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Tropospheric Sentinel-1 phase delay corrections for the purposes of DInSAR studies

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The revisiting time of 6 days for the Sentinel-1 SAR acquisitions provides a strong tool in DInSAR investigations of non-linear fast terrain deformations. A challenge for the adequate interpretation of the results is the differentiation of the tropospheric delay contribution to the microwaves as part of the interferometric pattern. Weather conditions with negative impact on SAR image quality include: cloud cover, larger refractivity due to fog and turbulence. The impact is represented in the phase delay. Estimation of the weather dependent effect is possible by use of 1) Numerical Weather Prediction (NWP) models or atmospheric reanalysis, or 2) Zenith Total Delays (ZTD) from ground-based GNSS stations. Both methods have certain advantages and disadvantages. The first one, NWP model/reanalysis, has both high temporal and spatial resolution but can have insufficient predictability skills during fog events, summer convection or days with high turbulence. The second method based on GNSS ZTD is characterized by high temporal resolution and high accuracy of delay determination for a given station however but with a lower spatial resolution. If the test area is characterized by a low density of the GNSS stations, this results in the possibility of a delay determination error during the interpolation operation. This study will present a methodology for estimating tropospheric delay by using: 1) the Power Law Model (PLE) based on ERA-5 reanalysis product of European Centre for Medium-Range Weather Forecasts (ECMWF) and 2) the Iterative Tropospheric Decomposition Model (ITD) method based on ZTDs from EUREF Permanent GNSS Network (EPN). Verification of the correctness of both methods and their comparison will be presented as well as the conclusion for the results. The studied time period covers the whole year of 2017 and 4 days have been selected with different weather conditions. The region under investigation is the Upper Silesian Coal Basin in southern Poland. This region is characterized by the occurrence of terrain deformation caused by mining activities. Therefore, the study will include a discussion on the use of the above-mentioned methods for measuring deformation with DInSAR applications.