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Using Neighborhood and Machine Learning to Improve Dust Storm Predictions in the Middle East

Sand and dust storms (SDS) represent a significant obstacle to sustainable development, impeding economic, social, and environmental progress. They impede the achievement of numerous Sustainable Development Goals (SDGs), including the eradication of poverty, the assurance of food security, the promotion of health, and the provision of clean water and energy. The Middle East and Central Asia contribute approximately 30% of global dust emissions, which are influenced by factors such as landscape, vegetation, soil conditions, and weather patterns. The prediction and management of SDS is challenging due to the complex factors involved. This study explored various methods to develop new techniques using machine learning and neighborhood data to improve dust storm prediction. The findings suggest that the use of new predictors and the creation of neighborhood statistical predictors can improve how machine learning identifies spatial relationships, resulting in a more sustainable method.

Keywords: Physical Geography and Ecosystem analysis, Machine Learning, Spatial Neighborhood, Geographically Weighted Random Forest, XGBoost

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