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A comparison of integrated water vapour products over the Iberian Peninsula

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Water vapour is a key parameter in numerical weather forecast and climate models, not only because it is the most abundant greenhouse gas in the atmosphere but also because it is frequently associated to the occurrence of extreme precipitation events. Infrared and microwave sensors onboard the conventional geostationary and polar orbiting remote sensing platforms do not allow the spatial and/or temporal sampling that is adequate to properly characterize this rapidly varying parameter. The Global Navigation Satellite Systems (GNSS) network has proven to be a good alternative, since it is very sensitive to the refractivity changes within the troposphere, mainly caused by water vapour. It is possible to use this information to retrieve the total column water vapour above a given ground station. Many meteorological services already use Precipitable Water Vapour (PWV) as a nowcasting tool and as input data to be assimilated by numerical models.

The Portuguese Institute for the Sea and Atmosphere (IPMA) is now using a GNSS-PWV product as well. This product is obtained using zenithal tropospheric delay (ZTD) estimates provided by 6 GNSS receiver networks both in Portugal - RENEP (47) and SERVIR (30) – and Spain - Andalucia (17), Castilla (28), Extremadura (11) and IGN (20) – in a total of 153 stations. ZTDs are estimated by SEGAL (Space & Earth Geodetic Analysis Laboratory), who collects GNSS ground receiver network data, satellite orbit information provided by the Jet Propulsion Laboratory (JPL) and process them using the GIPSY-OASIS software, using a Precise Point Positioning approach. The conversion to PWV needs extra information about the surface pressure and temperature at the station level; in the developed scheme these are provided by IPMA, extracting them from ECMWF forecasts and interpolating them for each station. The estimates are sent hourly to IPMA, with 5 min resolution. Unfortunately the timeliness exceeds 2h, which limits the nowcasting capability.

The estimates were compared with other reference products for the same variable. The Satellite Application Facility for Nowcasting (NWC-SAF; http://nwc-saf.eumetsat.int) develops software to compute the clear-sky PWV, based on the Meteosat Second Generation SEVIRI instrument data. This software is routinely run at IPMA and provides PWV estimates every 15 min. The ECMWF analysis are also a reference dataset as the system combines many different observations to produce its analysis. Other estimates include daily radiosondes launched from Lisbon and Santiago de Compostela, the AERONET stations in Evora and Cabo da Roca (Portugal) and the MW radiometer also in Evora.