



Tropical cyclones and the pulsed eco–hydrological dynamics of Australia’s arid zone: As revealed by AVHRR, MODIS and GRACE

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Pulses of vegetation growth following significant rains are a characteristic of water limited systems. However, the underlying climatic control often remains elusive. We show that throughout Australia’s west and central arid zones, comprising two thirds of the continent’s area, most significant pulses of vegetation growth are associated with the passage of tropical cyclones. The analysis used a combination of MODIS Normalised Difference Vegetation Index (2002 – 2009), AVHRR fraction Absorbed Photosynthetically Active Radiation (1981 – 2006) as well as historical cyclone tracks. We also find a significant correlation between these pulsed vegetation dynamics and variation in the equivalent water thickness stored in the landscape as estimated by GRACE products (2002 – 2009). In areas away from the monsoonal tropics and southern Mediterranean climatic regions, these correlations show little or no lag at monthly time scales and both gravity and vegetation signals show similar levels of persistence, typically five-seven months following a cyclone. Recent low vegetation greenness as well as a deficit in water storage over north-west Australia appears to be associated with a decline in cyclone activity over the last few years. Climate change, as well as inter-annual and inter-decadal oscillations in sea surface temperatures across Australia’s north, impacting upon the frequency of cyclones, are therefore anticipated to have significant effects on vegetation dynamics throughout much of Australia’s arid zone.