DATA SYSTEM DESIGN AND IMPLEMENTATION FOR QUERY AND ANALYSIS OF SYNTHETIC APERTURE RADAR DATA SETS IN SUPPORT OF GLOBAL SCALE MAPPING OF INUNDATED WETLANDS.

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ABSTRACT

Wetlands exert major impacts on global biogeochemistry, hydrology, and biological diversity. The extent and seasonal, interannual, and decadal variation of inundated wetland areas play key roles in ecosystem dynamics. 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. Spaceborne microwave remote sensing offers effective tools for characterizing wetlands since it is particularly sensitive to surface water and to vegetation structure, and it allows monitoring large inaccessible areas on a temporal basis regardless of atmospheric conditions or solar illumination.

As part of a NASA Earth science project, we are constructing a global-scale Earth System Data Record (ESDR) of inundated wetlands to facilitate investigations on their role in climate, biogeochemistry, hydrology, and biodiversity. A primary component of this ESDR consists of fine-resolution (100 meter) time series mappings of wetland extent, wetlands vegetation type, and seasonal inundation dynamics derived from Synthetic Aperture Radar (SAR). Development of these data sets utilizes dual polarization (HH and HV) standard beam PALSAR imagery and multi-temporal HH-polarized ScanSAR imagery acquired at 17-to-46 day intervals over 1- to 2-year timeframes for regional to continental-scale areas covering major wetland regions across the globe. These contemporary-era mappings utilize currently on-going data collections from the Phased Array L-Band SAR (PALSAR) sensor on-board the Advanced Land Observing Satellite (ALOS). This instrument package, built and operated by the

Japanese Aerospace Exploration Agency (JAXA), has been collecting SAR image data since early 2006. The PALSAR-based wetland products are generated using legacy algorithms already developed and tested with similar datasets. The algorithms are based on an object-oriented image segmentation approach and a statistically based decision tree classifier [1]. This approach follows directly from previous work on mapping of tropical and boreal wetlands with SAR data from the Japanese Earth Resources (JERS-1) satellite [2] [3] [4].

Derivation and utilization of these large-scale products from relatively fine resolution radar imagery necessitates establishment of a large database of SAR images and development of effective software tools supporting image manipulation and regional-scale analysis. To support this end, we are constructing a user-accessible data system available through a World Wide Web portal to facilitate assembly, analysis and distribution of ESDR components. This framework interfaces powerful and flexible software tools for mosaic assembly of SAR images and derived ESDR products, and for data product display, assessment, and distribution to the science community. Data products will be accessible via this interface through a project web site at JPL and through the University of Montana NTSG ESIP site.

Organization of the image products and examination of those products based on desired criteria can be simplified by utilizing widely-available Earth data visualization tools. By construction of "KML" files and a stack of multi-resolution data sets, vast quantities of SAR or other data sets, including associated digital elevation data and other ESDR components, can be easily displayed in combination with currently accessible optical imagery. Flexible mosaicking is achieved through use of an on-line mosaicking tool combined with visualization tools for data examination, selection of the data sets for mosaicking through a link to a webpage (based on thematic or temporal considerations), and lastly, execution of software on the server to mosaic the user-specified data. Therefore, in addition to producing a wetland classification for each PALSAR data collection cycle, it will be possible to construct a wetland classification corresponding to, for example, maximum or minimum inundation extent, or, using ancillary sources of information, maximum or minimum rainfall periods, or any other condition of scientific interest that can be quantified by date and location.

This type of visualization software can also facilitate the comparison of the global inundation data sets and the regional PALSAR-based data sets. Since the SAR data are unevenly distributed temporally and spatially, this visualization capability greatly simplifies combined analysis of these data sets. Each can be loaded into visualization software for inspection, with particular regions and/ or time spans identified. Based on this visualization, the appropriate data sets can be downloaded and analyzed.

We present details of ESDR construction including remote sensing data collections, algorithm application, and planned data set distribution. The status of current efforts to assemble this ESDR, including data processing and wetland classification are presented. We discuss the details of data system development and the unique features addressed in data system implementation. This ESDR will provide the first high-resolution, accurate, consistent and comprehensive global-scale data set of wetland inundation and vegetation, including continental-scale multi-temporal and multi-year monthly inundation dynamics at varying scales.

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2. REFERENCES

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