

On the variational assimilation of GNSS zenith total delays and tropospheric gradients

Zus, Florian¹; Dick, Galina¹; Wickert, Jens^{1,2}

¹ GFZ Potsdam, Germany

² TU Berlin, Germany

Keywords *GNSS, ZTDs, tropospheric gradients, variational data assimilation*

Abstract

GNSS data collected at a single station allow the estimation of the Zenith Total Delay (ZTD) and tropospheric gradients. The ZTD can be related to the Precipitable Water Vapor (PWV) above the considered station, and the tropospheric gradient can be roughly related to the first-order horizontal PWV gradient at the respective station. These relations explain the interest of severe weather monitoring and prediction in such observations. In this contribution we study several aspects of the variational assimilation of ZTDs and tropospheric gradients. At first we show how to obtain cost efficient forward, tangent-linear and adjoint operators for the respective observations. Second we run our experimental assimilation system (Zus et al., 2019) and study the role of dense and sparse network configurations. For example, when we consider a single station we can expect a clear improvement when tropospheric gradients are assimilated in addition to the ZTDs whereas when we consider a dense station network we cannot expect significant improvement when tropospheric gradients are assimilated in addition to the ZTDs because the tropospheric gradients do not contain information that is not already contained in the ZTDs.

Zus, F.; Douša, J.; Kačmařík, M.; Václavovic, P.; Dick, G.; Wickert, J. Estimating the Impact of Global Navigation Satellite System Horizontal Delay Gradients in Variational Data Assimilation. *Remote Sens.* 2019, 11, 41. <https://doi.org/10.3390/rs11010041>