ALOS

K&C Initiative

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An Earth System Data Record of Inundated Wetlands Derived from ALOS PALSAR and Coarse-Resolution Microwave Data Sets: Global Monitoring of Wetland Extent and Dynamics

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Project Summary:

Wetlands exert major impacts on global biogeochemistry, hydrology, and biological diversity. The extent and seasonal, interannual, and decadal variation of inundated wetland area play key roles in ecosystem dynamics. Wetlands contribute approximately one fourth of the total methane annually emitted to the atmosphere and are identified as the primary contributor to interannual variations in the growth rate of atmospheric methane concentrations. Climate change is projected to have a pronounced effect on global wetlands through alterations in hydrologic regimes, with some changes already evident. In turn, climate-driven and anthropogenic changes to tropical and boreal peatlands have the potential to create significant feedbacks through release of large pools of soil carbon and effects on methanogenesis. Despite the importance of these environments in the global cycling of carbon and water and to current and future climate, the extent and dynamics of global wetlands remain poorly characterized and modeled, primarily because of the scarcity of suitable regional-to-global remote-sensing data for characterizing their distribution and dynamics.

We are constructing an Earth System Data Record (ESDR) of Inundated Wetlands to facilitate investigations on the role of inundated wetlands in climate, biogeochemistry, hydrology, and biodiversity. The ESDR will enable advances in understanding the role of wetlands in 1) global cycling of methane, carbon dioxide and water, 2) interactions among climate, greenhouse-gas emissions, and water exchange, 3) climate change effects and feedbacks, 4) maintaining ecological health and biodiversity of critical habitats, and 5) management of water resources for long-term sustainability.

The ESDR will provide the first accurate, consistent and comprehensive global-scale data set of wetland inundation and vegetation, including continental-scale multitemporal and multi-year inundation dynamics at multiple scales. Each component of the ESDR has been designed to facilitate a range of studies by addressing critical gaps in data and understanding of the role of inundated wetlands in important cycles and processes. The regional high-resolution component derived from the SAR observations provide key information needed for regional- to continental-scale studies focusing on biogeochemistry, hydrology, plant and animal biodiversity, water resource management, and long-term sustainability of wetland ecosystems. The global, monthly ~25 km inundation data set, spanning almost two decades, represents a unique, comprehensive source of quantitative information to support analyses and modeling of wetlands in global cycling of methane, carbon dioxide and water, and in simulating interactions among climate, greenhouse-gas emissions, and water exchange for past, current and future time periods.

ESDR Components:

The Inundated Wetlands ESDR will consist of two complementary components:

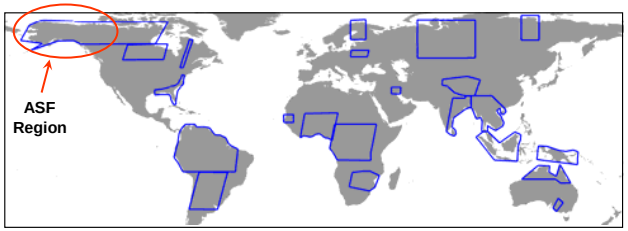
1) Fine-resolution (100m) maps of wetland extent, vegetation type, and seasonal inundation dynamics, derived from ALOS PALSAR, for continental-scale areas covering crucial wetland regions.

2) Global mapping of inundation extent at ~25 km resolution and high temporal fidelity for 1992-2009, derived from multiple satellite observations.

Comparison and validation of these data sets will ensure self-consistency within the ESDR. Accuracy assessment of the fine-scale regional wetlands data sets takes advantage of high-resolution wetlands maps to be made available through K&C Initiative collaborators.

I. Regional inundated wetlands data sets from Synthetic Aperture Radar (SAR)
- Spatial coverage: Major global wetland regions, 100m resolution
- Temporal coverage: 1-2 year time series at 17-to-46 day intervals during 2006-2009 † ‡
- Retrospective 1990's-era from archived JERS data covering Alaska, Canada, Amazon
1. Wetland extent (maximum inundatable area, including water bodies).
2. Wetland vegetation type (Non-vegetated, Herbaceous, Shrub, Woodland, Forest).
3. Inundation state (Flooded, Non-flooded; 17-46 day intervals) ‡
4. Annual inundation duration
II. Global monthly inundation data sets derived from multiple satellite data sources
- Spatial coverage: Global, 25 km resolution
- Temporal coverage: Monthly monitoring with annual summaries, 1992-2009 †
1. Globally gridded (0.25°) inundated area fraction
2. Globally gridded (0.25°) annual inundation duration

Fine-resolution Domain: PALSAR ScanSAR



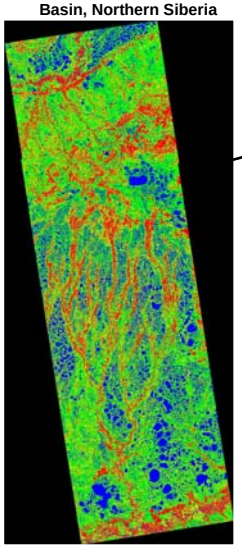
Regions for which ALOS PALSAR repeat acquisitions in ScanSAR HH-polarization mode (descending node) have been planned (ref: ALOS Kyoto & Carbon Science Plan, v.2.0, 2006). We focus generation of the regional fine-resolution inundated wetlands data sets ESDR on regions covered by these ScanSAR polygons. **Selected to enable consistent, repeat coverage across large wetland regions, all of these regions receive at least one year of coverage with a 45-day repeat cycle, allowing mapping and monitoring of major wetland regions at 100-meter resolution**. All areas also receive PALSAR coverage in fine-resolution mode (ascending node) at least once for all continents except Antarctica, with the bulk of those data coming from HH+HV-polarization acquisitions. These data are provided to our project directly from JAXA/EORC through the ALOS K&C Panel. ScanSAR data for the region encircled in red is being acquired and processed by the Alaska Satellite Facility (ASF) and provided to our project through associated arrangements.

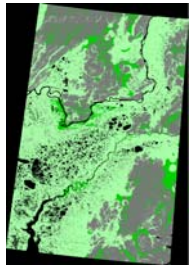
NASA JPL Jet Propulsion Laboratory JAXA

Methodology: Wetlands vegetation mapping with PALSAR datasets

A decision tree classification approach is used to classify the SAR data. Ancillary datasets including DEMs and Landsat imagery may be included within the classification construct to support mappings of wetlands ecosystems. The classifications depict open water and principal vegetation classes (e.g. non-vegetated, herbaceous, shrub, woodland, forest) and their associated inundation state. The examples shown here were generated from fine-beam PALSAR data provided through the K&C project and the AUIG.

Wetland Classification of Servut Basin, Northern Siberia



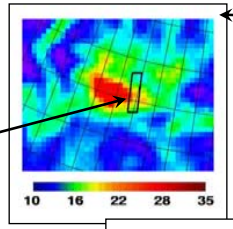


Wetland Classification the Yukon-Kuskokwim Delta region of western Alaska.

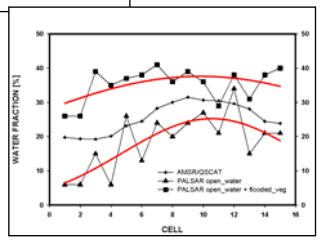
Open water | Inundated Vegetation | Saturated Soil | Vegetation

Harmonization of Data Products

Comparison of PALSAR products with coarse-resolution inundation products



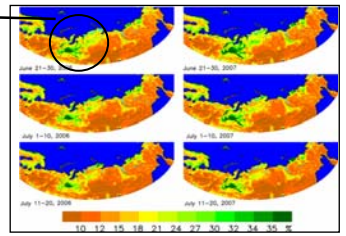
Comparisons of aggregate high resolution ALOS PALSAR surface water fraction (open water plus inundated vegetation) with AMSR-E/QSCAT for July 11, 2006 across the Western Siberian Lowland transect.

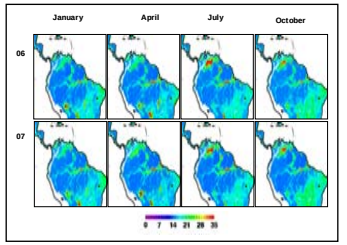


The top figure depicts the compared area delineated with the black box. The graph shows the comparison between high and low resolution data. The AMSR-E/QuikScat product is sensitive to open water and to open water and flooded vegetation.

Landscape Inundation

Inundation Fraction 2006 vs. 2007 from AMSR-E and QuikSCAT





10 day composites of landscape inundation fraction for 2006 and 2007 for Northern Eurasia and the Amazon

This work was carried out at the Jet Propulsion Laboratory, California Institute of Technology under contract with the National Aeronautics and Space Administration. This work has been undertaken in part within the framework of the JAXA ALOS Kyoto & Carbon Initiative. PALSAR data were provided by JAXA EORC.

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K&C project title

Project objectives

Provide a short and concise description of the aim of the project

Results

Describe results obtained so far. Highlight the particular importance and contribution of L-band SAR.

Image x

As this is a poster aimed at JAXA management, use large and eye-catching PALSAR data.

If multi-pass, multi-temporal or mosaic data have been used, please use it to illustrate the regional-scale aspect of your results (which is what makes K&C different from the PI programme)

Image z…

Image y

Image captions

ALOS PALSAR data used

xxxxxxx

Other data sources

yyyyy

K&C Science Team member

Your name, affliliation and contact details

Your Logo