Mapping and Characterization of Recurring Spring Leads and Landfast Ice in the Chukchi and Beaufort Seas, Coastal Marine Institute Project (NOFA MMS09HQPA0004T)

Monthly progress report, June 2009

This is the first of the monthly progress reports on this project. In addition to the copy going out to MMS/CMI as per request by W. Horowitz (MMS), a courtesy copy will be sent to contacts at Shell (Allan Reece) and Conoco-Phillips (J. Cologgi).
As the project was late to get off the ground, the current monthly report reflects progress made during a time period between about April and the end of June when it was clear that the work would be funded.

(1) Summary of work performed and progress made during preceding month

A. Analysis of ice distribution and lead patterns

Work started early on this study in anticipation of the contract award, so that data needed for other aspects of the project would be available as soon as possible. To aid our project, the GINA Swathviewer (sv.gina.alaska.edu) tool has been reconfigured to allow more efficient browsing of the large number of scenes (several thousands) that need to be examined for this study.

Subsequently, one AVHRR image per day of the Chukchi Sea has been examined for the months of November through June for the winters of 1993-94 through 1996-97. Images including clear views of specific areas of potential interest for other phases of the project were recorded, and data for this study were also taken and organized.

B. Analysis of landfast ice extent

Refinements to the landfast ice mapping area and the resulting study area for the Chukchi (think red line in Fig. 1) are being considered. The RADARSAT acquisition area may be expanded to include all of Kotzebue Sound as a logical geographic boundary if this does not entail too much additional data processing. Additionally, the north-western corner will be modified to terminate on the east side of Kolyuchin Bay at 174°W.

Data mining for RADARSAT ScanSAR Wide Beam imagery was initiated. The Beaufort Sea SAR data catalog from the previous study was utilized in developing queries against the Alaska Satellite Facility archive to derive repeat coverage of the Beafort Sea for the 2004-05, 2005-06, 2006-07 and 2007-08 ice seasons. Minor gaps (primarily along the eastern edge of the study area) need to be double checked and manually filled. Automating much of the data mining for the Chukchi portion of the study was also initiated. It appears that there will be a few challenges in synchronizing the date ranges with existing mosaics of the Beaufort (for the 1996-2004 ice seasons) to keep the time span for the source frames in each mosaic within 5 days.

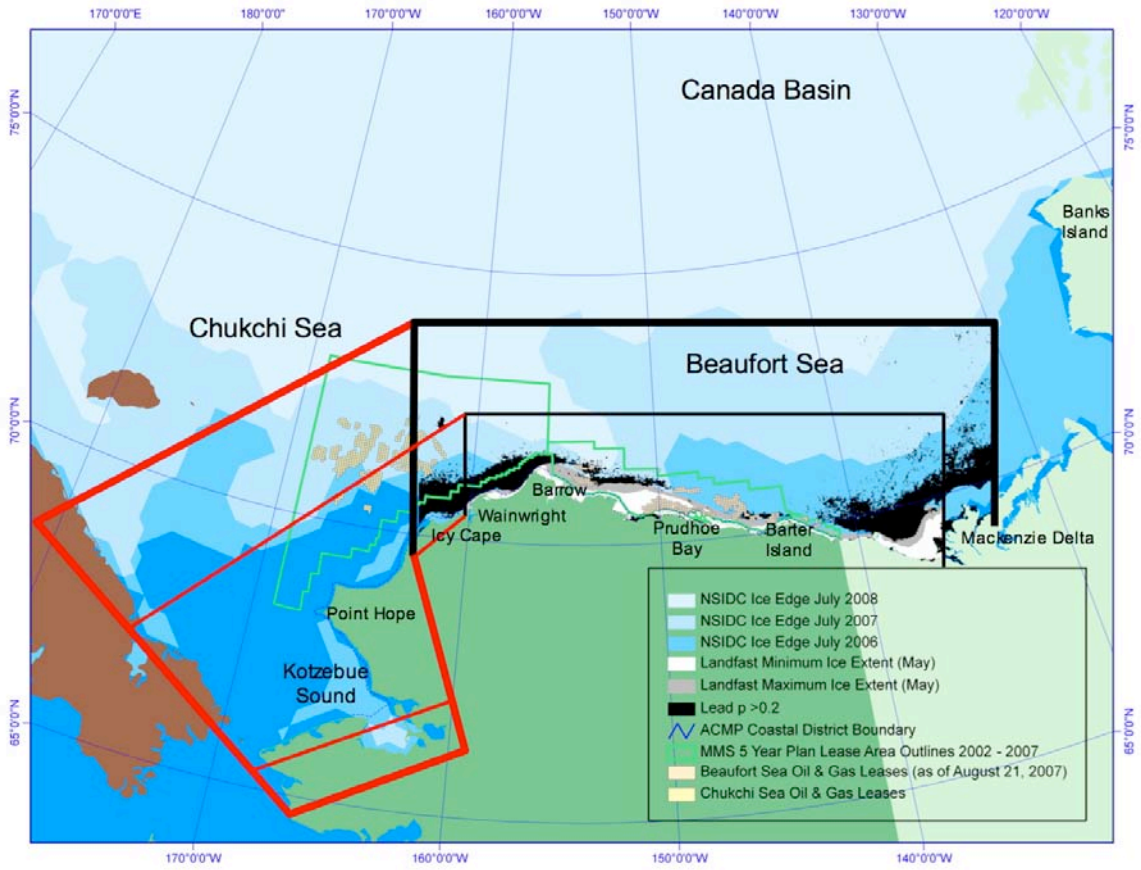

Figure 1: Overview of study areas as identified in the proposal (red – this study; black – study area of past work completed in 2006). Note that the area scanned for visible range satellite imagery (thick lines) to study lead patterns now also includes Wrangell Island and will be adjusted based on program contact feedback. Along the same lines, the outline of the study area (thin lines) for landfast ice extent will be modified after first analysis of data available in the archive.

C. Assessing potential alternative approaches at deriving landfast ice edge locations and landfast ice stability

In order to assess and analyze the performance of L-band SAR interferometry for deriving and locating the landfast ice edge and landfast ice stability, several L-band SAR images of the Advanced Land Observing Satellite (ALOS) PALSAR sensor were acquired from the America's ALOS Data Node (AADN). The datasets cover the coastal and nearshore areas at Barrow, Alaska.

Pairs of SAR images were processed to interferograms using the GAMMA RS software and interferometric coherence was derived. As interferometric coherence indicates areas in the images that remained unchanged within the observation time it is assumed that such data contain information about the outer edge of the stationary landfast ice. First results of this analysis are shown in Fig. 2. This first example clearly shows areas of high coherence on sea ice along the coast, corresponding to sea ice that did not move or undergo significant change during the observation interval.

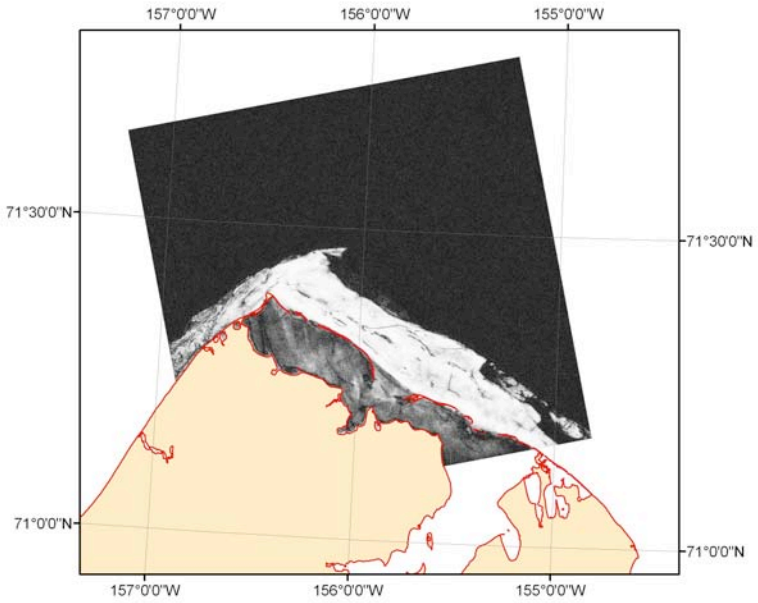

Figure 2: Coherence map (dark – low coherence, bright – high coherence) for an ALOS L-band interferogram for images acquired 6 March and 21 April 2008. All land areas area masked out.

In the next step of the analysis, the extent of the coherent areas will be compared to the position of the seaward landfast ice edge as derived from our standard algorithm and from ground-based data, in order to assess the performance of interferometric coherence as an indicator of landfast ice stability and extent. Additionally, a comparison with ice thickness data will be performed to understand variations in coherence. An assessment of interferometric phase will be completed later in the project.

(2) Summary of significant technical, schedule or cost problems encountered during preceding month
n/a

(3) Summary of resolutions agreed to between Contractor and MMS re item (2)
n/a

(4) Significant meetings held or other contacts made in connection with project during preceding month

A project planning meeting was held on 24 April 2009 with all investigators and to plan work schedule and related issues.

(5) Action items, open questions etc.

Review of satellite imagery covering the Chukchi Sea out to Wrangell Island indicates that lead patterns differ significantly from those observed in a previous study in the Beaufort and Eastern Chukchi Seas. Within the next few months, a project meeting

(either online/teleconference or in-person) should be scheduled to assess in particular the information needs of industry (i.e., Conoco-Phillips and Shell as providers of matching funds) in addition to reviewing MMS' information needs.