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Quantification of rainfall prediction uncertainties using a cross-validation based technique. Methodology description and experimental validation.

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In this paper we present a new methodology to compute rainfall fields including the quantification of predictions uncertainties using raingauge network data. The proposed methodology comprises two steps. Firstly, the ordinary krigging technique is used to determine the estimated rainfall depth in every point of the study area. Then multiple equi-probable errors fields, which comprise both interpolation and measuring uncertainties, are added to the krigged field resulting in multiple rainfall predictions. To compute these error fields first the standard deviation of the krigging estimation is determined following the cross-validation based procedure described in Delrieu et al. (2014). Then, the standard deviation field is sampled using non-conditioned Gaussian random fields.
The proposed methodology was applied to study 7 rain events in a 60x60 km area of the west coast of Galicia, in the Northwest of Spain. Due to its location at the junction between tropical and polar regions, the study area suffers from frequent intense rainfalls characterized by a great variability in terms of both space and time. Rainfall data from the tipping bucket raingauge network operated by MeteoGalicia were used to estimate the rainfall fields using the proposed methodology. The obtained predictions were then validated using rainfall data from 3 additional rain gauges installed within the CAPRI project (Probabilistic flood prediction with high resolution hydrologic models from radar rainfall estimates, funded by the Spanish Ministry of Economy and Competitiveness. Reference CGL2013-46245-R.).
Results show that both the mean hyetographs and the peak intensities are correctly predicted. The computed hyetographs present a good fit to the experimental data and most of the measured values fall within the 95% confidence intervals. Also, most of the experimental values outside the confidence bounds correspond to time periods of low rainfall depths, where the inaccuracy of the measuring devices deteriorates. The coverage of the experimental data determined following the proposed methodology is very similar to the one obtained following the conditional simulations technique described in Vischel et al. (2009). In addition, the computational time of the proposed methodology halves the ones obtained for the conditional simulation technique. The amplitude of the uncertainty bounds is particularly sensitive to the rain intensity and higher uncertainties are expected in the rain events with higher rainfall intensity. However, this increase of the uncertainty bounds also results in higher coverage of the experimental data.

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