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EVALUATING POLARIMETRIC AIRBORNE SAR DATA OF THE TONLE SAP RIVER FLOODPLAIN WITH A VIEW TOWARD POTENTIAL RADARSAT-2 APPLICATIONS

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ABSTRACT

The floodplain of the Tonle Sap river is a major part of the Mekong River drainage basin in Southeast Asia. Owing mainly to the monsoon rainfall, its hydrologic regime is governed by highly dynamic seasonal cycles. Wetlands, agricultural landscapes, and flooded terrain need to be monitored closely, as human activities threaten to upset the balance of the natural hydrological systems. Synthetic aperture radar (SAR), by virtue of its cloud penetration capability, is a valuable data source for monitoring hydrological and land cover changes in this region. This paper assesses the capability of AIRSAR polarimetric SAR data to discriminate environmental features associated with the Tonle Sap floodplain in Cambodia. Particular emphasis is placed on the evaluation of AIRSAR data parameters that are similar to those that will be available to the user community on Canada's RADARSAT-2 in 2004. AIRSAR data were acquired in POLSAR mode during peak flood conditions over the Tonle Sap River in Cambodia in September of 2000 as part of the PACRIM-2 mission. Field observations at the time of data acquisition assisted in the evaluation of the multi-frequency, polarimetric SAR response to various land cover types and flooded environments. We also collected a time series of RADARSAT-1 fine mode data over the study site throughout the year to gain a better understanding of the seasonal hydrological cycle and land cover changes. This data set served as a reference for the evaluation of the AIRSAR polarimetric data.

For the evaluation of the high resolution multi-frequency / polarimetric AIRSAR data we employed a decision tree classification approach to determine the best discrimination of natural wetland surfaces. Specific attention was paid to environmental features that allow seasonal changes in the floodplains and wetlands to be monitored. We used single and multi-polarization, total power and phase difference images as the basis for the analysis. Polarimetric signatures of specific wetland classes were also extracted to help characterize the radar interactions with the surfaces being studied. In addition, we performed a qualitative comparison between the spatial resolution capabilities of the AIRSAR data and the RADARSAT-1 fine mode data to obtain an indication of how classification of surface cover types may improve with the RADARSAT-2 Ultra Fine mode (3m) data.