A climatological approach for operational radar rainfall bias correction

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Most radar quantitative precipitation estimation (QPE) products systematically deviate from the true rainfall amount. This makes radar QPE adjustments unavoidable for operational use in hydro-meteorological (forecasting) models. Most correction methods require a timely available, high-density network of quality-controlled rain gauge observations. Here, we introduce a set of fixed bias reduction factors for the Netherlands, which vary per grid cell and day of the year. With this approach, we aim to provide an alternative to current practice, because the climatological factors are both operationally available and independent of the real-time rain gauge availability.

The correction factors were based on 10 years of 5-min radar QPE and reference rainfall data. We tested this method on the resulting rainfall estimates and subsequent discharge simulations for twelve Dutch catchment and polder areas. In addition, we compared the results to the operational mean field bias (MFB) corrected rainfall estimates and a reference dataset. This reference consisted of the radar QPE, spatially adjusted with a network of 356 validated rain gauge observations. Of this network, only 31 are automatic gauges. Hence, only these were available in real-time for the operational MFB corrections.

The climatological correction factors show clear spatial and temporal patterns. The factors are higher far from the radars and higher during winter than in summer. The latter pattern is likely a result of sampling above the melting layer during the months December–March, which causes higher underestimations. Estimated yearly rainfall sums are generally comparable to the reference and outperform the MFB corrected rainfall estimates for catchments far from the radars (south and east of the country). This difference is absent for catchments closer to the radars, where both products tend to marginally overestimate the rainfall sums. The differences amplify when both QPE products are used to force the hydrologic models. Discharge simulations based on the proposed QPE product outperform the MFB corrected rainfall estimates for all but one basin. Moreover, the climatological factor derivation shows little sensitivity to the moving window length and to leaving individual years out of the training dataset. The presented method provides a robust and straightforward operational alternative. It can serve as a benchmark for further QPE...
algorithm development in the Netherlands and elsewhere.