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AI-Driven Predictions: Foreseeing Mediterranean Extreme Weather in a Changing Climate

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The Mediterranean region, recognized as a climate change hotspot, faces increasing and intensity of extreme weather events, posing significant challenges to vulnerable communities. In response we propose a novel artificial intelligence (AI) model designed to predict two distinct extreme weather phenomena in the Mediterranean basin: major Medicanes (across the entire basin) and severe coastal winds (tested in the Valencian Community). Our model employs a hybrid AI framework, adapted from former work on tropical cyclone forecasting rooted in a binary classification method, to enhance forecasting capabilities for these heavily non-linear extreme weather events, especially under rapidly evolving conditions. Our methodology involves analyzing datasets associated with each weather phenomenon, categorizing them into extreme and non-extreme based on the maximum wind speeds. By leveraging infrared satellite imagery and atmospheric reanalysis data, we extract critical features preceding the peak intensity of these events. These features enable the prediction of extreme wind conditions up to two days in advance in both cases. For the Medicanes study, our AI model successfully predicted 65-80% of extreme cases. The predictive accuracy of Western Mediterranean coastal winds averaged a precision of 85% for the region. This innovative and versatile methodology can be adapted to diagnose various severe weather phenomena beyond Medicanes and coastal winds, offering a robust tool for climate change adaptation strategies. Our research contributes to a deeper understanding and better management of nonlinear, climate-influenced weather events in the Mediterranean region.