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Quantifying the Role of Atmospheric Forcing in Ice Edge Retreat and Advance Including Wind-Wave Coupling

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Office of Naval Research (ONR), Arctic and Global Prediction Program Department Research Initiative (DRI), *Sea State and Boundary Layer Physics of the Emerging Arctic Ocean*

FY 2013 Annual Report

Quantifying the Role of Atmospheric Forcing in Ice Edge Retreat and Advance Including Wind-Wave Coupling

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LONG-TERM GOALS

1. Representing surface fluxes and ocean waves in coupled models in the Beaufort and Chukchi Seas.
2. Understand the physics of heat and mass transfer from the ocean to the atmosphere.
3. Improve forecasting of waves on the open ocean and in the marginal ice zone.

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OBJECTIVES

1. Quantifying the open-ocean fluxes of momentum, sensible and latent heat, shortwave radiation, and longwave radiation in the Chukchi and Beaufort Seas.
2. Quantifying atmospheric and oceanic characteristics strongly linked to these fluxes, such as ocean wave characteristics and surface-layer temperature, atmospheric kinetic and thermodynamic profiles, atmospheric cloudiness and basic meteorological parameters.
3. Improving and verifying model parameterizations of turbulent momentum and heat fluxes plus radiative fluxes in the Beaufort and Chukchi Seas
4. Quantifying temporal and spatial variability in surface forcing
5. Providing "ground truth"

APPROACH

Our approach will be to perform the following measurements during a cruise in 2015.

Table 1. Shipboard Measurements

Category – Parameters Measured **Sensors**
Surface Meteorology – Wind Vector, Air Temperature, Air Humidity, Air Pressure, Precipitation **Propeller Anemometer, Aspirated and Shielded Thermistor/Humidity probes, Barometer, Tipping Bucket and Tympani Rain Sensor**
Eddy Correlation Fluxes and Spectra – Wind Stress, Sensible + Latent (Moisture) Heat Flux, CO_2 Flux **Sonic Anemometer, Thermistor, LICOR (Humidity, CO_2)**
Sky Radiation – Downwelling and Upwelling Solar and Longwave Radiation, Sky Temperature f(band) **Pyranometer, pyrgeometer, narrow band IR radiometer, microwave radiometer,**
Surface Temperature – Ocean surface temperature, ice surface temperature **IR Narrow Band Radiometer, Dragged Thermistor, Ship intake, Manual Bucket**
Tropospheric Profiles, 4/day – Pressure, Temperature, Humidity, Wind Vector **Rawinsonde (Weather Balloon)**
Low-Level Profiles, Pressure, Temperature, Humidity **Rawinsonde (Kite)**
Wave Characteristics, Wind wave and swell heights lengths, periods and surface wave 2-D spectra **Multibeam laser altimeters, fast pressure sensors**
Cloud characteristics – cloud cover, cloud base height, water phase **Ceilometer**, **W-band cloud radar**
Continuous wind vector profiles - low level wind field **449 MHz wind profiler**
Observations, Upwind ice types and concentration, cloud type and coverage, sea state, visibility, weather **Human eye, visible and IR photography, range finders**

WORK COMPLETED

FY 2103 was a spin-up planning year. The PIs attended planning meetings with other investigators and amongst themselves. The PIs contributed to the preparation of the Sea State DRI Science plan.

RESULTS

At this point only planning has been performed and the PIs have not achieved any scientific results based on work performed with this funding.

IMPACT/APPLICATIONS

The main impact in FY2013 was the planning and preparation of a Science Plan.

RELATED PROJECTS

None

PUBLICATIONS

J. Thomson, V. Squire, S. Ackley, E. Rogers, A. Babanin, P. Guest, T. Maksym, P. Wadhams, S. Stammerjohn, C. Fairall, O. Persson, M. Doble, H. Graber, H. Shen, J. Gemmrich, S. Lehner, B. Holt, T. Williams, M. Meylan, and J. Bidlot, 2013: Science Plan Sea State and Boundary Layer Physics of the Emerging Arctic Ocean, *APL Technical Report APL-UW 1306*, Applied Physics Laboratory University of Washington, 1013 NE 40th Street Seattle, Washington 98105-6698, September 2013