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Breaks and trends in MODIS time series across the semi-arid Paroo River catchment, Australia

Shawn Laffan

Affiliations: Earth and Sustainability Science Research Centre, School of Biological, Earth and Environmental Sciences, UNSW, Australia.
Email: Shawn.Laffan@unsw.edu.au

Abstract: Spatio-temporal analysis of earth observation time series is important for understanding changes across regional extents. A key source of such data is the MODIS time series, collected by sensors on the Terra and Aqua platforms. Of the numerous analysis methods for such data, many assume a consistent seasonal pattern with no abrupt changes in the overall trends. The latter is unusual for many geographic regions due to disturbances such as fires, floods and land clearing, while seasonality is unusual for arid and semi-arid environments due to irregular rainfall and subsequent vegetation responses. The Breaks for Additive Seasonal and Trend (BFAST; Verbesselt et al. 2010) algorithm has been demonstrated to work well when analysing such data (Watts and Laffan 2013, 2014). More recently, the Bayesian Estimator of Abrupt change, Seasonality, and Trend (BEAST; Zhao et al. 2019) algorithm has been developed for the same general problem space. It requires less parameterisation and provides more diagnostic data than BFAST, albeit at the cost of greater computational requirements. The aim of this work is to compare the BEAST and BFAST algorithms for the Paroo region analysed by Watts and Laffan. MODIS 16-day vegetation index data (MOD13Q1; Didan 2021) for the period Feb-2000 to Jun-2025 are analysed to assess if consistent features are identified by both methods, temporally and geographically. An additional benefit of the work is that it extends the time series Watts and Laffan, meaning several of the conclusions can be revisited in light of 13 years of additional data spanning several La Nina/El Nino periods and the associated vegetation response to rainfall patterns.

Keywords: *MODIS, time series, change detection, vegetation dynamics*

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