**Comparison of Sentinel-2 and Landsat-8 in Assessing Vegetation Response to Soil Moisture Variation in Droughty Environments**

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### Methodology

**Sentinel-2**

*Visibility & NIR - 30m*  
*Visible & NIR - 10m*  
*4x20m Narrow NIR*

**Landsat-8**

*Visible & NIR - 30m*  
*30m NIR*  
*10m NIR*  
*4x20m Narrow NIR*

The principal aim of this study was to determine the extent to which S2 NDVI time series reflects soil moisture conditions, and whether this offers an improvement over LS8.

On the basis of exposure to drought over the study period (14 April-16 March 2017), availability of cloud-free imagery and measured soil moisture, five sites in South-Western United States were selected. These sites normally dry to arid, were classified as being in various states of drought, but in general this represented extension and recession of a significant drought event.

A secondary focus of the study therefore was the extent to which S2 NDVI time series reflects soil moisture conditions, and whether this offers an improvement over LS8.

### Results & Conclusions

- No significant correlations between Landsat-8 NDVI and measured soil moisture were found.
- High significant correlations were present between moisture at depths of <30cm and Sentinel-2 NDVI at three sites (Fallbrook, Falbrook & Ford Dry Lake).
- No significant correlations between Sentinel-2 NDVI and soil moisture at two sites (Desert Centre & Las Cruces).
- These sites were characterised by much lower vegetation cover, suggesting a minimum cover threshold of ~30-40% is required for NDVI values to report significant correlations with soil moisture.
- The principal component analysis (PCA) shows that at all sites of significant positive moisture/NDVI correlations, the linear combination of the red-edge bands produced stronger correlations than the poorer spectral, but higher spatial resolution band.
- NDVI calculated using the higher spatial resolution bands may therefore be of greater use in this context than the higher spatial resolution band.
- These results suggest high potential for the application of Sentinel-2 NDVI in drought monitoring, even in extreme environments, thus allowing us to further our understanding of local scale plant-soil dynamics.

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