Estimation and Validation of Floe Size Distribution from Upward Looking Sonars

Todd Mudge; Keath Borg; Kaan Ersahin; Ed Ross; Dawn Sadowy; Jessy Barrette;
Nikola Milutinovic. ASL Environmental Sciences Inc., Victoria, BC, Canada.

Abstract

Moored upward looking sonars (ULS) have been used extensively for over twenty years to measure sea ice draft thicknesses and ice keel widths. They have rarely been used to analyze ice floe sizes. In 2015, Statoil Canada, ArcticNet, the Research & Development Corporation of Newfoundland and Labrador (RDC) and Husky Energy partnered in an offshore research expedition, a component of which was Ice Profiler Sonar (IPS) and Acoustic Doppler Current Profiler (ADCP) measurements in waters off Newfoundland. This provides an excellent opportunity to develop methods to estimate floe size distributions in the marginal ice zone.

IPS data is typically analyzed for ice draft and for the presence and absence of sea ice. ADCP bottom tracking data during periods of high ice concentrations provides direct measurement of ice drift. Deriving these ULS-based parameters in the low concentrations and often energetic wave environment of the marginal ice zone is difficult. A six-day period of relatively low wave energies was analyzed for ULS derived ice floe sizes. Over 1000 floes were detected with most of the detected widths being less than 30 m and a peak in the distribution at less than 10 m. Ice concentrations and ice drifts as derived from the ULS were similar to those reported by Canadian Ice Service daily ice charts.

Analysis of both theoretical and natural ice floe shapes suggests that the average of the ULS determined ice floe widths is typically about 70 to 80% of the equivalent diameter and about 55% of the typical maximum horizontal extent. Thus, much of the ULS detected floes were likely smaller than the resolution of satellite imagery. As the ULS moorings measure ice draft every one or two seconds and ice speeds every one minute, estimates of average floe mass, momentum and energy of ice features observed during the six-day analysis episode were possible.

Contact Information

Todd Mudge
ASL Environmental Sciences Inc.
1-6703 Rajpur Place
Victoria, B.C.
V8M 1Z5
Canada

m: +1-778-977-3385 | t: +1-250-656-0177 x 116 | f: +1-250-656-2162
e: tmudge@aslenv.com | w: www.aslenv.com

ARCTIC TECHNOLOGY CONFERENCE
AN OTC EVENT
ST. JOHN'S
NEWFOUNDLAND AND LABRADOR
24-26 OCTOBER 2016
ST. JOHN'S CONVENTION CENTRE