AGU Abstract

Evaluation and correction of uncertainty due to Gaussian approximation in radar – rain gauge merging using kriging with external drift

Authors: Francesca Cecinati, Omar Wani, Miguel A. Rico-Ramirez

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It is widely recognised that merging radar rainfall estimates (RRE) with rain gauge data can improve the RRE and provide areal and temporal coverage that rain gauges cannot offer. Many methods to merge radar and rain gauge data are based on kriging and require an assumption of Gaussianity on the variable of interest. In particular, this work looks at kriging with external drift (KED), because it is an efficient, widely used, and well performing merging method. Rainfall, especially at finer temporal scale, does not have a normal distribution and presents a bi-modal skewed distribution. In some applications a Gaussianity assumption is made, without any correction. In other cases, variables are transformed in order to obtain a distribution closer to Gaussian. This work has two objectives: 1) compare different transformation methods in merging applications; 2) evaluate the uncertainty arising when untransformed rainfall data is used in KED. The comparison of transformation methods is addressed under two points of view. On the one hand, the ability to reproduce the original probability distribution after back-transformation of merged products is evaluated with qq-plots, on the other hand the rainfall estimates are compared with an independent set of rain gauge measurements. The tested methods are 1) no transformation, 2) Box-Cox transformations with parameter equal to $\lambda = 0.5$ (square root), 3) $\lambda = 0.25$ (square root – square root), and 4) $\lambda = 0.1$ (almost logarithmic), 5) normal quantile transformation, and 6) singularity analysis. The uncertainty associated with the use of non-transformed data in KED is evaluated in comparison with the best performing product. The methods are tested on a case study in Northern England, using hourly data from 211 tipping bucket rain gauges from the Environment Agency and radar rainfall data at 1 km/5-min resolutions from the UK Met Office. In addition, 25 independent rain gauges from the UK Met Office were used to assess the merged products.