

# Transport and Mixing in the Arkona Sea

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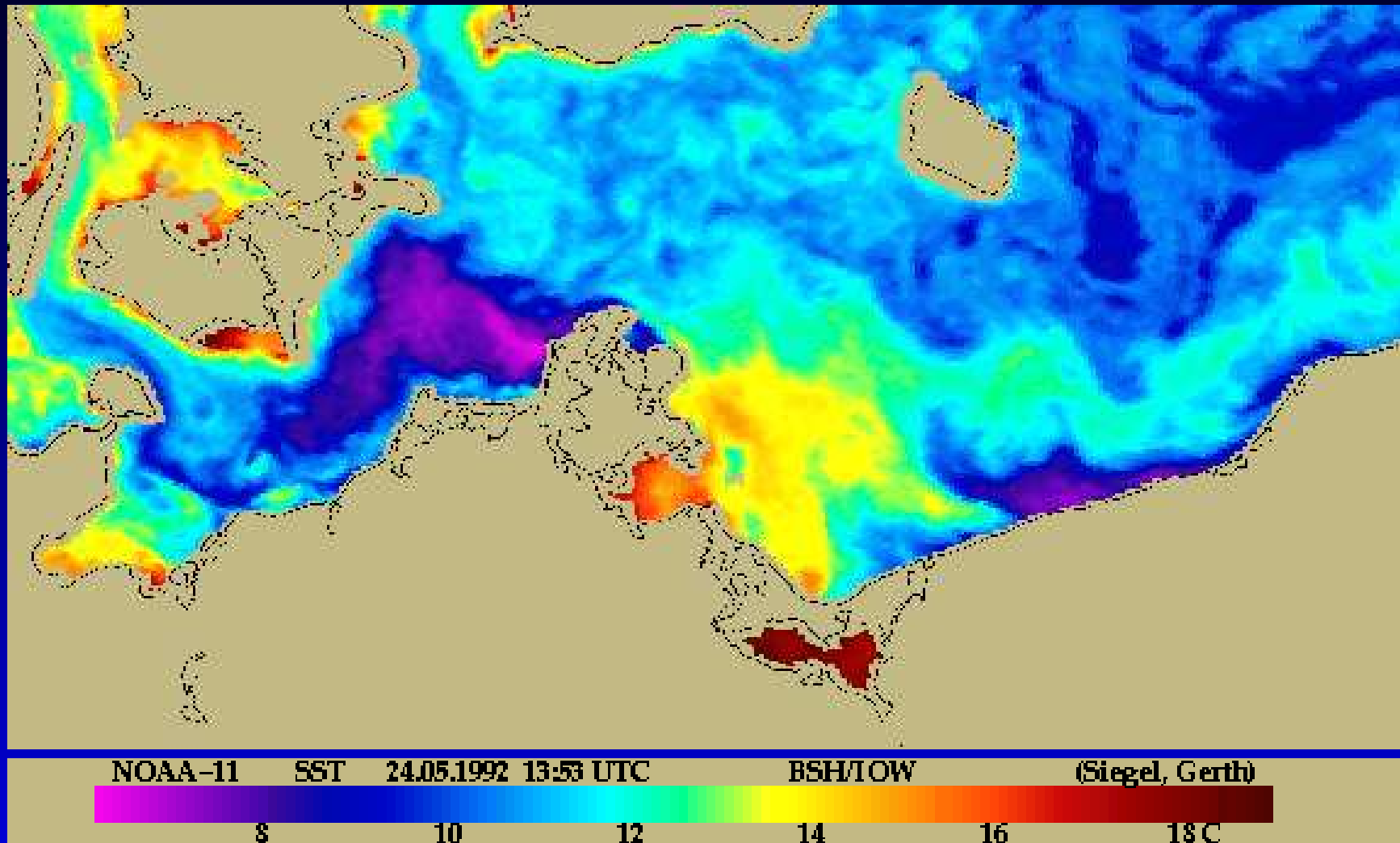
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- 2. Bolding & Burchard Hydrodynamics, Denmark**

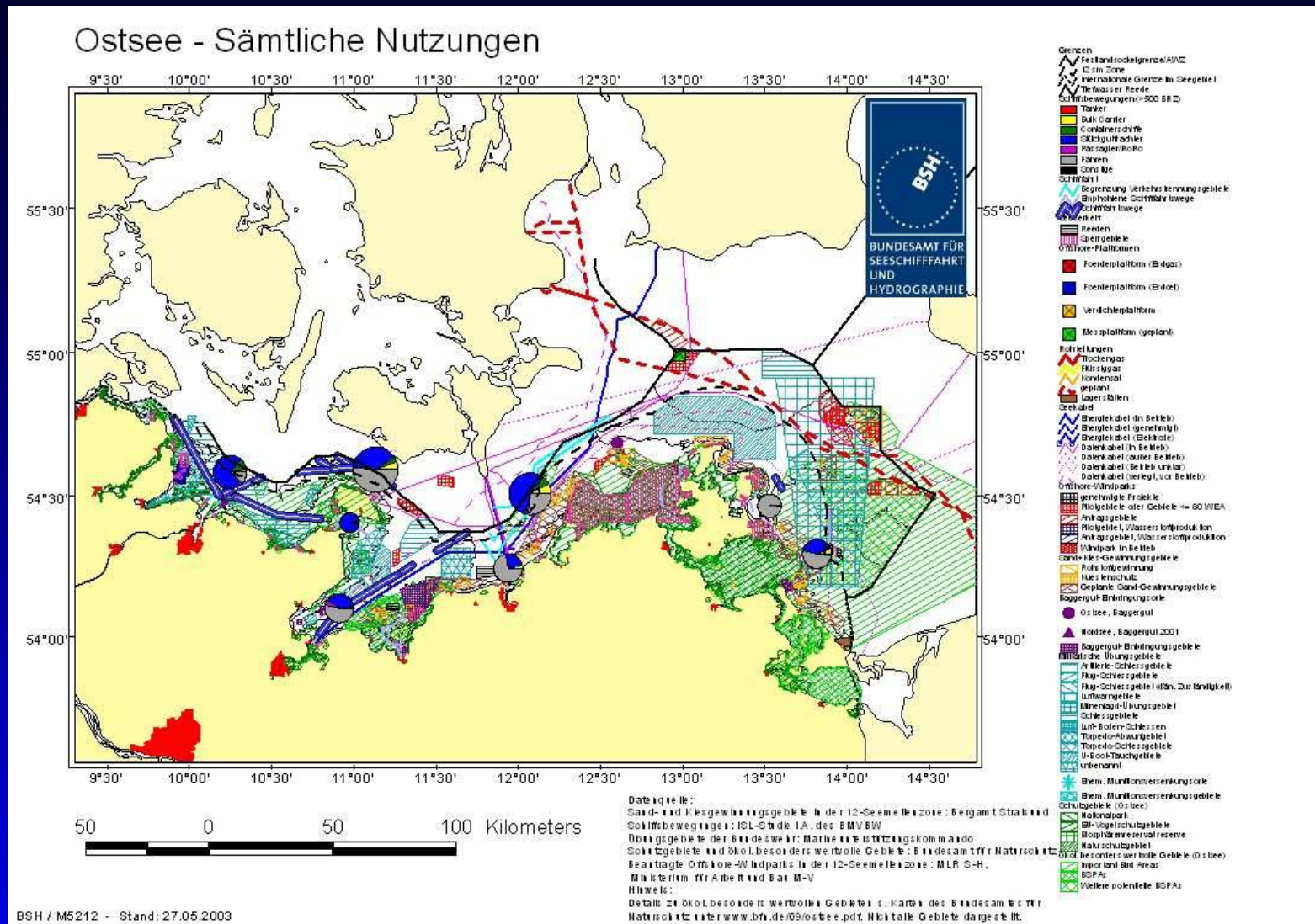
# Contents

- Potential problems with off-shore wind farms in Arkona Sea
- The QuantAS project cluster (funding requested)
- Along-slope bottom plume (geostrophic balance)
- Downslope bottom plume (pressure-friction balance)
- Idealised simulations for Arkona Sea
- Comparison to recent observations

# Arkona Sea from space

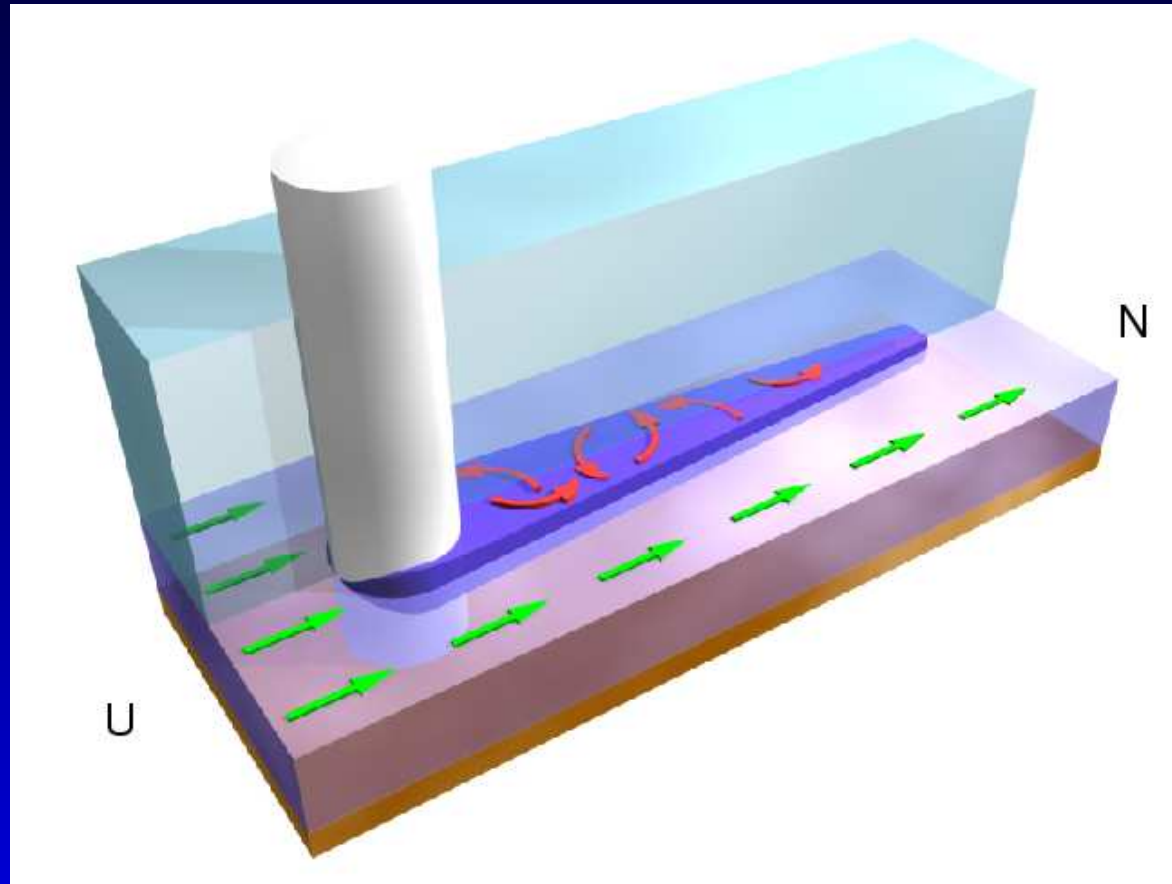


# Conflict of interests



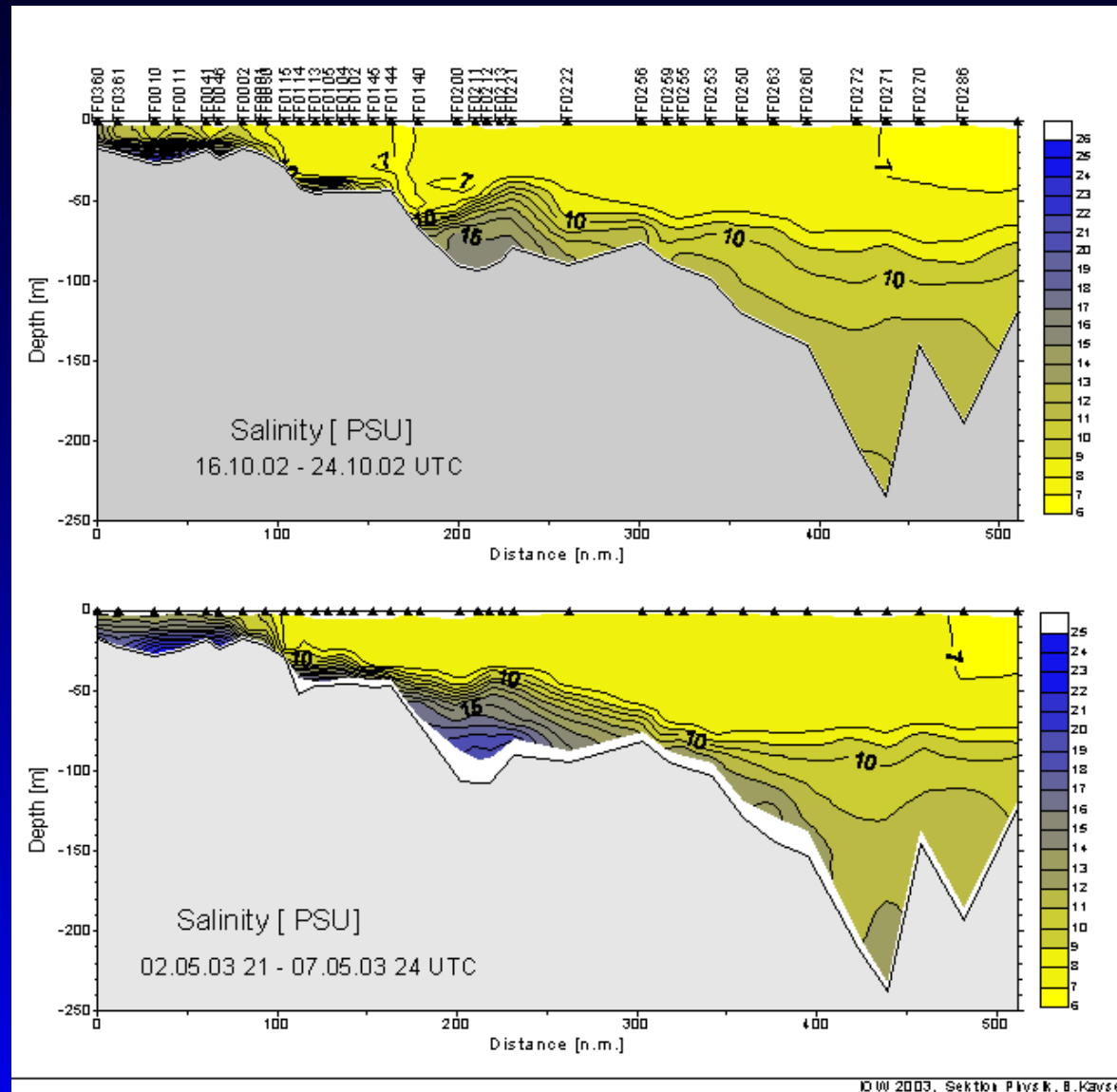
# Offshore Constructions

Additional *user* conflict due to additional mixing by  
Offshore Wind Farms ?



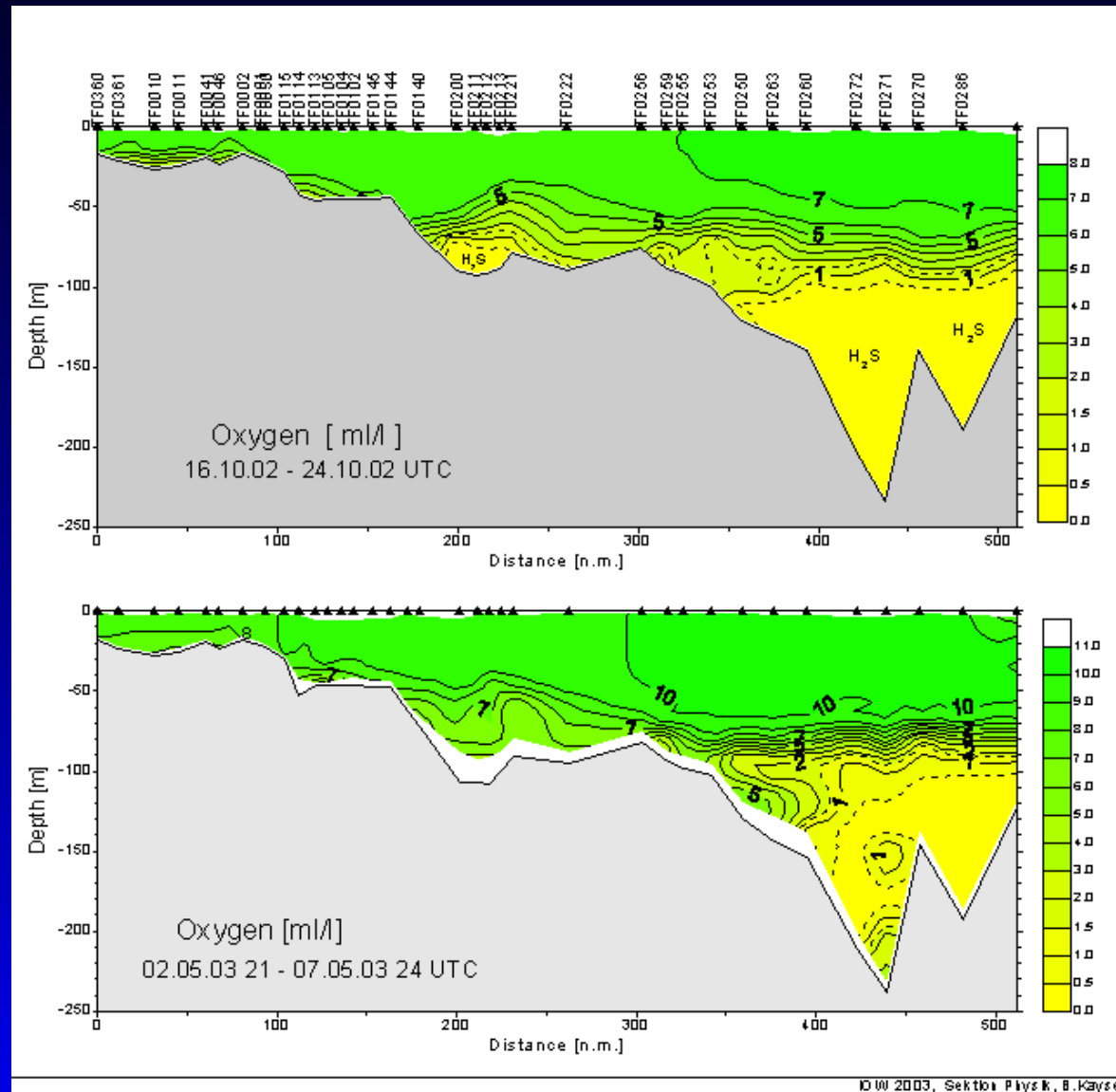
Graphics by Jan Donath (IOW)

# Baltic cross section: salt



IOW 2003, Sektion Physik, B. Kayser

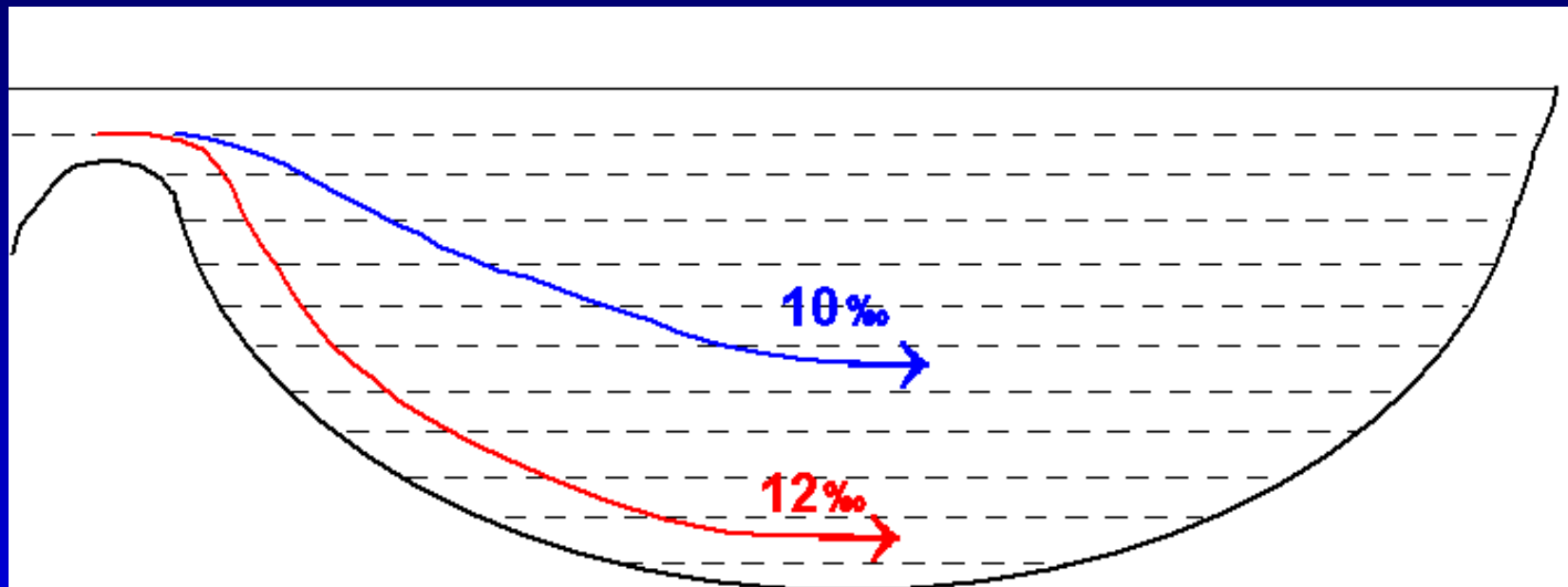
# Baltic Sea cross section: O<sub>2</sub>



IOW 2003, Sektion Physik, B. Kayser

# Consequence of extra mixing

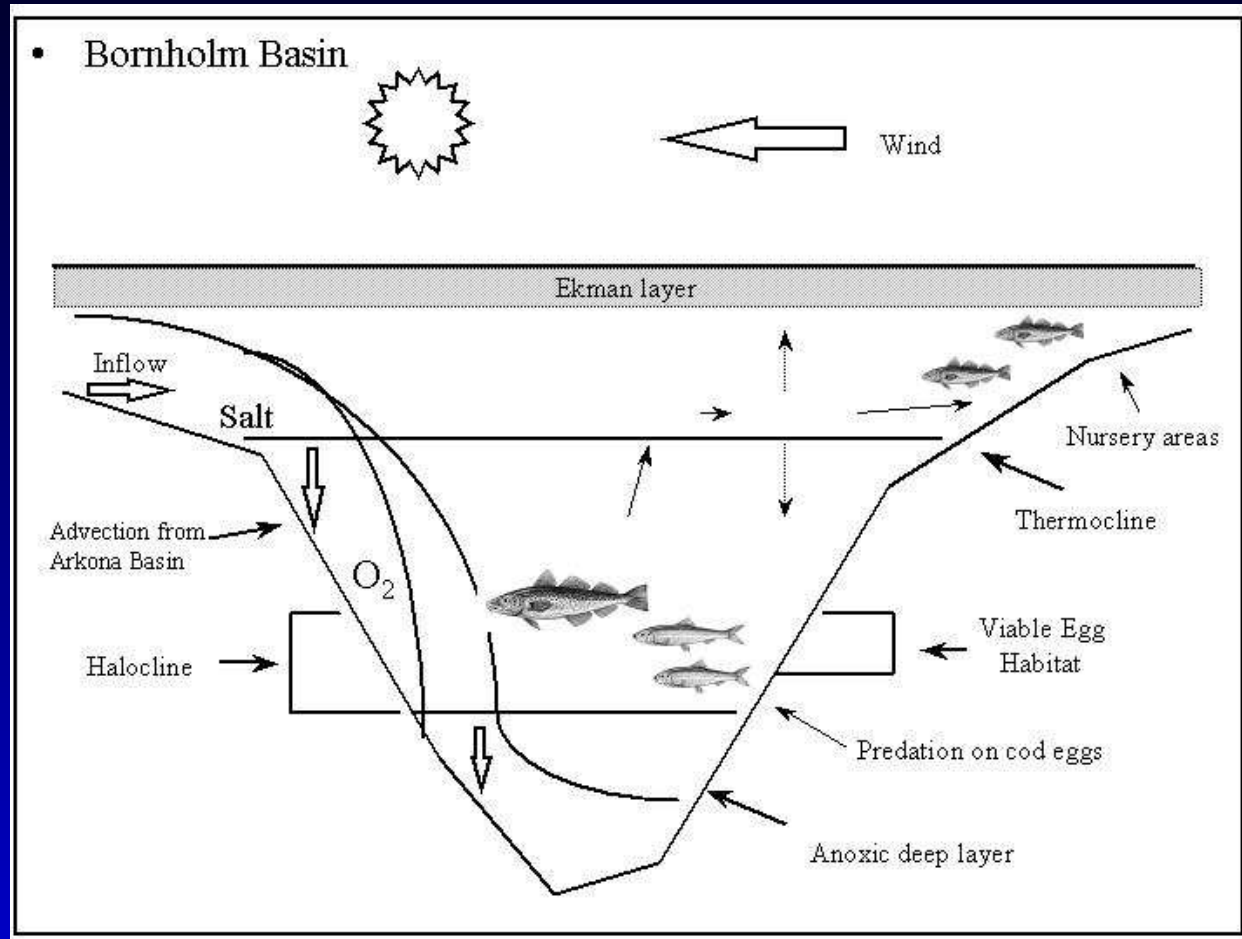
- Diluted bottom water sandwiches less deep into the basins of the Baltic Sea.
- The oxygen of the intermediate and deep waters will be renewed less.



# So what ... ?

- **Cod eggs float in the area of the 13 ppt isopycnal and need an oxygen concentration of  $> 2$  ml/l.**
- **In case of reduced ventilation, the oxygen concentration may sink below this level.**

# Floating cod eggs



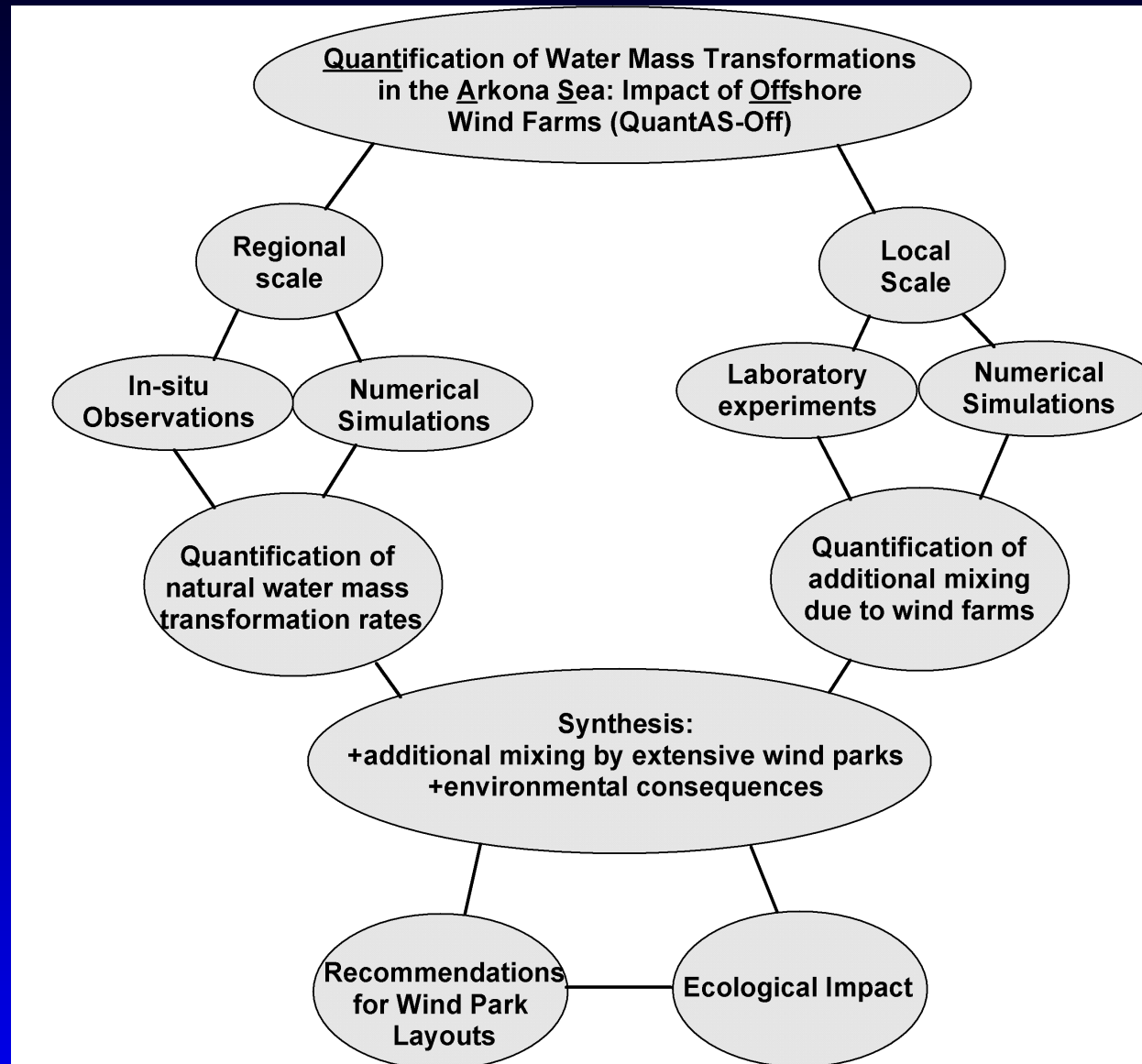
Graphics from Rolf Schneider, IOW

# QuantAS-Consortium

For the purpose of estimating the effect of offshore wind farms on the mixing in the Arkona Sea, the QuantAS (Quantification of Water Transformation Processes in the Arkona Sea) has been built, with members from Denmark, Sweden, Poland and Germany.

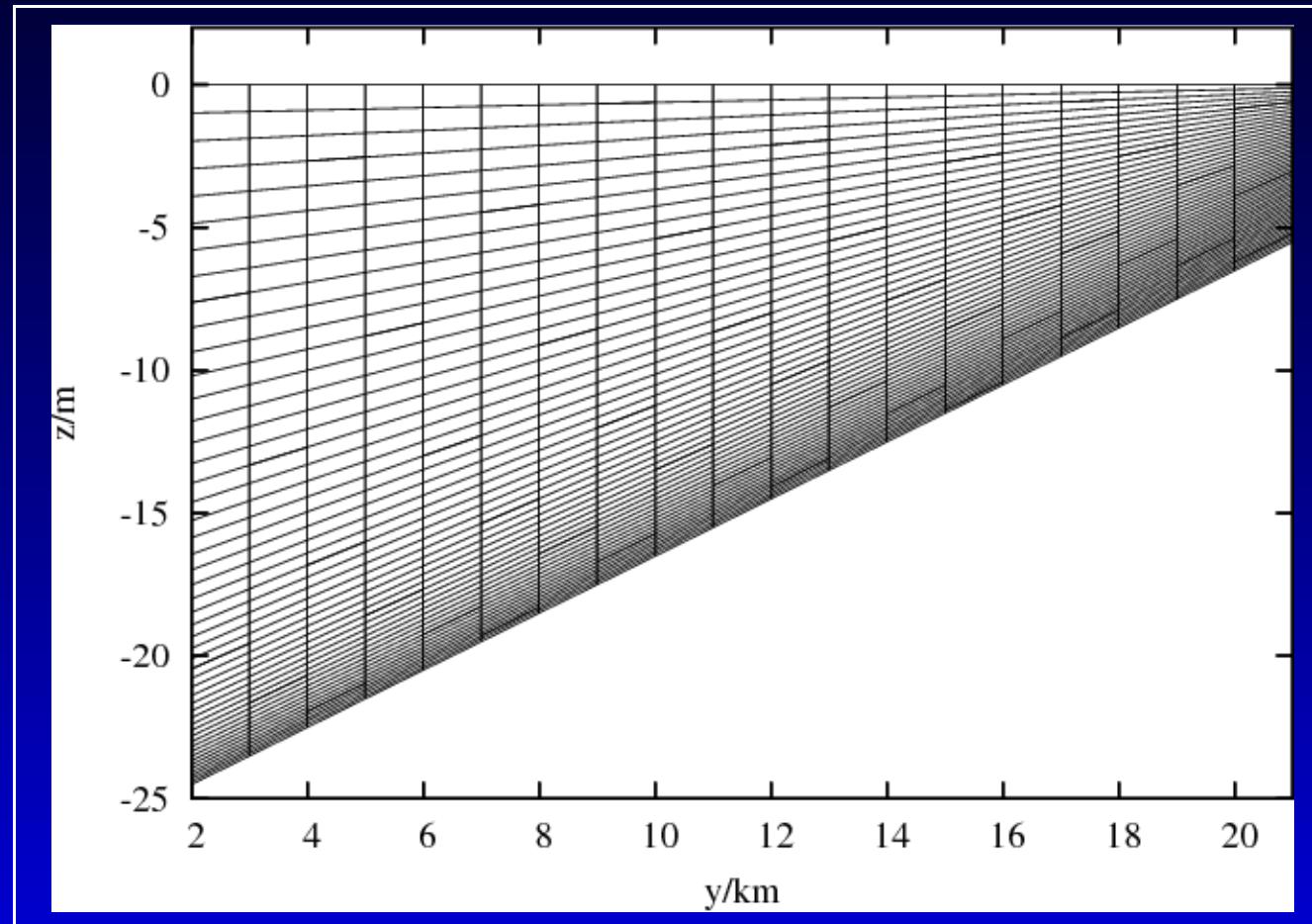


# QuantAS structure



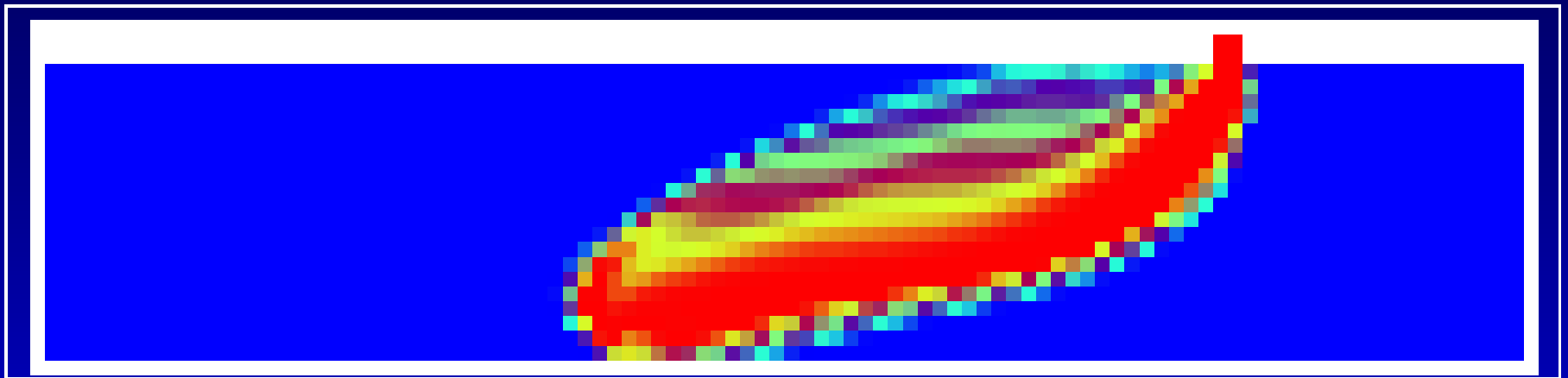
# Along-slope flow

## Downslope grid



# Along-slope flow

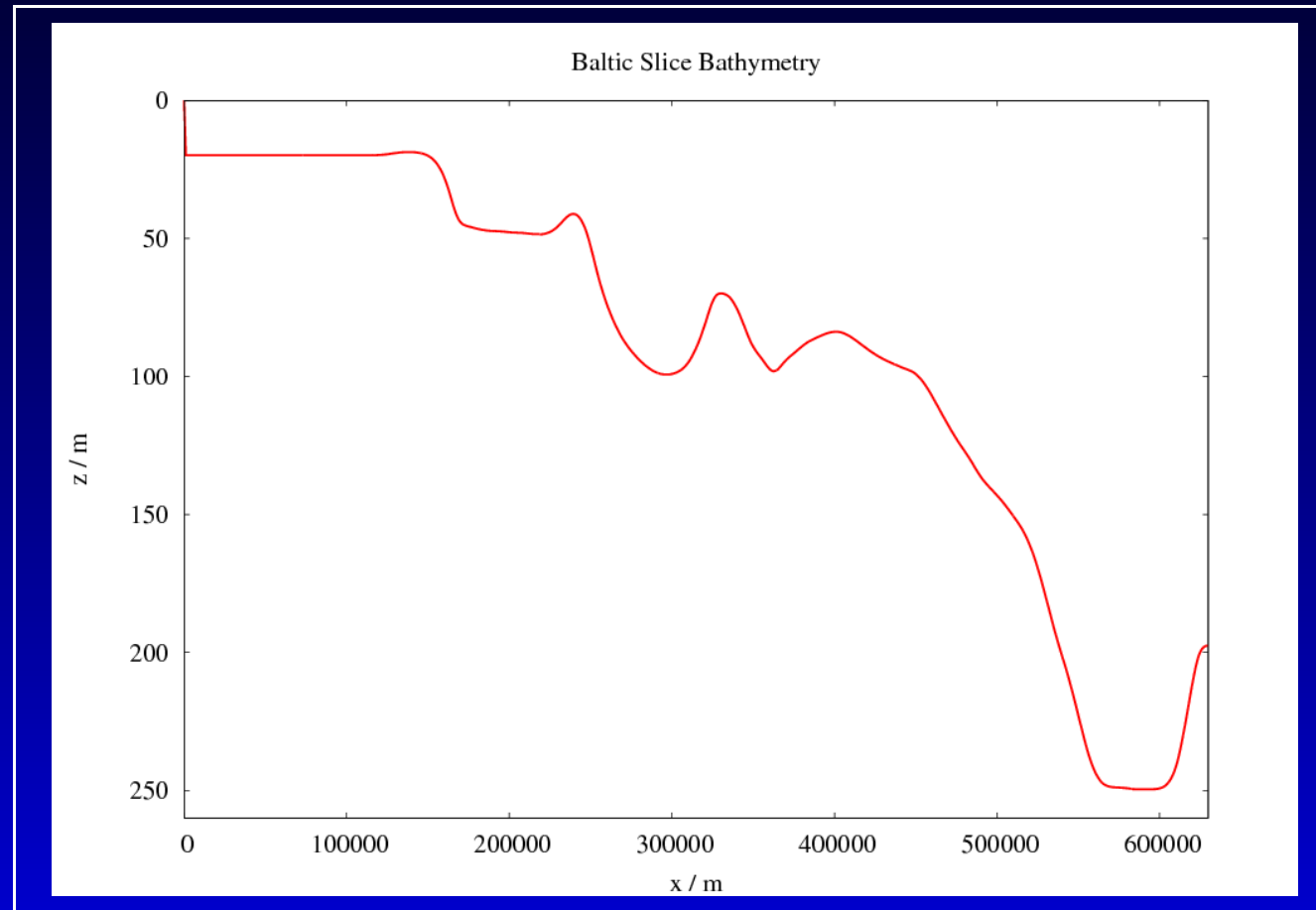
Bed salinity after 1 day (min: 8 psu, max: 25 psu)



(Look at animation)

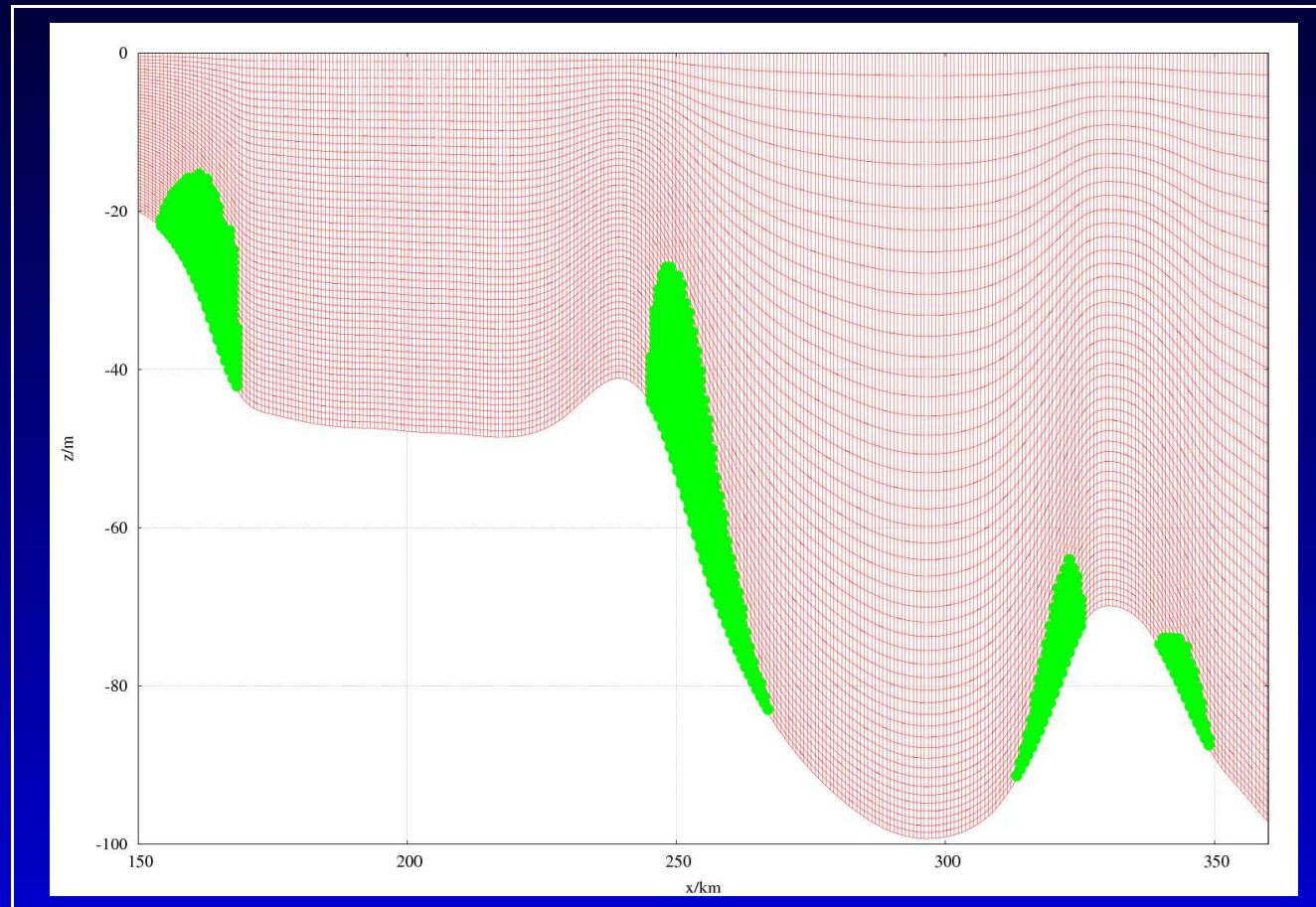
# Down-slope flow

As initial condition, the left part will be filled with salty water



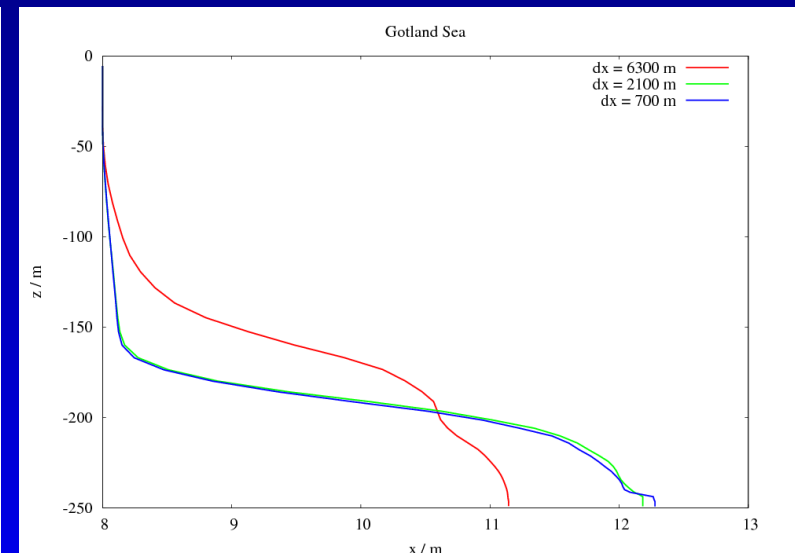
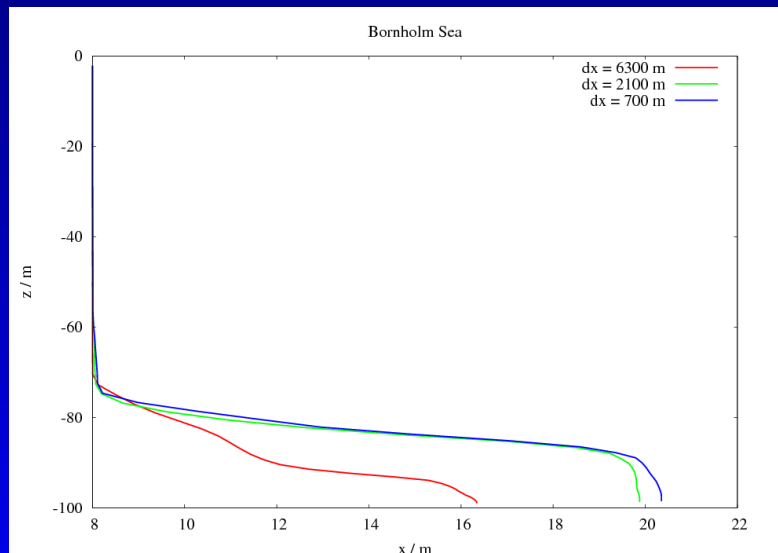
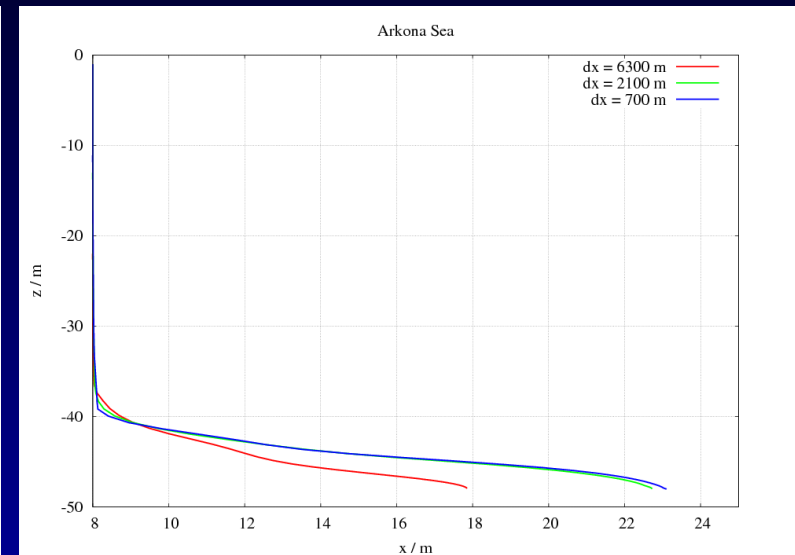
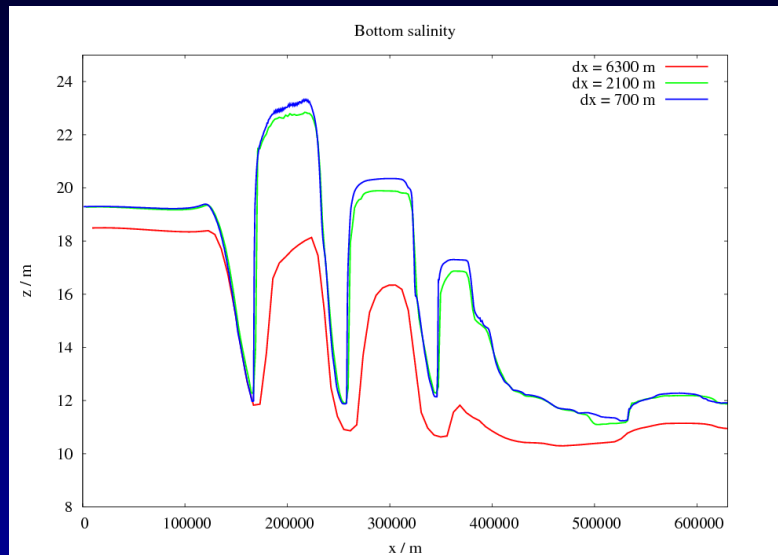
# Down-slope flow

Part of high-resolution grid with HHC violations marked in green

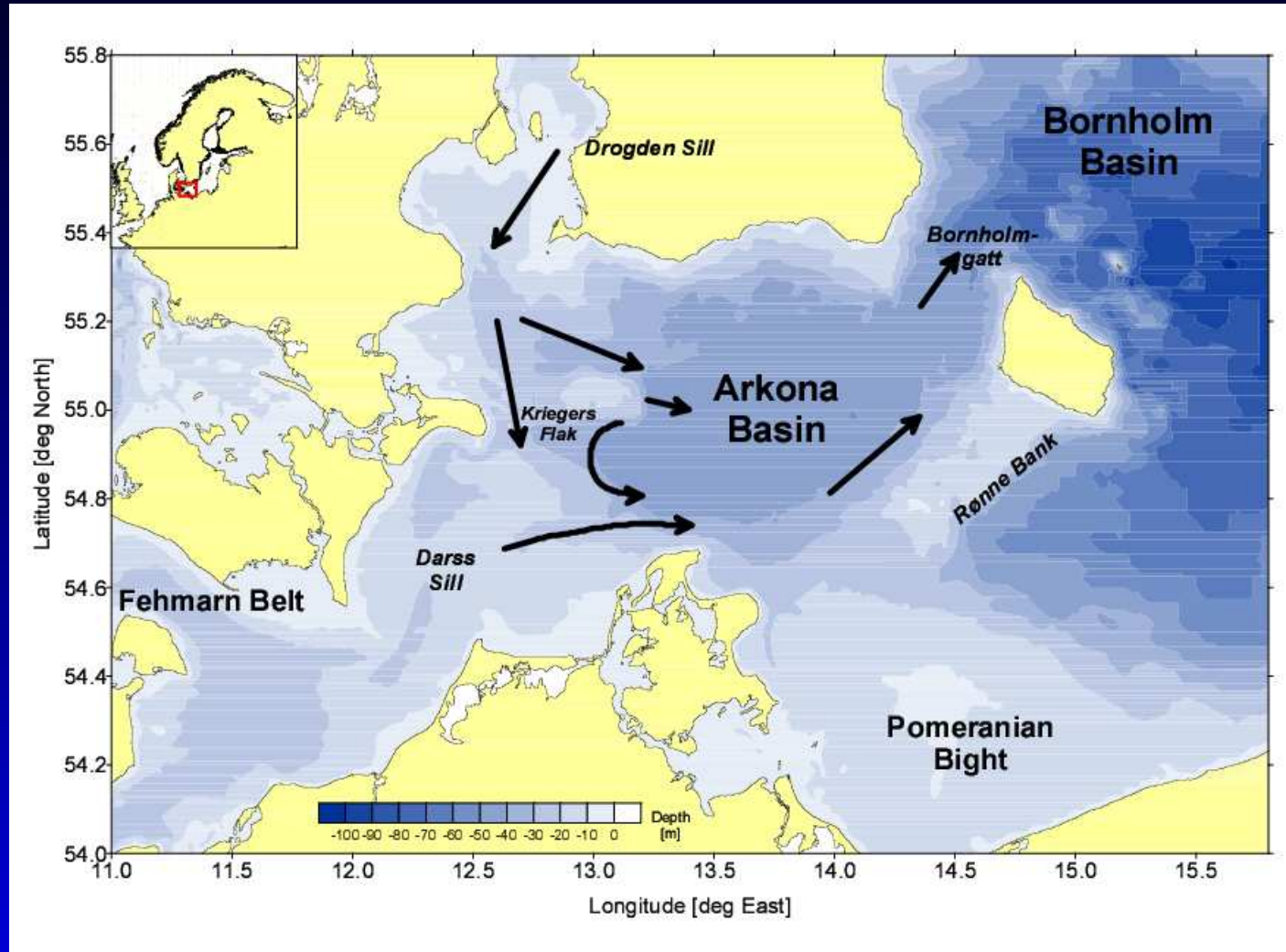


# Down-slope flow: salt profiles

Horizontal & vertical salt profiles after 1 month of inflow



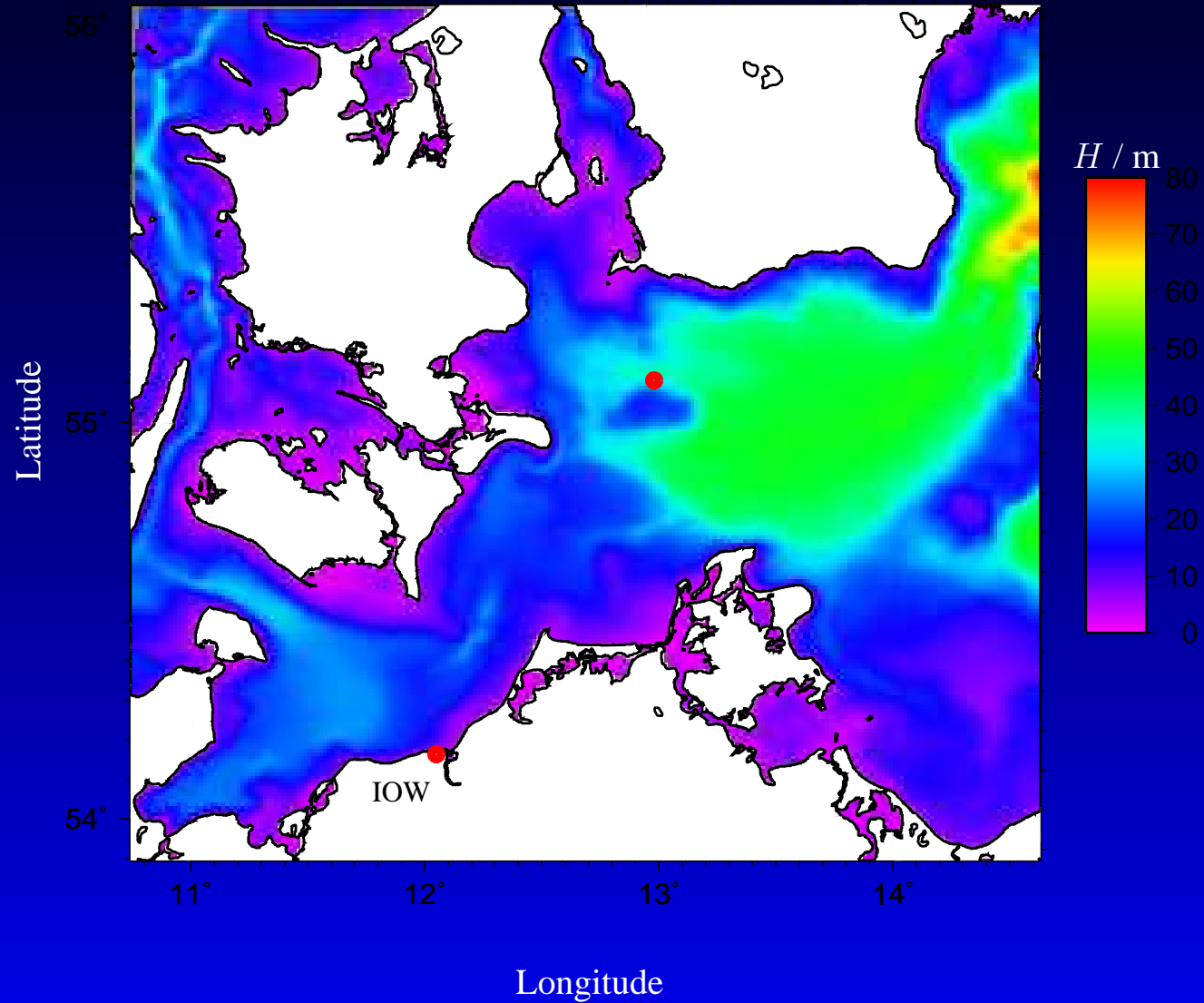
# Arkona Sea



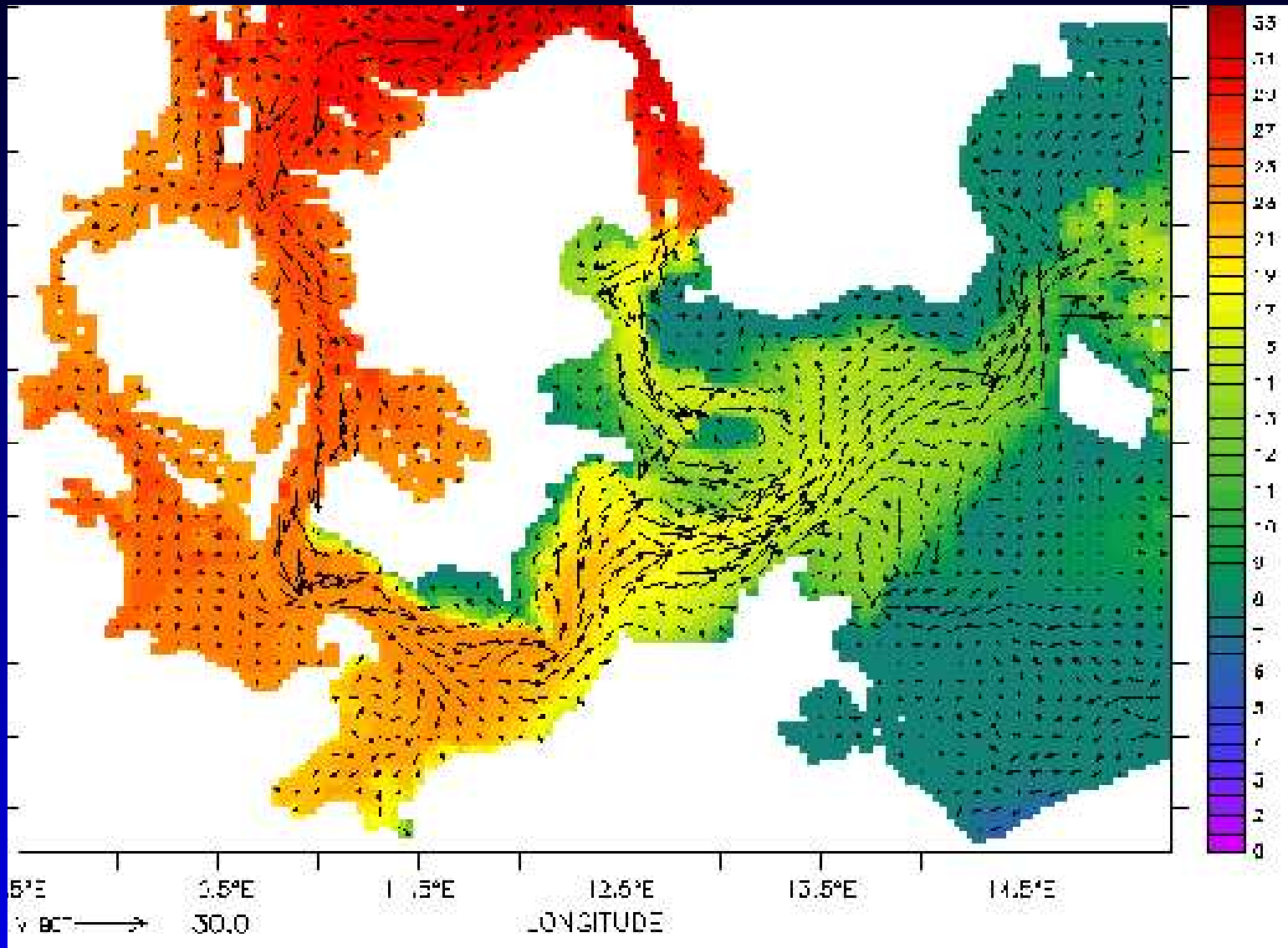
Graphics by Volker Mohrholz, IOW

# Arkona Sea

Model bathymetry



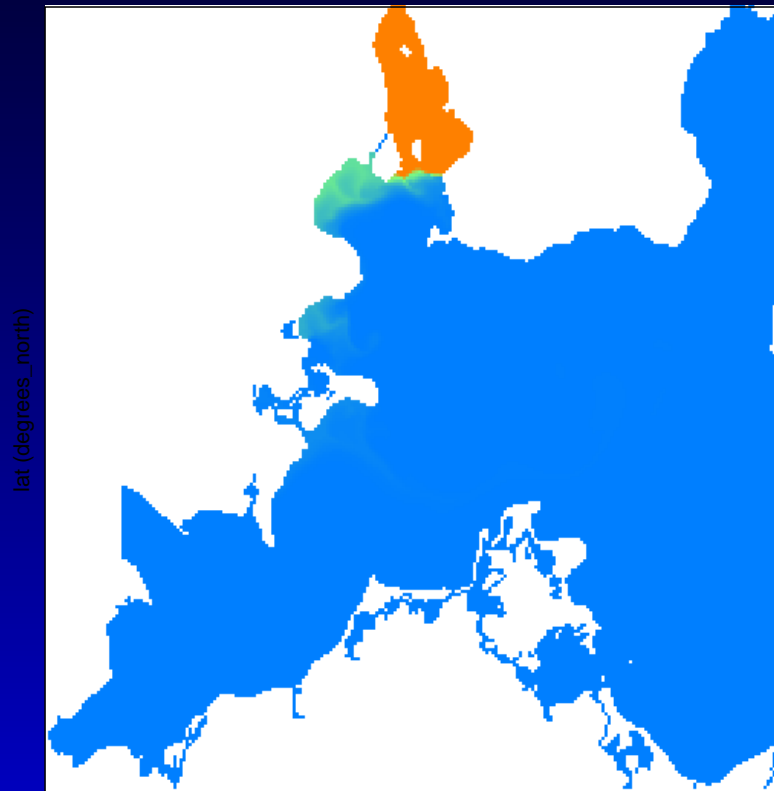
# Computer simulation (MOM)



# Arkona Sea

Surface salinity (8-25 psu)

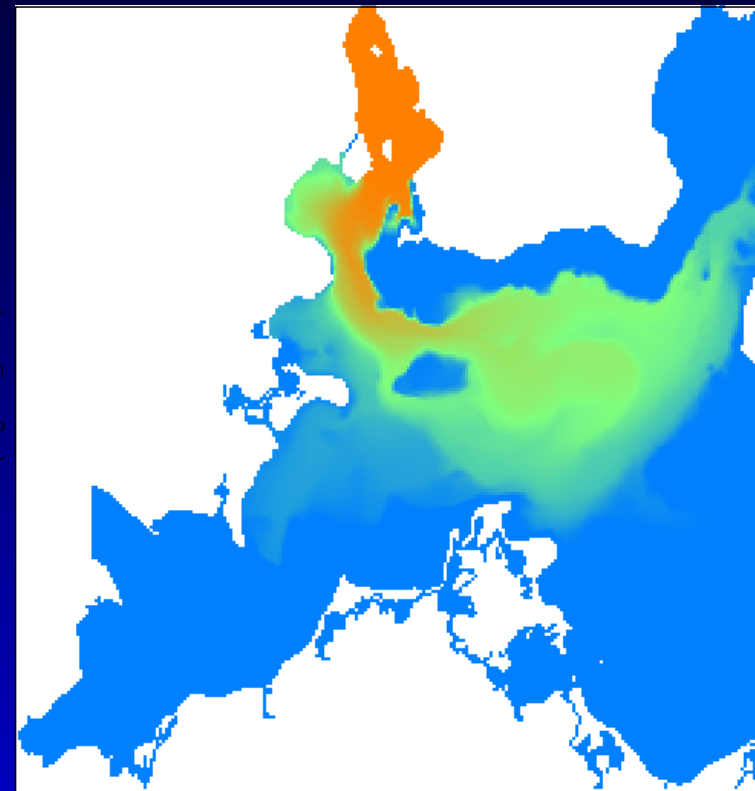
surface salinity (PSU)



lon (degrees\_east)

Bottom salinity (8-25 psu)

bottom salinity (PSU)

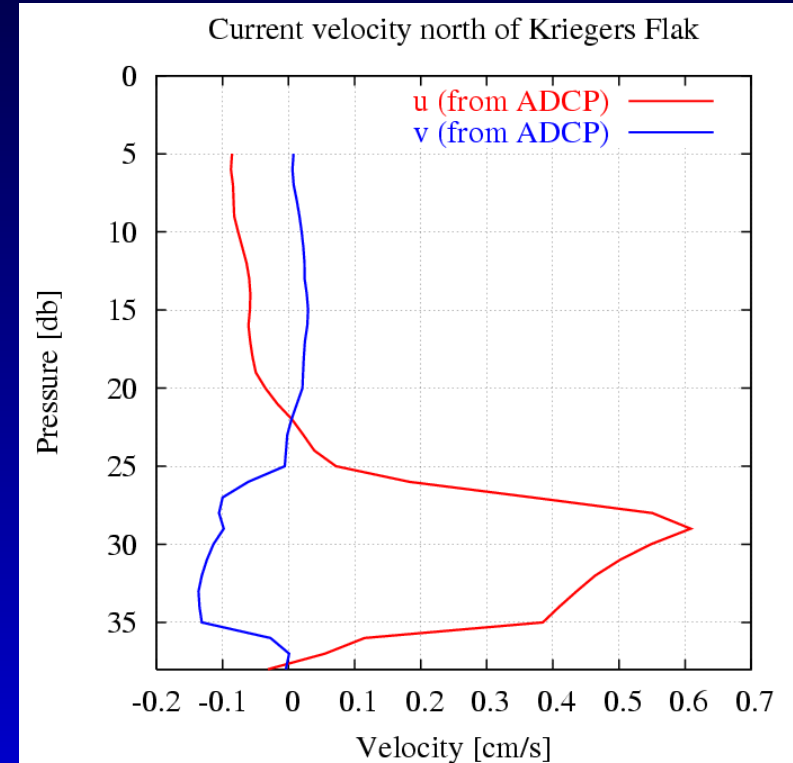
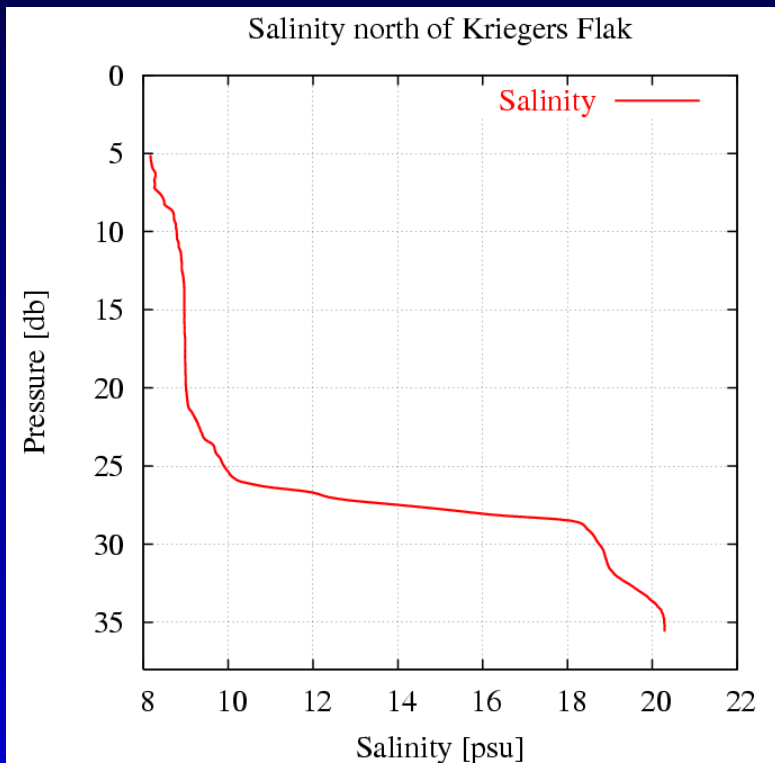


lon (degrees\_east)

Simulation with GETM

# Arkona Sea

Observations from moored ship (MzB Helmsand)



Data by Jürgen Sellschopp, Volker Fiekas, FWG Kiel

# Arkona Sea

Idealised simulations (with GETM)

