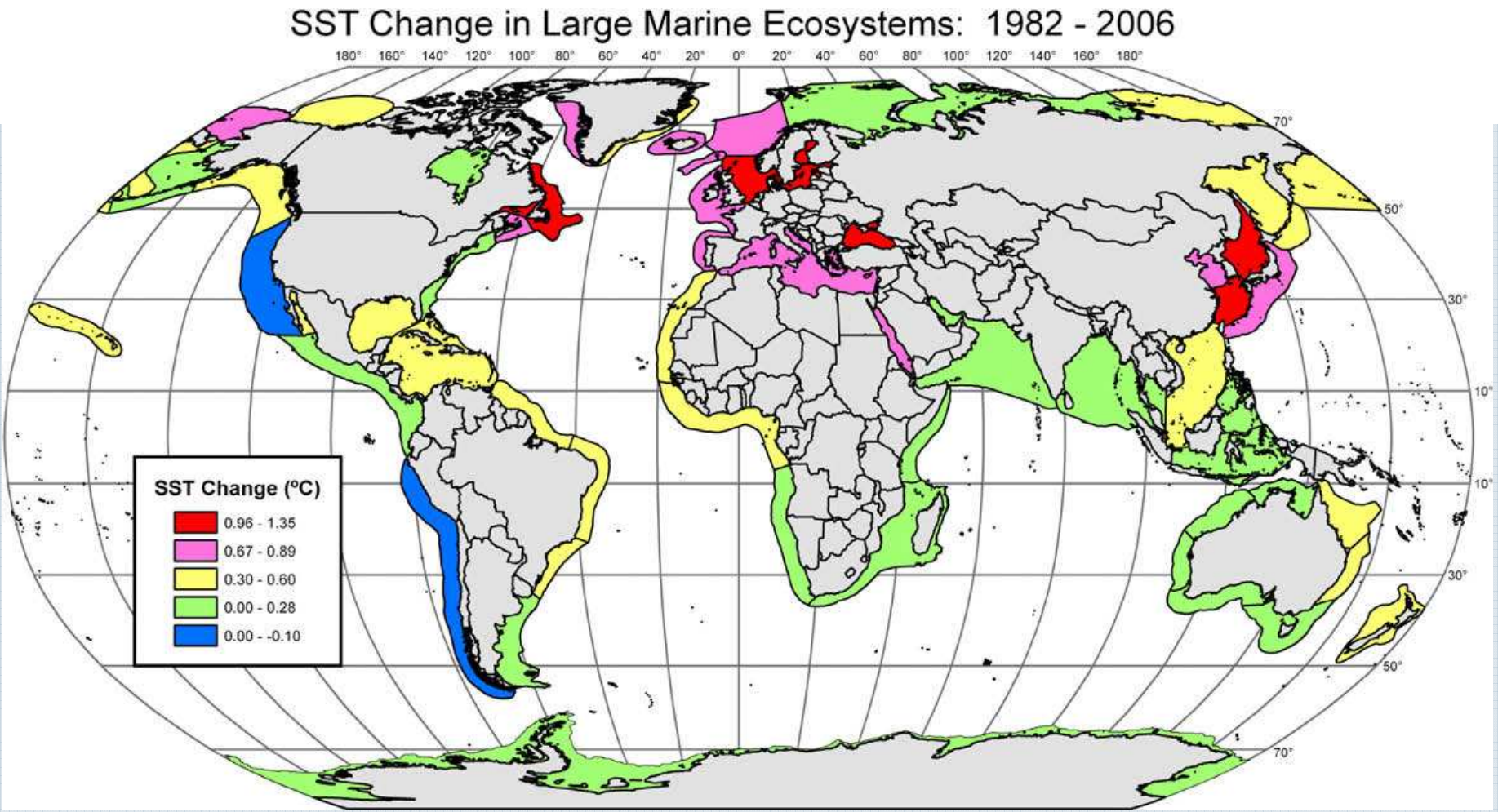

Net SST change (C) in Large Marine Ecosystems, 1982–2006

(Source: Belkin 2009)

ECOSUPPORT

Advanced modeling tool for scenarios of the Baltic Sea ECOsystem to SUPPORT decision making

Annual General Assembly 15 Oct 2009

ECOSUPPORT

Advanced modeling tool for scenarios of the Baltic Sea ECOsystem to SUPPORT decision making

11 partner institute
from 7 Baltic Sea
countries

Annual General Assembly 15 Oct 2009

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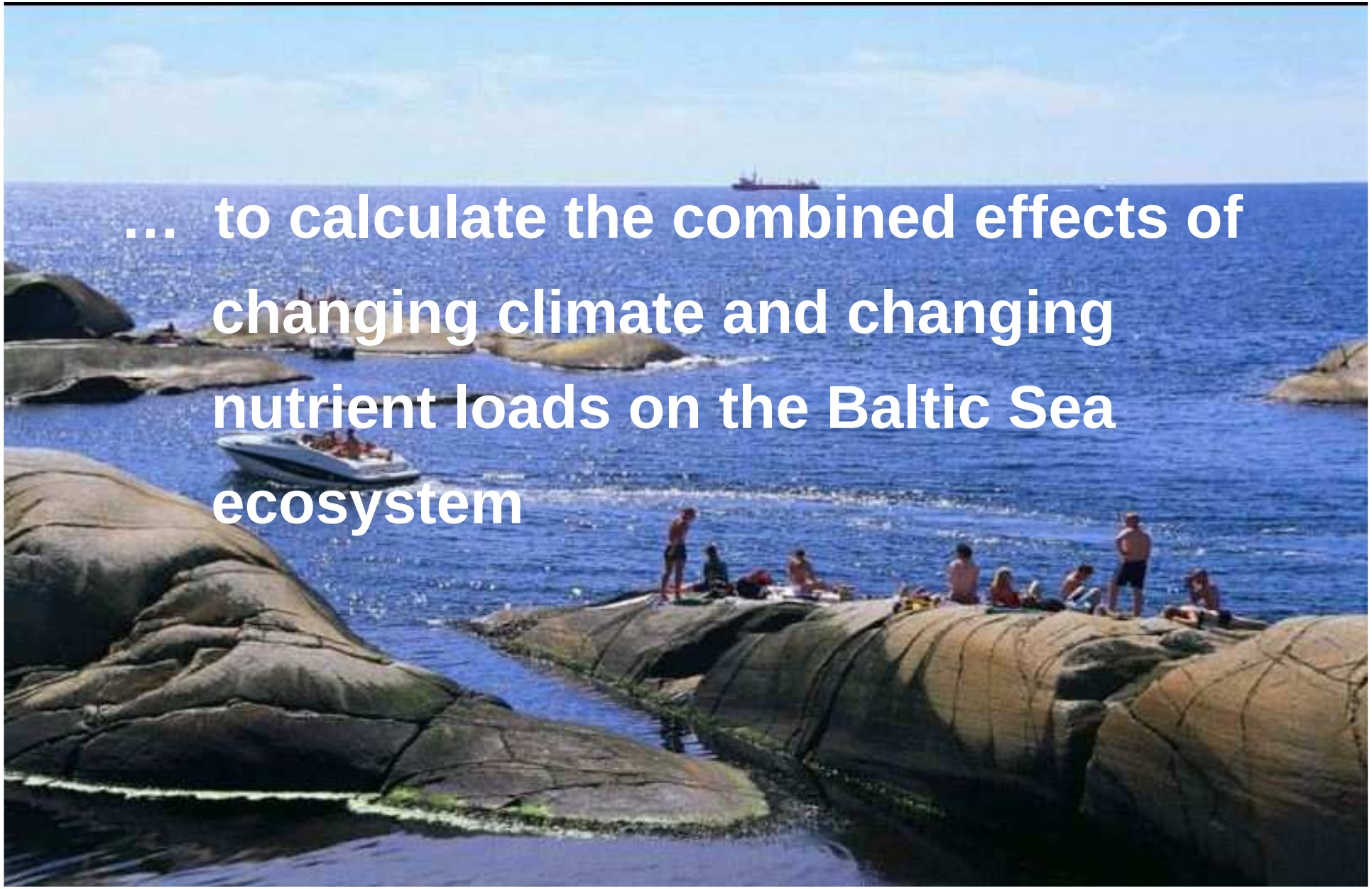
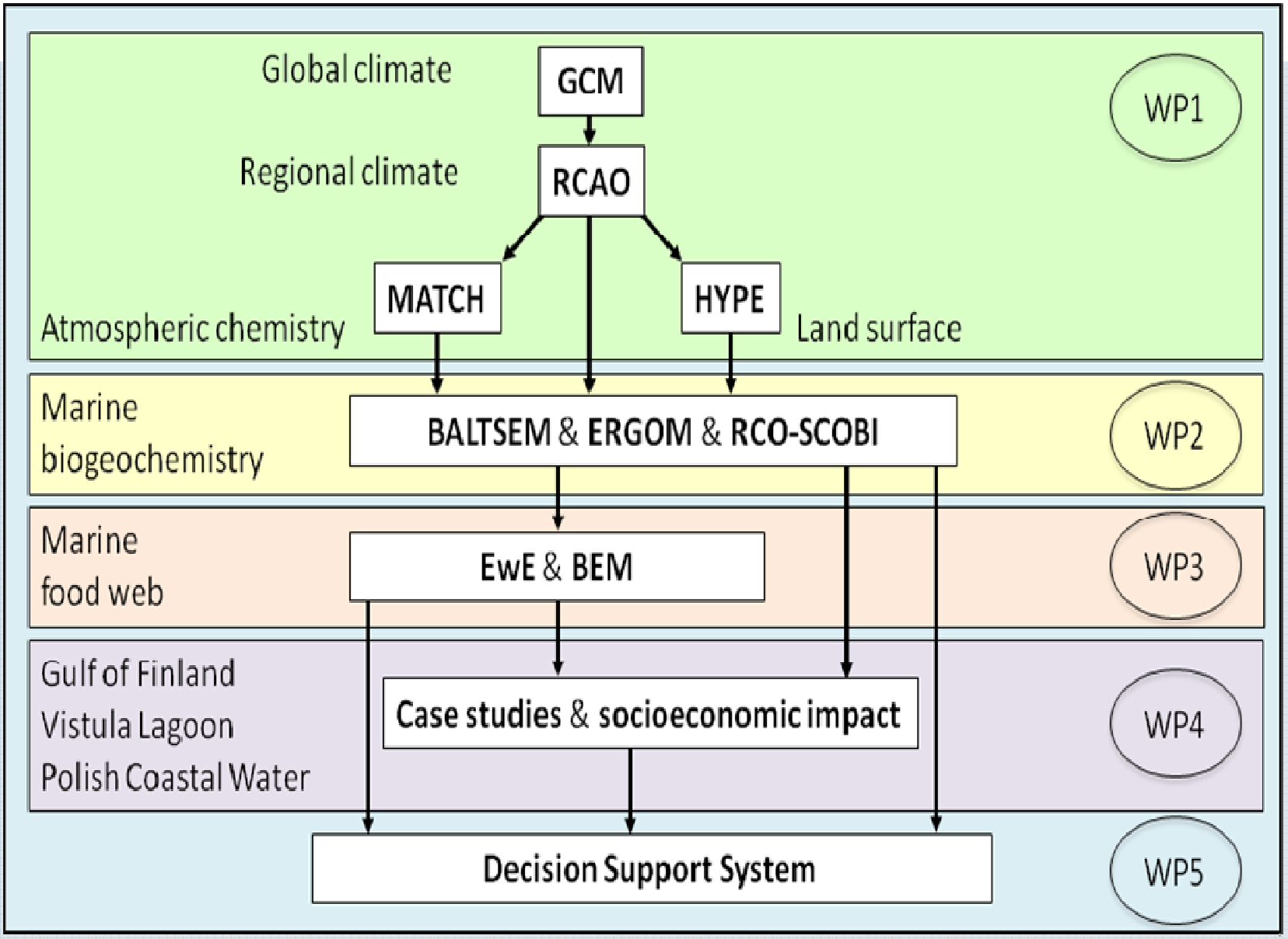
New system models are needed

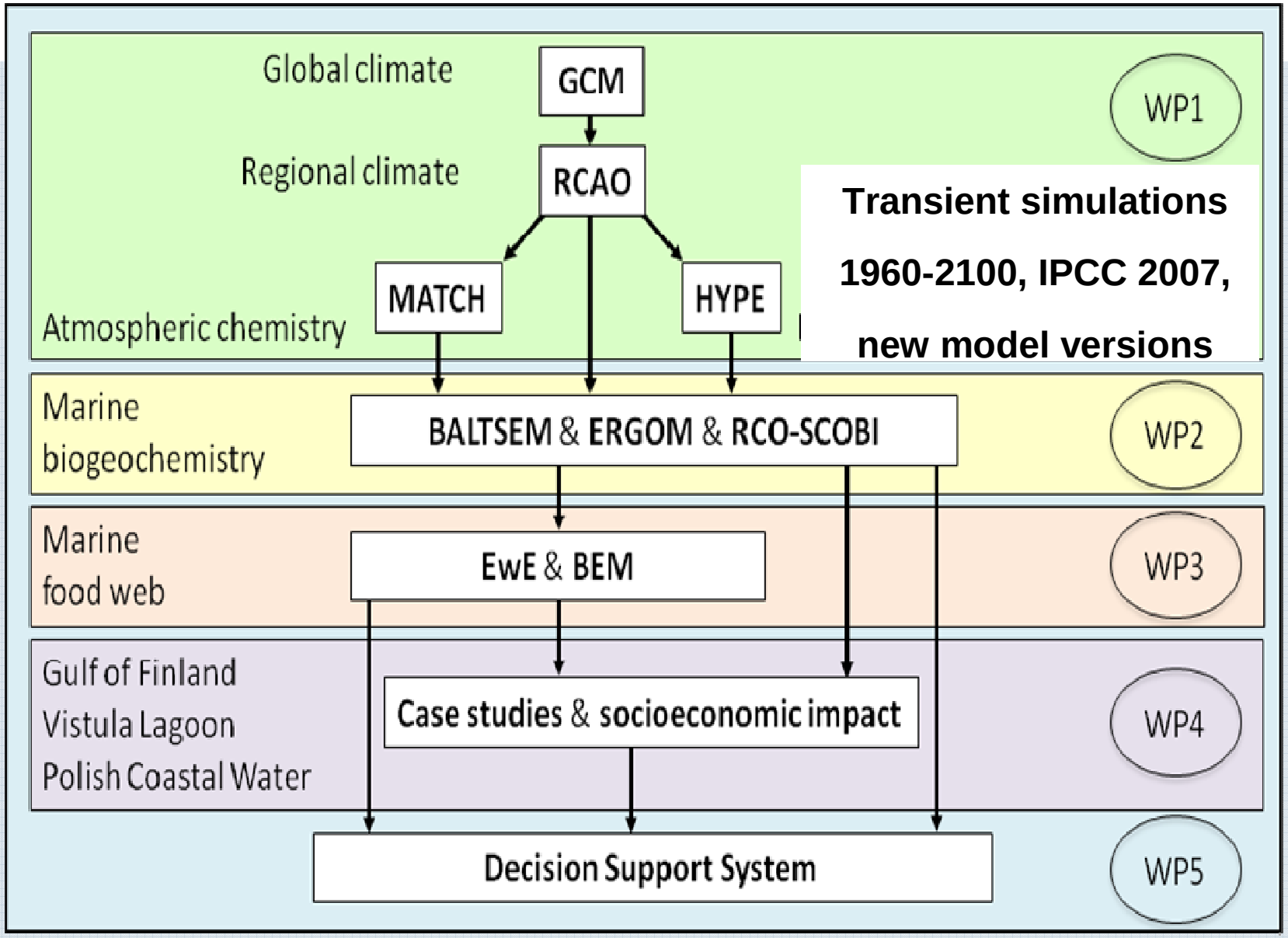


Model hierarchy in ECOSUPPORT

www.baltex-research.eu/ecosupport



Model hierarchy in ECOSUPPORT



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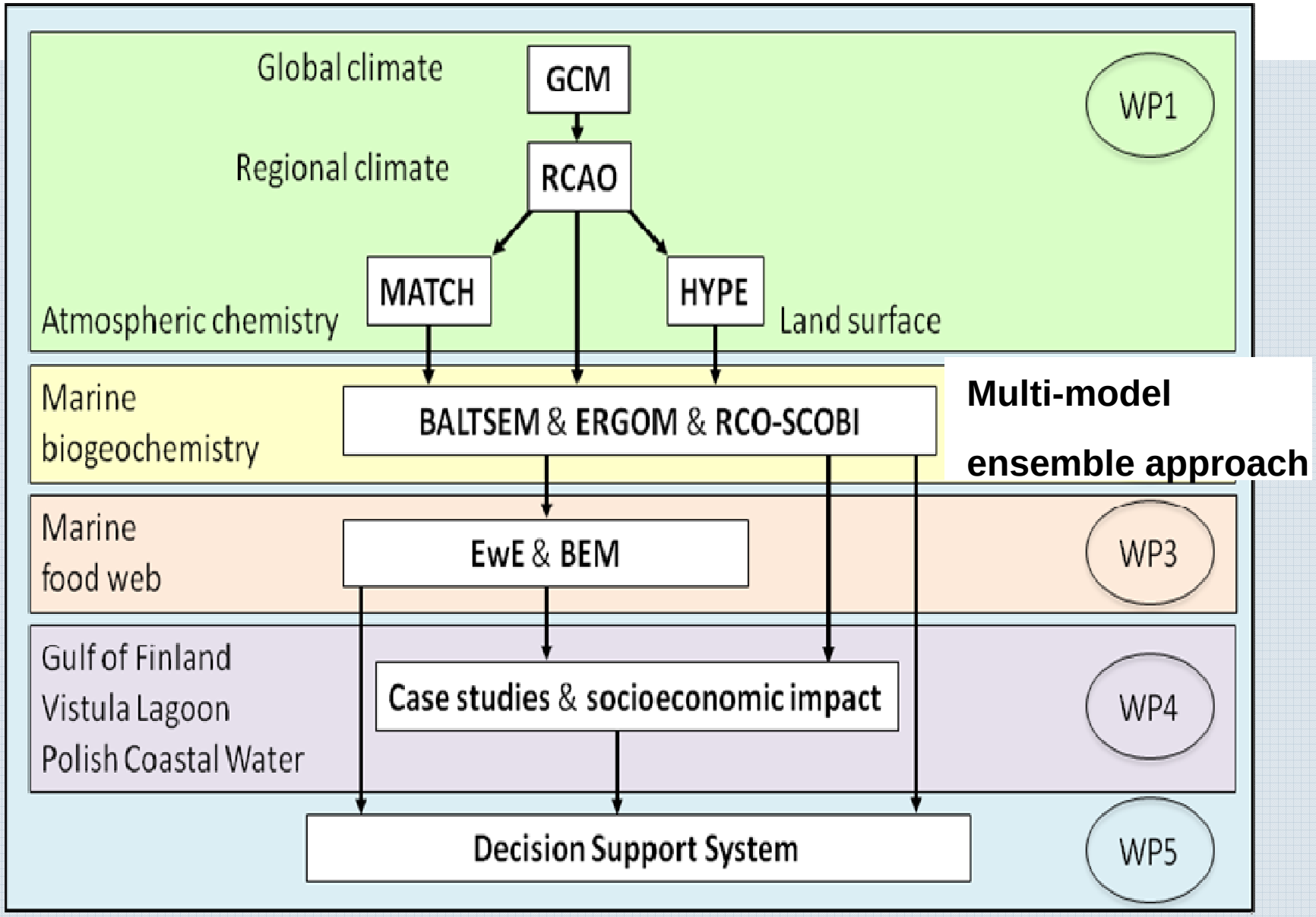
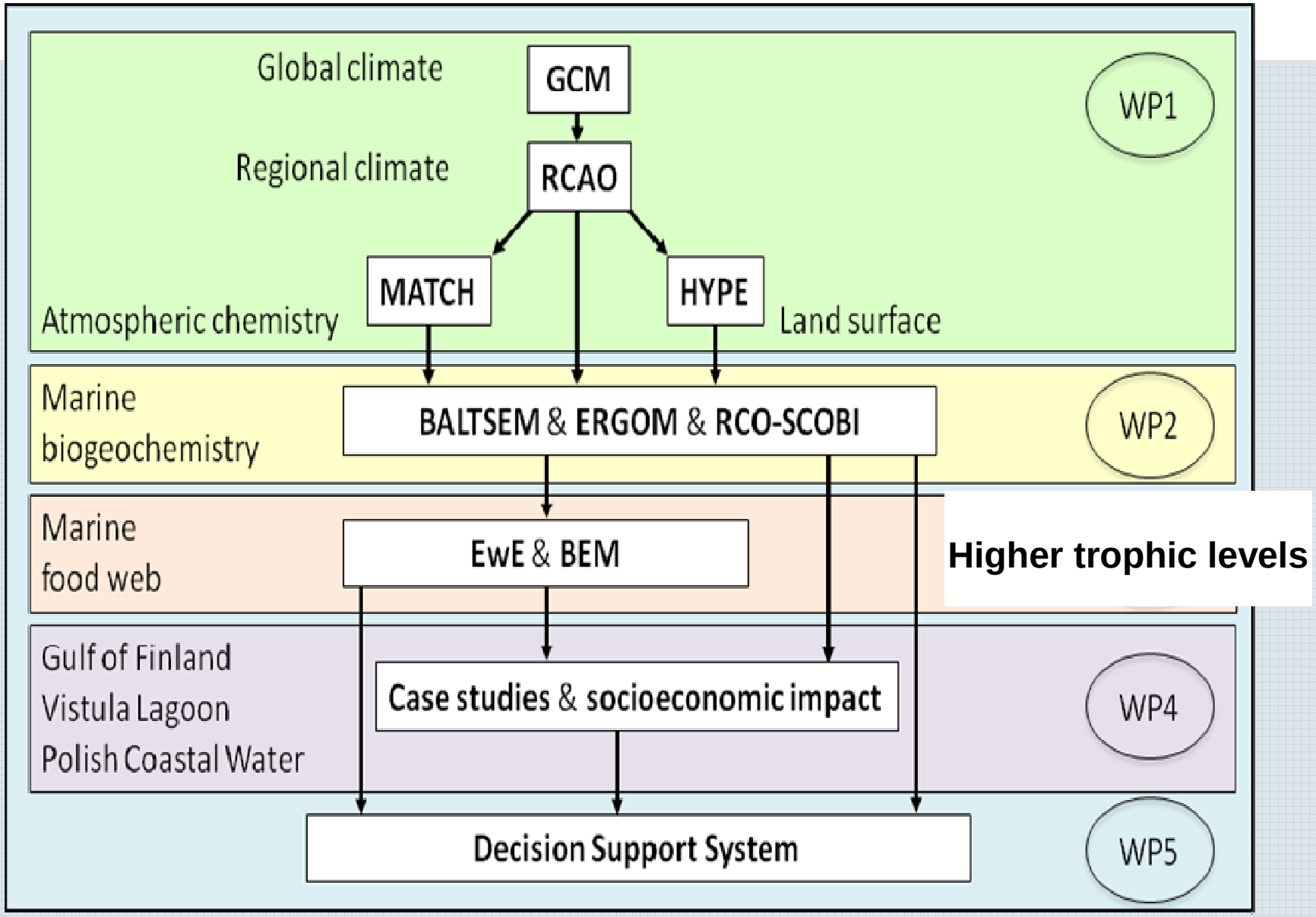
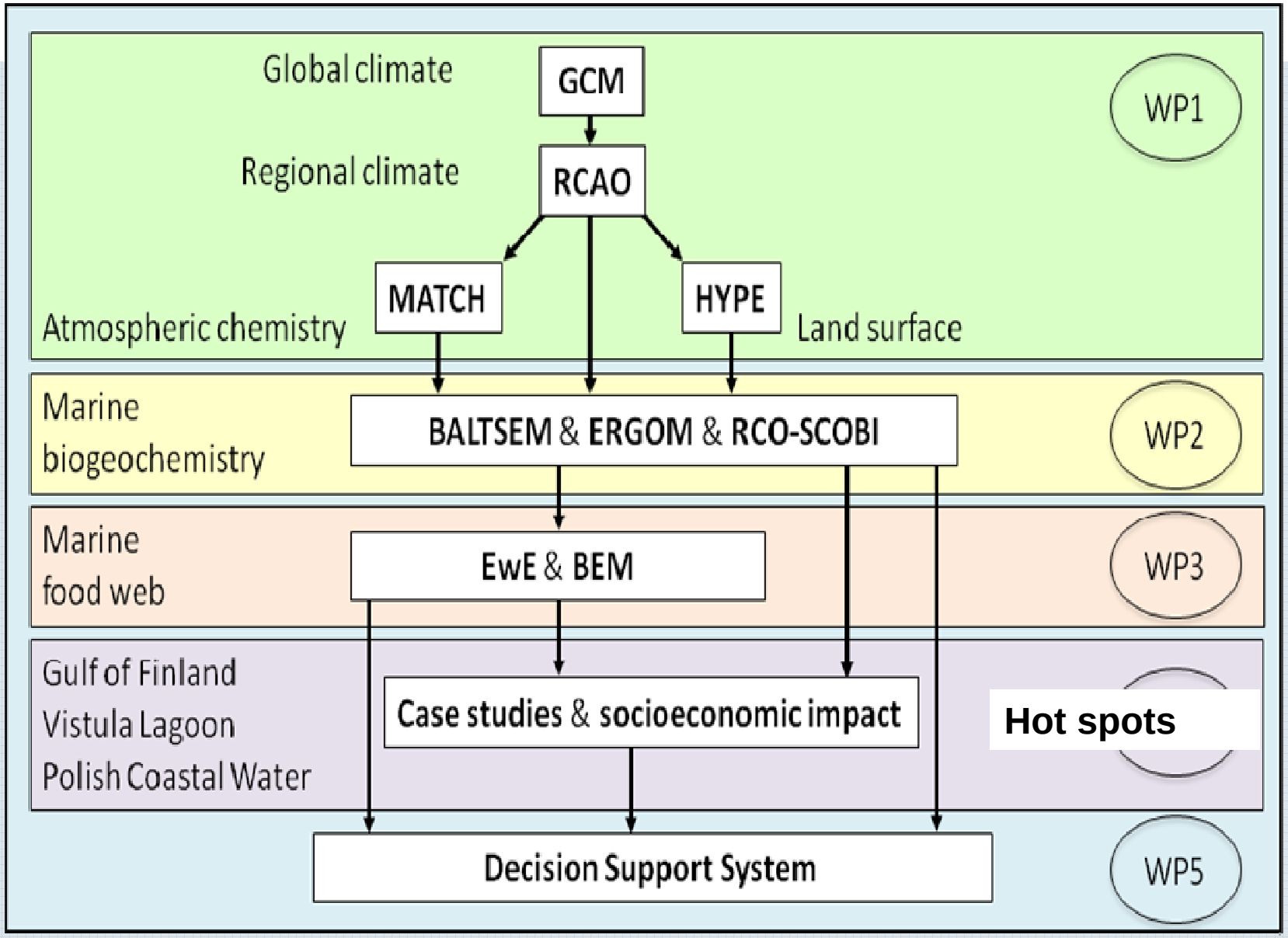


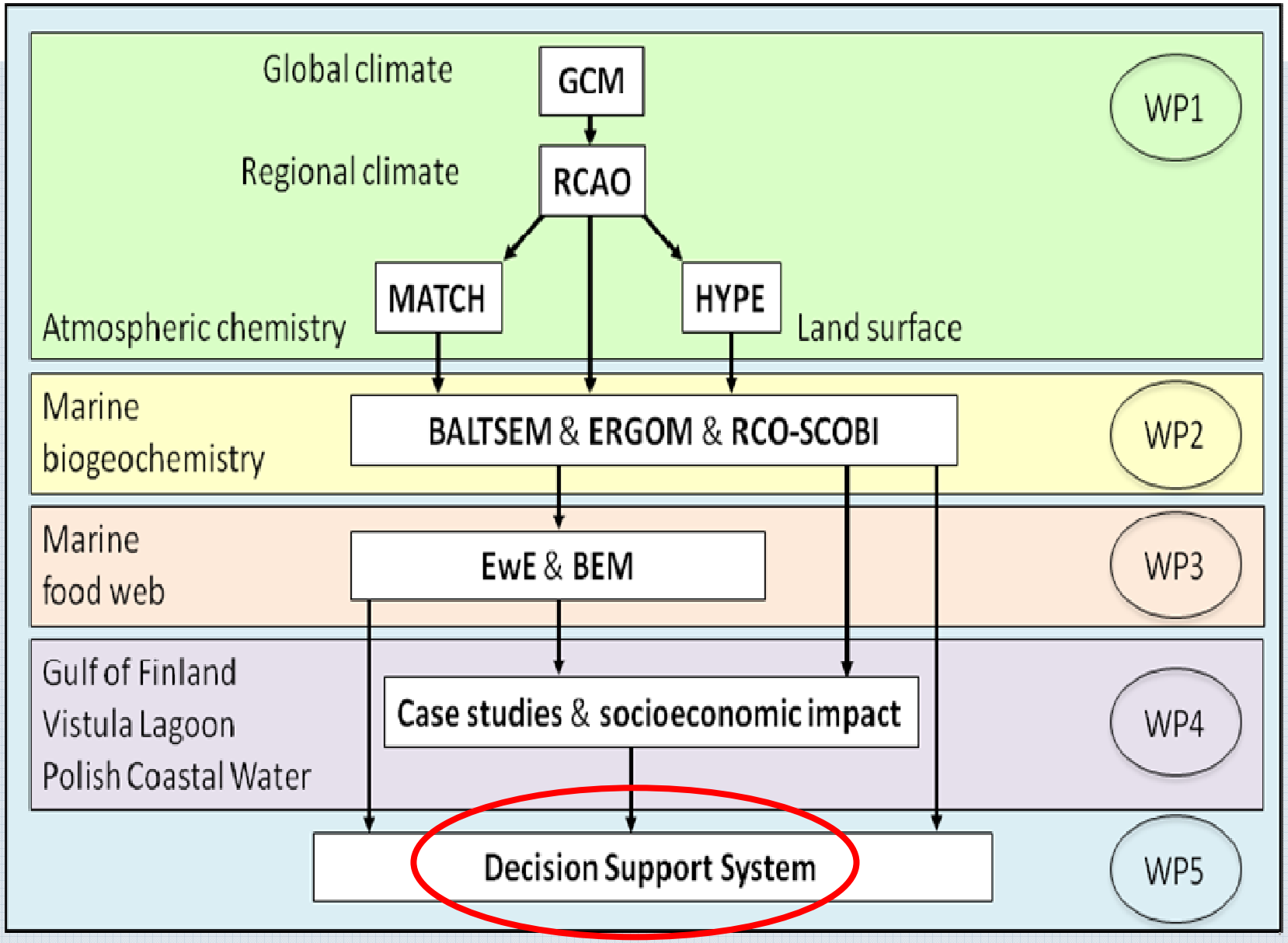
Model hierarchy in ECOSUPPORT



Model hierarchy in ECOSUPPORT



Model hierarchy in ECOSUPPORT



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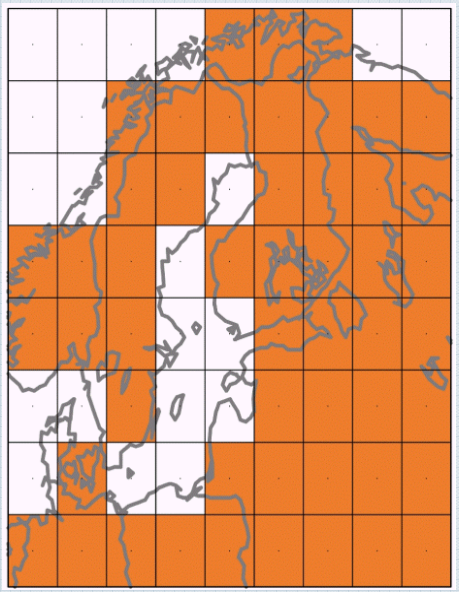
Planned ECOSUPORT simulations:

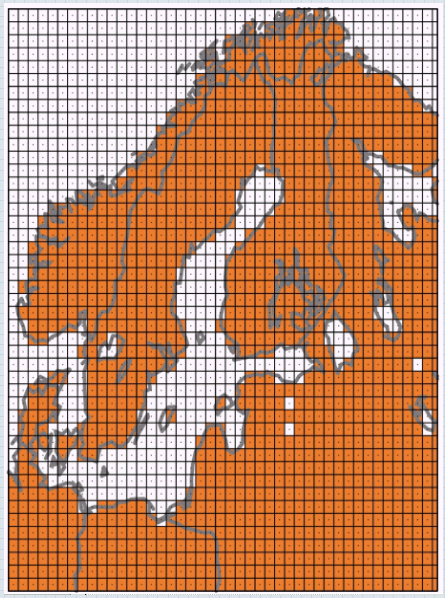
1. Hindcast simulation 1960-2007: RCAO/ERA-40
2. Four transient simulations 1960-2100: RCAO/GCM

Regional climate models:
Improving global climate scenarios

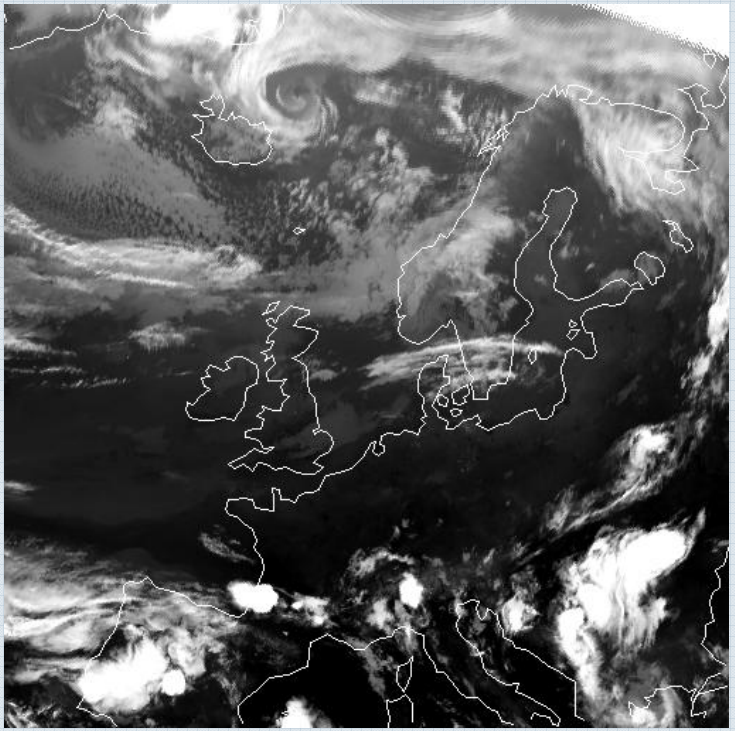
- Increased resolution → detailed regional forcing
- Greater number of explicitly resolved processes



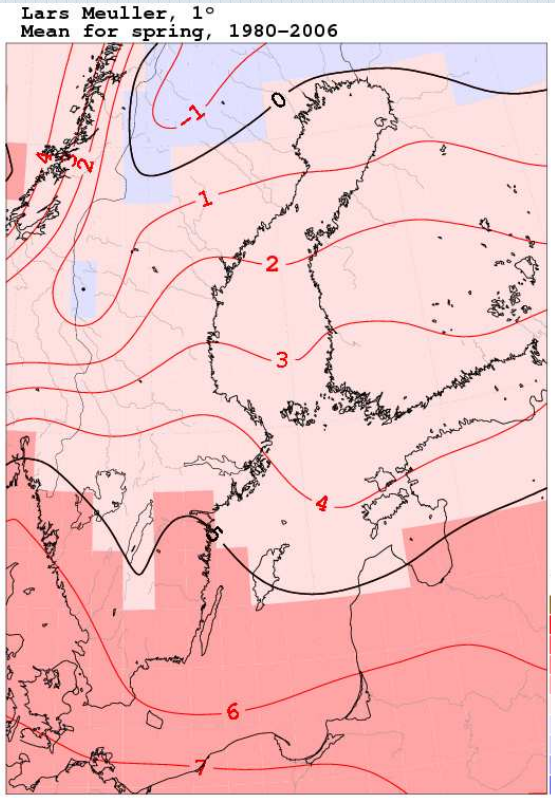
Global

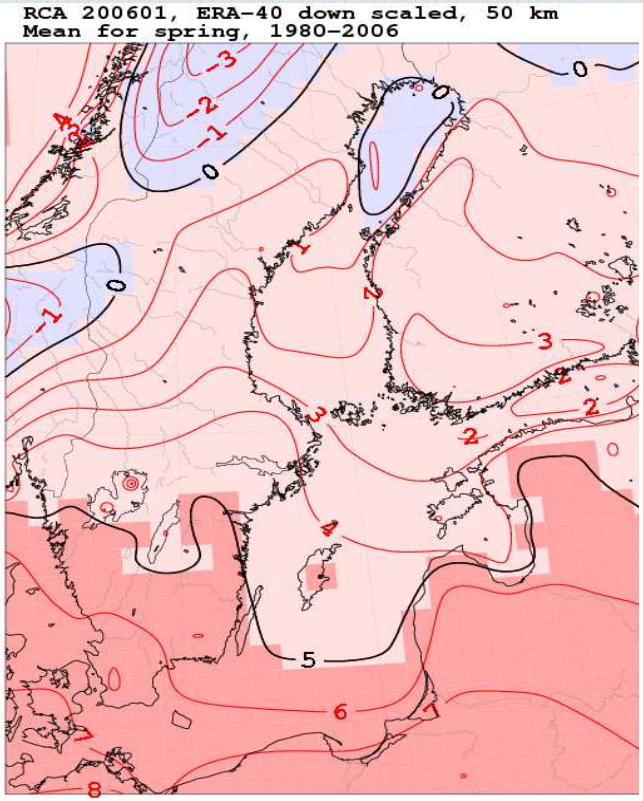


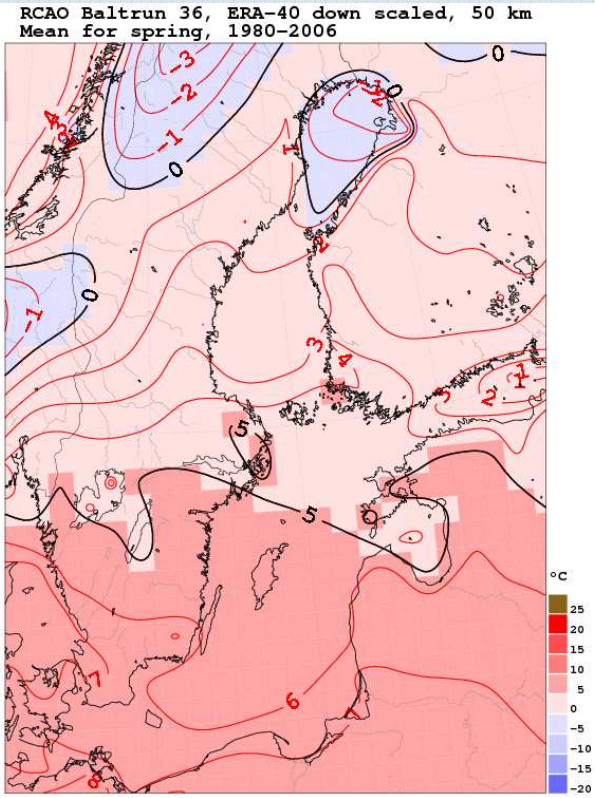
Regional



First results:
Mean air temperature (spring), 1980-2006







Observations **RCA** **RCAO**

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The R
Cen

No	AOGCM (Institute, country)		Emission scenario	Horisontal resolution (km)
1	Arpège (CNRM, France)		A1B	50
2	BCM (NERSC, Norway)		A1B	50
3				25
4	CCSM3 (NCAR, USA)		A2	50
5			A1B	50
6			B2	50
7	ECHAM4 (MPI-met, Germany)		A2	50
8			B2	50
9	ECHAM5 (MPI-met, Germany)		*A2*	50
10			A1B	50
11				50
12				50
13				25
14				*12.5*
15			B1	50
16	HadCM3 (Hadley Centre, UK)	ref (Q0)	A1B	50
17		low (Q3)		50
18		high (Q16)		50
19		low (Q3)		25
20	*IPSL-CM4 (IPSL, France)*		*A1B*	*50*

All simulations on the ENSEMBLES grid with RCA3

SMHI

The Rossby Centre ensemble

Different AOGCMs

All simulations on the ENSEMBLES grid with RCA3

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13				25
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SMHI

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Different initial conditions

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SMHI

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Different initial conditions

Different model formulation (GCM)

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SMHI

The Rossby Centre ensemble

Different AOGCMs

Different initial conditions

Different model formulation (GCM)

Different emission scenarios

Different horizontal resolution

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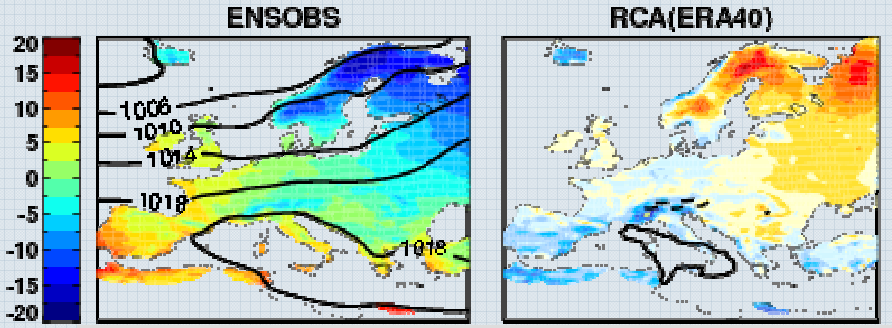
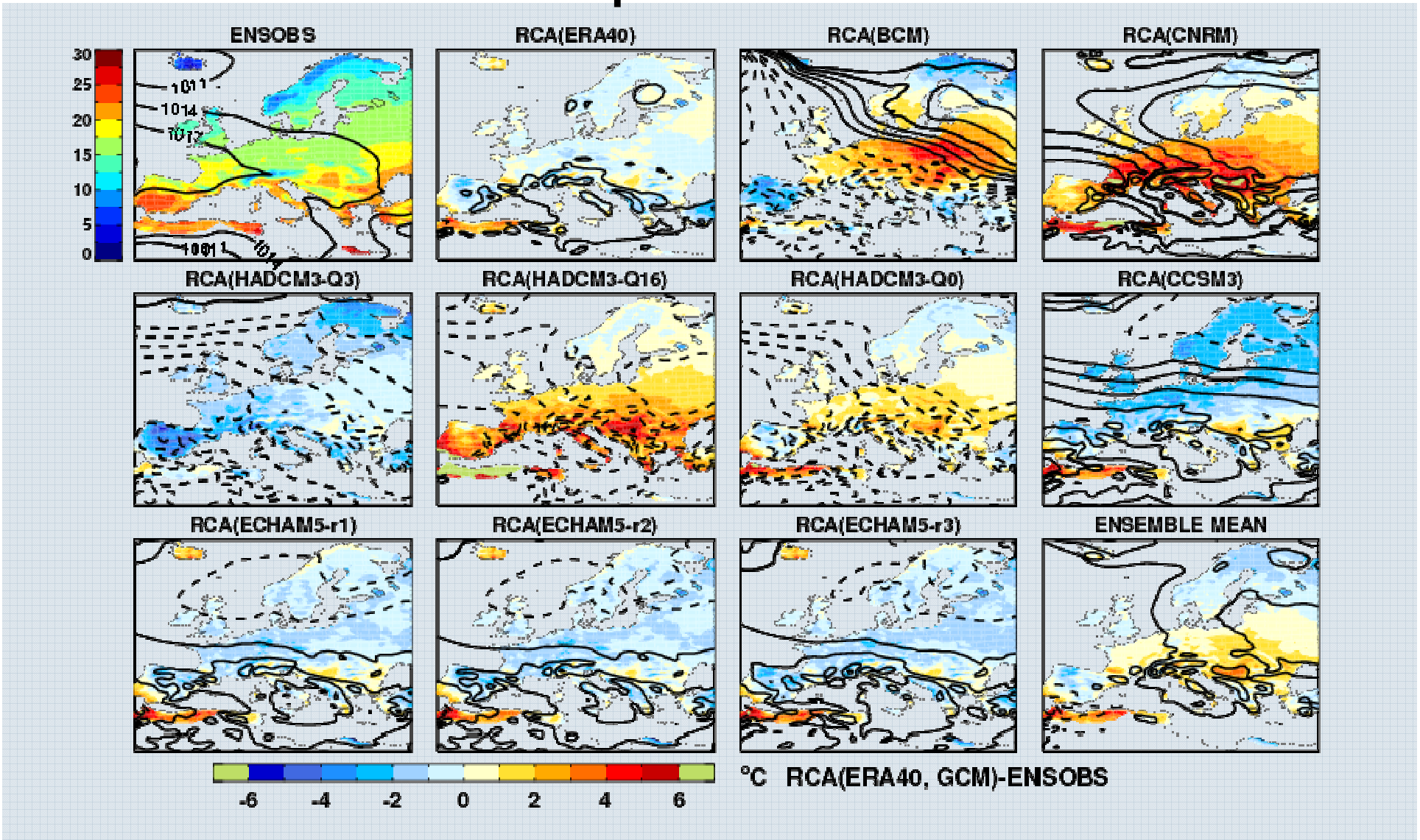
Biases in the recent past climate (1961-1990): winter (DJF) mean temperature and MSLP

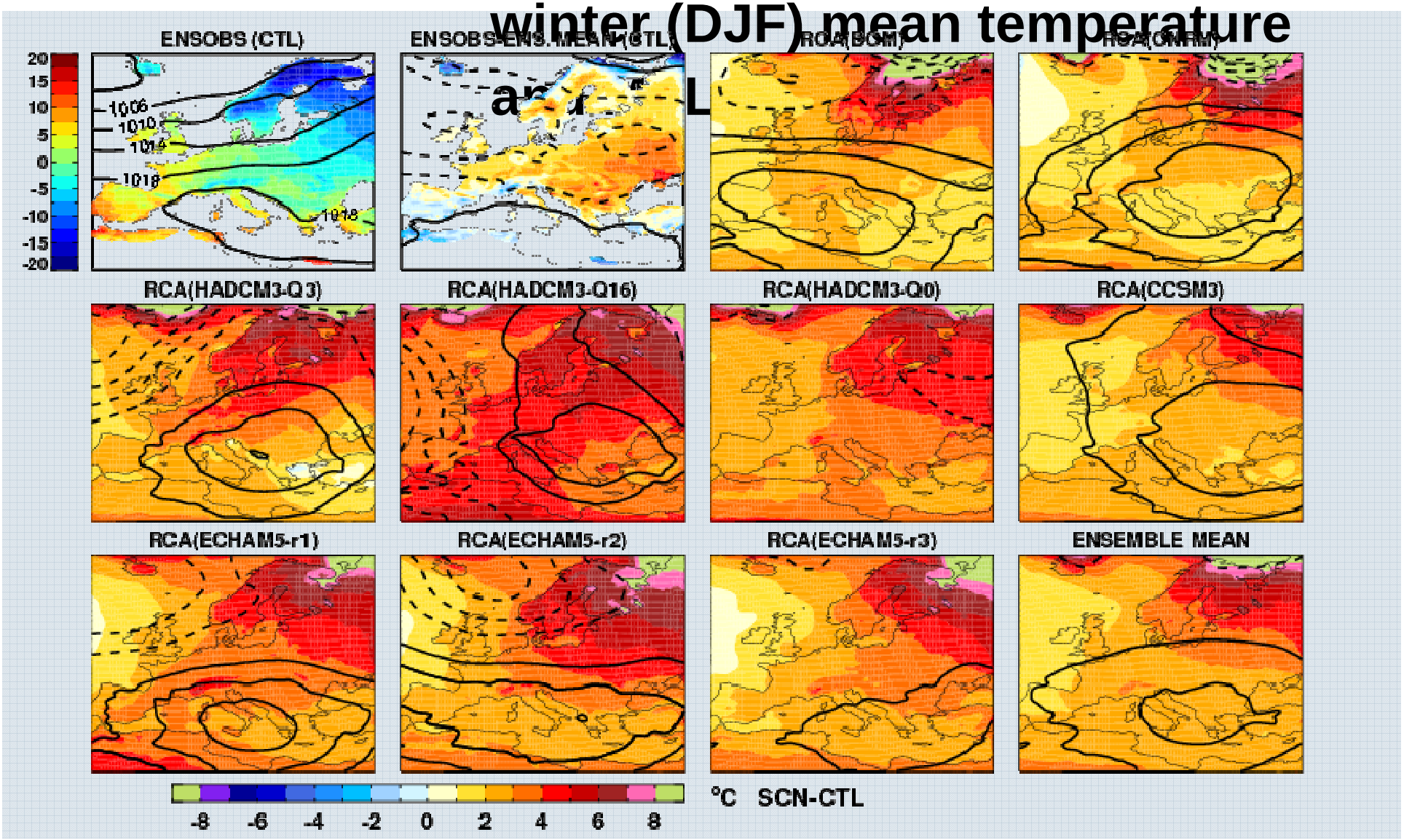


Biases in the recent past climate (1961-1990): summer (JJA) mean temperature and MSLP



Climate change (2071-2100 vs 1961-1990):

winter (DJF) mean temperature and [illegible]



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Climate change (2071-2100 vs 1961-1990):

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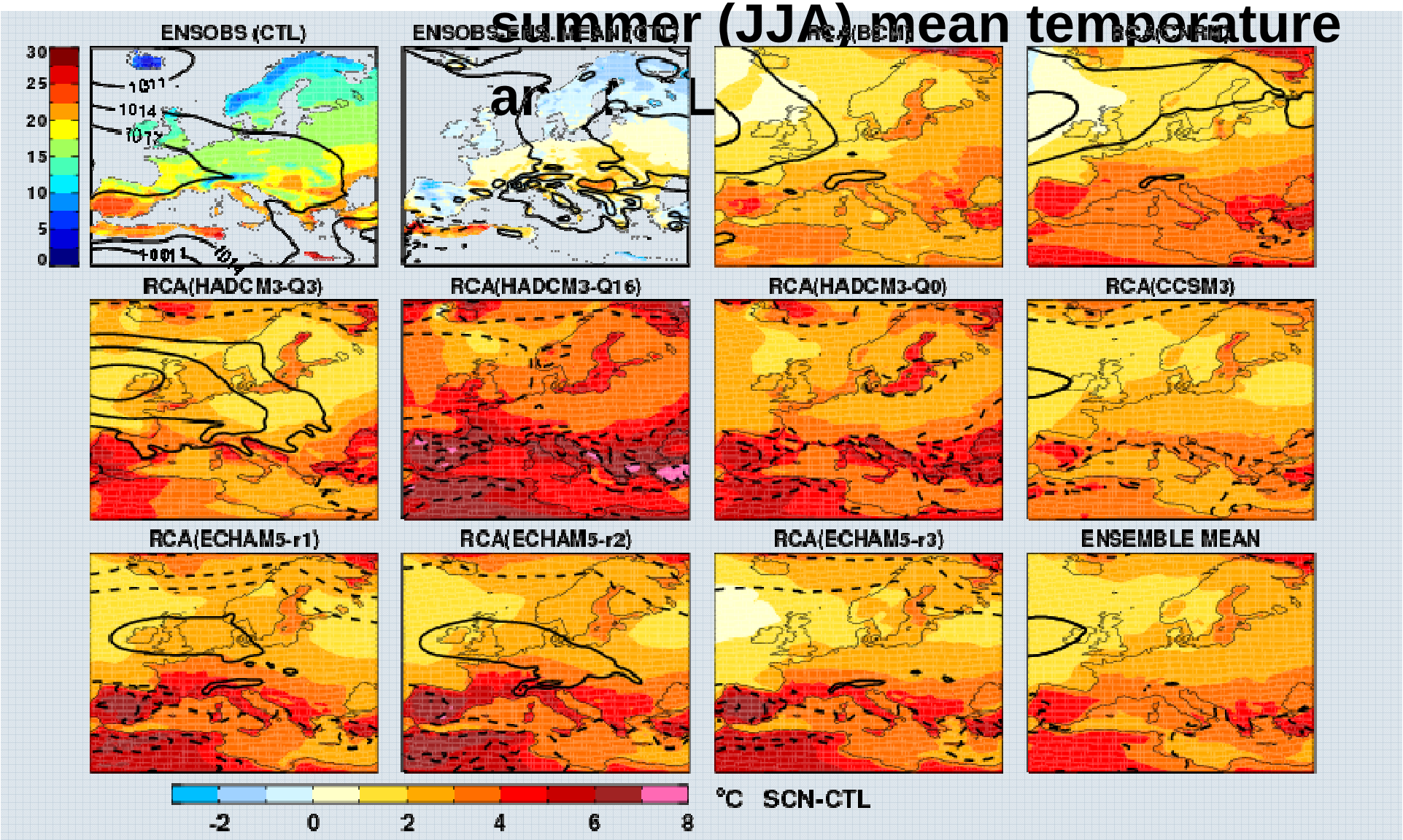
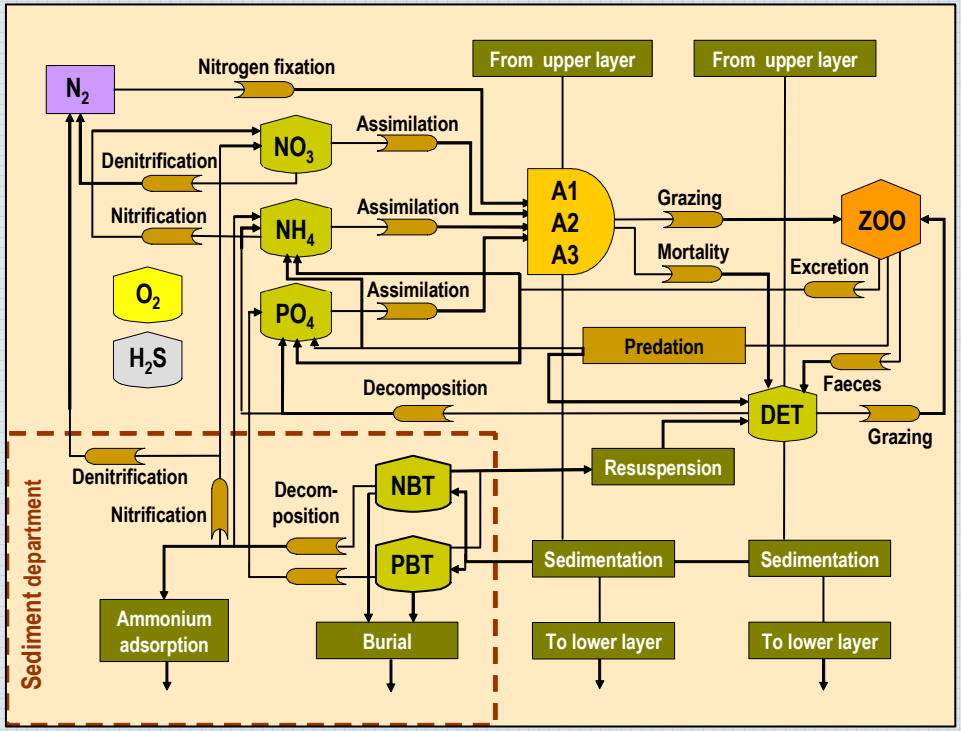


RCO-SCOBI – a high-resolution 3-D coupled physical-biogeochemical model for climate and process studies



Pelagic variables:

- ***nitrate*** ***(NO3)***
- ***ammonium*** ***(NH4)***
- ***phosphate*** ***(PO4)***
- ***autotrophs*** ***(A1,A2,A3)***

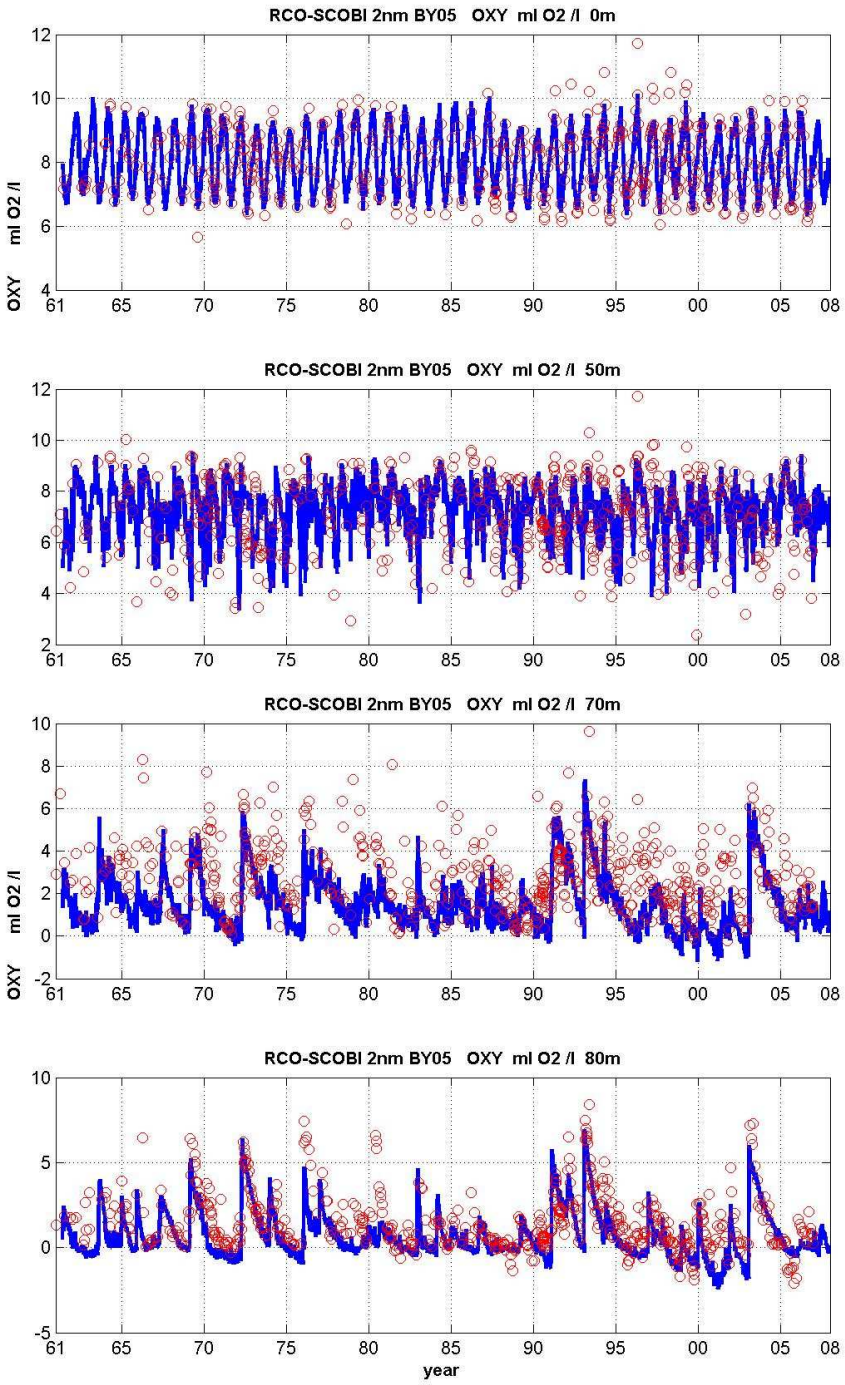
(diatoms, flagellates etc., cyanobacteria)

- ***zooplankton*** ***(ZOO)***
- ***detritus*** ***(DET)***
- ***oxygen*** ***(O2)***
- ***Hydrogen sulfide*** ***(H2S) is included as negative oxygen.***

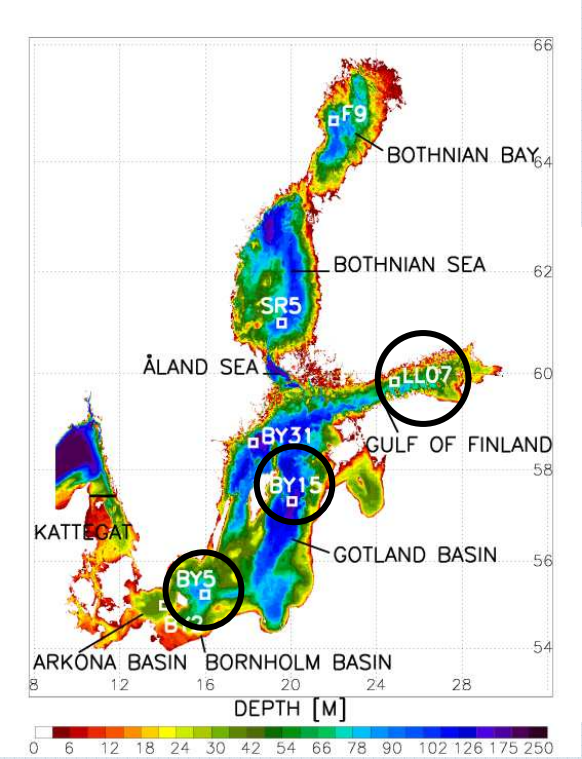
- **The sediment contains nutrients in the form of benthic nitrogen (NBT) and phosphorus (PBT)**

•Improvement of re-suspension by implementing a wave model and dissolved organic matter (carbon, nitrogen, phosphorus)

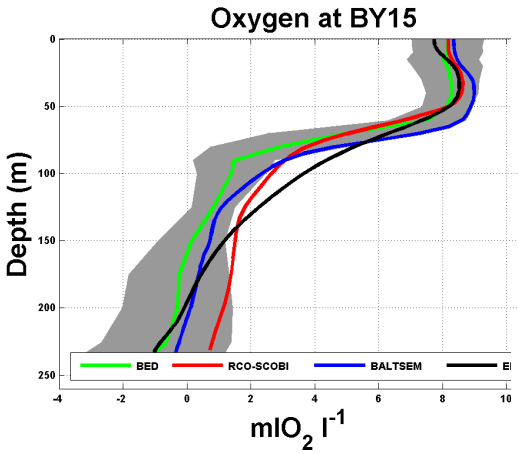
- **Two versions of the sediment model (runs 30 and 45)**
- **Reference: Eilola, K., H.E.M. Meier and E. Almroth (2008), see poster**

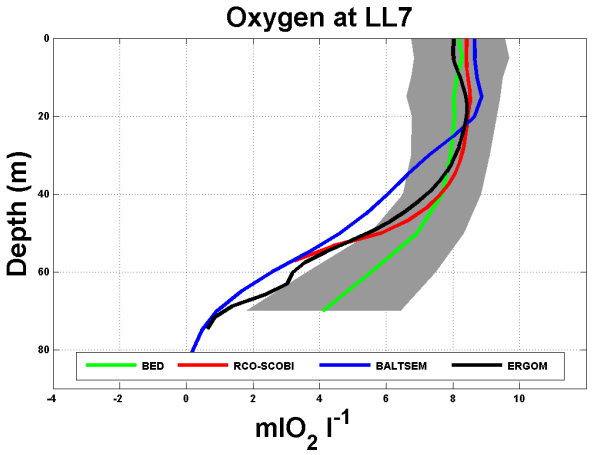

RCO-SCOBI 2nm BY05 OXY ml O2 /l 0m
RCO-SCOBI 2nm BY05 OXY ml O2 /l 50m
RCO-SCOBI 2nm BY05 OXY ml O2 /l 70m
RCO-SCOBI 2nm BY05 OXY ml O2 /l 80m
OXY ml O2 /l
year
61 65 70 75 80 85 90 95 00 05 08

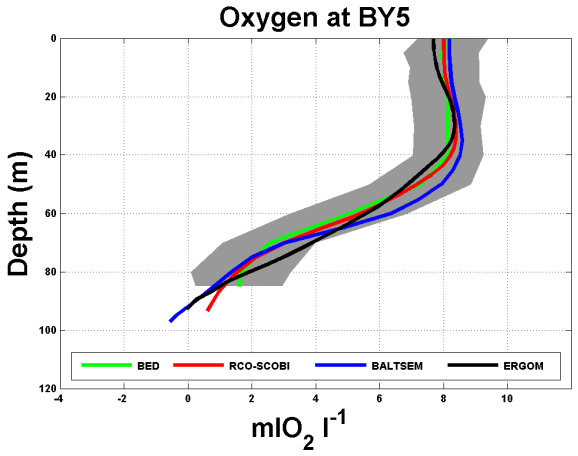
First results:
Annual average 1970-2005



Oxygen







Station list

SMHI

First results based on RCO-SCOBI and IPCC 2001:

1. Future climate might be characterized by increased water temperatures, increased mixing, and (reduced loads) in the Baltic Proper
2. Increased water temperatures => decreased oxygen concentrations in all regions
3. Increased mixing => increased oxygen concentrations below the halocline => reduced winter DIP and reduced denitrification (i.e. increased DIN)
4. Increased water temperature and increased mixing => increased (decreased) phytoplankton concentrations in the south-western (northern) Baltic Proper
5. In future climate the ”business-as-usual in agricultural practices” scenario may have larger impacts than in present climate
6. The BSAP will likely reduce the phytoplankton concentrations also in future climate

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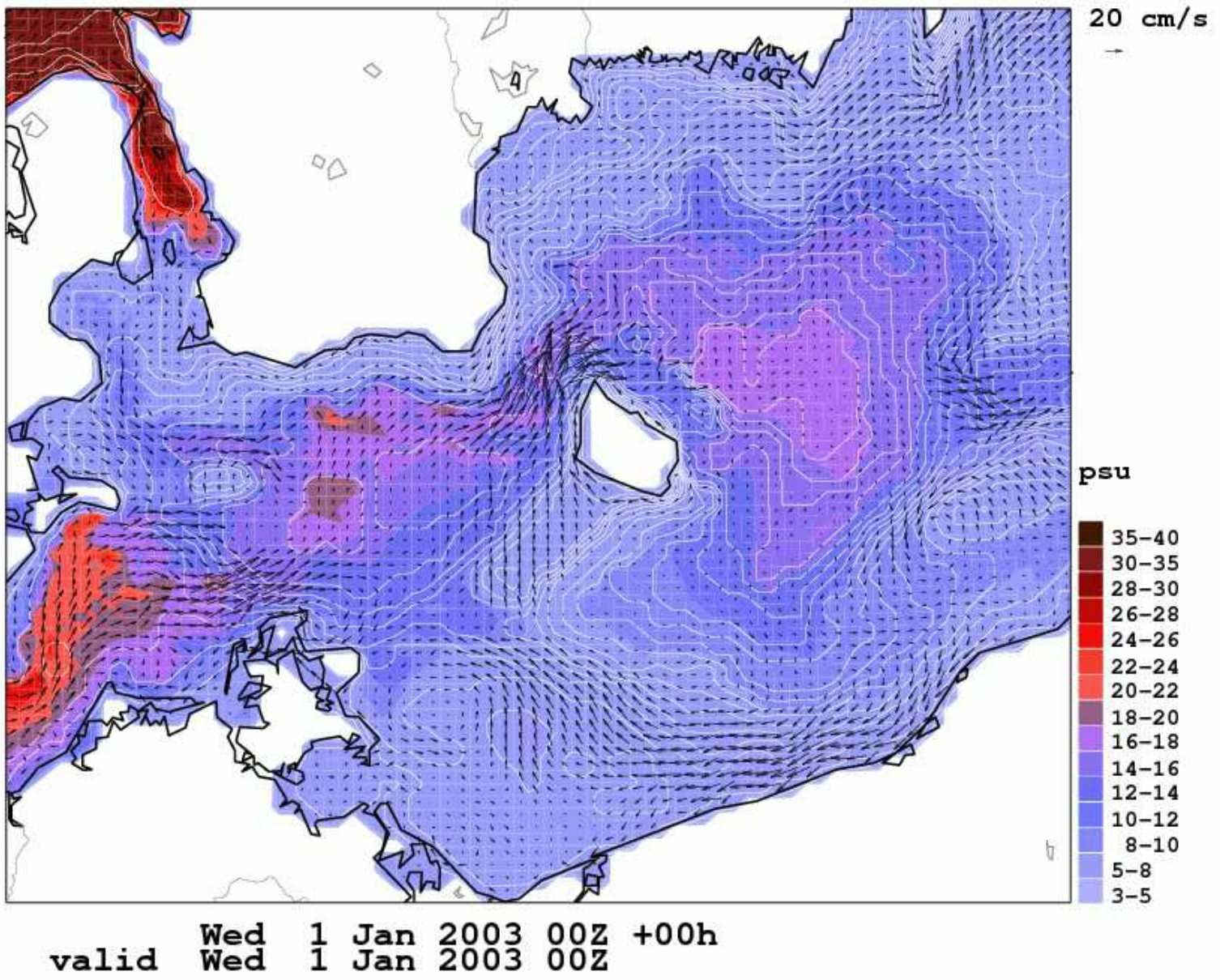
SMHI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5-8
3-5
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