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GNSS-Derived Water Vapour for Riyadh from SOLA IGS Station

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Water vapor is the most abundant and highly variable component of the important gases in the atmosphere. It influences many physical and thermodynamical processes in the atmosphere and plays an important role in the hydrological cycle and has effects on our climate and weather systems. Water vapour affects the electromagnetic radiation through the atmosphere, which is of significance in fields of astronomy, radar, communications and remote sensing. Precipitable water vapor (PWV) is the amount of water obtained if all the water vapor in the atmosphere were to be compressed to the point at which it condenses into liquid.
PWV is difficult to measure adequately due to its variable distribution both spatially and temporally. Most of the current techniques (e.g., radiosondes or satellites) are only available at few locations and not continuously (few observations per day at most). However, in the last decades, GPS observations have been proven to accurately measure the ZTD (Zenith Tropospheric Delay) at high frequencies (normally every 5 minutes) above the station. This quantity can be converted to PWV if temperature and pressure is know at the station location.
In early 2004, King Abdulaziz City for Science and Technology (KACST) established a GPS network for geodetic and geophysical applications to contribute to the International GNSS Service IGS. In this study, we will present the first PWV measurements obtained from Global Navigation Satellite System GNSS receiver at the Solar Village (SOLA), 60 km from Riyadh. GNSS observations for the period between 2004-2006 are used to study the daily and seasonal variations of ZTD, and consequently of PWV in SOLA. In addition, we also compare the GNSS-derived PWV with sunphotometer and radiosonde estimates at SOLA in order to evaluate the compatibility of these techniques in a dry climate as the one in Riyadh.