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## Multifractal analysis of spatial heterogeneity in Spanish arid rangelands

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Rangeland and agricultural landscapes are complex and multifractal based on the interaction of biotic and abiotic factors such as soil, meteorology, and vegetation. The effects of land-uses on these areas modify their characteristics and dynamics. The use of Normalized Difference Vegetation Index (NDVI) and NDVI anomalies (NDVIa) from satellite time series can effectively aid on understanding the differences among rangeland uses and types.

Multifractal detrended fluctuation analysis (MDFA) focuses on measuring variations of the moments of the absolute difference of their values at different scales. This allows us to use different multifractal exponent such as generalized Hurst exponent ( $H(q)$ ), and the scaling exponent ( $\zeta(q)$ ) to characterize each area.

We collected the time series using satellite data of MODIS (MOD09Q1.006) from 2002 to 2019. One area from southeastern Spain (Murcia province) of 6.25 Km<sup>2</sup> were selected. This area comprises 132 pixels with a spatial resolution of 250 x 250 m<sup>2</sup> and a temporal resolution of 8 days. This area represents a mix of tree crops rainfed and irrigated, rainfed herbaceous crops, and grazelands with shrubs and/or tree coverage.

MDFA was used on every pixel of the study area and  $H(q)$  was plotted and compared. Our results report different exponent behaviours for diverse rangeland type or use. Within the same vegetation type, MDFA can allow us to distinguish among pixels, such as the top central part of our area, where different persistence levels are found for the same land use. Comparing the Hurst exponent ( $H(2)$ ) of NDVI and NDVIa also suggest a difference of influence on the multifractal character of long-range correlations.

We conclude that MDFA is a good tool to characterize arid rangelands spatial heterogeneity, particularly for rangeland with different vegetation types. It can be used to monitor and manage arid rangeland. It can be useful for policy-makers for short- and long-term solutions.

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