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Validation of crowdsourced automatic rain gauge measurements in Amsterdam

Lotte de Vos (1), Hidde Leijnse (2), Aart Overeem (2), and Remko Uijlenhoet (1)

(1) Wageningen University, Wageningen, Netherlands, (2) Royal Netherlands Meteorological Institute (KNMI), de Bilt, Netherlands

The increasing number of privately owned weather stations and the facilitating role the internet to make this data publicly available, has led to several online platforms that collect and visualize crowdsourced weather data. This has resulted in ever increasing freely available datasets of weather measurements generated by amateur weather enthusiasts. Because of the lack of quality control and the frequent absence of metadata, these measurements are often considered as unreliable. Given the often large variability of weather variables in space and time, and the generally low number of official weather stations, this growing quantity of crowdsourced data may become an important additional source of information.

Amateur weather observations have become more frequent over the past decade due to weather stations becoming more user-friendly and affordable. The variables measured by these weather stations are temperature, pressure and dew point, and in some cases wind and rainfall. Meteorological data from crowdsourced automatic weather stations in cities have primarily been used to examine the urban heat island effect. Thus far, these studies have focused on the comparison of the crowdsourced station temperature measurements with a nearby WMO-standard weather station, which is often located in a rural area or the outskirts of a city, generally not being representative of the city center. Instead of temperature, the rainfall measurements by the stations are examined. This research focuses on the combined ability of a large number of privately owned weather stations in an urban setting to correctly monitor rainfall.

A set of 64 automatic weather stations distributed over Amsterdam (The Netherlands) that have at least 3 months of precipitation measurement during one year are evaluated. Precipitation measurements from stations are compared to a merged radar-gauge precipitation product. Disregarding sudden jumps in station measured precipitation, the accumulative rainfall over time in most stations showed an underestimation of rainfall compared to the accumulative values found in the corresponding radar pixel of the reference. Special consideration is given to the identification of faulty measurements without the need to obtain additional meta-data, such as setup and surroundings. This validation will show the potential of crowdsourced automatic weather stations for future urban rainfall monitoring.