

# **Integrated Agricultural Drought Assessment over the Souss-Massa Basin, Morocco: A Machine Learning-Based Approach**

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The increasing frequency and intensity of drought events in Morocco's Souss-Massa Basin pose significant challenges to agricultural sustainability and regional food security. Traditional drought monitoring methodologies, predominantly reliant on univariate precipitation metrics, exhibit limited capacity to capture the complex interactions between climate, soil, and vegetation dynamics that characterize agricultural drought. This study presents the development and validation of an Integrated Agricultural Drought Index (IADI), adapted to the specific environmental and agricultural context of the study area. The proposed IADI employs machine learning to synthesize multiple agro-climatological parameters: the Standardized Precipitation Index (SPI), Land Surface Temperature (LST), Soil Moisture (SM), and Normalized Difference Vegetation Index (NDVI). This approach enables comprehensive drought characterization across temporal and spatial dimensions. Methodological validation focuses on using rainfed cereal yields selected for their regional agricultural significance. The IADI will be evaluated against historical drought events, particularly focusing on the most severe drought seasons recorded in Morocco such as 2015-2016 and 2023-2024, to assess its capacity to identify and characterize agricultural drought intensities and their spatial distribution. By integrating diverse data sources and leveraging advanced statistical techniques, this study aims to improve the precision of agricultural drought monitoring and support informed decision-making for drought mitigation and crop management in water-scarce regions. Comprehensive results and validation metrics will be presented at the conference, demonstrating the IADI's potential for operational drought monitoring applications.