Response of the hydrography and marine biogeochemistry to multiple drivers in the Baltic Sea region

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Earth System Science for the Baltic Sea region

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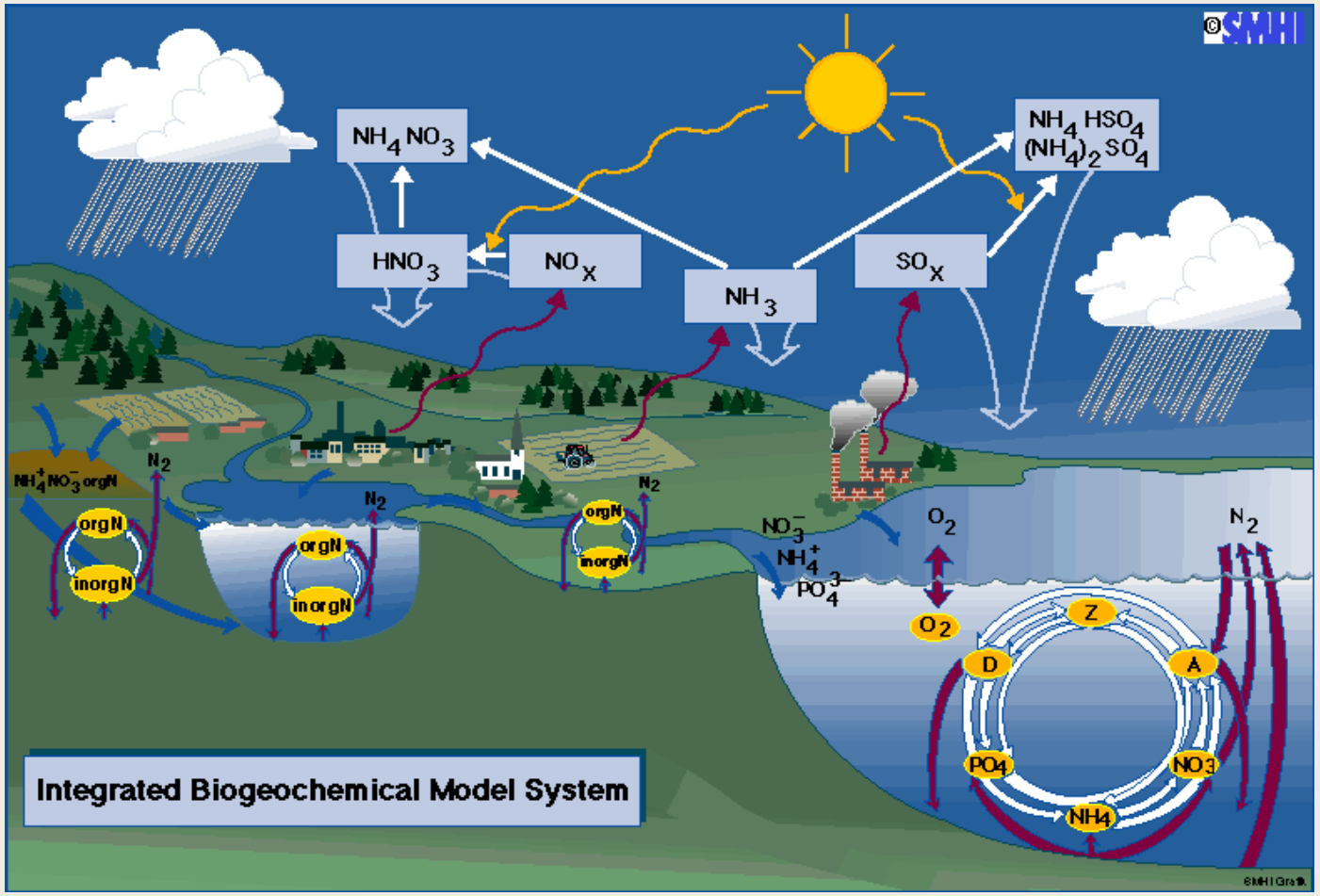
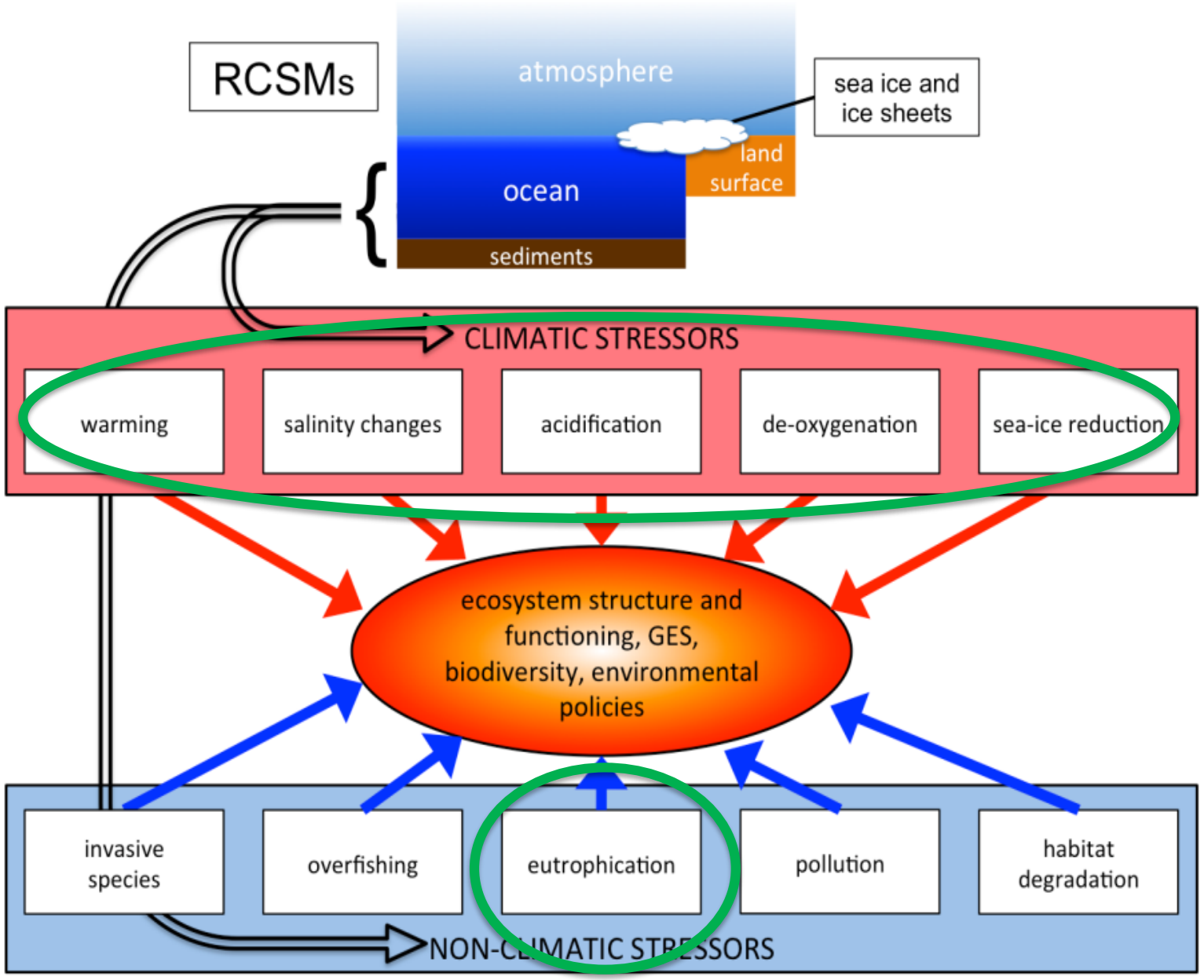
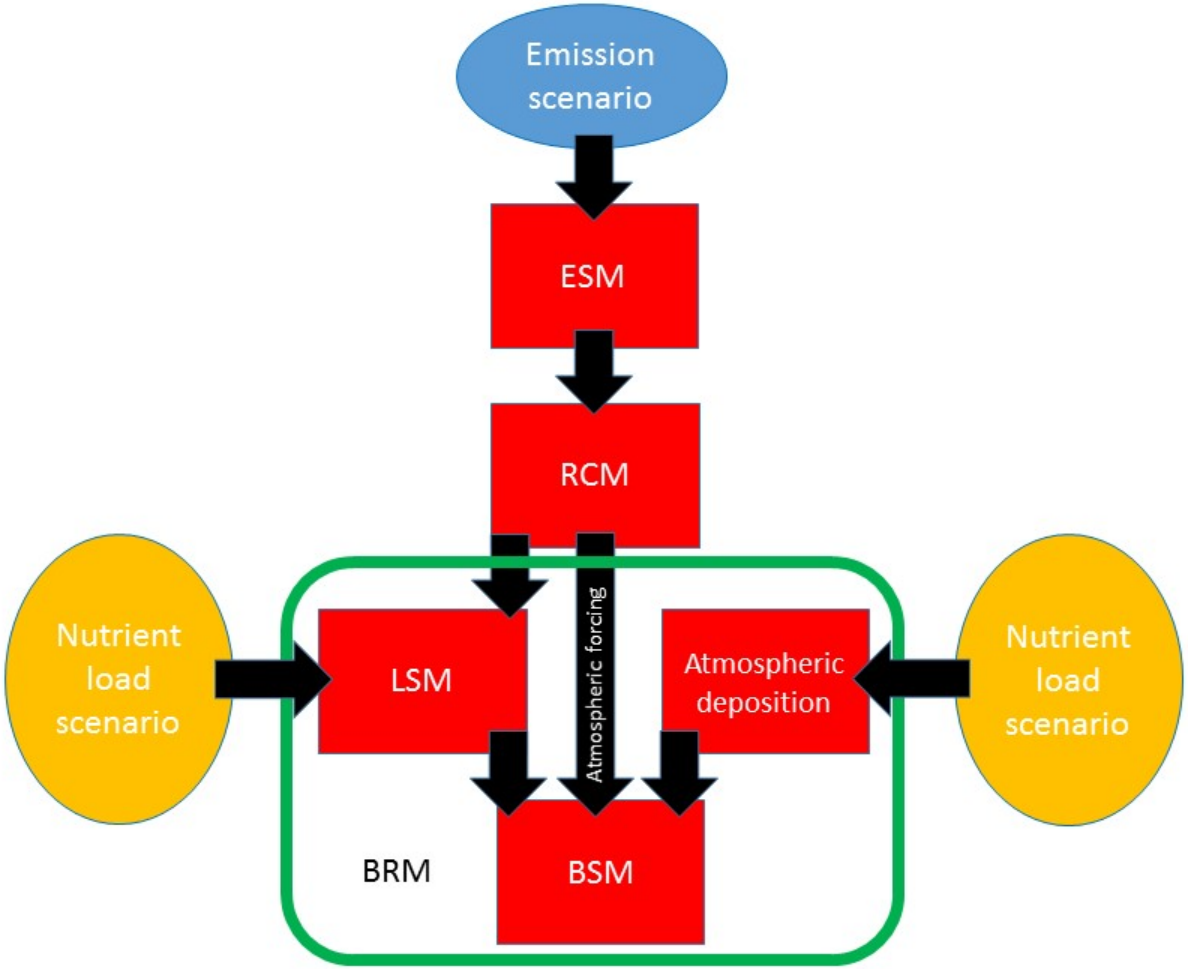


Earth system science treat the Earth as an integrated system and seeks a deeper understanding of the physical, chemical, biological and human interactions that determine the past, current and future states of the Earth



(Source: S. Schimanke, IMPROVE)

Dynamical downscaling



(Meier et al., 2018; Frontiers in Marine Science)

frontiers in Marine Science

ORIGINAL RESEARCH
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Assessment of Eutrophication Abatement Scenarios for the Baltic Sea by Multi-Model Ensemble Simulations

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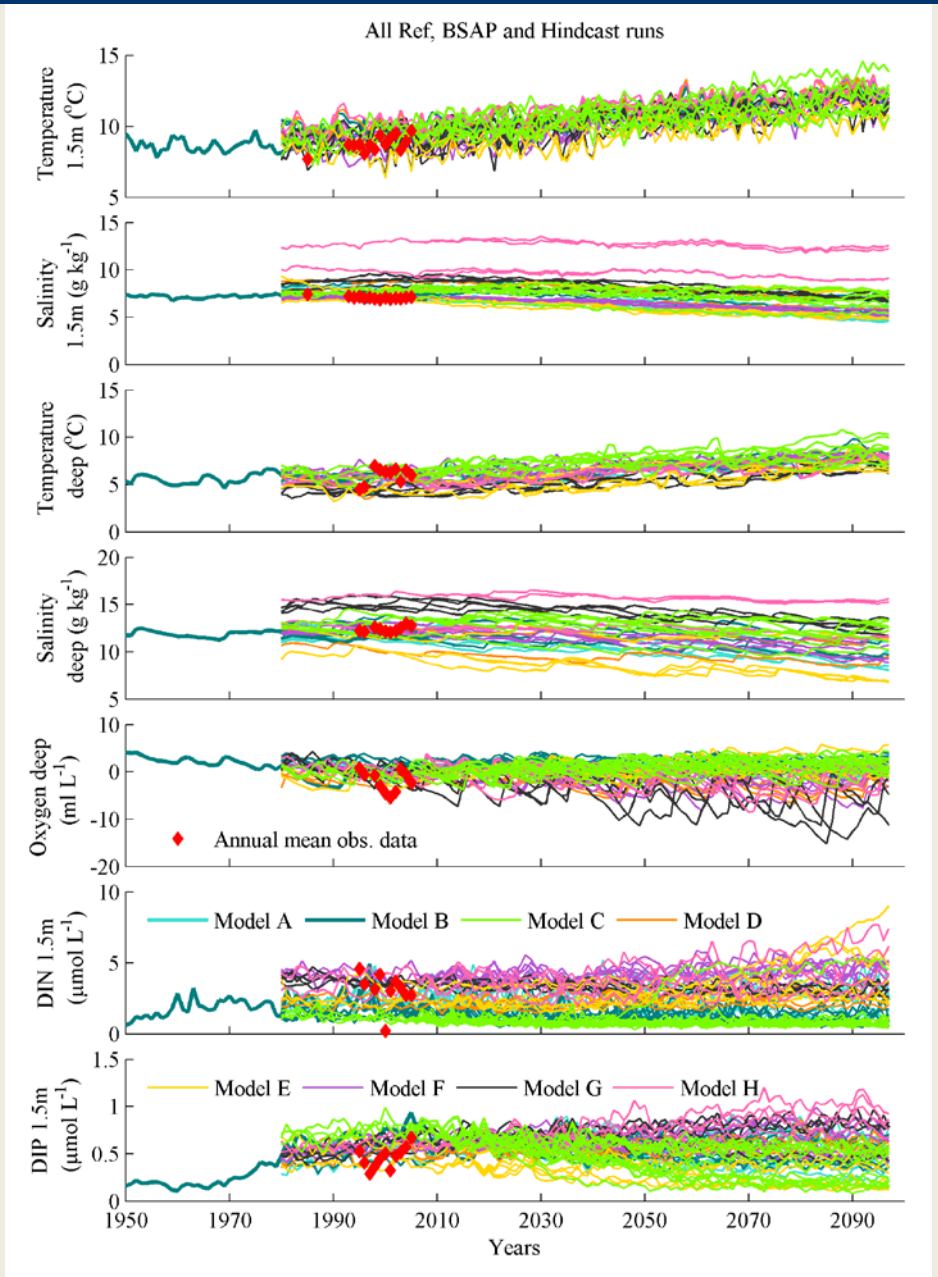
Baltic Sea: future projections

- **7 different global climate models**
- **A1B and A2 scenarios, RCP4.5 and 8.5**
- **3 realizations**
- **3 regional climate model (RCAO, CLM, RCA-NEMO)**
- **3 hydrological models**
- **6 Baltic Sea physical-biogeochemical models**
- **10 nutrient load scenarios: BSAP (- 25…- 30%) to BAU (+ 40%)**
- **Total: 29+29+... scenario simulations**

ECO SUPPORT

(Meier et al., 2018; Frontiers in Marine Science)

(Source: Meier et al., 2018; Frontiers in Marine Science)



Surface temperature

Surface salinity

Deep water temperature

Deep water salinity

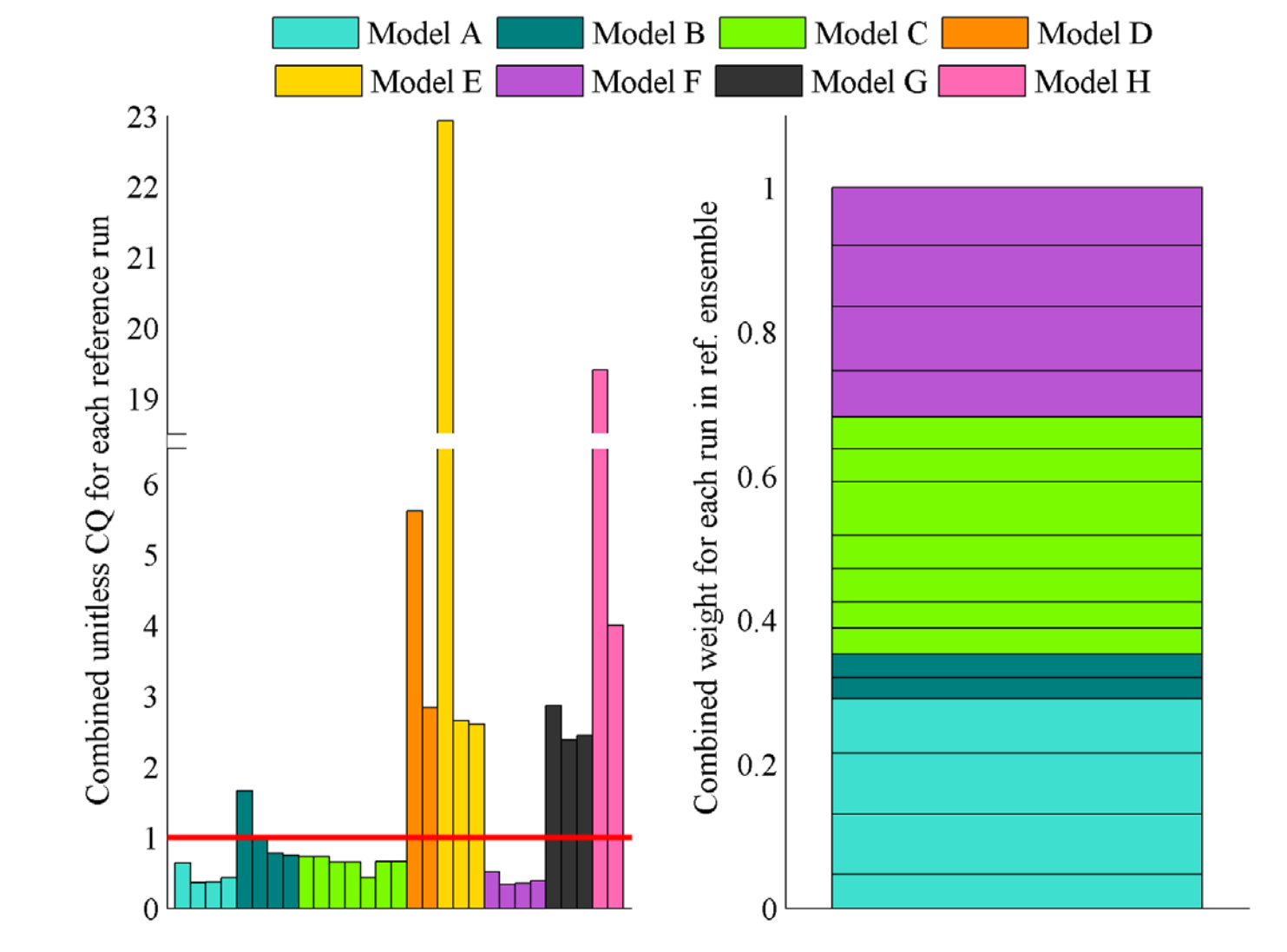
Deep water oxygen concentration

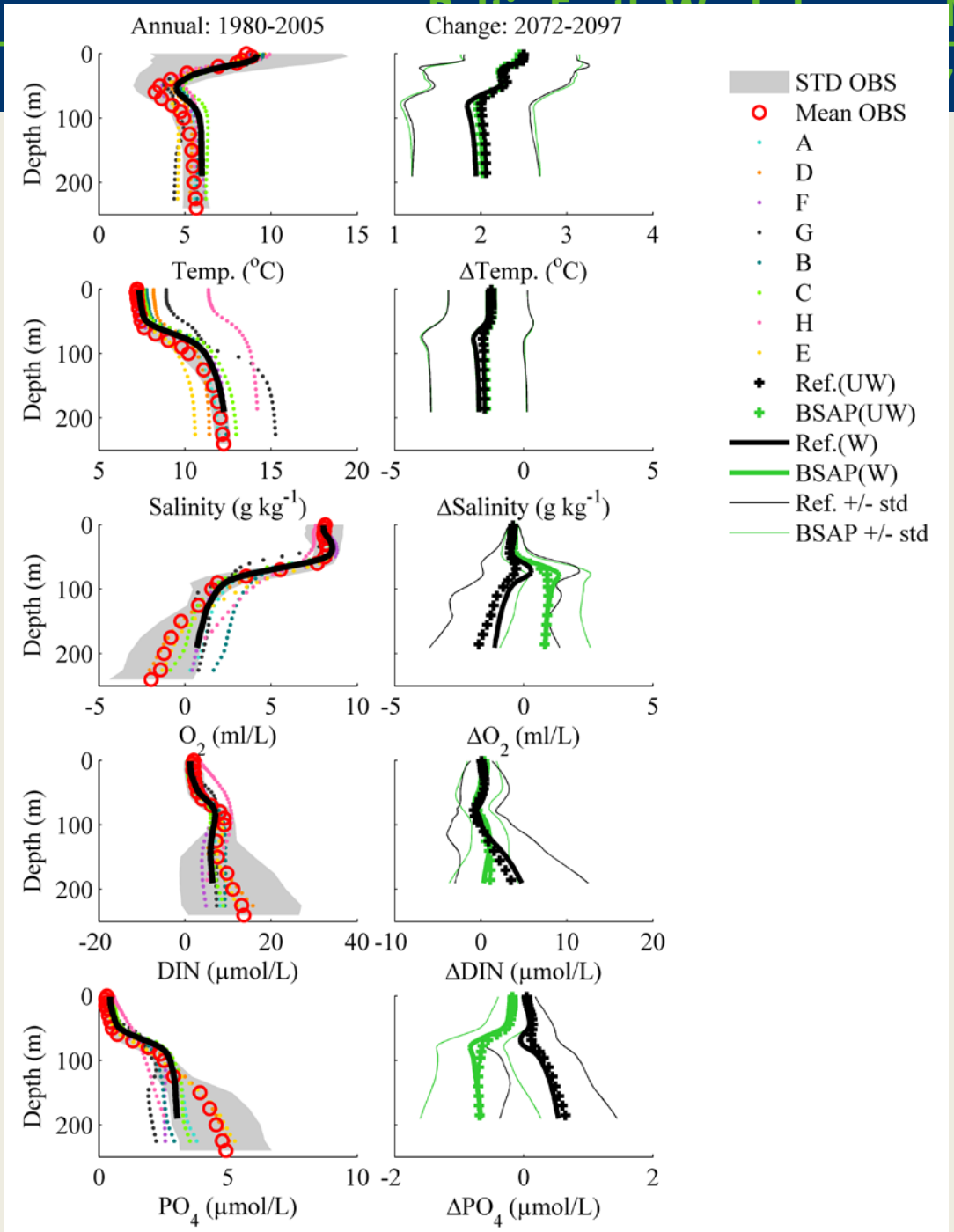
Surface DIN

Surface DIP

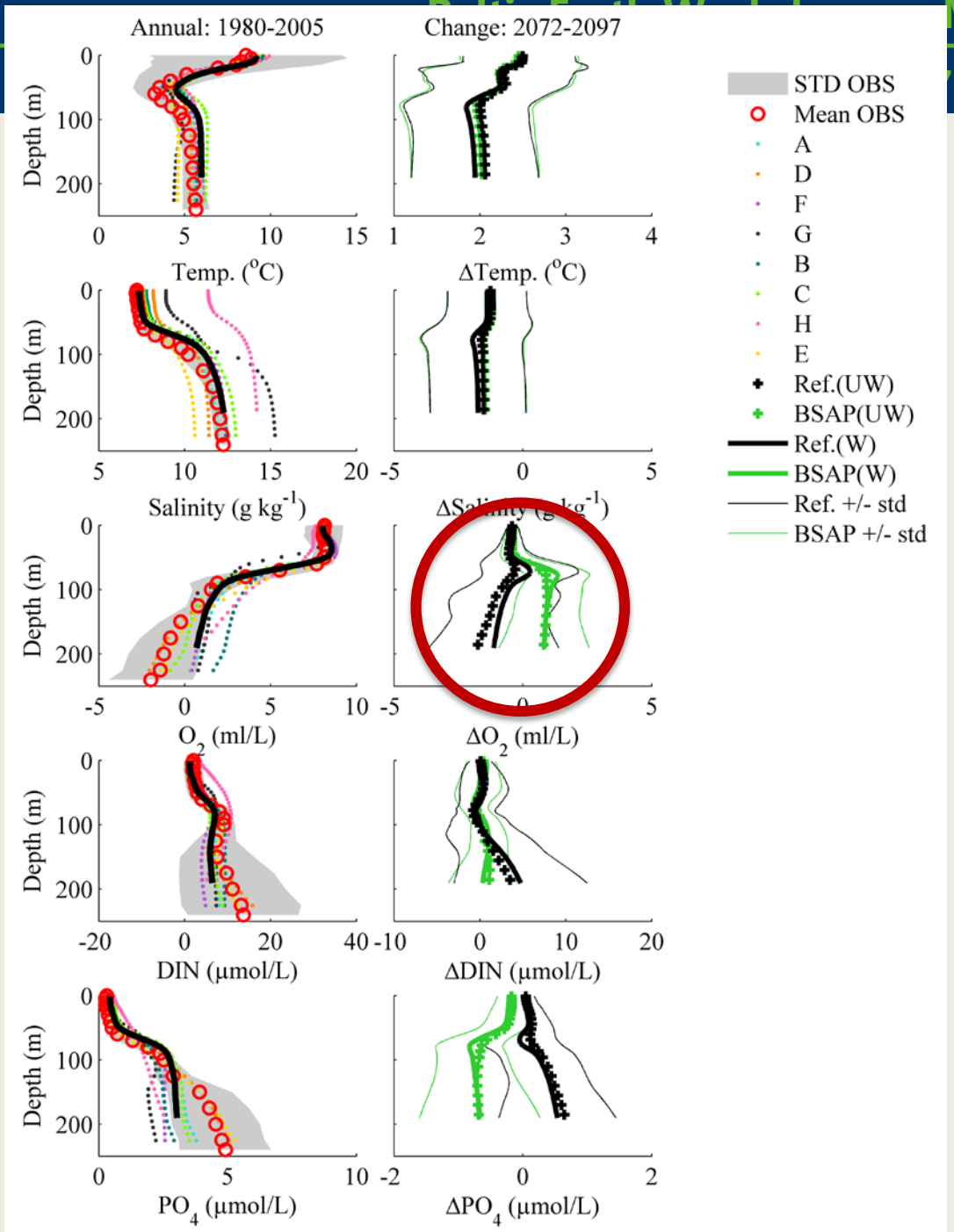
Combined cost function per model

(Source: Meier et al., 2018; Frontiers in Marine Science)





(Source: Meier et al., 2018; Frontiers in Marine Science)



(Source: Meier et al., 2018; Frontiers in Marine Science)

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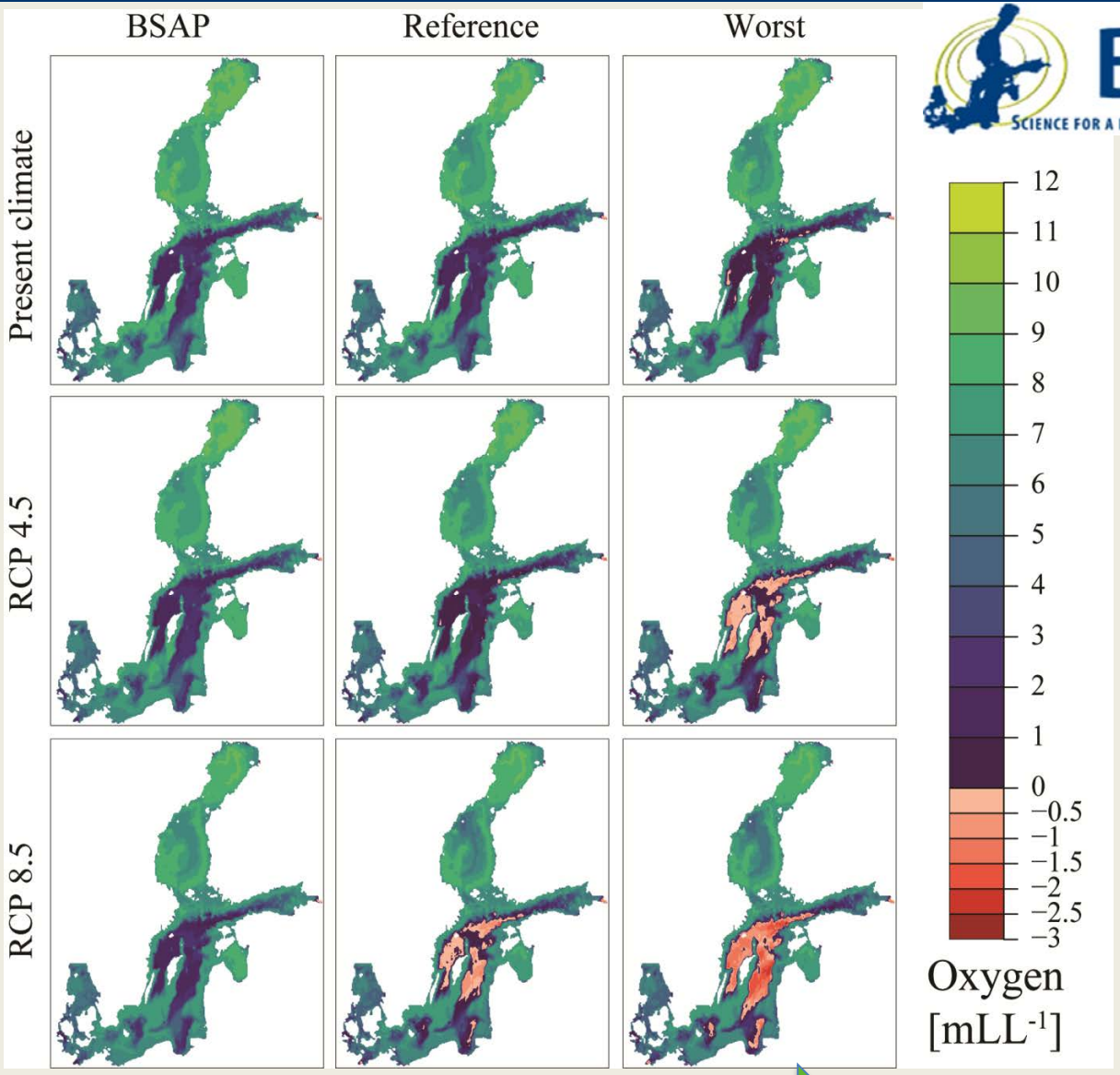
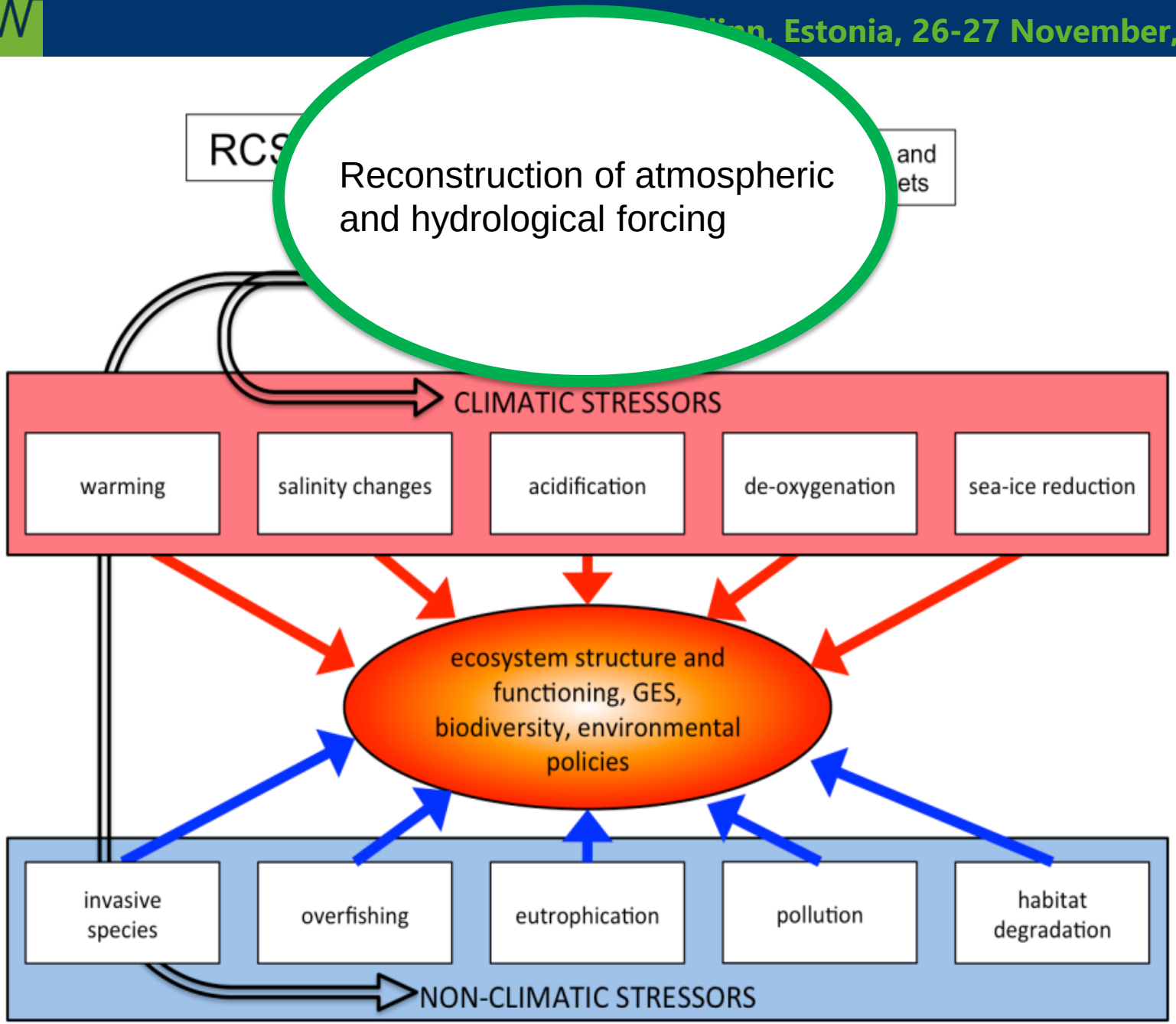
Future bottom oxygen and hydrogen sulfide concen-trations

warmer



higher loads

Source: Saraiva et al., 2018, Climate Dynamics



(Source: S. Schimanke, IMPROVE)

Climate Dynamics
https://doi.org/10.1007/s00382-018-4296-y

CrossMark

Disentangling the impact of nutrient load and climate changes on Baltic Sea hypoxia and eutrophication since 1850

H. E. M. Meier[1,2] · K. Eilola[2] · E. Almroth-Rosell[2] · S. Schimanke[3] · M. Kniebusch[1] · A. Höglund[2] · P. Pemberton[2] · Y. Liu[2] · G. Väli[4] · S. Saraiva[5]

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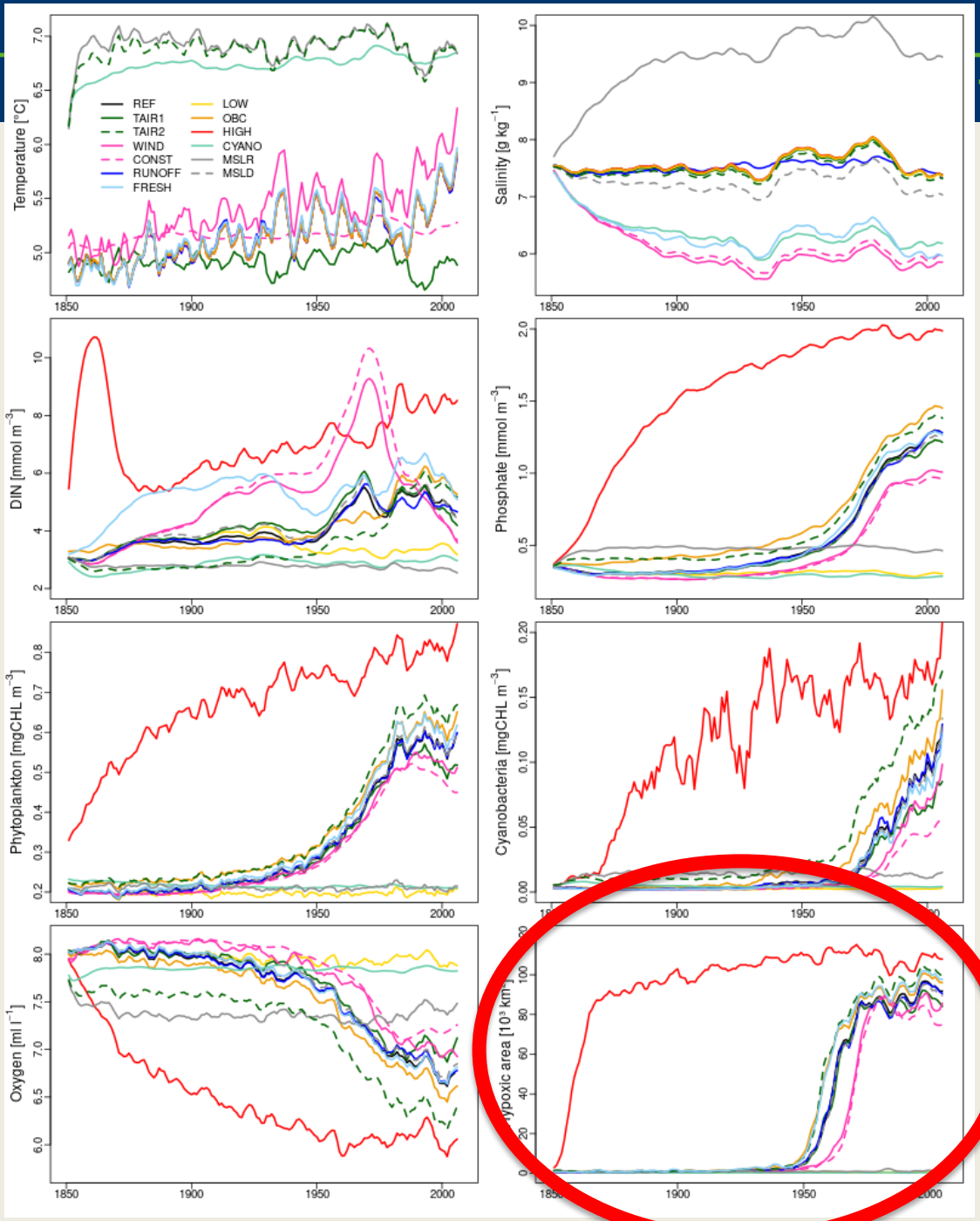
(Meier et al., 2018, Climate Dynamics)



Conclusions

(1) External nutrient loads are the main driver of oxygen depletion.

(2) Future climate change will amplify oxygen depletion. The impact of climate change is larger in case of higher nutrient loads.

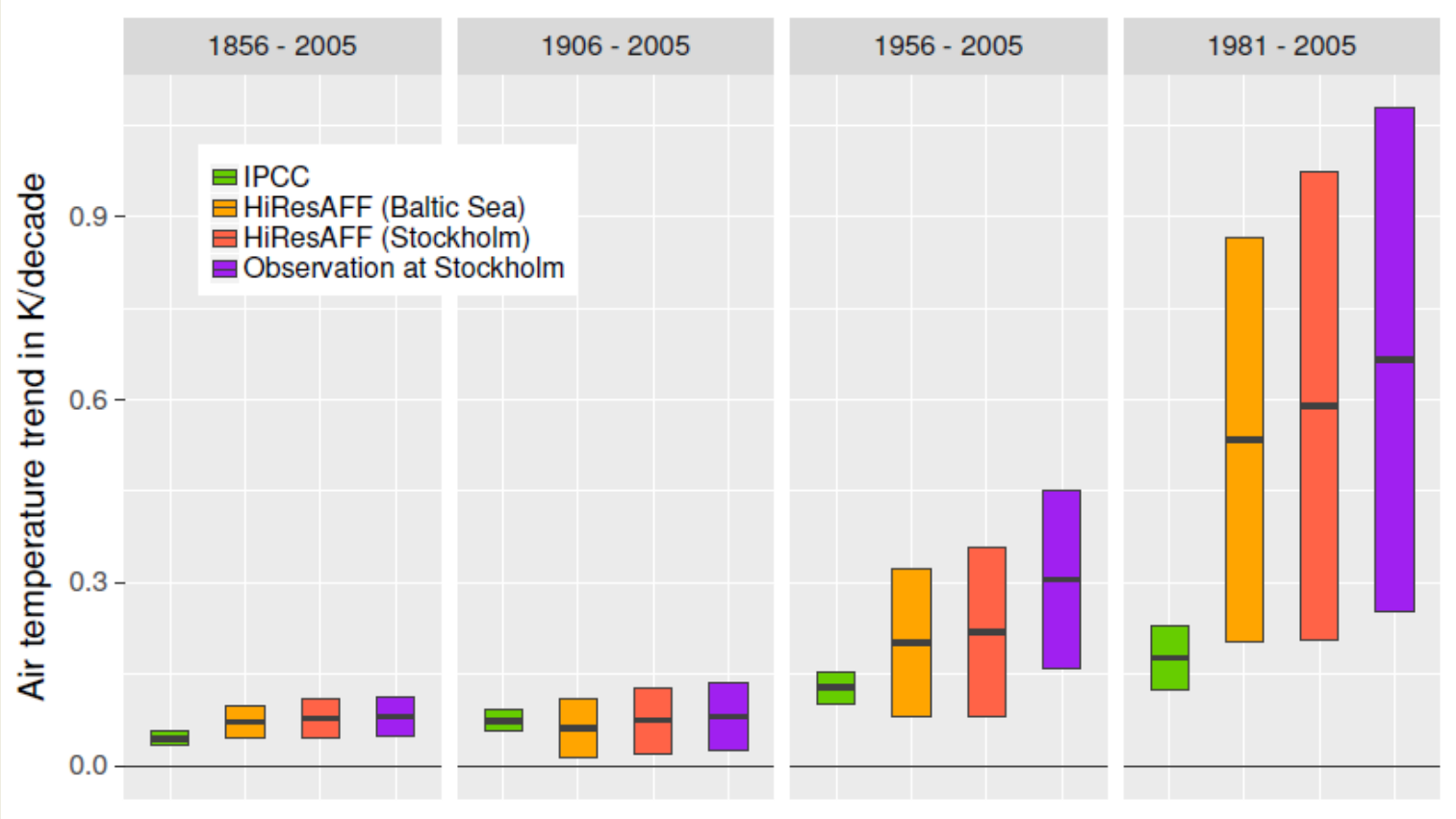
(3) Hence, the implementation of the BSAP is needed. The BSAP will lead to a significantly improved marine ecosystem.

(4) The response of the Baltic Sea to nutrient load changes is slow.

Thank you for your attention!

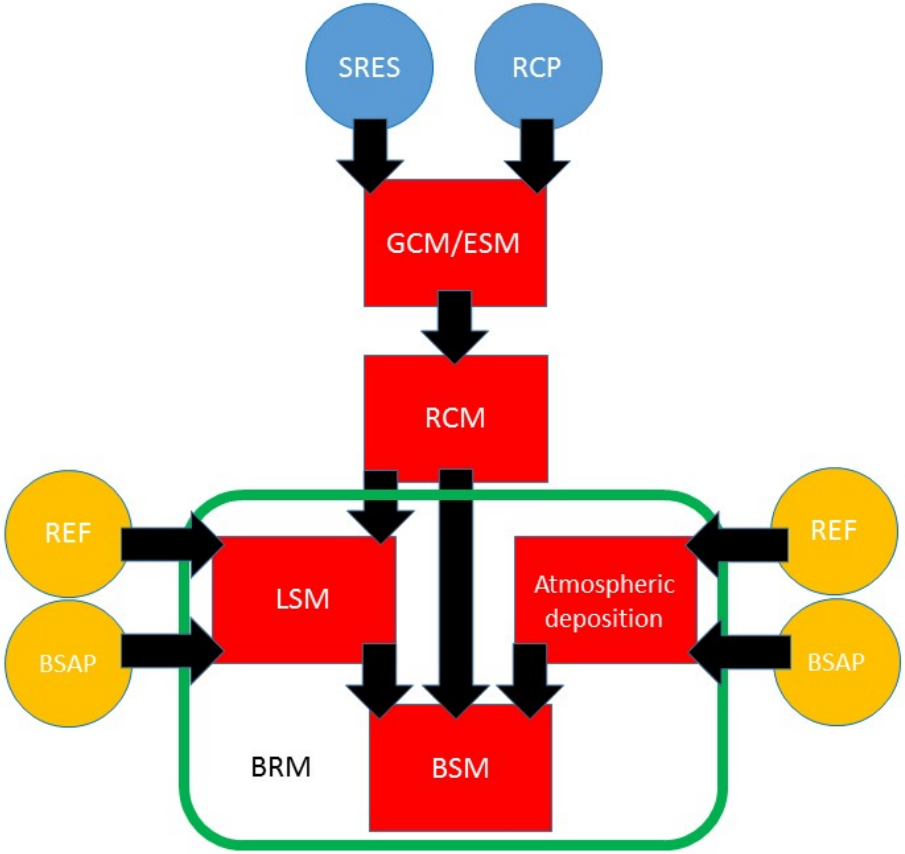
(Photo: R. Prien, IOW)

Baltic Sea as laboratory for climate change and environmental drivers



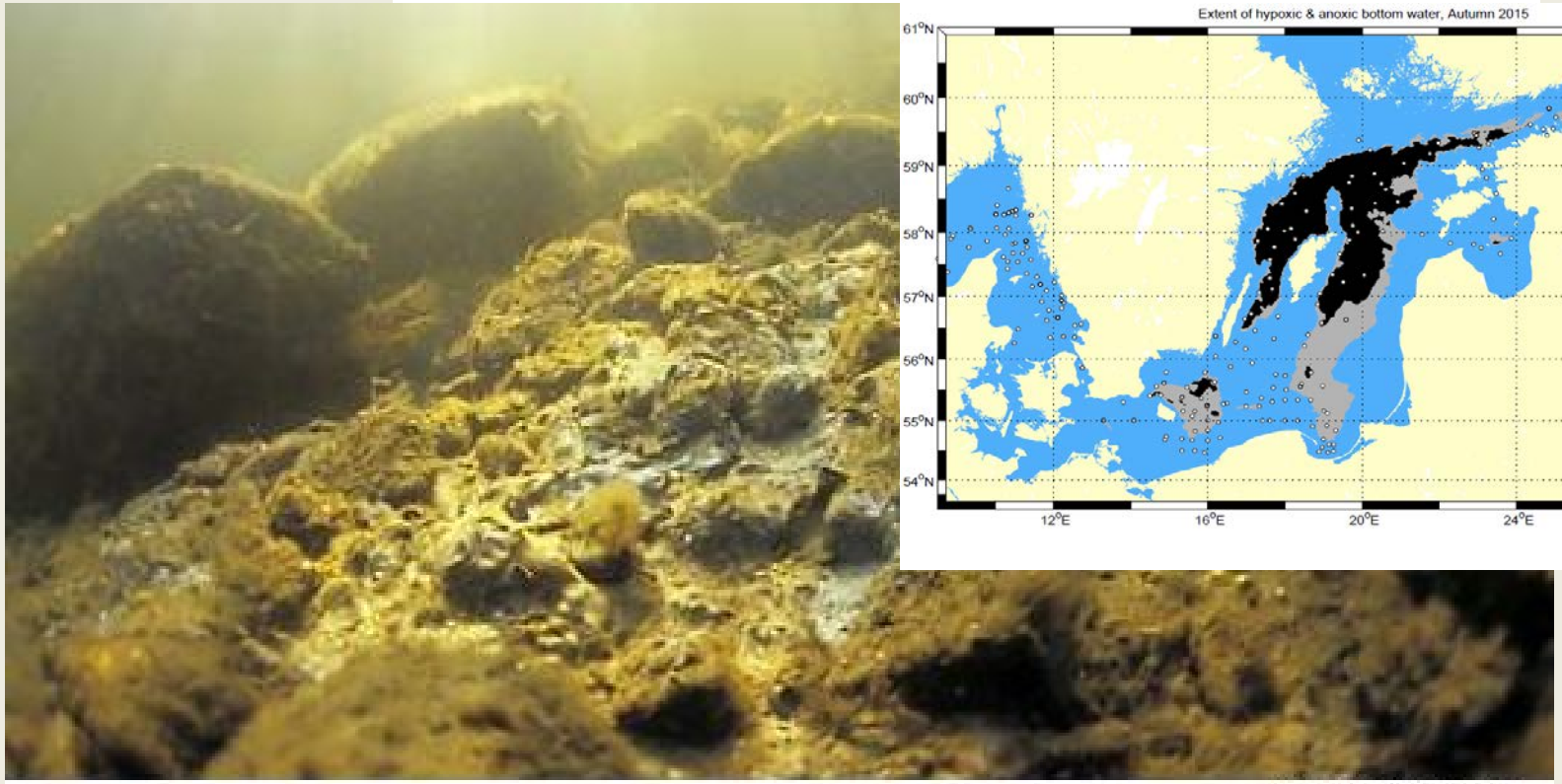
(Source: Kniebusch et al., under review)

Dynamical downscaling

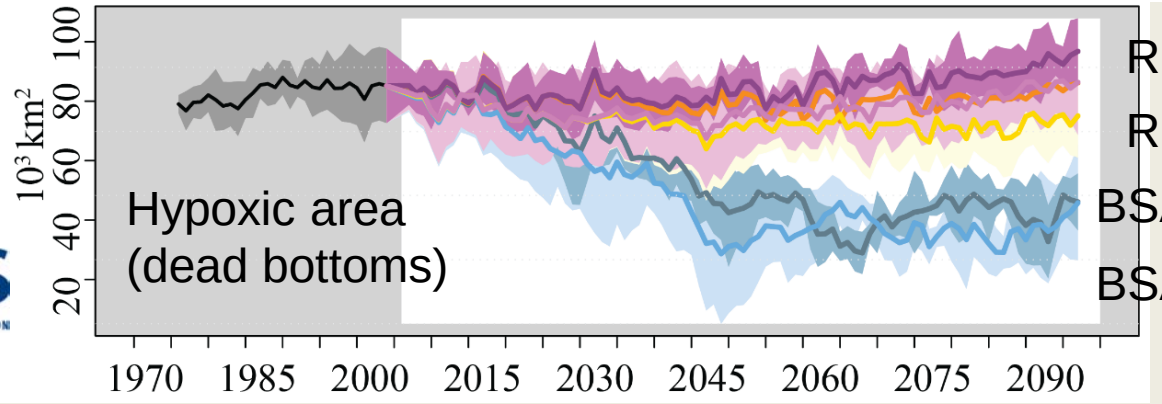


(Source: Meier et al., 2018; Frontiers in Marine Science)

BSAP RCP4.5 RCP8.5
Reference RCP4.5 RCP8.5
Worst RCP4.5 RCP8.5
Historical



Source: Saraiva et al., 2018



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