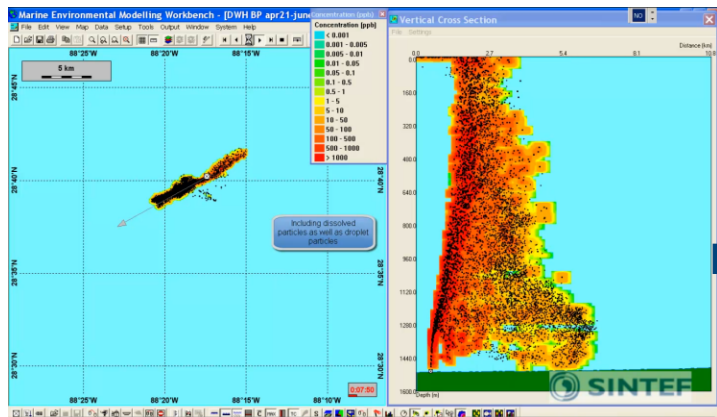Planned and In-Progress

Oil Spill-Related Research: Partial Summary

Baton Rouge Forum

Organized by the Coastal Response Research Center

January 10 – 11, 2012

Mark Reed

SINTEF Institute for Materials and Chemistry

Department of Marine Environmental Technology

**Trondheim, Norway**

Outline: 5 project areas

- JIP: Decision Support Tool for Coastal and Nearshore Oil Spill Response (2011 – 2013)

- EU Project: ACCESS (Arctic Climate Change Economy and Society, 2011 – 2014)

- GRI U Texas Project: Fate of Oil Spills – bridging small scale processes with meso-scale modeling (2012 – 2014)

- SINTEF Funded: Ocean Space Surveillance (2009 – 2012)

- Continued 3D oil spill model development (OSCAR)

Decision Support Tool for Coastal and Near-shore Oil Spill Response

- Funded by the Norwegian Research Council, Statoil, Shell Norge, Eni Norge
- 16 million Nok (~3 million $US)
- 2011 – 2013
- Develop and implement improved algorithms for numerical modeling
  - Oil on shorelines
    - Deposition
    - Distribution of oil on and within shoreline sediments
    - Removal
  - Fate of oil droplets with and without dispersants
    - Interactions in the water column
      - Zooplankton
      - Suspended particulate matter
   - Bottom sediments

WP1: Oil on shorelines

• Based on re-analysis of dataset on tidal-cycle-dependent penetration in sediments

• Product of an earlier Coastal Oil Spill Joint Industry Project (2007-2010)
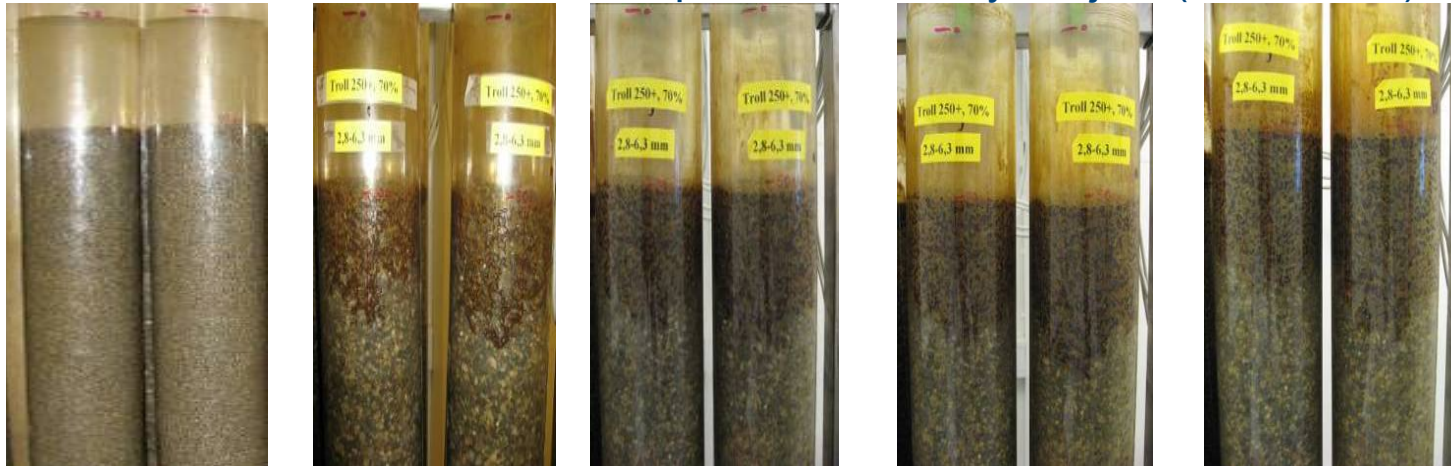
• Controlling parameters
  • Oil rheological properties: density, viscosity, pour point
  • Grain size distribution of shore sediment
  • Loading of emulsion (thickness of emulsion applied to the surface of shore

WP1: Modelling of oil penetration into shoreline sediments

- Discretization of shoreline
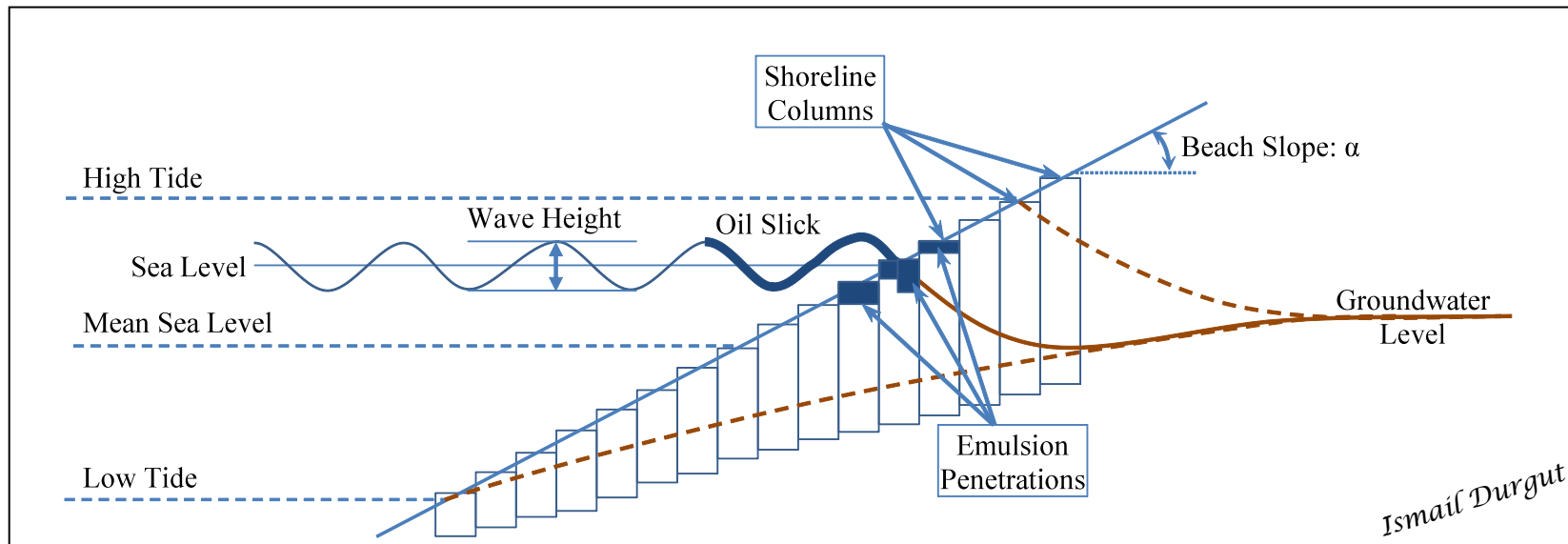
- Controlling factors of oil penetration
  - Shore sediment properties (grain size range, storativity, transmissivity)
  - Shoreline parameters (beach slope, tide range)
  - Oil properties (viscosity, density)

WP 2: Fate of dispersed oil in the water column

- Filtering capacity by filtrating organisms (*Calanus finmarchicus* and *Mytilus edulis*)

C. finmarchicus exposed to dispersed oil
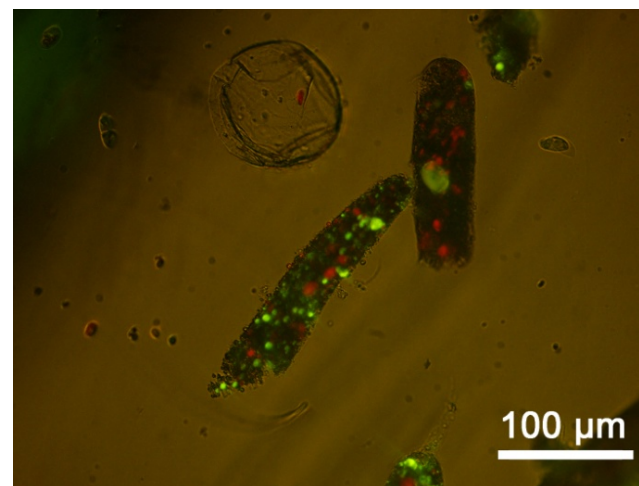
Fecal products of *C. finmarchicus* exposed to dispersed oil

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WP 3: Interactions between oil droplets, bottom sediments and organisms

- Interaction between naturally and chemically dispersed oil and suspended sediment particles and bottom sediments

- Depletion of oil droplets through filtration by benthic filter feeders

- Biodegradation of dispersed oil in and on the surface of marine sediments

- Integration of new data with results from previous international studies

- Development, implementation, and testing of algorithms

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EU Project: ACCESS (Arctic Climate Change Economy and Society, 2011 – 2014)

28 Partners; Coordinated by the University Pierre et Marie Curie, Paris
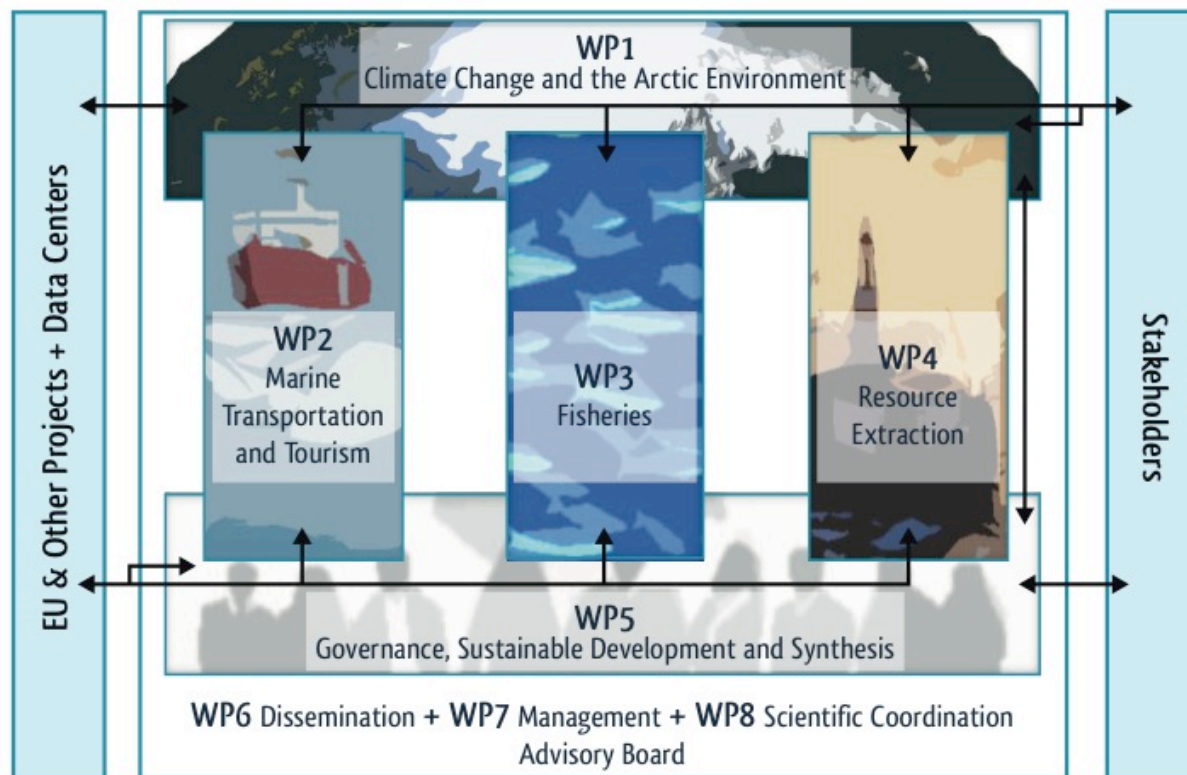
5 Technical Work Packages
11 million Euros (~14 million $US)

University of Texas GoMGRI Project: Impact of Biological, Physical and Chemical Processes on the Fate of Oil Spills – bridging small scale processes with meso-scale modeling (2012 – 2014)

SINTEF Activities:

- Development and testing of algorithm to calculate the oil droplet and gas bubble size distributions after turbulent breakup regime in an underwater blowout plume
  - Experiments in meso-scale blowout tower
- Improvement of droplet and bubble rise rate calculations accounting for the effect of turbulence on terminal velocities
- Effects of turbulence on oil droplet interactions with suspended particulate matter in the water column, and on rising/settling velocities
- Continuation of zooplankton-oil droplet interactions and eventual oil fates
- Bacterial bio-degradation rates and products
- Model development, testing and validation

SINTEF meso-scale blowout tower

- **Total height 6 m, internal diameter 3 m, filled with approximately 40 m3 of sea water**

Oseberg blend (North Sea oil)

+1.5 m
+1.0 m
+0.5 m
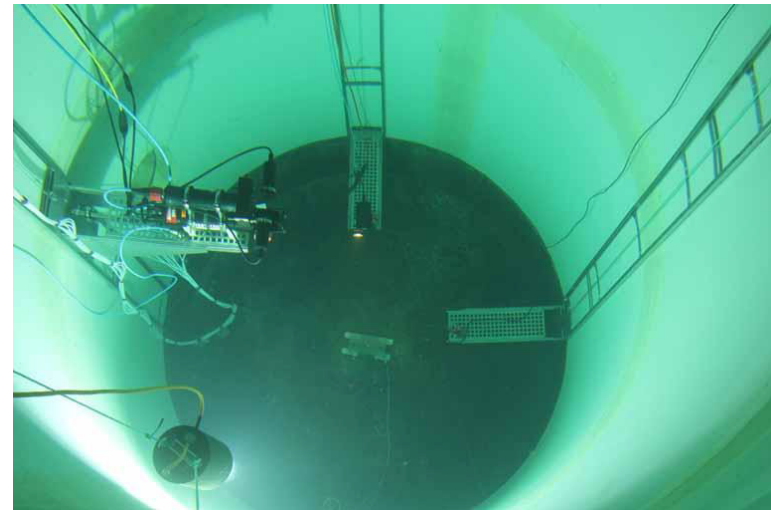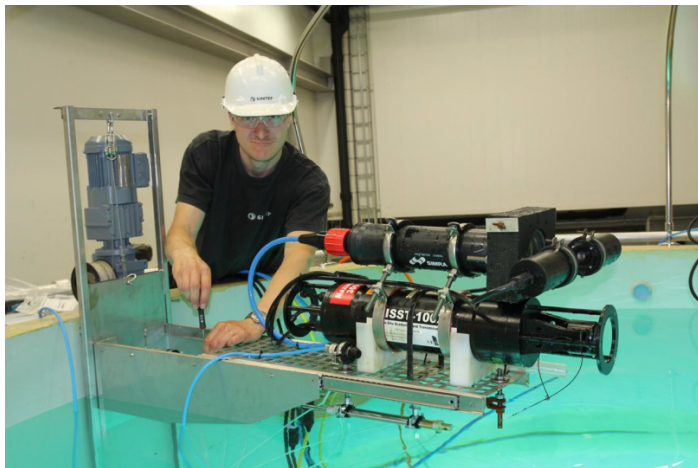
SINTEF project: Ocean Space Surveillance (2009 – 2012)

- Real-time coupling between wireless underwater sensor networks and numerical models
- Data assimilation and forecasting: hydrodynamics and oil spill models
- Planning and execution of at-sea operations
    - Fishing, aquaculture
    - Monitoring and management of operational releases
    - Oil spill response support
- 3-years, ~ $4 million
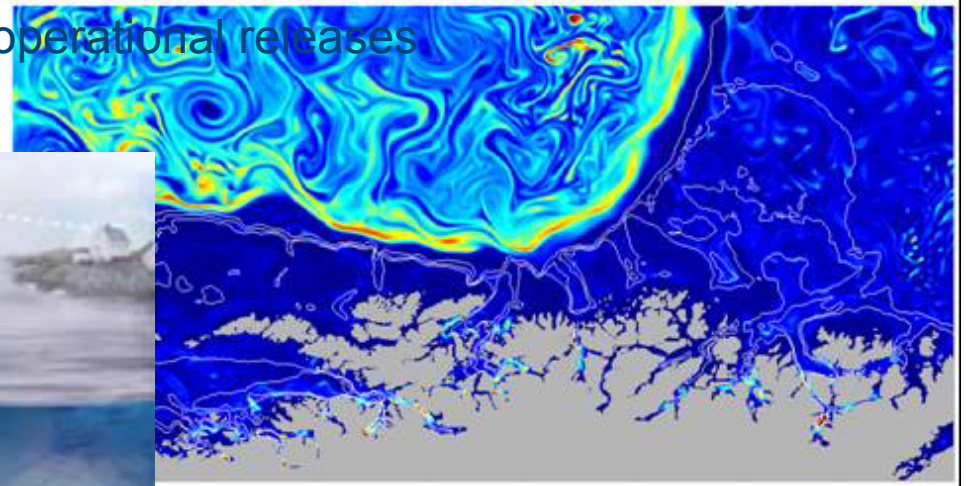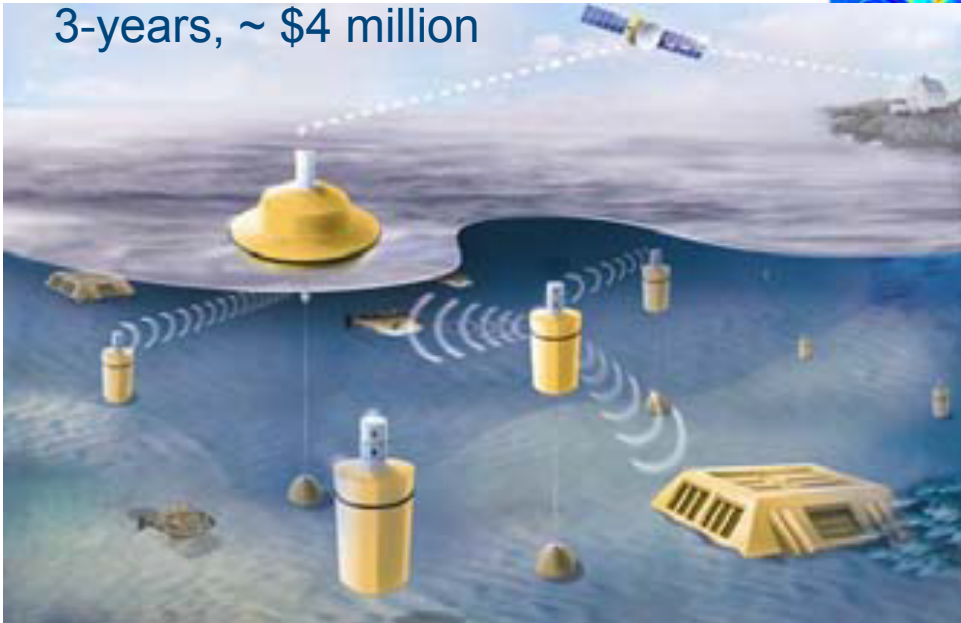
Deepwater blowout modeling as background for U Texas GRI model development
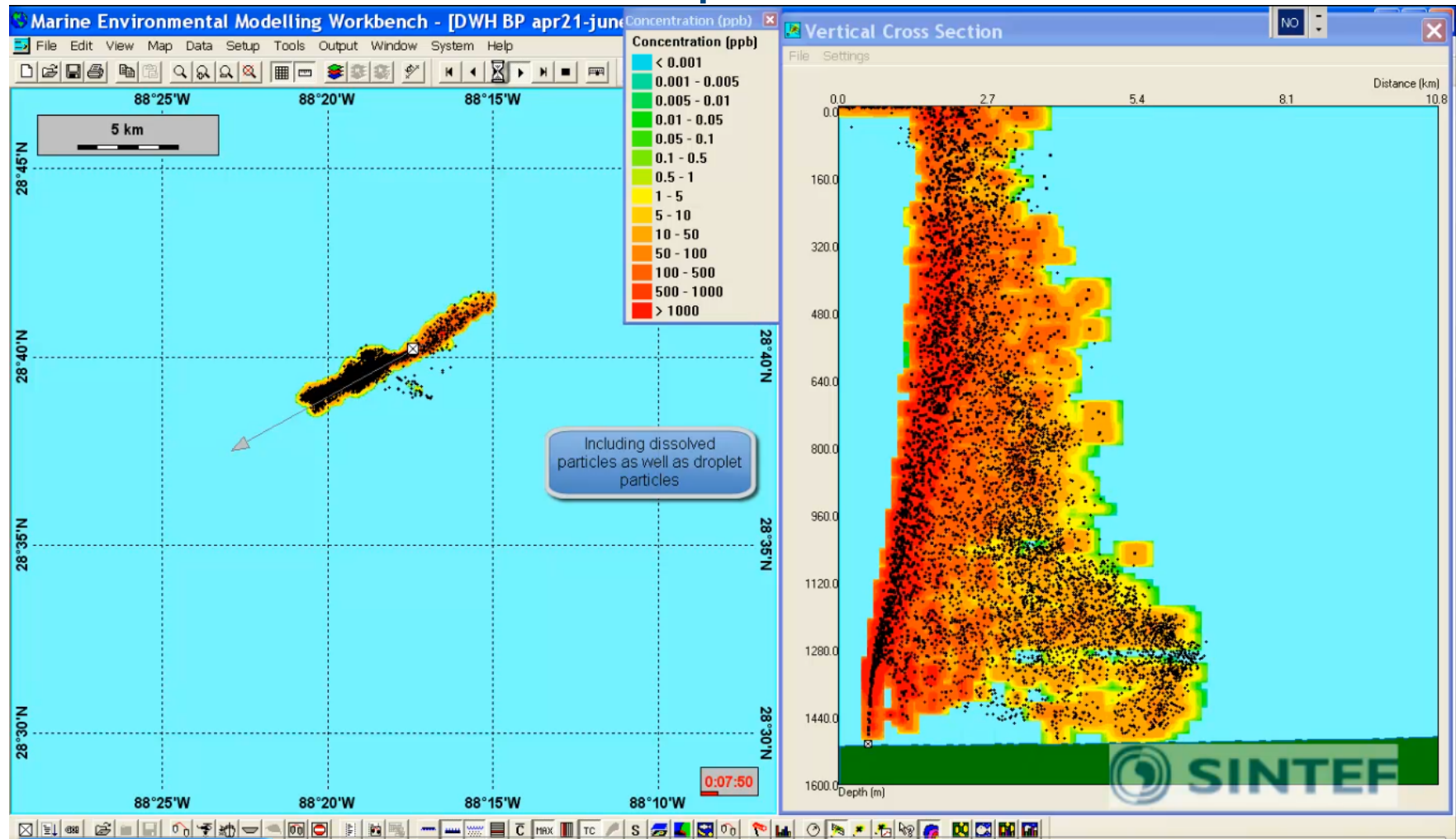
Picture series taken during dispersant injection test May 9-10, 2010

Courtesy of Ocean Imaging
Winds @ 0850 40° / 16 knots
Avg winds 64° / 16 knots

Wind direction

Release Site May 9, Prior to Injection Test

05/09/2010 8:52am CST

Copyright 2010 Ocean Imaging Corp.

West

South

East

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Release site May 10, after 3 hrs of injection

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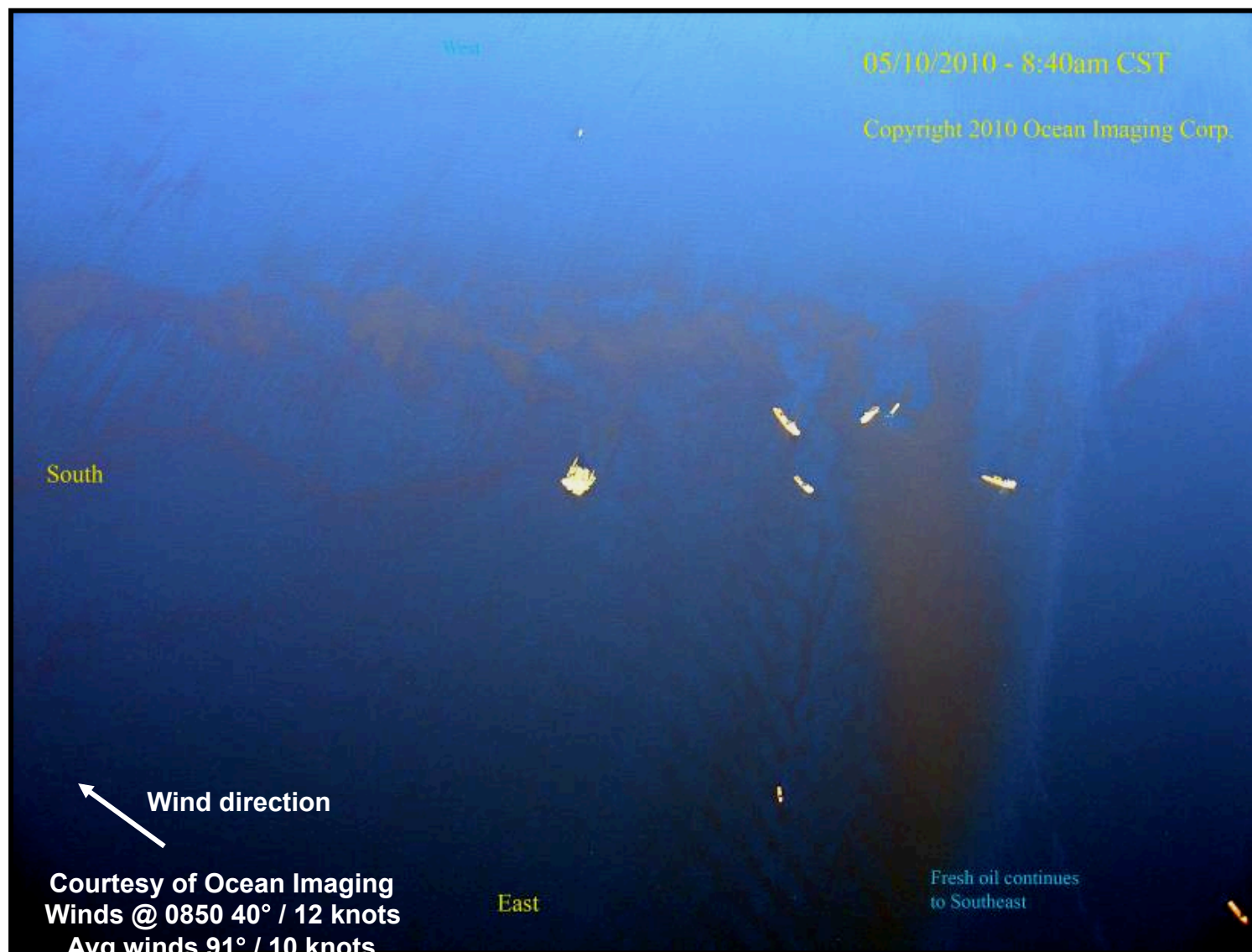
Release site May 10, after 11 hrs of injection

05/10/2010 - 5:05pm

@ 11 hrs. after start of
subsurface dispersant release

Copyright 2010 Ocean Imaging Corp.

South

North

Wind direction

Courtesy of Ocean Imaging
Winds @ 1700 120° / 14 knots
Avg winds 91° / 10 knots

East
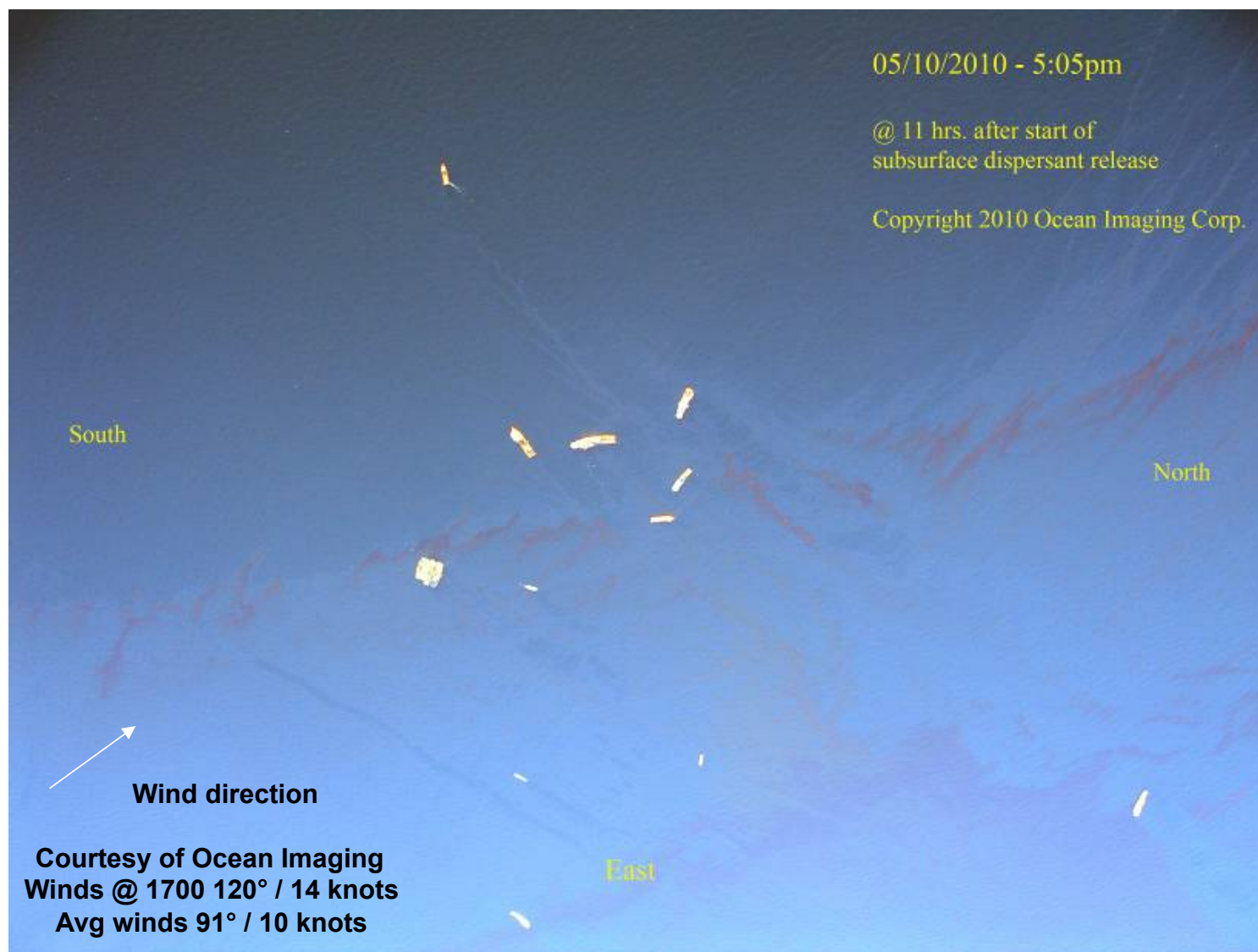
Release site May 11, 5 hrs after injection ended

05/11/2010 - 9:10am CST

Subsurface dispersant release ended 4am

Copyright 2010 Ocean Imaging Corp.

South

North

Wind direction

Courtesy of Ocean Imaging
Winds @ 1700 140° / 8 knots
Avg winds 134° / 10 knots

East

Oil continues curving
toward Southeast

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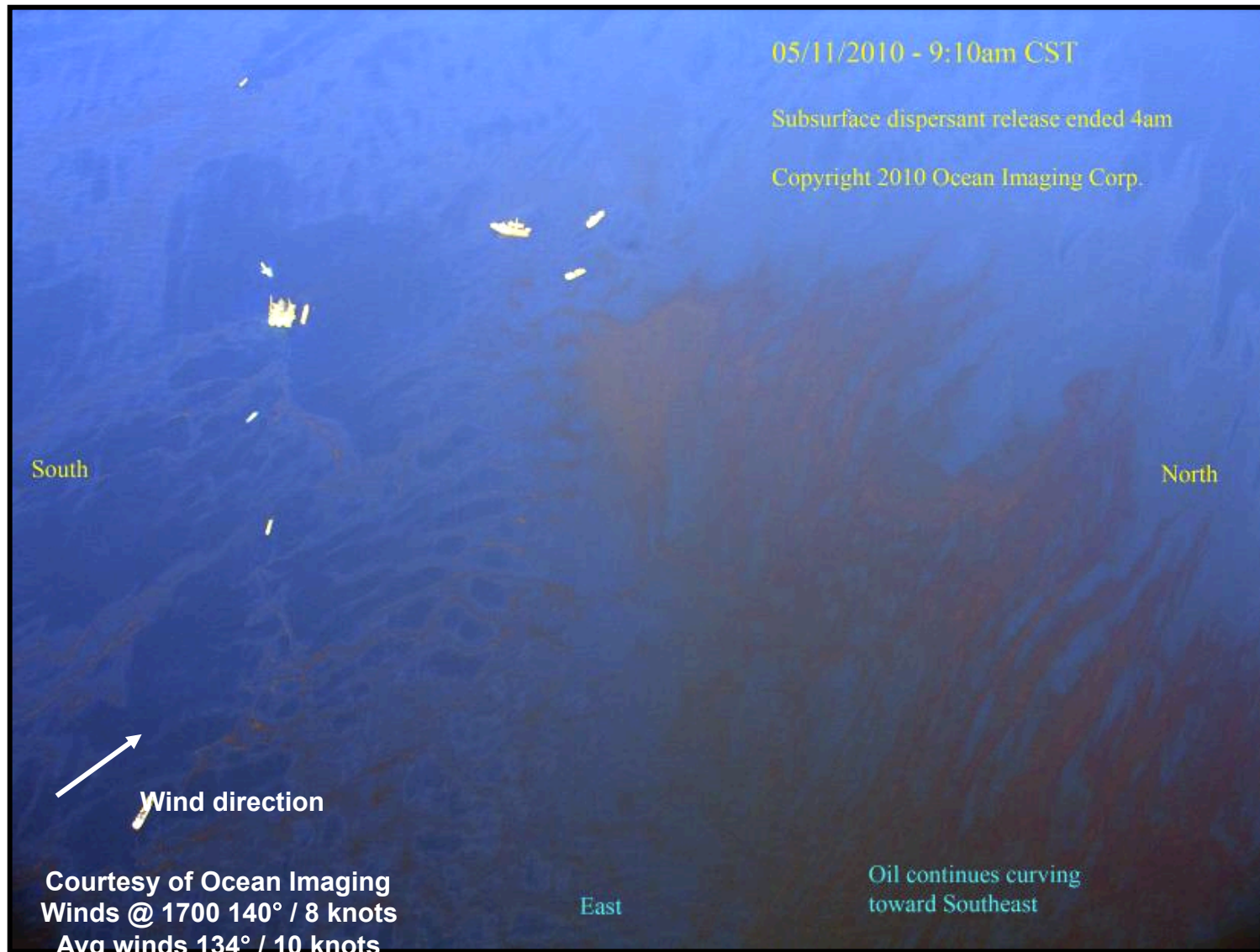
Release site May 12, 28 hrs after injection ended

Courtesy of Ocean Imaging
Winds @ 0850 150° / 7 knots
Avg winds 130° / 7 knots

Wind direction

South

North

05/12/2010 - 8:35am CST

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East