

TIME SERIES ANALYSIS OF THE LAC BAM WETLAND USING DUAL-POLARIZED X-BAND SAR DATA

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ABSTRACT:

Lac Bam is the largest natural lake in Burkina Faso, and is of high importance for the local inhabitants for irrigated farming, animal watering, and extraction of water for drinking and sanitation. Wetlands in semi-arid African areas are prone to strong seasonal fluctuations and their waters are often covered by floating or standing vegetation, and can be very turbid and sediment-rich. During the rainy season cloud-cover is very strong, and during this time, only active microwave-based remote sensing systems like SAR sensors are suitable. While SAR intensity images have been successfully used to detect open water, polarimetric SAR applications have shown promising results to also distinguish between open water, floating, flooded, and standing vegetation, and land of the wetland's environment. A time series of StripMap data from TerraSAR-X has been acquired from August 2013 (rainy season) to May 2014 (end of dry season), with an interval of 11 days. Images are geocoded and calibrated, and further processed to Multi-scale Multi-looked normalized Kennaugh elements. Results clearly show that using the Kennaugh elements from co-polarized HH-VV bands open water can be well identified from one Kennaugh element (K0), and two more Kennaugh elements (K3, K4) clearly enable the detection of floating and standing vegetation in water. Applied on the full time series, seasonal fluctuations become apparent, and proof that monitoring the temporal development of wetlands is possible despite water being covered by vegetation. The method will also be tested for a dual-pol HH-HV Radarsat-2 time series in preparation for Sentinel-1 data. Results of the analysis are validated based on optical very high resolution data from WorldView-2 and RapidEye, available for selected dates. This study contributes to a better understanding of dynamics of African wetlands, as well as concludes to the capability for the use of dual-polarimetric SAR imagery for regular wetland monitoring which is essential for water management and wetland ecology.