

The value of modern adaptive sediment spill monitoring and management – illustrated by an example from the Baltic Sea

Mathias Singsaas Frøseth, DHI Norway
Sina Saremi, DHI Denmark

Lofoten, 04-09-2024

About DHI



Global consulting company with deep expertise, leading technology and continuous innovation



Independent foundation, profit-for-purpose



Supporting sustainability in aquatic environments



1100+ employees, 80% with MSc or PhD



Representing 60+ years of experience and dedicated research



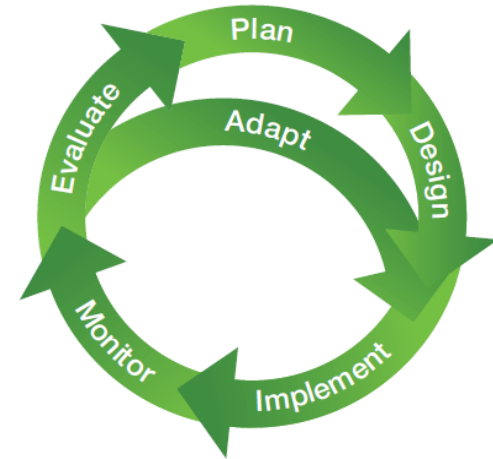
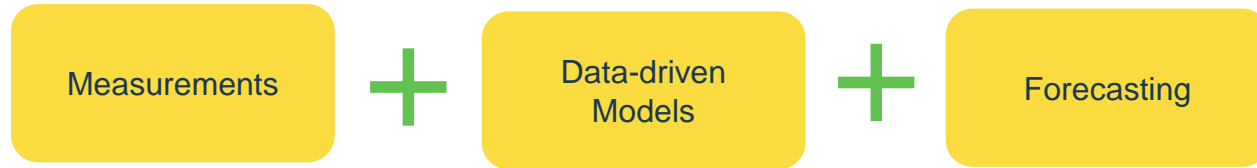
Environmental challenges in dredging

- Substantial impacts on marine ecosystems
- Water quality degradation
- Disposal of dredged

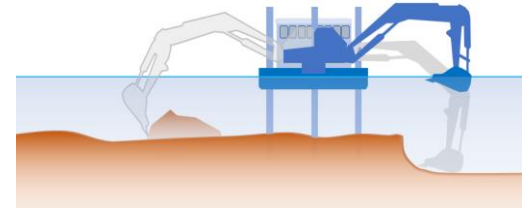
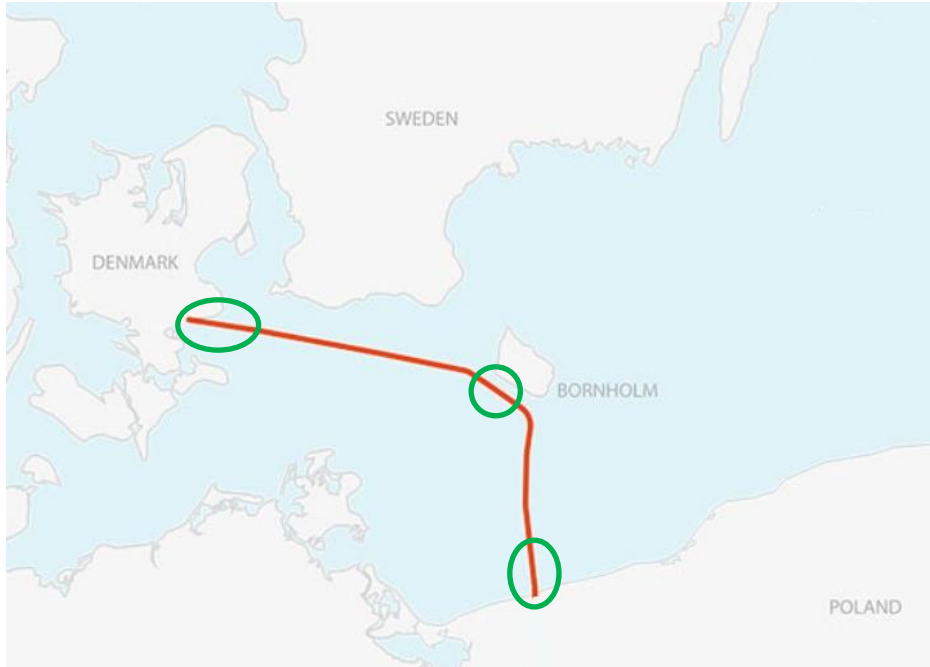


Feedback & Adaptive EMMP (Environmental Monitoring & Management Plan)

Proactive Adaptive Management
with Operational Hindcast/Forecast Modelling



Case Study – Pipeline trenching/backfilling in Baltic Sea



Environment



According to EIA:

Depth-averaged suspended sediment concentrations induced by project spill must not exceed:

- 10 mg/l for more than 4 days (in the two Northern sections of the trench – Danish sections)
- 5 mg/l for more than 4 days, and 15 mg/l for more than 2.5 days (in the Southern section of the trench – Polish section)



Till

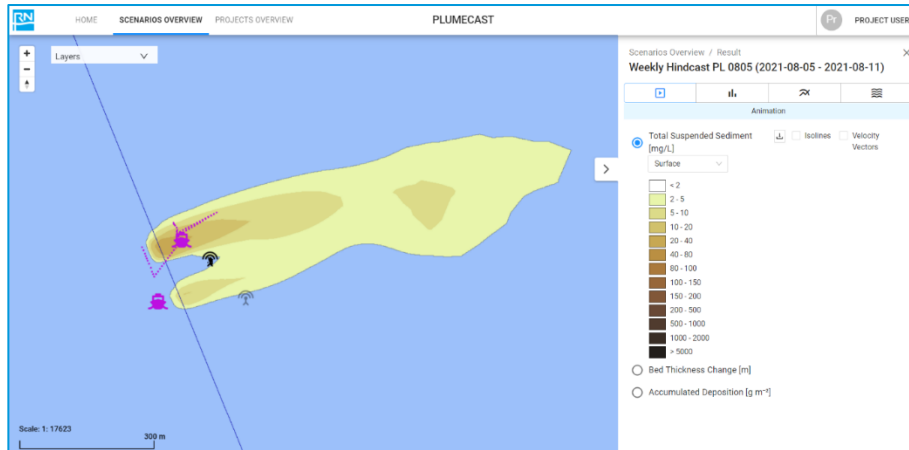


Gyttja



Sand

Spill Monitoring & Management: Measurements vs. Modelling

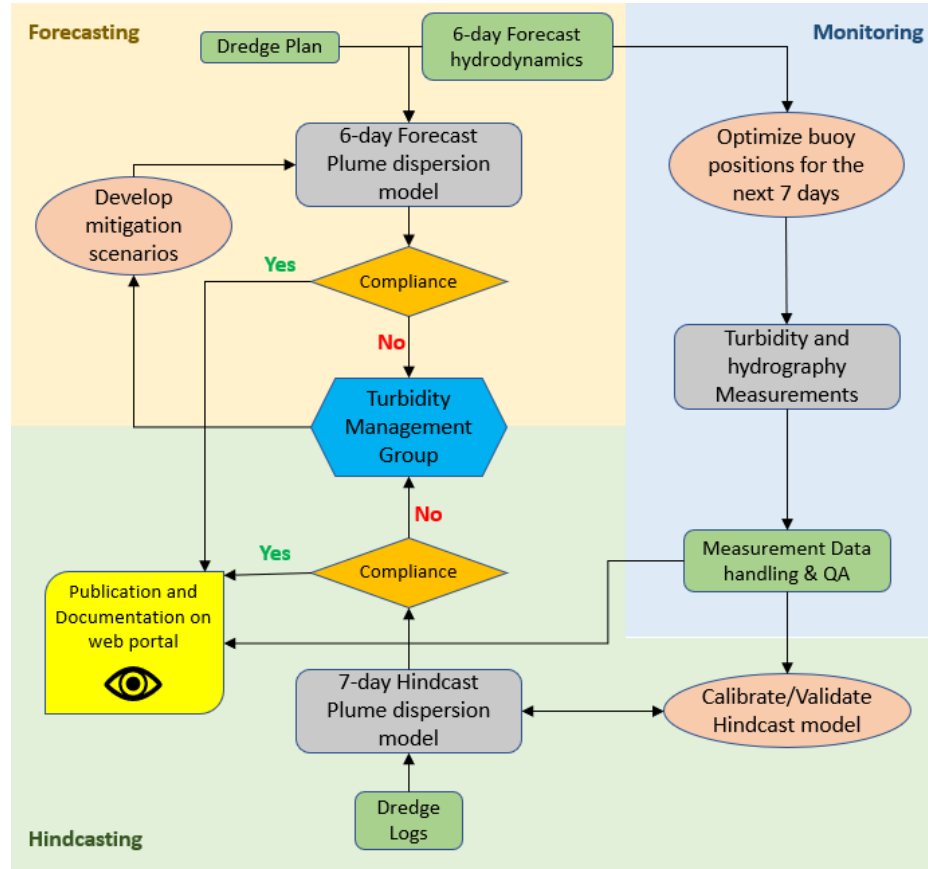


Challenges:

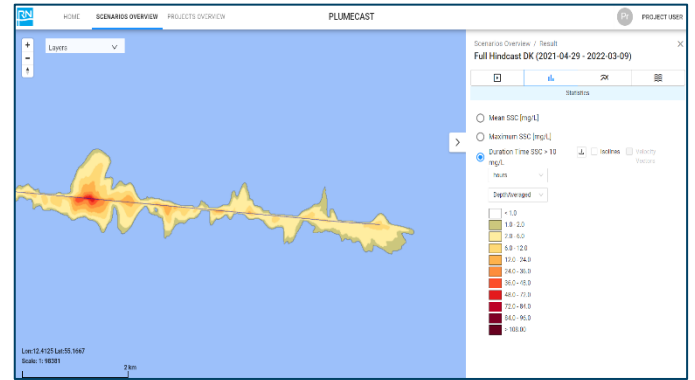
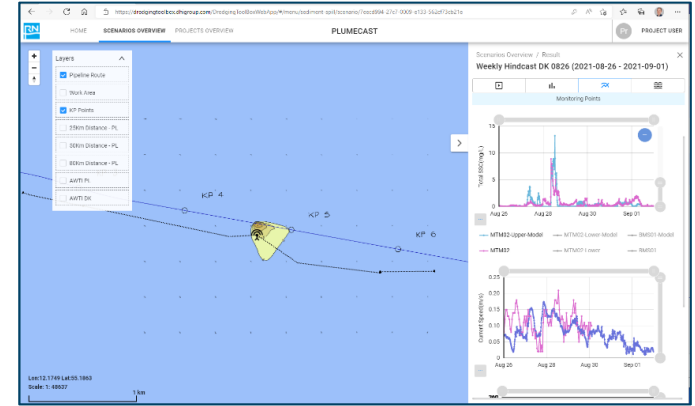
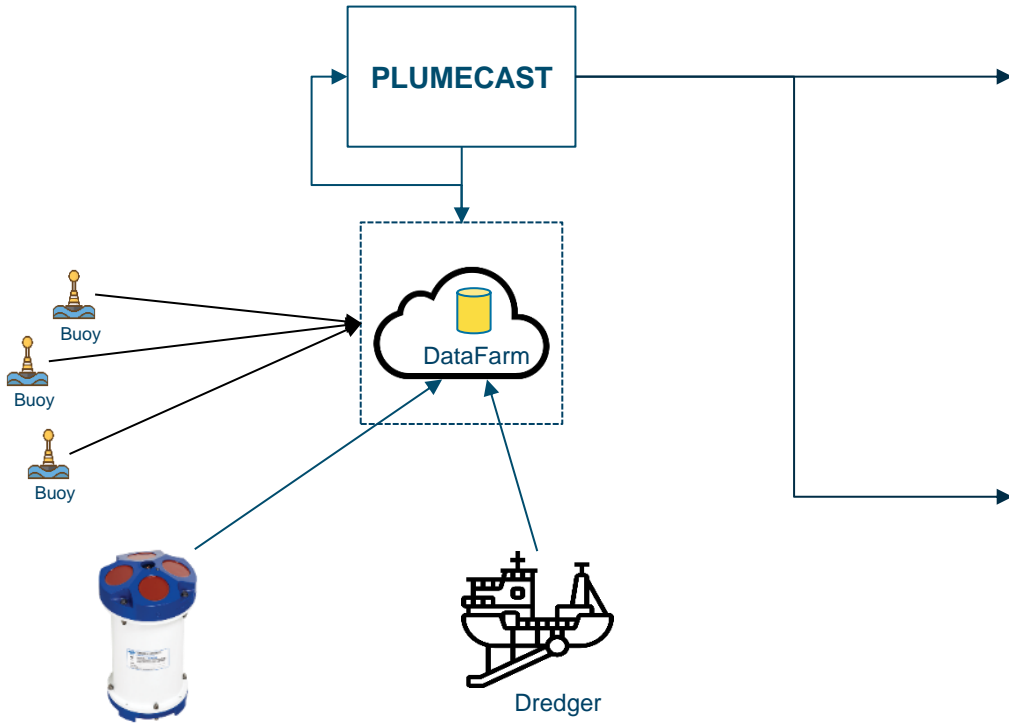
- Spill source (Dredger) moves up to 400 m/day during trenching period and even faster during backfilling
- Dynamic dredging plan on the daily scale
- Environmental criteria based on “full-picture” and depth-averaged values over the entire site

- **Model-based monitoring of spill compliance**
- **Mobile online buoys with turbidity sensors assigned to each dredger**
- **Daily re-positioning of the buoys handled by the dredging crew**

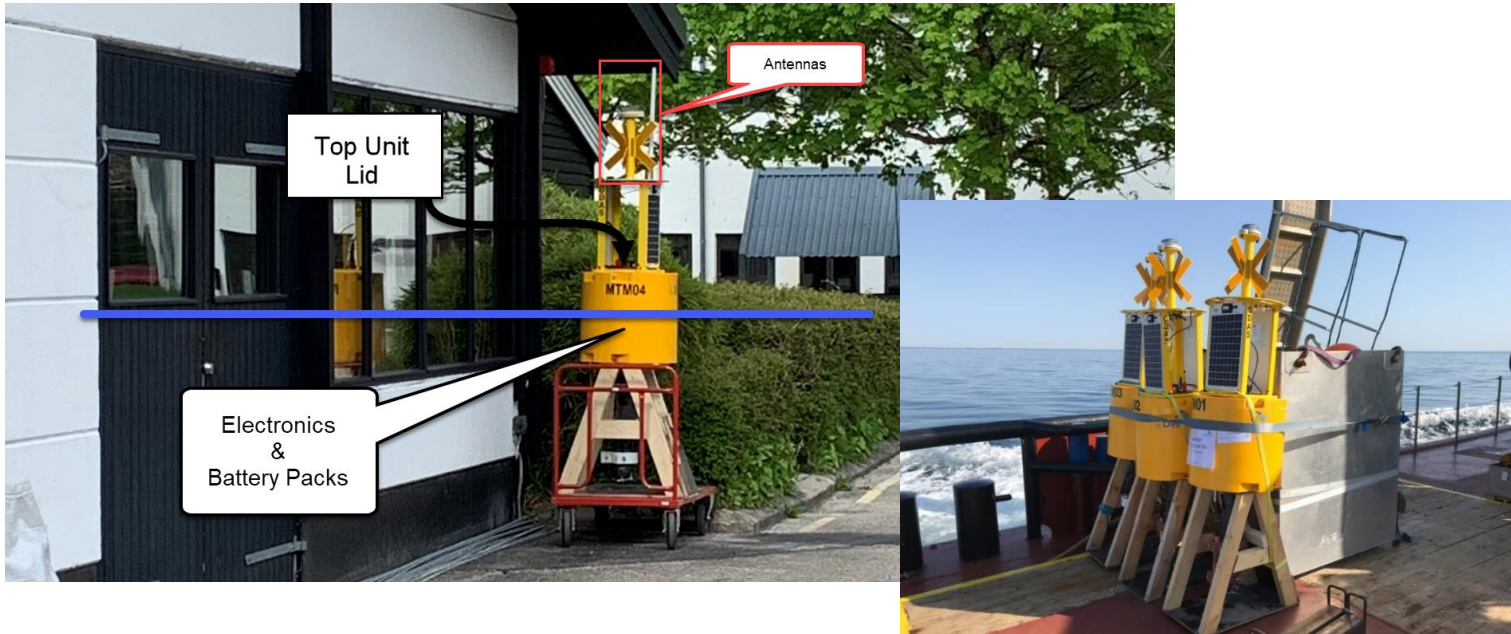
Turbidity Management System



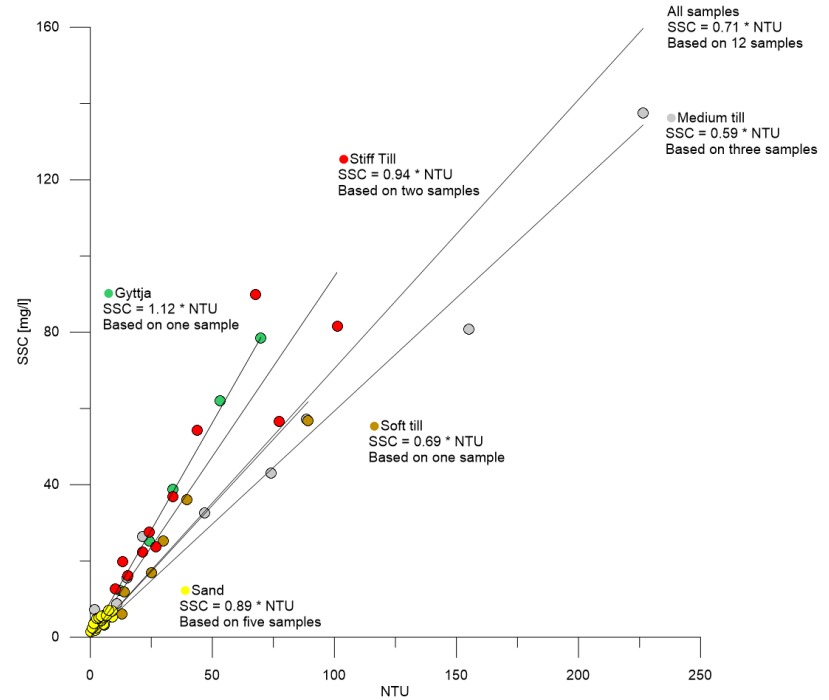
Operational Spill Monitoring & Management



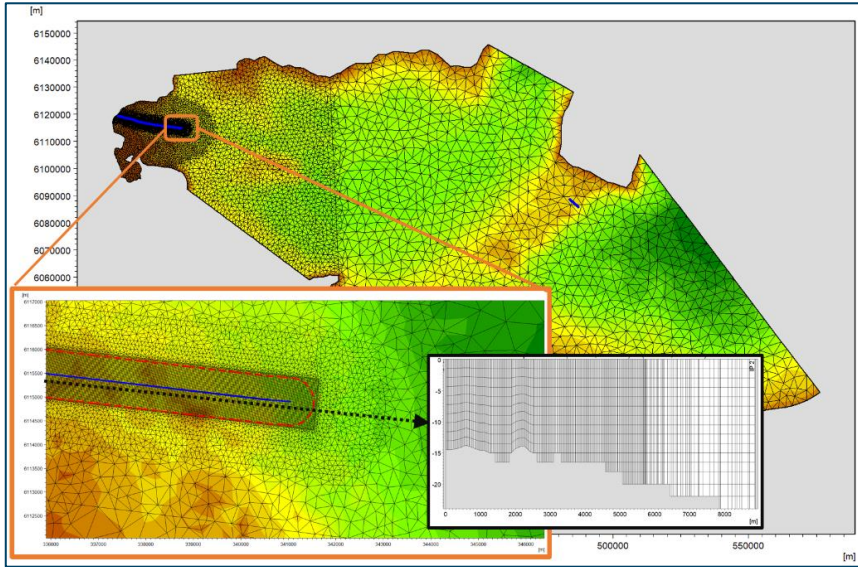
Development of repositionable turbidity monitoring buoys



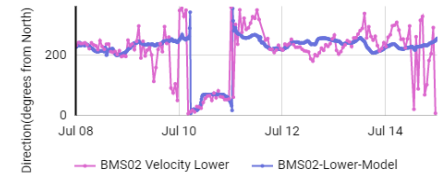
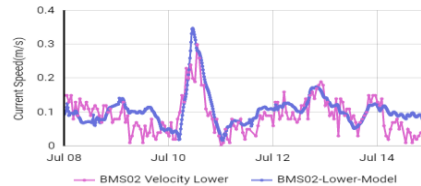
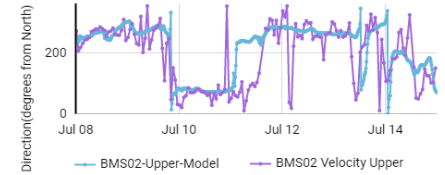
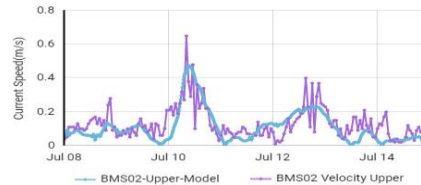
NTU-SSC Conversion



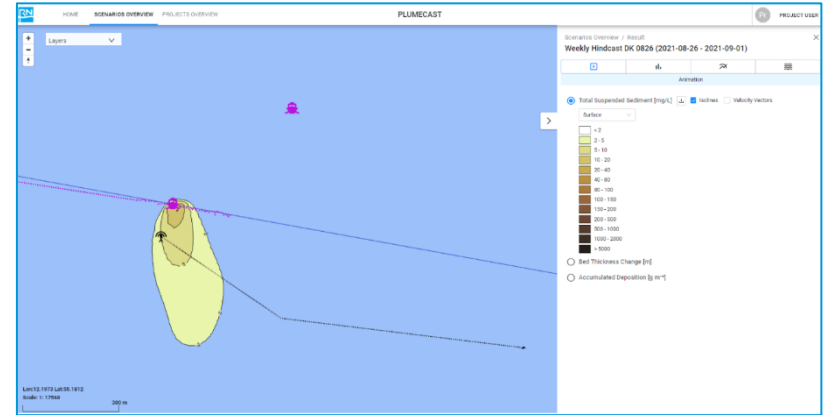
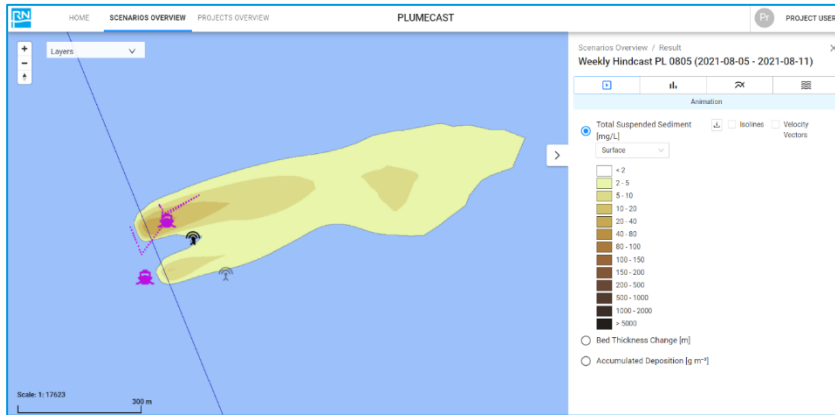
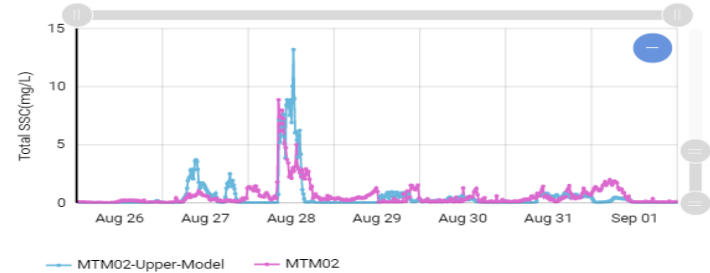
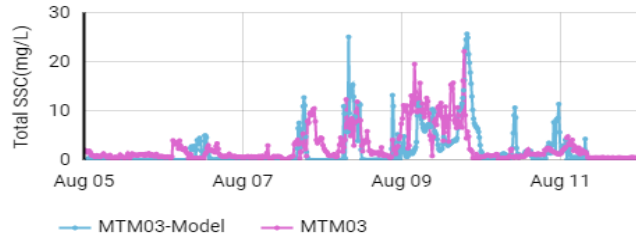
3-Dimensional hydrodynamic model



Example of modeled (blue) vs. measured (purple/pink) currents, 1m below surface & 3m above seabed, at the stationary location of the background monitoring station



Weekly calibration of sediment transport model



Conclusions



- Flow of data
- Resilience of mobile monitoring buoys
- Percentage of spill
- 1-year of continues weekly hindcast/forecast modelling
- Communication/Transparency

Questions?



Thank you for your attention
Mathias Singaas Frøseth

