PROJECT SUMMARY REPORT - 2016 SERF CAMPAIGN

Subproject: Characterisation of thermodynamic and dielectric properties of oil-contaminated sea ice through scatterometer and lidar measurements

Actual field dates: January 6th – March 6th , 2016
Field site: Sea-ice Environmental Research Facility (SERF), University of Manitoba, Winnipeg (Canada)
Number of man-days in the field: 60

Summary:

This experiment was the first of its kind performed at the University of Manitoba in which a large amount of crude oil was introduced in a specially-designed oil-contaminated sea ice tank for the purpose of detection, chemical, and thermodynamic investigations. In the first phase of this experiment, the tank (equipped with water sampling and temperature logging system, capable of mixing and temperature-increasing mechanism) was filled with artificial sea water only, and the sea ice was grown for about 2 weeks. In the second phase of the experiment, the sea ice was grown from open water to a certain thickness, and then crude oil was pumped from beneath the ice. The sea ice kept growing after this stage for about two weeks. A layer of snow was later added on this surface. During both phases, the time-series NRCS associated with the profiles was measured continuously through a C-band scatterometer. Moreover, physical sampling of snow and sea ice was performed during both phases. Due to the hazards associated with the crude oil, special procedures and precautions were observed during the whole experiment.

The achievements of this experiment for the detection team are as follows. (i) Many technical and safety challenges were identified and tackled (e.g., cross-contamination, correct sampling and processing procedures for oil-contaminated samples, introduction and distribution of oil in the tank, etc.) (ii) part of the introduced oil was encapsulated in the sea ice, and part of it migrated through the channels within the sea ice. This also contaminated the base of the snow layer. Consequently, the dielectric of the profile was changed and reduced, and the thermodynamic properties of the profile was altered. (iii) A reduction in the measured NRCS was recorded after the introduction of the oil in the tank. (iv) The trend of temporal NRCS is significantly different between the two phases, utilized for oil-spill detection through radar data.

Figure 1

Figure 2

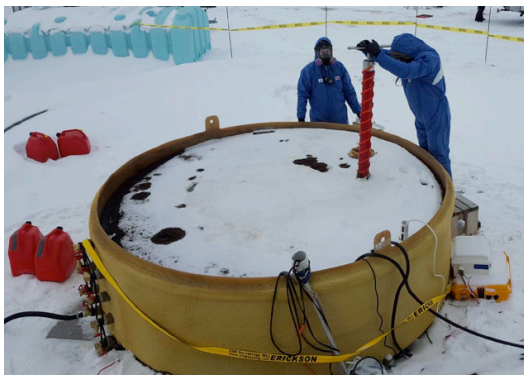

Figure 3

Photos:

Fig.1: The oil tank and scatterometer at SERF, University of Manitoba
Credit: Thomas Neusitzer
Fig. 2: The oil tank after the introduction of oil from beneath the sea ice.
Credit: Dr. Gary Stern
Fig. 3: Physical sampling of the oil-contaminated sea ice. Credit: Thomas Neusitzer

Participants:

Nariman Firoozy (CEOS); Tyler Tiedet (CEOS); Thomas Neusitzer (CEOS); Durell Desmond (CEOS); Jack Landy (CEOS); Dr. Puyan Mojabi (CEOS); Dr. Monika Pucko (CEOS); Dr. David Barber (CEOS)

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For more information contact: Nariman Firoozy (firoozyn@umanitoba.ca)