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Support vector regression-based model for the prediction of surface displacement and vibration using meteorological data

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Can we use environmental data to predict changes in surface displacement fields? Do severe weather events alter the near-surface geomechanical properties? The seasonal variations in GPS time series and crustal seismic velocities have been frequently observed at different study areas. Such variation has been tied closely to the cyclic hydrological loads [e.g., Costain et al., 1987; Heki, 2003; Roth et al., 1992], which its association with tectonic deformation remains debated. Using the 15 years meteorological, geodetic, and seismic data recorded in southern Taiwan (near Chaozhou fault where the background seismicity level is relatively low), we aim to explore the possibility of predicting surface displacement and vibration using climatic variables (time series of temperature, precipitation, and wind velocity) and groundwater levels. Here the Support Vector Regression (SVR) model is developed for the prediction of the GNSS and seismic signals, while 15-yr datasets are divided into groups of 75% and 25% datasets for model calibration and testing. When the predicted surface displacement is compared with the real data, the R-square values reach 95%, indicating the applicability of SVR model on long-term surface deformation prediction. In the future, long-term prediction model will be conducted to target several extreme weather events in Taiwan.

Keywords: Surface displacement, Meteorological data, Machine learn