Recent Improvements in the Processing of JASON-2 Altimetry Products for Continental Waters (PISTACH Project)


Overview

The core of the PISTACH (Protocole Innovant de Système de Traitement par les Applications CNES et Hydrologie) prototype consists in several algorithms dedicated to the processing of Jason-2 altimetry data over coastal areas and continental waters.

Over continental waters, the altimeter waveforms are highly perturbed by emerged lands within the radar footprint. Nearby specular echoes are also frequently encountered. Dedicated retracking algorithms are required to properly retrieve the altimetric range and possibly other waveforms parameters. The retracking strategy (classification of the waveforms + multi-retracking) implemented in the PISTACH prototype is presented along with preliminary results on Jason-2 data.

The wet tropospheric correction, that is also crucial over continental waters, cannot be computed from the onboard radiometer because the land emissivity overrules the signal coming from water bodies. The model backup correction has proved to be not accurate enough over continental waters. Therefore we developed for PISTACH a new wet troposphere model correction based on a more accurate integration of the atmospheric parameters.

The implementation of the prototype is now completed and products in V1.0 are accessible since cycle 12 of Jason-2.

Geophysical Corrections - Local Models

The PISTACH products include several state of the art geophysical corrections as well as higher resolution global/local models. In addition to the content of standard Jason I-GDR, the continental part of the prototype, the following data sets have been selected and corresponding values are computed for each 20Hz altimetric measurement:

- Geoid: EGMM2008 (Pavlis 2008, NGA)
- DEM: SRTM3_CGIAR (Zanne et al. 2008, http://srtm.csi.cgiar.org) to be replaced by ACE2 (3''arc)
- Land Cover Class: GLOBCOVER (10''arc) (ESA/Guadeloupe Project, led by MAREIS-France)
- Land/Water Mask: 3RD/HyBam
- Distance to Shoreline

Wet and Dry Tropo Corrections

Over land, the radiometric correction is erroneous and the ECMWF model geometry does not restitute small-scale topography, especially over water bodies in mountainous terrains.

- Basic formula (wet tropo)

  \[ \delta \eta = -0.002277 \times Psat \times (1 + 0.0026 \times \cos(2 \times \phi)) \]

  \[ \delta \delta \eta = -0.002277 \times Psat \times \phi \]

  \[ \phi \text{ = latitude} \]

  \[ Psat \text{ = surface pressure computed as explained above.} \]

  \[ \delta \eta \text{ = wet tropo. correction(m)} \]

  \[ \delta \delta \eta \text{ = specific humidity (kg/kg)} \]

  \[ \delta \eta \text{ = wet tropo. correction(m)} \]

  \[ \phi \text{ = latitude} \]

  \[ Psat \text{ = surface pressure computed as explained above.} \]

The wet tropospheric correction is recomputed from ECMWF 3D meteo fields with the bottom (and thus thickness) of the atmosphere column given by each altimetric measurement.

Similar considerations apply to the dry tropospheric correction, that is computed using the Saastamoinen formula:

\[ \delta \eta = -0.002277 \times 0.00263 \times \cos(2 \phi) \]

Products Version 1.0

- Experimental products ➔ feedback from users welcome and product assessment to be pursued
- High resolution along-track products: 20 Hz sampling rate, 1 file per track, no editing
- Format (NetCDF) and variables/attributes nomenclature similar to standard Jason-2 I-GDR
- PISTACH products easily handled by Jason-2 GDR users
- Extensive variable description in the headers
- ~ 80 additional fields wrt to standard Jason-2 I-GDR
- I-GDR fields interpolated/copied at 20Hz
- CALVAL report to be issued for each cycle
- 2 products:
  - Coastal: whole ocean + 25 km fringe over lands ➔ 7 Go/cycle (uncompressed)
  - Hydro: all emerged lands + 25 km fringe over oceans ➔ 3 Go/cycle (uncompressed)


Future Evolutions

- Possibility of adding new fields (land/water masks, snow cover climatology ...)
- Conception of a lighter, easy-to-use product and with primary editing ➔ gain new users!