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A Study of the Covariance Function of Slant Wet Delays over a Tropical Area: A Tahiti Case

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Nowadays, troposphere parameters are widely estimated based on Global Positioning System (GPS) technology. The Zenith Total Delays (ZTDs) and Precipitable Water Vapor (PWV) estimated from GPS measurements cannot reflect the spatial repartition of water vapor. In contrast, the Slant Wet Delays (SWDs) can provide the distribution of water vapor for tomographic techniques. In this paper, we focus on the estimation of the tropospheric SWDs from GPS observations and discuss the accuracy of the SWD estimates. Firstly, we estimate the SWDs using the Bernese GNSS Software Version 5.2 based on a Precise Point Positioning (PPP) approach in a tropical site located in mid-ocean (Tahiti). We use the hydrostatic Vienna mapping function (VMF1), with input data from the European Center for Medium-Range Weather Forecasts (ECMWF), as well as the a priori Zenith Hydrostatic Delays (ZHD) model, with wet and dry VMF1 mapping functions. Secondly, we discuss the accuracy of the SWDs computed from GPS measurements by considering horizontal gradients and post-fit residuals. We found that the distribution of the post-fit residuals fit a Gaussian distribution. Finally, the space-time covariance of the SWDs is calculated over a grid with a spatial resolution of 5 degrees (angular separation) and time resolution of 30 minutes (time separation). The covariance grid shows that the SWDs are highly correlated in time over one-and a-half day, over all special separations.