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Analysis of extreme rainfall events in Piedmont (NW Italy) using the CondMerg software on weather radars and a dense network of rain gauges

Diego Guenzi (1), Simona Fratianni (1), Rodolfo Boraso (2), and Roberto Cremonini (3)

(1) Università degli Studi di Torino - Scienze della Terra, Turin, Italy (diego.guenzi@unito.it), (2) CSP - Innovazione nelle ICT, Turin, Italy, (3) ARPA Piemonte - Sistemi previsionali, Turin, Italy

Successful monitoring and forecasting of extreme rainfall events requires accurate precipitation estimation. In order to do this estimation, we focused on the Piedmont region, in the north-western part of Italy, using two weather radars and a dense network composed by more than three hundred tipping-bucket rain gauges. Weather radars are particularly good in observing the rainfall field structure, with both high spatial and temporal resolution. However, due to several uncertainties, weather radar observations lack in precision determining rainfall amounts. A common technique used to reconstruct the rainfall field with better accuracy is the comparison between weather radar observations with ground measurements given by rain gauges, which are limited in space but very accurate. In order to do this association, we implemented the conditional merging algorithm in R language, adding some variants to this approach. The software (called CondMerg) is the first open source R implementation of conditional merging freely available online; it is optimized for batch processing of multiple events but it is also usable in near real time applications. The algorithm applies the k-fold cross-validation on all the elaborated merging methods, offering scatter plots and indexes to evaluate the results. All output files are available in standard GIS compatible formats for easy visualization and analysis. We have verified CondMerg on rainy days on July 2014 with very promising results, increasing the accuracy of our knowledge related to that type of extreme event and confirming that a merging step is necessary to get accurate data from both radar and gauges.