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A space-time geostatistical framework for ensemble nowcasting using rainfall radar fields and gauge data

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Floods are responsible for a major part of the total damage caused by natural disasters. Nowcasting systems providing public alerts to flash floods are very important to prevent damages from extreme events and reduce their socio-economic impacts. The major challenge of these systems is to capture high-risk situations in advance, with good accuracy in the intensity, location and timing of future intense precipitation events. Flash flood forecasting has been studied by several authors in different affected areas. The majority of the studies combines rain gauge data with radar imagery advection to improve prediction for the next few hours. Outputs of Numerical Weather Prediction (NWP) models have also been increasingly used to predict ensembles of extreme precipitation events that might trigger flash floods. One of the challenges of the use of NWP for ensemble nowcasting is to successfully generate ensemble forecasts of precipitation in a short time calculation period to enable the production of flood forecasts with sufficient advance to issue flash flood alerts. In this study, we investigate an alternative space-time geostatistical framework to generate multiple scenarios of future rainfall for flash floods nowcasting. The approach is based on conditional simulation and an advection method applied within the Turning Bands Method (TBM). Ensemble forecasts of precipitation fields are generated based on space-time properties given by radar images and precipitation data collected from rain gauges during the development of the rainfall event. The results show that the approach developed can be an interesting alternative to capture precipitation uncertainties in location and intensity and generate ensemble forecasts of rainfall that can be useful to improve alerts for flash floods, especially in small areas.