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The Use of ALOS PALSAR for Mapping Boreal Wetlands for Assessment of Land-Atmosphere Carbon Exchange

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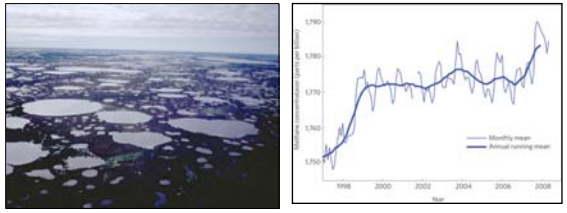
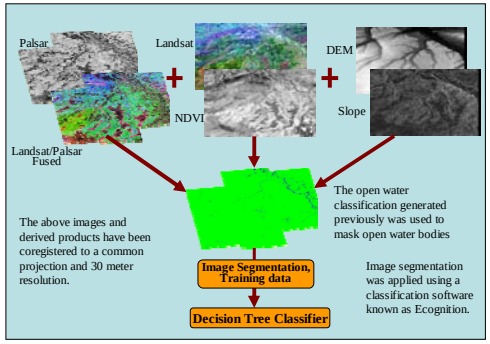
Objective:

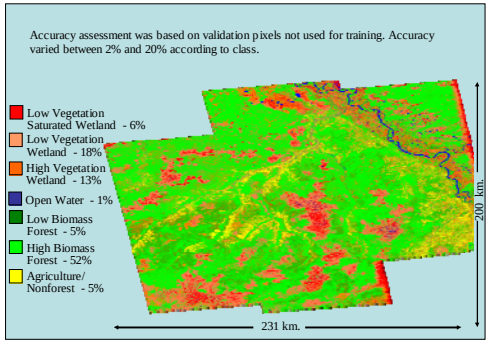
Wetlands and open water are dominant features in the northern high latitudes. Their carbon and methane emissions can have a large impact on global climate and hence the importance of assessing their spatial and temporal extent to improve upon global net carbon exchange estimates. Here we are using high resolution L-band SAR datasets over specific basins within the NEESPI domain to derive wetland classification maps and assess their carbon exchange.



Atmospheric methane concentration peaks in 2007 after record high wetland extent and river discharge in Western Siberia (Schroeder et al., 2009, in review), graph courtesy of Matthew Rigby

Example Wetlands Classification from ALOS PALSAR: Chaya Basin



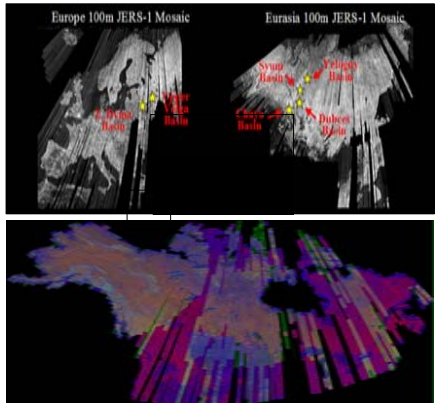


Approach:

A decision tree classification based on the Random Forests approach was used to classify the SAR data. The ancillary datasets (described above and below right) were used within the classifier to support product generation. Application of the Random Forest approach for SAR-based classification was demonstrated previously in development of a wetlands map of Alaska using JERS datasets (below left). This was the first synoptic wetlands map for Alaska developed from a single remote sensing data source (Whitcomb et al 2009). Similar products are under development for several hydrologic basins in our NEESPI domain (shown at right).

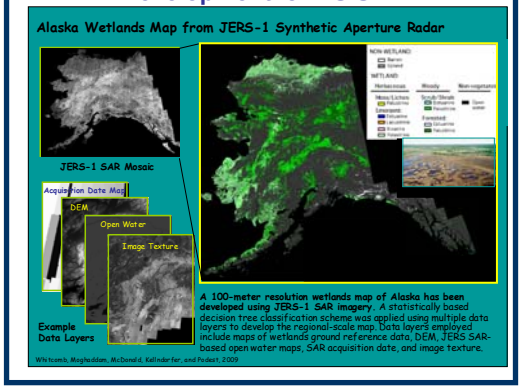
Domain:

Multi-temporal PALSAR and JERS SAR datasets spanning growing seasons from the beginning of the non-frozen period through the end of summer were assembled over selected hydrologic basins within the Northern Eurasia Earth Science Partnership Initiative (NEESPI) domain and boreal North America.

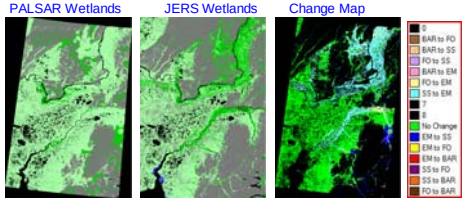


JERS SAR mosaics of Eurasia and North America

Legacy Datasets and Algorithm Development: JERS SAR



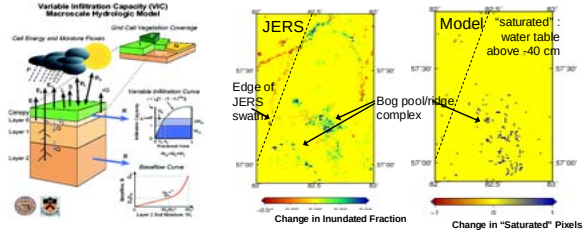
Decadal Change in Boreal Wetlands: JERS SAR and ALOS PALSAR



Wetlands Change in the Yukon-Kuskokwim Delta, Western Alaska

Hydro-Methane Model Simulations: Chaya Basin

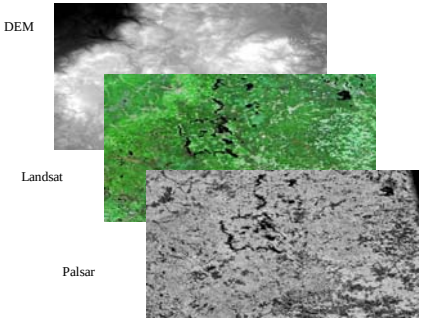
Change in near-surface hydrology from day 100 to day 143 of 1995



The SAR data, from PALSAR and JERS, provide a capability for assessment of hydrologic processes and associated land-atmosphere carbon exchange within seasons and across multiple years (example at left). Here, we employ the Variable Infiltration Capacity (VIC) hydrologic model (diagrammed above left) within a larger methane flux modeling framework. The SAR data are used to calibrate and validate VIC model performance in prediction of water table depth -- a key parameter for assessment of methane flux.

Datasets:

We employ multi-temporal PALSAR data (L-band, 30 m resolution, HH and HV-polarizations) to map wetland distribution within sub-regions of the NEESPI and North American domains. a digital elevation model (DEM), derived slope, and LANDSAT data were used as ancillary datasets in the NEESPI domain.



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