GNSS-Based Machine Learning Storm Nowcasting

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Abstract

Nowcasting of severe weather events and summer storms, in particular, are intensively studied as they have great potential for large economic and societal losses. Use of Global Navigation Satellite Systems (GNSS) observations for weather nowcasting has been investigated in various regions. However, combining the vertically Integrated Water Vapour (IWV) with vertical profiles of wet refractivity derived from GNSS tomography has not been exploited for short-range forecasts of storms. In this study, we introduce a methodology to use the synergy of IWV and tomography-based vertical profiles to predict 0–2 h of storms using a machine learning approach for Poland. Moreover, we present an analysis of features importance that takes part in the prediction process. The accuracy of the model reaches over 87%, while the precision of prediction is about 30%. The results show that wet refractivity below 6 km and IWV on the west of the storm are among the significant parameters with potential for predicting storm location. The analysis of IWV demonstrates a correlation between IWV changes and storm occurrence.