Geophysical Research Abstracts
Vol. 13, EGU2011-6762-1, 2011
EGU General Assembly 2011

Zenith tropospheric delays from GNSS and its application to coastal altimetry

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In the scope of the ESA funded project COASTALT (Development of Radar Altimetry Data Processing in the Coastal Zone) a method for determining the wet tropospheric correction in the coastal zone has been developed, the GNSS-derived Path Delay (GPD) algorithm. During this development, a number of studies have been conducted, aiming at the improvement of the algorithm and its global implementation.
This work presents two aspects of these studies: 1) a global comparison between Zenith Total Delays (ZTD) determined at University of Porto (UPorto) and various international institutions which provide these products online: the EPN (EUREF Permanent Network) and the IGS (International GNSS Service); 2) methods for a correct separation of the two components of the tropospheric path delay: the dry or Zenith Hydrostatic Delay (ZHD) and the Zenith Wet delay (ZWD).
Concerning the first topic, it is shown that IGS solutions are uniform since 2000, being computed using the PPP (Precise Point Positioning) technique. On the other hand, the EPN solutions reveal several discontinuities during the analysed period (2002—2009) and show a significant improvement since November 2006. Considering the period from November 2006 to December 2009, the comparison between UPorto and EPN/IGS ZTD, at a set of 52 well distributed GNSS (Global Navigation Satellite System) stations around the world shows a mean of 0.0 mm and a standard deviation of 4.4 mm.
Regarding the second topic, a comparison has been made between the dry path delay obtained with in situ surface pressure measurements at a set of 66 coastal GNSS station and the corresponding values obtained from the sea level pressure field provided by the ECMWF (European Centre for Medium Range Weather Forecasts). The results show that in situ pressure data often possess various problems: outliers, discontinuities, calibration (bias, drifts, etc.). The ZHD values derived from ECMWF agree with the corresponding values determined from in situ pressure data at reliable stations within 1-2 mm (1 σ).
At present, in order to obtain an adequate separation of the dry and wet components, in the generation of the ZWD corrections for coastal altimetry at UPorto, the ZHD estimates are determined using the values computed from the ECMWF model. In this way a separation of the two components is obtained within a few millimetres accuracy, allowing its separate and required altitude reduction to sea level, for use in coastal altimetry.