Crowdsourcing the urban wind

Arjan Droste (1), Bert Heusinkveld (1), Daniel Fenner (2), and Gert-Jan Steeneveld (1)

(1) Meteorology & Air Quality, Wageningen University & Research, Wageningen, Netherlands (arjan.droste@wur.nl), (2) Institute of Ecology, Technische Universität Berlin, Berlin, Germany

The use of crowdsourcing – obtaining large quantities of data through the internet – has been of great value in urban meteorology in recent years. Typically crowdsourcing has been used to obtain and analyse urban temperature data from various sources such as mobile phones or private weather stations. Precipitation and air pressure data have also been investigated, but so far wind has not been researched. Urban wind is highly variable and measurements are strongly dependent on the location and setup of the instruments, and thus difficult to grasp in urban areas. Crowdsourcing urban wind data can provide a denser network of wind observations than standard observational networks, and could provide insight into the spatial pattern of wind in the city. This research uses over 2 years of crowdsourced wind observations from 60 NetAtmo private weather stations in the city of Amsterdam, the Netherlands. In addition to the urban stations, an experimental NetAtmo station is set up at the weather observatory of Wageningen University, as well as on the roof of the Technical University of Berlin, to assess the quality of the NetAtmo wind meter when compared against high-quality sonic anemometer measurements. The NetAtmo station appears to systematically underestimate the actual wind speed (by roughly 30%, especially at higher wind speeds), while rainy and humid episodes also impede measurement quality. We have developed a quality assurance protocol to correct the NetAtmo wind speed measurements for these error sources, after which the resulting RMSE is 0.76 km/h. While the resulting urban wind observations are still noisy, the probability density functions (PDF) of the wind speed can provide some insight into the wind behaviour of the city's various neighbourhoods. The PDF of urban wind is well captured by a mixture Weibull distribution to account for the high frequency of low wind speed in the urban area.