Status of Boreal Wetlands Mapping and Freeze-Thaw Science Activities Kyle C. McDonald Water and Carbon Cycles Group Jet Propulsion Laboratory California Institute of Technology Pasadens, California, U.S.A.

> ALOS Kyoto & Carbon Science Team Meeting Tsukuba, Japan

> > 11-13 June 2007

Current Status and Work in Progress

- JERS-based wetlands map of Alaska (static) completed
- Data assembly and analysis system for PALSAR (and JERS) is under development
- Proposals to NASA
 - MEaSUREs
 - Carbon Cycle Science
 - McDonald, Moghaddam, Lettenmaier, PIs







An Inundated Wetlands Earth System Data Record: Global Monitoring of Wetland Extent and Dynamics

- **Objective:** Development of a data set to facilitate global and regional studies of the role of inundated wetlands in studies of climate, biogeochemistry, hydrology, and biodiversity.
- Key Issues: Global, time series, established (published) algorithms, multiple sensors, data distribution

Principal Investigator: Kyle McDonald (JPL)

Project Members:

Bruce Chapman (JPL) Laura Hess (UCSB) John Kimball (University of Montana) Elaine Matthews (NASA/GISS) Mahta Moghaddam (The University of Michigan)

Collaborators:

Wenjun Chen (CCRS) Nick Davidson (Ramsar) Max Finlayson (International Water Management Institute) Martti Hallikainen (H.U.T.) Catherine Prigent (LERMA - France) Ake Rosenqvist (JRC) Masanobu Shimada (EORC-JAXA)

Components of the Proposed Inundated Wetlands Earth System Data Record

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°) monthly inundated area fraction
- 2. Globally gridded (0.25°) annual inundation duration

PALSAR Regional Coverage: ScanSAR regions

- Inundated wetland area (swath-by-swath)
- Principal wetland vegetation classes (non-vegetated, herbaceous, shrub, woodland, forest),
- Seasonally based summary products describing timing and extent of wetland inundation
- Production is phased according to K&C acquisitions



Monthly global data sets of inundated area fraction







FEDERATION OF EARTH SCIENCE INFORMATION PARTNERS

Earth observation information from satellites and ground-based collection sites has the potential for providing scientifically valid answers to many of the world's most pressing environmental problems. However, the data sets tend to be very large, poorly cataloged, widely distributed and difficult to access.

The Federation of Earth Science Information Partners is a unique consortium of more than 90 organizations that collect, interpret and develop applications for remotely sensed Earth observation information. Included in the ESIP network are NASA, NOAA and USGS data centers, research universities, government research laboratories, supercomputing facilities, education resource providers, information technology innovators, nonprofit organizations and commercial enterprises.

With our Strategic Partners the National Aeronautical and Space Administration and the National Oceanic and Atmospheric Administration, the Federation and its operations arm, the Foundation for Earth Science, are working to make observation information relating to a broad spectrum of Earth science issues more available and understandable to researchers, educators, policy makers and the general public. By so doing, the Federation hopes to contribute significantly to the creation of a healthy and sustainable planet.

FEATURED ESIP PARTNER - NSIDC

The National Snow and Ice Data Center offers some of their data in the form of images and maps.

NSIDC created Google Earth files that enable you to overlay data based images on a virtual globe. Their goal is to help people better understand the cryosphere - where the world is frozen - by making their data more visible and interactive. You can use Google Earth to view snow, ice, glaciers, permafrost, and sea ice on the globe.

The NSIDC "Atlas of the Cryosphere" Web site allows visitors to explore and dynamically map the Earth's frozen regions. Viewed from a polar perspective, the available scenes include snow cover, sea ice extent and concentration, glaciers, permafrost, and other critical components of the Earth's cryosphere.

NUMERICAL TERRADYNAMIC SIMULATION GROUP



College of Forestry The University of Montana

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Principal Investigator: Steven W. Running Faculty and Research Associates: Ramakrishna R. Nemani, Peter E. Thornton, Kenlo Nishida Director of Software Development: Joseph M. Glassy

> The NASA Earth Observing System is a \$7.3 billion program planning satellite-based earth monitoring for 15 years, and is the heart of global change science for the United States.

The central sensor on board the <u>Terra Satellite</u> <u>Platform</u> is the Moderate Resolution Imaging Spectroradiometer (<u>MODIS picture</u>). Terra was successfully launched on December 16, 1999, and a second MODIS-based satellite, Aqua, was launched May 4, 2002.



The University of Montana is the only Forestry School in the country with a member on the EOS science team. Our responsibility is to provide computer programs to use this new satellite data to calculate global photosynthesis and evapotranspiration for all terrestrial biomes. We envision the EOS satellite to provide a dramatic improvement in our ability to accurately monitor global ecological conditions. Large scale climate shifts, deforestation, desertification, pollution damage, crop conditions, glacial retreats, flooding, wildfires and urbanization are examples of the types of earth system monitoring planned. Currently, as we work on these software products, we are using Montana as a testbed for this advanced satellite technology.

Integrated Master Schedule

1. Data Acquisition and Assembly	Year	1	Ye	ar 2	Y	ear 3	Y	ear 4		Yea	ar 5
a. Acquire existing JERS data archives										Π	
 b. Preprocessing of post-2000 SSM/I data 				П		ТГ	Π	П	Т	Π	
c. Dual Pol SAR mosaics for ScanSAR regions N&S America			Π	П			Π	Π	Т	Π	
d. Mosaics of N. and S. America: ScanSAR data							Π		T	Π	
f. Dual Pol PALSAR mosaics: outside Western Hemisphere		Π					П		T	Π	
g. Complete preprocessing of post-2000 SSM/I data		Π				++	П		T	Π	
h. Mosaics of ScanSAR data outside Western Hemisphere										\square	
2. Validation											
a. SSM/I inundation vs. JERS wetland classification				Π		ТГ		П	Т	Π	
b. SSM/I inundation vs. PALSAR wetlands classification		Π			П		Π	Π	Т	Π	
c. Document SSM/I based inundation dynamics into ESDR		Π	Π	П		ТГ	Π	П	Т	Π	
3. Develop products											
a. JERS-1products: inundated wetlands Amazon, Canada,				Π		ТГ		Т	Т	Π	
Alaska					┞┼	++	₽		4	++	
d. PALSAR products: inundated wetlands Northern S. America and S.E. USA									I		
e. Global SSM/I monthly inundation dynamics 2001-2009		Π		\square					T	Π	
f. PALSAR based inundation for N. America, Africa, Australia, Tigris, Pantanal, Asia											
4. Data Analysis System											
A. Integrated web site											
 b. Tools integrated within web site 											

Mapping Wetlands Dynamics for Reducing Uncertainties in the Boreal North American Carbon Budget

Principal Investigator: Mahta Moghaddam (The University of Michigan)

Project Members:

Kyle McDonald (JPL), Bruce Chapman (JPL), Wenjun Chen (CCRS) Ake Rosenqvist (JRC), Masanobu Shimada (EORC-JAXA)

Diagnosis and prognosis of changes in lake and wetland extent on the regional carbon balance of northern Eurasia

Principal Investigator: Dennis Lettenmaier (University of Washington)

Project Members:

Kyle McDonald (JPL), Sergey A. Zimov (Northeast Science Station, Cherskii, Russia) Martin Heimann (Max Planck Institut fur Biogeochemie) Reiner Zimmermann (Universty of Hohenheim) Ake Rosenqvist (JRC), Masanobu Shimada (EORC-JAXA)

- Product name:
 - Inundated wetlands datasets
- Description:
 - Inundated natural wetland area (swath-by-swath)
 - Principal wetland vegetation classes
- PALSAR mode:
 - ScanSAR and Dual Pol
- Observation cycles:
 - Continuous from 2007
- Production schedule:
 - see Master Schedule
- Estimated date of delivery:
 - see Master Schedule