Waves and Fetch in the Marginal Ice Zone

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Award Number: N00014-12-1-0113
http://www.apl.washington.edu/project/project.php?id=miz
FY13 report (year 2 of 5)

LONG-TERM GOALS

The long-term goal is to improve prediction of the arctic Marginal Ice Zone (MIZ) by improving basic understanding of the interaction between waves, sea ice, and open water (i.e., fetch).

OBJECTIVES

The primary objective is to improve wave source/sink parameterizations by directly measuring the growth and dissipation of waves in the MIZ. The secondary objective is to develop a surface wave climatology of the arctic ocean and the relation to the seasonal MIZ.

APPROACH

The technical approach is to use Surface Wave Instrument Floats with Tracking (SWIFT) buoys to measure waves, winds, and turbulence at the air-sea-ice interface (Thomson, 2012). The observations are planned for the summer of 2014. These seasonal SWIFT measurements are to be placed in context using mutliyear subsurface Acoustic Wave And Current (AWAC) moorings and regional WAVEWATCH3 model results.

WORK COMPLETED

The first year-long time series from the AWAC on a Beaufort Gyre mooring 'A' was recovered and has been processed. The instrument was redeployed on mooring 'A' (N 75, W 150), and another AWAC was added to mooring 'D' (N 74, W 140). These instruments will be recovered, offloaded, and redeployed in 2014.

The SWIFT buoys intended for deployment in the 2014 experiment were succesfully tested in the marginal ice zone during a cruise on the USCCG Healy in September 2013, as part of a collaboration with Ted Maksym and Hanu Singh at WHOI. Figure 1 show a picture of a SWIFT in the ice. Minor software issues were identified in the processing and telemetry of real-time data, which will be corrected and re-tested prior to the 2014 field experiment.

Figure 1. SWIFT buoy deployed from USCGC Healy in Sep 2013 for ice testing prior to 2014 field experiment.

Detailed logistical planning has continued for the 2014 field effort, including drafting a cruise plan for two charter vessel operations (R/V Ukpik in July 2014 and R/V Norseman II in Sept 2014). Contracting is now in process for these vessels. Coordination with satellite imagery collections is also underway.

RESULTS

Wave and ice observations from the year-long AWAC deployment are shown in Figure 2. Wave heights became almost 5 m with the passage of a storm on 18 Sep 2012, which is the highest known wave measurement in the Beaufort and a rare validation of the WAVEWATCH3 forecasts for storm conditions in the Arctic. Open water and wave activity persisted until mid-October, when ice cover became complete and persisted until the mooring was recovered in Aug 2013. Analysis is now underway to understand the influence of fetch and partial ice coverage, using satellite products, on the waves at this location.

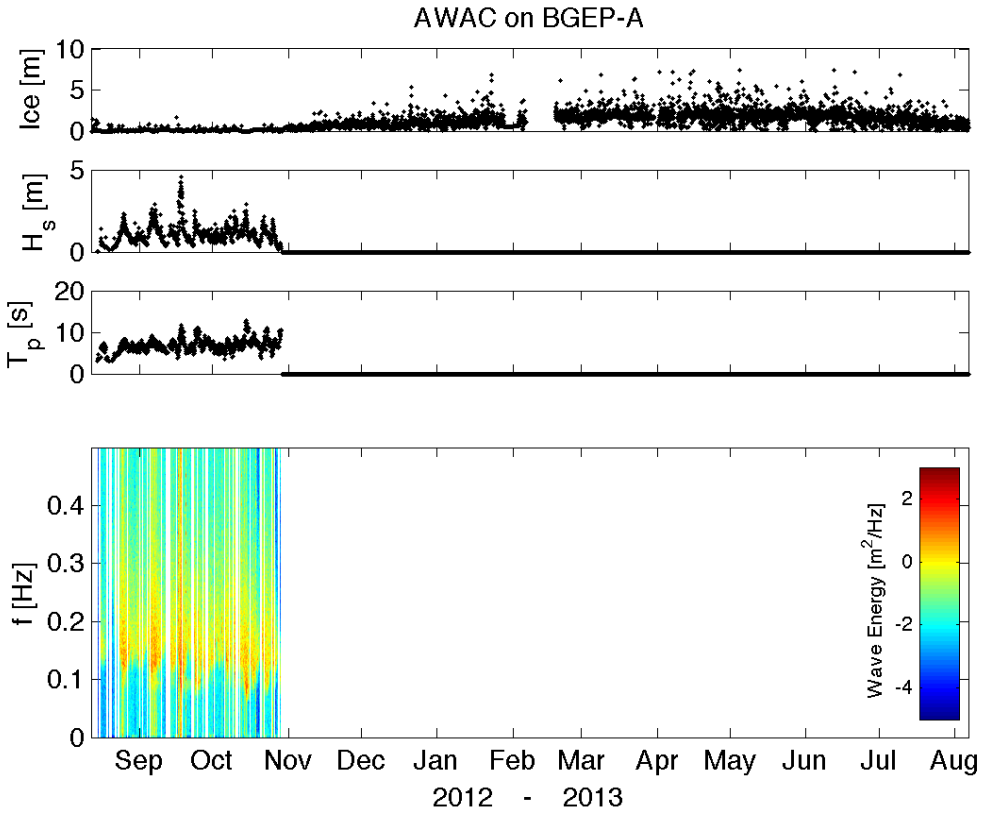

Figure 2. Ice thickness, wave height, wave period, and wave energy spectra from the AWAC on Beaufort Gyre mooring 'A'.

IMPACT/APPLICATIONS

Improved wave and MIZ predictions in the Arctic Ocean will enable safe naval operations in the region.

RELATED PROJECTS

A contract with Scitor Corp. is supporting a graduate student to analyze declassified satellite images for wave information in the Beaufort region.

Resources are data are shared with the "Sea State and Boundary Layer Physics of the Emerging Arctic Ocean" DRI. More information is at
http://www.apl.washington.edu/project/project.php?id=arctic_sea_state

PUBLICATIONS

Thomson, J. "Observations of wave breaking dissipation with SWIFT drifters," *J. Atmos. and Ocean. Tech.*, 2012. [published, refereed].

Craig, L. et al, "Science Plan for the Mariginal Ice Zone program," *APL-UW Tech. Report 1201,* 2012. [published].