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Local asymmetry in ground-based GPS slant delay data

R. Eresmaa (1), **H. Järvinen** (1), S. Healy (2), K. Salonen (1) and S. Niemelä (1)

(1) Finnish Meteorological Institute, (2) European Centre for Medium-Range Weather Forecasts

Applications of GPS meteorology are believed to provide observations needed for future operational high resolution NWP systems. Slant delay (SD) observations are scalar measures of atmospheric refractivity along individual signal paths connecting GPS satellites with ground-based receivers. The SD observations potentially contain information on local asymmetries of atmospheric refractivity. This aspect is of interest from the NWP point of view.

Observation modelling with two alternative algorithms for SD is discussed. These algorithms differ in the method applied for signal path determination. An inter-comparison study shows no significant differences between the algorithms in terms of modelling accuracy or computational efficiency.

Special attention is paid on the contribution of azimuthal asymmetry to SD. This contribution accounts for a few parts per thousand of the total observed SD and it is found to contain a meteorological signal. Observation modelling studies are conducted with several NWP model resolutions. It is concluded necessary to decrease the NWP grid spacing to around five kilometers, or below before the asymmetry information can be properly extracted in data assimilation for NWP.