

# Potential impact of offshore wind farms on deep water renewal in the Baltic Sea

**Hans Burchard**

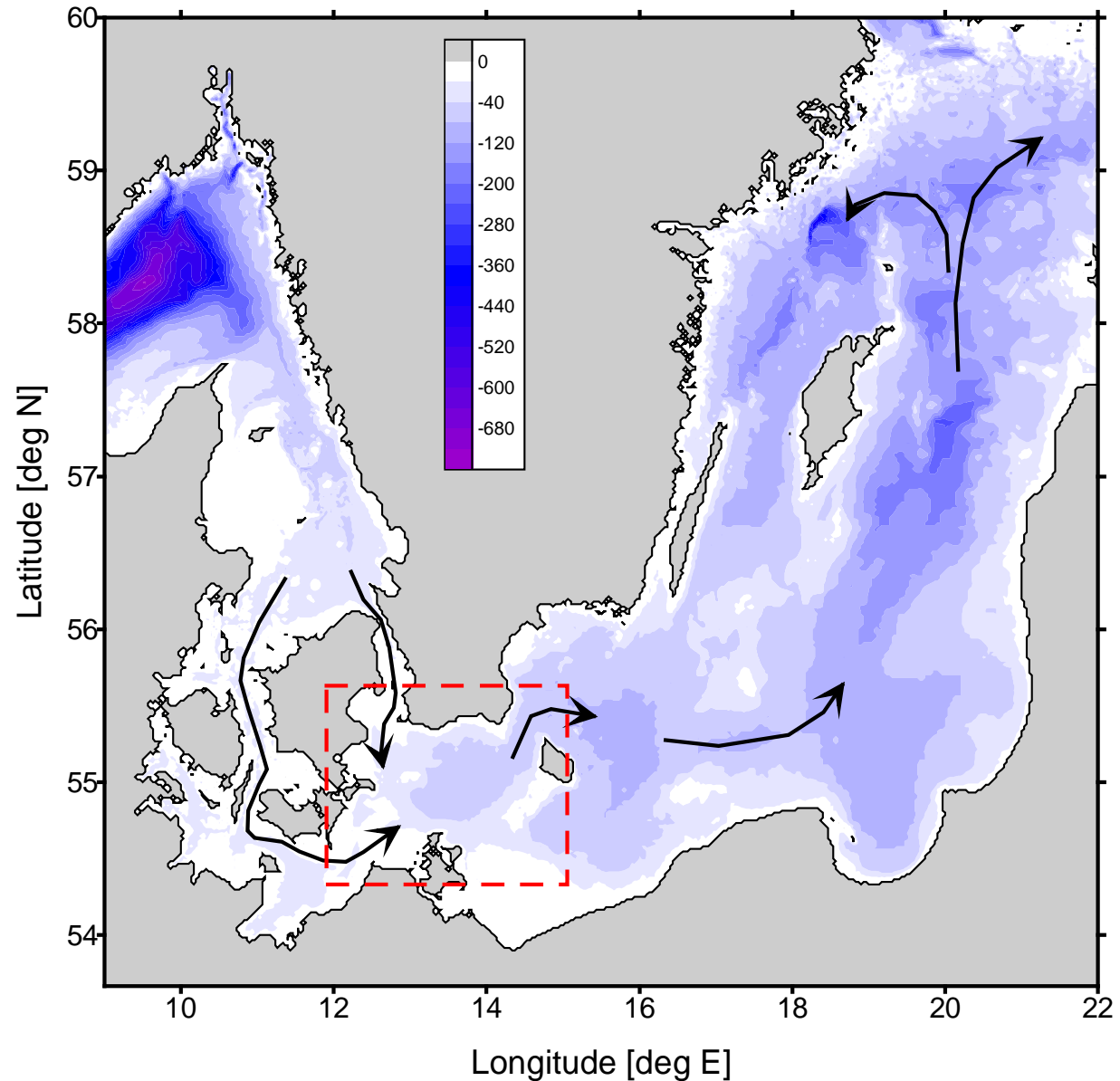
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**Baltic Sea Research Institute Warnemünde**

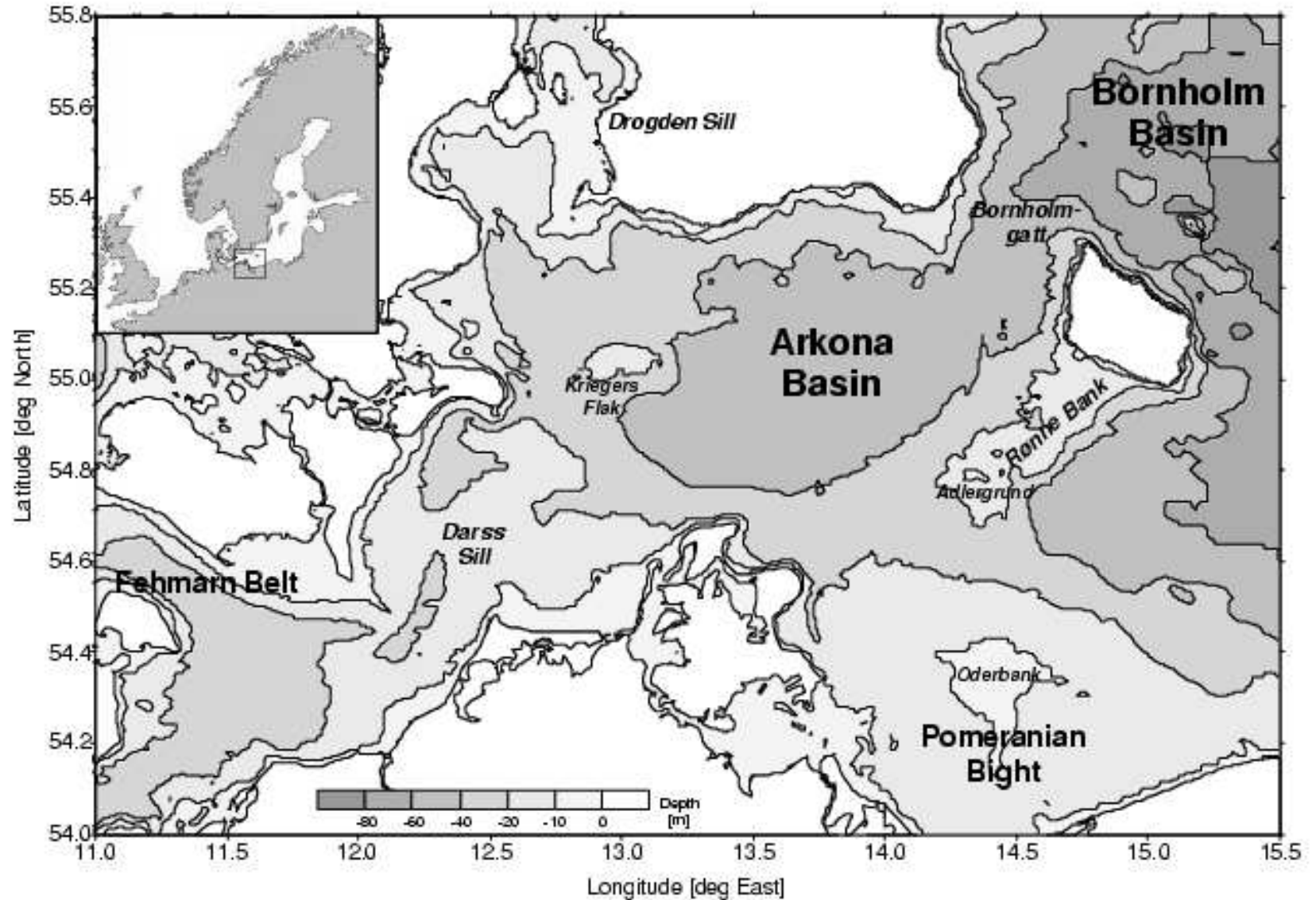
# Program of Lecture

- Bathymetry of the Baltic Sea
- Where to place offshore wind farms ?
- How does the Baltic Sea work ?
  - Laboratory demonstration
  - Computer simulations
- Effect of wind farms
- Potential consequences for the Baltic Sea

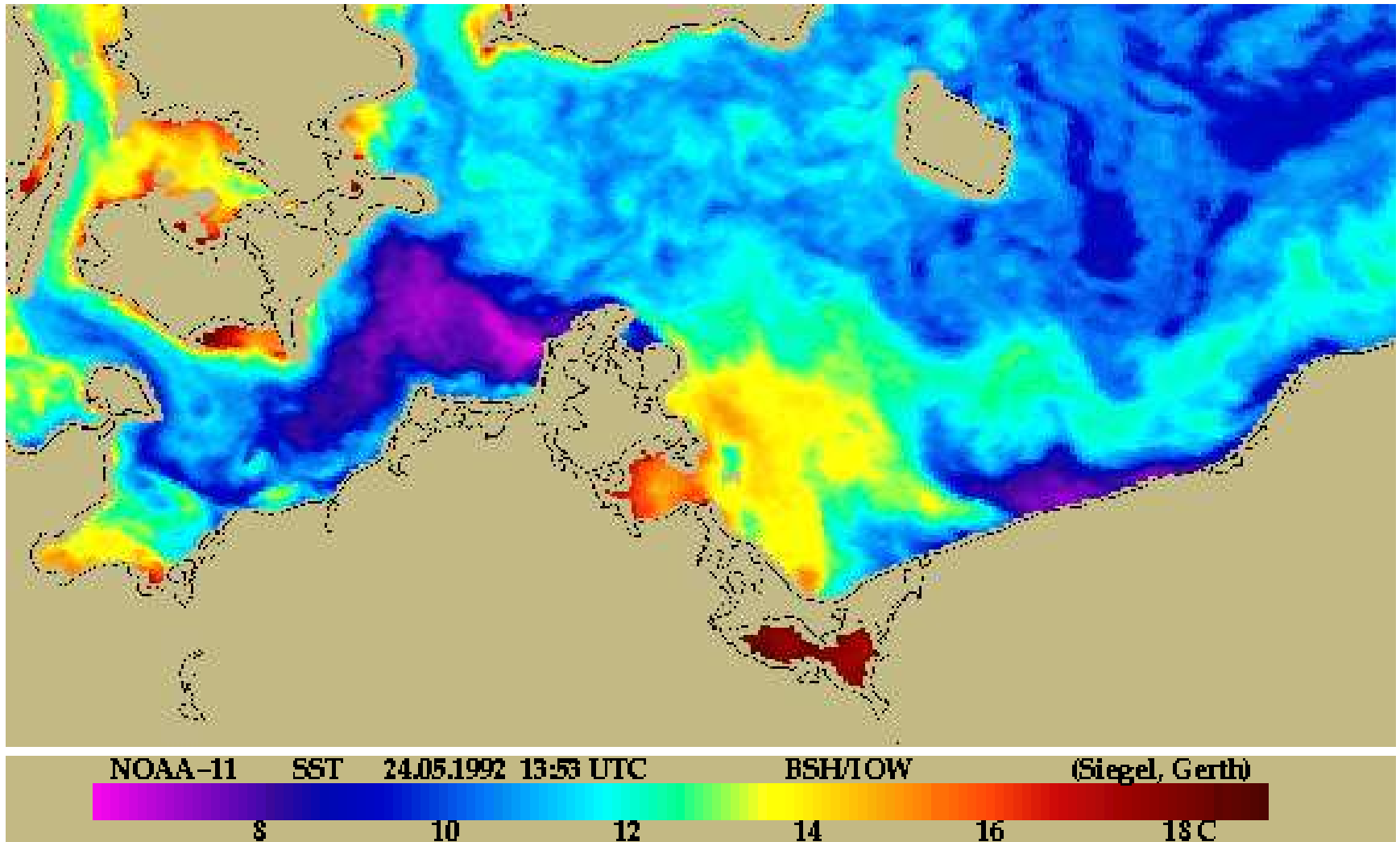
# The Baltic Sea ...



# ... and the Arkona Sea.



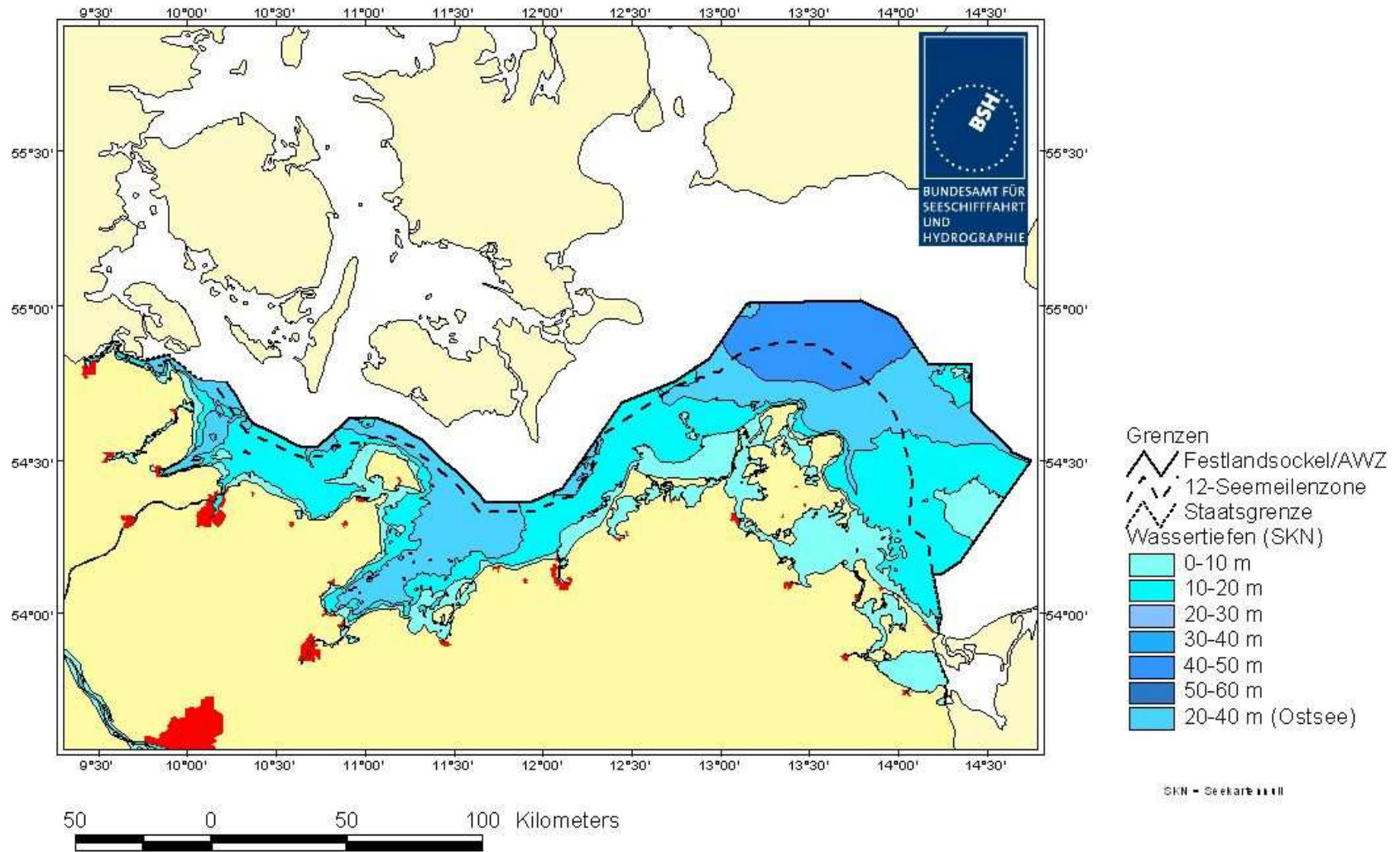
# A view from space.



NOAA image compiled by Herbert Siegel and Monika Gerth (IOW)

# The German perspective ...

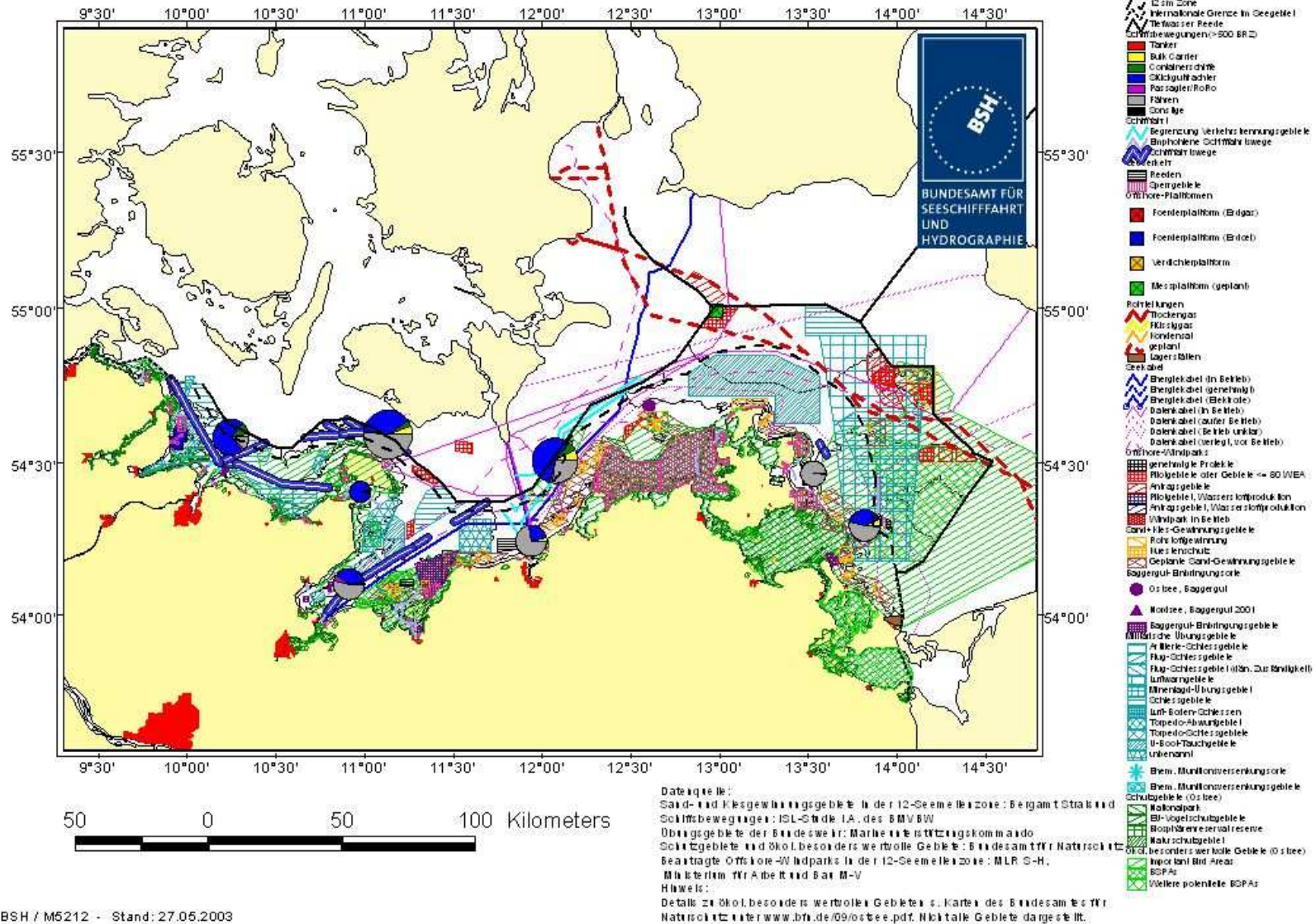
Ostsee - Deutscher Festlandsockel/Ausschließliche Wirtschaftszone (AWZ)



BSH / M5212 - Stand: 26.09.2001

# All problems considered ?

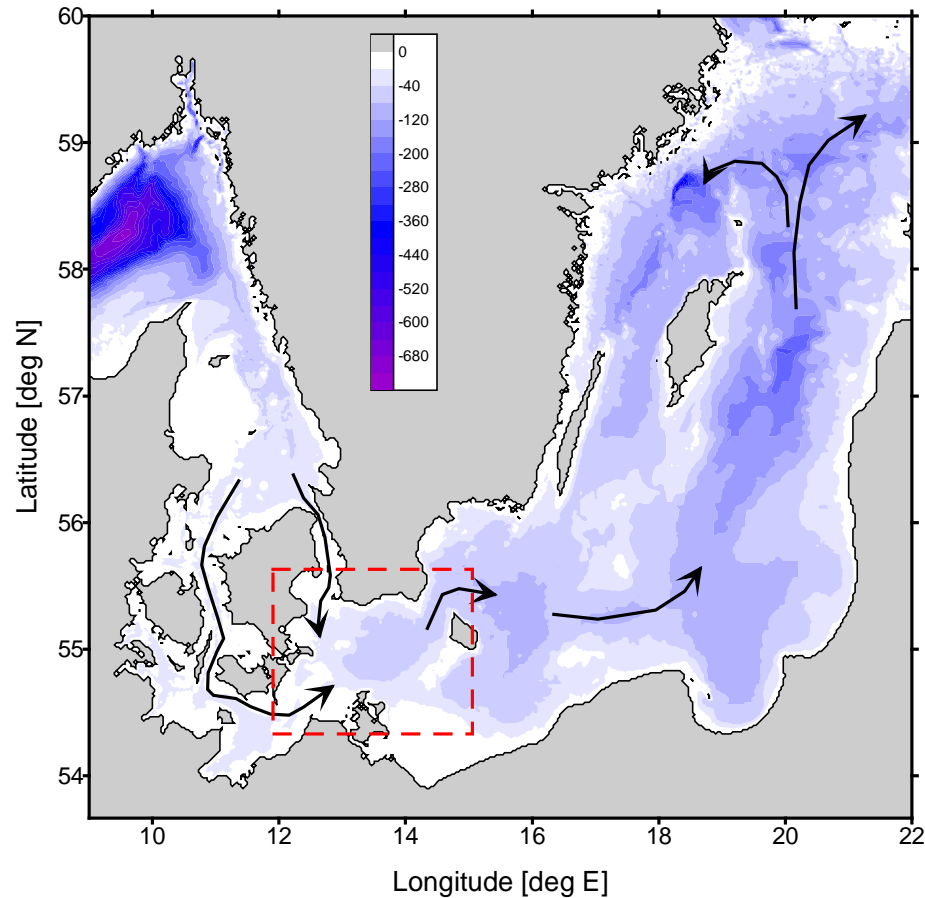
Ostsee - Sämtliche Nutzungen



BSH / M5212 - Stand: 27.05.2003

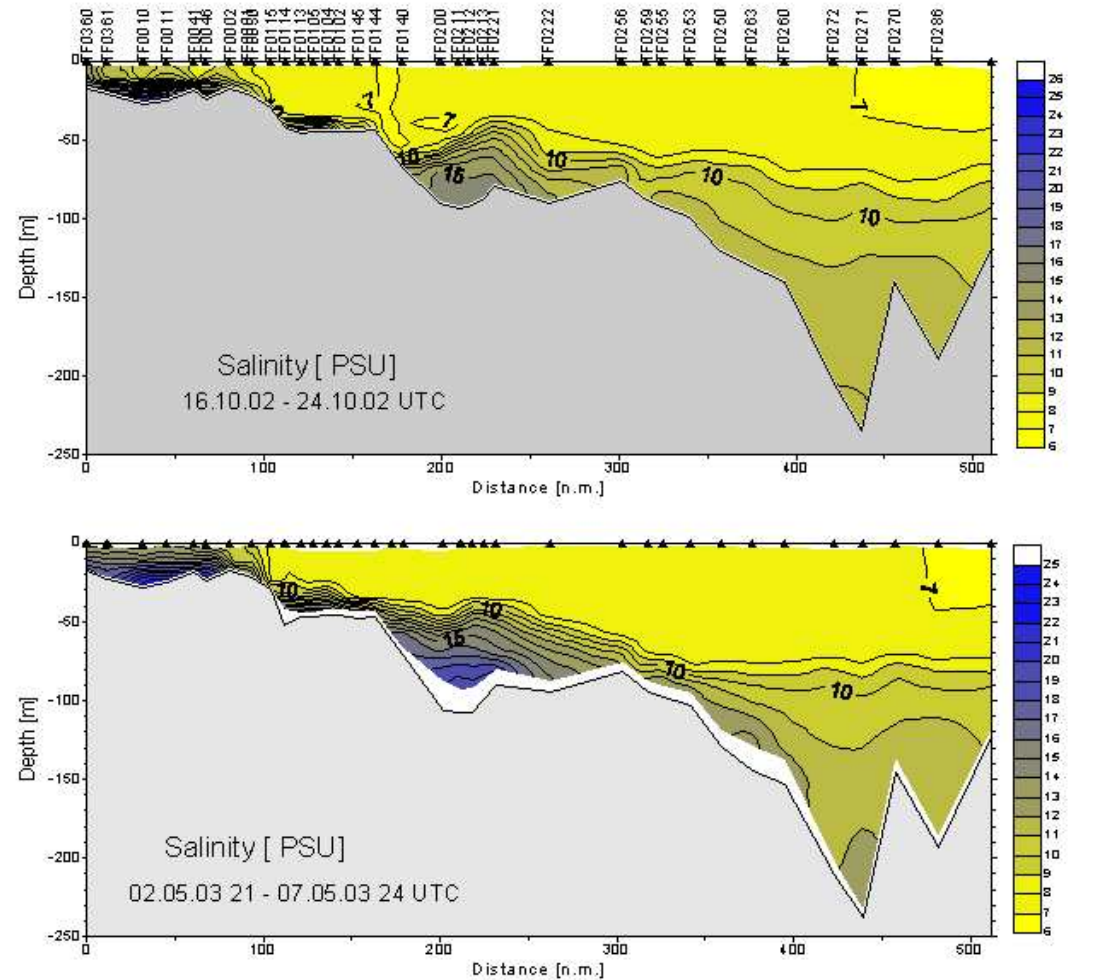
# How does the Baltic Sea work ?

Precipitation - evaporation + river runoff =  
outflow ( $\approx 15.000 \text{ m}^3/\text{s}$ )



For comparison: River Elbe outflow  $\approx 750 \text{ m}^3/\text{s}$ .

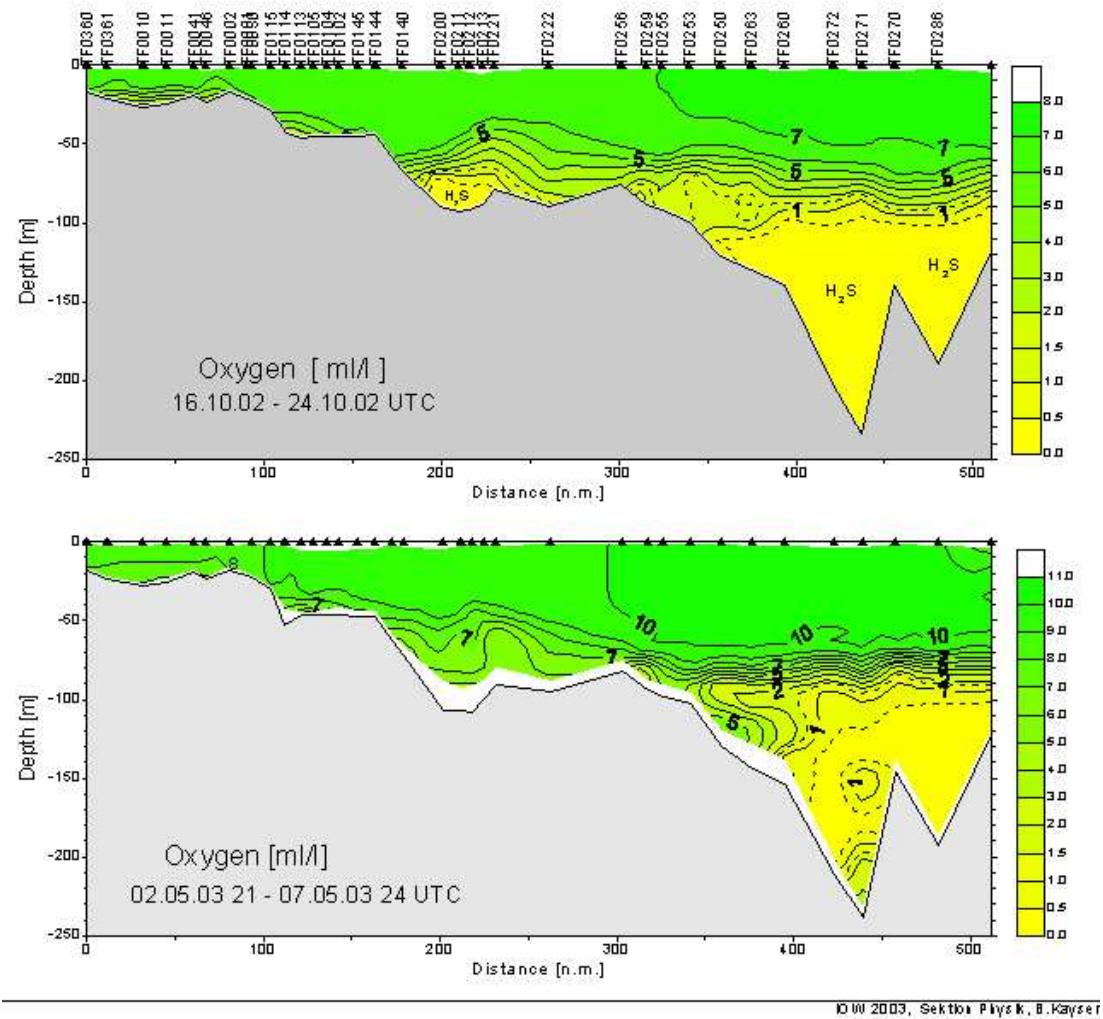
# Cross section: salt



IOW 2003, Sektor Physik, B. Kayser

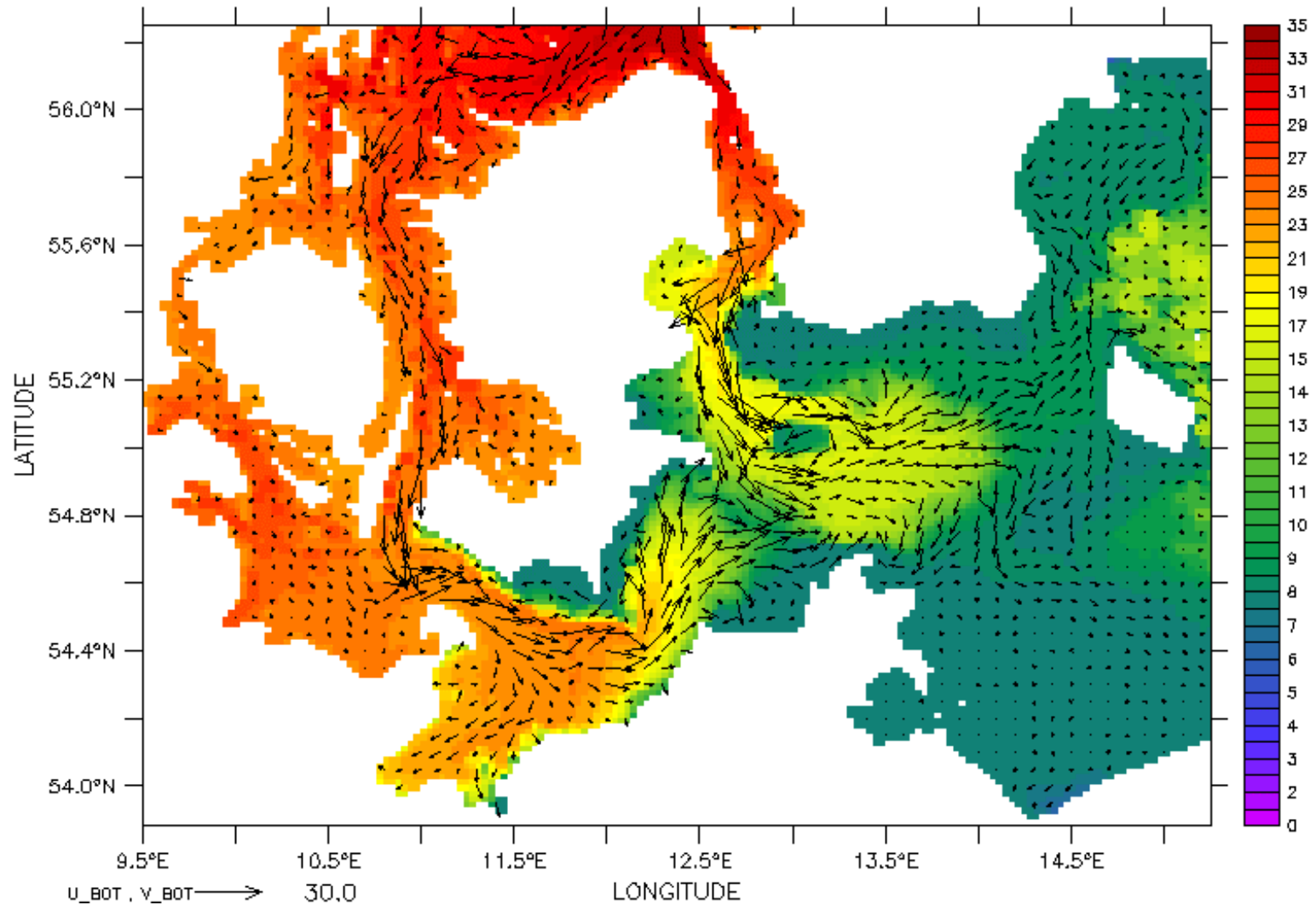
Data by Rainer Feistel, Uli Lass, and Günther Nausch (IOW)

# Cross section: O<sub>2</sub>

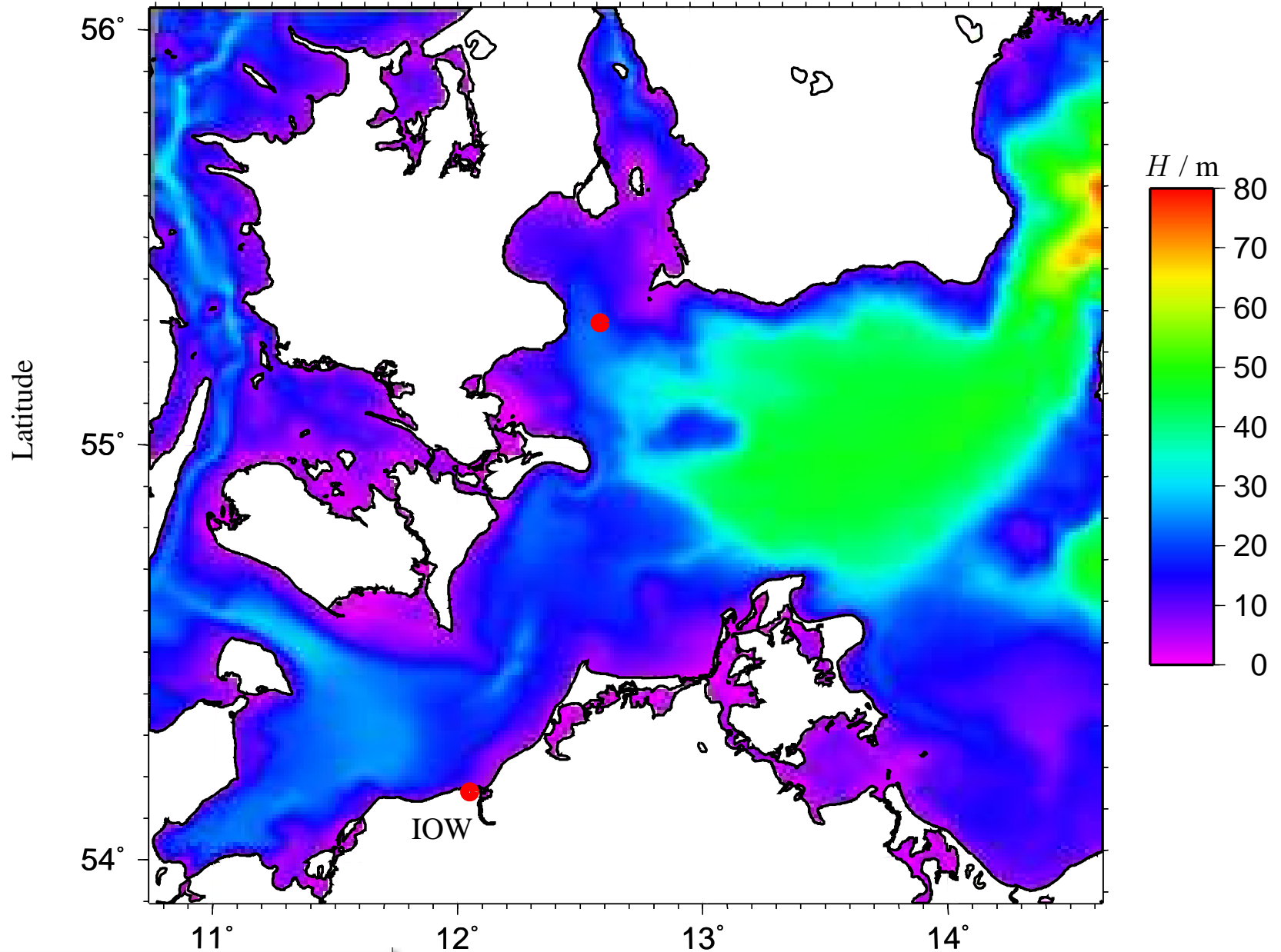


Data by Rainer Feistel, Uli Lass, and Günther Nausch (IOW)

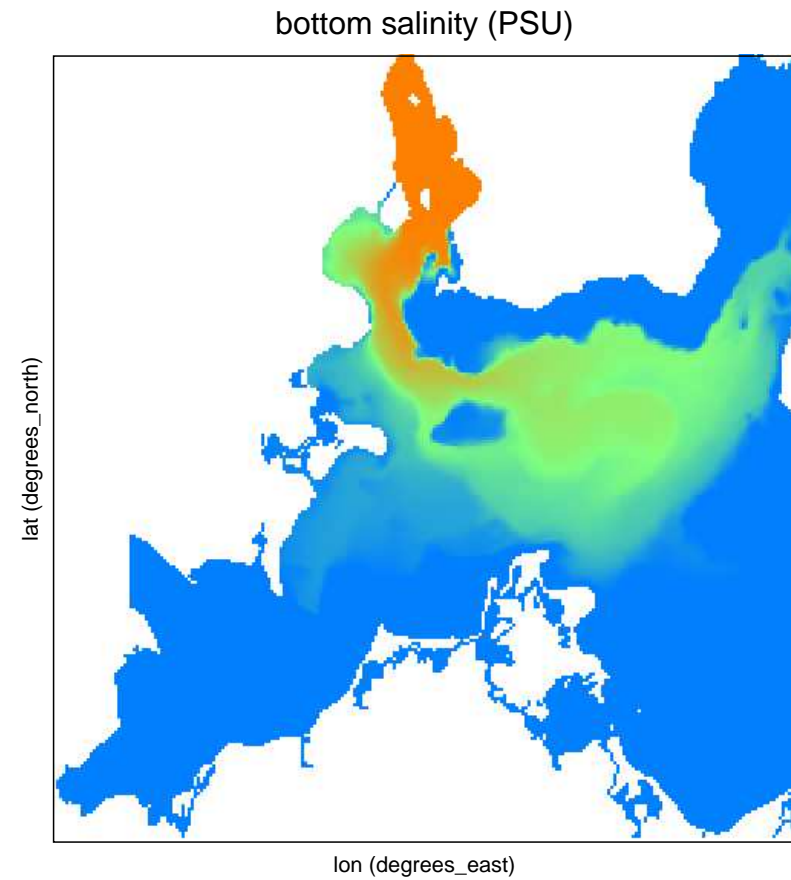
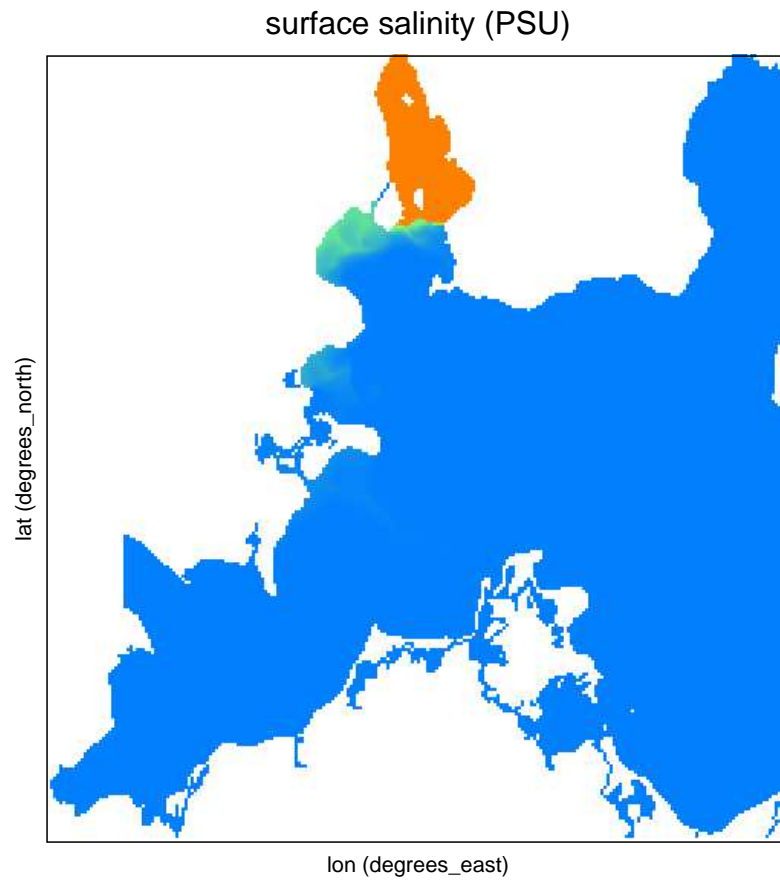
# Computersimulation: inflow



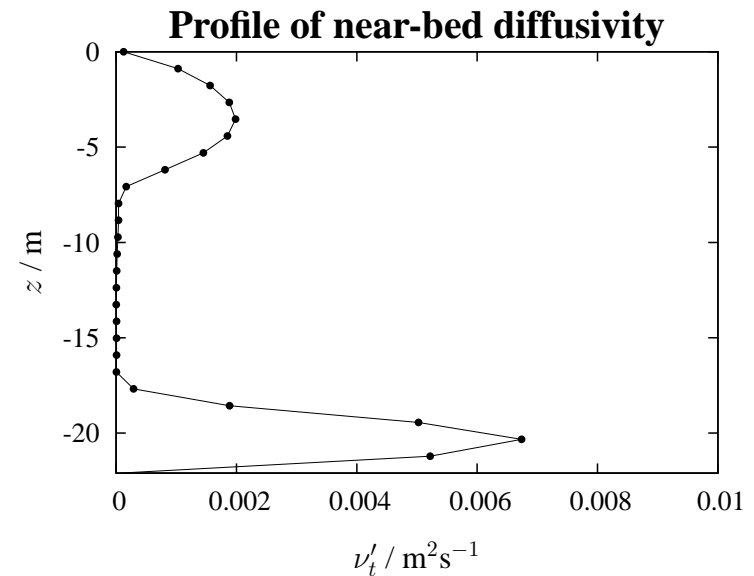
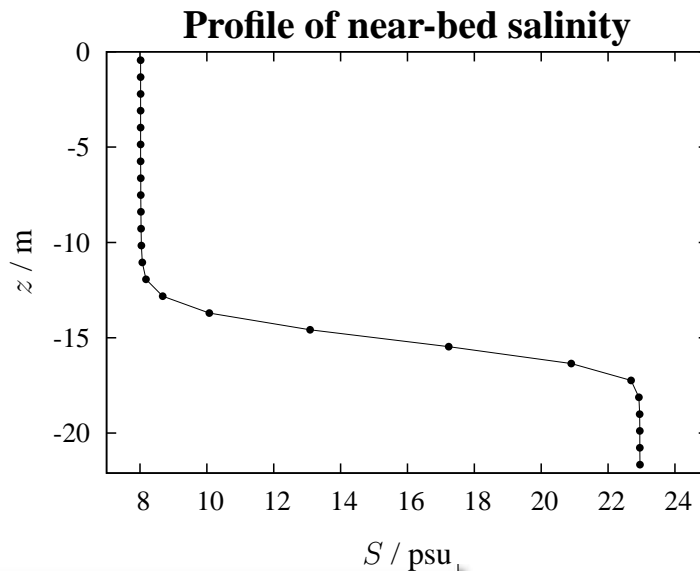
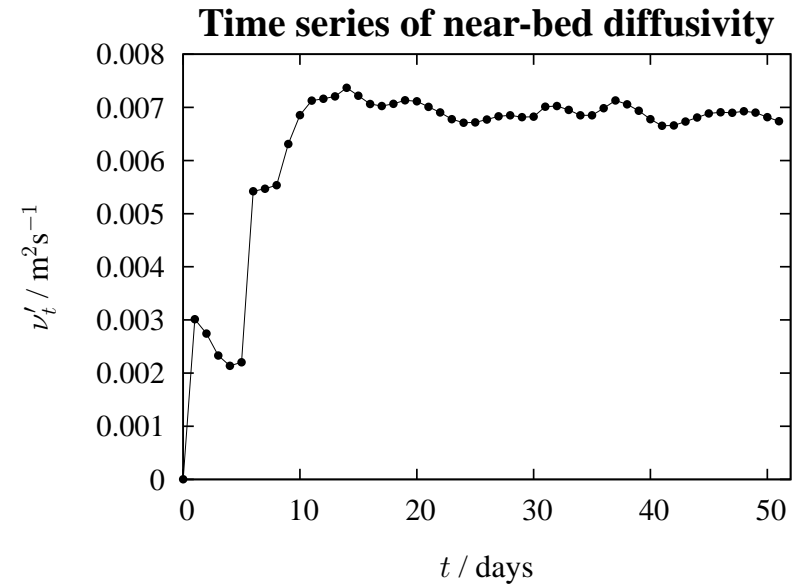
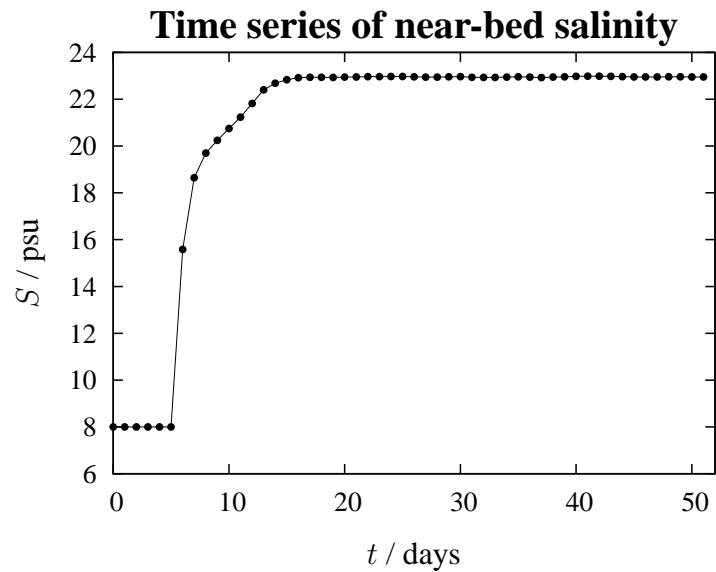
# Arkona Sea study



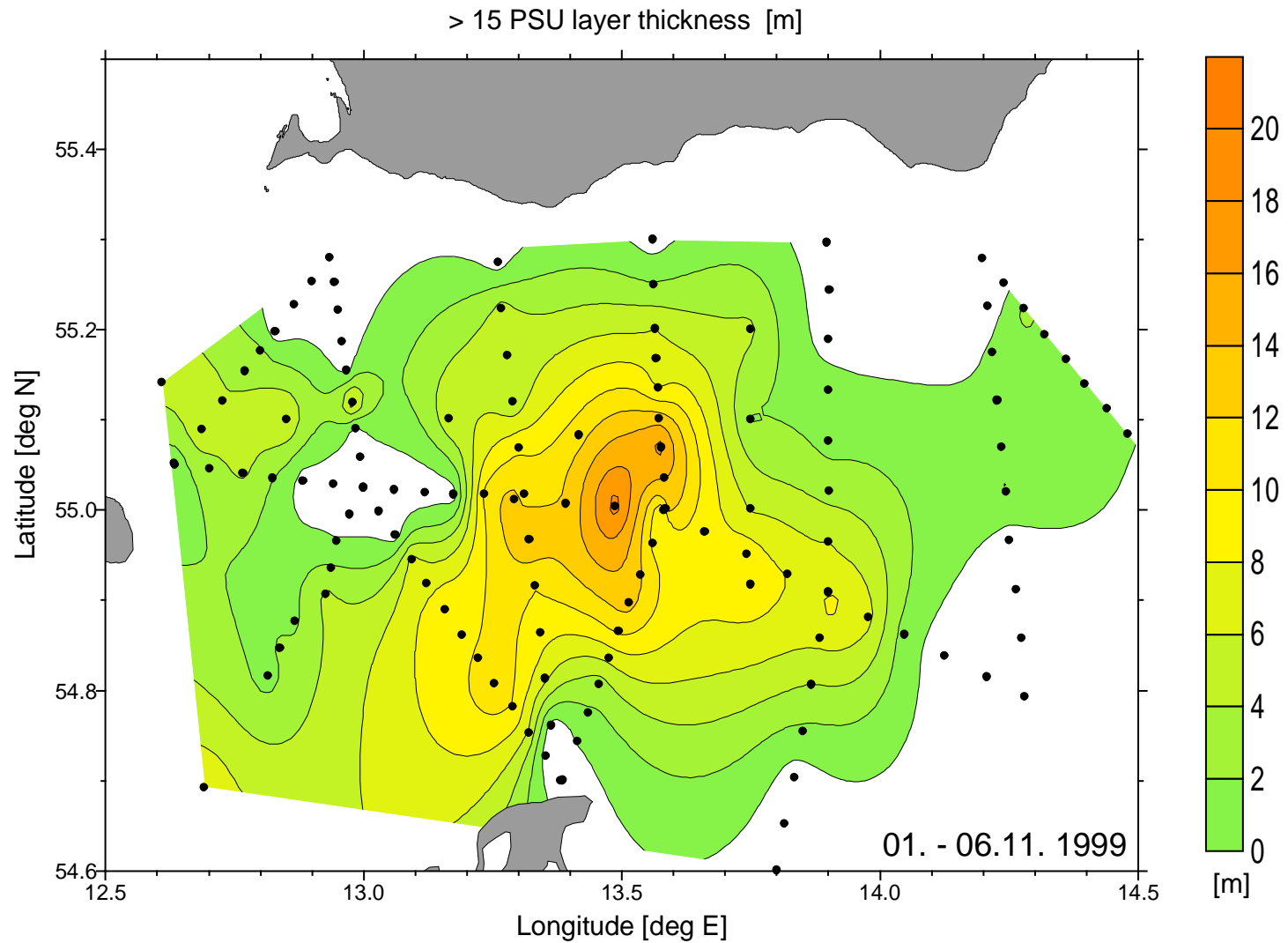
# Arkona Sea study



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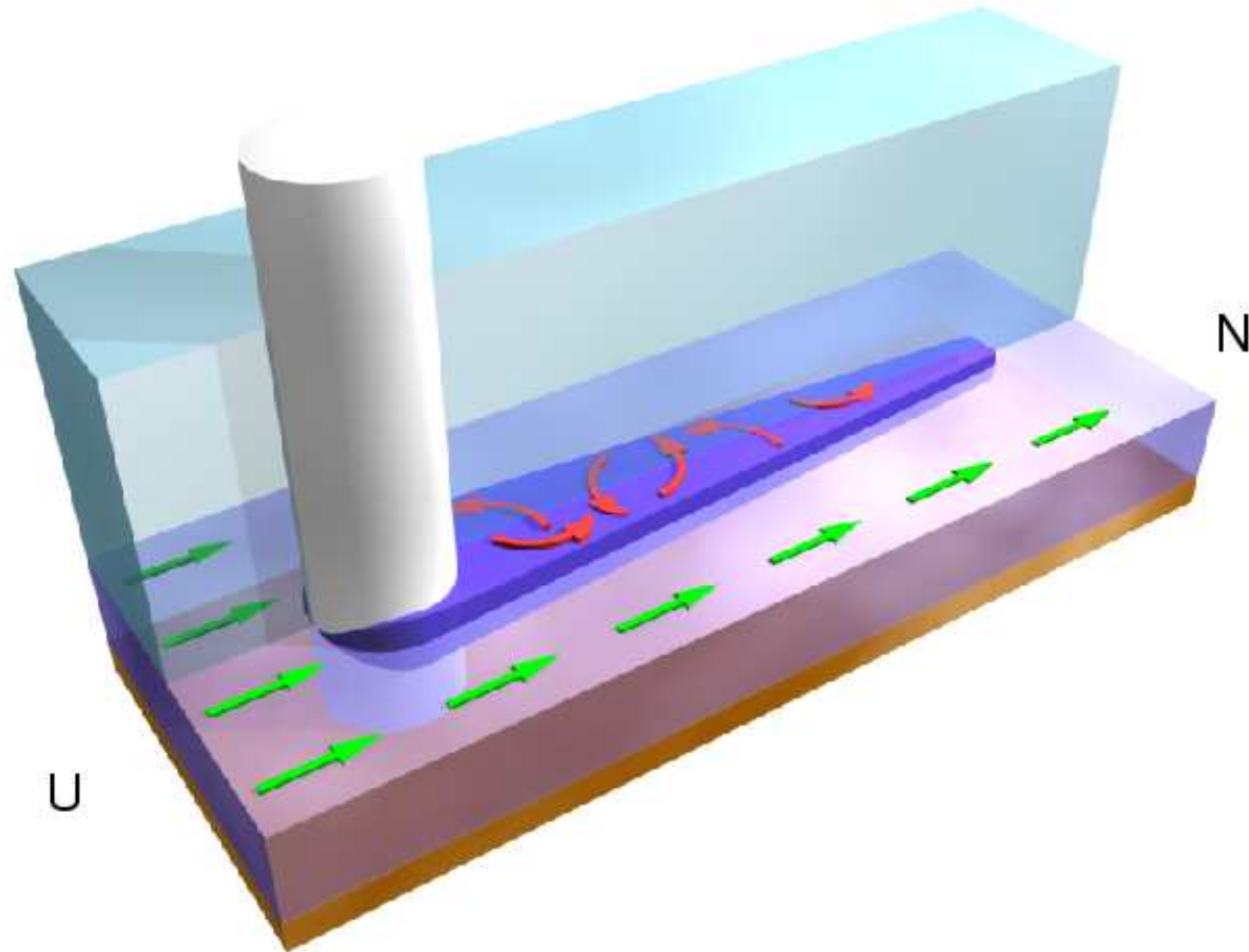


# Salty water: observed



Data by by Volker Mohrholz (IOW)

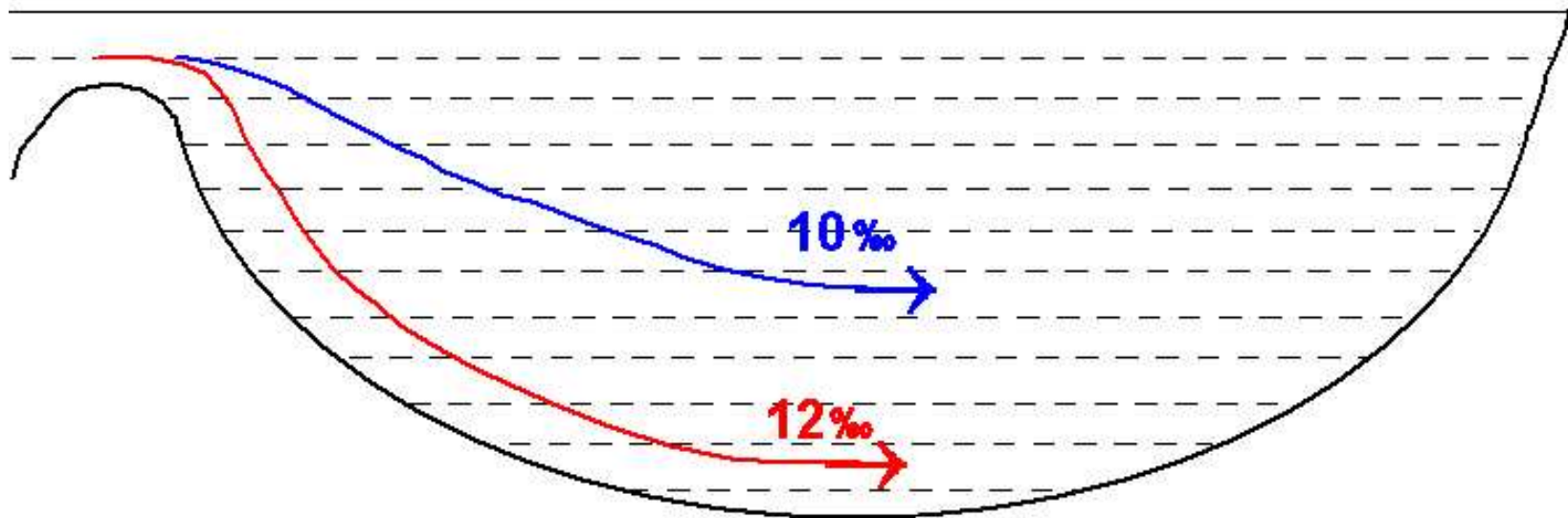
# Mixing at piles



Graphics by Jan Donath (IOW)

# Consequence

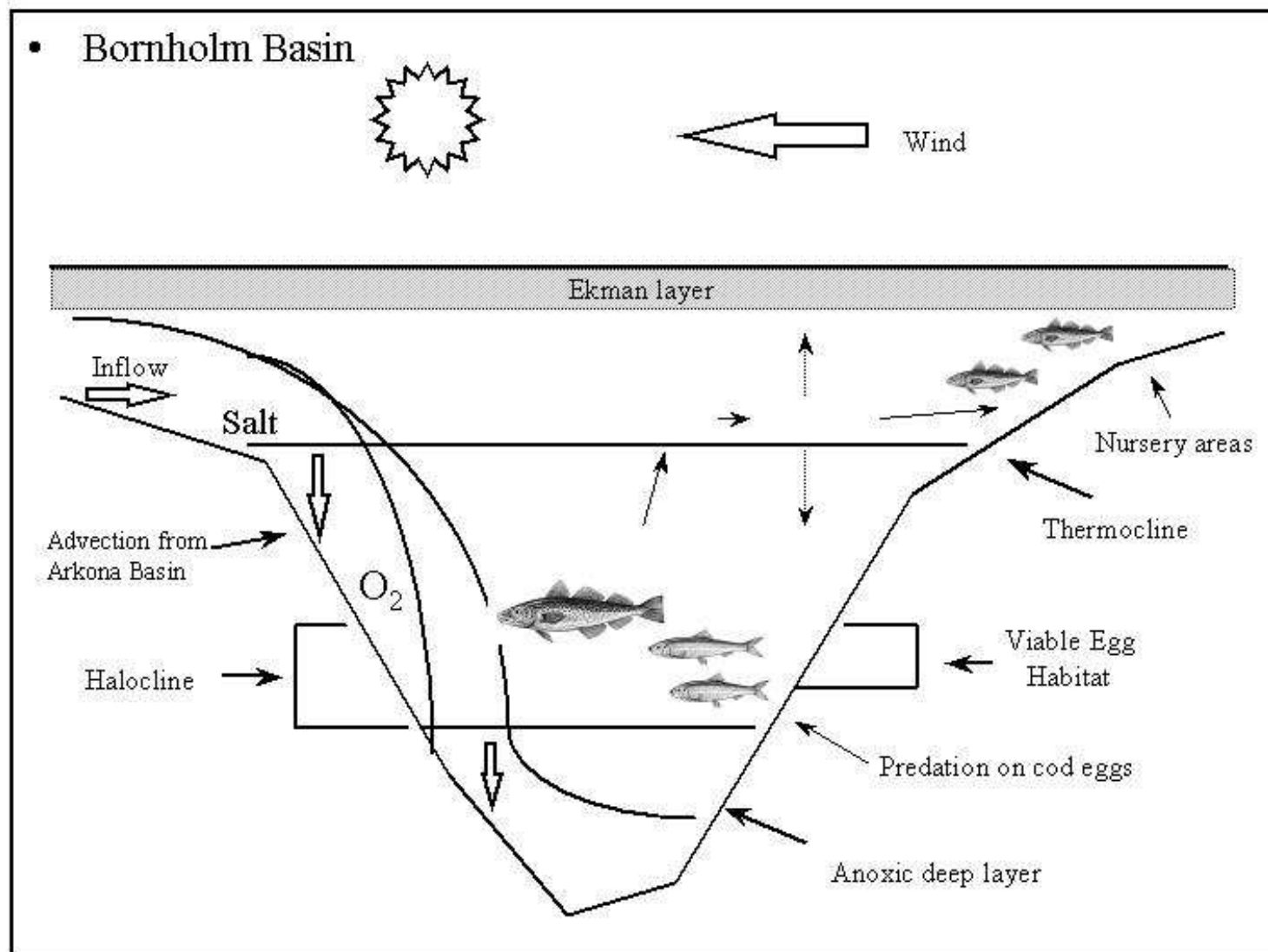
- **Diluted water is sandwiched less deep into the basins of the Baltic Sea.**
- **The oxygen of the deep water is renewed less frequently.**



# So what ... ?

- **Cod eggs are floating in the region of the 13 ppt isopycnal and need an oxygen concentration of  $> 2$  ml/l.**
- **With the ventilation of the deeper waters decreasing, the oxygen concentration is falling below that threshold value.**

# Floating cod eggs



# Conclusions

- Offshore wind farms might indeed have an impact on the dynamics of the whole Baltic Sea.
- It will be a scientific challenge to quantify these impacts and to help finding wind farm locations with low environmental impact.
- The construction of a few wind farms of limited extent will help us to study the general environmental impact.

