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Assimilation of GNSS slant delay information for numerical nowcasting

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Humidity measurements for operational numerical nowcasting are sparse. Radiosonde and satellite humidity information is valuable for numerical weather prediction (NWP), but generally have a data latency of the order of 45 to 90 minutes. Another source of upper air humidity information that can be derived from a network of Global navigation satellite system (GNSS) receivers is called Zenith Total Delay (ZTD). This information, which is related to the total amount of humidity above the observation site, has proven to be valuable for numerical nowcasting, using the hydrostatic HIRLAM model, and NWP. The latency is short enough.

The actual measurements from a GNSS network are time delays from (moving) satellites to the receiver and thus contains more information on the distribution of upper air humidity. Within the COST-Action GNSS4SWEC, which ended May 2017, a benchmark campaign was created with high quality GNSS products. In this study we have assimilated Slant Total Delay (STD) estimates from a dense network in a non- hydrostatic NWP model Harmonie, at 2.5 km resolution with a three hour update cycle. The first results show a positive impact on cloud cover and rainfall forecasts. Additionally, the STD observations are assimilated in a 1 km grid Harmonie model for numerical nowcasting (one hour cycle), which is nested in the 2.5 km Harmonie model. A case study shows the potential of this system.