



Hi, thank you for reading my presentation !

I am presenting in this document the <u>2020 upgrades of</u> <u>the OLTC tables performed on nadir altimeters</u>, and the benefits for altimetry users.

- This work was performed by a *great team* of several individuals from CNES (my colleagues François Boy and Nicolas Picot), LEGOS (Denis Blumstein and Léa Lasson), Noveltis (Simon Boitard) with the support of Pierre Féménias from ESA/ESRIN.
- All these people worked really hard during this very special year and we managed to perform 4 OLTC upgrades and uploads while mainly teleworking from home ! Thanks to this great team !



This is the outlook of my presentation.



Section 1 of this presentation :

Some useful reminders on the **principles of the altimeters Open-Loop Tracking Command (OLTC)**, also known as Diode/DEM mode, and its use for inland waters measurement



- Here are some reminders of how altimeters work over hydrology (already presented in previous meetings)
- The Open-Loop mode uses onboard OLTC tables which contain a priori information elevation. It is used by the altimeter to control and center the waveforms reception window.
- The a priori information H₀ contained in OLTC tables is key to acquire measurements in all terrain configurations.
- If this H₀ is not correctly set, no signal is recorded. No signal, no data...



- H₀ used by the altimeter is stored in the onboard memory
- A database of hydrology targets is used to compute the OLTC tables.
- All users can view the elevation information contained in current OLTC tables (Sentinel-3) through the OLTC web portal : <u>https://www.altimetry-hydro.eu</u>.
- Anyone can also contribute by submitting new targets ! (login required)
- For more details on the generation of the 2020 hydrology targets databases, please refer to Blumstein et al. presentation (this OSTST)



Switch to section 2 of this presentation :

Description of OLTC upgrades performed in 2020



- This year, all nadir altimeters have been updated with new OLTC versions !
- The main challenge of these upgrades was the addition of numerous targets over inland waters to enhance the capability of nadir altimeters to acquire measurements over hydrology.
- I provide in the « Organization » section some information on how new versions of OLTC are generated, uploaded and validated, and who is involved.



- I present here some key figures of the 2020 OLTC upgrades for inland waters : the total number of targets taken into account to build OLTC tables for each altimetry mission.
- **In grey**: number of hydro targets in previous OLTC versions
- In green: number of hydro targets considered in 2020 OLTC versions for Jason-3, Jason-CS and both Sentinel-3 missions
 - On Jason-3 we have increased the number of targets by a factor of almost 7 !!
 - On Sentinel-3 we have increased the number of targets by a **factor of 2** !
 - NB: Jason-CS / Sentinel-6 OLTC tables have been computed using the same hydrology targets database than Jason-3 (very few differences)
 → this will ensure comparisons during the upcoming S6/J3 Tandem Phase
- Next slide you will find detailed information on OLTC targets database contents and activation date.

OLTC up	grad	des in 202	20 : detailed numbers				
Mission	OLTC	Date of activation	Cycle / Pass	Number of hydro targets (total)	Number of hydro targets by t rivers / lakes / reservoirs / gla identified as such for OLTC defin	ype : ciers, Applicable geographic ition area	
Jason-3	V3.0	August 31, 2017	cycle 57 pass 160	4.721	4.366 / 355 / - / 0	Global	
Sentinel-3B	V2.0	November 27, 2018	cycle 19 pass 219	32,515	17.016 / 14.245 / 1.231 / 23	Latitudes inside +60°	
Sentinel-3A	V5.0	March 19, 2019	cycle 42 pass 317	33.261	17.409 / 14.427 / 1.386 / 39	Latitudes inside ±60°	
Sentinel-3B	V3.0	June 18, 2020	cycle 40, pass 277	73,899	21,719 / 47,738 / 4,419 / 23	Global	
Sentinel-3A	V6.0	August 27, 2020	cycle 62 pass 244	72,050	20,100 / 47,637 / 4,262 / 51	Global	
Jason-3	V4.0	September 3, 2020	cycle 168 pass 109	31,473	8,602 / 21,393 / 1,478 / 0	Global	
Jason-CS/Sentinel-6A	V1.1	TBD	TBD	31,805	8,655 / 21,666 / 1,484 / 0	Global	
Proportion of each type of hydro targets in the database before (top) and after (bottom) OLTC upgrade			LAX-UKN RES ICE 8% 0% 0% RIV 22% Jason-3 v3.0		RES 02 4.2% 0,1% 1/409 RV 52.3% Sentinel-3A v5.0	RES LCE 3,8% 0,1% 12245 43,8% 77016 RV 52,3% Sentinel-3B v2.0	
Colorcode: River	s, Lak	es, Reservoirs	1478 0 RES ICE 5% 0% 8602 RIV 21393 LAK+UKN 85% Lason 3 vd 0		4262 51 RES LCE 5,9% 0.1% 20100 RIV 27,9% 47637 LAK-UKN 66,1% Septimel.30 v6 0	4419 23 RES LEE 6,0% 0,0% 22739 RIV 29,4% 47738 LAK-UIXN 64,6%	

- Please zoom in to better see the table and charts
- The table describes the previous (grey lines) and new (blue lines) OLTC versions and contents, and associated activation dates.
- The pie charts indicate the proportion of each type of hydro targets (top row = before, bottom row = 2020, for Jason-3, Sentinel-3A and Sentinel-3B (left to right, respectively)).
- → Besides the major increase of the total number of hydro targets used for OLTC definition, the pie charts indicate a major increase of the number of lakes and reservoirs targets. River targets still represent a great part of the total number of hydro targets.

→ More information on the generation of this hydrology targets database is detailed in **Blumstein et al. presentation** (OSTST 2020)



 This is a map of the hydro targets for **previous versions** (up until Summer 2020) on **both Sentinel-3A and Sentinel-3B**



- This is the **New** map of hydro targets considered for OLTC tables on **Sentinel-3A and Sentinel-3B**
- (click back and forth to see the before/now effect)
- As you can see the network of hydro targets has been much densified everywhere and also extended above 60°N to ensure a global and dense coverage of Sentinel-3 over land.



 Jason-3 hydro targets before (Aug. 31 2017 – Sep. 3 2020)



- Jason-3 hydro targets **NOW** (since Sep. 3, 2020)
- The database of targets has been highly densified (by a factor of almost 7 !) everywhere, for rivers and lakes at all latitudes covered by Jason-3.



Switch to section 3 of this presentation :

First validation results after new OLTC tables upload on-board



- This slide explains how we proceed to validate a new OLTC version.
- The acquisition indicator (OK/NOK) is used to evaluate if the received waveform is exploitable, thus indicating that the OLTC elevation command is correctly set. This is a first quality indicator (not representative of the quality of the water surface height performance).
- More details on how this indicator is computed from the waveforms can be found in *Le Gac et al. ASR 2019*.

	OLTC performance OOO 2020 OLTC first validation				
and the second second	Results based on analysis of all hydrology targe • below 60°N				
		Global	Jason-3 Cycle 169	S-3A Cycle 63	S-3B Cycle 41
		All hydro	91,8 %	84,1 %	84,8 %
		Results by target type	Jason-3 Cycle 169	S-3A Cycle 63	S-3B Cycle 41
		Lakes	90,1 %	82,5 %	83,0 %
		Reservoirs	88,7 %	78,4 %	79,0 %
1110		Rivers	96,2 %	89,9 %	90,1 %
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- We present here **global results** (score, in %, of OK acquisition indicators) for the three new OLTC versions :
 - Jason-3 cycle 169 (first full cycle after upload during Cycle 168)
 - Sentinel-3A cycle 63 (first full cycle after upload during Cycle 62)
 - Sentinel-3B cycle 41 (first full cycle after upload during Cycle 40)
- Acquisition indicator is computed for targets centers located below 60°N for all missions : this is to make sure that all these targets are measured in Open-Loop mode (the Open-Loop mask on Sentinel-3 is defined up to 60°N).
- Global results (upper table) show a very satisfactory overall acquisition performance of 92% for Jason-3 and 84% for Sentinel-3 (A&B) ! ^(C)
- Detailed results by type of targets (bottom table) reveal some differences between Jason-3 and Sentinel-3. Waveforms are correctly acquired over ~90% of the river targets, whereas this score slightly decreases for lakes and reservoirs.
- Jason-3 scores are better than Sentinel-3 scores, see next slide for some explanation



 One possible explanation about the « lower » scores (still >80%) on Sentinel-3 than on Jason-3 is that some lakes and reservoir targets are defined « off-nadir », meaning that the position used to define these targets is not located at the nadir of the theoretical ground track (i.e. further than 1 km). We believe the altimeter is capable of measuring these off-nadir targets (large antenna footprint, cf. *Blumstein et al.*), deeper analysis is in progress.



- The overall performance when considering nadir-only targets reaches 91% - 92% success on all three missions
- When considering nadir-only targets, the acquisition performance is >90% over lakes and ~85% over reservoirs



Switch to section 4 of this presentation :

Other applications linked to OLTC



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Switch to the last section of this presentation :

Conclusion and perspectives



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Thank you for your attention !

If you have any questions related to OLTC tables management and contents, please reach out to us !

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And don't forget to visit the OLTC web portal : <u>https://www.altimetry-hydro.eu</u>