



Evaluation of the Sentinel-3 Hydrologic Altimetry Processor prototypE (SHAPE) methods

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THE PROJECT

Outline

The SHAPE project is funded by ESA through the Scientific Exploitation of Operational Missions Programme Element to prepare for the exploitation of Sentinel-3 data over the inland

TEAM

ALONG-TRACK: Prime, Alti-Hydro, Innovative Signal Proc., Production and use of Updated Water Masks,





water domain (water heights and discharge).

Objectives

- Characterise CryoSat-2 SAR data over inland water.
- Assess the performances, in Hydrology, of applying the Sentinel-3 IPF to CryoSat-2 data and emulating repeat orbit Alti-Hydro Products (AHP).
- Analyse weaknesses of the Sentinel-3 IPF at all levels.
- Assess the benefits of assimilating the SAR/RDSAR derived AHP into hydrological models.
- Design innovative techniques to build and refine the L1BS and assess their impact onto L1B and AHP.
- Improve SAR/RDSAR retracking over river and lakes.
- Provide improved L2 Correction (tropospheric, geoid) for Sentinel-3 over land and inland water.
- Specify, prototype, test and validate the Sentinel-3 Innovative SAR Processing Chain for Inland Water.

THE PROCESSOR

The SHAPE Processor implements all of the steps necessary to derive rivers and lakes water levels and discharge from Delay-Doppler Altimetry and perform their validation against in situ data. The processor uses FBR CryoSat-2 data as input (and will switch to Sentinel-3A data whenever possible) and various ancillary data (proc. param., water masks, L2 corrections, etc.), to produce surface water levels. At a later stage, water level data are assimilated into hydrological models to derive river discharge.

Retracking.

isardSAT : Innovative SAR Altimetry Chain, Retracking.
SMHI: Assimilation of AHP into Hydrological Models.
University of Porto: Atmospheric and Geoid
Corrections.

Regions and Time Periods of Interest

- Amazon (downstream): 2015-03→2016-02
- Danube: $2015-03 \rightarrow 2016-02$.
- Vänern lake: $2015-03 \rightarrow 2016-02$
- Titicaca lake: $2015-03 \rightarrow 2016-02$

Project Website

Documents & demo products to be available at http://projects.along-track.com/shape/







KEY IMPROVEMENTS

• **STACK ALIGNMENT**: Stack formation using the river profile to the properly select the reference beam when the on-board tracker is not following the terrain fast enough. Example for Danube stack when coming from mountainous area. The on-board tracker is not able to follow the terrain variation and the signal coming from the river is only acquired in the final part of the stack





• **CORRECTIONS** Wet and dry tropospheric corrections computed at surface elevation.







RETRACKING
 New analytical retracker
 including waveform filtering
 and two step fitting.







MIGRATION

To mimic the use of Sentinel-3A data, CryoSat-2 water level measurements 2010-2015 where first migrated along the river path to Sentinel-3A tracks crossing, and secondly migrated to the selected Amazon-HYPE sub-basin river outlets.





- New empirical retracker using water masks. Waveform classification by **water fraction** (indicator of how much footprint area is intersecting the water mask). Plots showing the groups of waveforms depending on the water fraction in the Amazonas region.



HYPE MODEL ADAPTATION

Use of altimetry RWL data in computation and modelling of River Water Discharge. Example of altimetry assimilation in the Amazon Water level and Water Discharge



