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Estimation of Atmospheric Precipitable Water Vapour in Thailand using an Artificial Neural Network

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Water vapour is a main natural greenhouse gas and has impact on the atmospheric system. Atmospheric water vapour can be quantified as precipitable water vapour (PWV). In general, PWV can be derived from radiosonde and spectral solar radiation measurement data. However, the spatial distribution and temporal frequency of the measurements are usually limited due to high equipment and operational costs. In this work, an Artificial Neural Network (ANN) was proposed to estimate monthly average PWV using surface ambient air relative humidity (rh), surface ambient air temperature (Ta), saturated water vapour pressure (pvs) and month (m) as input data. The multi-layer perceptron ANN was employed for deriving PWV. The input layer of this ANN comprises rh, Ta, pvs and m, and the output layer consists of only one parameter, namely PWV. Additionally, this ANN has two hidden layers. A five-year period (2009-2013) of the input and output data collected from three meteorological stations, namely Chiang Mai (18.98°N, 98.98°E), Ubon Ratchathani (15.25°N, 104.87°E) and Songkhla (7.20°N, 100.60°E) were used to train the ANN employing the back propagation algorithm. A two-year period (2014-2015) of the input and output data from these stations were used to evaluate the performance of the trained ANN. It is found that PWV derived from the ANN agrees well with that obtained from the measurement, with the discrepancy in terms of root mean square error (RMSE) and mean bias error (MBE) of 7.6% and -3.5%, respectively.

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