SWOT HR

LAKE STORAGE CHANGE STATUS

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2025 SWOT SCIENCE TEAM MEETING
15 OCTOBER 2025

C1 - Publique

INTRODUCTION

Storage change availability – Version C vs Version D

- PGC0, PIC0 and PIC2: 25 lakes with storage change variables
- PGD0, PID0: 5,370,449 lakes with storage change variables
- Major update: 91% of PLD lakes with storage change variables (total = 5,897,941 lakes)

STORAGE CHANGE ALGORITHMS

From SWOT Algorithm Theoretical Basis Document: L2_HR_LakeSP

The storage change variables in the LakeSP_Prior file:

- ds1_l: linear model with direct approach: volume of a trapezoidal prism
- ds1_q: quadratic model with direct approach: volume of truncated pyramid

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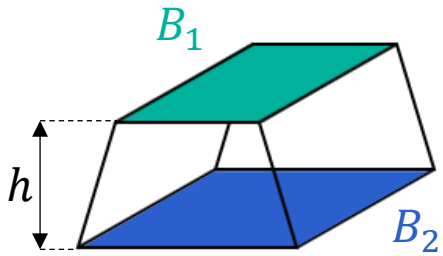
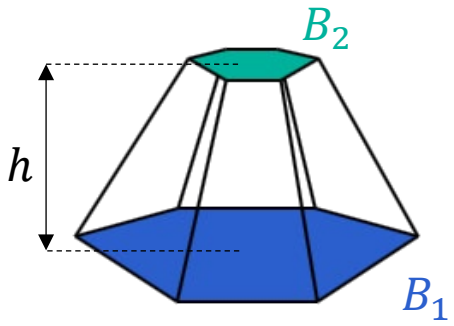


$$V = \frac{h}{2}(B_1 + B_2)$$



$$V = \frac{h}{3}(B_1 + B_2 + \sqrt{B_1 * B_2})$$

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Volume change in km^3 between the current SWOT observation t_i and the first valid observation by SWOT at time t_0. Ground segment constrains the use of only the current observation, not the previous one, even for reprocessing.

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current SWOT observation t_i values

$$\Delta V_l(t_i) = \frac{wse_{t_i} - ref_wse}{2}\left(area_total_{t_i} + ref_area\right)$$

Reference values in the PLD

STORAGE CHANGE ALGORITHMS

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current SWOT observation t_i values

$$\Delta V_q(t_i) = \frac{wse_{t_i} - ref_wse}{3}\left(area_total_{t_i} + ref_area + \sqrt{area_total_{t_i} * ref_area}\right)$$

Reference values in the PLD

STORAGE CHANGE ALGORITHMS

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Volume change in km^3 between the current SWOT observation t_i and the first valid observation by SWOT at time t_0

$$ds1_[l|q] = \frac{\Delta V_{l|q}(t_i)}{1000} - ds_t0$$

storage change between the first valid observation by SWOT and the reference state

STORAGE CHANGE ALGORITHMS

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Storage change uncertainty: ds[1|2]_u_[l|q] (wse_u, area_tot_u)
=> cfr. ATBD for more information

STORAGE CHANGE ALGORITHMS

From SWOT Algorithm Theoretical Basis Document: L2_HR_LakeSP

The storage change variables in the LakeSP_Prior file:

- ds1_l: linear model with direct approach
- ds1_q: quadratic model with direct approach
- ds2_l: linear model with incremental approach
- ds2_q: quadratic model with incremental approach

Based on the hypso curve (wse, area_total) => not yet available

VALIDATION APPROACH

Example over Lake Orient (France), lake_id = 2320116363

- PLD

lake_id	date_t0	ref_wse	ref_area	ds_t0
2320116363	2023-09-10 08:46:02	93.78	21.85692	0.879081

- in situ

time	volume
t_0	v_0
t_i	v_i
...	...
t_n	v_n

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- in situ

time	volume	
t_0	v_0	$- v_i$
t_i	v_i	$- v_i$
...	...	...
t_n	v_n	$- v_i$

time	Δv
t_0	Δv_0
t_i	$\Delta v_i = 0$
...	...
t_n	Δv_n

Volume variation comparable to SWOT storage change

VALIDATION APPROACH

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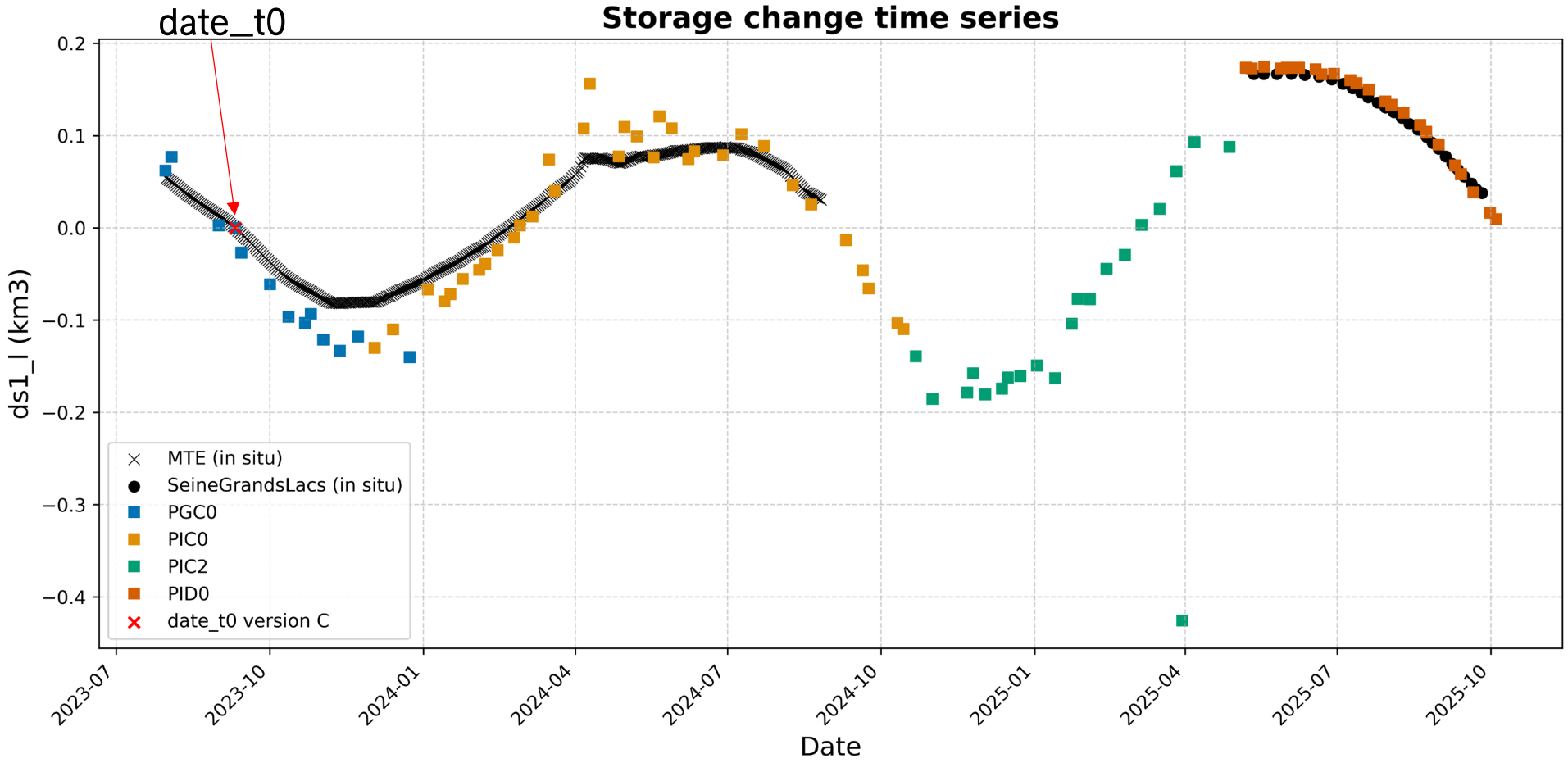

SUMMARY AND OUTLOOK

Version D LakeSP data

- 91% of PLD lakes with storage change
- Note that the data have not been thoroughly validated yet! Please use with caution!

Future activities

- Storage change validation (call for in situ data contribution)
- Potential algorithm evolutions
- Need for a storage change working group ?

Don’t hesitate to share your work

SPREADING THE WORD: RELATED PRESENTATIONS

Thu, Oct 16 2025, 09:00 - 10:30 Oral and 17:30 – 18:30 Poster
Hydrology: SWOT Lakes, Estuaries and Wetlands (SLEW)

- Improved SWOT surface water storage monitoring through multi-sensor harmonization (Levenson et al.)
- Water volume dynamics in West African lakes and reservoirs by SWOT and optical satellite sensors (Grippa et al.)
- Lakes and reservoirs storage changes from SWOT and ancillary database in Quebec (Canada) (Chuette et al.)
- Comparing multi-mission altimetry derived reservoir storage changes with SWOT Level 2 Lake Single-Pass product (Garkoti et al.)
- Monitoring surface water storage in Peruvian Andean lakes and reservoirs with SWOT and Sentinel-1: Toward integrated mountain hydrology (Visitacion Bustamante et al.)

among others...

THANK YOU
FOR YOUR ATTENTION

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