



Monitoring Drought Impacts on Rainfed Olive Orchards in the Iberian Peninsula Using Satellite-Derived Vegetation Indices

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INTRODUCTION & AIM

- Analyse the impact of drought on rainfed olive orchards in two traditional regions of the Iberian Peninsula (IP).
- Analyse spatial-temporal dynamics of vegetation indices: Soil-Adjusted Vegetation Index (SAVI) and Normalized Difference Moisture Index (NDMI) in response to drought conditions from 2015 to 2023.
- Drought severity quantification using the Mediterranean Palmer Drought Severity Index (MedPDSI), specifically developed for olive trees.
- Evaluate the effectiveness of combining satellite vegetation indices with drought indicators for monitoring olive tree health.

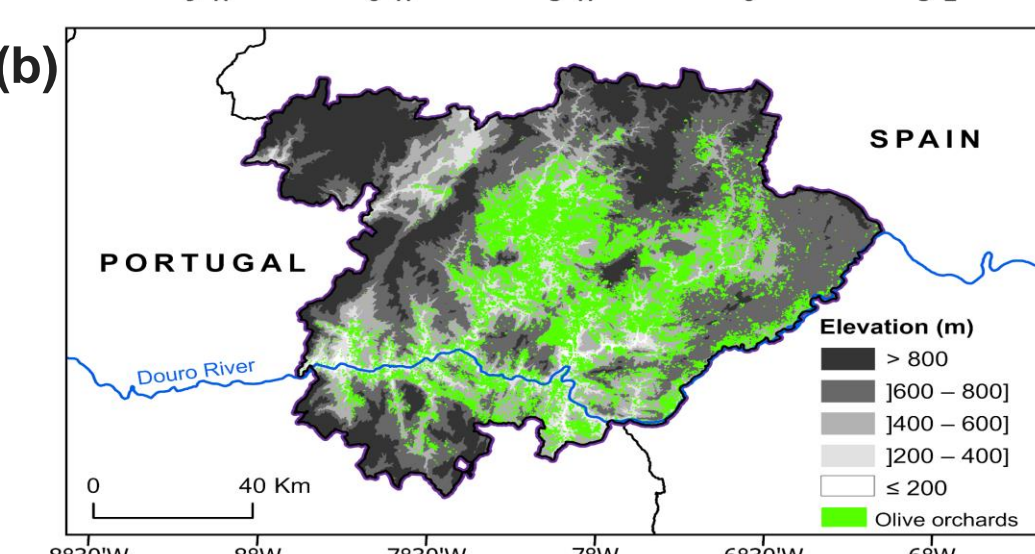
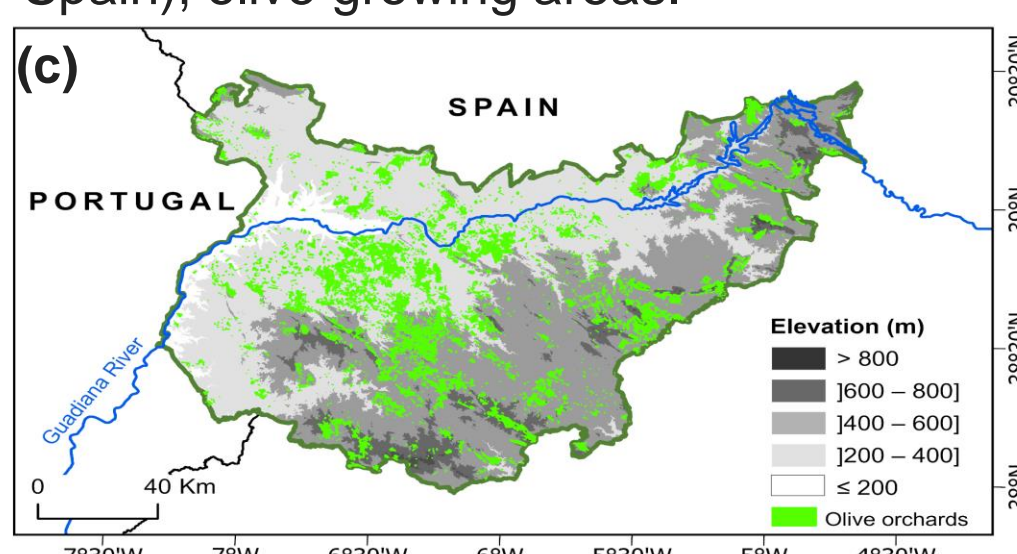
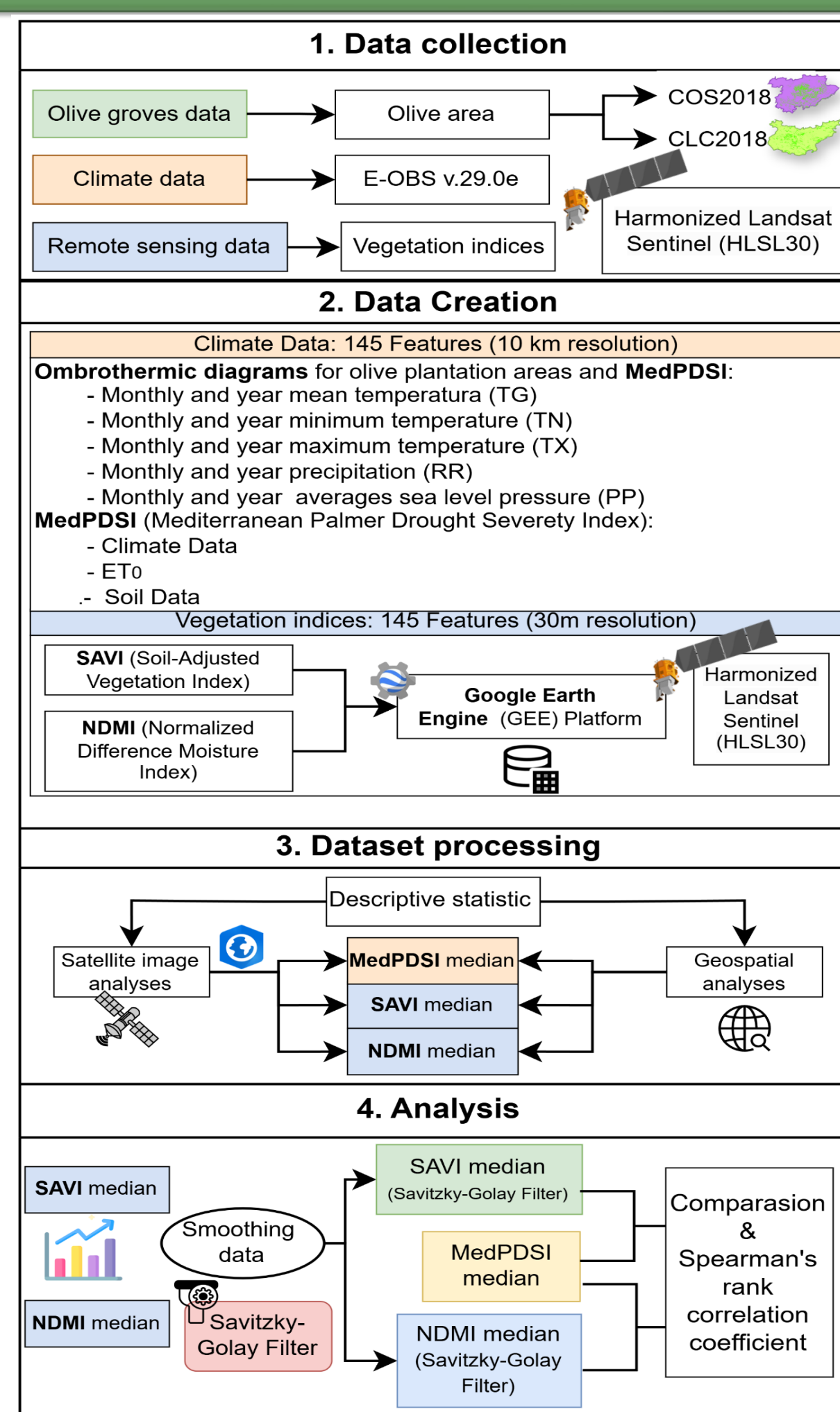


Figure 1. Study area and olive production in the territories of Badajoz province (Spain) and Trás-os-Montes agrarian region (Portugal). (a) Location and spatial extent of the study regions; (b) elevation of TM (“Trás-os-Montes” agrarian region, Portugal) and olive orchard areas; and (c) elevation of BA (Badajoz province, Spain), olive growing areas.



METHODOLOGY



RESULTS & DISCUSSION

- The results reveal significant regional differences, with BA experiencing more intense and prolonged drought conditions, particularly during the warm season, compared to TM.
- Seasonal variations in vegetation indices strongly correlate with MedPDSI, with the most pronounced lagged response occurring at a two-month interval. Both SAVI and NDMI indicate vegetation stress during dry seasons, especially in the extreme drought years of 2017 and 2022.
- Rainfed olive orchards in BA show greater susceptibility to long-term drought-induced stress, while TM appears to exhibit slightly higher resilience.
- The integration of satellite-derived vegetation indices with drought indicators provides a valuable approach for monitoring olive groves and improving water management strategies.
- These findings contribute to the development of adaptive measures that enhance the sustainability, resilience, and productivity of rainfed olive orchards in the IP, particularly under climate change scenarios.

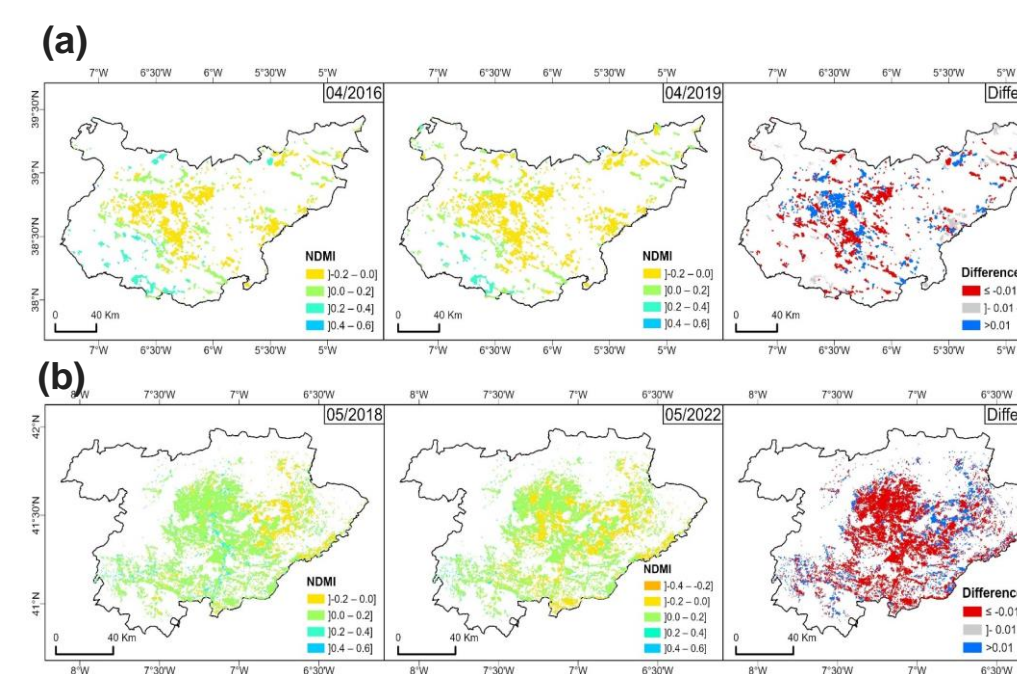
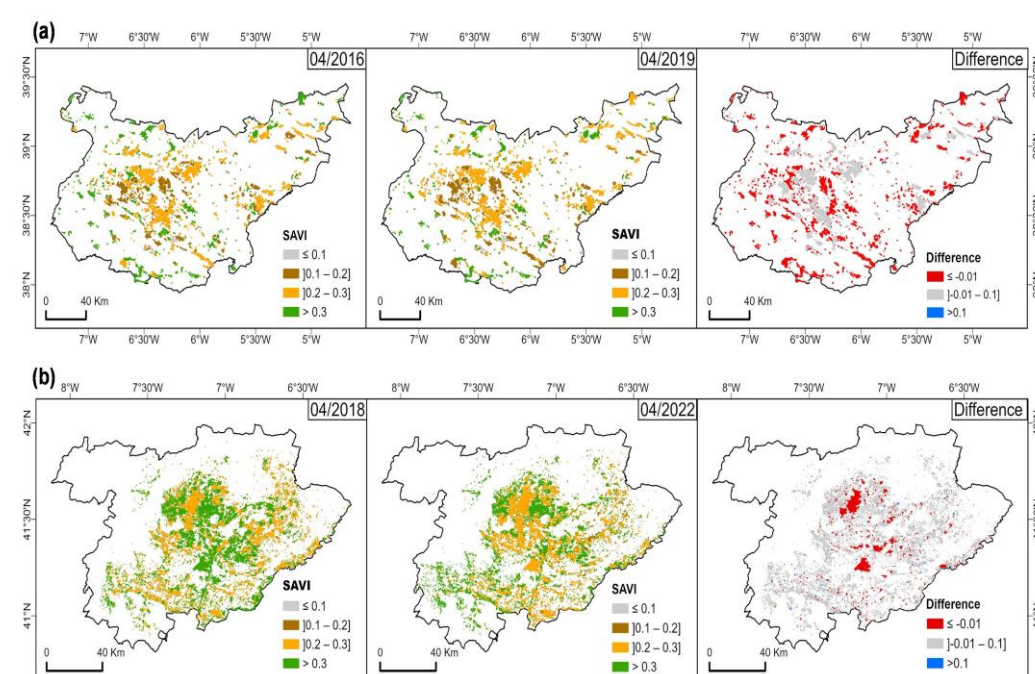


Figure 3. Normalized Difference Moisture Index (NDMI) median values for olive grove areas in March 2016 and 2019 in Badajoz (BA) province; (a) in May 2018 and 2022 in “Trás-os-Montes” (TM) agrarian region; (b) and the difference between the two periods in each region.

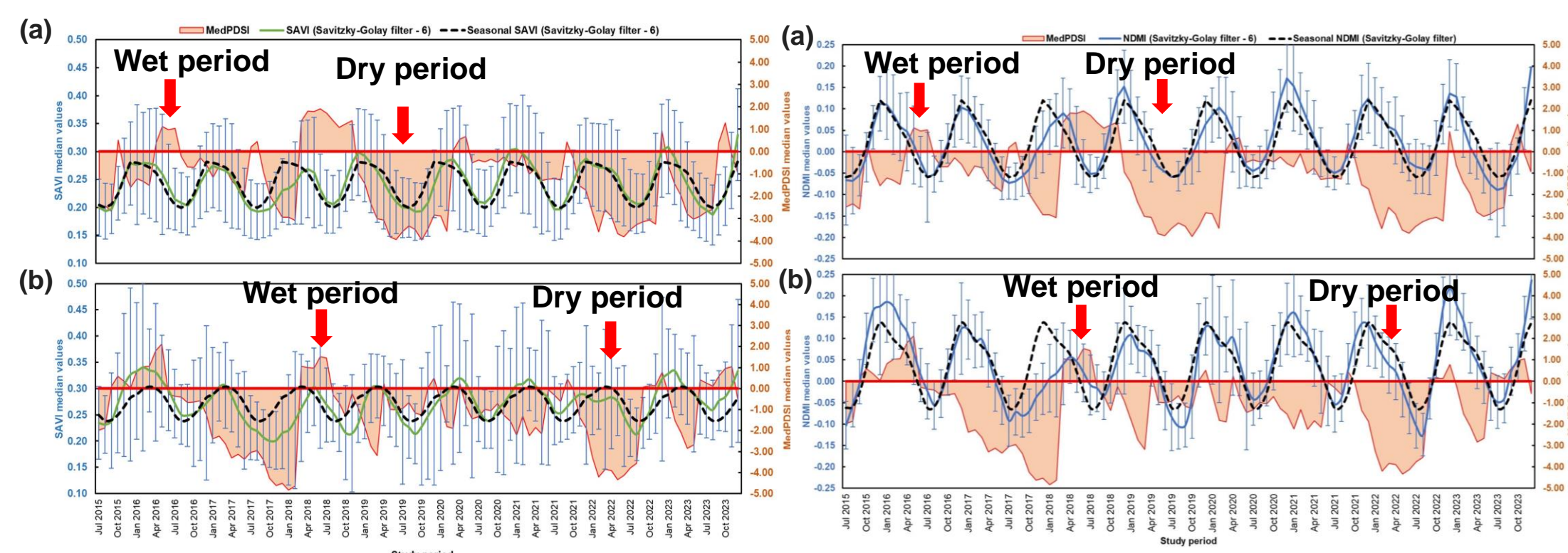


Figure 4. Comparison of median Soil-Adjusted Vegetation Index (SAVI) values (Savitzky-Golay filter) and Mediterranean Palmer Drought Severity Index (MedPDSI) values in (a) BA (Badajoz province, Spain) and (b) TM (“Trás-os-Montes” agrarian region, Portugal).

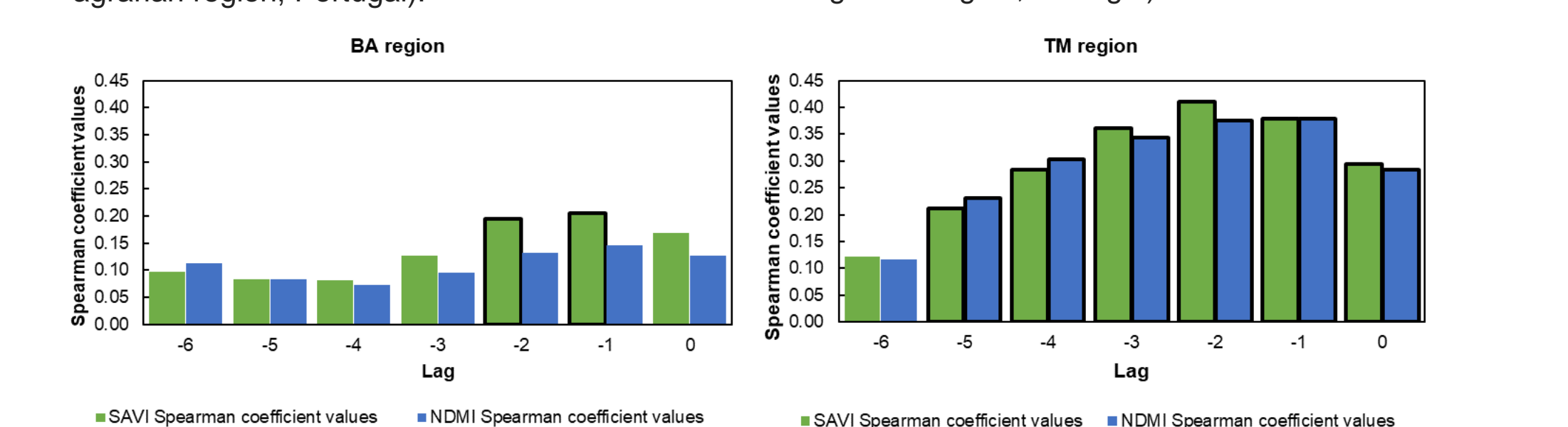


Figure 5. Comparison of median Normalized Difference Moisture Index (NDMI) values (Savitzky-Golay filter) and Mediterranean Palmer Drought Severity Index (MedPDSI) values in (a) BA (Badajoz province, Spain) and (b) TM (“Trás-os-Montes” agrarian region, Portugal).

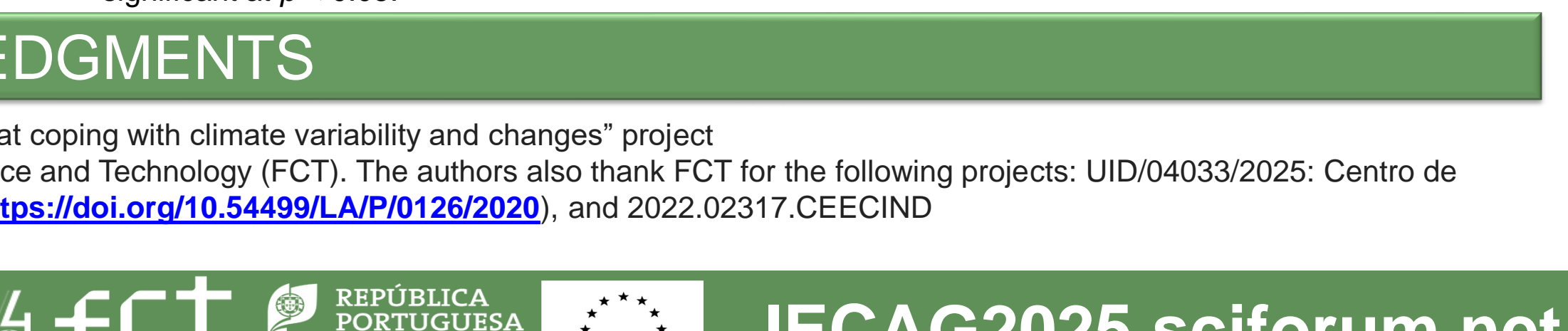


Figure 6. Auto-correlograms of Spearman coefficient values for the SAVI and NDMI: (a) BA (Badajoz, Spain), (b) TM (“Trás-os-Montes” agrarian region, Portugal). Bars with black contours are significant at $p < 0.05$.

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