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Editorial

Editorial for the Special Issue "Climate Modelling and Monitoring Using GNSS"

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Reliably modelling and monitoring the climate requires robust data that can be used to feed meteorological models, and, most importantly, to independently validate those models. For over three decades now, global navigation satellite systems (GNSS) have proven to be a powerful technology that can provide accurate position, navigation, and timing information. However, GNSSs can also serve as an atmospheric sounding sensor typically through an inversion procedure. The estimation of the total propagation delay encountered by GNSS electromagnetic signals at the receiver's zenith, the total zenith delay (ZTD), can be used to derive the amount of precipitable water vapor (PWV) in a column. This quantity has been extensively used in meteorology, either incorporated into numerical weather prediction (NWP) models by a number of meteorological services organizations around the world, or being used to validate the NWP models and other observational datasets (e.g., radiometers or spectrometers onboard satellite platforms). GNSS-derived ZTD can also be used to build climatological models, which are valuable tools for initial predictions.

Continuous GNSS observations have been collected for over 30 years now and have offered an unprecedented opportunity in exploiting the potential of these valuable measurements for climate studies through geodetic data analytics. As an essential climate variable, water vapor is a key component for the earth's climate. It is the most important natural greenhouse gas and responsible for the largest known feedback mechanism for driving climate change. Like for weather research (e.g., for nowcasting applications), there is a growing interest in assessing and maximizing the benefits of GNSS measurements for climate studies. This includes the evaluation of PWV trends and variability in addition to the interest of feeding and validating climatic models.

This Special Issue consists of twelve research papers, which cover a variety of topics, ranging from analyzing long-term GNSS-derived PWV, NWP evaluation using GNSS measurements, GNSS radio occultation (RO), to GNSS ionospheric modelling. Those papers can be arranged in major groups. Several papers [1–3] discuss different aspects in dealing with the estimation of long-term GNSS-derived water vapor trends and intercomparisons with external sources and NWP models. Other papers [4] use GNSS-estimated tropospheric parameters to evaluate NWP models and use these parameters for building ZTD climatological [5–7] or precipitation [8,9] models. Paper [10] focuses on GNSS-radio-occultation-retrieved temperature and specific humidity profiles. Paper [11] presents an application of GNSS- and radiosonde-derived PWV for the monitoring of forest fires. To determine tropospheric parameters to be used in the climate, other biases that affect GNSS measurements need to be properly dealt with. Paper [12] discusses modelling of the ionospheric delay with TEC maps using Australian national positioning infrastructure (regional GNSS network) with an artificial neural network method.

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