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Using GNSS observations to investigate variations of Pluviometry in the Semi-Arid Brazilian region

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The Semi-Arid Brazilian region is the most densely populated, semi-arid region in the world. It is located in the Northeastern part of Brazil and corresponds to approximately 982,563 square kilometers (about 11% of the total Brazilian territory). The temperatures remain nearly uniform throughout the year and are typically tropical, often extremely hot with little interannual variability, exert a strong effect on the potential evapotranspiration, which in turn determine the annual water deficit leading to extensive droughts in some years. The annual rainfall averages between 500 and 800 millimeters and have great climatic variability and an irregular distribution in space and time. Most of the year the region is strongly influenced by the inter-tropical convergence zone which remains in the northern hemisphere near the equator most of the year due to the cold waters of the Atlantic Ocean.
The GNSS technique has been established as a valid tool to sense the amount of PWV in the atmosphere. The direct estimated product is the ZTD (Zenith Troposphere Delay) that can be transformed to PWV by knowing the Pressure and Temperature at the station position. However, such values are not always collected together with the GNSS observations, which can force us to limit the analysis to the ZTD directly.
In this work we have used data of the existing continuous GNSS (Global Navigation Satellite Systems) stations in the Semi-Arid Brazil to investigate the variability of precipitable water vapor (PWV) in the region. We firstly analysis the accuracy of using global models of pressure and temperature fields to calculate the PWV at the GNSS station locations in the Northeast of Brazil. To do such, we have estimated and compared values of PWV using both global models and local measurements at Natal city, Brazil. The differences provide us a reliable estimate of the error associated with the use of global models to compute the PWV from ZTD measurements for Northeastern Brazil. Secondly, we have correlated the estimated time-series of ZTD/PWV acquired since last decade with the Pluviometry of the Semi-Arid Brazilian region. The correlation is evident with clear annual seasonal signals for the ZTD/PWV values. This is not identical at every station of the analyzed network with different maximums related with the geographical location.