第33回北方圏国際シンポジウム
The 33rd Okhotsk Sea & Polar Oceans, 2018

Oil Spill Response Technology in Cold Water Condition
- State-of-the-art of the recent studies -

Naoki Nakazawa	中澤 直樹	システム工学研究所(株)
Hajime Yamaguchi	山口　一	東京大学
Akira Kurokawa	黒川　明	(一財)エンジニアリング協会
Jun Ono	小野　純	JAMSTEC
Takashi Terashima	寺島 貴志	(株)クマシロシステム設計
Genki Sagawa	佐川 玄輝	(株)ウェザーニューズ
Shuho Yano	矢野 州芳	(一社)日本作業船協会
Kay I. Ohshima	大島 慶一郎	北海道大学

Our study on oil spill in cold water condition started in 2017 to collect information and to review various researches of spill response technology.

Up-to-date information of spilled oil drift is indispensable for the development and implementation of an effective response.

We are grateful to the Hokkaido University Arctic Research Center for study funding.

Exxon Valdez vs. Deepwater Horizon

Exxon Valdez, Exxon	Deepwater Horizon, BP
March 24, 1989, Alaska	April 20, 2010, Gulf of Mexico
Tanker, grounding	Offshore-oil-drilling rig, explosion
11 million gallon , crude oil	**220 million** gallon , crude oil
Loss of life: 0	Loss of life: 12
Cold, no ice	Warm, no ice

What is the available response in COLD and ICE water

YES we can or NO we cannot????????

Three Arctic Oil Spill Response Research 1/3

Early 1970s: in Beaufort Sea

Large-scale work on oil spills in sea ice began in the early 1970s in Canada and the United States with the Beaufort Sea Project (e.g., Lewis, 1976). This project involved the first significant field release of oil under growing sea ice during the winter season.

Oil under ice recovery tests Beaufort Sea, May 1975

Three Arctic Oil Spill Response Research 2/3

In 2007-2010 : in Barents Sea

An Oil in Ice Joint Industry Program was managed by SINTEF. Oil was deliberately released to assess weathering, burning, herding agents, skimmers, and in-situ burning (ISB)

(Sørstrøm et al., 2010).

Three Arctic Oil Spill Response Research 3/3

In 2012-2015 : JIP

In 2012, an Arctic Oil Spill Response Technology JIP, with nine participating companies, launched a range of research projects on all aspects of responding to oil spills in the Arctic. This is the largest research program of its kind. (Mullin, 2012)

Nine Participating Companies

bp
Chevron
ConocoPhillips
eni
ExxonMobil
NCOC
NORTH CASPIAN OPERATING COMPANY
Statoil
TOTAL

Arctic Oil Spill Response JIP

Project	2012-2015 : JIP key areas
1	Fate of dispersed oil under ice
2	Dispersant testing under realistic conditions
3	Environmental impacts from arctic oil spills and their response
4	Oil spill trajectory modelling in ice
5	Oil spill detection and mapping in low visibility and ice
6	Mechanical recovery of oil in ice infested waters
7	In situ burning state of knowledge
8	Aerial ignition systems for in-situ burning
9	Chemical herders and in-situ burning
10	Field research experiments testing

Net Environmental Benefit Analysis (NEBA)

is a process used by the response community for making the best choices to minimize impacts of oil spills on people and the environment.

What we have to learn:

- ✓ What is Net Environmental Benefits Analysis (NEBA)?
- ✓ How is NEBA used during the entire oil spill preparedness and response process?
- ✓ How can you support effective use of NEBA to minimize impact on the environment and communities?

Yamaguchi et al. 2011, OTC22123:
Numerical Prediction of Spilled Oil Behavior in the Sea of Okhotsk Under Sea Ice Conditions

Nakazawa et al. 2012, OTC23801:
Numerical Prediction of Spilled Oil Behavior under Sea Ice Conditions: Modification of the 2011 Model

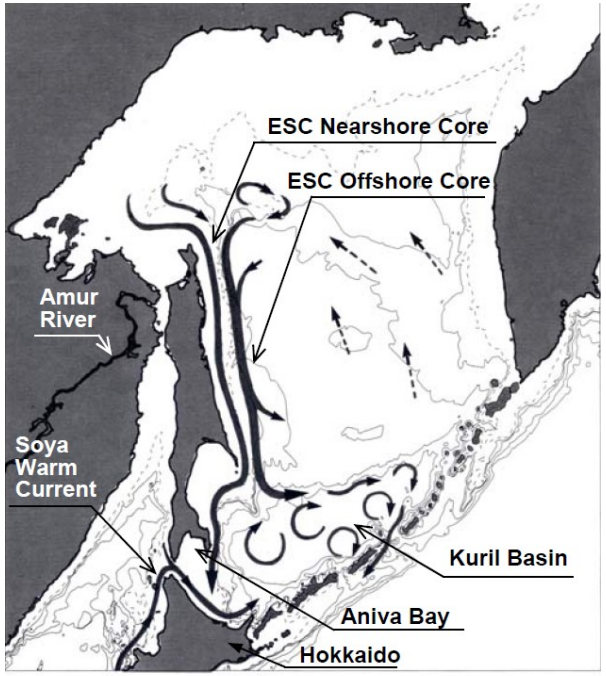
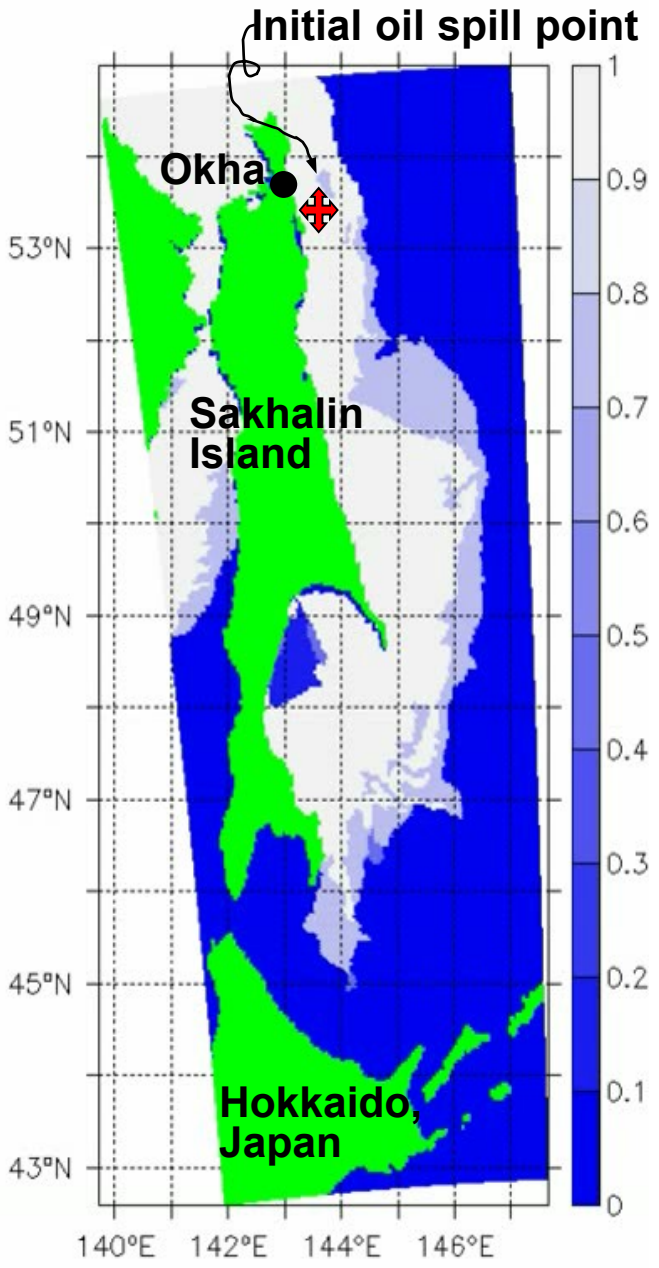


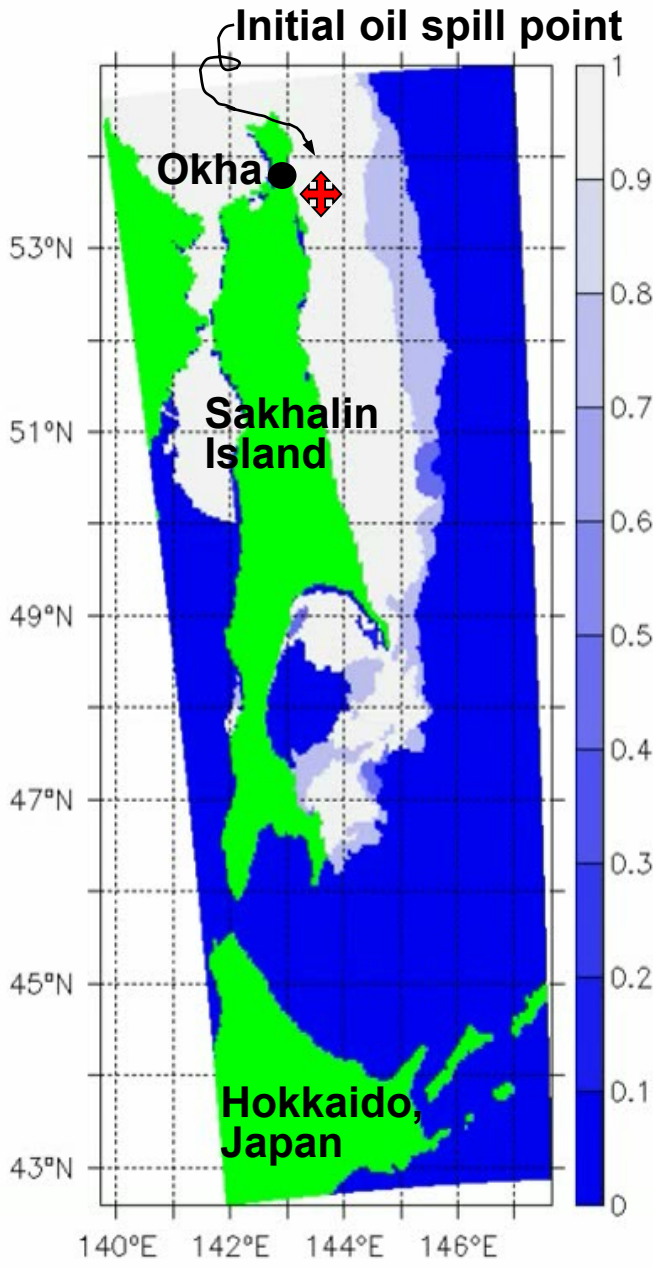
Fig. 2 Schematic of the East Sakhalin Current (ESC) flowing southward along the east coast of Sakhalin: nearshore core on the shelf and offshore core over the shelf slope. (modified from Ohshima et al., 2002)

Fig. 1 Schematic of the Sakhalin I

Initial oil spill on Jan.3, 2003



Initial oil spill on Jan.4, 2005



The best scenario is to never have an oil spill.

From API official homepage