

## Daily rainfall data validation, a Bayesian procedure

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The validation of the data collected by a rain-gauge network is a very topical issue (e.g., Sungmin et al., 2018). Such validation was manually performed in the past, but since the introduction of automatic rain-gauges it brings along a new issue: the need to also carry out validation with automatic procedures. It is not rare, in fact, that a rain-gauge actually collects and transmits data, but those data are compromised by some mechanical problem or, more often, by some obstruction of the gauge. It can take some time to detect and fix the problem whereas the purpose is to set a quick alert, for which it is necessary a real-time procedure to have the gauge checked soon. The Regional Center for Civil Protection (RCCP) has been facing this situation, with its automatic rain-gauge network, during the last 20 years.

This work is the result of the scientific support provided by CUGRI and University of Salerno, under an agreement with the Central Campania Basin Authority, to the definition and implementation of an automatic procedure for validation of historical as well as real time daily rainfall data. The procedure is divided into two steps, each based on the interpolation of the data recorded by the nearest 10 rain-gauges and a Bayesian processor of the results.

The first step analyzes the intermittency of the process, using both the rain/not rain and the rain depth data: the procedure provides the a-posteriori probability of observing rainy day in a site given the observations in the surrounding stations. The analysis of the trade-off between two different types of errors suggests an optimal probability threshold for this step of the validation.

Once validated as a rainy day, the second step analyzes the amount of rain, conditional on the day to be rainy, and provides the a-posteriori probability of the actual rainfall to be larger than the observed one. If this probability is above a chosen threshold, the record is considered not valid.

The entire database is divided into a large calibration set, used for the estimation of the a-priori probabilities and of the likelihood functions required for the Bayesian framework, and a smaller validation set, used for evaluating the performances of the procedure. The application shows that the proposed procedure provides results that are consistent with the confidence intervals chosen for the validation. In some known cases of malfunction of given rain-gauges, the procedure correctly did not validate the data.

### References

Sungmin O, U. Foelsche, G. Kirchengast and J. Fuchsberger (2018) Validation and correction of rainfall data from the WegenerNet high density network in southeast Austria, *Journal of Hydrology*, **556**, 1110-1122. doi: 10.1016/j.jhydrol.2016.11.049