GNSS tomography as part of HyMeX in the frame of HyMeX

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Interest of GNSS tomography for nowcasting in the frame of HyMeX

This work is a contribution of the COST Action ES1206 GNSS4SWEC - http://gnss4swec.umbri.univ.it - Advanced Global Navigation Satellite Systems tropospheric products for monitoring severe weather events and climate) to HyMeX project.

HyMeX (Hydrological cycle in the Mediterranean Experiment) aims at a better understanding and quantification of the hydrological cycle and related processes in the Mediterranean, notably with emphasis on high-impact weather events (www.hymex.org).

GNSS tomography as part of HyMeX

The 1st HyMeX Special Observation Period (SOP1; Ducrocq et al., 2014) took place in autumn 2012. Six Intensive Observation Periods (IOP) have been achieved with respect to severe weather. This study focusses on IOP15b (21-22 October), investigating the interest of GNSS tomography for nowcasting (retrievals of water vapour density, wet and total refractivity, with a resolution of 10 km horizontally and 0.5 km vertically).

Investigations for nowcasting using outputs from AROME-WMED

The sensitivity to a priori model tended to initialise the tomographic retrievals, has been investigated by considering both very-short-term forecasts (e.g. Real-Time forecasts +3h) and analyses (and e.g. Reanalysis 3) from a high resolution numerical weather prediction system (NWP), i.e. AROME-WMED with a domain covering the western Mediterranean area). Pseudo slant observations have been considered in GNSS tomography to improve the geometrical distribution considered in retrievals (see Brenot et al., 2012, 2014 and poster EGU2017-10708: X3.186).

Preliminary results of validation by external observations

Validation of tomography retrievals using external observations (GNSS radio occultation).

Conclusions and future works

This study illustrates the use of Real-Time forecasts (+ 3 hours) from AROME-WMED to initialise GNSS tomography products (e.g. during IOP15b of SOP1 with a case of heavy rain in southeastern France), showing a good potential for an operational use, with improvement of the understanding of the meteorological situation (nowcasting scenario).

Retrievals of water vapour density, wet and total refractivity from GNSS tomography are available for 25 days of Autumn 2012, covering 5 Intensive Observation Periods (IOPs). The potential of GNSS tomography for these IOPs still need to be investigated.

A preliminary result of validation of GNSS tomography by radio occultation (RO) is presented showing a better agreement between RO and GNSS than between RO and AROME-WMED. The next step of validation is to consider other data available during these IOPs, like ground-based Raman lidar, airborne Léandre II lidar, radiosondes and other radio occultations profiles, to obtain statistics results between observations and NWP.

References


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