

Including PWS gauge data in radar merging improves real-time precipitation estimates: Methodology and 1-year evaluation for the Netherlands

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Accurate precipitation estimation relies on adjusting radar data with rain gauge measurements to correct spatially and temporally varying errors. While official gauge networks are typically too sparse to sufficiently capture the precipitation variability in real time, recent studies have demonstrated the potential of using crowdsourced rain gauge data from low-cost personal weather stations (PWSs) which provide a much higher density of observations despite some quality issues.

Here we present a methodology for merging real-time radar data with both PWSs and professional rain gauges, explicitly considering the higher uncertainty of PWS observations. Combining crowdsourced data from >4000 Netatmo PWSs and 32 official KNMI automatic weather stations, we evaluate estimates of 1-hour and 24-hour precipitation accumulations for the period February 2023 –January 2024 in the Netherlands against an independent set of professional rain gauge measurements.

We show that including PWSs in the radar merging in addition to the official rain gauges improves real-time precipitation estimates even when applying only a simple and quick PWS quality control. The largest improvements are obtained during heavy rainfall and for areas far from the official stations. The benefit of including PWSs in the merging is also preserved for lower PWS densities, making this method potentially applicable in a wide range of other locations. These findings underpin the value of incorporating crowdsourced data into radar products and offer a pathway for more accurate operational precipitation monitoring.

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Authors: SVATOS, Jiri (Wageningen University & Research); OVEREEM, Aart (Royal Netherlands Meteorological Institute (KNMI))

Co-authors: ROMBEEK, Nathalie (Delft University of Technology, Faculty of Civil Engineering and Geosciences, Department of Water Management); BRAUER, Claudia (Wageningen University & Research)

Presenter: SVATOS, Jiri (Wageningen University & Research)

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