



Estimating the impact of GNSS horizontal delay gradients in variational data assimilation

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We developed operators to assimilate GNSS Zenith Total Delays (ZTDs) and horizontal delay gradients. In this study we consider observations from a small station array, i.e. 25 stations with a station separation of 0.5° located near Potsdam, Germany. In our experiment the refractivity field is derived from the Global Forecast System (GFS) which is available with a horizontal resolution of 0.5° on 31 pressure levels. We extract ZTDs and horizontal delay gradients from the GFS analysis, add noise to mimic observation errors (10 mm for the ZTD and 0.5 mm for the horizontal delay gradient), and assimilate these simulated observations into the GFS 24h forecast valid at the same time. Data are assimilated every 6h for a period of 2 months (June and July, 2017). We consider three scenarios: (1) the assimilation of ZTDs (2) the assimilation of horizontal delay gradients and (3) the assimilation of both ZTDs and horizontal delay gradients. The impact is measured by utilizing the refractivity fields. We find that the assimilation of the horizontal delay gradients in addition to the ZTDs improves the refractivity field around 850 hPa.