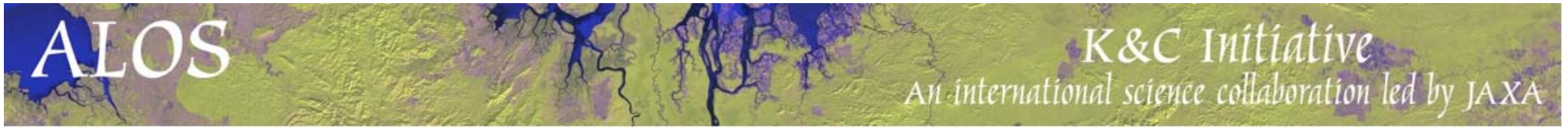


Using PALSAR to map Canadian Lakes and provide Carbon Sequestration estimations

Kevin Telmer, Jamie MacGregor
Daniel Stapper, Maycira Costa

University of Victoria
School of Earth and Ocean Sciences,
Department of Geography

University of Victoria

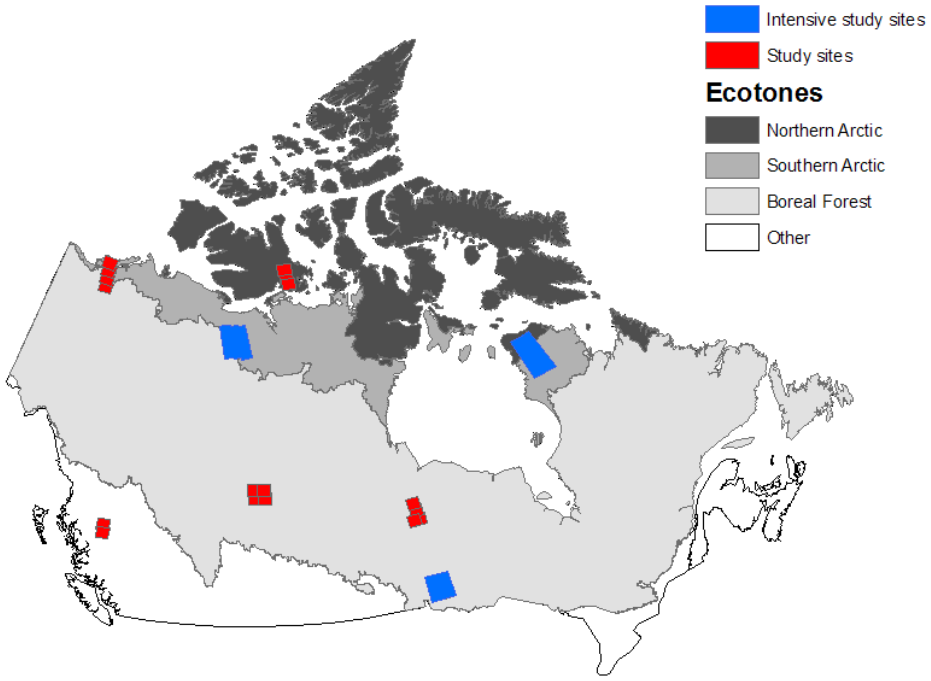
School of Earth and Ocean Sciences:
Aqueous Geochemistry and
Remote Sensing Laboratory

Completion of work from Phase 1

Received data for all of Canada. Goals:

1.) To create a digital map of Canadian lakes from a singular time period using PALSAR imagery.

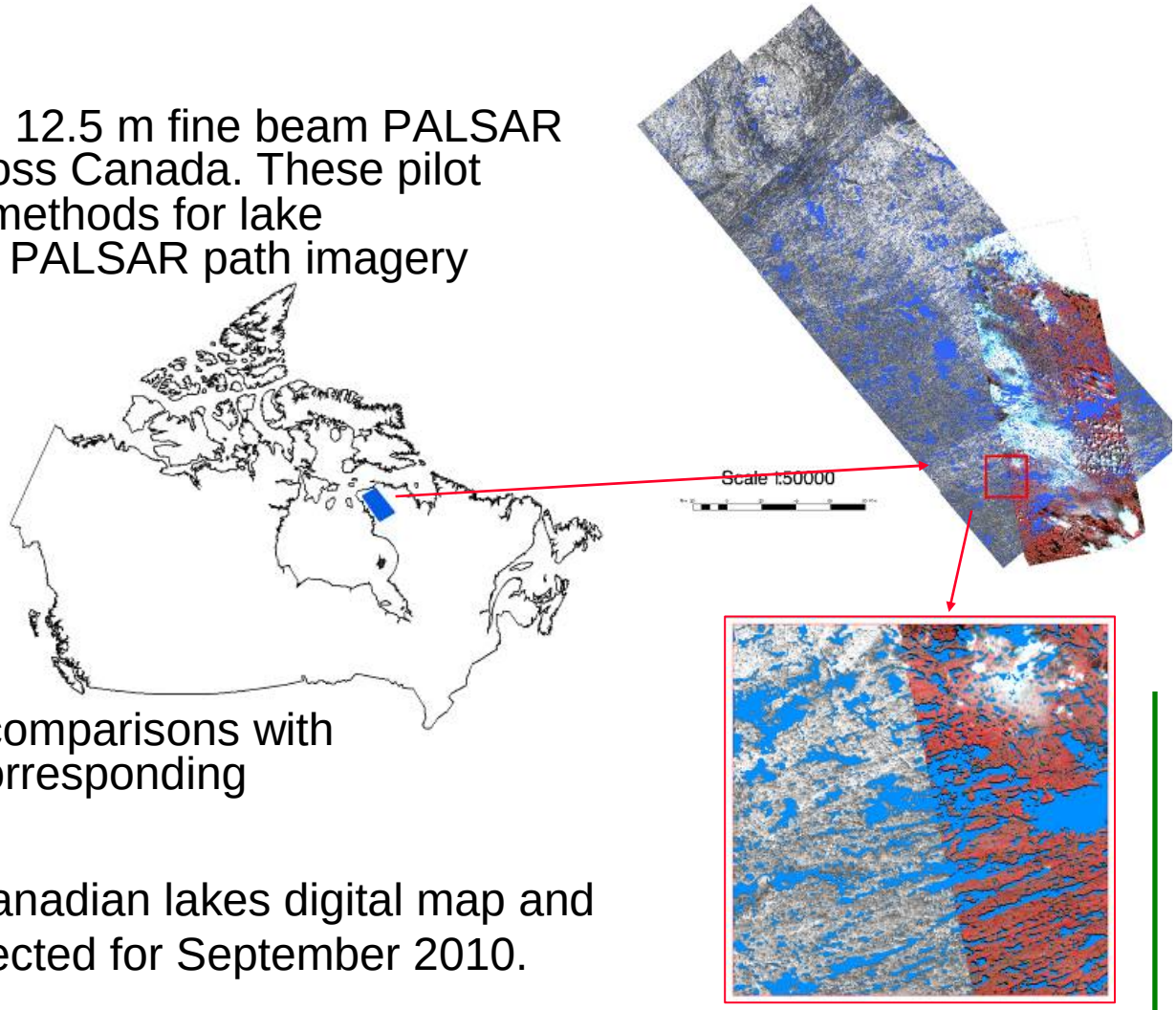
2.) To estimate carbon burial in Canadian lake sediments at regional scales.



Completion of work from Phase 1

Digital Map of Canadian Lakes

- Analysis to date has focussed on 12.5 m fine beam PALSAR images for several pilot sites across Canada. These pilot sites have been used to assess methods for lake classification that will be used on PALSAR path imagery over Canada.



• lake classification using supervised thresholds for pilot sites have been completed resulting in digital maps describing the number, size, and location of lakes.

• Accuracy has been validated by comparisons with the CANVEC lake inventory and corresponding ALOS AVNIR imagery.

• completion of PALSAR derived Canadian lakes digital map and carbon sequestration model is projected for September 2010.

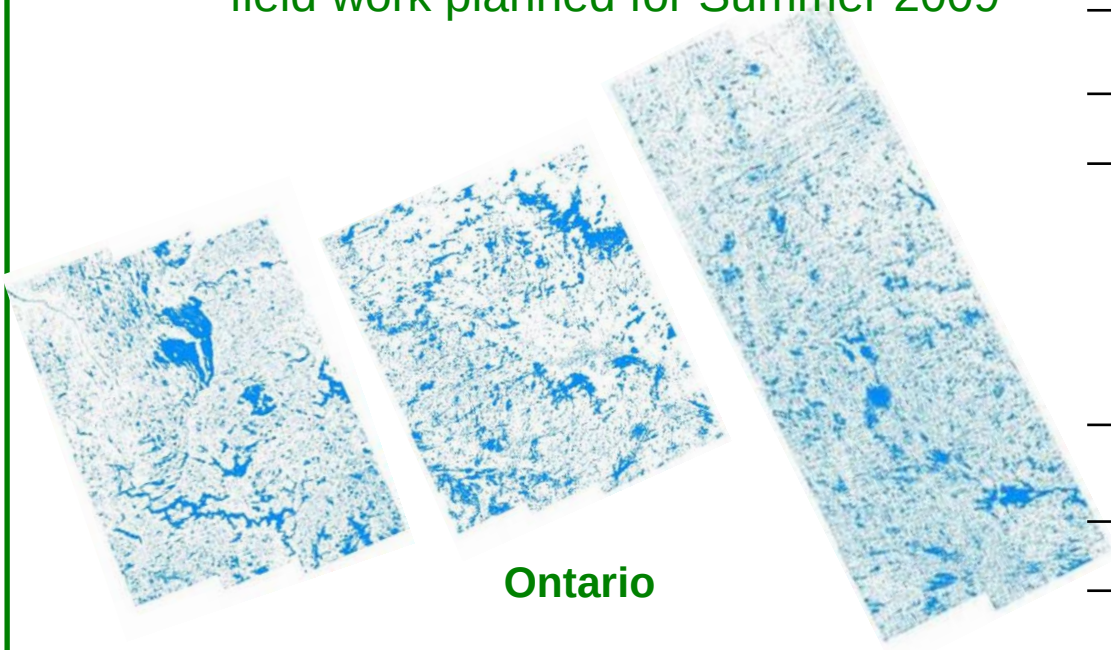
Completion of work from Phase 1

Present status: Regional carbon accumulation estimates from Canadian lakes

- Extrapolation of established carbon accumulation in boreal lakes (by Pajunen, 2004) has been completed for lakes within the pilot study areas. This has provided an initial assessment of lake carbon accumulation which has been scaled up to regions of Canada.
- Current estimates are based on fine beam pilot sites and will be expanded utilizing the Canada wide 50m PALSAR coverage.
- A refined Canada wide estimate of carbon sequestered in and accumulated in lakes is anticipated by September 2010.

Results from Phase 1

- Digital Map of Canadian Lakes – not yet completed
- Lake classifications completed for fine beam pilot regions, lake attributes compiled
- Carbon Accumulation Estimates of Canadian Lakes: preliminary results below, field work planned for Summer 2009



PALSAR derived carbon accumulation in Canadian lakes per 100,000 km² per year

Lake size km²	Boreal[2]	South Arctic	North Arctic
<0.1	0.15	0.24	0.08
0.1-1	1.07	0.94	0.20
1-10	1.10	0.79	0.10
10-100	0.76	0.28	0.11
>100	0.57	0.20	0.00
Total Carbon in megatonnes (Mt)	3.65	2.45	0.48
Mt CO_2 Equivalent	13.39	9.00	1.77
Number of Cars[1]	2,579,000	1,733,000	342,000

[1]Based on EPA average annual emissions for passenger cars, April 2000. (http://www.epa.gov/oms/consumer/f00013.pdf)
[2] carbon sequestration rate data from Pajunen, H. 2004

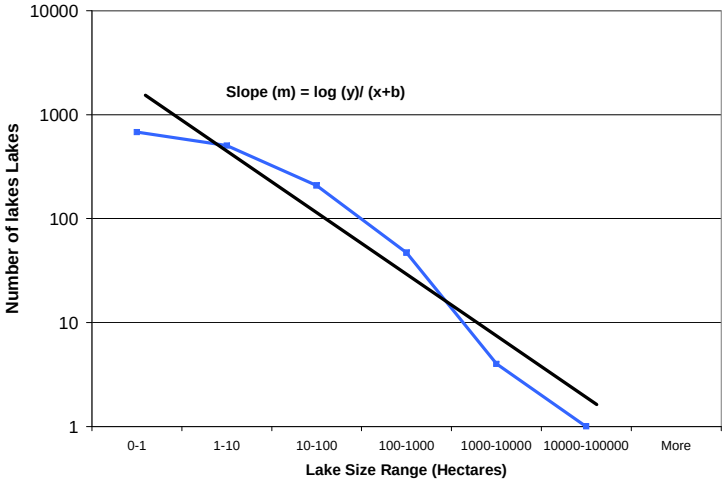
Carbon accumulated per year in all of Canadas lakes = 288.4 Mt or ~ 200 million passenger cars
Total carbon accumulated in Canadian lakes (based on Pajunen) is 2,880,000 Mt

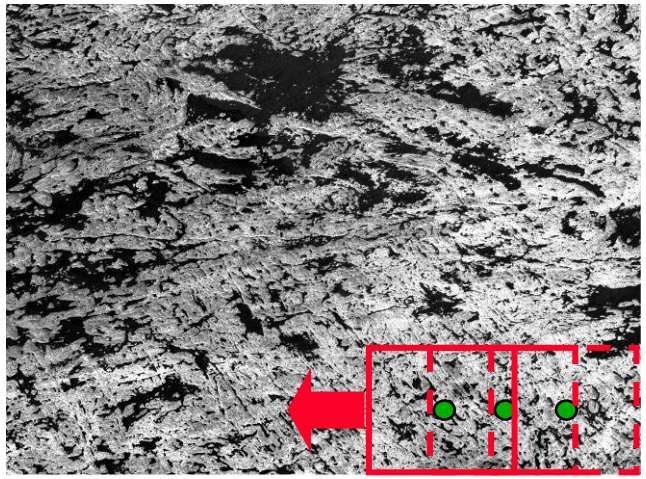
Updated data requirements:

- None at this time; working on and looking forward to using the 50m HH mosaic; fine beam results will be scaled to this data
- We will complete the analysis of acquired data before requesting additional PALSAR data

Ahead in Phase 2 …

Methodological development of Size Distribution Map





Lake Size Distribution is described by slope “m”

m is the slope of a regression line based on a semi log plot

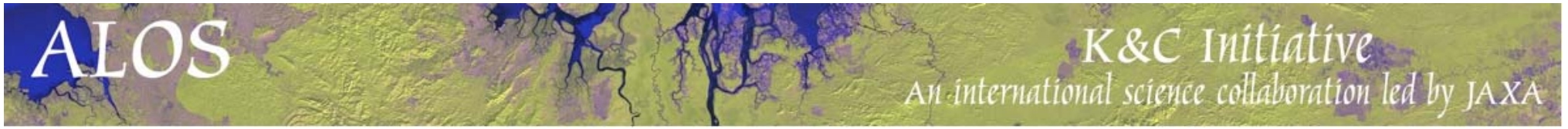
[m = log (y)/(x + b), where y is lake count and x is size class]

Methods of recursively determining m for neighborhoods of varying size are currently being explored.

The ultimate product will be a thematic map of “m” illustrating how lake size distribution varies across Canada – “a raster of lake size distribution”.

This is used:

1. To extrapolate lake sediment carbon accumulation field measurements across Canada
2. To provide an important parameterization of the land surface (lakes) for use in climate modeling studies. Currently lakes, which are known to have strong feedbacks on the atmosphere, are not adequately represented in models.



Thank you

MANY THANKS TO JAXA, Natural Resources Canada, JPL !!

Team members:

Kevin Telmer[1](ktelmer@uvic.ca), Daniel Stapper[1](dstapper@uvic.ca)
Jamie MacGregor[1] (jmac0132@uvic.ca),
and Maycira Costa[2] (maycira@office.geog.uvic.ca)
[1]School of Earth and Ocean Sciences, [2]Department of Geography,
University of Victoria, 3800 Finnerty Road, Victoria, BC Canada V8P 5C2.

University of Victoria

School of Earth and Ocean Sciences:
Aqueous Geochemistry and
Remote Sensing Laboratory