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Active Moving Area Identification using Machine Learning. Case study: Ometepe Island, Nicaragua

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This study aims to propose the use of spatio-temporal Remote Sensing information and Machine learning techniques (ML) for Active Moving Area Identification and Forecast. Mass Movements are frequent in Central American countries, mainly due to the combined extreme hydro-meteorological events with the seismic activity and the characteristics of the geological formations in the region. Ometepe Island is located in Lake Cocibolca, Nicaragua; it has two volcanoes (one active) and Mass Movements happen quite often in the area, where many of them represent a big risk for the population. The triggering factors for these Mass Movements are mainly volcanic activity in conjunction with high and quick precipitations. The process of identification of a Mass Movement from Remote Sensing images is used first as a way to characterise the data, and then a lagged time step was used to evaluate the forecasting capabilities in a time window of precipitation forecast. For this, Remote Sensing was used to create the Active Moving Area Inventory, using InSAR technique with Sentinel-1 SAR images. SNAP software was used to locate occurrences of displacements in the island. This inventory was used to develop ML models that had Rainfall and Soil Moisture as dynamic variables; and DEM, Land Use, Geomorphology, and others as static variables. These were trained and evaluated using Logistic Regression (LR), Random Forest (RF) and Long Short-Term Memory (LSTM) to detect occurrence of Displacement in a particular area of the island. The results were analysed performance-wise and compared to each other. The results of this methodology are a first step into a larger framework of spatiotemporal analysis for forecasting using Machine Learning.