NRL completes ICEX2016 expedition, mapping of Arctic ice

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US Naval Research Laboratory (NRL) scientists from the Marine Geoscience Division, and a US Naval Academy (USNA) Midshipman intern, participating in the Navy's March 2016 ICe Exercise (ICEX), lived and worked for one week at the ICEX Ice Camp located above the Arctic Circle on an ice floe in the Beaufort Sea. During the day, usually in minus 25- to minus 45-degree temperatures, the team worked collecting ice thickness and snow character data in support of their NRL Sea Ice Physics research. Coincident airborne sensor data was also collected over the ground team's work sites. Pictured (l-r): Dr. Andrei Abelev, NRL; Dr. Rick Hagen, NRL; MIDN Haadi ElSaawy, USNA; and Dr. Joan Gardner. Credit: U.S. Navy photo by Mass Communication Specialist 2nd Class Tyler N. Thompson

A team of U.S. Naval Research Laboratory (NRL) scientists from the Marine Geoscience Division have concluded a month-long sea-ice research expedition as part of the Navy's March 2016 ICe Exercise (ICEX) designed to develop a comprehensive understanding of the physical structure and evolution of Arctic sea-ice. The project collected data useful in assessing the operability and safety of Navy and commercial assets along future Arctic routes.

The team, comprised of geologists, geophysicists, and data analysts, was sent to the North Slope of Alaska to investigate the degree of ice-coverage and ice parameters, such as strength and thickness. These data provide the theoretical underpinnings of the modeling of such parameters from remotely sensed data collected from aircraft and satellite platforms, cross-evaluated with ground truth data.

"Until now, characterization of sea-ice has been primarily at very small, local scales from in-situ core measurements and some ground-based scatterometry," said Dr. Joan Gardner, NRL geologist. "Our proposal executes a combined program of airborne measurements and coincident on-ice measurements used to characterize surface and volumetric scattering from the bottom of the sea-ice to the top of the snow surface."

The fundamental goal of this research is to better understand the physics and evolution of sea-ice with age from its initial salty, relatively uniform state through the gradual thickening, and freshening process via the formation and expelling of brine pockets. This research utilizes airborne data collected with an ultra-wide-band, low-frequency, polarimetric synthetic aperture radar (SAR), a wide-band snow-radar, and LiDAR (Light Detection and Ranging). These data are used to create models of surface and volumetric scattering across a range of frequencies and polarizations of differing sea-ice and snow surfaces and types, such as fresh snow, slightly saline ice, brine pockets of various geometries, and solid salt inclusions.

Utilizing these tools, the NRL team was also instrumental in acquiring and analyzing the parametric data necessary for establishing the ICEX camp. Funded by the Office of Naval Research (ONR) the team collected data from six candidate ice floes identified from satellite imagery by the National Ice Center (NIC) as potential sites. This information was provided to the members of the Arctic Submarine Laboratory (ASL) to utilize in

their decision making process for locating a viable ice floe for ICEX. ASL establishes a temporary ice camp every 2 to 3 years in the Beaufort Sea during the month of March. The camp is used for submarine force asset tactical training, sensor testing, and research and development (R&D).

The ASL mission requires an ice floe that can support the infrastructure for the exercise—robust enough to support a runway, submarine surfacing area, and the small village of buildings necessary to house personnel for the month long exercise. This has historically been done using visual photos taken from a Coast Guard aircraft and various satellite imageries.

The ASL is responsible for developing and maintaining expertise in Arctic specific skills, knowledge, equipment, and procedures to enable the submarine force to safely and effectively operate in the unique Arctic Ocean environment.

Provided by Naval Research Laboratory