Nye verktøy for kartlegging av partikkelspredning fra sjødeponi

NYKOS Avslutningskonferanse

Oslo, 14 Mai 2019

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Frænfjorden, Omya Hustadmarmor
~35m^3/h Calcium carbonate

What is the environmental impact and risk?
How to control & minimise?

Develop useful tools to:

- Map tailings distribution & transport
- Understand tailings behavior in the sea
- Predict impact, risk, potential problematic events
- Optimize discharge and monitoring

NYKOS

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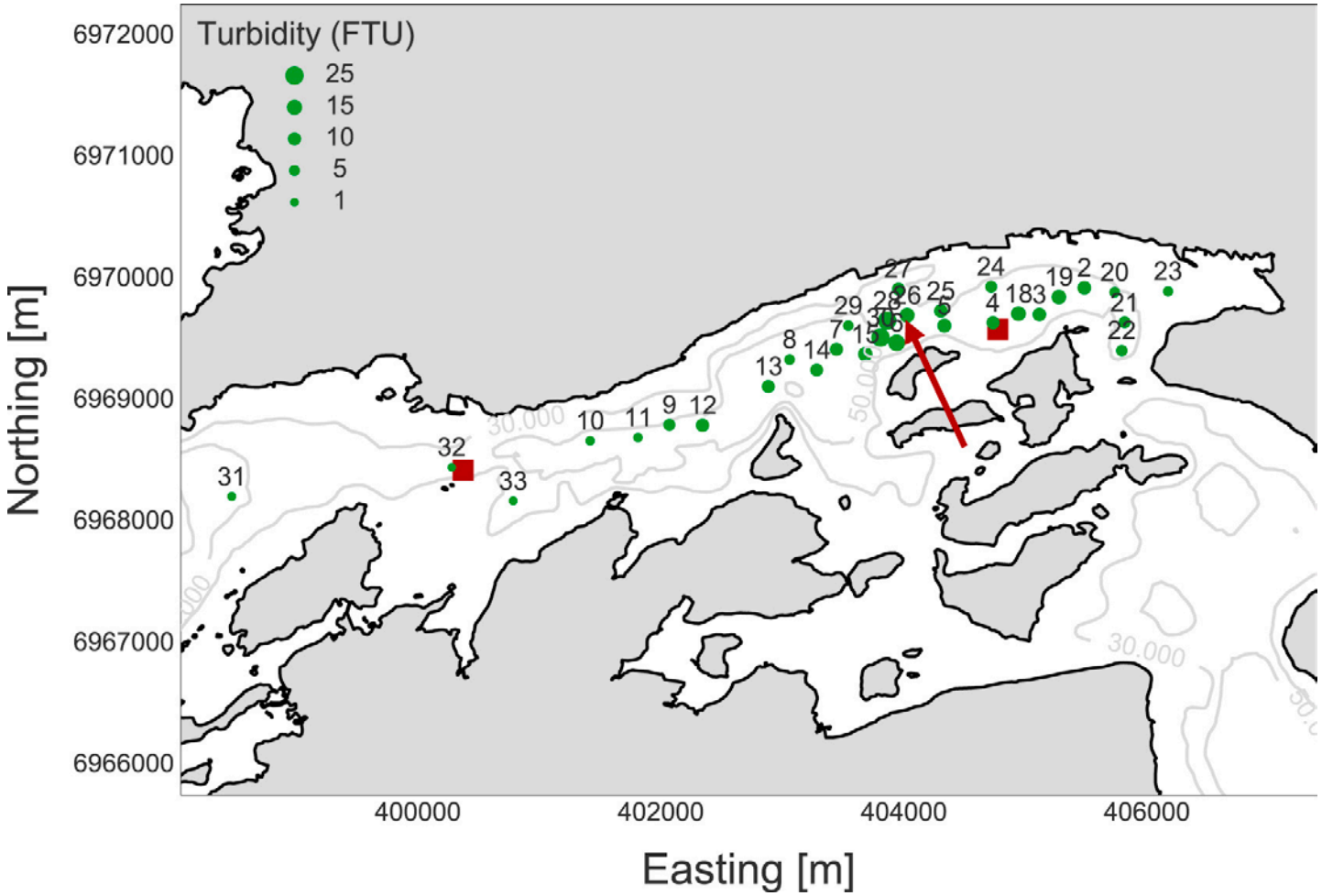
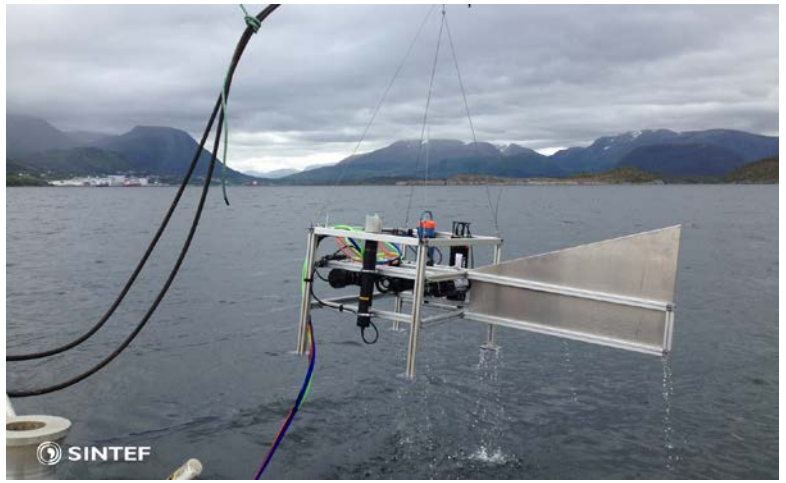
Particle measurements in Frænfjorden

24-26 June, 2015





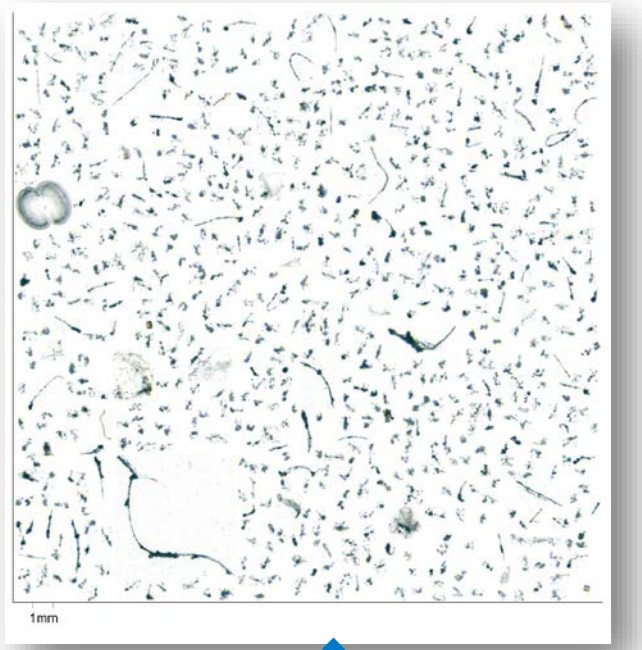
Silhouette camera system

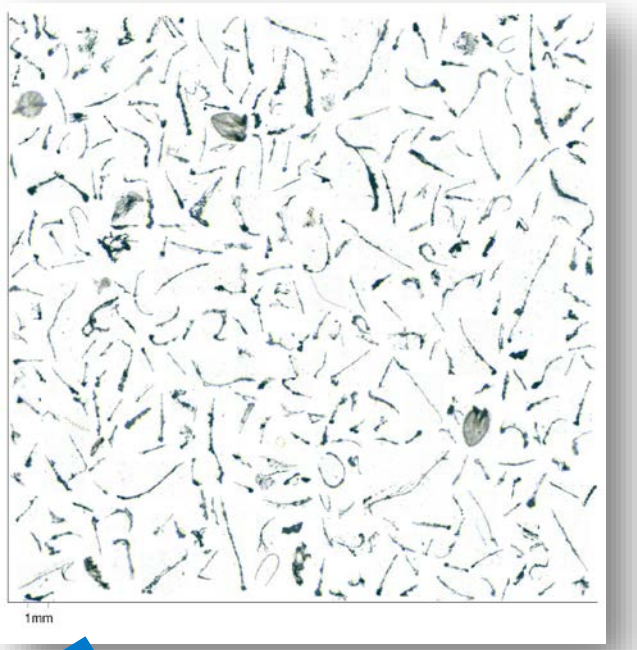
- In-situ imaging system
- Quantify particles in a large size range (mikrons – centimeter)
- Open source processing and analysis software for automation
  - Image analysis
  - Aggregate statistics (e.g. concentration, particle size distribution)
  - Particle classification with deep neural networks

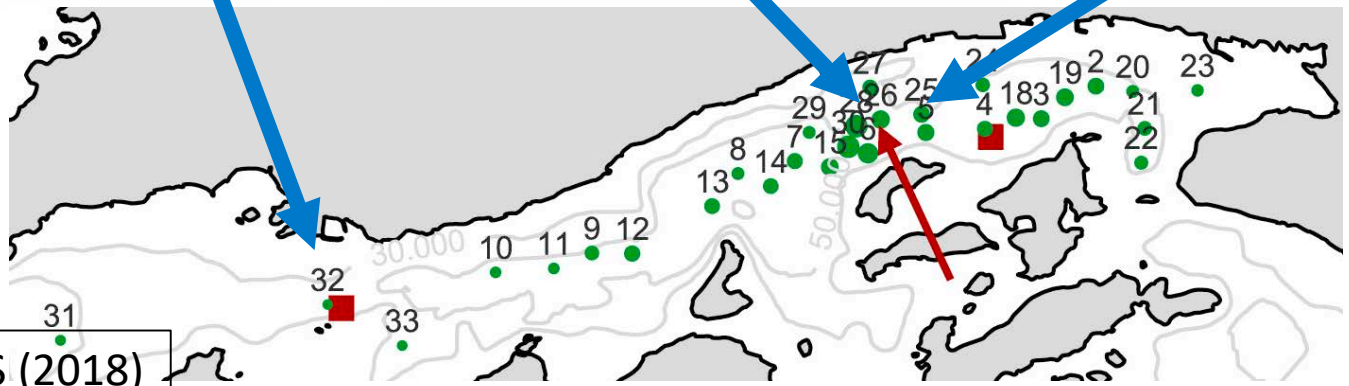
EJ Davies, PJ Brandvik, F Leirvik, R Nepstad (2017)

github.com/emlynjdavies/PySilCam

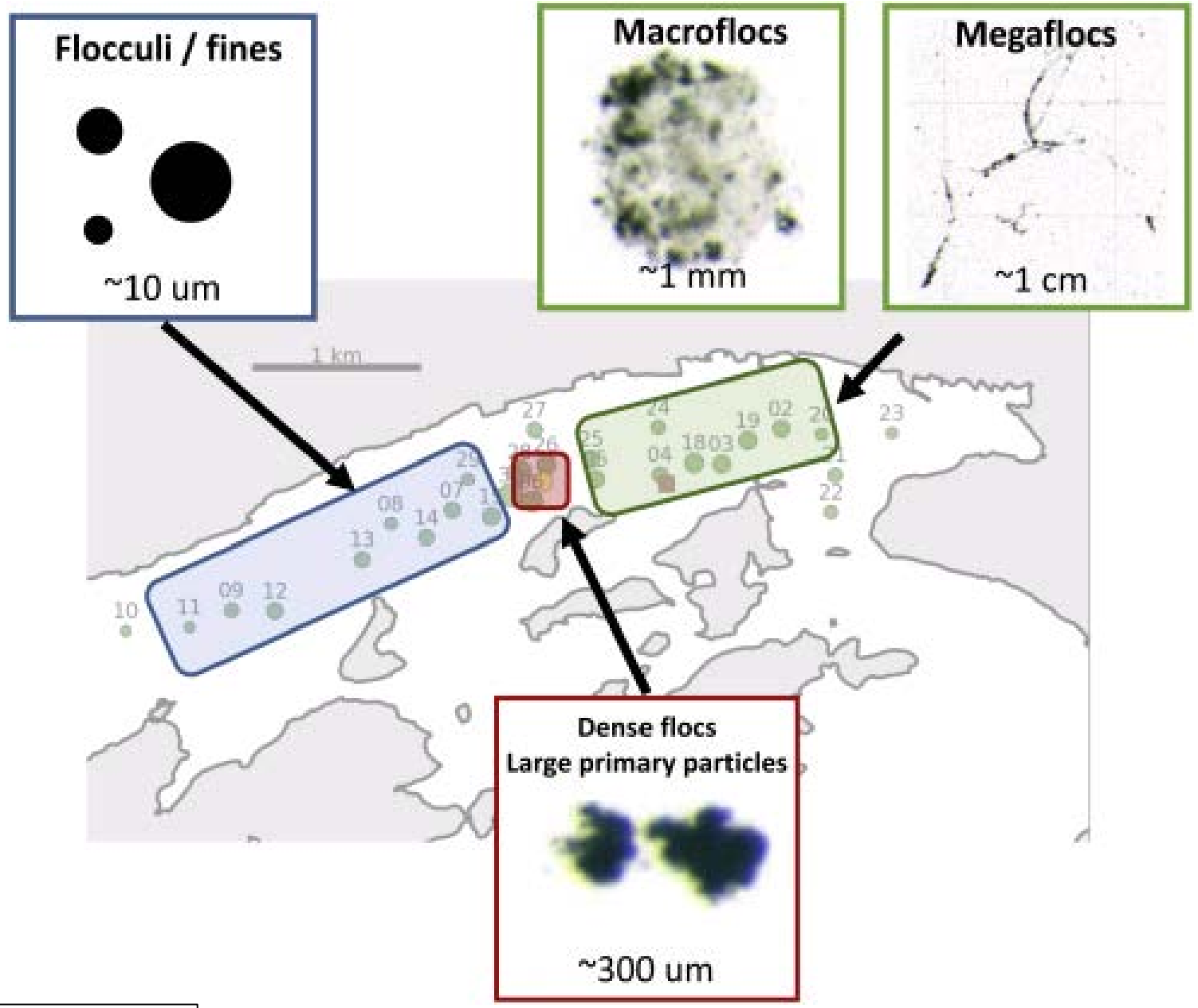
Imaging particles and flocs







Davies, E., Nepstad, R., RiMS (2018)



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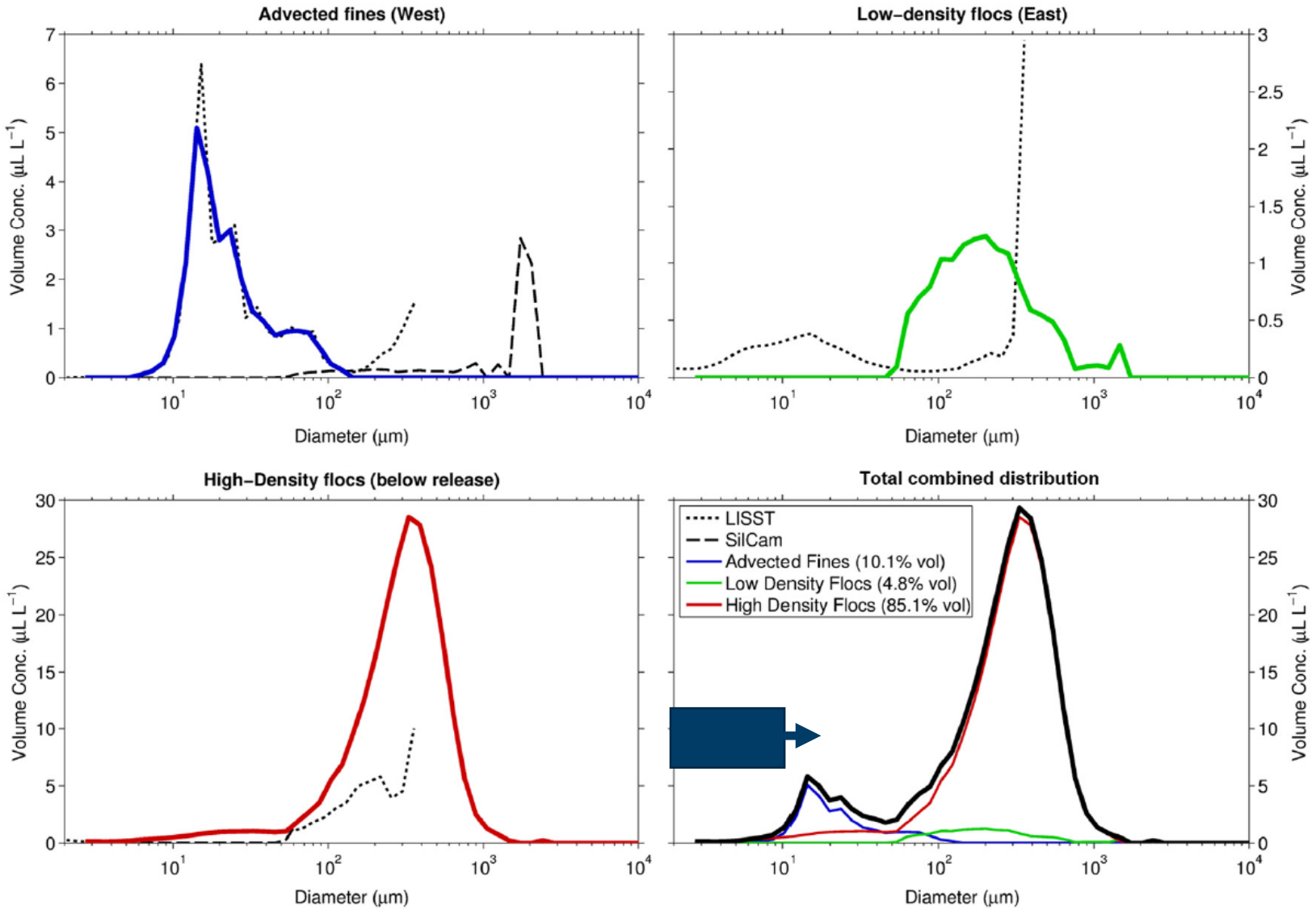
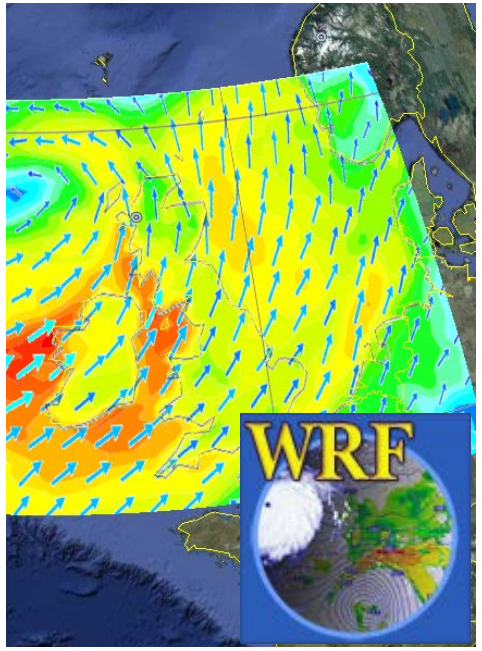


Davies, E., Nepstad, R., RiMS (2018)

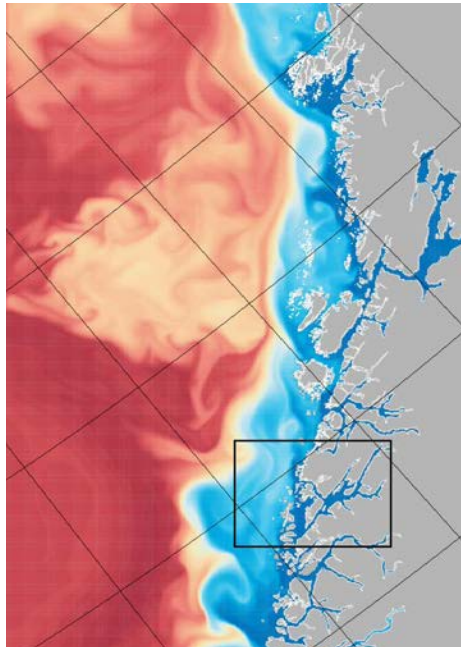
Modelling tools

www.wrf-model.org



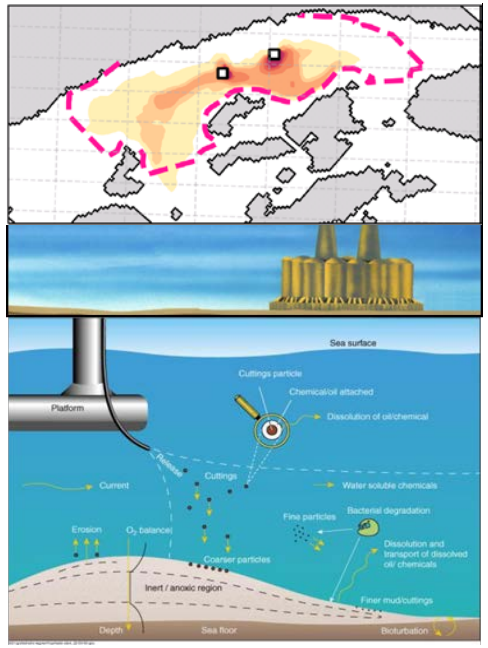
Atmospheric forcing

www.sinmod.no



Hydrodynamics
Currents
Ecosystem

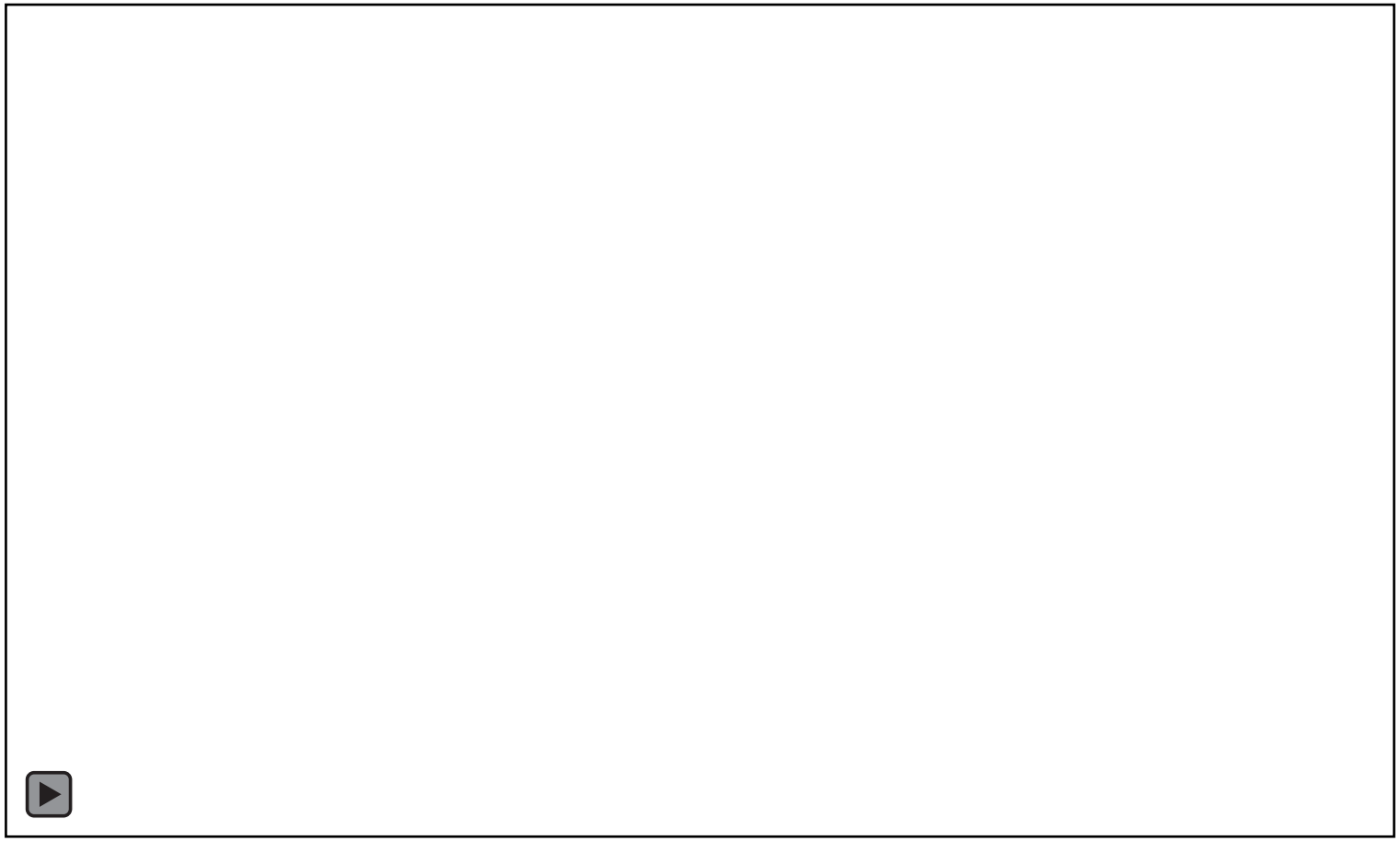
www.sintef.no/DREAM



Transport
Fate
Effects

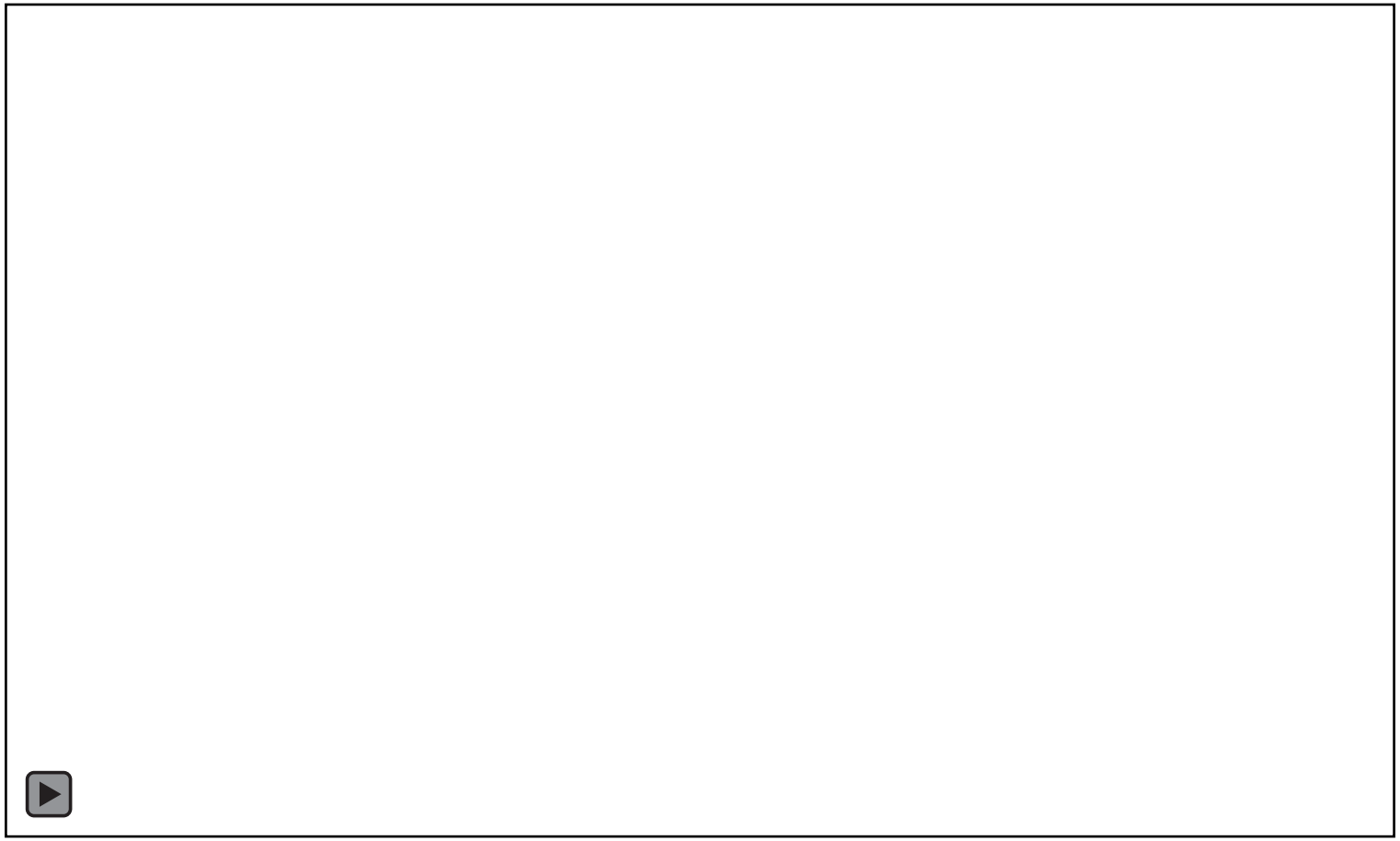
Model simulation of tailings spreading

November 2013 - suspended tailings concentrations (> 1 mg/L)



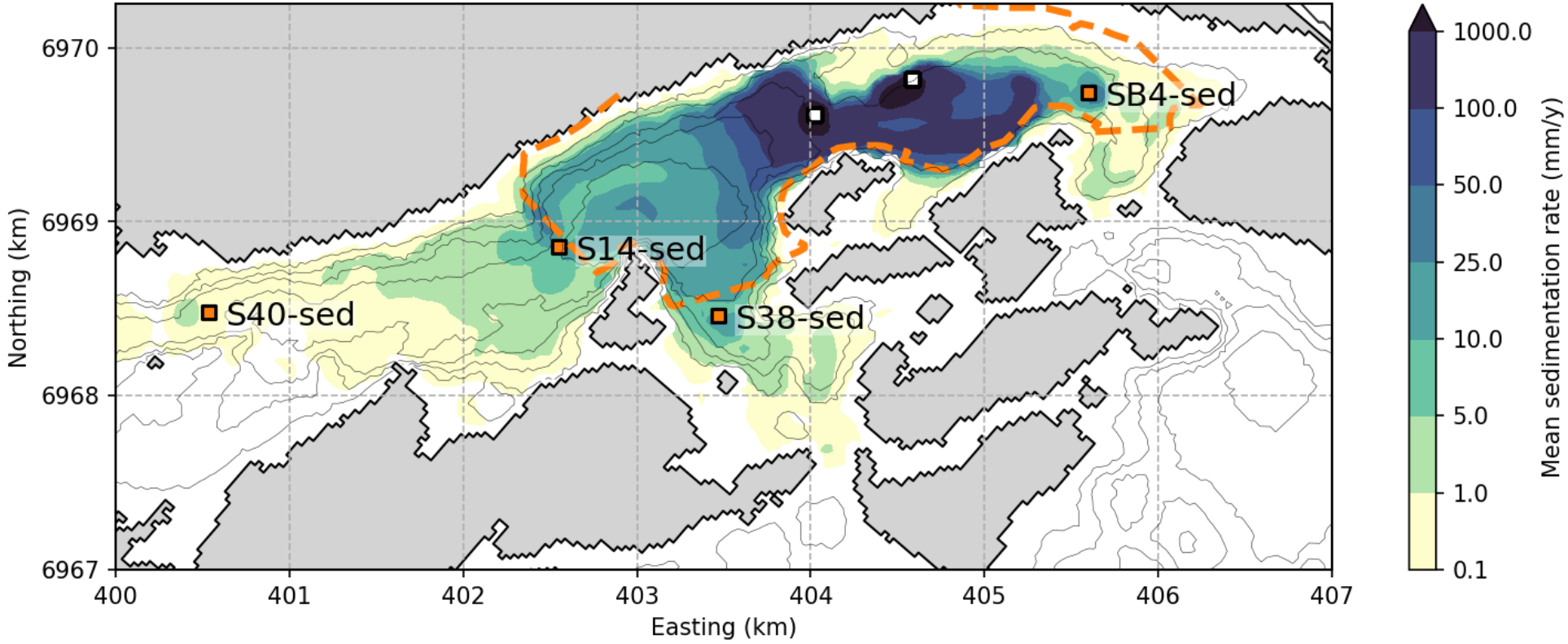
Model simulation of tailings sedimentation

November 2013 – tailings/area (> 0.1 kg/m^2)

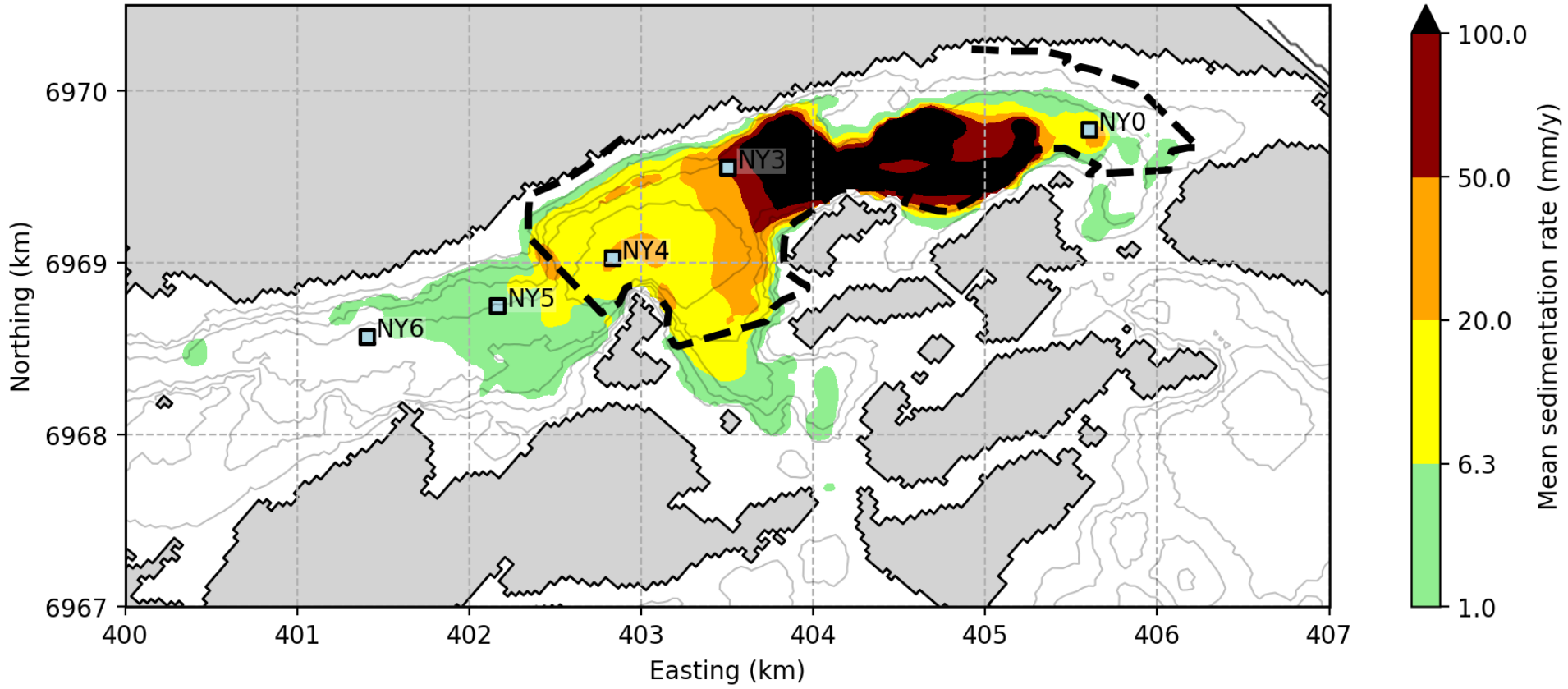


Sedimentation rates

Estimated mean yearly sedimentation rate

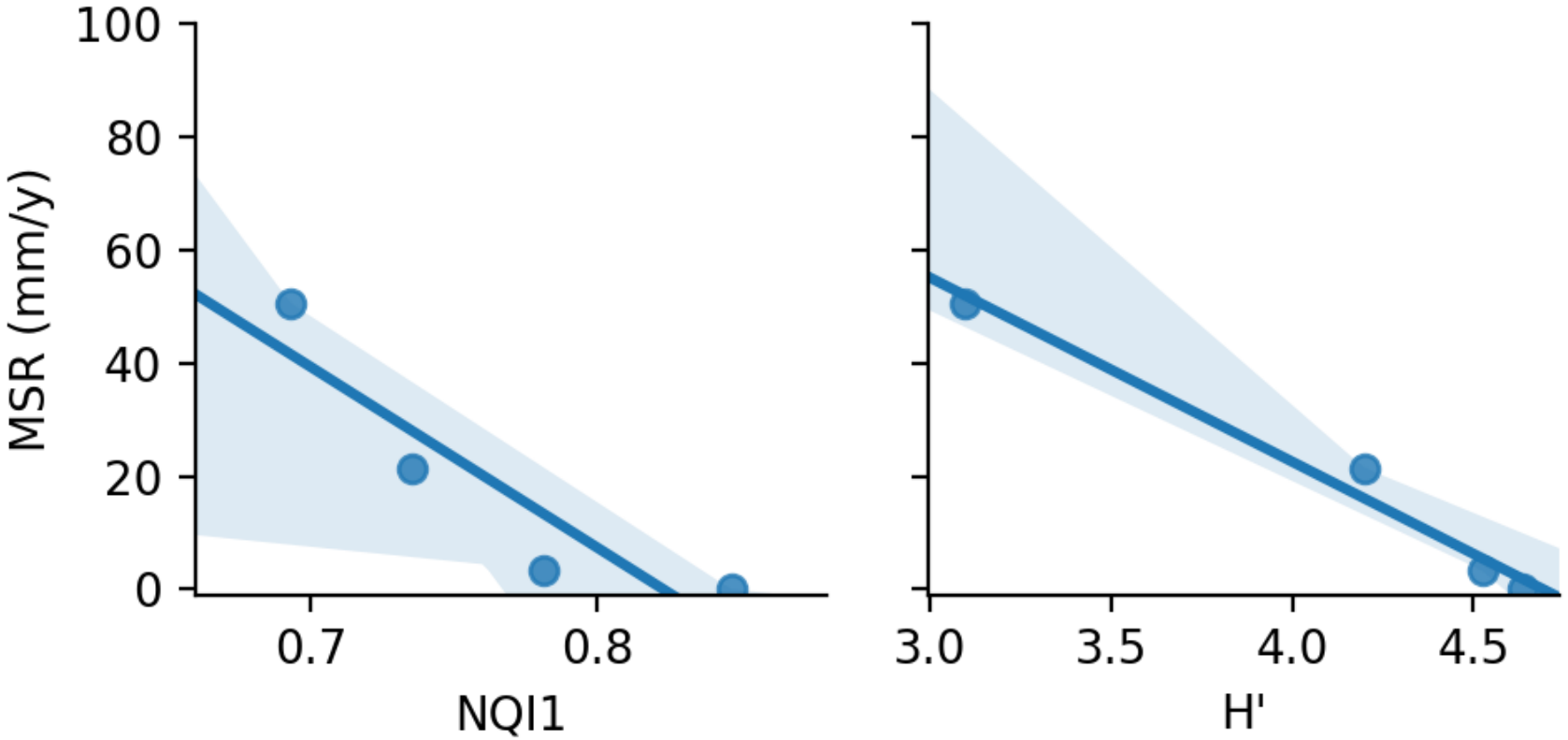


Combining NYKOS results to estimate environmental risk



(Model predictions and NIVA data)

Combining NYKOS results to estimate environmental risk



(Model predictions and NIVA data)

Beyond the NYKOS project – using the results

- Continuous improvement
- Model scenarios: use numerical models for testing different options (pipe position, discharge composition, etc)
- Operational forecasts systems, integrate models with online measurements
- Combining particle measurement instruments with emerging technologies (AUVs) and acoustics for better coverage

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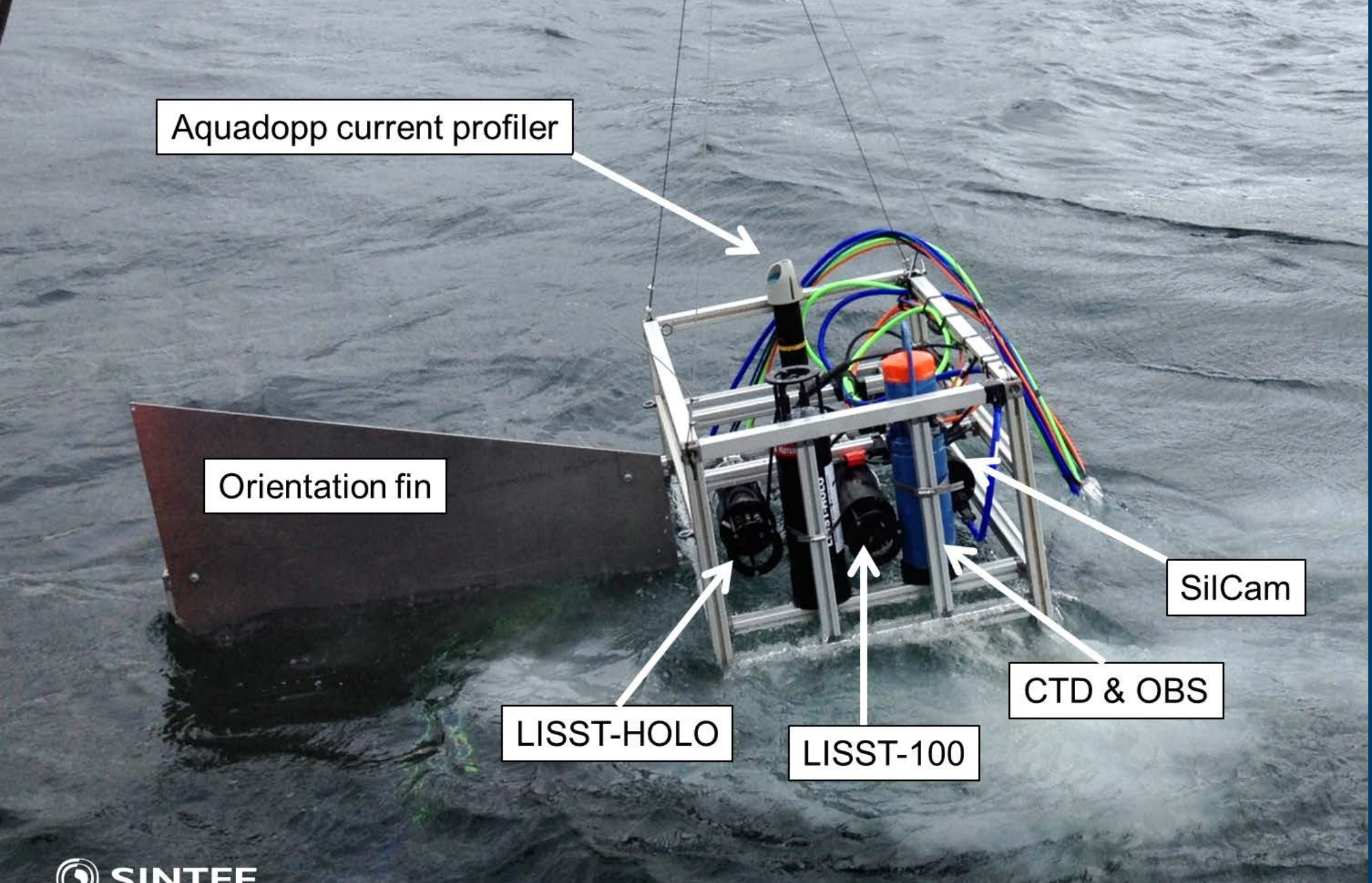
Teknologi for et bedre samfunn



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Transport-fate model (DREAM)

Originally developed for O&G industry

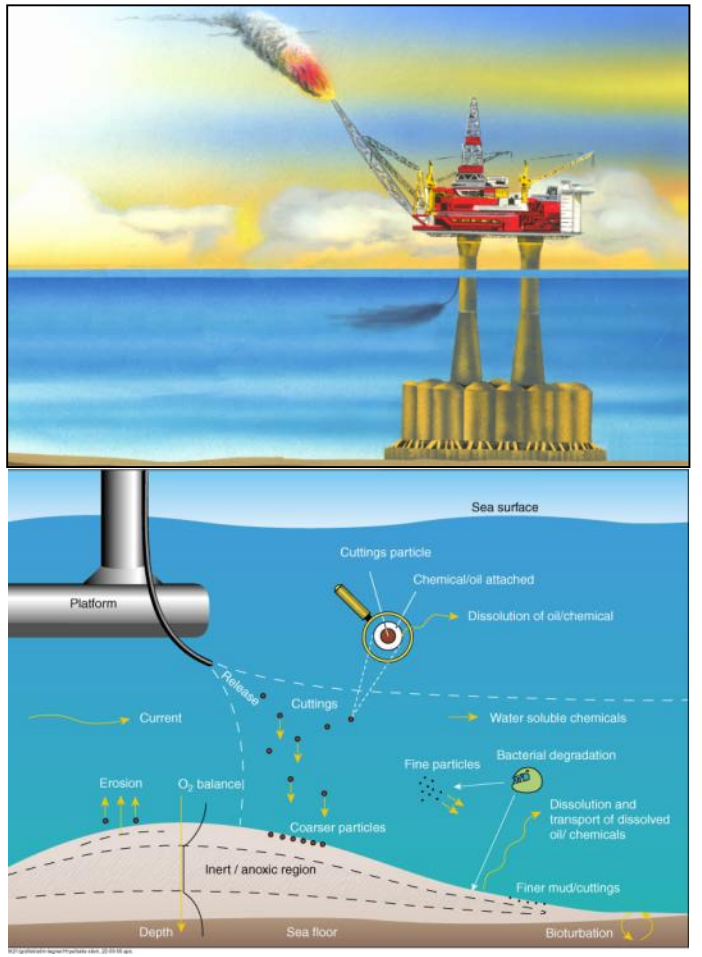
- Produced water discharges
- Drilling discharges

Three-dimensional Lagrangian transport model

- Multi-site, multi-component releases
- Chemical and biological fate processes
- Predict concentrations, sedimentation in space and time

Optional submodels:

- Sediment resuspension
- Benthic fate model
- Sediment toppling
- Flocculation (new)



www.sintef.no/DREAM

Flocculation model

- Flocculation: particles colliding and sticking together
  - Increased settling speed
  - Lower density
  - Relevant for mine tailings in sea water
- Model approximates effect of floccluation on settling speed
- Settling speed related to concentration of particles