

Basic Radar Altimetry Toolbox: Tools to teach altimetry

V. Rosmorduc⁽¹⁾, vros@clm.fr
 J. Benveniste⁽²⁾, L. Breebaart⁽³⁾, E. Bronner⁽⁴⁾,
 S. Dinardo⁽⁵⁾, D. Earith⁽⁶⁾, B.M. Lucas⁽⁷⁾,
 C. Maheu⁽⁶⁾, S. Nijmeier⁽²⁾, N. Picot⁽⁴⁾
 (1) CLS, France, (2) Esa/Esrin, Italy,
 (3) Science&Technology, The Netherlands,
 (4) Cnes, France, (5)SercO/Esrin, Italy,
 (6) Akka, France, (7) Deimos/Esrin, Italy

A joint ESA-CNES project, to make easier the use of altimetry

The Basic Radar Altimetry Toolbox is an "all-altimeter" collection of tools, tutorials and documents designed to facilitate the use of radar altimetry data, including the next missions to be launched, for all applications.

The Basic Radar Altimetry Toolbox is able:

- to read most distributed radar altimetry data, from ERS-1 & 2, Topex/Poseidon, Geosat Follow-on, Jason-1, Envisat, Jason- 2, CryoSat and the future Saral missions, for several processing levels
- to perform some processing, data editing and statistics,
- and to visualize the results.

It can be used several ways and at several levels:

- as a data reading tool, with APIs for C, Fortran, Matlab and IDL
- as processing/extraction routines, through the on-line command mode
- as quick-look tool, with the graphical user interface
- and as an educational tool, also with the graphical user interface

As part of the Toolbox, a Radar Altimetry Tutorial gives general information about altimetry, the technique involved and its applications, as well as an overview of missions, It also presents a series of data use cases, covering all uses of altimetry over ocean, cryosphere and land, showing the basic methods for some of the most frequent manners of using altimetry data.

BRAT is developed under contract with ESA and CNES. It is available at <http://www.altimetry.info> and <http://earth.esa.int/brat/>

Training in altimetry using BRAT

About 1/3 of the people downloading BRAT indicates 'Education' as one of their use of the tool (either as student or as teacher). Quite a number of persons repeatedly downloaded the Toolbox for remote sensing curriculum. The Tutorial is also there as basic material for teaching altimetry. It was also used in ESA "Ocean Remote Sensing" training courses, and by Eumetsat for a wind/wave curriculum.

The first point is often to make students aware of the "1D" quality of altimetry data – most think of satellite outputs as images...

Another point may be to show how much data are taken during e.g. 1 day, to explain the advantages and limitation of altimetry for real-time applications.

Data editing, and selections, also can be applied, with explanations about invalid data and physics of the measurements

One Envisat track (two different projections). This output is quite surprising for most students (expecting an 'image', i.e. gridded lon/lat data)

One day of SWH for Jason-1, Envisat and Jason-2 (image courtesy Eumetsat/IODE)

Edited (green) and un-edited (red) Jason-1 SLA data over one pass.

The second point is to show how sea surface heights and sea level anomalies are computed from the different data provided. Most students won't use that directly (especially not oceanographers), but it explains how it is done, and the possible improvements.

One can also "play" with the corrections, adding them one by one to show the effects.

Then it depends on the public: the different applications and/or level of expertise leads to different teaching modules :

- Work on gridded data, including statistics

SSH computation from Jason-1 data, with all the necessary corrections to apply over open ocean

Range Ku

Altitude - Range Ku

Ionospheric correction

Raw ADT - iono corr

Wet Tropospheric correction

Raw ADT - iono corr - wet tropo corr

Waveforms reading & plotting

Waveforms 20Hz ku (waveforms_20Hz_ku) - Unit: count