

Quality Assessment of Sentinel-3a PDGS Land products for the monitoring of Lakes and Rivers Water Level

L. Zawadzki¹, R. Jugier¹, M. Vayre¹, A. Paris¹, N.
Taburet¹, J. Dorandeu¹, M. Ablain¹, J-F Crétaux²
Acknowledgment: D. Blumstein², S. Calmant³, P. Femenias⁴

¹CLS, France, Lionel.Zawadzki@cls.fr

²CNES/LEGOS, France

³IRD/LEGOS, France

⁴ESA/ESRIN, Italy



Objective

Qualification of Sentinel-3a PDGS Land products (reprocessed cycles 5-16 in L2 version 6.7) to integrate this mission in operational water level services: **THEIA/Hydroweb** (hydroweb.theia-land.fr) and **Copernicus Global Land** (land.copernicus.eu/global/products/wl)

Quality Assessment Tools



User Requirements

	GCOS	Copernicus Global Land
Frequency	Daily	Daily, 10-day composite, monthly composite
Resolution	100m	<ul style="list-style-type: none">• River width: 500m (threshold), 100m (target)• Lake area: 1 km²
Accuracy	<ul style="list-style-type: none">• Rivers: 10 cm• Lakes (large): 3 cm• Lakes (remainder): 10 cm	<ul style="list-style-type: none">• 15 to 20 cm for high water (threshold)• 10 to 15 cm for low water (threshold)• 1 to 5 cm (target)
Stability	<ul style="list-style-type: none">• Rivers: 1 cm/yr• Lakes: 1cm/decade	-



RIVERS

Virtual station automatic building

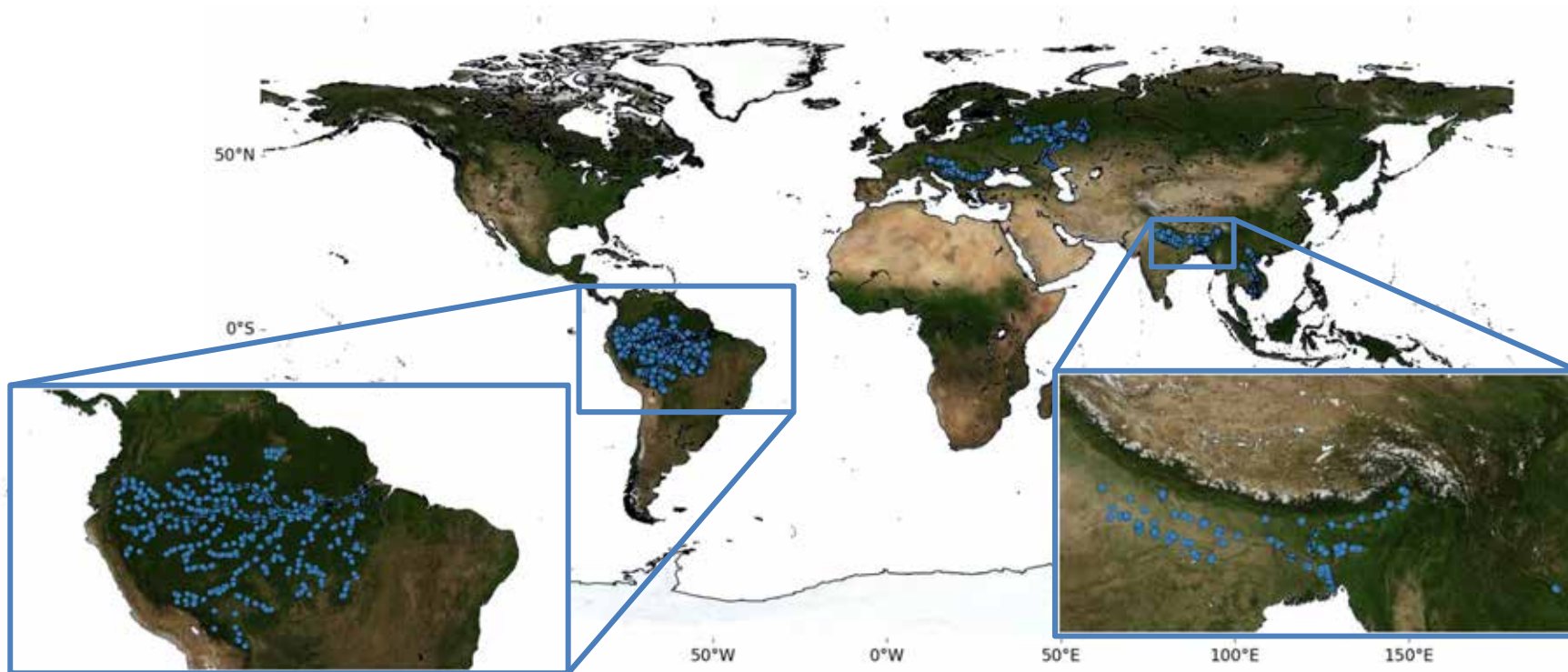


Focus on one station on the Amazon river

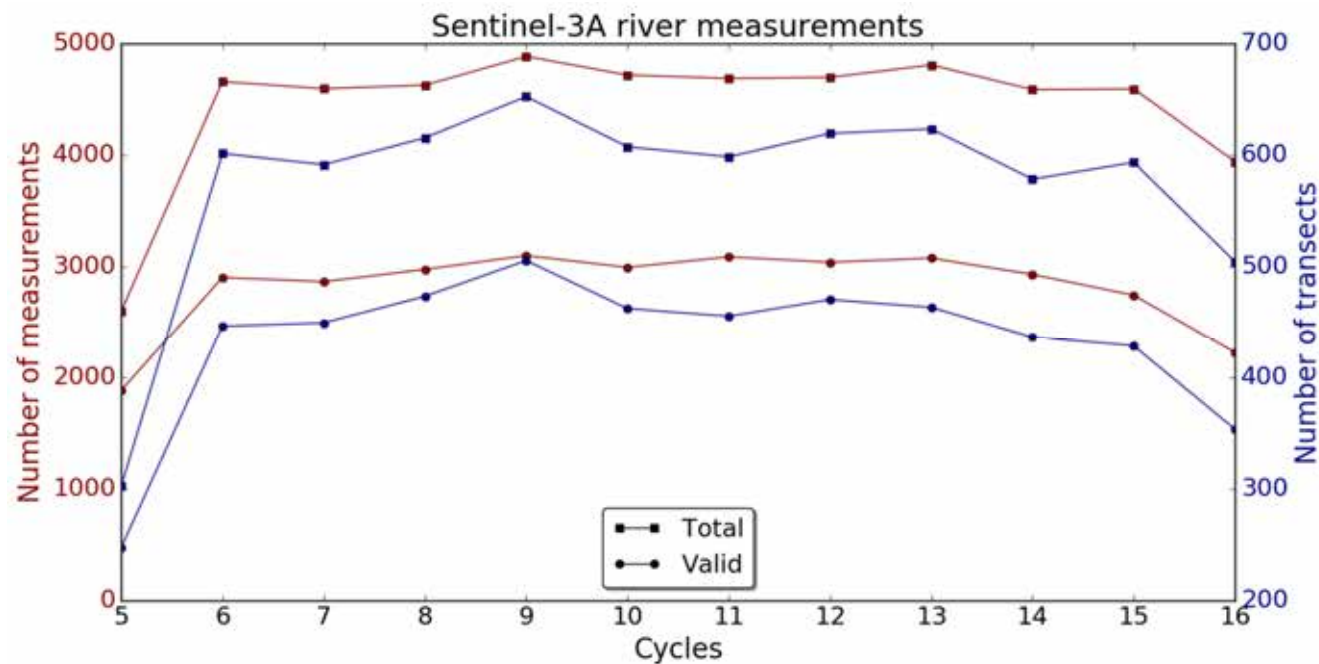
- Intersection between theoretical track and SWBD Land/Water mask
- Only for large rivers (at least 2 HR measurements in transect)
- Automatic delineation of a polygon for the selection of measurements: riverbank and 5km along river curvilinear abscissa.

Virtual station automatic building

~700 Virtual Stations over test hydrological basins: Amazon, Ganges/Brahmaputra, Danube, Volga, Mekong, Red River



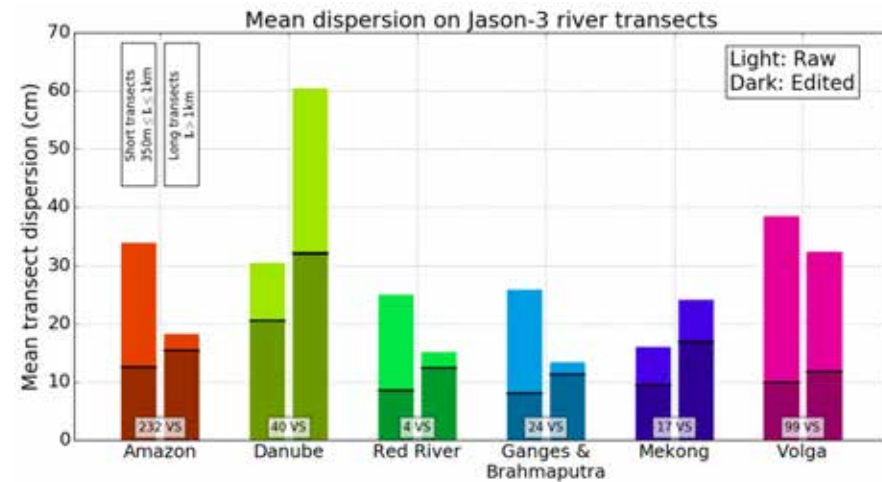
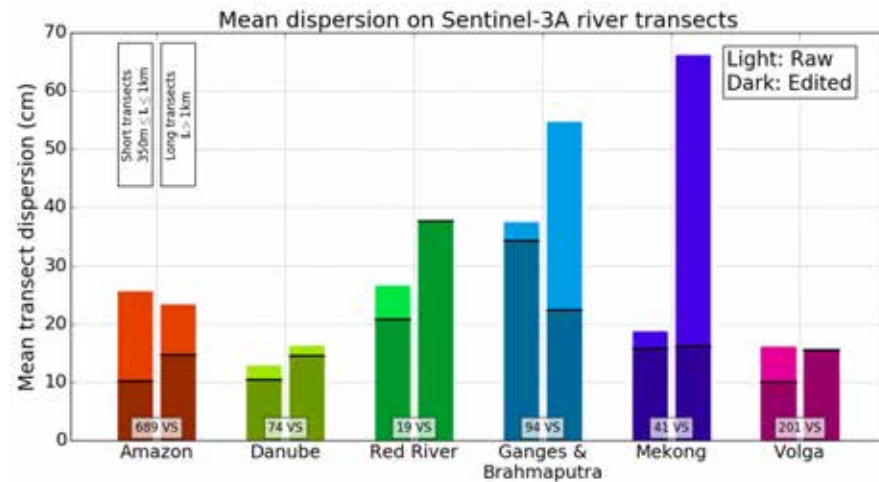
Quality Assessment on river transects



- Stable number of river measurements between cycles
- Cycles 5 and 16 are incomplete, 13 missing tracks on other cycles

Quality Assessment on river transects

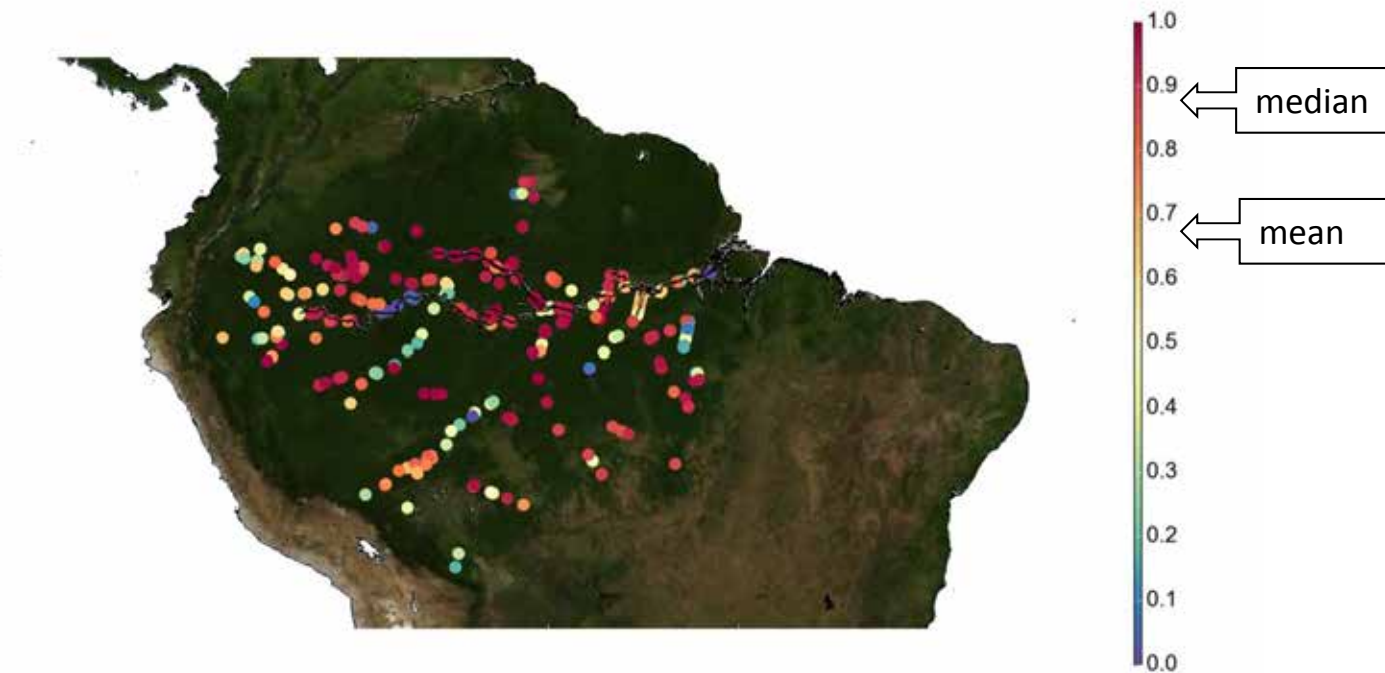
Similar dispersion along river transects between Sentinel-3A and Jason-3



Virtuals stations not at the same positions along the rivers for S3 and J3

Quality Assessment on river transects

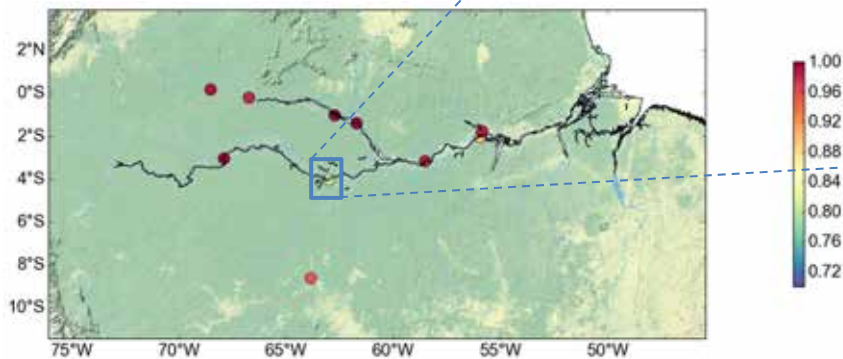
Correlation R^2 between Sentinel-3a and Jason-3 VS within same reach



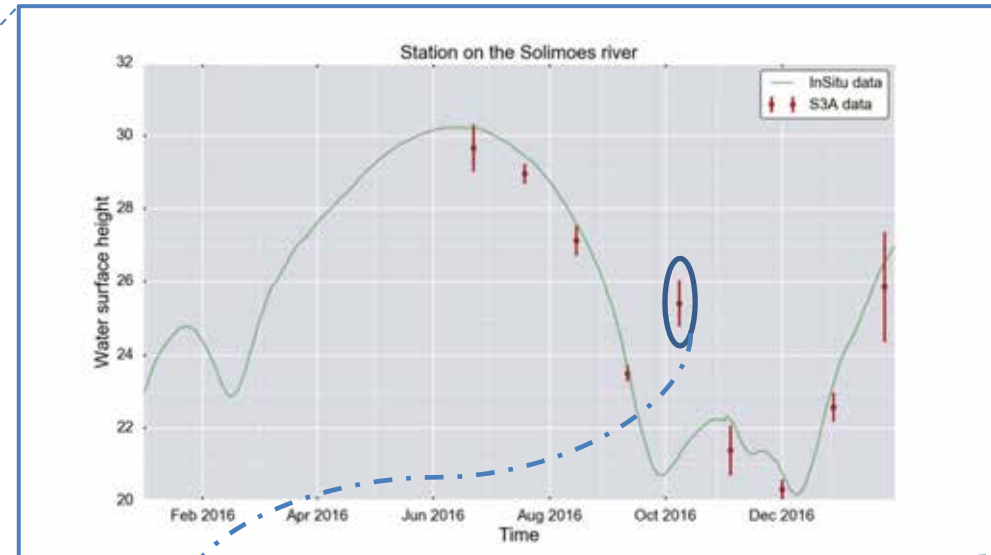
Good consistency between Sentinel-3 and Jason-3 measurements

Quality Assessment on river transects

- In situ upstream station about 10 km distant from S3A VS
- One outlier point, **good agreement** between altimetric and in situ data elsewhere



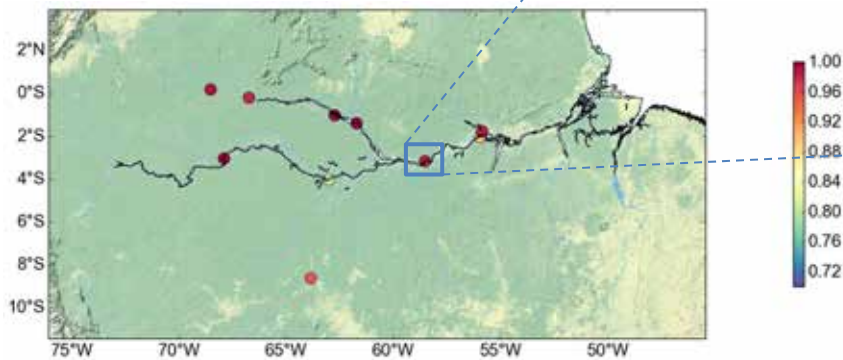
Color = Correlation between S3A VS and in situ data



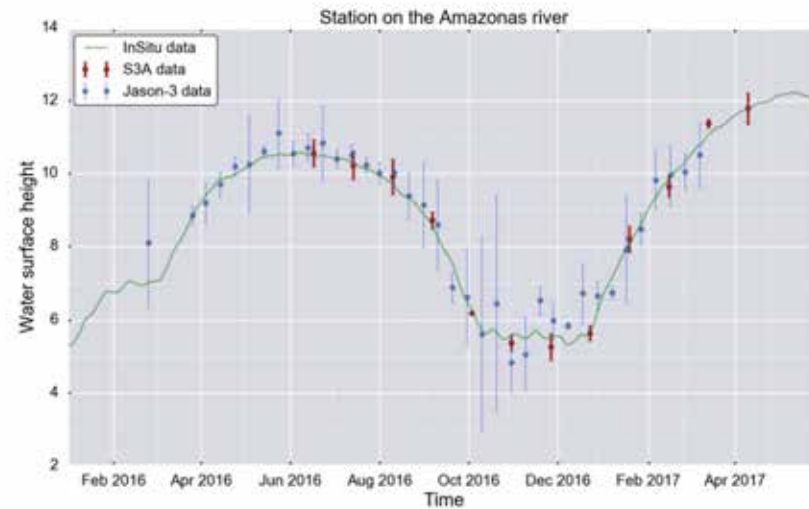
- **Outlier due to river morphology**
 - would be improved with tuned editing

Quality Assessment on river transects

- In situ downstream station (**abidos**) about 50 km distant from the S3A VS
- Jason-3 upstream station about 100 km distant from the S3A VS
- **Good agreement** between altimetric and in situ data



Color = Correlation between S3A VS and in situ data



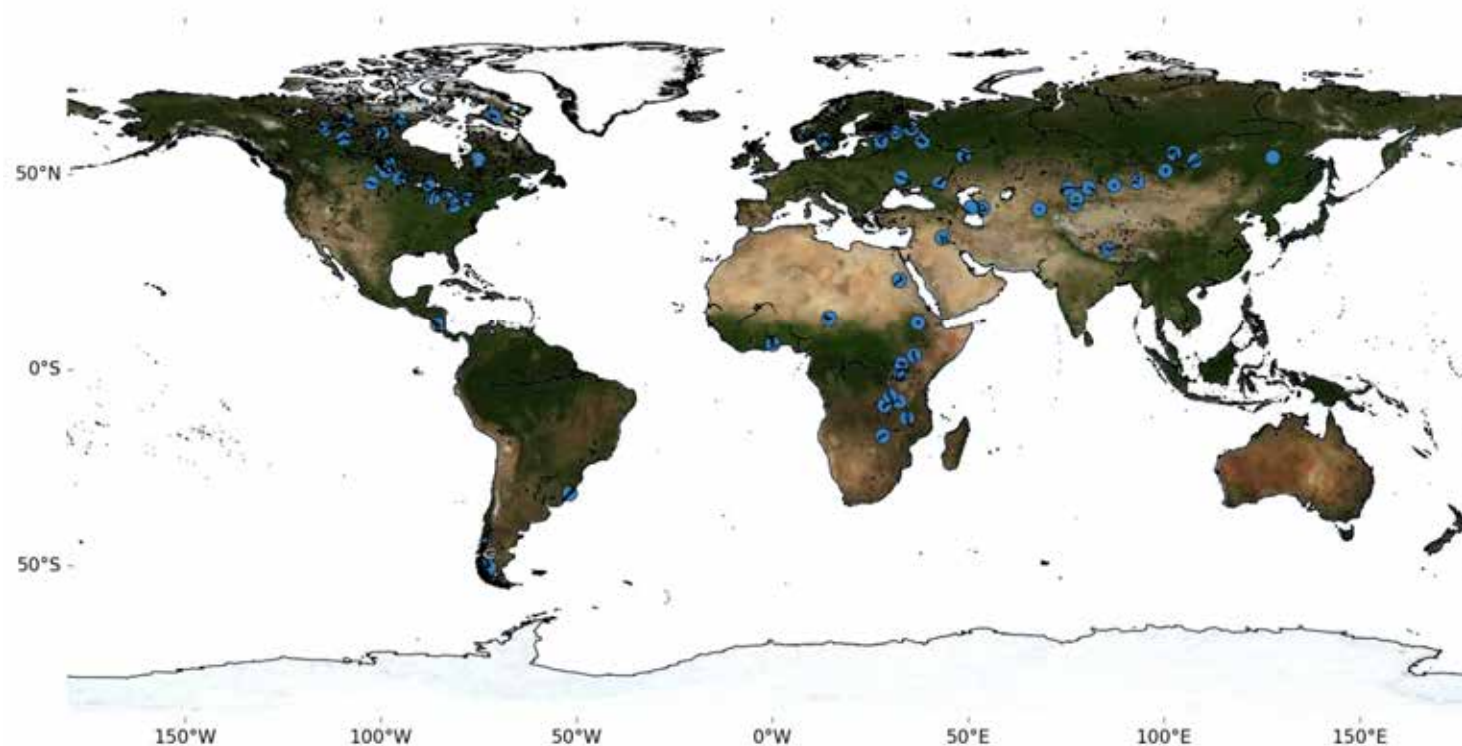
Quality assessment tools

- Editing process
- In situ comparison
- Other mission comparison (Jason-3)

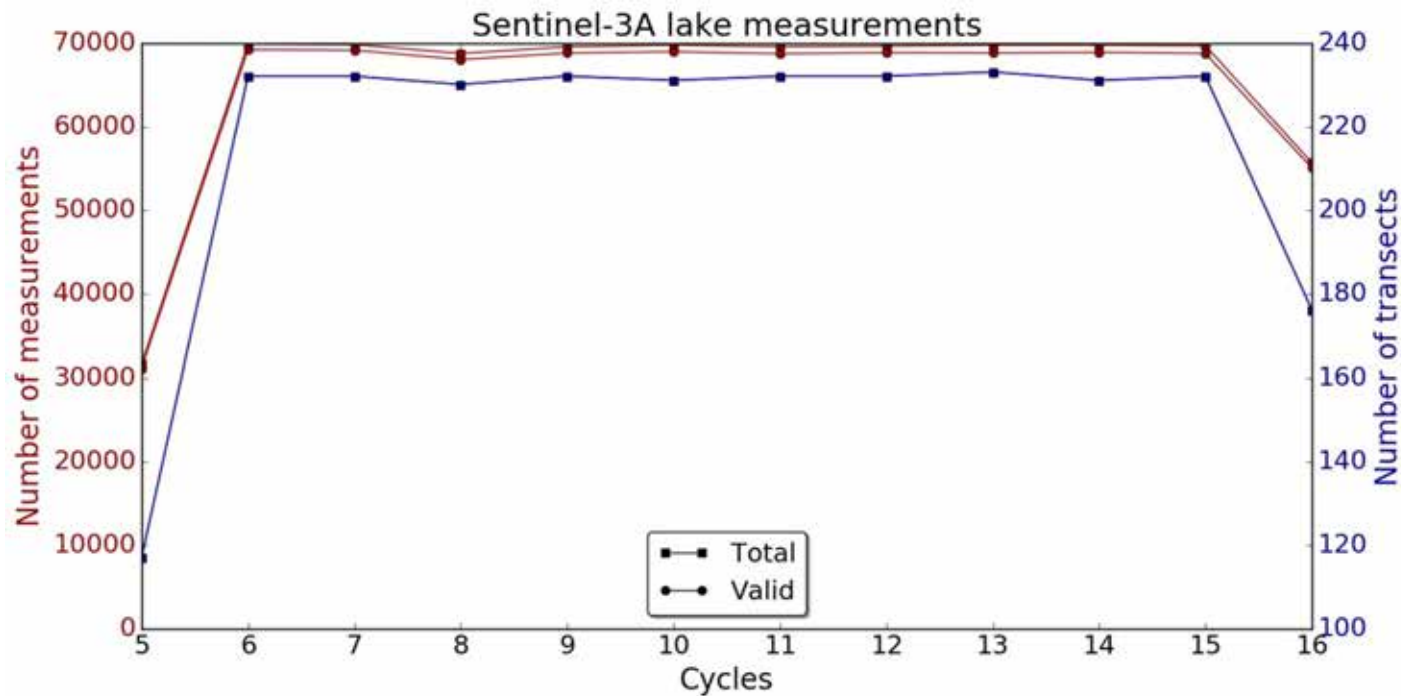


Quality Assessment on lake transects

55 lakes for Sentinel-3A quality assessment



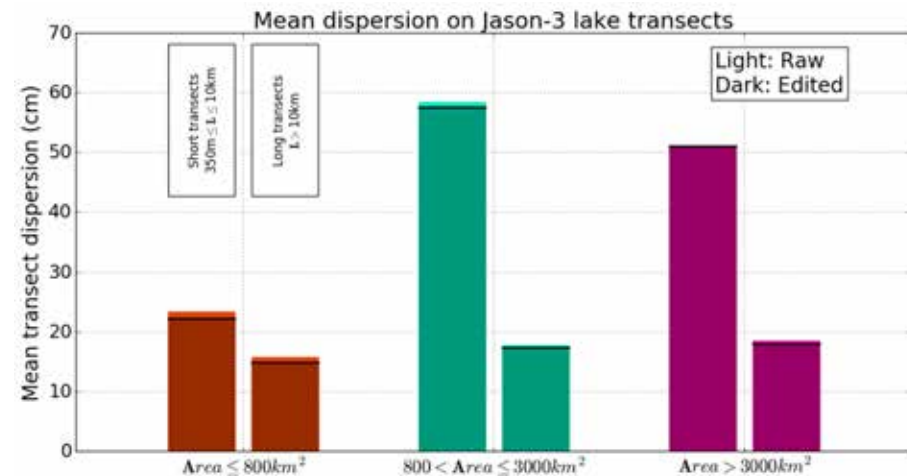
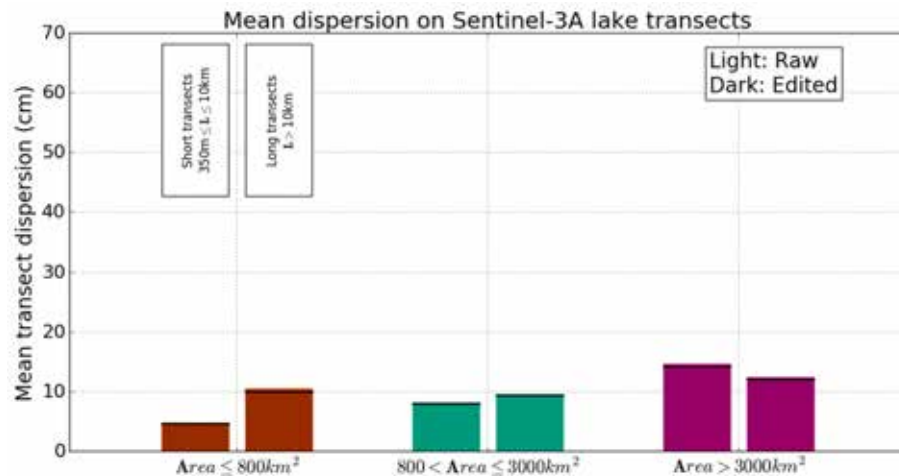
Quality Assessment on lake transects



Stable number of lake measurements between cycles
Cycles 5 and 16 are incomplete

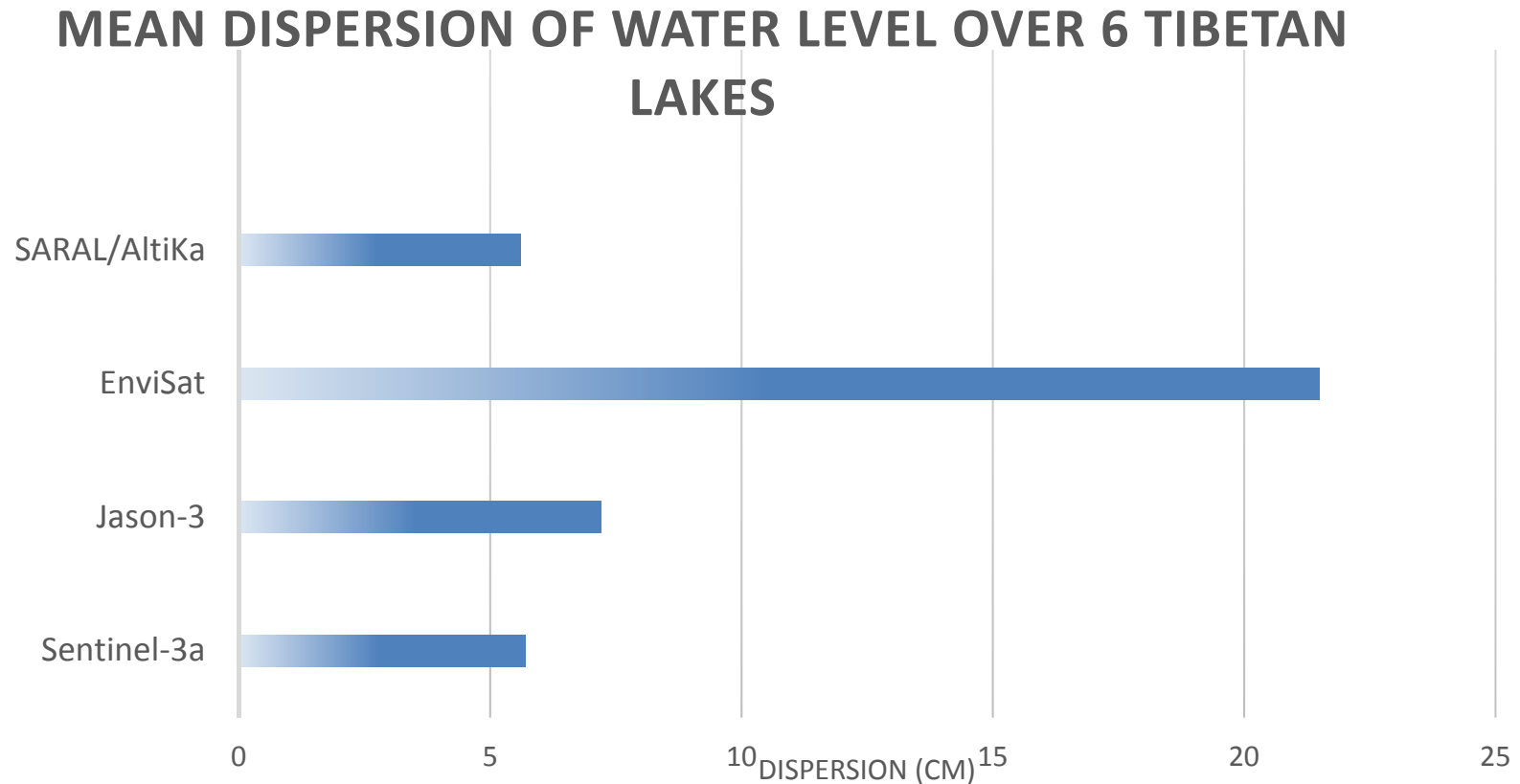
Quality Assessment on lake transects

Much lower dispersion on lake transects for Sentinel-3A when compared to Jason-3
Greater dispersion for greater lakes : not an error but a geophysical signal



Better results for S3 (SAR) than for J3

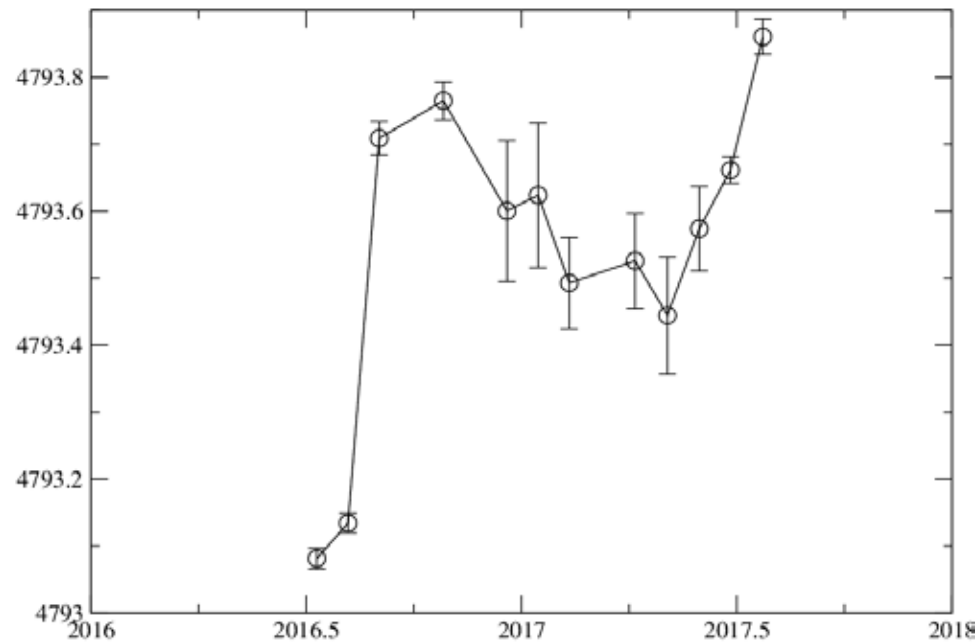
Quality Assessment on lake transects



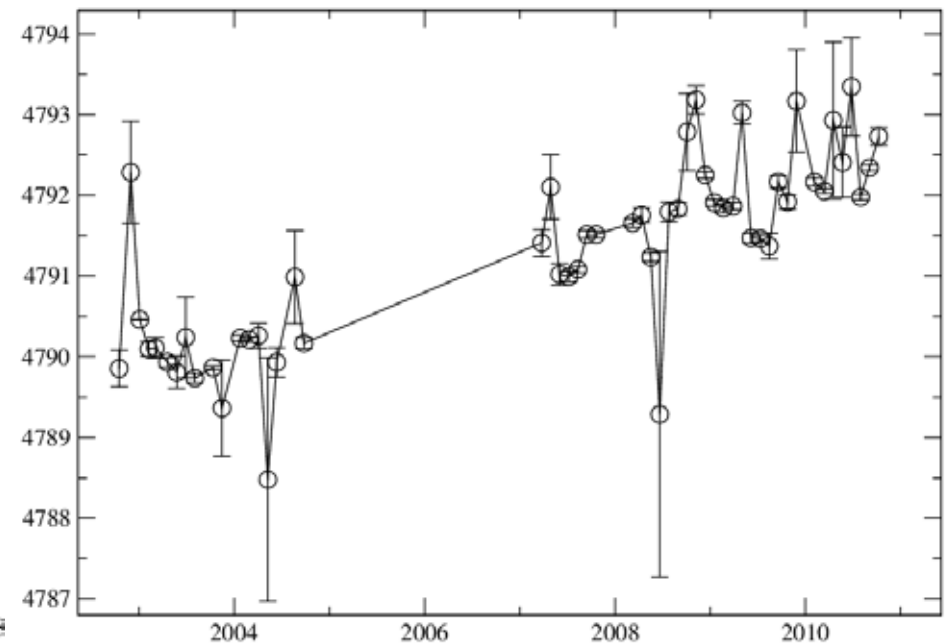
Quality Assessment on lake transects

Transect dispersion on Dogaicoring-Qangco Lake for Sentinel-3A w.r.t. Envisat

Sentinel3A: mean dispersion 5.3 cm



Envisat: mean dispersion 48 cm



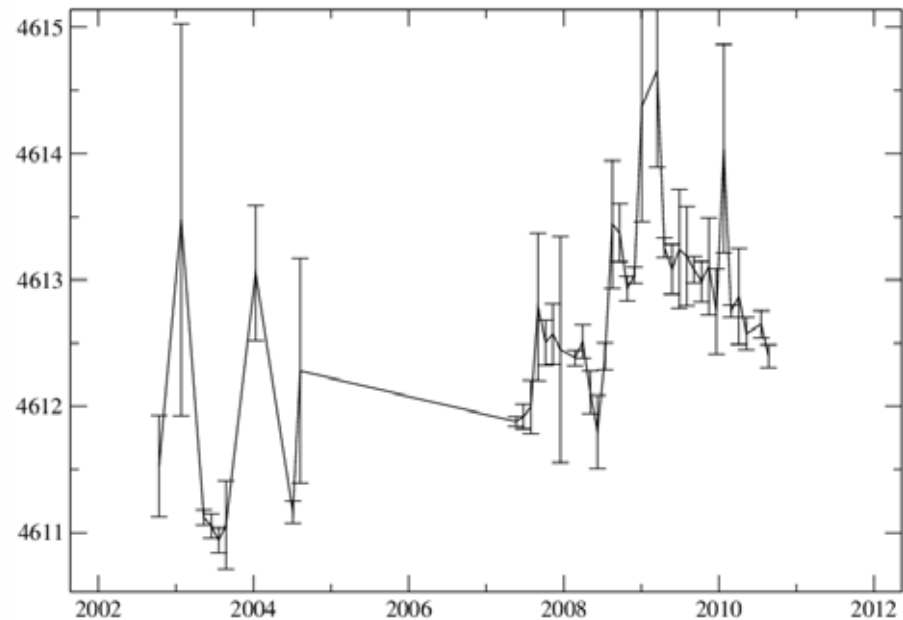
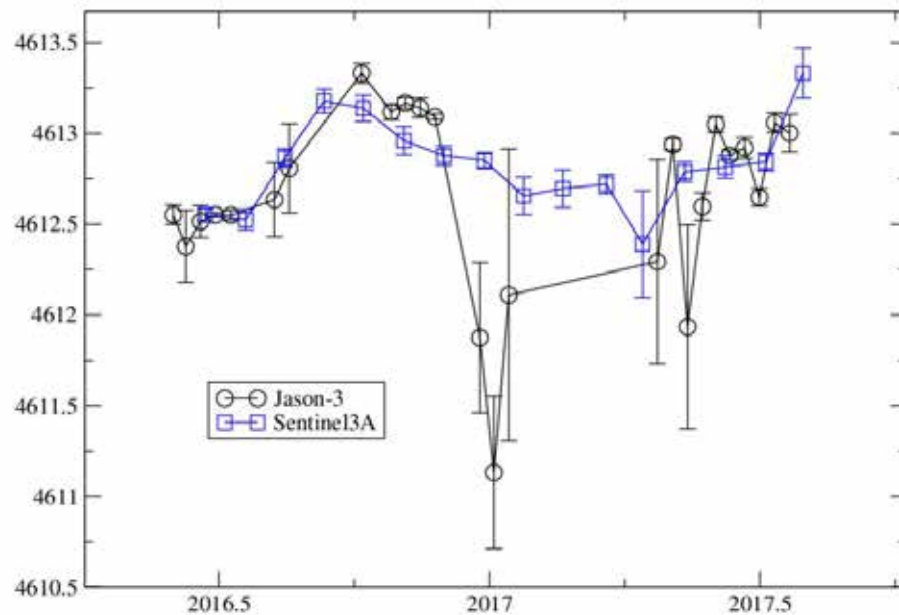
Quality Assessment on lake transects

Transect dispersion on Zhari-Namco Lake for Sentinel-3A w.r.t. Jason-3 and Envisat

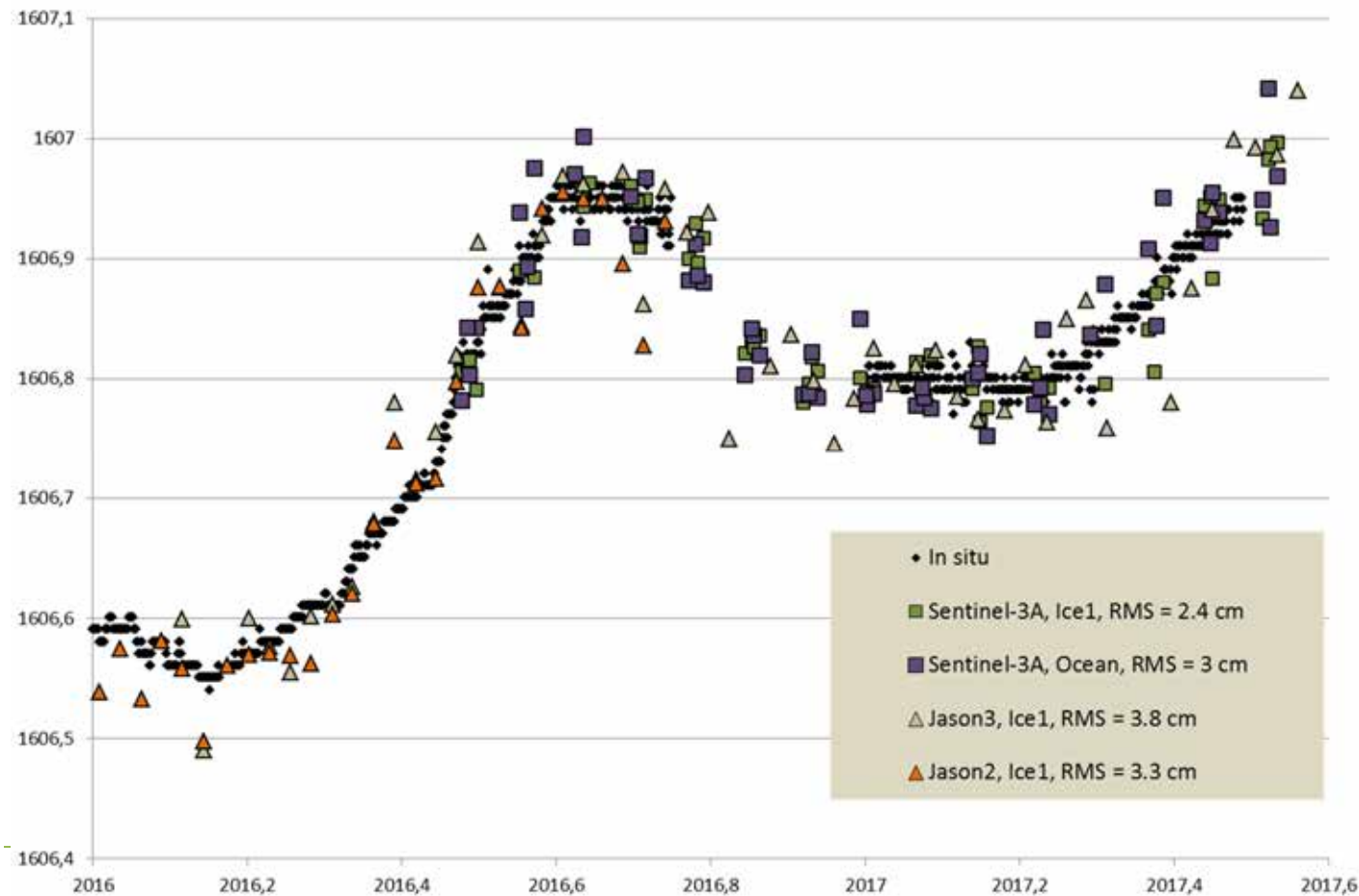
Sentinel-3A: mean dispersion 8.3 cm

Jason-3: mean dispersion 10.3 cm

Envisat: mean dispersion 22 cm



Quality Assessment on lake transects

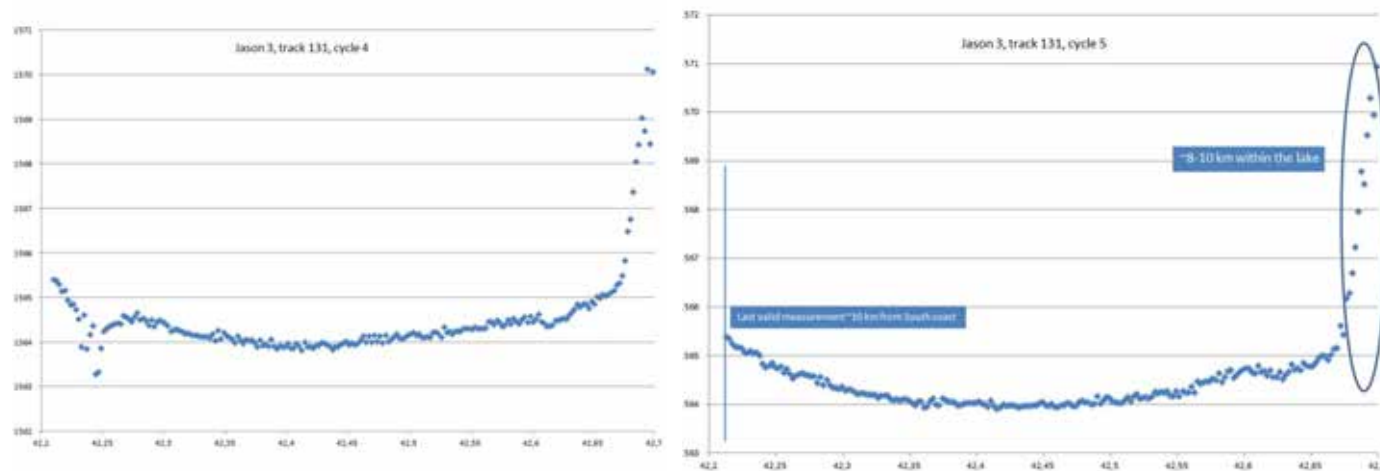


Issykkul Lake:
RMS error w.r.t
in situ data

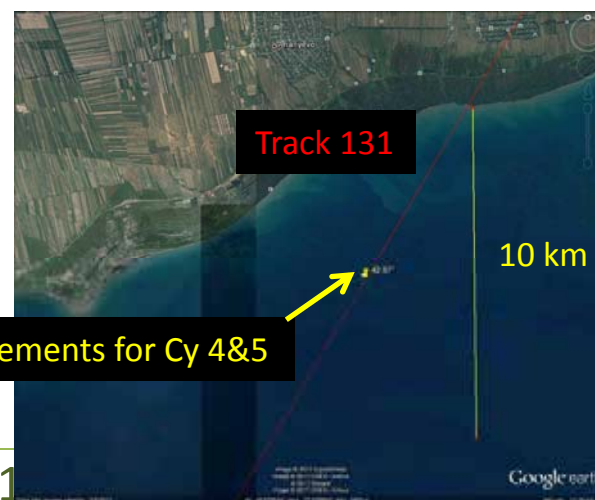
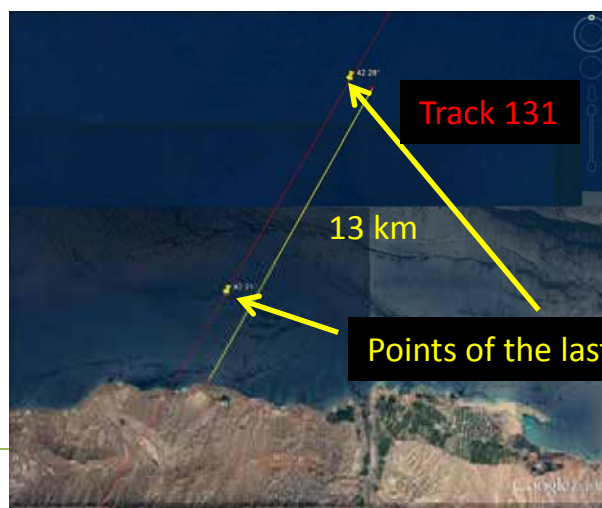


S3A track 66, valid measurements up closer than 1 km from the coast





Jason-3 track 131, valid measurements not closer than 4 up to 13 km from the coast



An aerial photograph of a river delta, showing a complex network of channels and distributaries. The text "CONCLUSIONS & OUTLOOKS" is overlaid in white, bold, sans-serif font in the lower right quadrant of the image.

CONCLUSIONS & OUTLOOKS

Conclusions

- Good global performance:
 - Hundreds of new VS and lakes containing valid data can be monitored
 - Low dispersion on lakes w.r.t Jason-3
- More thorough and detailed analysis is needed to better qualify mission performance:
 - In situ comparisons
 - Inter-mission comparisons
- Sentinel-3A data will be included in THEIA/Hydroweb and C-GLOPS as of January 2018: Hundreds of new VS (exact count still being assessed)

Improving the L2 PDGS Land products

- DEM improvements (Le Gac et al., OSTST 2017)
- New retracking solutions are under evaluation (Adaptive retracker) and could be integrated in a future evolution of the ground segment
- Evolution of L1 processing recommended (Opad/Hamming) especially for improving small river estimations
- Routine Operational Quality Assessment of Level-2 products and corresponding quality flag
- Integration of cycles 1 to 5 would allow inter-mission comparison with Saral-AltiKa before it was shifted to a drifting orbit



Questions ?

Lionel.Zawadzki@cls.fr

