SAR based estimates of lake size distribution and carbon burial across the Canadian landscape: Mid-term results

Project objectives:

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

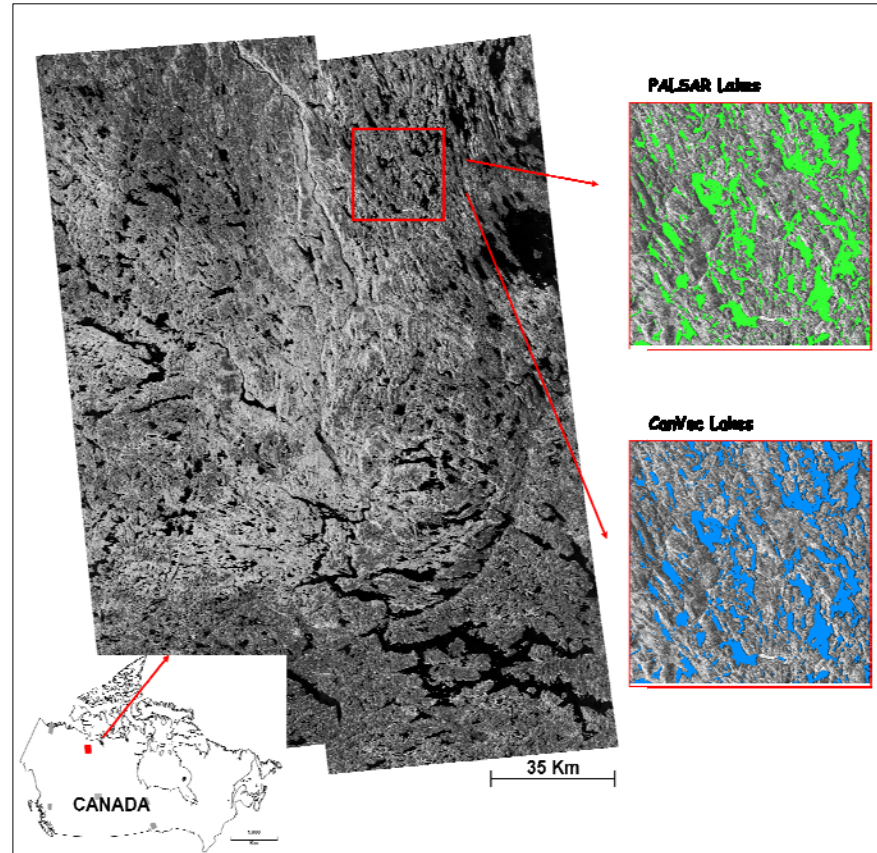-To estimate carbon burial in Canadian lake sediments at regional scales.

Methods:

-Classification of lakes was done by expert based threshold analysis and derivative analysis of SAR image histograms.

-Classification accuracy was assessed using the CanVec cartographic spatial dataset and high resolution satellite imagery.

-Lake sediment carbon accumulation rates were extrapolated to regional scales using the PALSAR lake distributions, published lake sediment carbon accumulation rates, and simplified terrestrial ecozones.

Results:

-Accuracy varied between regions and across lake size ranges. Overall, the PALSAR lake classification differed from the CanVec hydrographic dataset by -9% for lake area and -16.33%. for lake count.

-Errors can be attributed to spatial and temporal resolution limitations, physical properties of the landscape, the classification method, and errors in the comparison dataset.

-Carbon accumulation in boreal, southern arctic and northern arctic lake sediments could account for as much as 13.39, 9.00, and 1.77 megatonnes of CO_2e per 100,000 km^2. For perspective, in boreal lakes alone, this represents CO_2 emissions from over 2.5 million cars per 100,000 km^2 per year.

ALOS PALSAR data used:

-Current: PALSAR FBS/ FBD Level 1.5 imagery
-Future: PALSAR FBS/FBD strip acquisition data

Other data sources:

-CanVec cartographic spatial dataset, produced by Natural Resources Canada
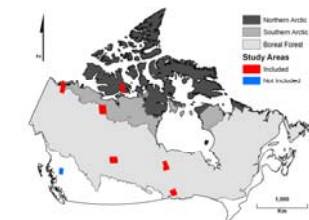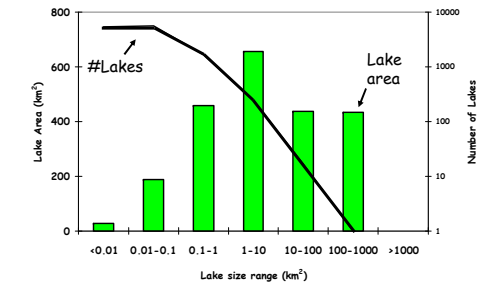
PALSAR derived carbon accumulation in Canadian lakes per 100,000 km² per year			
Lake size km²	Boreal	South Arctic	North Arctic
<0.1	0.15	0.24	0.08
0.1-1	1.07	0.94	0.20
1-10	1.10	0.79	0.10
10-100	0.76	0.28	0.11
>100	0.57	0.20	0.00
Total Carbon in megatonnes (Mt)	3.65	2.45	0.48
Mt CO₂ Equivalent	13.39	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)


Above: A mosaic of FBD Level 1.5 imagery in the Northwest Territories (NWT), Canada. This is one of 7 discrete sample sites used to test the lake classification in preparation for the PALSAR strip data mosaic and Canada wide assessment of lakes. **Right hand figures:** The graph shows lake count and area across lake size ranges estimated by PALSAR for the NWT sample site. The corresponding map shows the locations of all 7 sample sites relative to the generalized ecozones- boreal, southern arctic, and northern arctic. These ecozones were used to scale carbon accumulation rates before they were applied to the PALSAR dataset. One sample site was not included because it did not fall within one of the three ecozones. The table shows carbon accumulation rates derived from the PALSAR lake distribution and scaled up to 100,000 km² for each ecozone.

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