EGU22-12896
https://doi.org/10.5194/egusphere-egu22-12896
EGU General Assembly 2022

Machine Learning Techniques for Spatiotemporal drought patterns forecasting

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The erratic drought nature and its great spatiotemporal variability make conventional forecasting systems or stochastic forecasting systems very limited in terms of the monitoring of its dynamic characteristics. Therefore, this study proposes a dynamic forecasting methodology based on machine learning models by tracking the spatial and temporal characteristics of drought events.

This methodology consists of four main phases. 1) the drought spatiotemporal characteristics calculation and extraction such as spatial aggregations or extensions, geospatial properties (area, perimeter), centroid location and trajectory from their connectivity, which are generated following the contiguous drought area analysis (CDA) proposed by Corzo--- 2) feature engineering and dataset preparation, which is consolidated according to the hierarchy and relative importance of the associated predictor and predictor variables 3) implementation of an intelligent analysis method based on deep neural network architecture (CNN, LSTM) techniques, which combines spatial observation mediated by convolution integrated with temporal analysis for prediction. Thus generating primary results against the future propagation pattern or trajectory of a spatial unit. 4) Analyzing the various model performances based on statistical metrics, validation of the generated trajectories using the area under the curve (AUC) and receiver operating characteristic (ROC) and error approach as Root Mean Square Error (RMSE).

This methodology is presented using indexes derived from the ERA 5 reanalysis dataset as SPEI and SPI on the Central America dry corridor (1979-2020), where the performance of the intelligent system will be evaluated not only taking into account the statistical performance, but also in the identification and forecasting of those regions with major drought generation tendencies.