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Analysing different parameterisation methods in GNSS Tomography using the COST benchmark dataset

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GNSS tomography is a new remote sensing technique in the meteorology that is gaining attention in recent years. This method is used as an excellent tool for atmospheric (particularly troposphere) sensing and then applied in modern nowcasting and forecasting systems. Therefore, the tomographic approach can be applied to resolve the distribution of water vapor, the most active component of the atmosphere and one of the important factors in understanding atmospheric processes and their implications. In this method, a large number of line of sight integral observations at different locations and directions are utilized to derive 3D images of a water vapor structure. One of the challenges in the GNSS tomography is related to different parameterization methods for computing the design matrix. Here, the effect of straight-line versus ray tracing methods is investigated for computing length of a ray which passes through the model element. Also the effect of considering the topography of the area in the tomography model is analyzed. Moreover, the spread value of the model parameters is used to verify the solution quality as an indicator. The accuracy of the developed model is verified using radiosonde measurements in the COST benchmark dataset. This work is conducted within COST Action ES1206 advanced global navigation satellite systems tropospheric products for monitoring severe weather events and climate (GNSS4SWEC) (2013–2017) and IAG Working Group „GNSS tomography”.