Abstract

The wet tropospheric correction is one of the major error sources in coastal altimetry. The most accurate method to derive the correction, from Microwave Radiometer (MWR) measurements, becomes unreliable due to the large radiometer footprint.

This study addresses the problem of improving the wet tropospheric correction in the coastal regions. Two methods are discussed: the GNSS-based Path Delay (GPD) and the Dynamically Linked Model (DLM).

The GPD is a simple and easy-to-implement method where the invalid radiometer measurements are replaced by a model-based correction, such as ECMWF, dynamically linked to the closest valid radiometer measurement, to avoid discontinuities. This approach is presented as a backup-which can be adopted whenever a more sophisticated method is not applicable.

GPD is based on zenith total path delay (ZTD) determined at a network of inland and/or buoys GNSS stations. With additional in-situ pressure data each ZTD can be split into a sum of a Zenith Hydrostatic Delay (ZHD) and the dry tropospheric correction and a Zenith Wet Delay (ZWD) or the wet tropospheric correction.

The major issues related with the determination of the wet tropospheric correction of altitude data by using the GPD approach are analyzed.

Concerning the GPD approach, a comparative analysis of different tropospheric corrections and the corresponding data break determined by a GNSS (ZTD, ZHD, and ZWD) is presented. The aim is to understand the spatial and temporal variability of tropospheric corrections present on altitude data and GNSS derived fields for further development of a merging data methodology.

DLM Approach

- The method uses GDR fields: wet-radiod (radiometer wet tropospheric correction) and a meteorological model correction (ECMWF).
- Using a maximum gap length, data are split into segments. For each segment identifies zones with invalid wet-radiod correction, i.e., with radiometer flags = 1 (not points).
- For points inside invalid zones, the wet field is replaced by the model correction, forced to fit wet-rad on the closest good points, using ill and blue parameters (green points).
- Algorithm has been applied to various missions.
- Implementation is global.
- Requires as input parameters:
  - GDR wet-radiod correction
  - GDR Model correction
  - GDR Radiometer band or Distance to land

Example shows the algorithm behavior for ENVISAT track 123 over the Canaries.

GPD Main Issues

- Determination of ZWD and ZTD at local stations
  1. Software used GAMIT/GLOBK.
  2. Network configuration: Requires adequate network configuration. Although solutions of interest might be regional the network shall include stations with a good global distribution. For each solution the number of stations shall not exceed 50.
  3. Accuracy: Accuracy of ZTD better than 1 cm (~5 km) accuracy of ZWD; for stations with meteorological data, accuracy of ZWD is the same for stations without meteorological data accuracy of ZHD and therefore of ZWD is degraded depending on model data used.

Comparative analysis between altimeter tropospheric corrections and GNSS derived fields

Altitude data used are CORRSLY sensor data. All available tracks have been used. For each point along each along-altimeter track GNSS data of the surrounding stations have been interpolated for the altimeter tropospheric corrections, for each station longitude for the reference ground track, a set of three time series of tropospheric fields have been generated: dry-ZWD, wet-ZWD and total (ZTD) altitude tropospheric correction - and another set of time series for the corresponding other GNSS station. For each pair of altimeter and GNSS derived fields (i.e., ZTD with ZWD). Accuracy of ZTD and ZWD has been considered in order to compute some statistical measures and analyse the differences.

From left to right, maps below show for each point and for period A: station for which the correlation is maximum, maximum correlation, mean, and standard deviation of the differences between altimeter field and GNSS derived field from UPorto GAMIT solutions. GNSS fields have been corrected for station height [3].

Summary of results

- Correlations are generally high for all fields, increasing with station proximity.
- Reduction of station height is crucial. Separate reduction for ZHD and ZWD seems to be appropriate.
- EURO3202 cannot be separated with 1 cm accuracy into ZHD and ZWD.
- UPorto derived ZHD + ZWD allows proper reduction of station height and separation between dry and wet components.
- Addition of model (ECMWF/Euro3202) data seems to be important to get spatial information.

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