Geophysical Research Abstracts
Vol. 19, EGU2017-14680, 2017
EGU General Assembly 2017

Using Low-Cost GNSS Receivers to Investigate the Small-Scale Precipitable Water Vapor Variability in the Atmosphere for Improving High Resolution Rainfall Forecasts

Andreas Krietemeyer, Marie-claire ten Veldhuis, and Nick van de Giesen
Water Management Department, Faculty of Civil Engineering and Geosciences, Delft University of Technology, Delft, NL
(A.Krietemeyer@tudelft.nl)

Recent research has shown that assimilation of Precipitable Water Vapor (PWV) measurements into numerical weather predictions models improve the quality of rainfall now- and forecasting. Local PWV fluctuations may be related with water vapor increases in the lower troposphere which lead to deep convection. Prior studies show that about 20 minutes before rain occurs, the amount of water vapor in the atmosphere at 1 km height increases. Monitoring the small-scale temporal and spatial variability of PWV is therefore crucial to improve the weather now- and forecasting for convective storms, that are typically critical for urban stormwater systems. One established technique to obtain PWV measurements in the atmosphere is to exploit signal delays from GNSS satellites to dual-frequency receivers on the ground. Existing dual-frequency receiver networks typically have inter-station distances in the order of tens of kilometers, which is not sufficiently dense to capture the small-scale PWV variations. In this study, we will add low-cost, single-frequency GNSS receivers to an existing dual-frequency receiver network to obtain an inter-station distance of about 1 km in the Rotterdam area (Netherlands). The aim is to investigate the spatial variability of PWV in the atmosphere at this scale. We use the surrounding dual-frequency network (distributed over a radius of approximately 25 km) to apply an ionospheric delay model that accounts for the delay in the ionosphere (50-1000 km altitude) that cannot be eliminated by single-frequency receivers. The results are validated by co-aligning a single-frequency receiver to a dual-frequency receiver. In the next steps, we will investigate how the high temporal and increased spatial resolution network can help to improve high-resolution rainfall forecasts. Their supposed improved forecasting results will be evaluated based on high-resolution rainfall estimates from a polarimetric X-band rainfall radar installed in the city of Rotterdam.