SWIFT observations in the Arctic Sea State DRI

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FY14 report (year 2 of 5)

LONG-TERM GOALS

The long-term goal is to understand the role of waves and sea state in the Arctic Ocean, such that forecast models are improved and a robust climatology is defined.

OBJECTIVES

The objectives are to: develop a sea state climatology for the Arctic Ocean, improve wave forecasting in the presence of sea ice, improve theory of wave attenuation/scattering in the sea ice cover, apply wave–ice interactions directly in integrated arctic system models, and understand heat and mass fluxes in the air–sea–ice system.

APPROACH

The technical approach is to measure waves, winds, and turbulence in the Arctic Ocean using drifting SWIFT buoys deployed during a 2015 cruise and moored Acoustic Wave and Current (AWAC) sub-surface instruments maintained yearly. These measurements will be used to estimate the fluxes of momentum and heat between the air, sea, and ice. Results will be integrated with remote sensing products and wave models.

WORK COMPLETED

Work during this second year of the DRI has centered around cruise planning for the 2015 effort and coordination of remote sensing products. To assist in cruise planning, a cruise module template has been developed and an example is shown in Figure 1. This template is intended for use across the science team to describe a coordinated response to conditions that are present during the 2015 cruise.

Work has also been completed to assess the skill of existing ice routines in the WAVEWATCH III spectral wave model, by comparing WWIII results (provided in a collaboration with Erick Rogers at the Naval Research Lab) with AWAC mooring measurements from 2012.

Finally, a workflow for utilizing remote sensing products during high-latitude cruises was tested during the MIZ-DRI experiment of 2014.

ONR Sea State DRI cruise planning template (3 day scenarios)

Scenario name: Open water
Science objective: baseline measurements, shakedown of equipment and deck ops
Ice condition: none
Wave condition: moderate to large… Hs at least 1 m
Met condition: moderate to strong winds… U at least 8 m/s

Activities (by hours allocated)

Category	Day 1: pre-event	Day 2: event	Day 3: post event
WAVE Process buoys SWIFT buoys Waverider buoys Wave radar	Prep all gear	 deploy 4 SWIFTs (1 hr) deploy 2 WRs (1 hr) Wave radar (-)	recover buoys (4 hr)
ICE Ship transects AUV transects IMB	Prep all gear	AUV mission (6 hr)	
MET Ship underway Ship head to wind Radiosondes AWS on ice	Prep all gear Radiosondes (4 x .5)	 Ship head to wind (4 x .5) Radiosondes (4 x .5)	 Radiosondes (4 x .5)
OCEAN CTD stations, 200 m towed CTD Shipboard ADCP towed sea snake glider	Prep all gear	 CTD casts (4 x .5) towing (4) ADCP off for AUV ops towing (4) glider mission (4)	

Sequencing

Timing	Day 1 (pre-event)	Day 2 (event)	Day 3 (post event)
Morning	quadcopter recon	quadcopter recon buoy deployments CTD cast, head to wind	quadcopter recon buoy recovery
Afternoon		AUV and glider ops CTD cast, head to wind	
Evening	POD meeting	POD meeting towing CTD cast, head to wind	POD meeting
Overnight		towing CTD cast, head to wind	

Figure 1. Example cruise module template.

RESULTS

The assessment of WAVEWATCHIII indicates that the model severly overestimates wave heights in the early and late portions of the open water season (in particular, mid August of Figure 2). These are periods when the ice edge is very close to the mooring location. It is yet to be determined if the bias is owing to errors in the model physics or errors in the ice products used as input to the wave model.

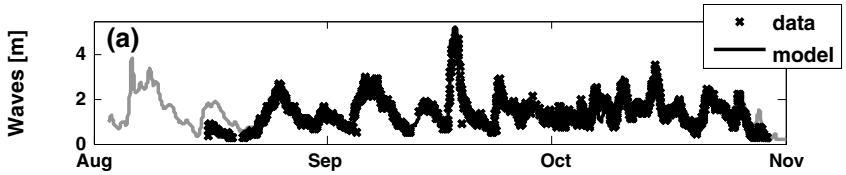

Figure 2. Wave heights measured by the AWAC mooring and hindcast by WAVEWATCH III during 2012.

IMPACT/APPLICATIONS

Improved sea state 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 "Marginal Ice Zone" DRI. More information is at http://www.apl.washington.edu/project/project.php?id=miz

PUBLICATIONS

Thomson, J. and E. Rogers, Swell and sea in the emerging Arctic Ocean, *Geophys. Res. Lett*., 41 (2014).

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