Determination of Hourly GNSS Precipitable Water Vapour using Machine Learning in the Eastern Part of Austria

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Abstract

Water vapour is a key parameter in the water cycle of the earth. This parameter is highly variable both temporally and spatially and therefore remains challenging to modelling. Water vapour plays an essential role in climatological studies over long periods, and in short period numerical weather prediction models. Hence, observing the tropospheric water vapour to produce a time series along with its spatial distribution is of essential importance for climate and atmosphere studies. Nowadays, the Global Navigation Satellite Systems (GNSS) are widely used to observe this important atmospheric constituent due to the swapping of the atmosphere by its signals. Thereby, accurate estimates of the water vapour can be provided through the GNSS measurements in different locations and times. One of the most interesting quantities is Precipitable Water Vapour (PWV) which supplies engaging datasets for meteorologists and climatologist scientists. The traditional formula needs meteorological parameters to estimate accurate PWV. This causes limiting the accuracy of this parameter for the area without any meteorological observations. Therefore, in this research, the hourly PWV is calculated using Machine Learning (ML) methods with the investigation on the impact of the meteorological measurements on the modelling of PWV. For this purpose, data from the eastern part of Austria located in the area of the EPOSA (Echtzeit Positionierung Austria) GNSS network for the years 2020-2021, along with the surface pressure, temperature, and relative humidity, are used. Then, the accuracy of the PWV model is evaluated by using ERA5 and the radiosonde observations located at Vienna airport (RS11035).