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Meteorological and agricultural drought indices in semiarid grasslands monitoring

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Mediterranean agriculture faces drought as one of the most challenging obstacles to overcome. Especially, in semiarid grasslands, where every year the biomass production suffers severe damage due to several factors, being one of them the lack of precipitation. For this reason, semiarid vegetation monitoring allows us to improve the management and conservation of these essential ecosystems. Meteorological drought is commonly monitored using indices such as the Standard Precipitation Index (SPI) and the Standard Precipitation Evapotranspiration Index (SPEI). On the other hand, agricultural drought is measured by the Vegetation Health Index (VHI). In this work, we present different methodologies to optimize the correlation between both droughts by standardizing the vegetation index and selecting the best time scale throughout the year.

First, we selected drought-vulnerable Mediterranean grasslands zones in the centre of Spain. By doing this, we pretend to evaluate the performance and the sensibility of the drought indices. MODIS data (MOD09Q1) was used to calculate the Normalized Difference Vegetation Index (NDVI), then it is standardised to define a standardized vegetation index (SVI). The meteorological indices SPI and SPEI were calculated using data collected from nearby weather stations. Overall, our results revealed that SPEI was better correlated with SVI and obtained better results in the critical seasons, in comparison to SPI. The quarterly scale was the most suitable, showing a higher relationship than the monthly scale. This fact suggest that vegetation growth phases should be considered in agricultural drought detection. The most sensitive time frame throughout the year was spring and autumn, implying that drought indices (SPI and SPEI) along with vegetation index (SVI) could offer an improvement in the monitoring during these periods.

References

Escribano Rodríguez, J.A., Díaz-Ambrona, C. H. y Tarquis Alfonso, A.M. (2014). Selección de índices de vegetación para la estimación de la producción herbácea en dehesas. Pastos, 44(2), 6-18.

Martín-Sotoca, J. J., Saa-Requejo, A., Moratiel, R., Dalezios, N., Faraslis, I., and Tarquis, A. M. (2019). Statistical analysis for satellite-index-based insurance to define damaged pasture thresholds, Nat. Hazards Earth Syst. Sci., 19, 1685–1702, https://doi.org/10.5194/nhess-19-1685-2019

Sanz, Ernesto Antonio Saa-Requejo, Carlos H. Díaz-Ambrona, Margarita Ruiz-Ramos, Alfredo Rodríguez, Eva Iglesias, Paloma Esteve, Bárbara Soriano and Ana M. Tarquis (2021). Normalized Difference Vegetation Index Temporal Responses to Temperature and Precipitation in Arid Rangelands. Remote Sens., 13(5), 840.

Andrés F. Almeida-Ñauñay, Rosa María Benito, Miguel Quemada, Juan Carlos Losada and Ana M. Tarquis (2021). The Vegetation–Climate System Complexity through Recurrence Analysis. Entropy, 23(5), 559.

Sanz, E.; Saa-Requejo, A.; Díaz-Ambrona, C.H.; Ruiz-Ramos, M.; Rodríguez, A.; Iglesias, E.; Esteve, P.; Soriano, B.; Tarquis, A.M. (2021). Generalized Structure Functions and Multifractal Detrended Fluctuation Analysis Applied to Vegetation Index Time Series: An Arid Rangeland Study. Entropy, 23, 576.

Almeida-Ñauñay, A. F., Benito, R. M., Quemada, M., Losada, J. C., & Tarquis, A. M. (2022). Recurrence plots for quantifying the vegetation indices dynamics in a semi-arid grassland. Geoderma, 406, 115488. https://doi.org/10.1016/j.geoderma.2021.115488