"Use of Declassified High-Resolution Imagery and Coincident Data Sets for Characterizing the Changing Arctic Ice Cover, and Collaboration with SIZRS"

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LONG-TERM GOALS

This task addresses the topic of using small-scale geophysical information from declassified, high-resolution visible band imagery for understanding physical processes of the Arctic Ocean sea ice cover.

OBJECTIVES

Literal Image Derived Products (LIDPs) provided through National Technical Means are high-resolution (~1 m) optical imaging of targeted locations on the ice cover. This project examines the use of LIDPs to understand geophysical processes within the Arctic Ocean with emphasis on supporting the goals of the SIZRS project: to provide records of sea ice concentration, ice edge location, melt pond coverage, floe size distribution and general surface conditions, for operational support and for synthesis with ocean, atmospheric, and ice data to arrive at an improved understanding of SIZ changes.

Specifically, this task plan addresses the potential uses of LIDPs and supporting datasets for:

- Retrieval of open water coverage to improve large-scale estimates of ice concentration and ice edge location.
- Estimation of melt pond coverage and its development.
- Derivation of floe size distribution.
- Extraction of ridge heights and ridge distributions.
- Estimation of openings and closings.
- Understanding the use of in-situ and other remote sensing datasets for enhancing the use of the LIDPs.

APPROACH

The ability of the LIDP acquisition system to follow an ensemble of ice floes using near real-time locations from drifting buoys is particularly useful for process studies, and the use this targeting capability. With an optical system, however, the temporal sampling interval is difficult to control as arctic stratus clouds frequently obstruct imaging of the surface during summer. Typically, it takes several acquisitions to obtain a single cloud-free scene of the surface. Thus, it should be recognized at the outset that non-uniform temporal sampling is a limitation if the LIDPs were not integrated with other components of an observational system. Within the timeframe of the SIZRS project, the approach is to use other remote sensing datastreams (at radar and visible wavelengths) and in-situ observations to support the development of the derived geophysical information from LIDPs.

A moderate effort to explore the potential use of LIDPs for Arctic sea ice science was started in late 2009 after the declassification of the LIDPs. The note published by *Kwok and Untersteiner* [2011] described an early assessment of the limited volume of data available at the time. A more detailed analysis is given in *Kwok* [2014]. We build upon the tools developed during this early assessment of the data and use these tools to support the objectives of the SIZRS project.

WORK COMPLETED

Over the next year, we plan to:

- Assemble available data sets of LIDPs and near-coincident imagery from other sources for the task.
- Identify available Lagrangian parcels (targeted by LIDP acquistions) for time-series analysis.
- Extraction of ridge heights and ridge distributions.
- Estimation of openings and closings.

RESULTS

There are no results to report at this time.

IMPACT/APPLICATIONS

This results from this task will inform the use of high-resolution imagery for understanding of sea ice processes of the Arctic Ocean sea ice cover.

RELATED PROJECTS

Developing Remote Sensing Capabilities for Meter-Scale Sea Ice Properties
Karen E. Frey, Christopher Polashenski

The Seasonal Evolution of Sea Ice Floe Size Distribution
Jacqueline A. Richter-Menge and Donald K. Perovich

Monitoring of Arctic Conditions from a Virtual Constellation of Synthetic Aperture Radar
Hans C. Graber, Peter J. Minnett

Applying High Resolution Imagery to Understand the Role of Dynamics in the Diminishing Arctic Sea Ice Cover
Sinead L. Farrell, Jennifer K. Hutchings, Jacqueline A. Richter-Menge

Seasonal Ice Zone Reconnaissance Surveys Coordination
James Morison

REFERENCES

Kwok, R., and N. Untersteiner (2011), New High-Resolution Images of Summer Sea Ice, *EOS Trans. AGU*, (7), 53-54.

Kwok, R. (2014), Declassified high-resolution visible imagery for Arctic sea ice investigations: An overview, *Remote Sens. Environ.*, 142, 44-56, doi:10.1016/j.rse.2013.11.015