

# Modeling environmental impact caused by spreading of dredged material during dredging and deposition

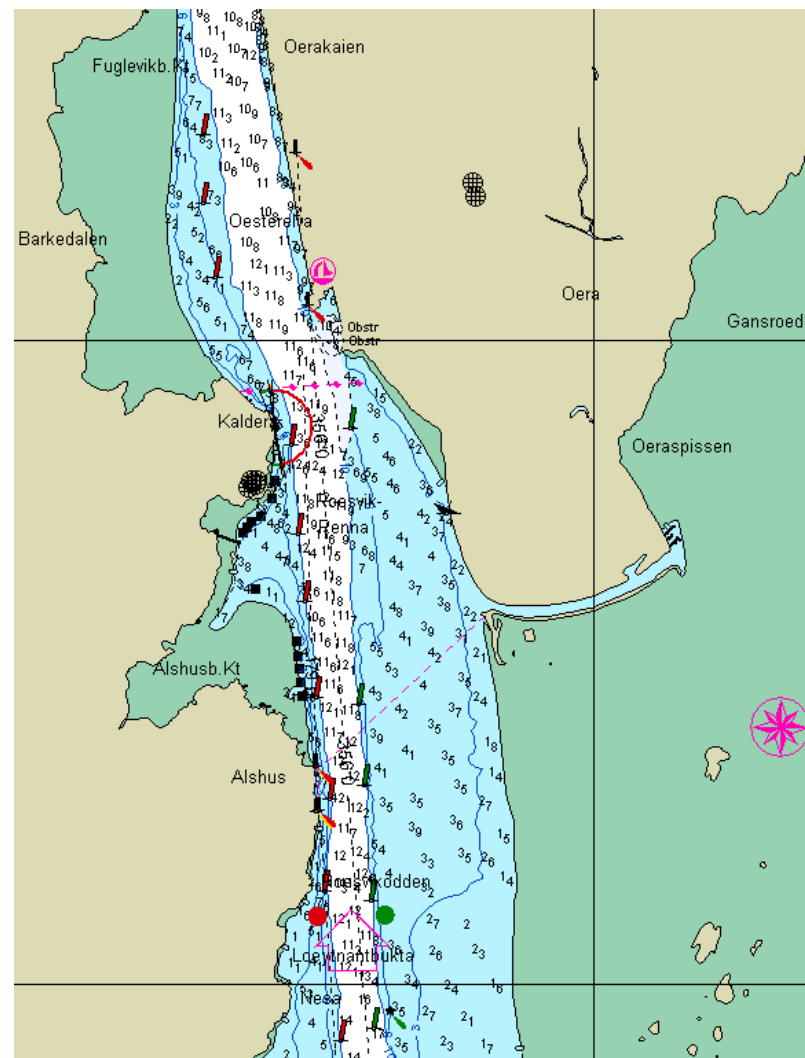
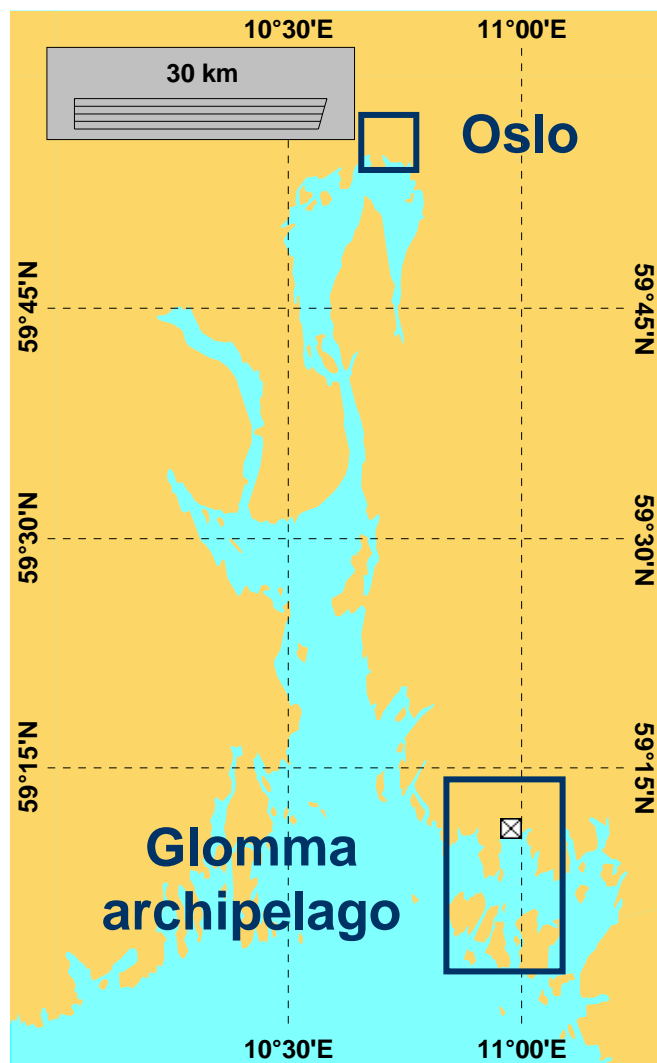
*by*

*Henrik Rye\*, Bård Brørs and Mark Reed, SINTEF*

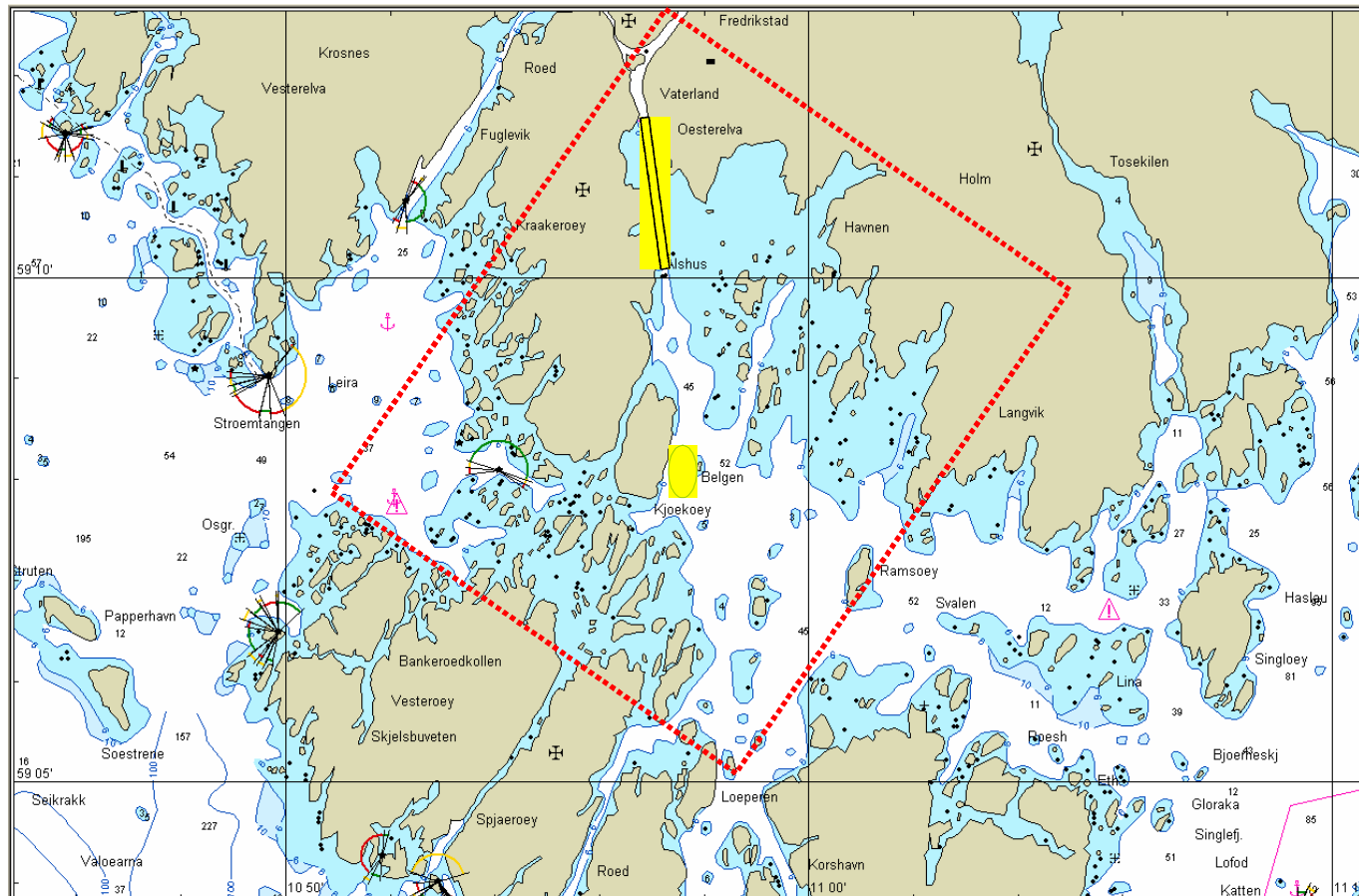
*\*presenter*

1. Modeling of currents
2. Modeling of spreading during dredging and deposition
3. Modeling of environmental risk

# Area considered:

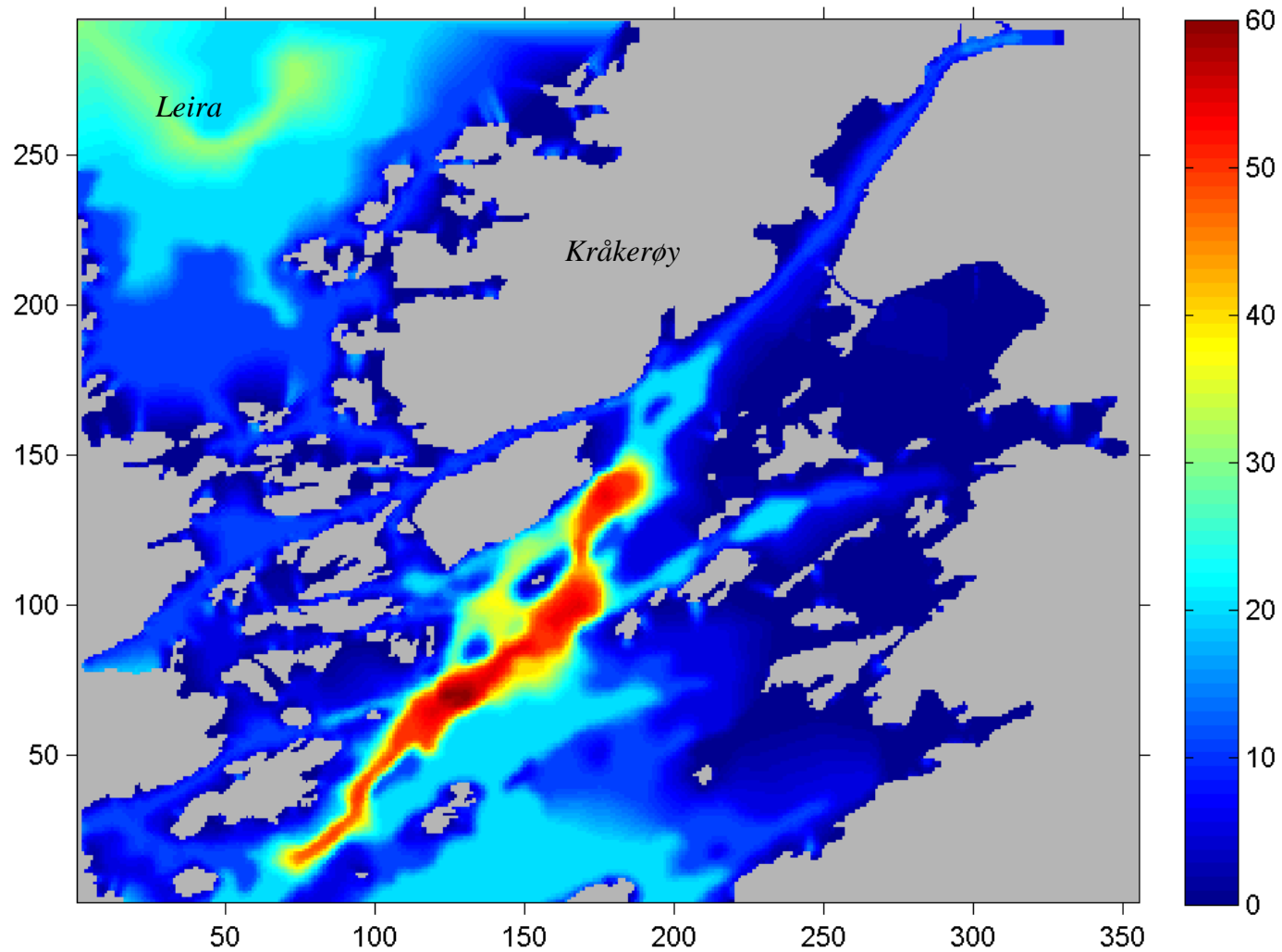


# Problem considered:



Length scale: 50 units = 1600 m

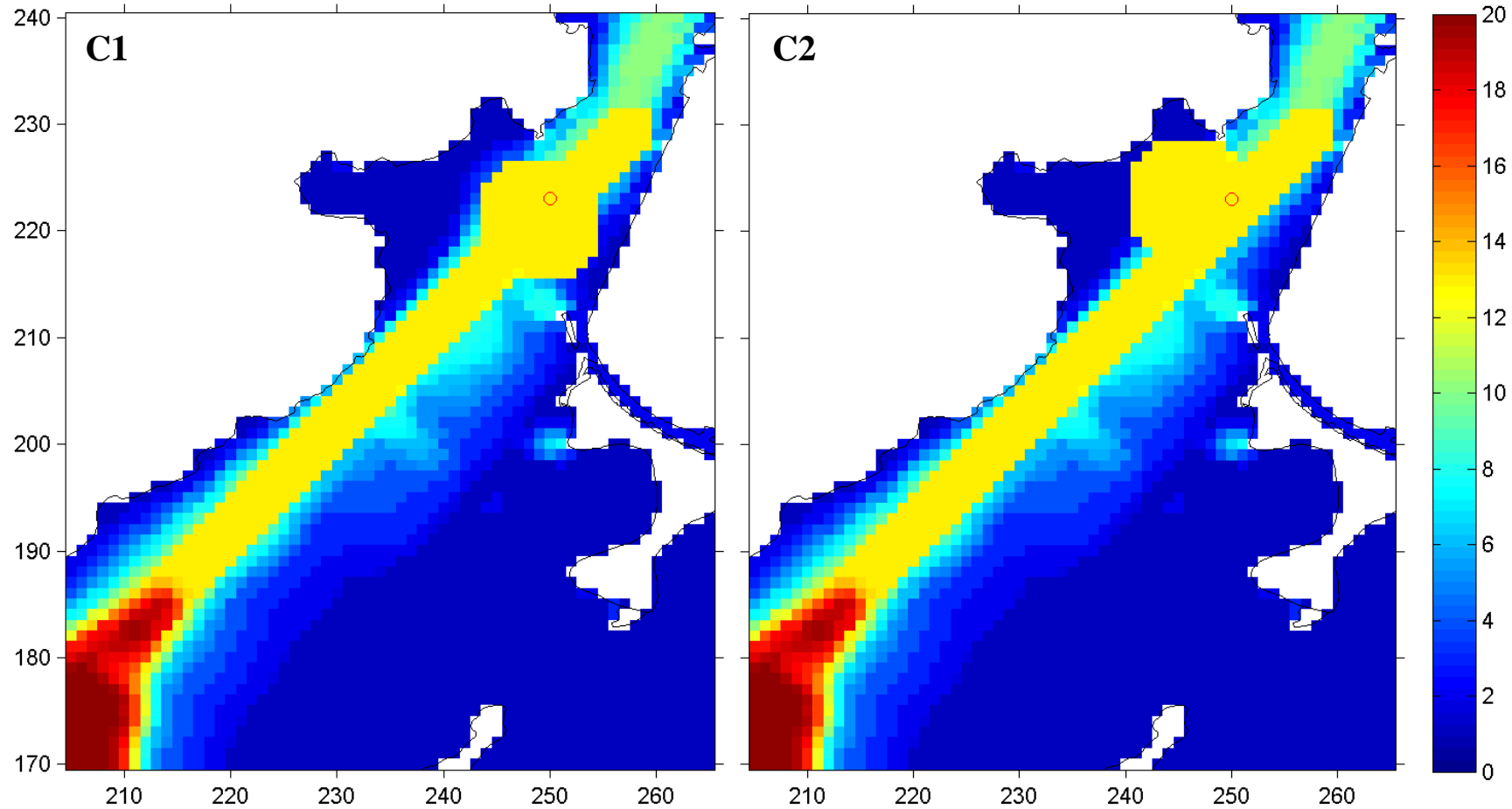
Color: Depths, scale to the right:



# Problem considered:

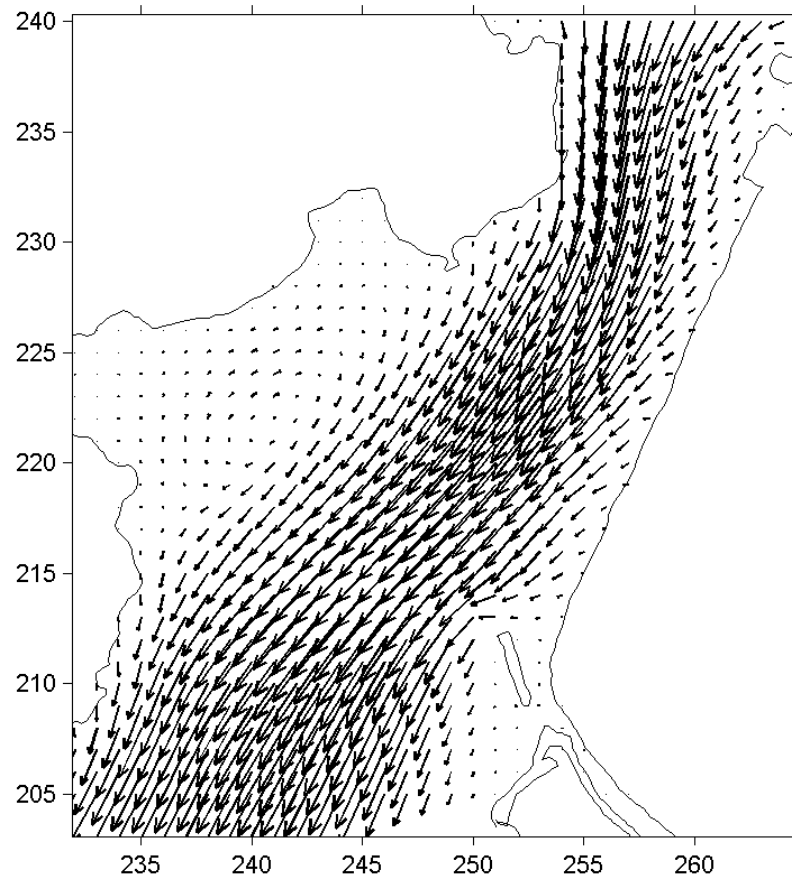
Length scale: 10 units = 320 m

Color: Depth, scale to the right:

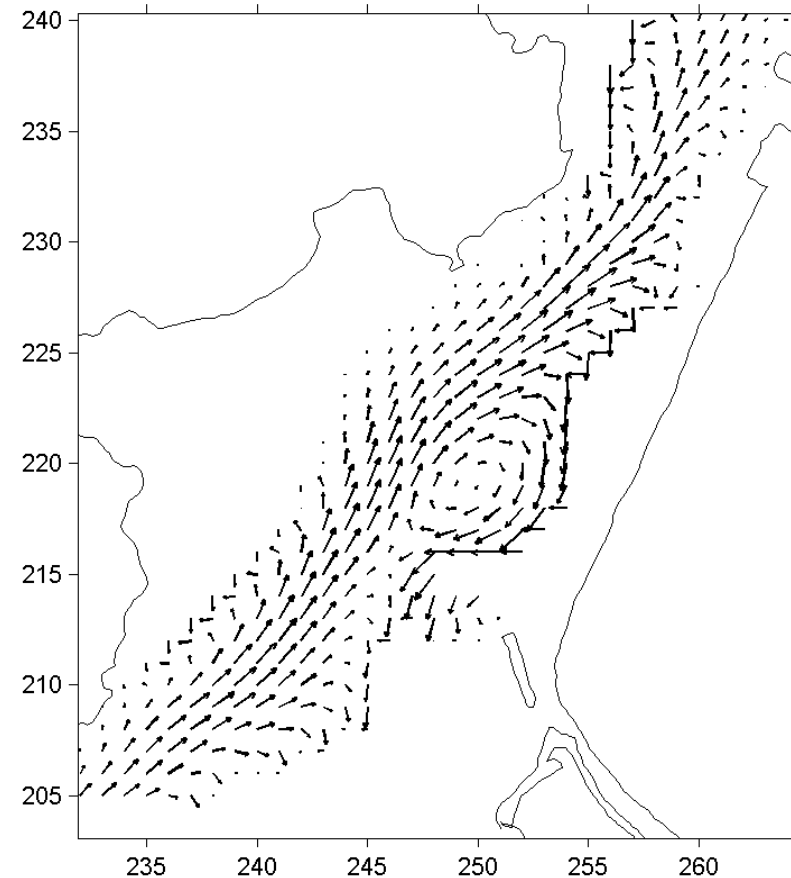


# Simulation of currents, river entrance:

Surface currents:

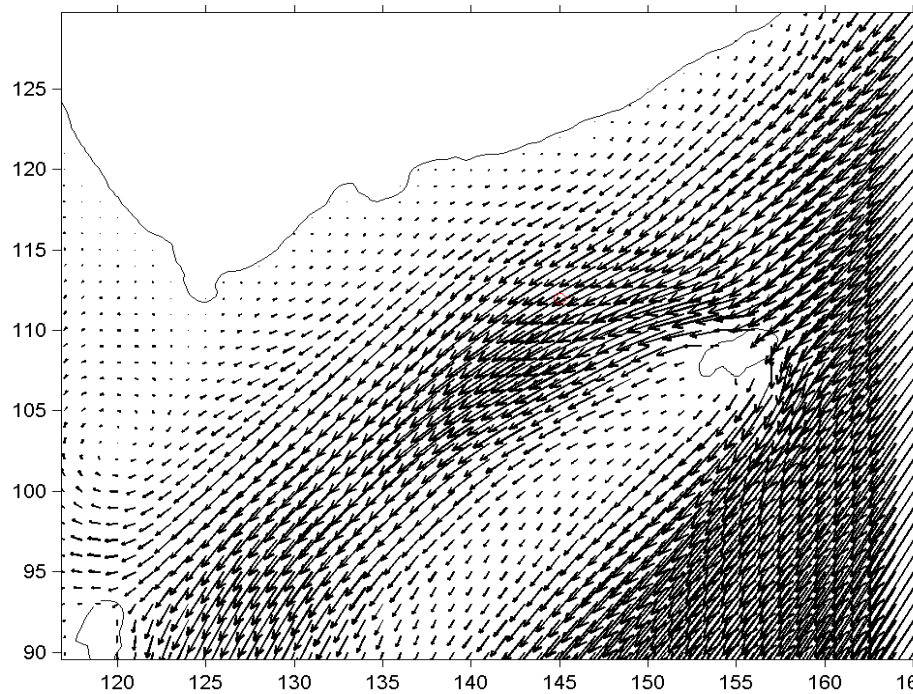


Currents at 10 m depth:

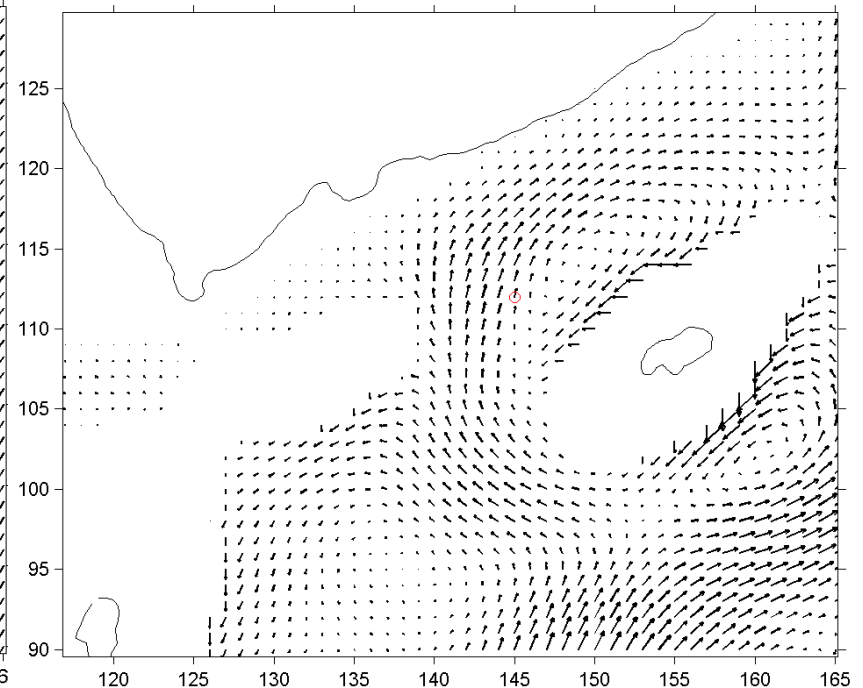


# Currents modeled at the deposition location:

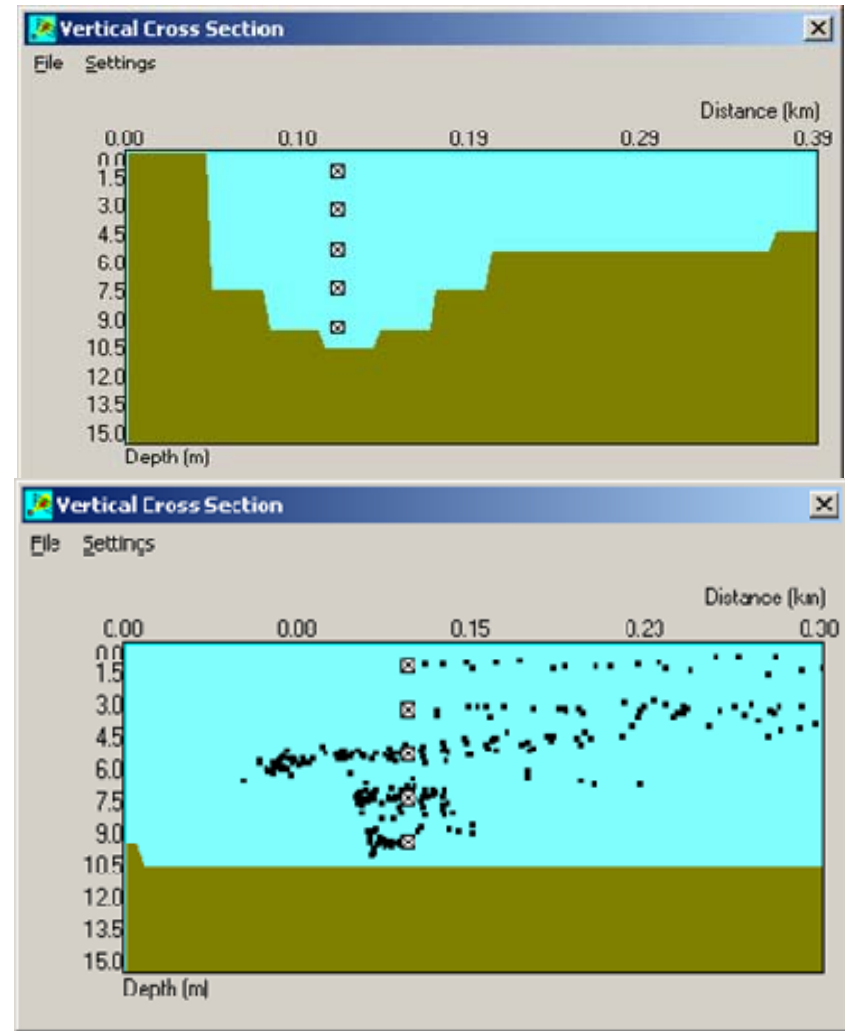
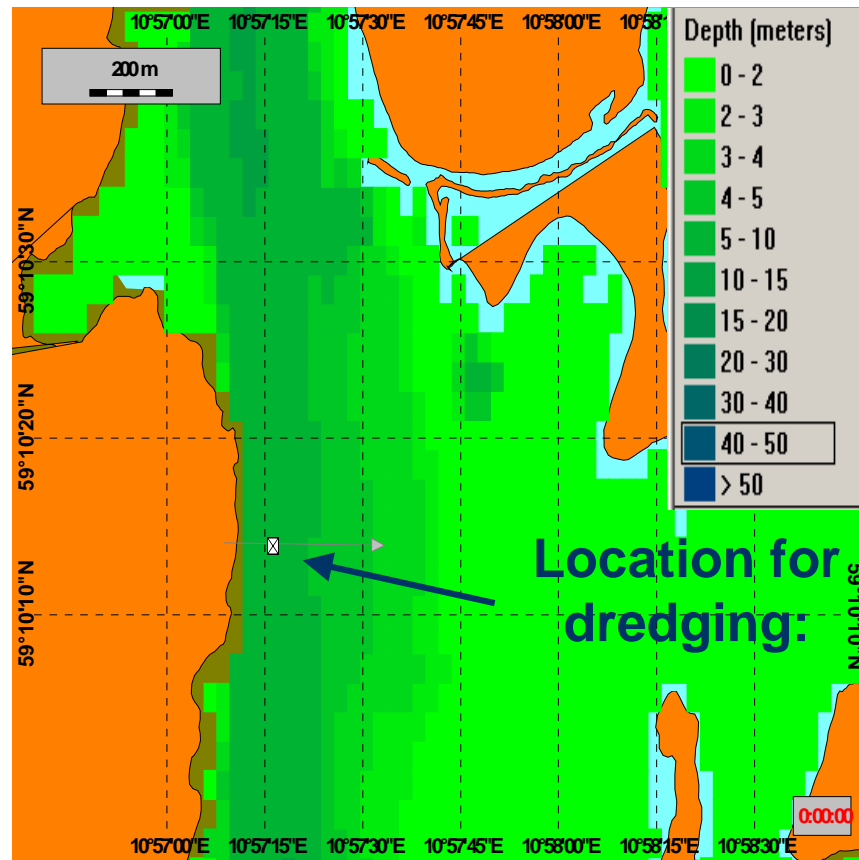
Surface currents:



Currents at 20 m depth:



# Spreading of particle matter during dredging in the Glomma entrance area:





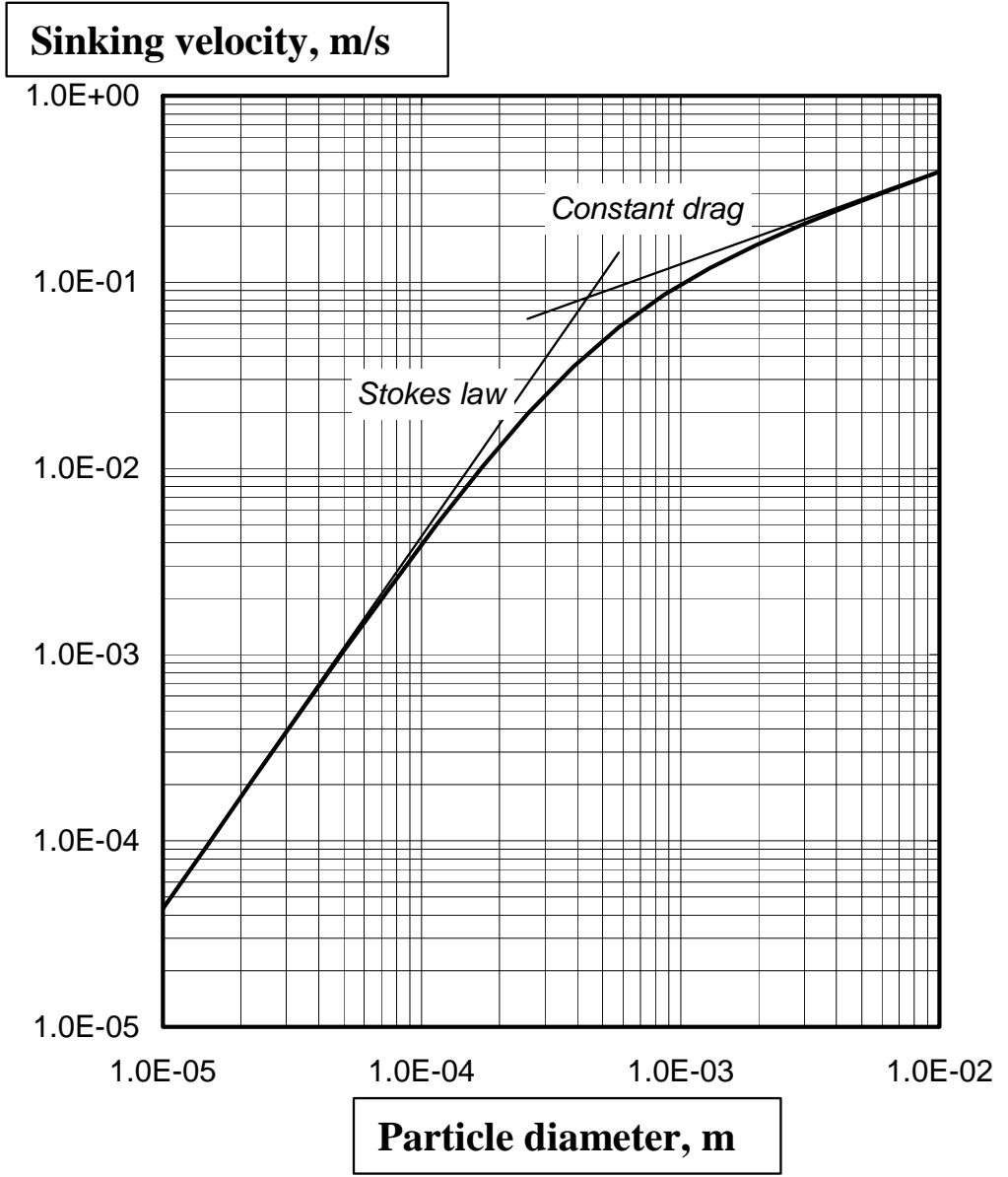
# Dredged material characterization:

## ■ Clean masses:

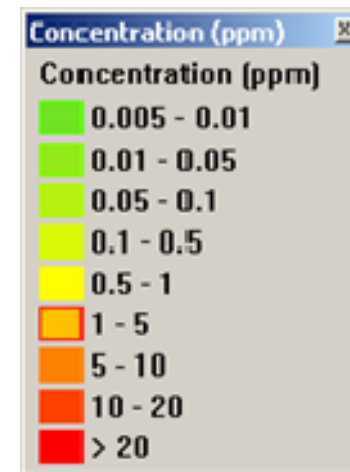
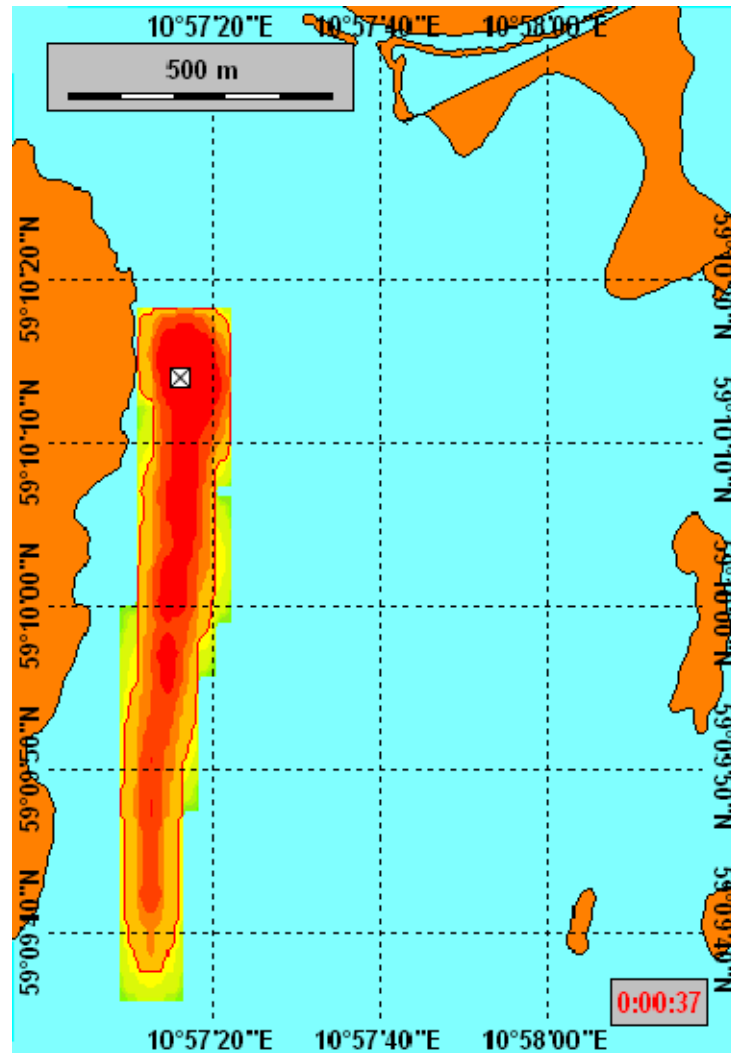
- Unconsolidated clay (5 %, particle size  $< 2 \mu\text{m}$ )
- Consolidated clay (45 %, particle size  $> 1 \text{ cm}$ )
- Unconsolidated silt (40 %, particle size  $2 - 60 \mu\text{m}$ )
- Silty sand (10 %, particle size  $60 - 100 \mu\text{m}$ ).

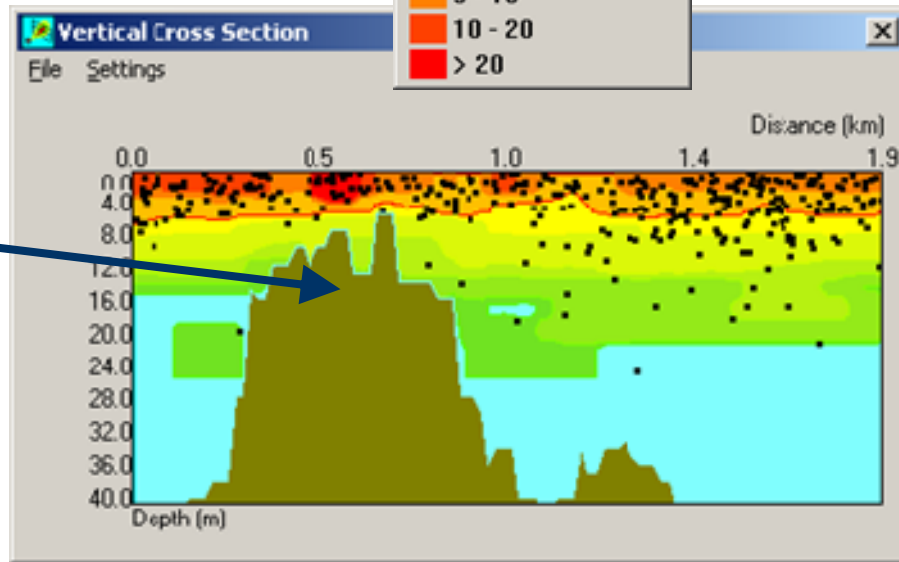
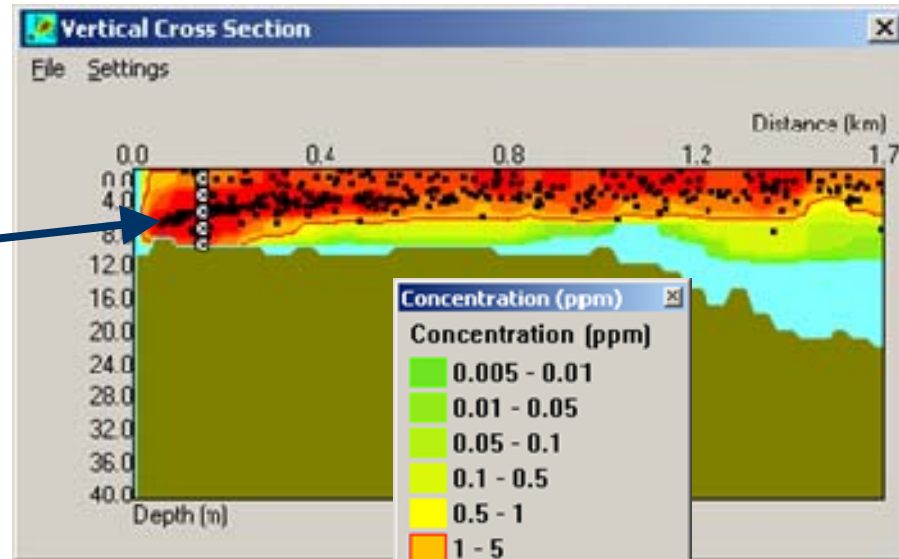
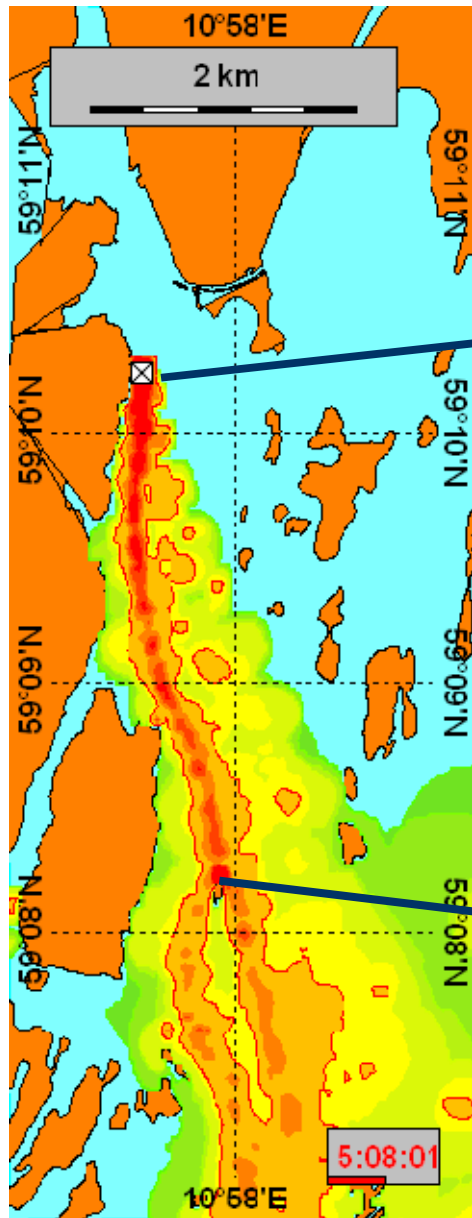
## ■ Polluted masses in local areas:

- Unconsolidated clay/mud (particle size  $< 2 \mu\text{m}$ )

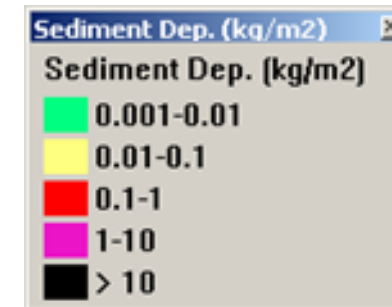
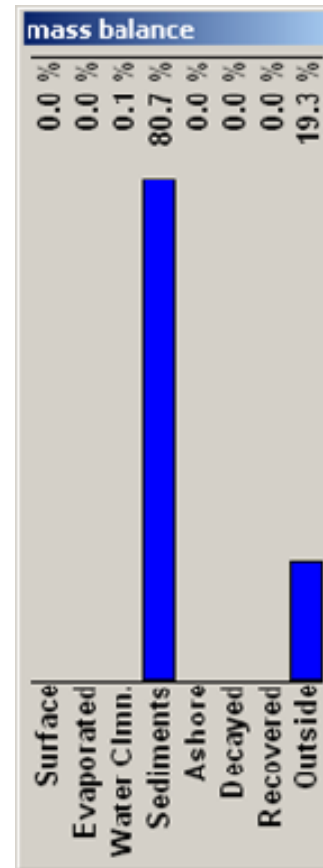
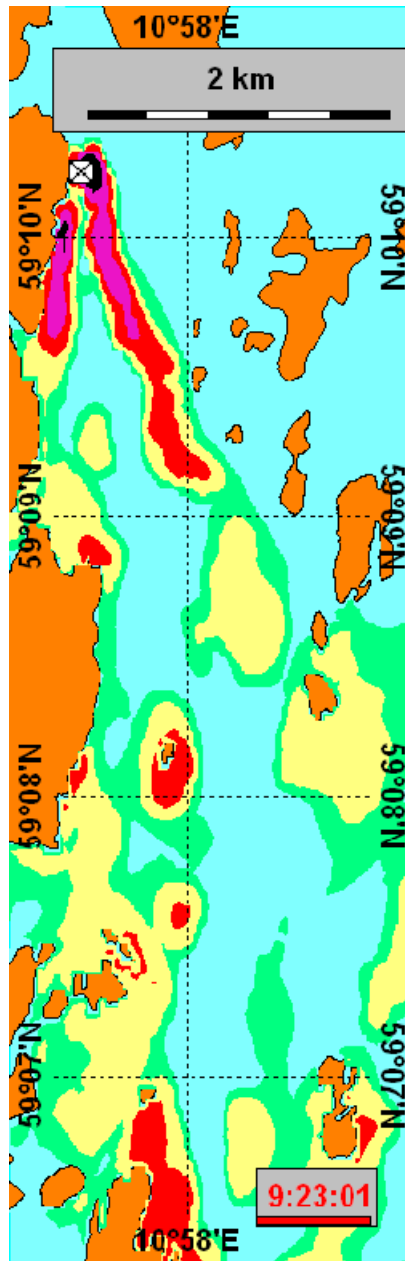


# Particle concentration in the water column:

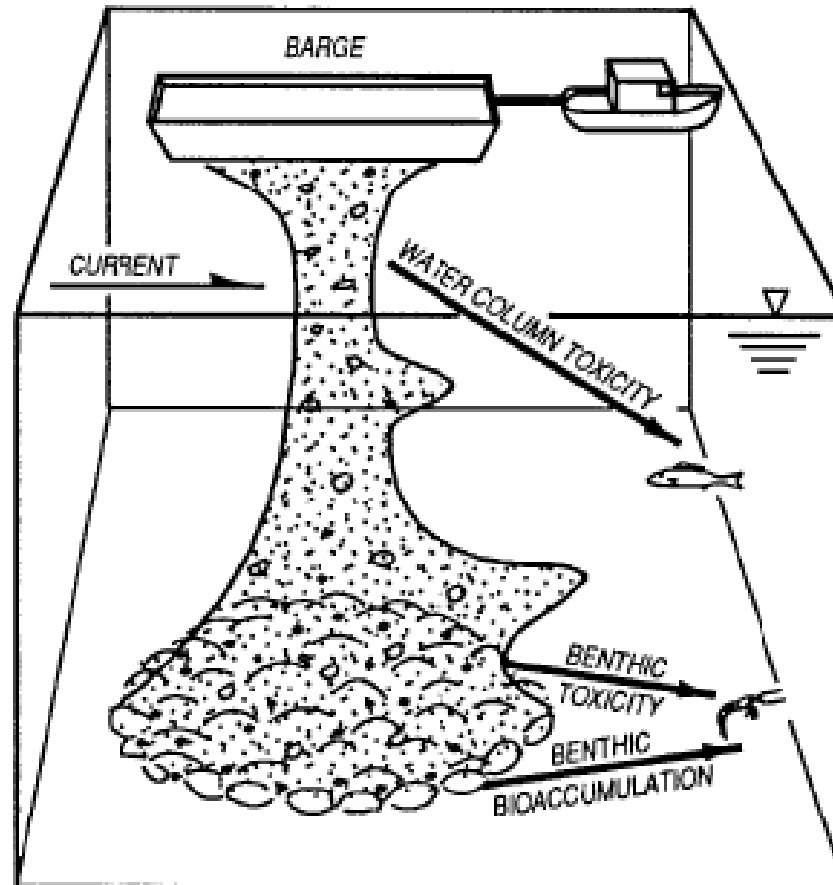




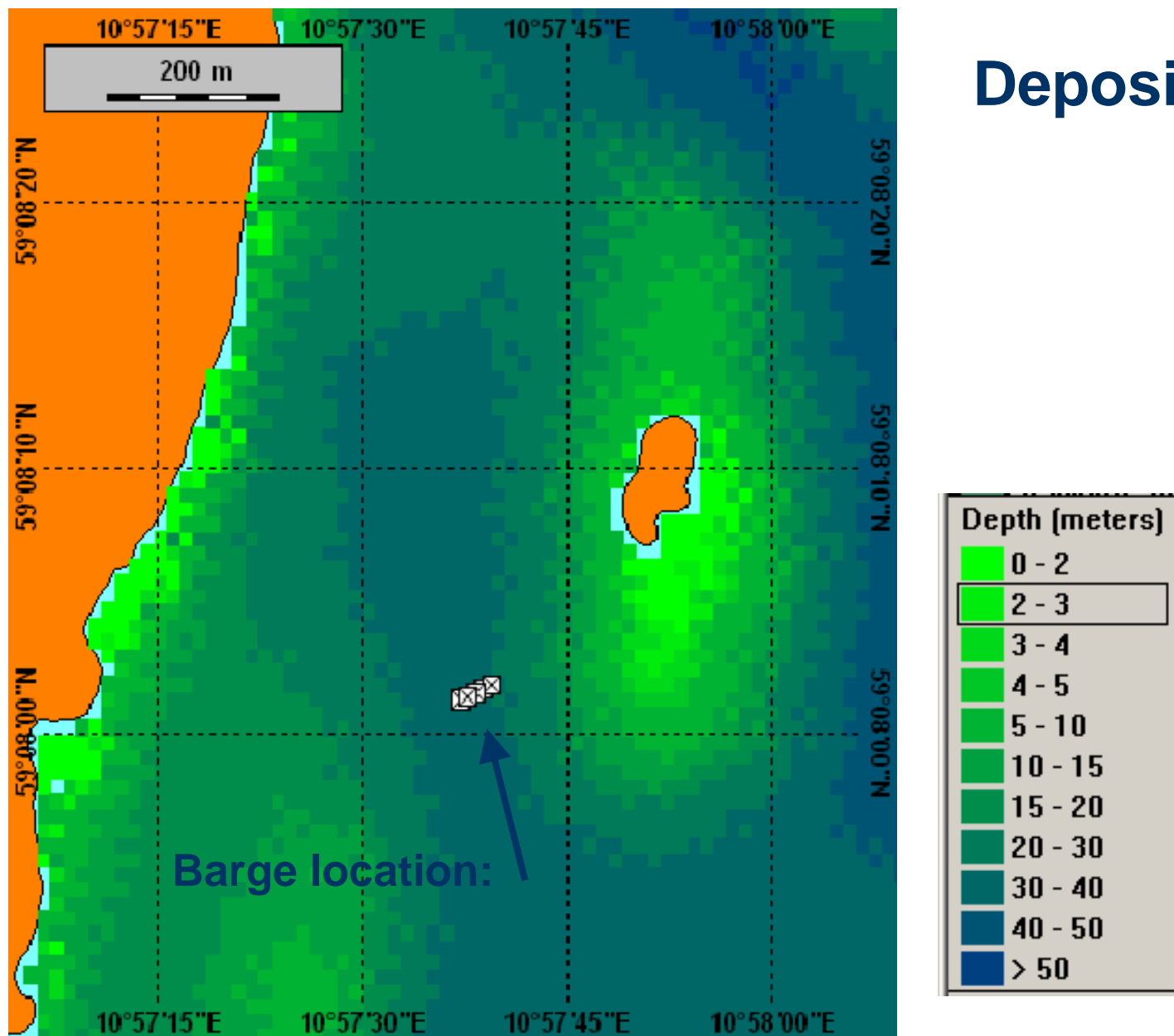
# Deposition on the sea floor:



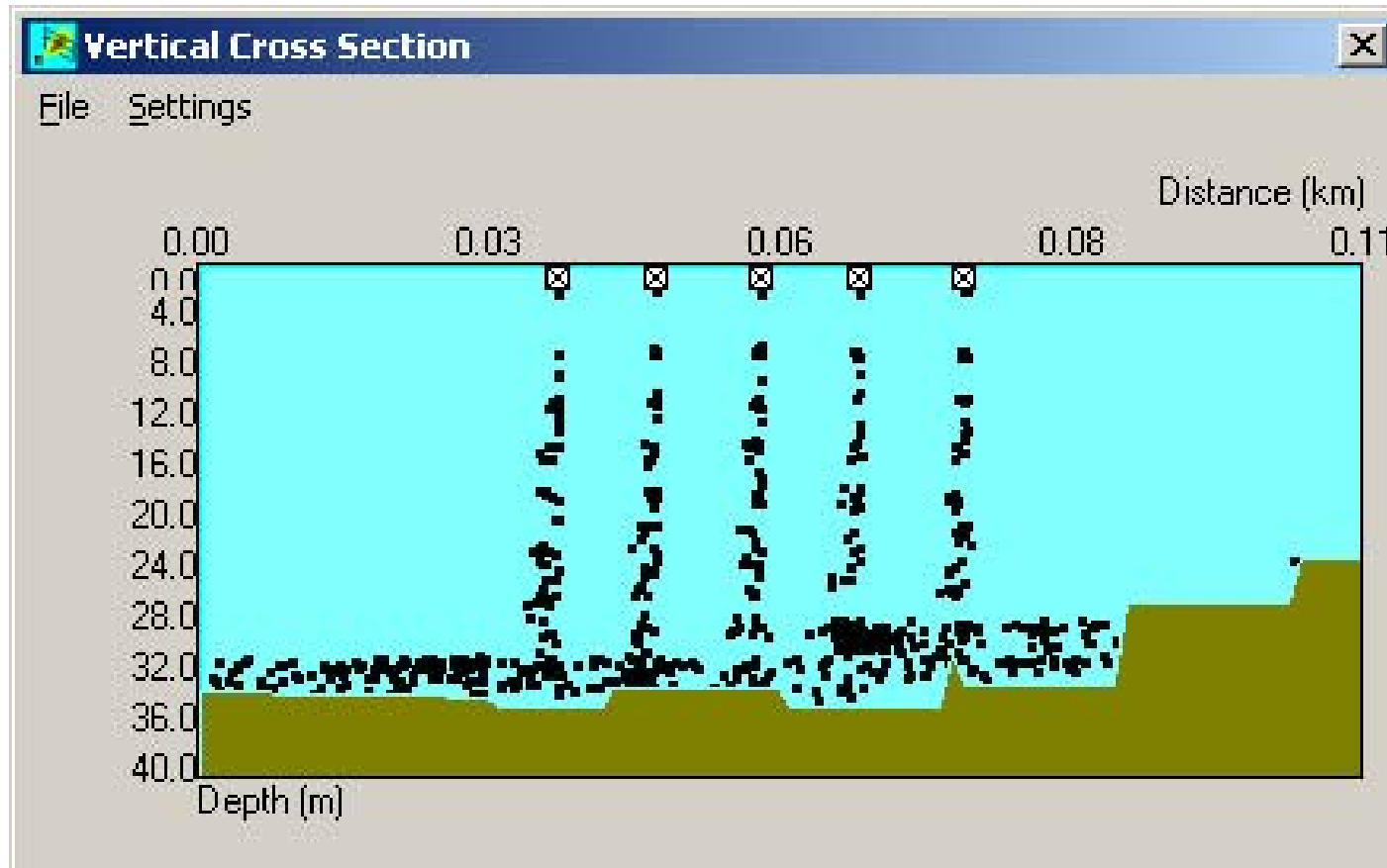
# Deposition of dredged material from a barge:



## Deposition area:

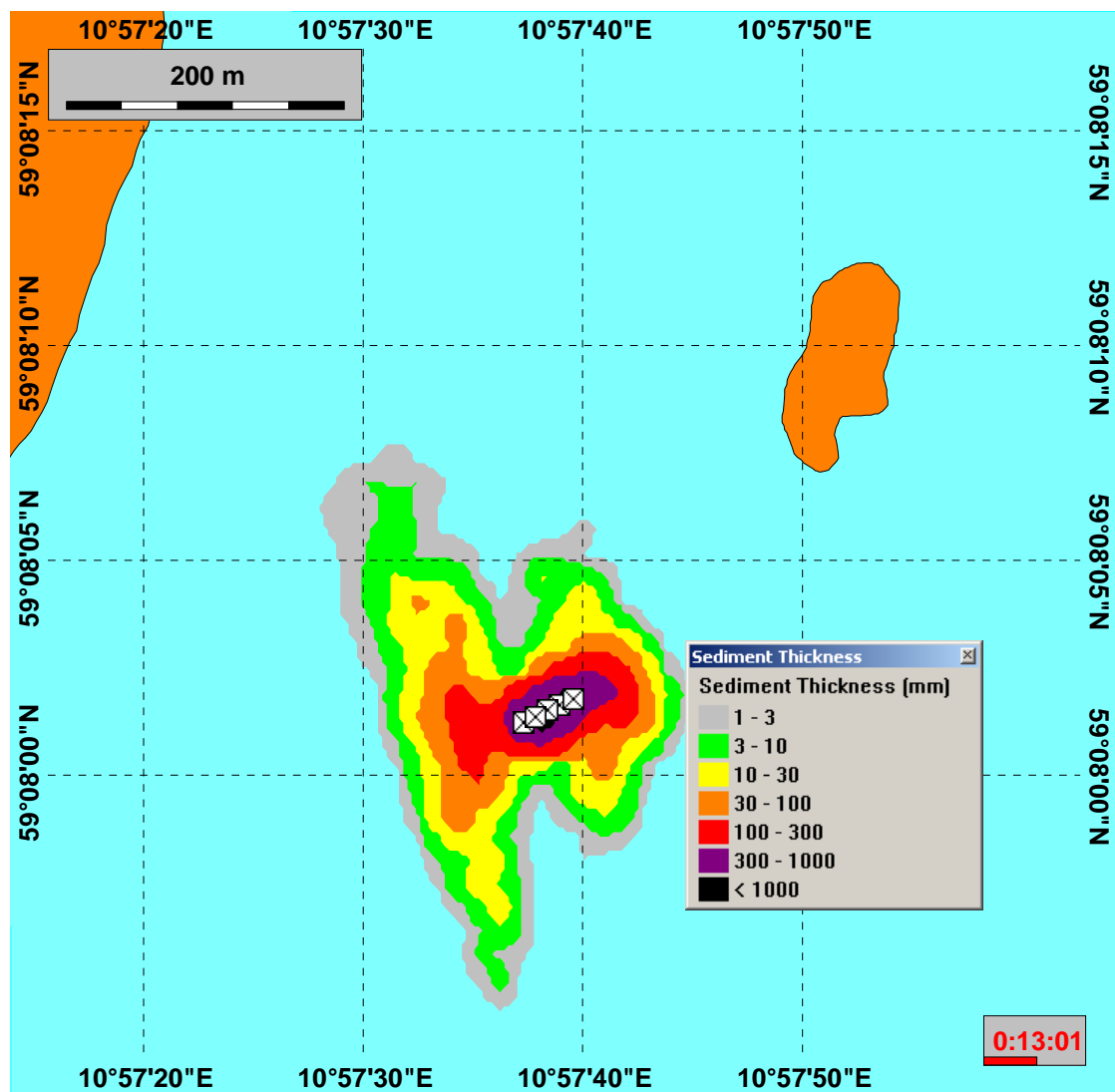


# Deposition of dredged material:

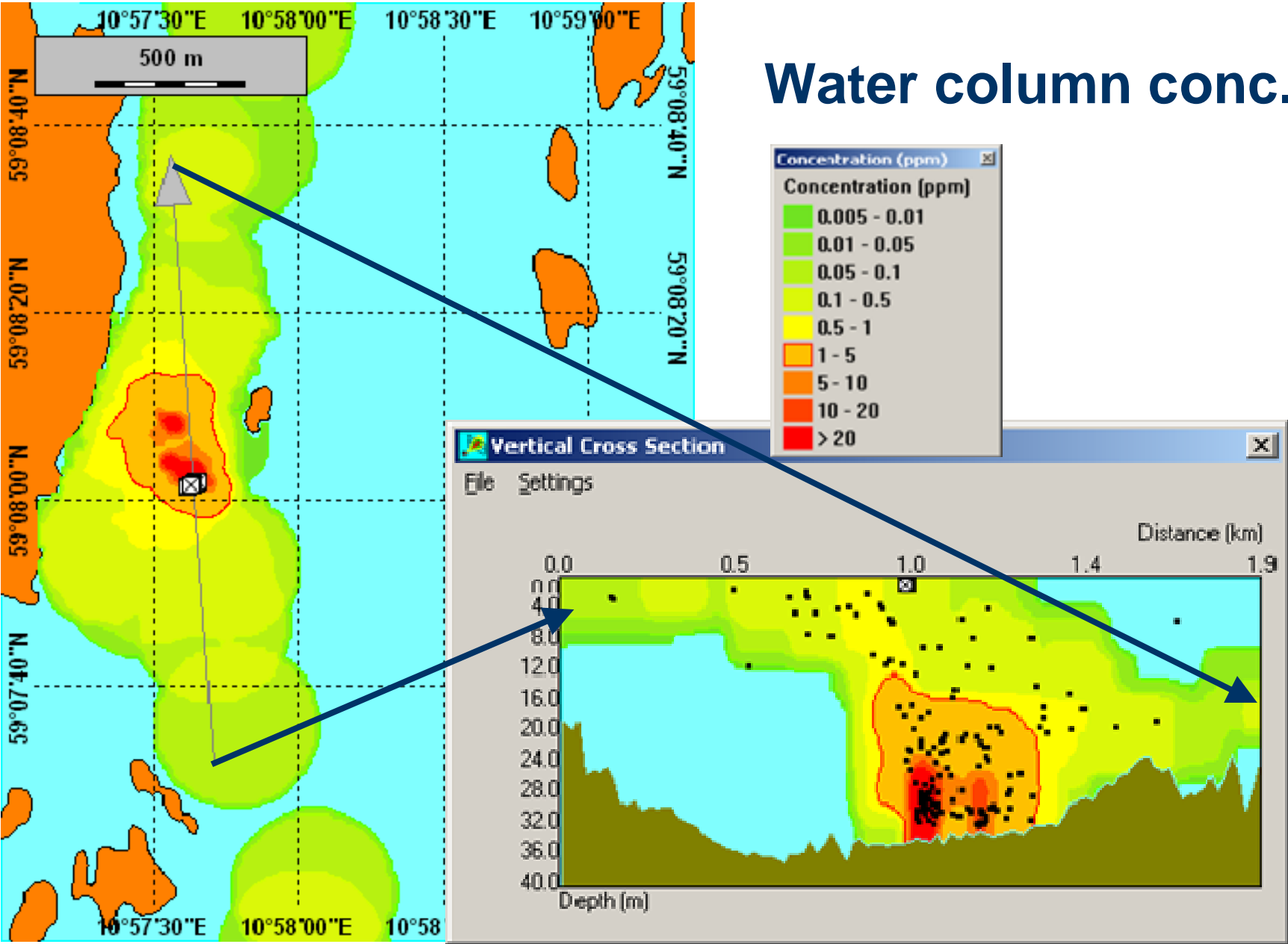




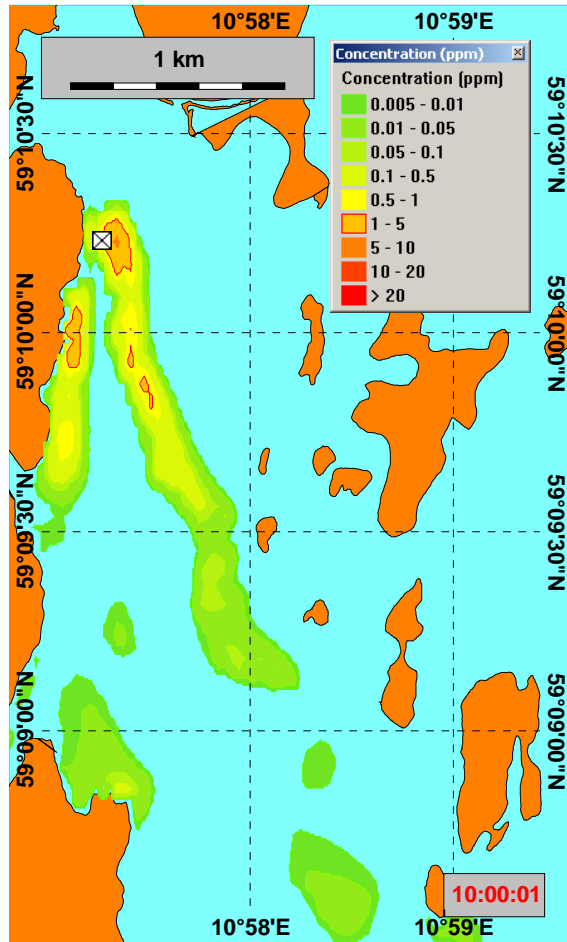
# Deposition of dredged material:



# Water column conc.:



# Example calculation for the environmental risk (PEC/PNEC approach):



Spreading during dredging:

Hg in sediment dredged = 6 mg/kg.

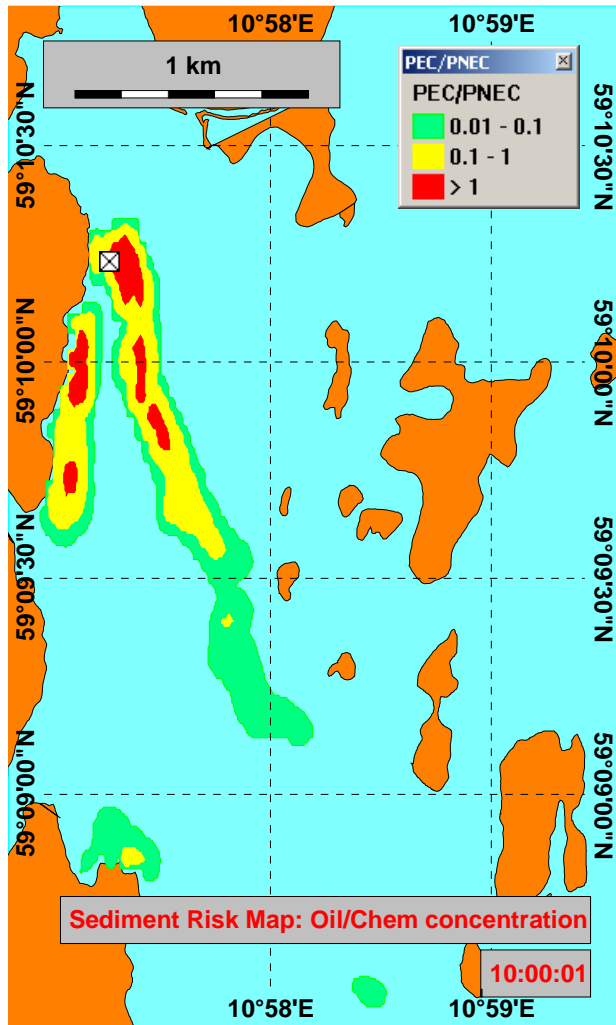
PNEC for Hg in sediment = 0.62 mg/kg.

Average over the upper 3 cm sediment layer calculated for the re-deposition

PEC = Predicted Environmental Concentration

PNEC = Predicted No Effect Concentration

# Environmental risk example calculation:



**Red area: PEC/PNEC > 1**

**Potential for environmental risk encountered.**

**Concentration above PNEC level of 0.62 mg Hg/kg sediment**

# SUMMARY:

- Three-dimensional hydrodynamic models, combined with the use of three-dimensional models for spreading of particle matter and pollutants, have a potential for assessing environmental impacts caused by dredging and deposition activities.
- The spreading model (DREAM) was originally developed by the offshore oil companies for simulating environmental risks caused by discharges of drill cuttings and mud. This model has a potential for application to environmental issues related to dredging and deposition of dredged material as well.

# Thank you for your attention !

- Web site for the DREAM model:

- <http://www.sintef.com/erms>

- Mail address to the presenter:

- [Henrik.Rye@sintef.no](mailto:Henrik.Rye@sintef.no)