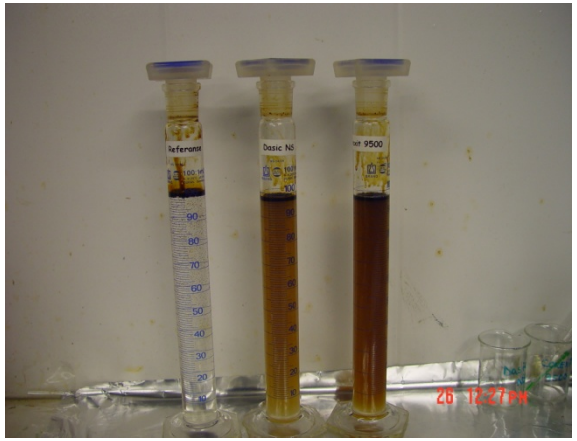
ITAC Meeting, Plymouth 26th – 28th September, 2017

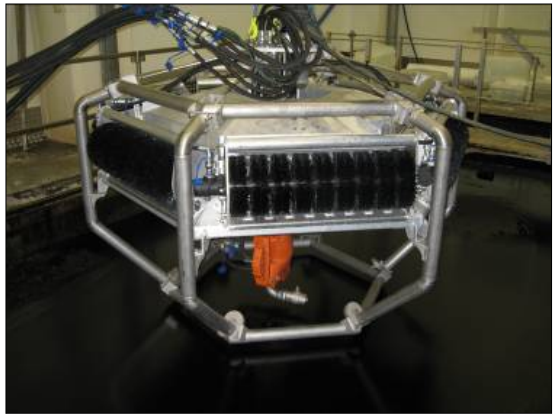
"Fate, behaviour and response to oil spills in the Arctic".

Ivar Singsaas, Senior Research Scientist
SINTEF Ocean

MARINE LABORATORY - SINTEF SEALAB

Trondheim, Norway





Small to medium scale laboratories

SINTEF

Background

Expected future and ongoing petroleum activities in Arctic areas:

- Norway – 23rd licensing round – Barents Sea (announced 2015)
- Potential new oil field productions in Barents Sea and Canada – offshore Newfoundland
- Other circumpolar areas / area with ice
  - Greenland
  - Russia – Kara Sea and Sakhalin

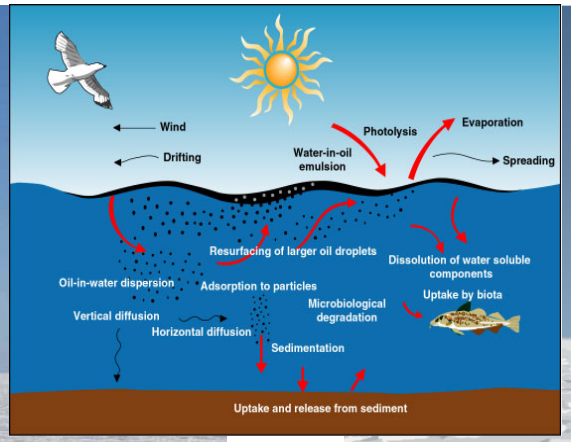
Common features: Activities in open water most of the year, but with the potential of an oil spill to be in conflict with ice edge or MIZ in periods of the year

SINTEF

Justification: two very different scenarios

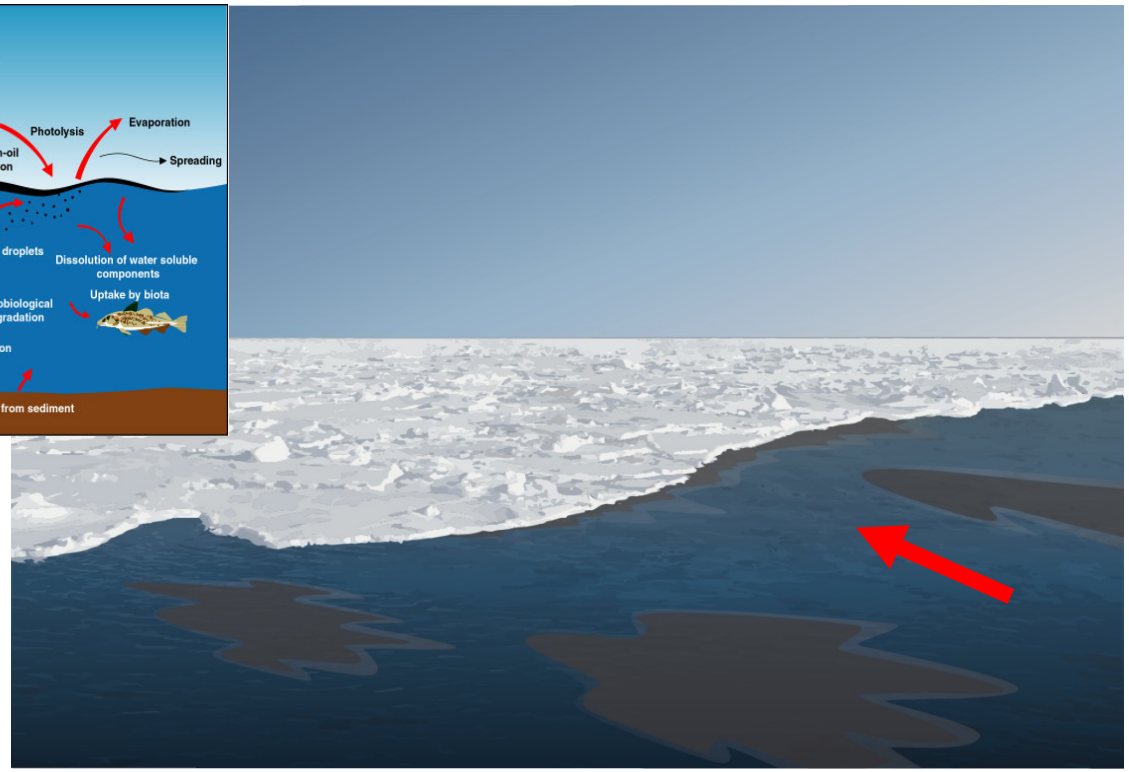
Oil spilled inside the ice:

- Slow weathering
- Dealing with fresh to lightly weathered oil
- Large window-of-opportunity for response



Oil spilled in open water drifting towards the ice:

- Rapid weathering
- Dealing with lightly to heavily weathered oil
- Restricted window-of-opportunity for response



SINTEF

FATEICE: FATE AND BEHAVIOUR OF DRIFTING OIL AT THE ICE EDGE AND IN THE MARGINAL ICE ZONE (MIZ)

SINTEF

FateIce – overall objective

to provide new knowledge of oils' fate and behaviour when drifting into the ice edge or in scattered ice conditions as a foundation for establishing robust oil spill response technologies, strategies and operations for such spill scenarios

Sponsors:

ConocoPhillips

Statoil

ENGIE

eni

OMV

AkerBP

Lundin Norway

Forskningsrådet

Cooperating partners:

NTNU

Canada CNRC·NRC

UNIVERSITY OF OSLO

MEMORIAL UNIVERSITY

Reference group:

NOFO

KYSTVERKET

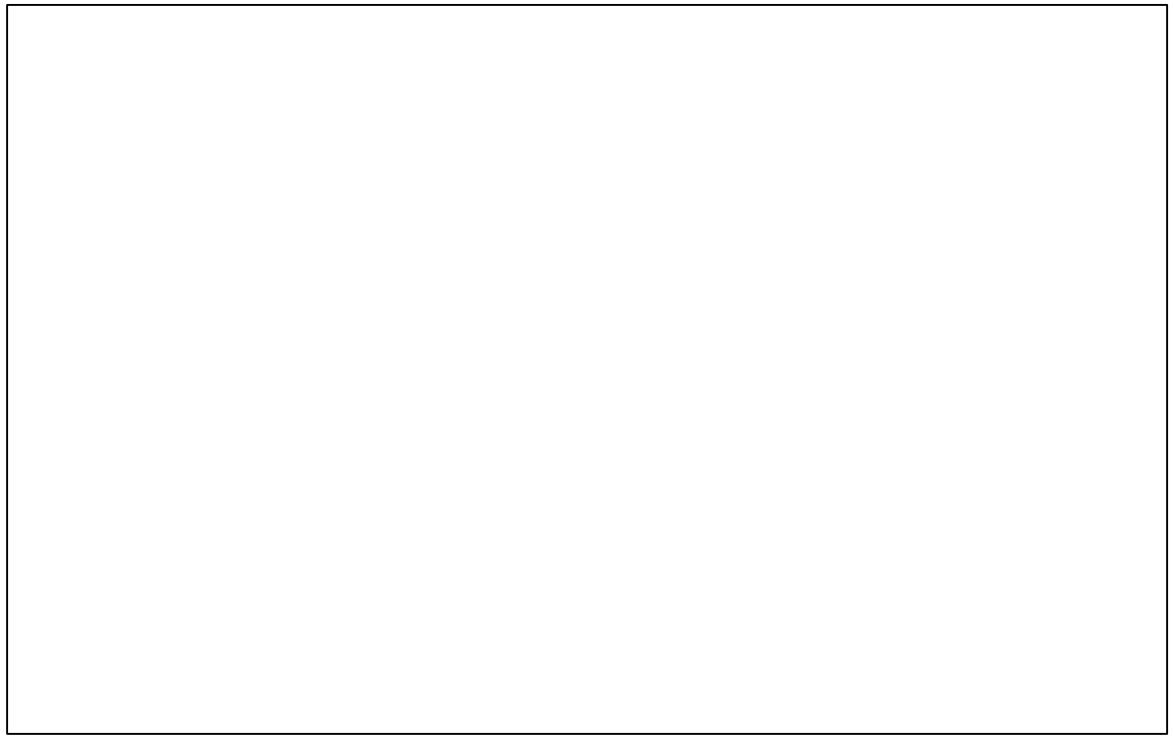
ECRC ~ SIMEC

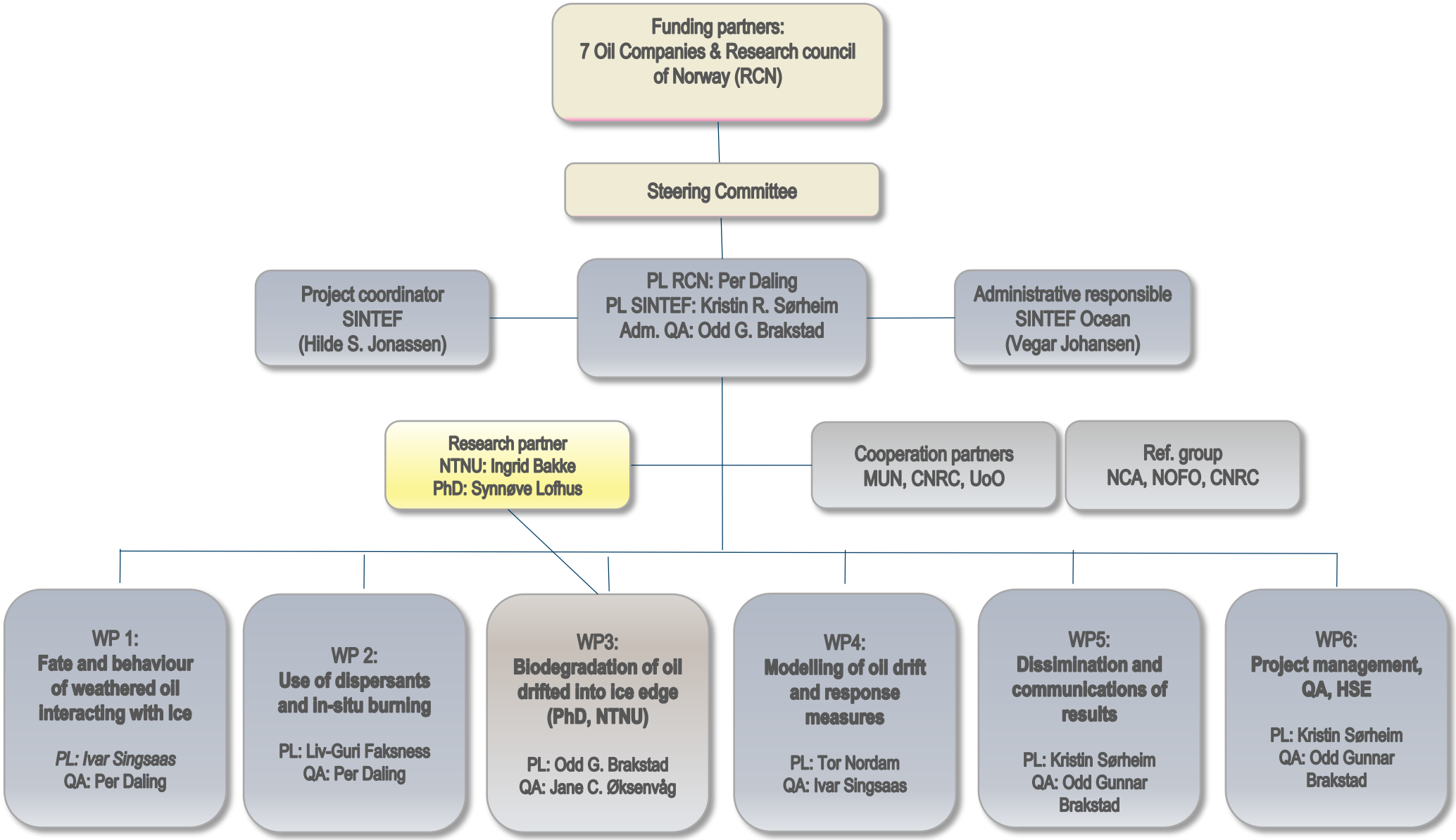
SINTEF

Knowledge needs

In order to obtain the main objective:

- *Increased understanding of physical processes when weathered oils are meeting the ice edge*
- *Evaluate the effectiveness of dispersants and ISB on weathered oils at the ice edge*
- *Biodegradation and improved understanding of microbial processes for different oils interacting with the ice edge*
- *Updated model framework to better describe transport, weathering, entrainment, dispersibility, ignitability and biodegradation for weathered oils at the ice edge and in the MIZ.*




Funding partners:
7 Oil Companies & Research council of Norway (RCN)
Steering Committee
Project coordinator
SINTEF
(Hilde S. Jonassen)
PL RCN: Per Daling
PL SINTEF: Kristin R. Sørheim
Adm. QA: Odd G. Brakstad
Administrative responsible
SINTEF Ocean
(Vegar Johansen)
Research partner
NTNU: Ingrid Bakke
PhD: Synnøve Lofhus
Cooperation partners
MUN, CNRC, UoO
Ref. group
NCA, NOFO, CNRC
WP 1:
Fate and behaviour of weathered oil interacting with ice
PL: Ivar Singsaas
QA: Per Daling
WP 2:
Use of dispersants and in-situ burning
PL: Liv-Guri Faksness
QA: Per Daling
WP3:
Biodegradation of oil drifted into ice edge (PhD, NTNU)
PL: Odd G. Brakstad
QA: Jane C. Øksenvåg
WP4:
Modelling of oil drift and response measures
PL: Tor Nordam
QA: Ivar Singsaas
WP5:
Dissimination and communications of results
PL: Kristin Sørheim
QA: Odd Gunnar Brakstad
WP6:
Project management, QA, HSE
PL: Kristin Sørheim
QA: Odd Gunnar Brakstad

Fate and behaviour

Oil	Category	Topped
Wisting Central	Naphtenic	250°C+
Troll B	Naphtenic	250°C+
Grane	Asphaltenic	200°C+ 250°C+
Oseberg Blend	Paraffinic	250°C+
MGO	Product	No

Task 1: Selection of oils and large-scale topping

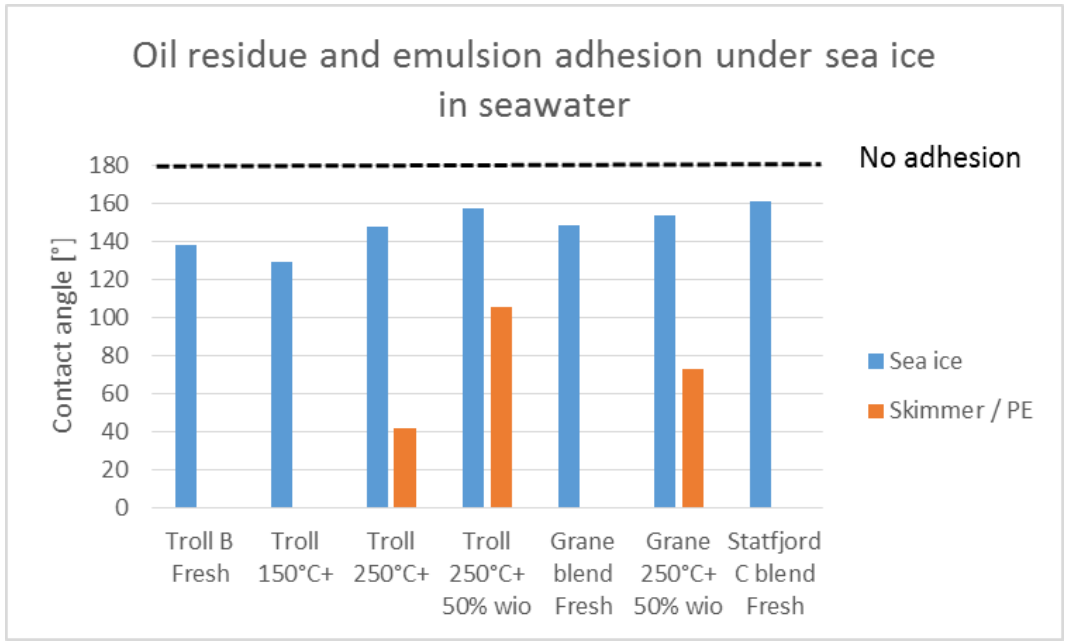
Task 2: Bench-scale experiments

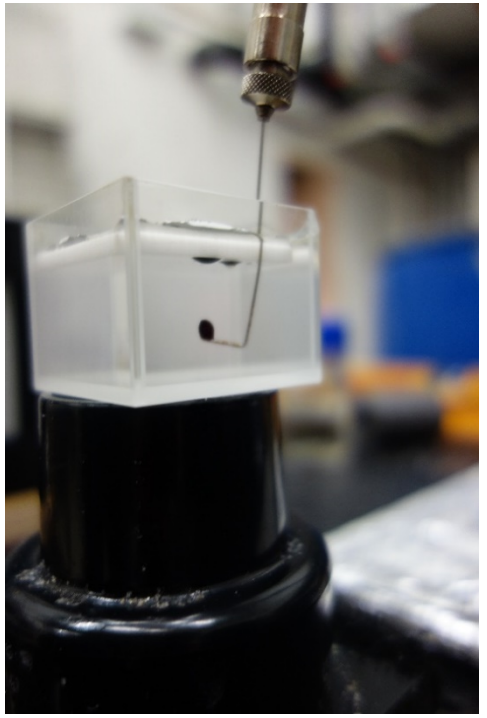
Task 3: Flume basin experiments

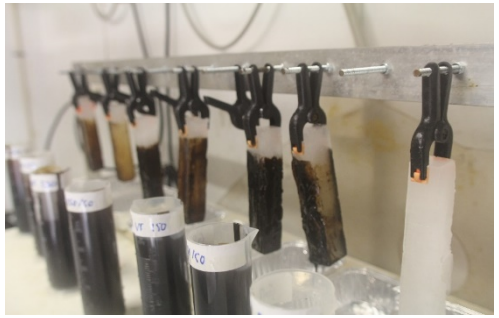
Task 4: Option: Basin experiments

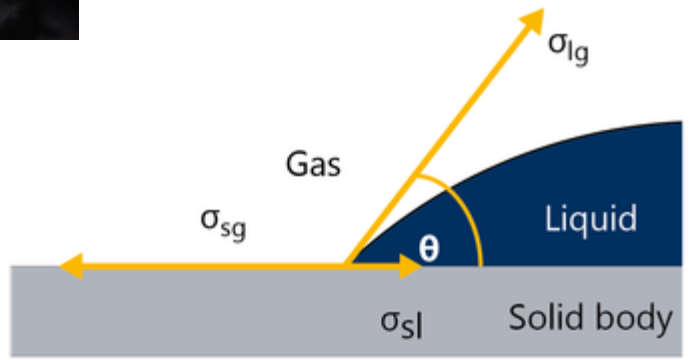
SINTEF

Oil – ice interaction. Initial testing









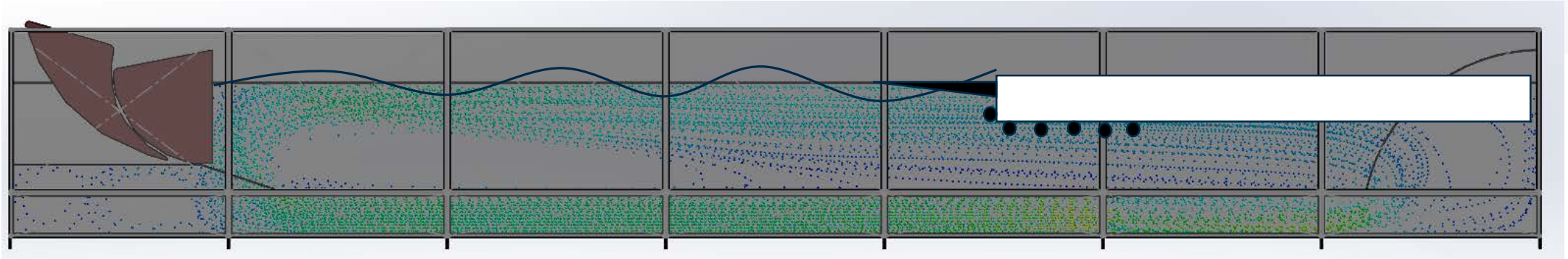
1. Adhesion test using ice rods submerged in oil
2. Oil under ice in sea-water, measuring contact angle
3. Oil on ice in sea-water, measuring adhesion and contact angle
   - Sea ice is very hydrophilic – repelling oil droplets immediately
   - Very low adhesion of oil to ice
   - Some variations between oil types
   - More adhesion to cold and dry ice compared to moist ice

SINTEF

Meso-scale experiments

- Interaction between weathered oil and solid ice edge
- Horizontal and vertical migration of weathered oil in slush ice (frazil ice)
- Movement of weathered oil among ice floes
- Use of dispersants on weathered oil at the ice edge

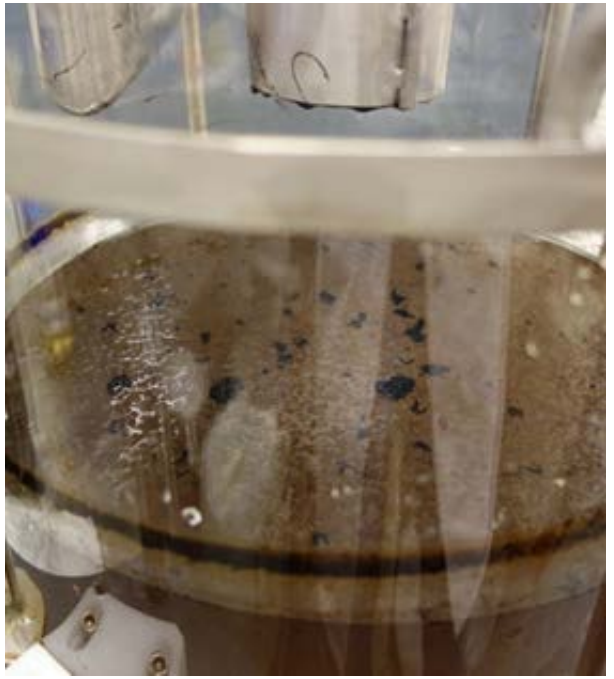
VIDEO



SINTEF

Dispersants and ISB

- Use of dispersants and in situ burning (ISB) as an alternative or supplement to mechanical recovery on oil drifting towards the ice edge and oil released in light and scattered ice conditions.
- Main focus:
  - Window of opportunity
  - Effectiveness
  - Application strategies for dispersants
  - Ignition for ISB



Other topics addressed

Biodegradation

- Obtain better biodegradation data and improve our understanding of microbial processes with respect to natural attenuation and chemically dispersed oil interacting with the ice edge.

Modelling

- Further development of a research version of a oil drift model that can simulate oil drifting into the ice edge/MIZ.

Operational Guideline

- Prepare an operational guideline describing the best available oil spill response methods and strategies for different spill scenarios when weathered oil is interacting with the ice edge.


Thank you for your attention ☺