A database of hydrology targets for the new DEM onboard Jason3

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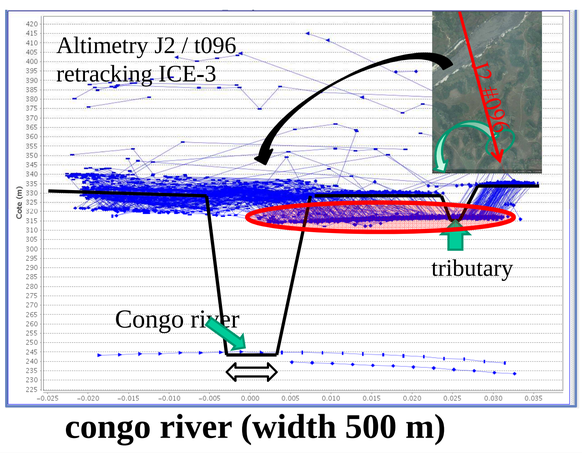
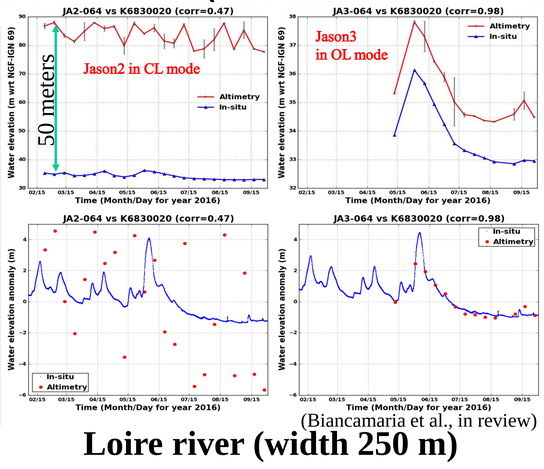
1. Abstract. On Jason-3, data acquisition over inland water bodies is performed in either Diode/DEM Open loop mode (OL) or Autonomous Close loop mode (CL) [1]. The OL tracking mode can be very useful for the altimeter to provide valid measurements over the water body even in difficult environments like rivers lying in the bottom of narrow valleys (see [2] for example). However, this tracking mode requires a prior knowledge of considered targets with a rather good exactitude (typically a dozen of meters). It is then not a completely trivial task to build a global onboard DEM that meets this constraint.

Therefore, given the interest for the whole hydrology community, LEGOS and CNES teams joined technical and scientific expertise to establish the right strategy for making such onboard DEMs. We first defined a small scale project over France (a database with about 100 targets) where precise topography, water masks and in-situ measurements of water heights are publicly available. This allowed us to validate the methods during the commissioning of Jason3, taking benefit of the tandem phase with Jason2. The results of this validation are presented in [3]. In a second step, we recently **expanded the database on a global scale** with about 4300 worldwide targets to build the new Jason3 onboard DEM. In the process, we paid a particular attention not to disturb acquisitions over hydrology targets already monitored in the databases providing measurement from spatial altimetry (GREALM, HYDROWEB and DAHITI). The implementation of the DEM in Jason-3 is presented in [4].

2. The problem and a solution : the Diode/DEM mode (also called OLTC or altimeter OL mode)



congo river (width 500 m)

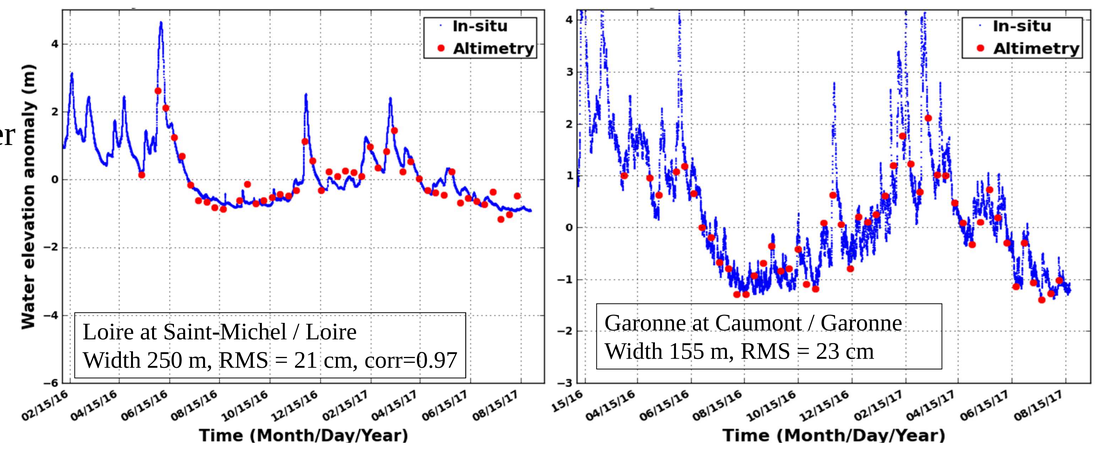


Loire river (width 250 m)

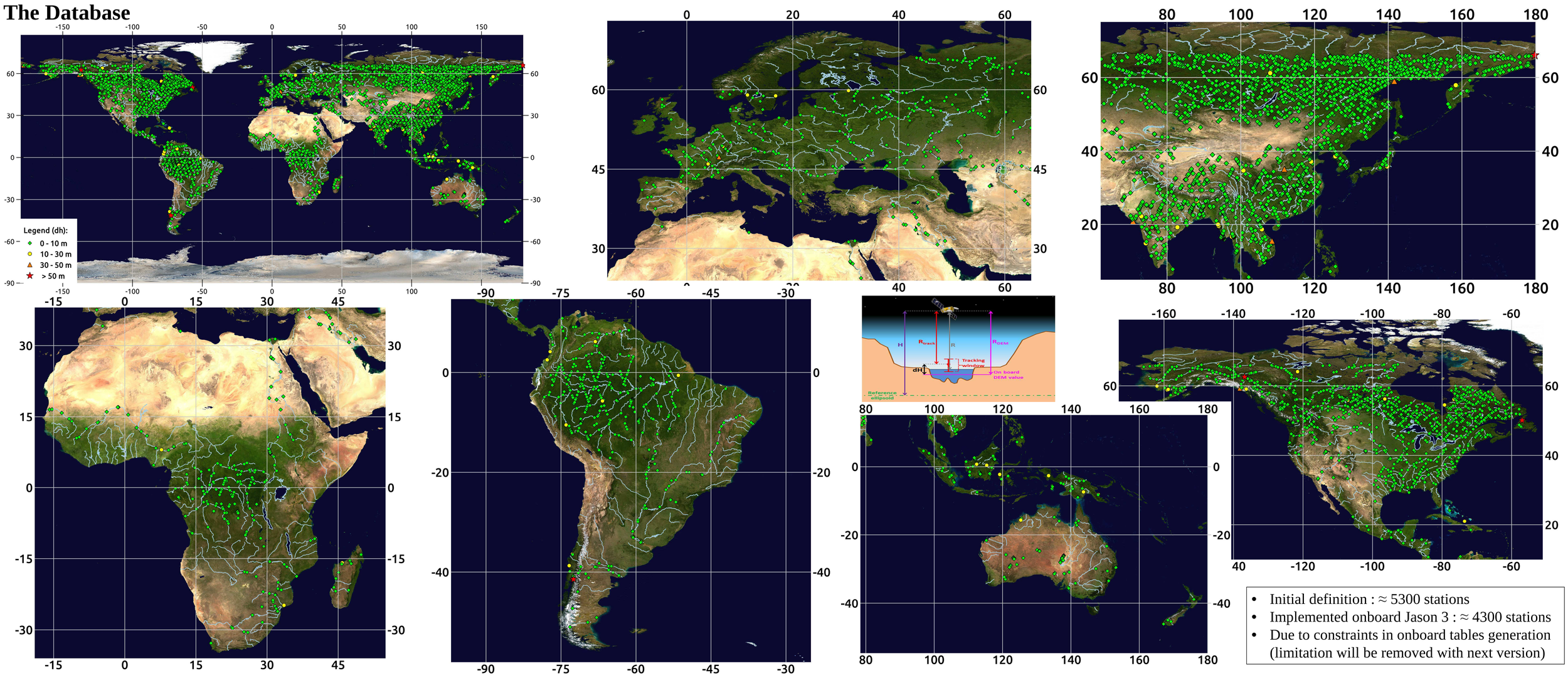
(Biancamaria et al., in review)

- Data from JA2/JA3 tandem phase
- Jason2 in CL mode never tracks the river
- Jason3 in OL mode always the river
- K6830020 : in situ station at Langeais
- JA-064 : altimetry station at Saint-Michel/Loire

Extended results with Jason3 in OL mode : very good agreement



3. The Database



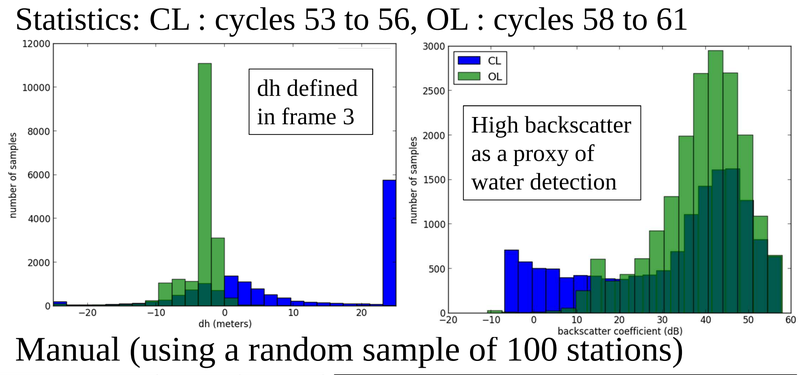
- Initial definition : ≈ 5300 stations
- Implemented onboard Jason 3 : ≈ 4300 stations
- Due to constraints in onboard tables generation (limitation will be removed with next version)

4. Methodology

- Manual approach
  - altitudes from SRTM or google earth
  - water from google earth
  - Africa, South America, South West Asia, northest Virtual Stations (VS)
- Automatic approach
  - altitudes from SRTM (with some corrections)
  - water mask from SWBD
  - South West Asia, Europe, North America
- Important points to keep in mind
  - impact of new dams built after SRTM flight
  - use altitude of water in reservoirs not in the outlet
  - take care of VS in existing hydrology database derived from altimetry

5. Validation

- Statistics: CL : cycles 53 to 56, OL : cycles 58 to 61

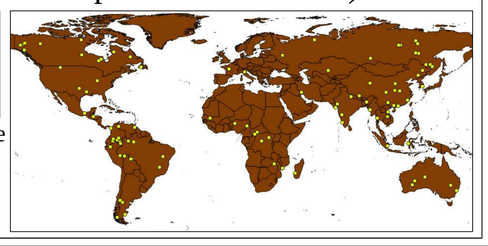


- Manual (using a random sample of 100 stations)

	CL	OL
tracking water	41 (54 %)	91 (91 %)
not tracking water	35 (46 %)	9 (9%)
Total	76(1)	100

(1) 24 stations already in OL mode during cycles 53 to 56

(2) 3 stations OK in CL mode are detected not OK in OL mode



6. Conclusions and Perspectives

- Successful update of Jason3 OLTC performed on cycle 57
- Large increase of the yield of the altimeter over inland water
- Densify and extend the network of stations over rivers, lakes, reservoirs and flooplains for Jason3
- Do the same job for Sentinel3
  - a lot more work to do : 3 times more tracks, 2 satellites in interleaved orbit, higher latitude, Sentinel3 cannot switch rapidly between OL and CL mode as Jason3 does
  - but worth the effort when considering the expected long life time of the Sentinel-3 series
- Input to agencies
  - hydrology is the driver of the OLTC contents
  - need to plan periodic updates (annual ?, incremental)
- Involve all the hydrology user community (+ new databases)

[1] Desjonqueres et al., *Jason-3/POS-3B First results*, OSTST 2016.

[2] Biancamaria et al., *Satellite radar altimetry water elevations performance over a 200 m wide river: Evaluation over the Garonne River*, **ASR, Vol.59, Issue 1, 2017**

[3] Biancamaria et al., *Validation of Jason-3 tracking modes over French rivers*, Rem. Sens. Env., submitted, 2017

[4] Le Gac et al., *Update and validation of the onboard Jason-3 DEM for enhanced acquisitions over inland water targets*, OSTST 2017 *(oral Wednesday)*

Acknowledgments : CTOH for Jason2 and Jason3 SIGDR