DeDop – Inland Water Case Study
Amazon river

Nicolas Bercher(1), Mònica Roca(2), Norman Fomferra(3), Hans Permana(3), David Cotton(4).
(1) Along-Track - (2) IsardSAT – (3) Brockmann Consult - (4) SatOC
Corresponding author: nbercher@along-track.com

Overview of the ACA-DDP Project

The ACA-DDP project is part of SEOM (Scientific Exploitation of Operational Missions).

In this Project, isardSAT and Brockmann Consult, together with a group of scientists in a larger consortium, **have developed "DeDop"** (for delay-Doppler), **an open source tool to allow the processing of delay-Doppler altimetry data**.

Being open source and distributed online, the tool allows the user to select input data, choose and run processing options, and immediately query and view the results. This introduces a new paradigm in the processing of altimetry data, allowing a much more direct and immediate interaction with the processor in comparison to the use of Agency's or specialist's products, with periodic updates implemented over longer-time scales.

We present results from a case study on inland water in which the **DeDop Core** processor has been implemented on Sentinel-3A data over the Amazon river. The processor has been run using a custom configuration specifically designed for inland surfaces and improving the overall quality of the river water level measurements.

DeDop tools overview

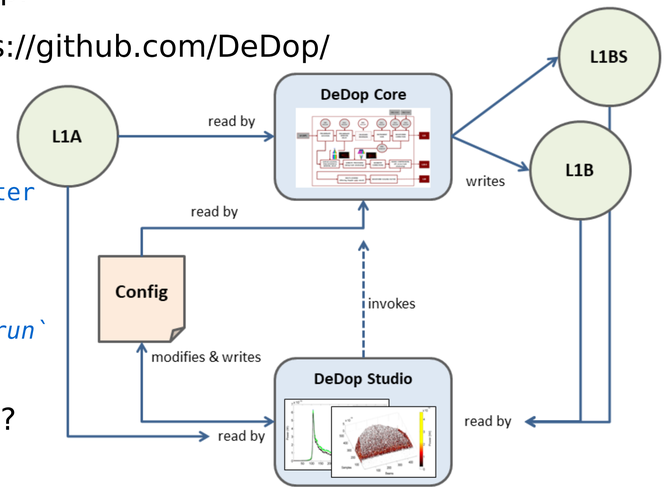
DeDop tools include command line interface **DeDop Core** and GUI oriented application **DeDop Studio**. All tools share configuration files and input/output data setup.

Find them on GitHub: https://github.com/DeDop/

Sample shell session:

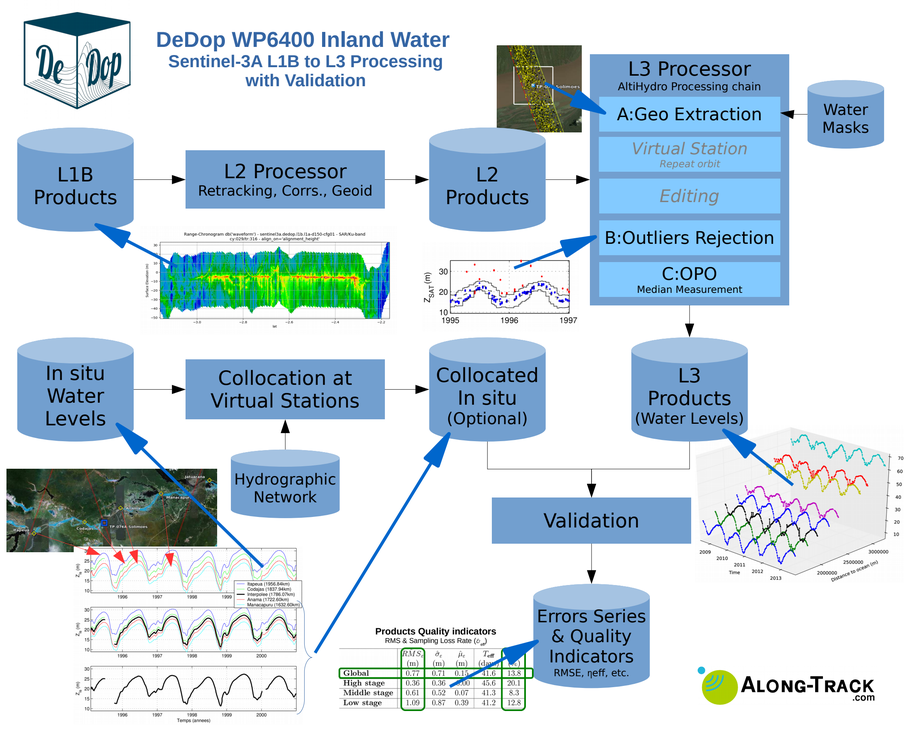
```
$ dedop workspace add amazon
$ dedop config add inland_water
# Then edit your config file
$ dedop input add files*.nc
$ dedop_run_scheduler
# Or run on its own: `dedop run`
$ dedop output list
```

You're done ! Easy, isn't it ?



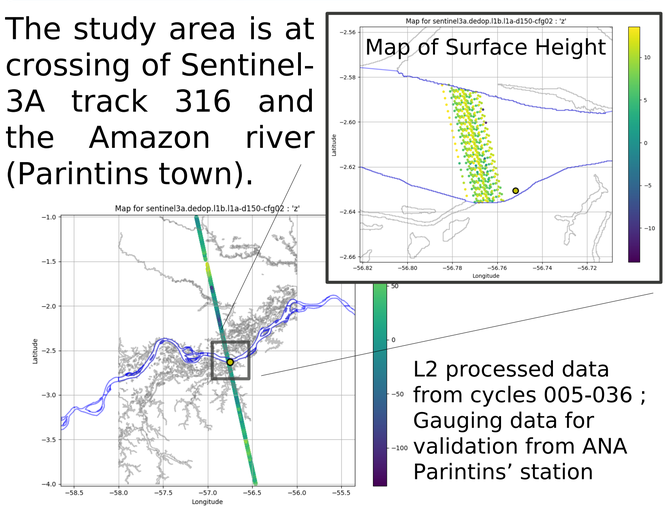
Processing stack : L2/L3Processors, Validation

In this study, we setup a complete L1A to L3 (water level time series) including the DeDop Core, basic L2 Processor (with Ice1 retracker, EIGEN6C4+DTU13 Geoid model and L2 corrections copied from Jason-3/GDR-d AVISO data) together with a L3 Processor (water masking, outliers Rejections, etc.) in order to estimate water level time series over the Amazon.



Case Study Area

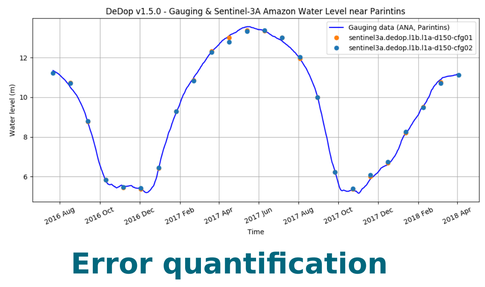
The study area is at crossing of Sentinel-3A track 316 and the Amazon river (Parintins town).



Results: L3 Validation

River Water Level time series (L3)

Sentinel-3A track 316, Amazon river Parintins gauging data.



Error quantification

L3 Water Level time series minus gauging data = Meas. Error → Quality Indicators.

Outputs of intermediate steps A/B/C of the L3 processor have also been validated:

L3 processor proves to be robust to variable quality of input L2 data

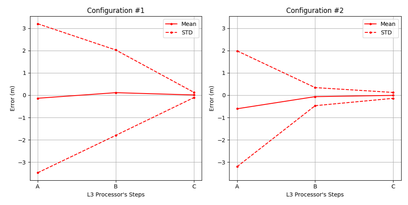
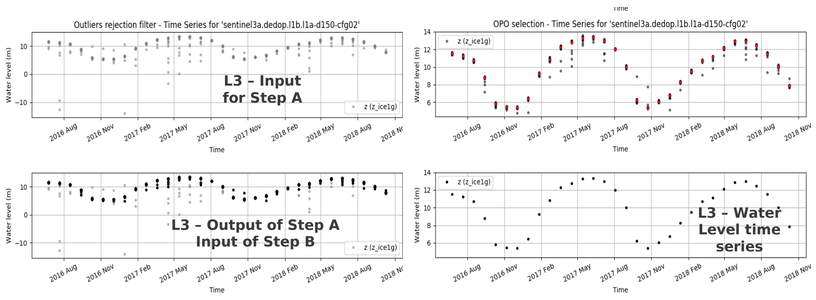


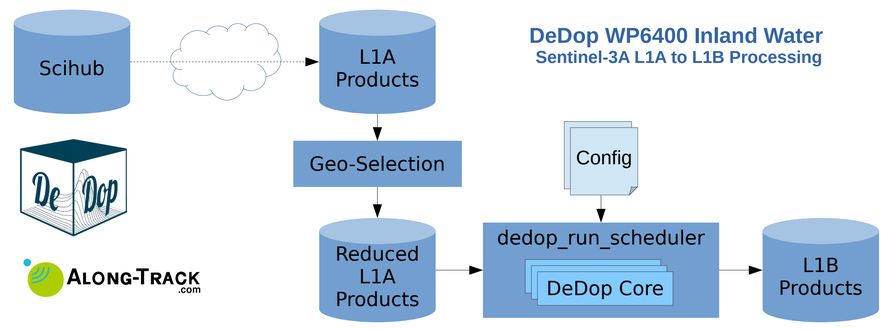
Table 3: Validation results for the L3 River Water Level time series. Detailed results for all steps of the L3 Processor, including: (A) L2 in water mask, (B) Outlier rejection and (C) final L3 for the two configurations #1 and #2.

L3 Processing Step	DDP Config	Nb meas.	Mean±STD (m)	RMSE (m)	Sampling Loss Rate (%)
Step A. L2 – All records in Water Mask	#1	422	- 0.14±3.34	3.34	*N.A. (SLR defined for L3 data only)*
	#2	422	- 0.61±2.60	2.66	
Step B. L2 – After outliers rejection filter	#1	380	0.11±1.91	1.92	
	#2	377	- 0.07±0.40	0.41	
Step C. L3 – Final: After OPO routine (median meas.)	#1	24	0.01±0.12	0.12	0%
	#2	24	- 0.01±0.13	0.13	0%



DeDop Core: L1BS/L1B Processing with dedop_run_scheduler

Sentinel-3A L1A product files are downloaded from scihub Copernicus portal. Since tracks are pole-to-pole, they have been truncated for latitudes matching the Amazon river location. DeDop Core has been run on them with companion tool **dedop_run_scheduler**. The outputs can be L1B with optional L1BS data product files:



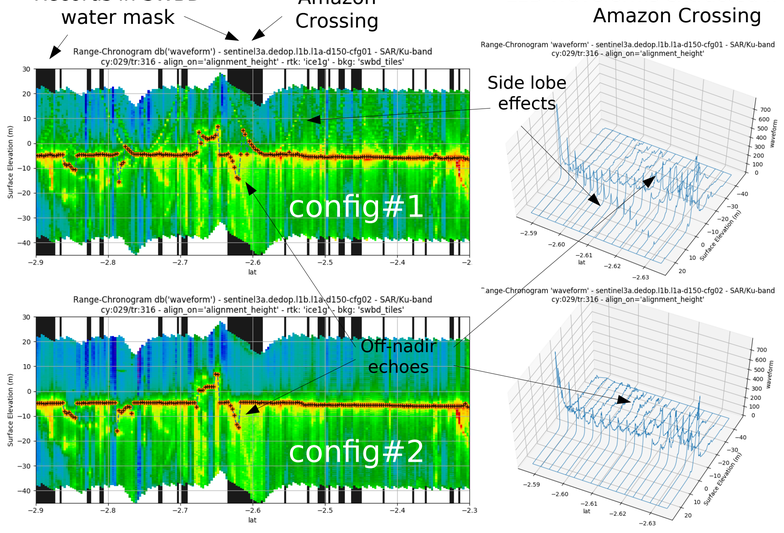
In order to make DeDop even more productive, Along-Track has developed a free and open source tool, named **dedop_run_scheduler**. This shell script allows to run several DeDop Core instances in parallel jobs (one input file processed per CPU core).

Go find **dedop_run_scheduler** on GitHub too:

https://github.com/nbercher-atk/dedop_run_scheduler

Results: L1B & L2 analysis

The whole processing chain (L1A→L3) has been run for two DeDop configurations: basic config#1 and inland water config#2 with Hamming Windowing, Zero Padding Factor=2 and Exact focusing. Analysis on cycle 29 exhibits both off-nadir and side lobe effects on the resulting waveforms (L1B) for config#1 while config#2 improves the radargram/waveforms data.



Conclusions

Conclusion

- DeDop Core tool (v1.5.0) has been implemented using Sentinel-3A L1A product files from Copernicus/Scihub to produce L1B data for two delay-Doppler configurations
- An add-on job scheduler has been developed in order to run several DeDop Core instances in parallel along with improvement in DeDop source Code (closed GitHub Issue #31)
- A full L2 → L3 Processing stack has been added on top of DeDop Core, in order to produce River Water Level time series
- Validation of the L3 River Water Level has been done against gauging data
- As expected, results demonstrates the benefits of a customised delay-Doppler configuration vs. a basic (ocean-like) configuration
- WARNING: Keep in mind that "Hamming windowing" destroys information that might be useful indeed...

What's to come?

- Test new processings approaches starting from L1BS data produced by DeDop Core
- Contribute to DeDop code & tools !!!

Acknowledgments

The ACA-DDP / DeDop project is founded by ESA

Altimetry data: Sentinel-3A L1A data from Copernicus https://scihub.copernicus.eu/dhus/. **Ancillary data:** In situ data from ANA (Brazil) ; in situ gauge stations leveling from Kosuth et al. (2006) ; Water mask are SWBD ShapeFiles from SRTM; Geoid model grids from GRGS & GFZ.

esa
This project is funded by ESA