

Impact of global change on coastal hypoxia

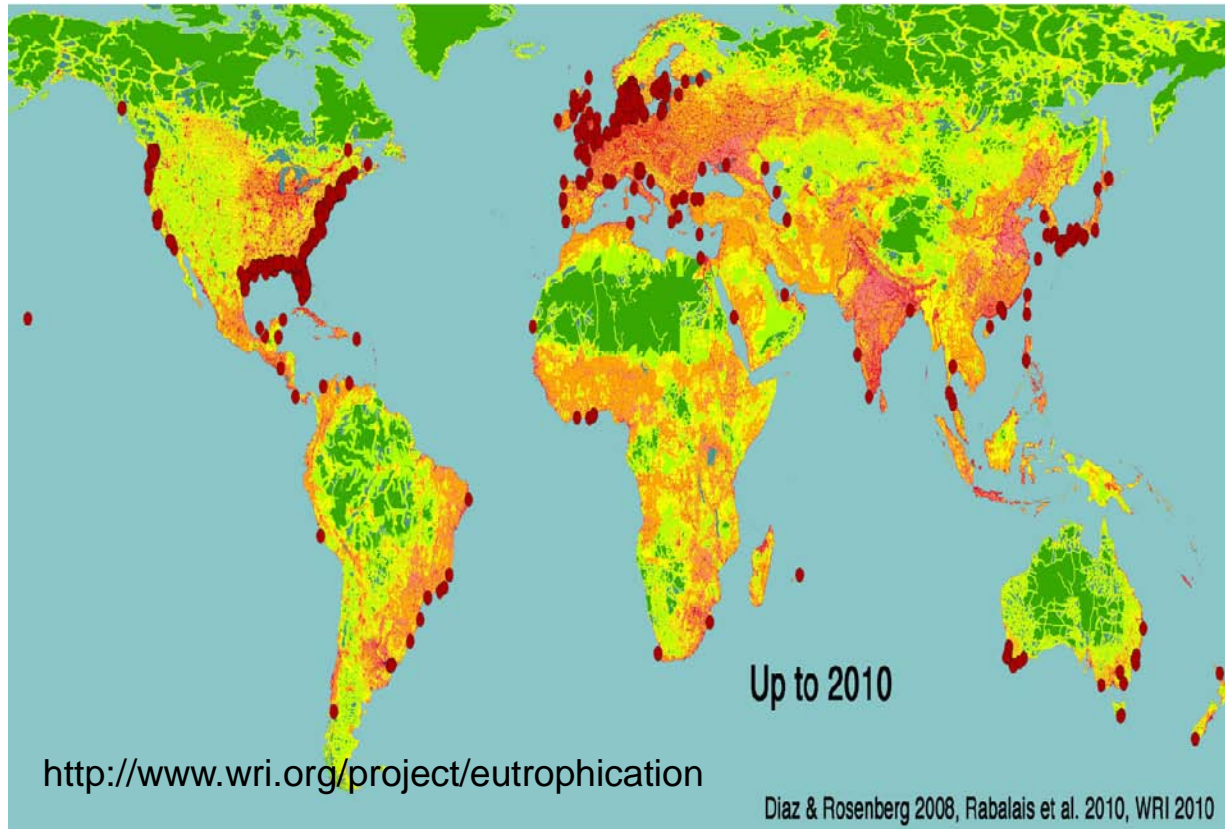
Ir. Lorenz Meire

Prof. Dr. Karline Soetaert

Prof. Dr. ir. Filip Meysman



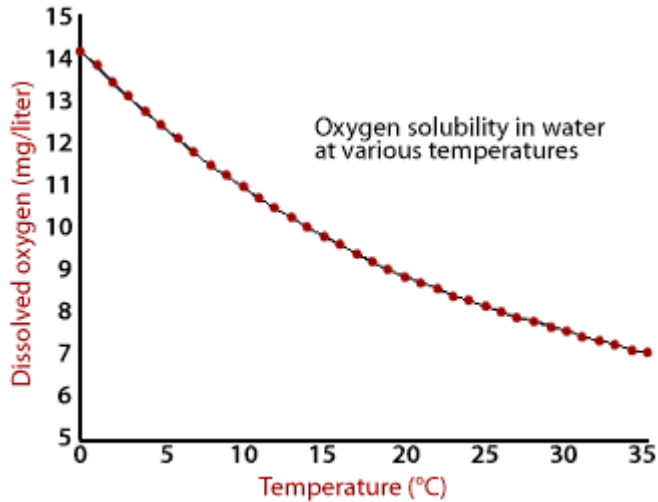
What is Coastal Hypoxia?



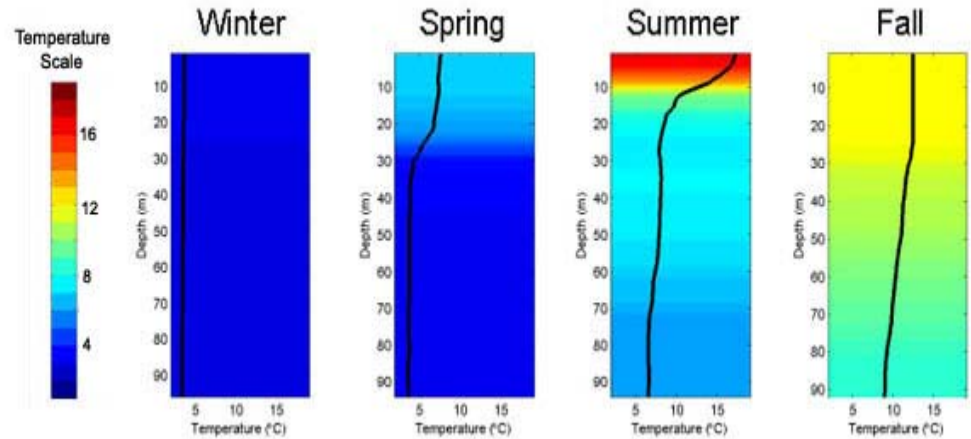
- Phenomenon with low **[O₂]** concentrations in **coastal bottom waters**
- Both in open ocean and **coastal areas**
- Exponential increase in coastal hypoxia since 1960s
- Strong ecological consequences (e.g. fish mortality, formation of dead zones)

What causes Hypoxia?

O₂ solubility



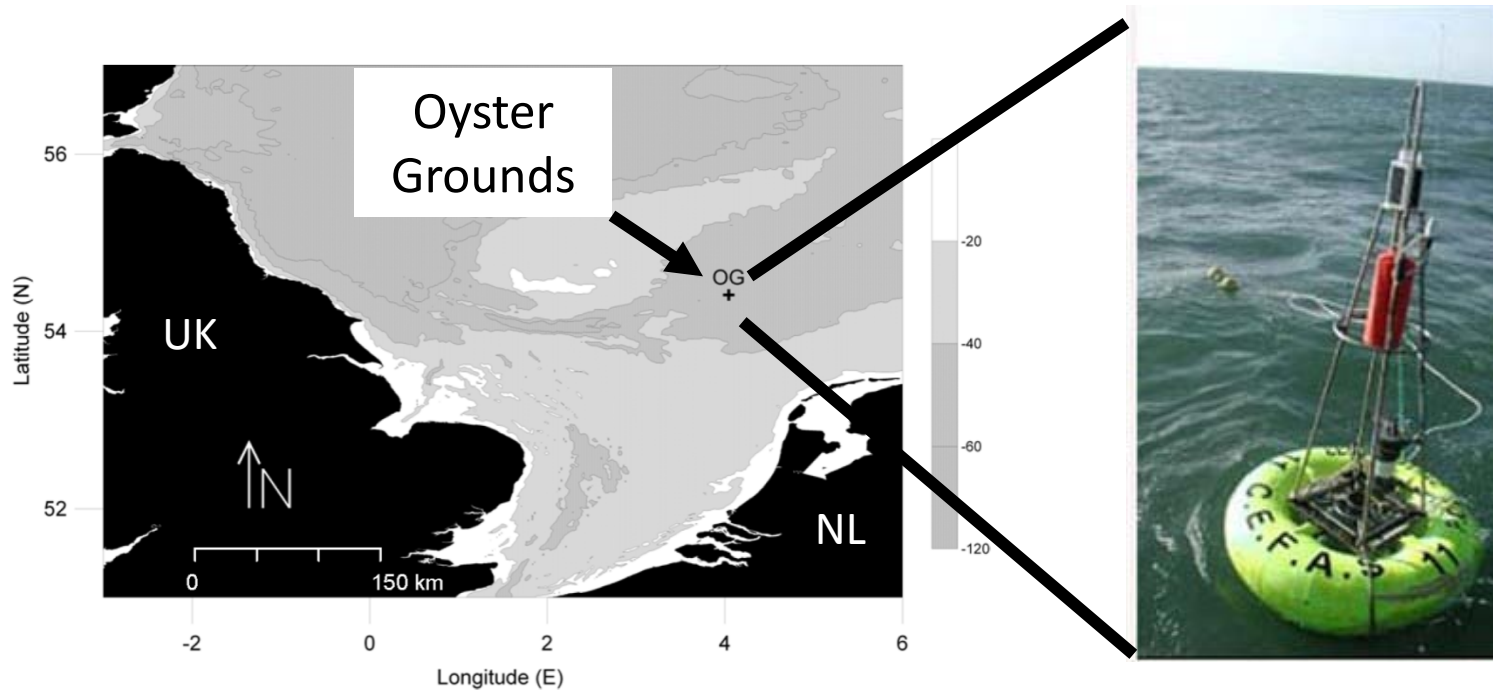
Water column stratification



Trends expected with climate change and global change:

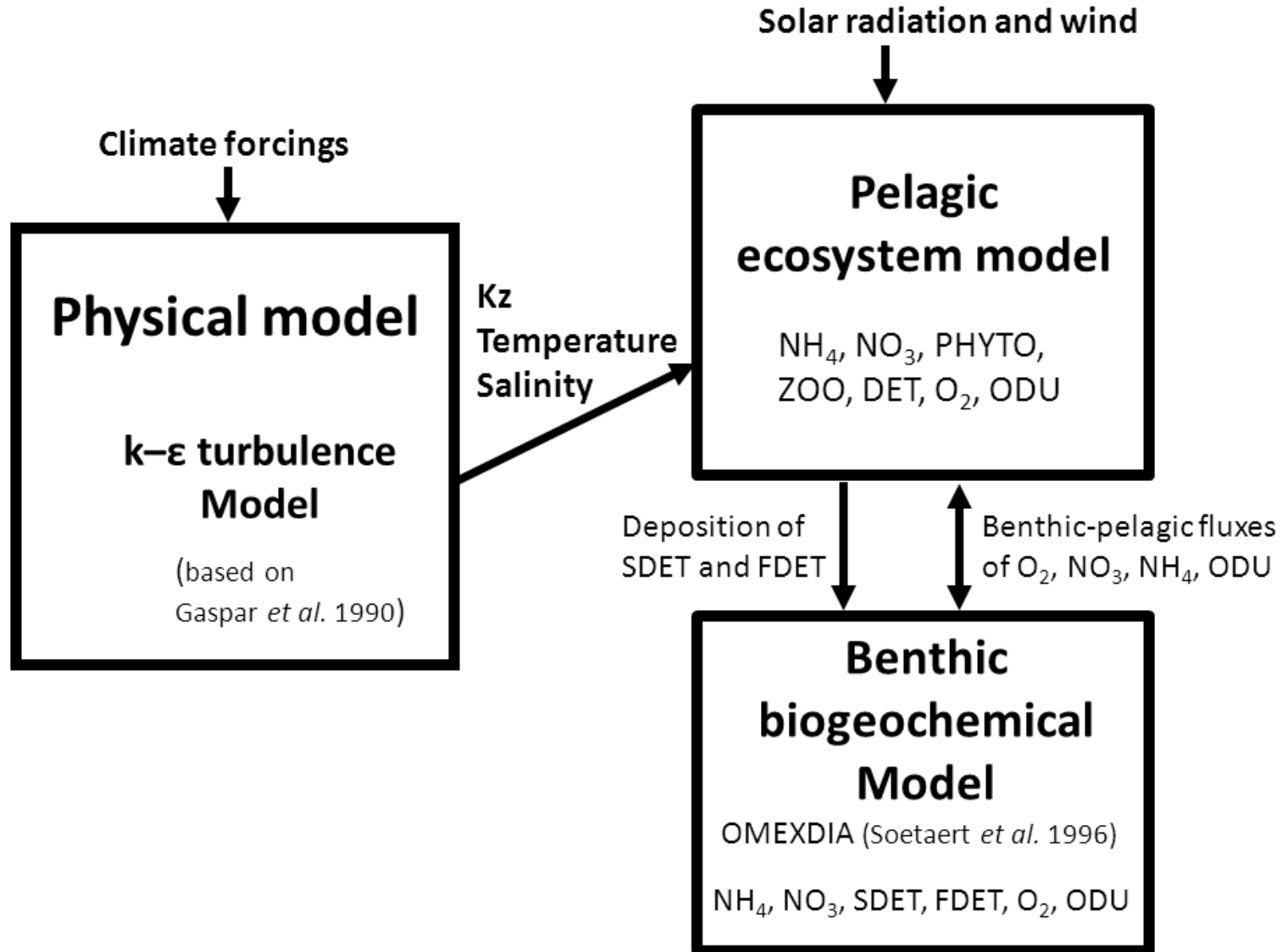
- (+) higher water temperature -> lower O₂ solubility
- (+) higher water temperature -> stronger stratification
- (+) higher water temperature -> more intense bottom water respiration
- (+) higher delivery of nutrients ->
- (-) more frequent and stronger storm events -> break up of stratification

What about hypoxia in the North Sea?

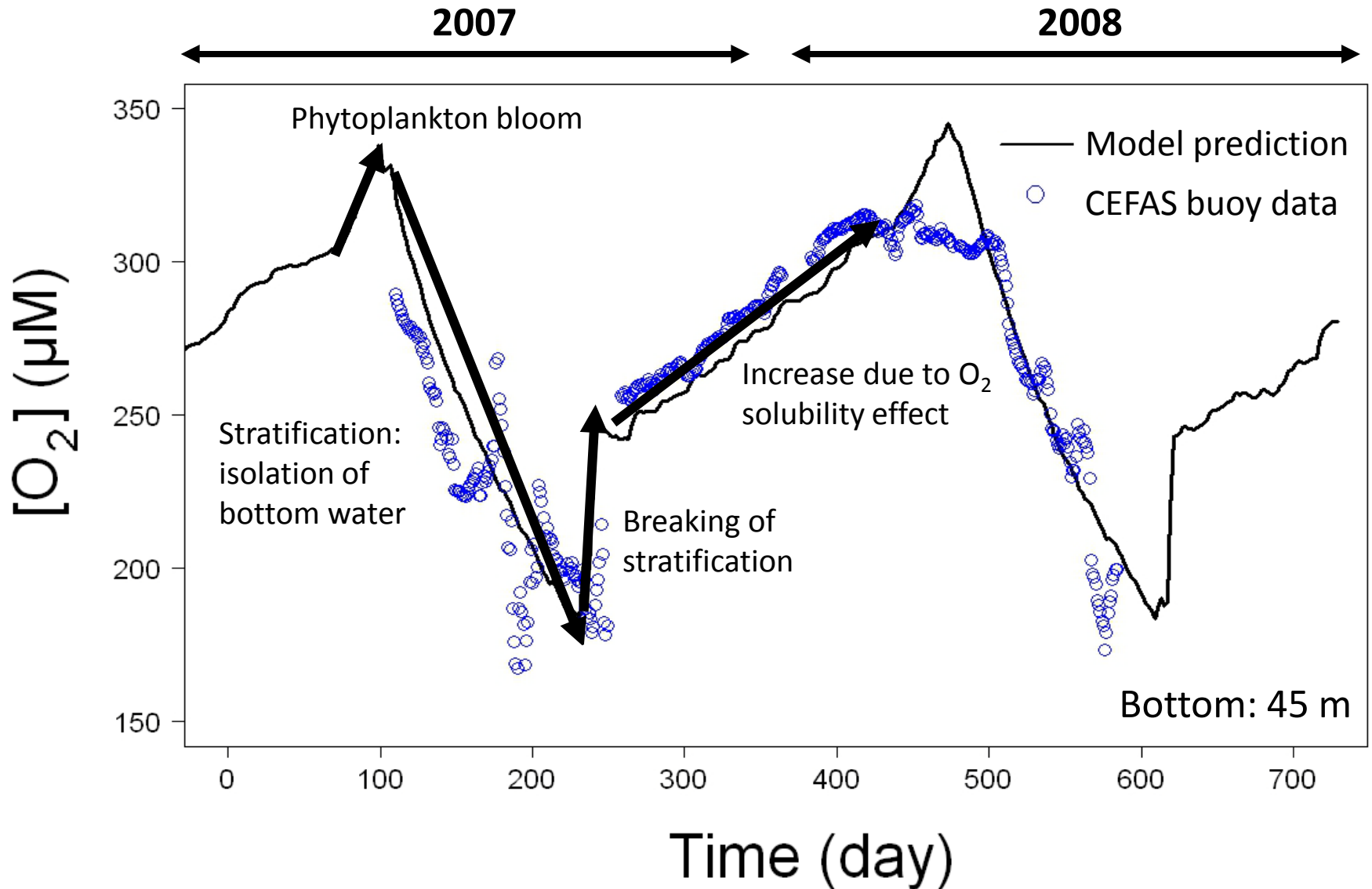


- Central North Sea, Oyster Grounds: ~45 m water column, stratified in summer
- ~70 μM in hot summer of 2003 (on the brink of hypoxia?)
- Oyster Grounds has a rich benthic fauna
- Data availability: CEFAS mooring – surface and bottom water (temp, sal, O_2 , turbidity)

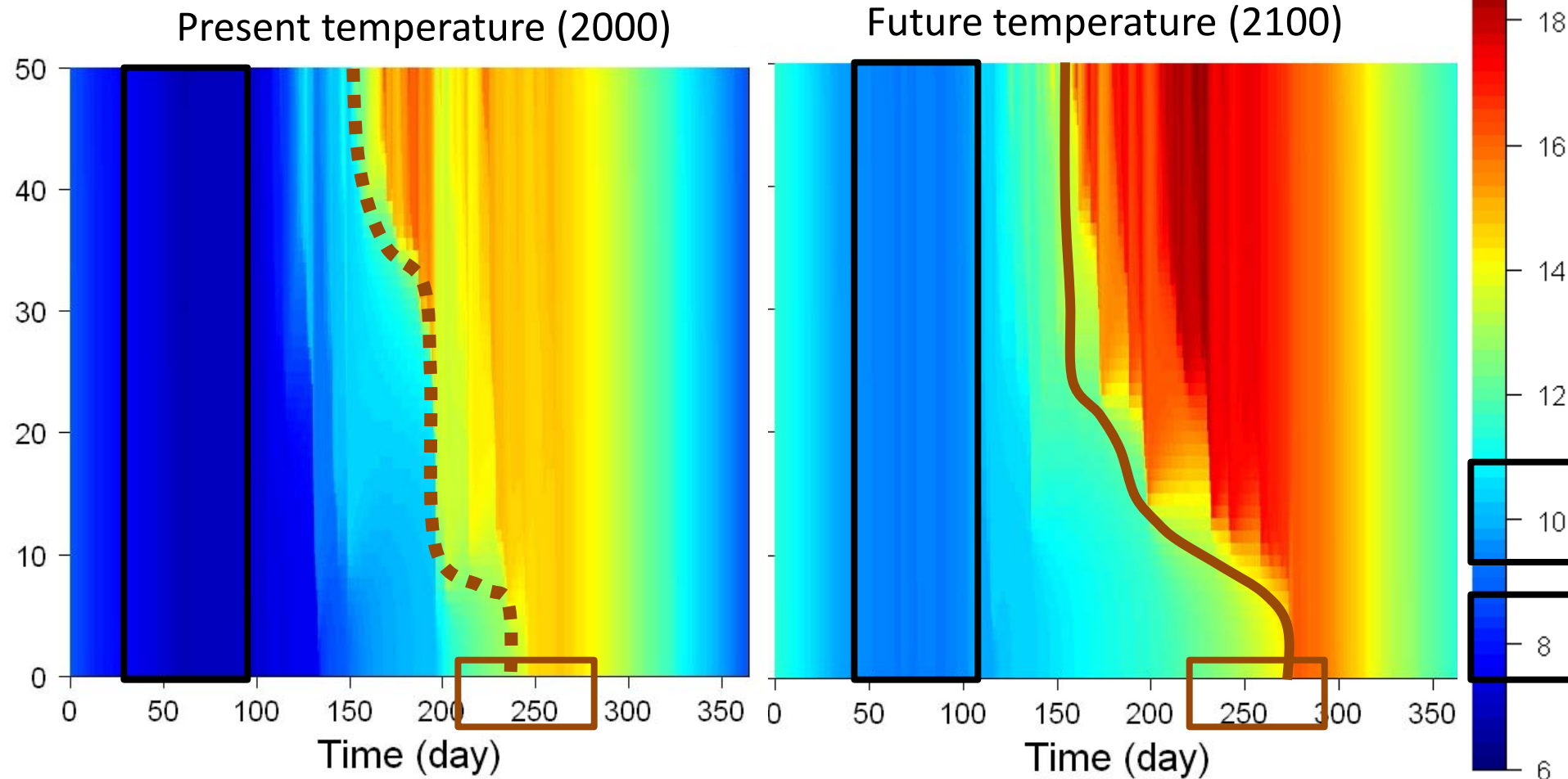
Coupled physical-biological model forced with climate model output



Comparison biological model and data



Effect of changing climate forcings (current nutrient loadings)

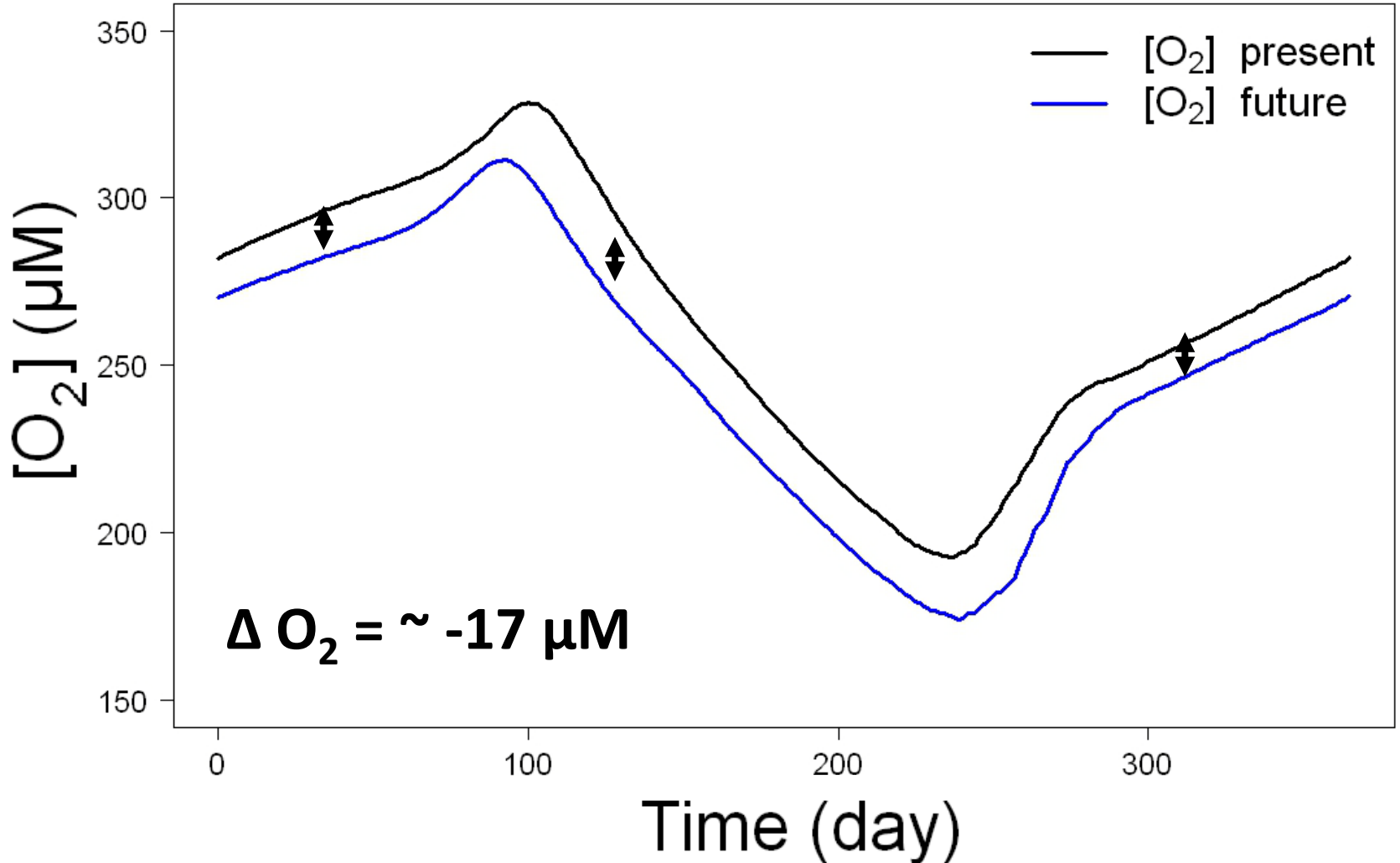


Increase in water temperature: $\pm 2^{\circ}\text{C}$

Increase in stratification duration: ± 10 days

Effect of changing climate forcings in 2100 (constant nutrient loadings)

O₂ concentration at 50 m (bottom): ensemble mean



Conclusions

- Model simulations reveal the impact of future climate forcings and nutrient loadings on hypoxia in stratified central North Sea
- These simulations indicate an increased risk of hypoxia in the North Sea with increased temperature
- Future storm effects are negligible in North Sea
- Reducing eutrophication (and effective nutrient management) is most efficient strategy to control coastal hypoxia
- Our study relevant to other coastal areas (Brazil, India, China)

Acknowledgments



Ocean & lakes



KNMI (Andreas Sterl and Engel Andriessen)



CEFAS (buoy data)



Remi Laane



NIOZ (Piet Ruardij)



Hypox project

Thanks for your attention!