New characterization of radiometer wet troposphere correction errors thanks to the ERA-interim reanalysis and AMSR products

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Overview

The Wet Tropospheric Correction (WTC):
• One of the main contributors to the uncertainties in long-term sea level trend derived from altimetry.
• Provided by onboard microwave radiometers for the main altimeter missions due to high variability of water vapor in time and space.

What about WTC models?
• Use only as a backup correction because of their poor temporal and spatial resolution.
• But very useful as reference in analyses of radiometer WTC errors.

Objective:
To Assess the quality, for climatic studies, of WTC from the ERA interim atmospheric model reanalyses provided by European Centre for Medium-range Weather Forecast (ECMWF) with respect to:
• ECMWF operational fields.
• Reanalyses from National Centers for Environmental Predictions / National Center for Atmospheric Research (NCEP/NCAR).
• Radiometers: TOPEX/Jason1/Jason-2, ERS-1/ERS-2/ENVISAT, AMSR-E

Conclusion:
The ERA-Interim is probably the best model to allow the identification of errors such as drift in the radiometers:
• Data from ERA-Interim have been processed homogeneously and its performances are stable with respect to the other WTC products.
• ERA-Interim is the closest, among the studied models, to radiometers in terms of WTC dynamic.

However, notable discrepancies between radiometers and ERA-Interim are still present, especially in wet atmosphere. Such differences could create artifacts when comparative analyses are made with ERA-Interim to detect radiometer errors.

Comparison of average water vapor maps (2004-2010) between ERA-interim and radiometers

Water vapor (WV) main component of WTC: 1g/cm²(WV)~ 6.4cm(WTC)

Comparison of average water vapor geographic distribution

Global Mean Sea level

Regional Mean Sea level trend differences between models and TOPEX/JASON-1/JASON-2

ECMWF is inconsistent with TOPEX (poor quality of the model for this period). Better consistency is achieved during Jason-1 period when the operational model is more accurate.

NCEP show high regional discrepancies (>3.0/mm/AN) in trends at low and mid latitudes with TOPEX and Jason-1.

The smallest differences are obtained with ERA-Interim, especially in the first decade but regional discrepancies are still present.

(*) references: