

Satellite-based estimates of vegetation density over Australia during 1988–2008

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Abstract Vegetation density plays an important role in the water and energy balance. Satellite based passive microwave instruments have shown an ability to monitor the total above-ground vegetation biomass at global scales. A recently developed approach to retrieving vegetation optical depth (VOD, an index of vegetation density) from microwave emissions can be used for all bands in the microwave domain, allowing data collected by different satellites (e.g. Special Sensor Microwave/Imager (SSM/I from middle 1987), Tropical Rainfall Measuring Mission (TRMM) Microwave Imager (TMI from 1998) and Advanced Microwave Scanning Radiometer – Earth Observing System (AMSR-E from middle 2002)) to yield a long-time series. However, differences in measurement specifications prevent merging the data directly. Here we develop a merged product by adjusting SSM/I and TMI products against the reference sensor (AMSR-E) using the cumulative distribution frequency matching approach. Results of Mann-Kendall trend analysis on the merged VOD product during 1988–2008 show that northwest Australia experienced considerable increases in vegetation density, whereas southeast Australia experienced considerable declines. Gridded rainfall and temperature products were used to assess climate induced changes during the study period over Australia. By performing multiple linear regression analysis over varying periods of precipitation, temperature and annual maximum monthly VOD, we identify the proportion of VOD change that is explained by precipitation and temperature, and distinguish the contribution of natural climate from human activities on the long-term change. Expanding analysis to the global scale along these lines should increase our understanding of the natural and anthropogenic impacts on terrestrial hydrology and vegetation dynamics.

Key words vegetation density; passive microwave; long term