The 36th International Symposium on Remote Sensing of Environment,
11 – 15 May 2015, Berlin, Germany, ISRSE36-547

REMOTE SENSING OF SURFACE WATER DYNAMICS FROM OVER TWO DECADES OF SEASONALLY CONTINUOUS LANDSAT DATA

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THEME: Water Cycle

KEY WORDS: Flooding, drought, climate variability, ecosystem change

ABSTRACT:

Surface water is a vital resource affected by changes in climate and anthropogenic factors (e.g., land use changes). Knowledge of surface water dynamics provides critical information for flood and drought management. Here we focused on the on the entire Murray-Darling Basin (MDB) of Australia, a large semi-arid region with scarce water resources, high hydroclimatic variability and competing water demands, impacted by climate change, altered flow regimes and land use changes. The MDB is also an area where substantial investment in environmental water allocation of large volumes of environmental flow was made.

We used Landsat TM and ETM+ time series to synoptically map the dynamic of surface water extent with an internally consistent algorithm (Tulbure and Broich, 2013) over decades (1986-2011). We used a subset of Landsat path/rows for image training in both wet and dry years (Australian Water Availability Project).

Results show high interannual variability in number and size of surface water, with surface water during the Millennium Drought (until 2009) being substantially smaller than during the excessive 2010-2011 La Nina flooding. Flooding frequency in 2006, a very dry year was lower than in 2010, the La Nina year when extensive floods occurred. At Barmah-Millewa, the largest river red gum forest in the world, we also mapped flooded forest and tracked changes in vegetation index. Higher vegetation index values were found in areas more frequently flooded. Knowledge of the spatial and temporal dynamics of flooding and the response of riparian vegetation communities to flooding is important for management of floodplain wetlands and vegetation communities and for investigating effectiveness of environmental flows and flow regimes.

Historic flood inundation extent mapped via remote sensing can be used to quantify spatially explicit changes in surface water dynamics for water cycle. This methodology is globally applicable and relevant to areas prone to flooding with competing water demands and can be used for mapping water availability in data scarce regions.

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