

**Monthly progress report, April 2011**

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

**A. Analysis of ice distribution and lead patterns**

Work is continuing towards a detailed summary of repeatable lead patterns in the Chukchi Sea, which will include the presence of open water around Wrangell Island as well as in the vicinity of Hanna and Herald Shoals. In latter cases, this can be used as an indicator of the presence of grounded ice on the shoals.

**B. Analysis of landfast ice extent**

**SAR data mining and processing**

No new data were acquired during April, but we have now completed SLIE delineations for four seasons landfast ice data in the Chukchi study region. Tables 1-4 below show the current status of SAR data mining and processing. Updates since the last report are highlighted in red.

**Table 1: Data acquisition and processing status for the Chukchi study region. Lower case y's indicate issues that will require further work / reprocessing**

<b>Chukchi</b>	<b>Order Placed</b>	<b>Order Retrieved</b>	<b>Geocoded</b>	<b>Mosaicked</b>	<b>Uploaded to web site</b>	<b>Notes</b>
1996-1997	Y	Y	Y	Y	N	20 km geocoding error on R97_186_189mos, R97_162_189gdif; leap year issue with fall frames dates
1997-1998	Y	Y	Y	Y	N	<b>Mosaics are good</b>
1998-1999	Y	Y	Y	Y	N	Mosaics are good
1999-2000	Y	Y	Y	Y	N	Mosaics are good
2000-2001	Y	Y	Y	Y	N	Mosaics are good. Rename r00_365_366mos to r00_363_366mos
2001-2002	Y	Y	Y	Y	N	Mosaics are good. Rename r02_208_210mos to r02_208_211mos
2002-2003	Y	Y	Y	Y	N	Mosaics are good.
2003-2004	Y	?	N	N	N	Mosaics pending
2004-2005	Y	Y	Y	Y	N	Mosaics are good.
2005-2006	Y	Y	y	Y	N	Need to re-run mosaics giving preference to Chukchi swath; 8 mosaics with >1km geocoding errors
2006-2007	Y	Y	Y	Y	N	Mosaics are good.
2007-2008	Y	Y	N	N	N	Mosaics are good. (data only through April)

**Table 2: Data acquisition and processing status for the Chukchi study region Lower case y's indicate issues that will require further work / reprocessing**

	Order Placed	Order Retrieved	Geocoded	Mosaicked	Uploaded to web site	Notes
<b>Beaufort</b>						
1996-1997	Y	Y	Y	Y	Y	Complete (Previous study)
1997-1998	Y	Y	Y	Y	Y	Complete (Previous study)
1998-1999	Y	Y	Y	Y	Y	Complete (Previous study)
1999-2000	Y	Y	Y	Y	Y	Complete (Previous study)
2000-2001	Y	Y	Y	Y	Y	Complete (Previous study)
2001-2002	Y	Y	Y	Y	Y	Complete (Previous study)
2002-2003	Y	Y	Y	Y	Y	Complete (Previous study)
2003-2004	Y	Y	Y	Y	Y	Complete (Previous study)
2004-2005	Y	Y	Y	Y	N	Complete, but not on web
2005-2006	Y	Y	y	y	N	Geocoding errors on 7 mosaics; mosaics need to be reprocessed
2006-2007	Y	Y	Y	Y	N	Complete, but not on web
2007-2008	Y	Y	Y	Y	N	Complete, but not on web

**Table 3: SLIE processing and database status for the Chukchi study region**

	SLIE Delineations	Shapefiles	Grids	GeoDB	Uploaded to web site	Notes
<b>Chukchi</b>						
1996-1997	Y	Y	Y	Y	Y	<b>Complete</b>
1997-1998						
1998-1999	Y	Y	Y	Y	Y	Complete
1999-2000						
2000-2001						
2001-2002						
2002-2003						
2003-2004						
2004-2005	<b>Y</b>	<b>Y</b>	<b>Y</b>	<b>Y</b>	<b>N</b>	<b>Delineations complete</b>
2005-2006						Need updated mosaics (unresolved geocoding errors, etc.)
2006-2007	Y	Y	Y	Y	Y	Complete
2007-2008						Need mosaics

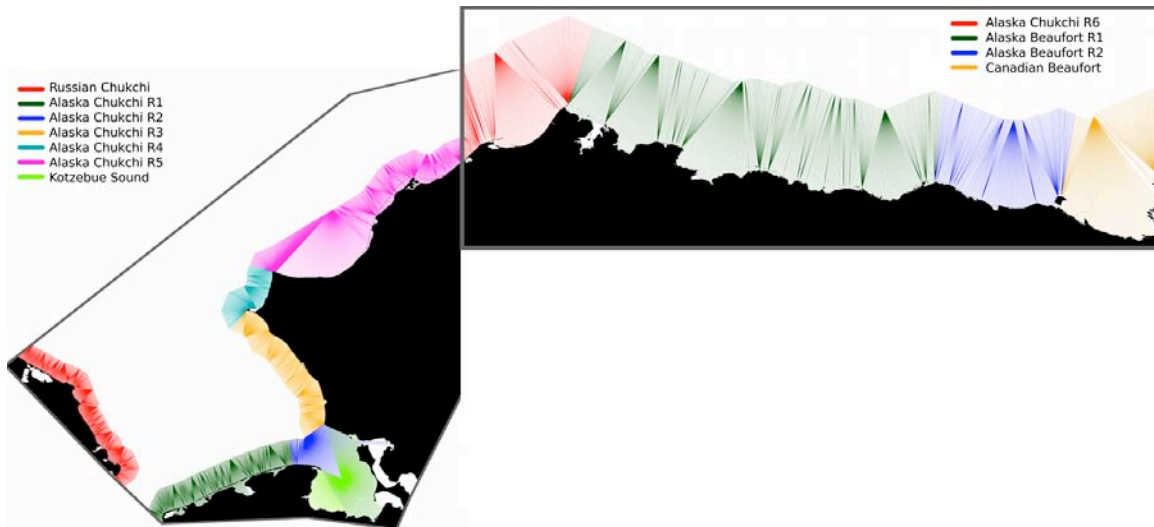
**Table 4: SLIE processing and database status for the Chukchi study region**

	SLIE Delineations	Shapefiles	Grids	GeoDB	Uploaded to web site	Notes
<b>Beaufort</b>						
1996-1997	Y	Y	Y	Y	Y	Complete (Previous study)
1997-1998	Y	Y	Y	Y	Y	Complete (Previous study)
1998-1999	Y	Y	Y	Y	Y	Complete (Previous study)
1999-2000	Y	Y	Y	Y	Y	Complete (Previous study)
2000-2001	Y	Y	Y	Y	Y	Complete (Previous study)
2001-2002	Y	Y	Y	Y	Y	Complete (Previous study)
2002-2003	Y	Y	Y	Y	Y	Complete (Previous study)
2003-2004	Y	Y	Y	Y	Y	Complete (Previous study)
2004-2005	Y	Y	Y	Y	Y	Complete
2005-2006						In progress; need mosaics (unresolved geocoding errors)
2006-2007	Y	Y	Y	Y	Y	Complete
2007-2008	Y	Y	Y	Y	Y	Complete

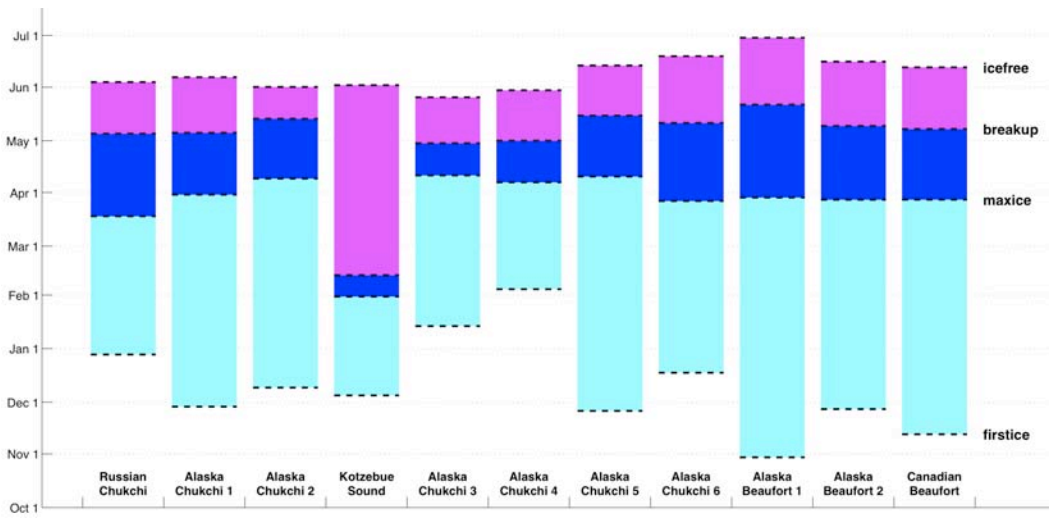
With four complete seasons of SLIE data processed for the Chukchi study region, we are able to calculate preliminary mean occurrence dates for certain key events within the landfast ice season for sub-regions in both the Beaufort and Chukchi seas. Figure 1 shows the distribution of the 11 different subregions (seven in the Chukchi and four in the Beaufort) that we will use to analyze landfast sea ice variability along the coasts of the Chukchi and Beaufort seas. For each of these regions, we have calculated the average occurrence date of four key events within the landfast ice year based on the SLIE data processed so far. These four events are:

- 1) First ice: the first date when landfast sea ice width reaches or exceeds 500m
- 2) Maximum ice: the date of maximum landfast ice width
- 3) Break-up: the onset of the final retreat of landfast ice extent (defined by the first date after which all changes in landfast ice width are negative or zero)
- 4) Ice free: the first date when landfast width falls and remains below 500m.

These occurrence dates of these events characterize the landfast ice cycle. Figure 2 shows the mean occurrence dates for of the 11 subregions. We must reiterate that these are only preliminary results based on a partial dataset (1996-97, 1998-99, 2005-06 and 2006-07 in the Chukchi region; 1996-2005 and 2006-2008 in the Beaufort region), but they reveal interesting regional differences that we will explore in more detail when all SLIE data are processed. For example, differences in formation and breakup dates are not simply explained by latitudinal differences. Coastal aspect is likely to have an influence as will nearshore bathymetry. We are still in the process of investigating bathymetric data for the Chukchi region.



**Figure 1: Distribution of sub-regions within the Chukchi and Beaufort study regions for analysis of landfast sea ice data**



**Figure 2: Mean occurrence dates for four key events within the landfast sea ice year**

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

We are continuing to address reviewers' comments on the manuscript we received back from *Remote Sensing of the Environment*. The comments received are extensive but constructive and we anticipate we will address them to satisfaction of the journal. The manuscript presents results demonstrating the promise for identifying landfast sea ice extent and dynamics using interferometry synthetic aperture radar (InSAR). In our study, we made use of L-band SAR data from the Japanese Space Exploration Agency's ALOS PALSAR sensor, which which was unfortunately terminated recently due to power system failure. However, it is important to note that the technique can be easily transferred to any other operational InSAR system.

InSAR based technologies will therefore continue to provide significant contributions to landfast ice mapping in the future. These contributions can be based on data of spaceborne InSAR systems like the currently flying Radarsat-2 (C-band; 24 days repeat

cycle), ERS-2 (C-band; currently 3-days repeat cycle), Cosmo-SkyMed (X-band; 4 satellite constellation; repeat cycle 1 to 16 days), and TanDEM-X (X-band; two satellite constellation; repeat cycle 11 days). The list of available InSAR systems will be extended in the near future by the sensors ALOS-2 (L-band; launch 2013; 14 days repeat cycle), SENTINEL-1 (C-band; launch 2013; two satellite constellation; 6 day repeat cycle), and SAOCOM 1A and 1B (L-band; launch 2012 – 2013; 16 day repeat cycle).

*D. Miscellaneous activities*

n/a

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

Project members Mahoney and Meyer attended an Arctic Oil Spill Workshop held at UAF on April 27-28. The aim of the workshop was develop ideas for a Science and Technology Center proposal to the National Science Foundation. The proposed center will be a focus for research aimed at prevention of and preparedness for oil spills in the Arctic. The products resulting from this project (i.e. improved understanding the coastal sea ice environment in the Alaska) will be of great value toward that goal. Moreover, partnerships with governmental agencies and industry will be vital to the success of any such center.

5) Action items, open questions etc.

n/a