

Computation of GNSS troposphere slant delay corrections based on fine-mesh numerical weather models

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In the last years numerical weather models have undergone an improvement of spatial and temporal resolution which made them useful for the computation of mapping functions. Moreover in recent studies it could be verified that meso-scale models can also be utilized to obtain slant troposphere delays from ray-tracing, which can be used to correct for atmosphere delays of GNSS measurements on the observation level. But since these models are still not capable to represent highly complex weather situations on smaller scales, it is necessary to estimate residual delays within geodetic analysis. Thus, utilization of fine-mesh models seems to be inevitable for provision of accurate total slant delays. The Japanese Cloud Resolving Storm Simulator (CReSS), which is designed to model typhoons, tornados, heavy rainfall, etc. seems to be a perfect candidate for this purpose. Its 1km x 1km spatial resolution, paired with the one-hourly time resolution, gives rise to the hope to obtain highly accurate corrections for GNSS applications. In our paper we are going to discuss about the features of this model as well as the details about the proper treatment within ray-tracing. We are going to evaluate the CReSS model by comparison of integrated water vapor with the one obtained from GPS ground measurements. Moreover, we demonstrate that the CReSS model enables us to detect even small scale structures within the atmosphere, which are not represented by JMA's meso-scale analysis (MANAL) model due to its coarse resolution. The main focus of this paper will be set on the utilization of ray-traced troposphere slant delays for the correction of GNSS measurements. We will discuss about to which extent such a fine-mesh is capable of providing realistic atmospheric delay corrections and if the estimation of troposphere residuals is still required. The paper will conclude with an outlook on the utilization of numerical weather models for GNSS applications and will briefly discuss the requirements for an user-friendly and time-critical provision of troposphere slant delays.