



Spatio-temporal evaluation of three rainfall prediction methods on French Riviera coastal catchments

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The French Riviera, located in the eastern part of the French Mediterranean coast, has experienced devastating flash floods, in particular during the last decade. These floods were generated by localized and intense or severe rainfall events, leading to significant material and human losses, especially on small coastal catchments. Flood forecasting is still challenging on those catchments because they often have sparse rain gauge networks and are mostly ungauged in terms of streamflow. For example, the October 2015 event affected the Riou de l'Argentière, Frayère and Brague coastal catchments (respectively 47 km², 21 km² and 72 km²) with rain intensities (up to 200 mm in only two hours) characterized by a significant spatial variability (up to two times more precipitation on the downstream part of the catchments). This study investigates whether today's operational precipitation forecasts are effective on the French Riviera to accurately predict the episodes of intense Mediterranean precipitation.

We evaluate the performance of three rainfall prediction methods on 47 French Riviera coastal catchments. The NOVIMET method is based on a "simple" advection of observed radar rainfall fields and provide predictions at a horizontal resolution of 1 km and up to 2 hours of lead time. An "elaborated" advection method using a machine learning algorithm which applies radar image analysis to provide predictions up to six hours at the same spatial and temporal resolutions. Finally, we also evaluate predictions based on a blended product based on the aggregation of radar extrapolation and atmospheric numerical model predictions: PIAF. PIAF, provides forecasts at a horizontal resolution of 1 km and shorter lead times (0-3h). Rainfall forecasts are provided either as a single estimation or as an ensemble of equiprobable forecasts.

We evaluate the methods on their ability to reconstruct historical precipitation events. Forecasts are evaluated against the hourly, 1km x 1km gridded COMEPHORE radar precipitation product of Météo-France, available from 1997 to 2020. We calculate metrics of forecast quality that capture the spatio-temporal characteristics of the precipitation events. The results are discussed from the point of view of users, who assist municipalities in flood risk forecasting and mobilizes teams when it is needed to monitor events and take appropriate actions to anticipate the risk of flooding.

