PRÉSENTATION DU NOUVEAU SATELLITE SWOT

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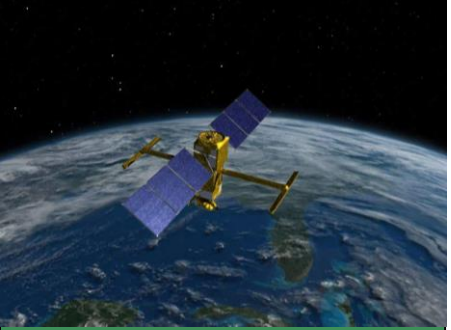
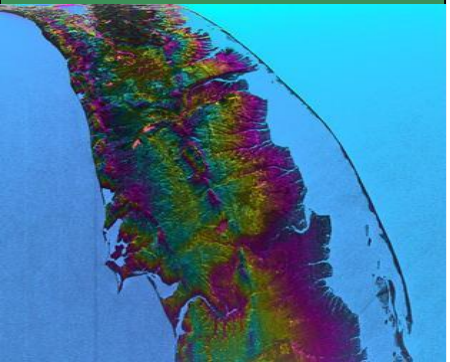
UNIVERSITÉ LAVAL
UDS Université de Sherbrooke
CANADIAN SPACE AGENCY AGENCE SPATIALE CANADIENNE





A) La mission SWOT en bref

B) Présentation des produits SWOT

C) Enjeux/Opportunités

D) Exemple sur un site d’étude

A) LA MISSION SWOT EN BREF

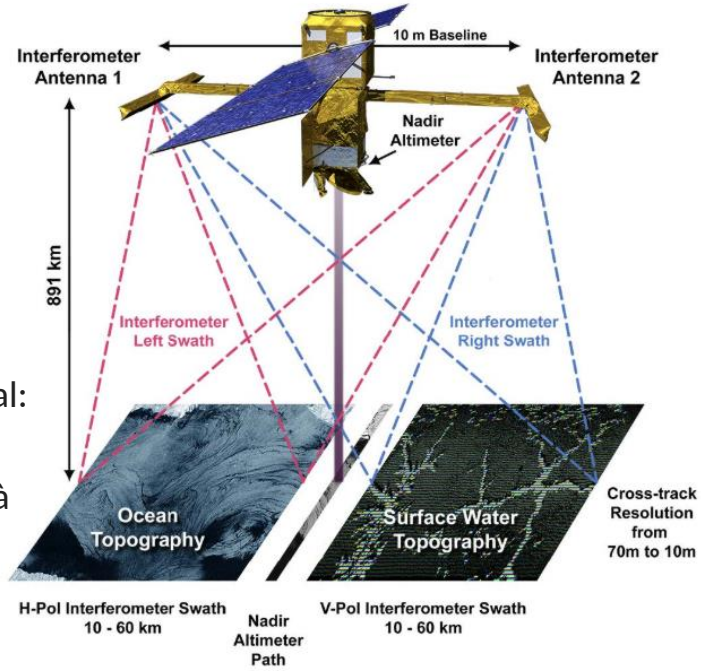
SWOT en bref

Caractéristiques:

- Partenariat entre la NASA et le CNES avec une contribution de CSA et UKSA.
- Lancement en décembre 2022
- Principal instrument: Ka-band Radar Interferometer (KaRIn)
- Mission de 3 à 5 ans
- Revisite tous les 21 jours, mais possibilité de plusieurs passages pour un même plan d'eau

Objectifs de la mission

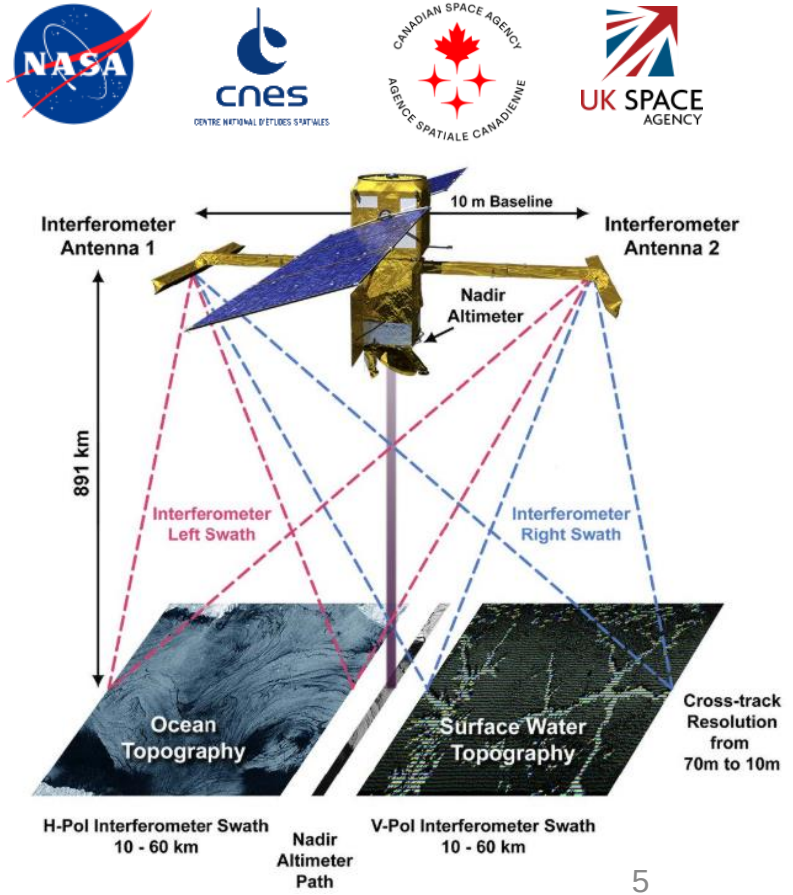
- Fournir un inventaire mondial de toutes les plans d'eau terrestres dont la superficie dépasse (250 $m)^2$ (goal: (100 $m)^2$, threshold: 1km^2) (lacs, réservoirs, milieux humides) and rivières dont la largeur dépasse 100m (goal: 50m, threshold: 170m)
- Mesurer le changement global de stockage dans les plans d'eau terrestres à des échelles de temps submensuelles, saisonnières et annuelles.
- Estimer le changement global du débit des rivières à des échelles de temps sub-mensuelles, saisonnières et annuelles.



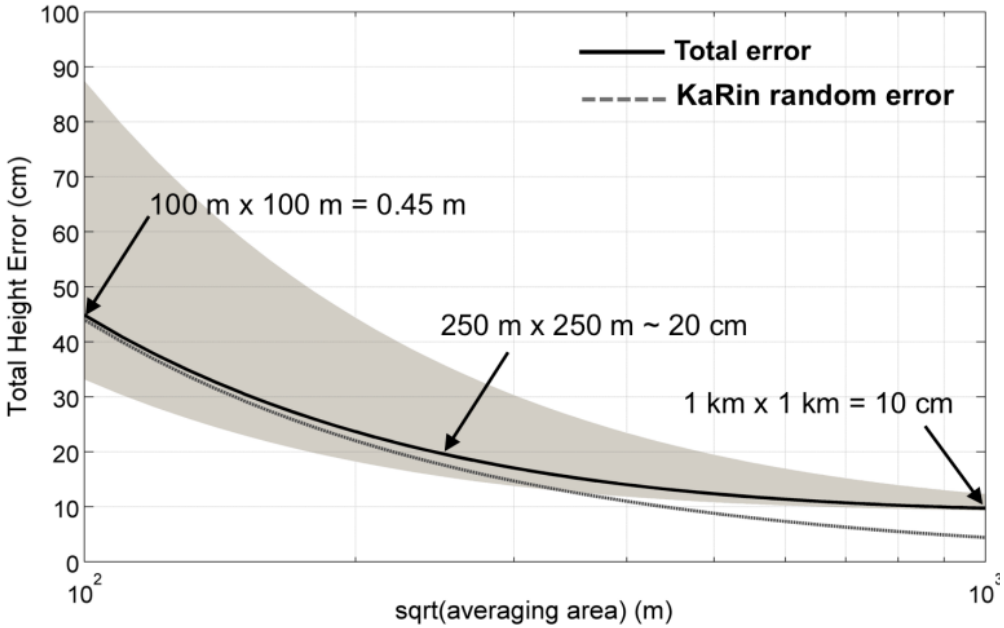
SWOT en bref

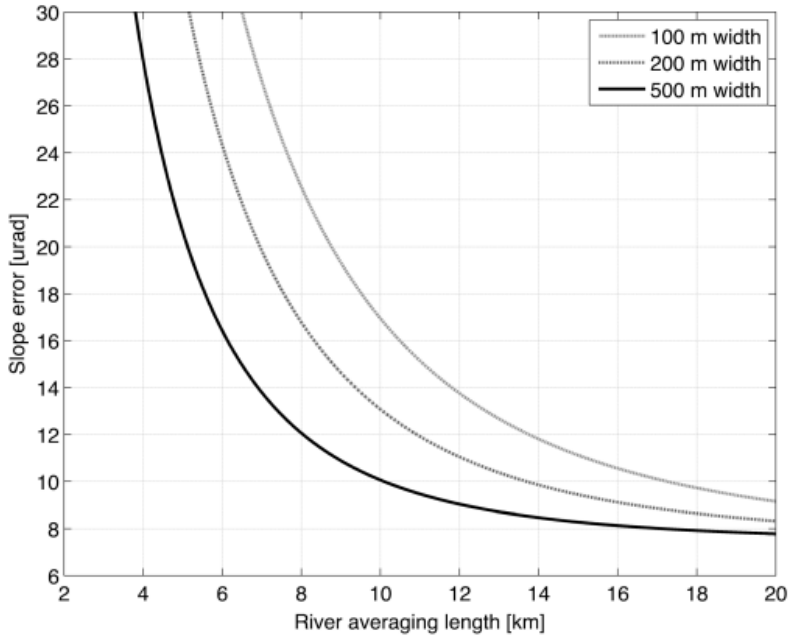
REQUIS SWOT

- La précision vertical des mesures de l'**élévation** de la surface de l'eau doit être (1) **10 cm** (1σ) ou mieux, pour les plans d'eau dont la surface non végétalisée dépasse **1 km²** and (2) **25 cm** ou mieux, pour les plans d'eau dont la surface non végétalisée est comprise entre (**250m x 250 m**) et 1 km²
- Les **superficies** estimées doivent présenter une erreur relative inférieure à **15** % (1σ) de la surface totale du plan d'eau pour les plans d'eau dont la surface non végétalisée dépasse **(250m x 250 m)** ou les tronçons de **rivière dont la largeur dépasse 100 m en moyenne et la longueur plus de 10 km**.
- Les **pentes des rivières** d'une largeur supérieure à 100 m doivent être mesurées avec une précision de 17 µrad **(1,7 cm/km)** après une moyenne ne dépassant pas 10 km en aval de la rivière.



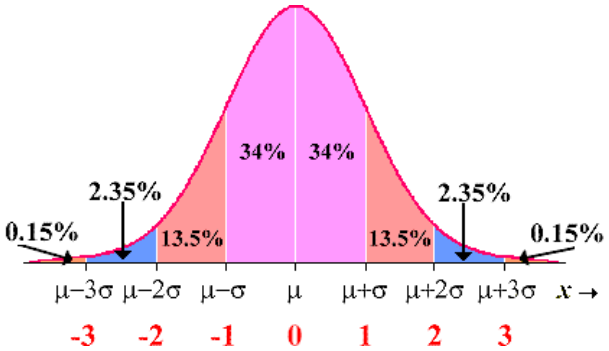
REQUIS SWOT HR

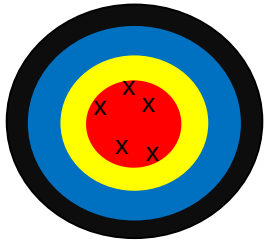




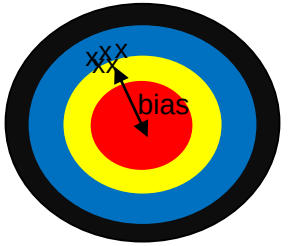
REQUIS SWOT HR

- Que veut dire 1σ ?

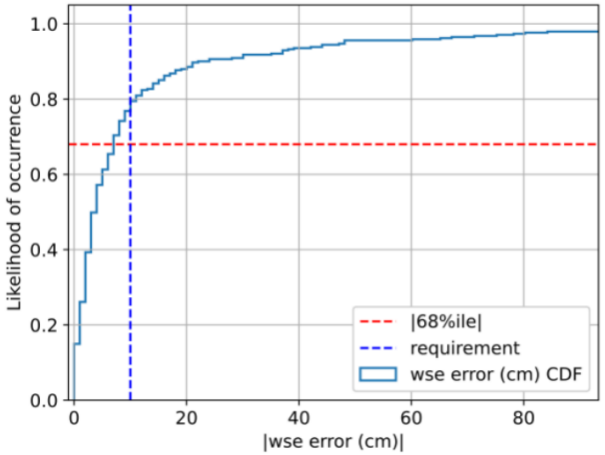




Exact mais non précis

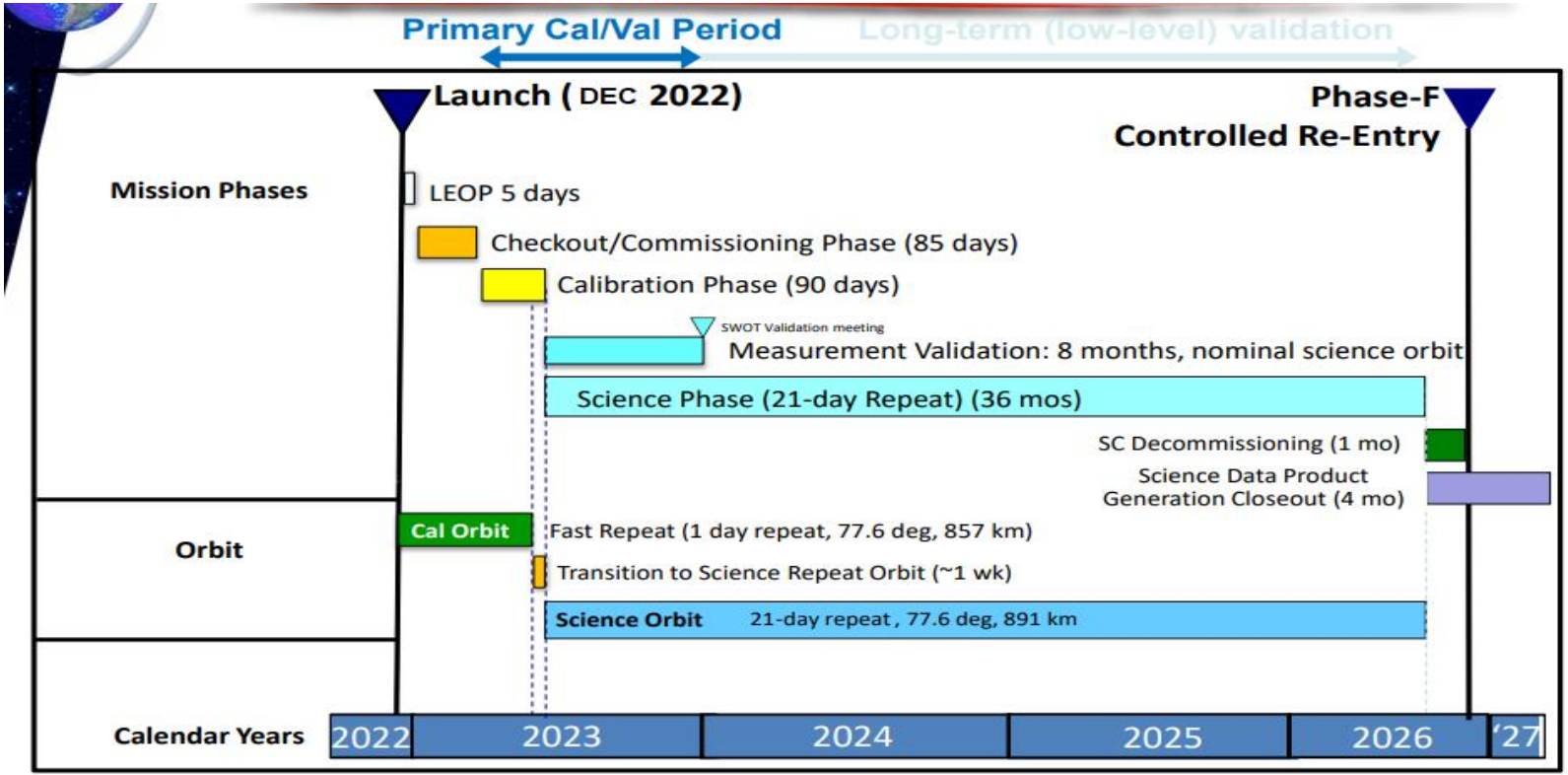


Précis mais non exacte



- Pour une gaussienne, 68% se situent à l'intérieur d'un écart-type (1σ)

SWOT dans le temps



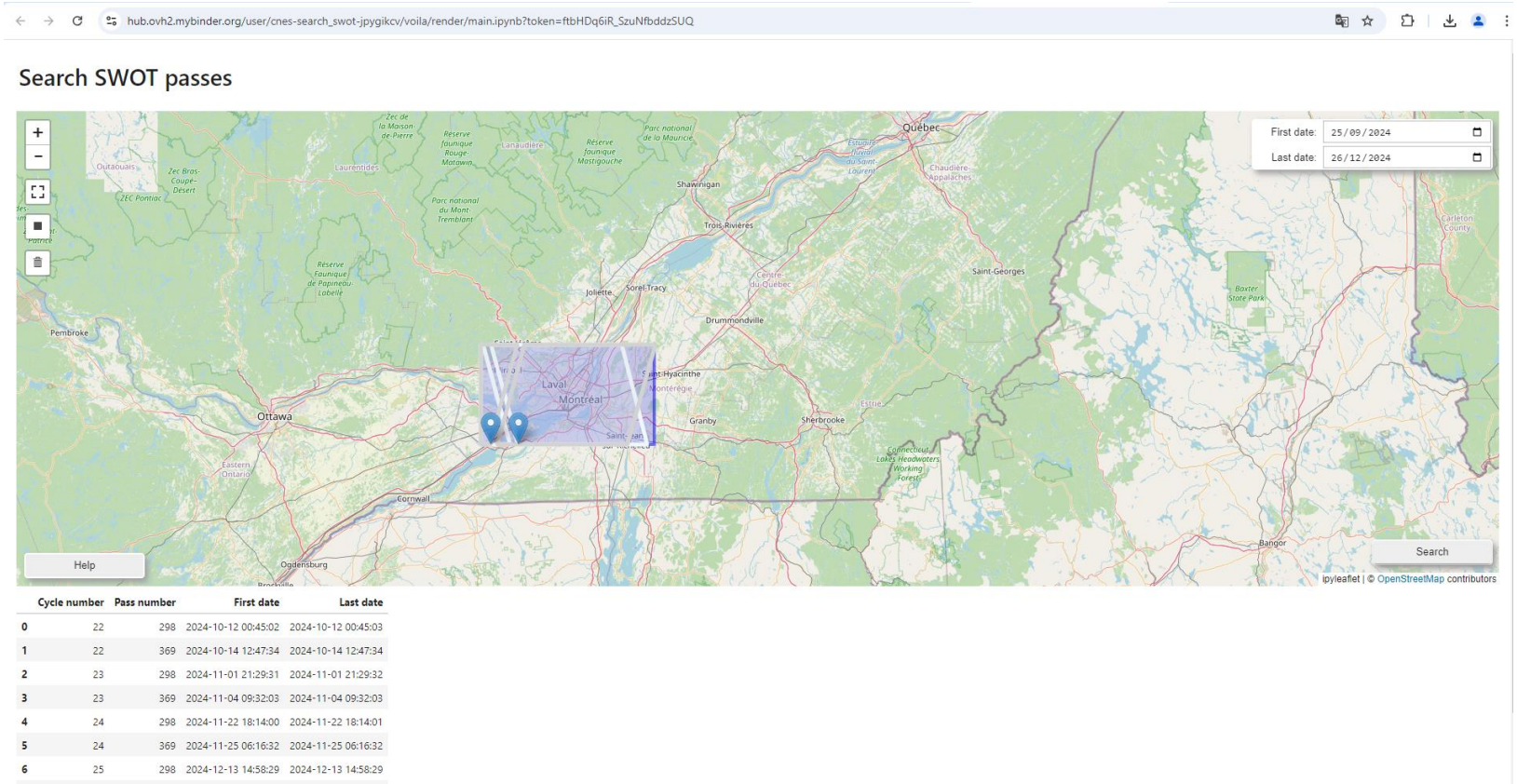
SWOT dans le temps

Actuellement Version C :
PGC0 : *Reprocessing* des données (CAL/VAL et Science)
PIC0 : *Forward*, Traitement dans les jours suivants l'acquisition
PIC2 : *Forward*, Depuis le 16 octobre 2024
PID0 : *Forward*, Depuis le 6 mai 2025

Reprocessing global (PGD0) en route, mais peu prendre un an.

Allez voir les enjeux connus dans les *Products Release Note*
https://podaac.jpl.nasa.gov/SWOT?tab=datasets-information&sections=about

SWOT dans le temps

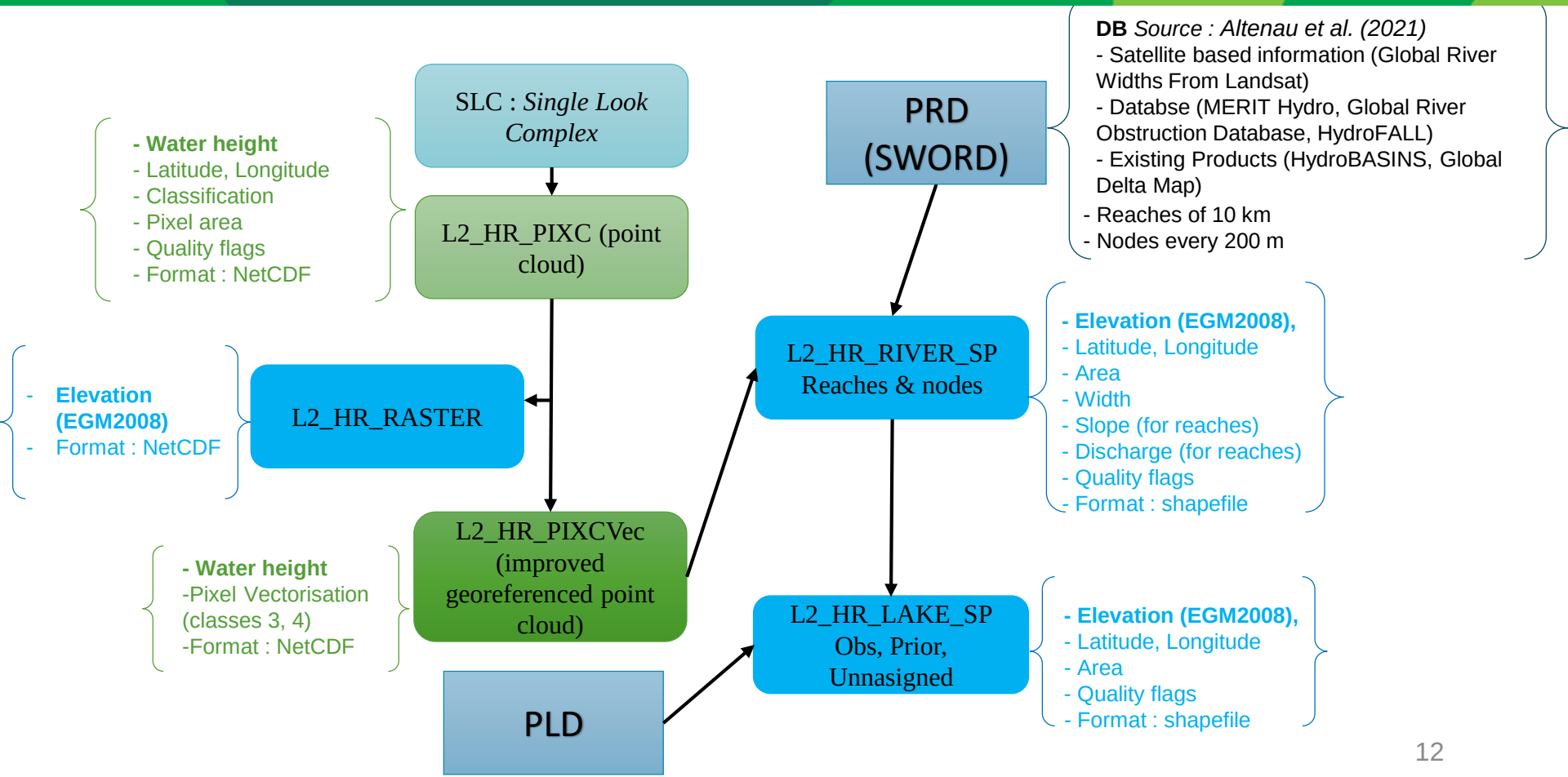


	Cycle number	Pass number	First date	Last date
0	22	298	2024-10-12 00:45:02	2024-10-12 00:45:03
1	22	369	2024-10-14 12:47:34	2024-10-14 12:47:34
2	23	298	2024-11-01 21:29:31	2024-11-01 21:29:32
3	23	369	2024-11-04 09:32:03	2024-11-04 09:32:03
4	24	298	2024-11-22 18:14:00	2024-11-22 18:14:01
5	24	369	2024-11-25 06:16:32	2024-11-25 06:16:32
6	25	298	2024-12-13 14:58:29	2024-12-13 14:58:29

https://swot.jpl.nasa.gov/mission/swath-visualizer/

B) PRESENTATION DES PRODUITS SWOT

PRODUITS SWOT HR



Type de fichiers

PRD (SWORD)

http://gaia.geosci.unc.edu/SWORD/

Altenau, E. H., Pavelsky, T. M., Durand, M. T., Yang, X., Frasson, R. P. D. M., & Bendezu, L. (2021). The Surface Water and Ocean Topography (SWOT) Mission River Database (SWORD): A global river network for satellite data products. *Water Resources Research*, https://doi.org/10.1029/2021WR030054

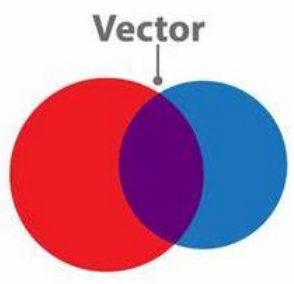
PLD

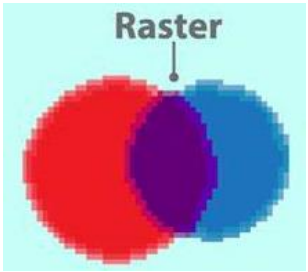
https://hydroweb.next.theia-land.fr/

Wang, J., Pottier, C., Cazals, C., Battude, M., Sheng, Y., Song, C., ... & Pavelsky, T. M. (2025). The Surface Water and Ocean Topography Mission (SWOT) Prior Lake Database (PLD): Lake Mask and Operational Auxiliaries. *Water Resources Research*, https://doi.org/10.1029/2023WR036896

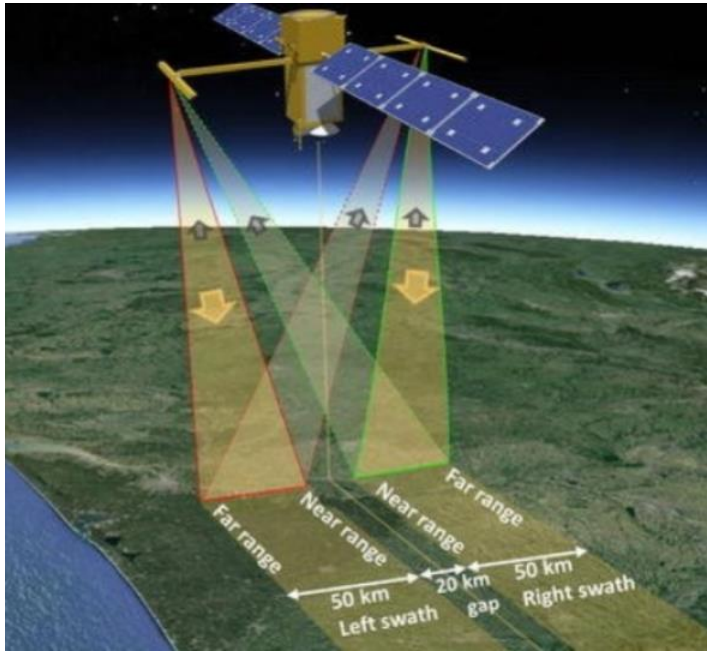
Type de fichiers

	Vector	Raster
Shape	Points, Lines & Polygons	Pixel
Format	NetCDF4 (.nc), Shapefile (.shp)	NetCDF4 (.nc)
Files	L2_HR_PIXC L1B_HR_SLC L2_HR_LakeSP L2_HR_RiverSP	L2_HR_Raster





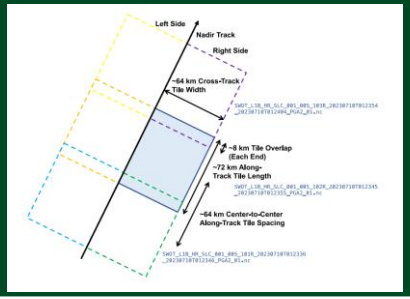
Découpage des fichiers

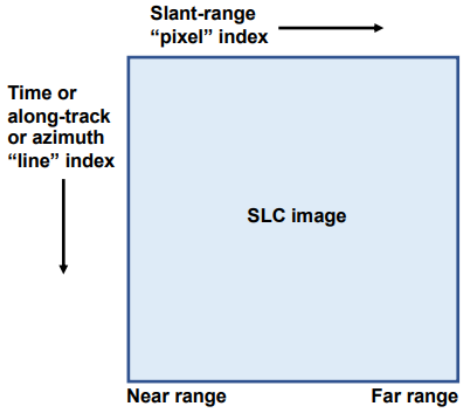


- **Pass** (1 to 584) - SWOT suit la même trajectoire tous les 21 jours, au cours de 292 orbites autour de la Terre. Chaque orbite comprend une partie ascendante (vol vers le nord) et une partie descendante (vol vers le sud), ou « passage ».
- **Swath** - zone terrestre couverte par l'instrument KaRIn
- **Tile** – chaque passage est divisé en tuile de 64x64 km^2, un à gauche et un à droite. Il n'y a pas de données utilisables dans l'intervalle de 20 km du nadir et au-delà de 64 km du nadir
- **Scene** – Tuiles gauche et droite ensembles 128x128 km^2

https://github.com/sfoucher/SWOT-Canada/tree/main/Data

L1B_HR_SLC

	SLC
File Name	SWOT_L1B_HR_SLC_<Cycle>_<Pass>_<Tile>[L/R]_<Beginning DateTime>_<EndingDateTime>_<CRID>_<ProductCounter>.nc
Format	NetCDF4 (.nc)
Time	UTC
Latency from data collection	At most 45 days
File organization	One NetCDF file with 5 groups : slc, xfactor, noise, tvp, grdem
Included informations 	• Wavelength • Polarization • slc_plus_y, slc_minus_y • xfactor_plus_y, xfactor_minus_y • noise_plus_y, noise_minus_y • roll, pitch, yaw, velocity_heading • height • Quality flags (ice, …)

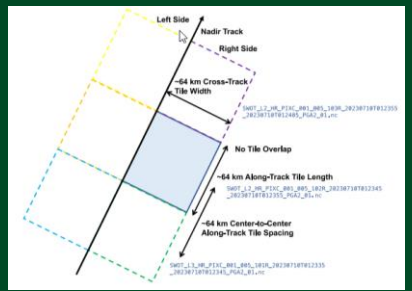


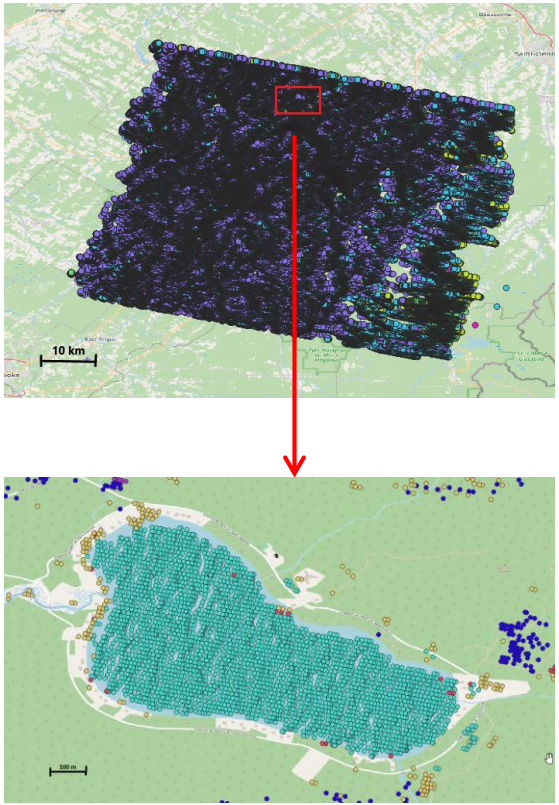
L1B_HR_SLC

Bit (from LSB)	Decimal	Hex	slc_qual	sc_event_flag	tvp_qual
0	1	1	tvp_suspect	yaw_flip_maneuver	good
1	2	2	sc_event_suspect	gyro_calibration_maneuver	
2	4	4	small_karin_gap	orbit_control_maneuver	
3	8	8		solar_array_rotation	
4	16	10		eclipse_entry	orbit_estimated_during_a_maneuver
5	32	20	tvp_bad	eclipse_exit	orbit_interpolated_over_data_gap
6	64	40	sc_event_bad	karin_bad_due_to_eclipse_event	orbit_extrapolated_for_a_duration_less_than_1_day
7	128	80	large_karin_gap	karin_bad_due_to_non_eclipse_ev	orbit_extrapolated_for_a_duration_between_1_to_2_days
8	256	100			orbit_extrapolated_for_a_duration_greater_than_2_days
9	512	200			
10	1024	400			attitude_suspect
11	2048	800			
12	4096	1000			
13	8192	2000			
14	16384	4000			attitude_suspect_and_orbit_estimated_during_a_maneuver
15	32768	8000			attitude_suspect_and_orbit_interpolated_over_data_gap
16	65536	10000			attitude_suspect_and_orbit_extrapolated_for_a_duration_less_than_1_day
17	131072	20000			attitude_suspect_and_orbit_extrapolated_for_a_duration_between_1_to_2_days
18	262144	40000			attitude_suspect_and_orbit_extrapolated_for_a_duration_greater_than_2_days
19	524288	80000			
20	1048576	100000			attitude_bad
21	2097152	200000			
22	4194304	400000			
23	8388608	800000			
24	16777216	1000000			attitude_bad_and_orbit_estimated_during_a_maneuver
25	33554432	2000000			attitude_bad_and_orbit_interpolated_over_data_gap
26	67108864	4000000			attitude_bad_and_orbit_extrapolated_for_a_duration_less_than_1_day
27	134217728	8000000			attitude_bad_and_orbit_extrapolated_for_a_duration_between_1_to_2_days
28	268435456	10000000			attitude_bad_and_orbit_extrapolated_for_a_duration_greater_than_2_days

Additionnal data : quality flags

L2_HR_PIXC

	PIXC
File Name	SWOT_L2_HR_PIXC_<Cycle>_<Pass>_<Tile>[L/R]_<BeginningDateTime>_<EndingDateTime>_<CRID>_<ProductCounter>.nc
Format	NetCDF4 (.nc)
Time	UTC
Latency from data collection	At most 45 days
File organization	3 groups of data in one file : **pixel_cloud**, tvp, and noise
Pixel_cloud informations 	• Classification (land land_near_water water_near_land open_water dark_water low_coh_water_near_land open_low_coh_wate) • Height • water_area • water_frac • Quality flags (ice, dark_fraction…) • Sig0 (radar backscatter) • cross_track (signed distance to the nadir) • Inc (Incidence angle

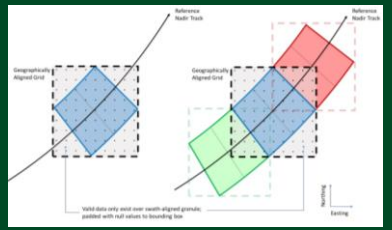


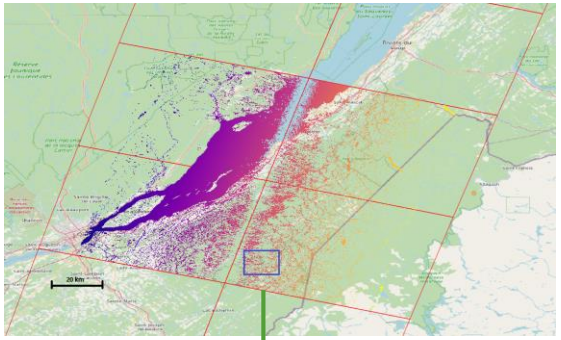
L2_HR_PIXC

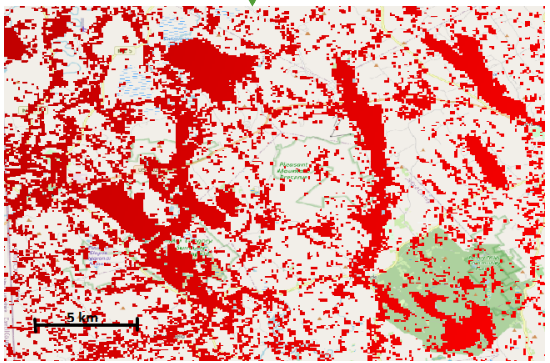
Bit (from LSB)	Decimal	Hex	interferogram_qual	classification_qual	geolocation_qual	sig0_qual	pixc_line_qual
0	1	1		no_coherent_gain	layover_significant	sig0_uncert_suspect	not_in_tile
1	2	2		power_close_to_noise_floor	phase_noise_suspect	sig0_cor_atmos_suspect	
2	4	4		detected_water_but_no_prior_water	phase_unwrapping_suspect	noise_power_suspect	
3	8	8		detected_water_but_bright_land	model_dry_tropo_cor_suspect	xfactor_suspect	
4	16	10		water_false_detection_rate_suspect	model_wet_tropo_cor_suspect		
5	32	20			iono_cor_gim_ka_suspect		
6	64	40			xovercal_suspect		
7	128	80					
8	256	100					
9	512	200					
10	1024	400					
11	2048	800	rare_power_suspect	coherent_power_suspect		rare_power_suspect	
12	4096	1000	rare_phase_suspect		medium_phase_suspect		
13	8192	2000	tvp_suspect	tvp_suspect	tvp_suspect	tvp_suspect	tvp_suspect
14	16384	4000	sc_event_suspect	sc_event_suspect	sc_event_suspect	sc_event_suspect	sc_event_suspect
15	32768	8000	small_karin_gap	small_karin_gap	small_karin_gap	small_karin_gap	small_karin_gap
16	65536	10000					
17	131072	20000					
18	262144	40000	in_air_pixel_degraded	in_air_pixel_degraded		in_air_pixel_degraded	
19	524288	80000	specular_ringing_degraded	specular_ringing_degraded	specular_ringing_degraded	specular_ringing_degraded	
20	1048576	100000			model_dry_tropo_cor_missing	sig0_cor_atmos_missing	
21	2097152	200000			model_wet_tropo_cor_missing		
22	4194304	400000			iono_cor_gim_ka_missing		
23	8388608	800000			xovercal_missing		
24	16777216	1000000			geolocation_is_from_refloc		
25	33554432	2000000				noise_power_bad	
26	67108864	4000000				xfactor_bad	
27	134217728	8000000	rare_power_bad	coherent_power_bad	no_geolocation_bad	rare_power_bad	
28	268435456	10000000	rare_phase_bad		medium_phase_bad		
29	536870912	20000000	tvp_bad	tvp_bad	tvp_bad	tvp_bad	tvp_bad
30	1073741824	40000000	sc_event_bad	sc_event_bad	sc_event_bad	sc_event_bad	sc_event_bad
31	2147483648	80000000	large_karin_gap	large_karin_gap	large_karin_gap	large_karin_gap	large_karin_gap

Additionnal data : quality flags

L2_HR_Raster

	Raster
File Name	SWOT_L2_HR_Raster_<DescriptorString>_<Cycle>_<Pass>_<Scene>_<BeginningDateTime>_<EndingDateTime>_<CRID>_<ProductCounter>.nc
Format	NetCDF4 (.nc)
Time	UTC
Latency from data collection	At most 45 days
File organization	One NetCDF file with 1 group containing both an UTM and geodetic lat-lon grids
Included informations 	• Wse (water surface elevation) • water_area • water_frac • Quality flags (ice, dark_fraction…) • Sig0 (radar backscatter) • cross_track (signed distance to the nadir) • Inc (Incidence angle)



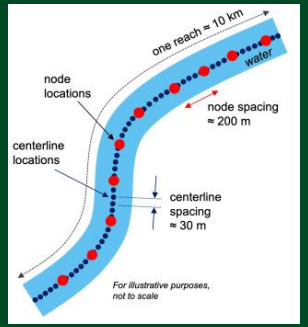


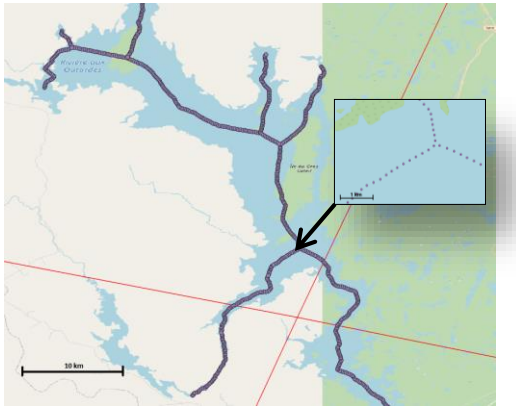
L2_HR_Raster

Bit (from LSB)	Decimal	Hex	wse_qual_bitwise	water_area_qual_bitwise	sig0_qual_bitwise
0	1	1			sig0_qual_suspect
1	2	2	classification_qual_suspect	classification_qual_suspect	classification_qual_suspect
2	4	4	geolocation_qual_suspect	geolocation_qual_suspect	geolocation_qual_suspect
3	8	8		water_fraction_suspect	
4	16	10			
5	32	20	large_uncert_suspect	large_uncert_suspect	large_uncert_suspect
6	64	40			
7	128	80	bright_land	bright_land	bright_land
8	256	100		low_coherence_water_suspect	low_coherence_water_suspect
9	512	200			
10	1024	400			
11	2048	800			
12	4096	1000	few_pixels	few_pixels	few_pixels
13	8192	2000	far_range_suspect	far_range_suspect	far_range_suspect
14	16384	4000	near_range_suspect	near_range_suspect	near_range_suspect
15	32768	8000			
16	65536	10000			
17	131072	20000			sig0_qual_degraded
18	262144	40000	classification_qual_degraded	classification_qual_degraded	classification_qual_degraded
19	524288	80000	geolocation_qual_degraded	geolocation_qual_degraded	geolocation_qual_degraded
20	1048576	100000			
21	2097152	200000	low_coherence_water_degraded		
22	4194304	400000			
23	8388608	800000			
24	16777216	1000000	value_bad	value_bad	value_bad
25	33554432	2000000			
26	67108864	4000000			
27	134217728	8000000			
28	268435456	10000000	no_pixels	no_pixels	no_pixels
29	536870912	20000000	outside_scene_bounds	outside_scene_bounds	outside_scene_bounds
30	1073741824	40000000	inner_swath	inner_swath	inner_swath
31	2147483648	80000000	missing_karin_data	missing_karin_data	missing_karin_data

Additionnal data : quality flags

L2_HR_RiverSP

	RiverSP
File Name	SWOT_L2_HR_RiverSP_<FileIdentifier>_<Cycle>_<Pass>_<Continent>_<BeginningDateTime>_<EndingDateTime>_<CRID>_<ProductCounter>.<extension>
Format	Shapefile (.shp) (and other extensions : .shx, .dbf, .prj, or .shp.xml)
Time	UTC
Latency from data collection	At most 45 days
File organization	2 Shapefiles (and their associated extensions) : Reach , Node
Included informations 	• Ids (lake, obs, reservoir, name, …) • Wse (water surface elevation) • Area_total • Width • Slope • xtrk_dist (distance to the nadir track) • Water_frac • Quality flags (ice, …) • geoid_hght (height for the geoid model EGM2008) • …



Node : points

Reach : lines

L2_HR_RiverSP

Prefix and suffix meaning :

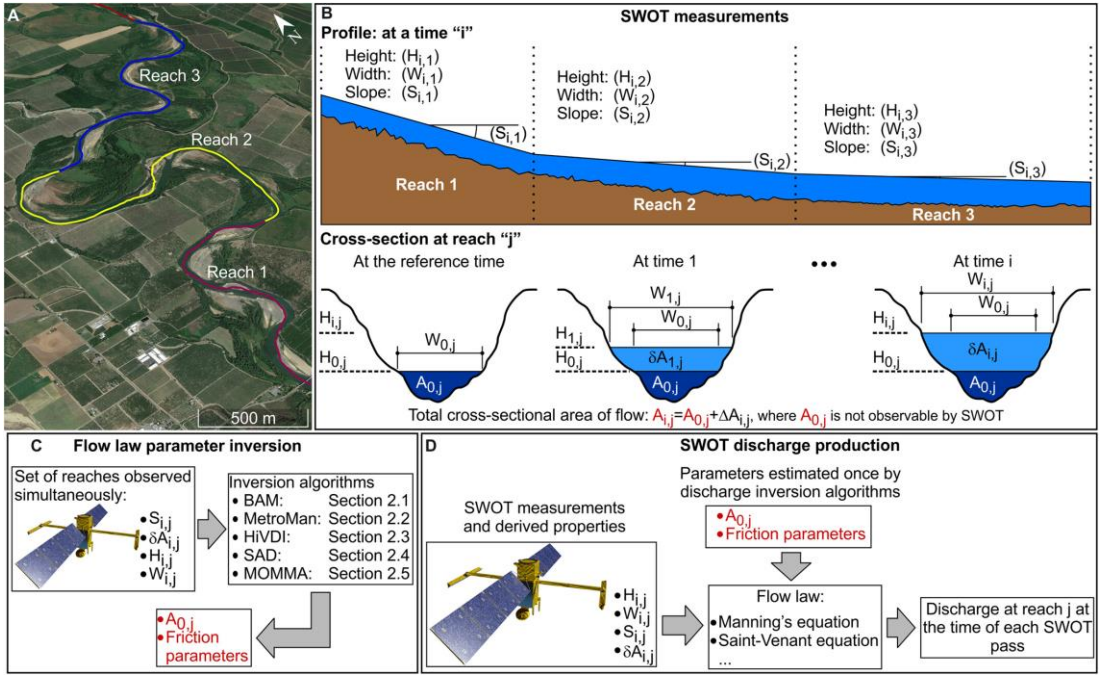
- **p_** : information taken from the PLD
- **_c** : correction
- **_f** : flag
- **_q** : quality flag
- **_u** : uncertainty (1sigma or 68th-percentile uncertainty estimates)

Bit (from LSB)	Decimal	Hex	dschg_q_b / dschg_gq_b	reach_q	node_q	p_low_slp	ice_clim_f	ice_dyn_f	partial_f	xovr_cal_q
0	1	1	reach_qual_suspect	good	good	low_slope_false	no_ice_cover	no_ice_cover	covered	good
1	2	2	big_slope_unc	suspect	suspect	low_slope_true	uncertain_ice_cover	partial_ice_cover	partially_covered	suspect
2	4	4		degraded	degraded		full_ice_cover	full_ice_cover		bad
3	8	8	metro_dxa_bad	bad	bad					
4	16	10	bam_dxa_bad							
5	32	20	hivdi_dxa_bad							
6	64	40	momma_b_gt_momma_h							
7	128	80	sads_dxa_bad							
8	256	100	sic4dvar_dxa_BAD							
9	512	200								
10	1024	400								
11	2048	800	incomplete_consensus							
12	4096	1000								
13	8192	2000								
14	16384	4000								
15	32768	8000								
16	65536	10000								
17	131072	20000								
18	262144	40000	reach_qual_degraded							
19	524288	80000								
20	1048576	100000								
21	2097152	200000								
22	4194304	400000	reach_qual_bad							
23	8388608	800000	no_discharge_outputs							
24	16777216	1000000	negative_slope							
25	33554432	2000000								
26	67108864	4000000								
27	134217728	8000000								
28	268435456	10000000								

Additionnal data : quality flags

L2_HR_RiverSP

Le produit L2_HR_RiverSP comprend des estimations de débits provenant de plusieurs algorithmes et une valeur consensus calculée avec tous les algorithmes.

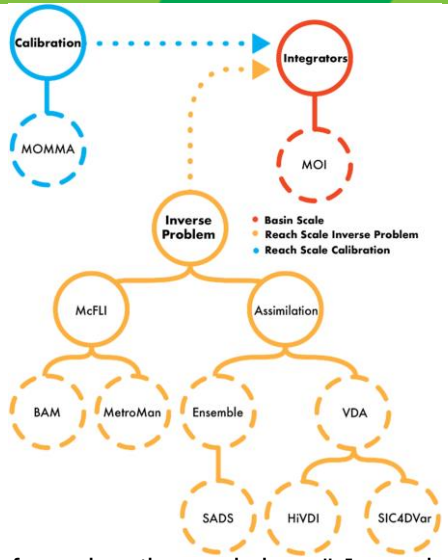


Frasson et al. (2021). Exploring the factors controlling the error characteristics of the Surface Water and Ocean Topography mission discharge estimates. *Water Resources Research*, https://doi.org/10.1029/2020WR028519

L2_HR_RiverSP

Algorithmes :

1. Metropolis-Manning (MetroMan) [1]
2. Bayesian AMHG-Manning (BAM) [2]
3. Hierarchical Variational Discharge Inference (HiVDI) [3]
4. Modified Manning Method Algorithm (MOMMA) [4]
5. SWOT Assimilated DiScharge (SADS) [5]
6. SIC 4D Var [6]



[1] Durand et al. "Estimating reachaveraged discharge for the River Severn from measurements of river water surface elevation and slope," Journal of Hydrology, 2014, https://doi.org/10.1016/j.jhydrol.2013.12.050

[2] Hagemann et al., "BAM: Bayesian AMHG-Manning Inference of Discharge Using Remotely Sensed Stream Width, Slope, and Height," Water Resources Research, 2017, https://doi.org/10.1002/2017WR021626

[3] Garambois et al., "Variational estimation of effective channel and ungauged anabranching river discharge from multi-satellite water heights of different spatial sparsity," Journal of Hydrology, 2020, https://doi.org/10.1016/j.jhydrol.2019.124409

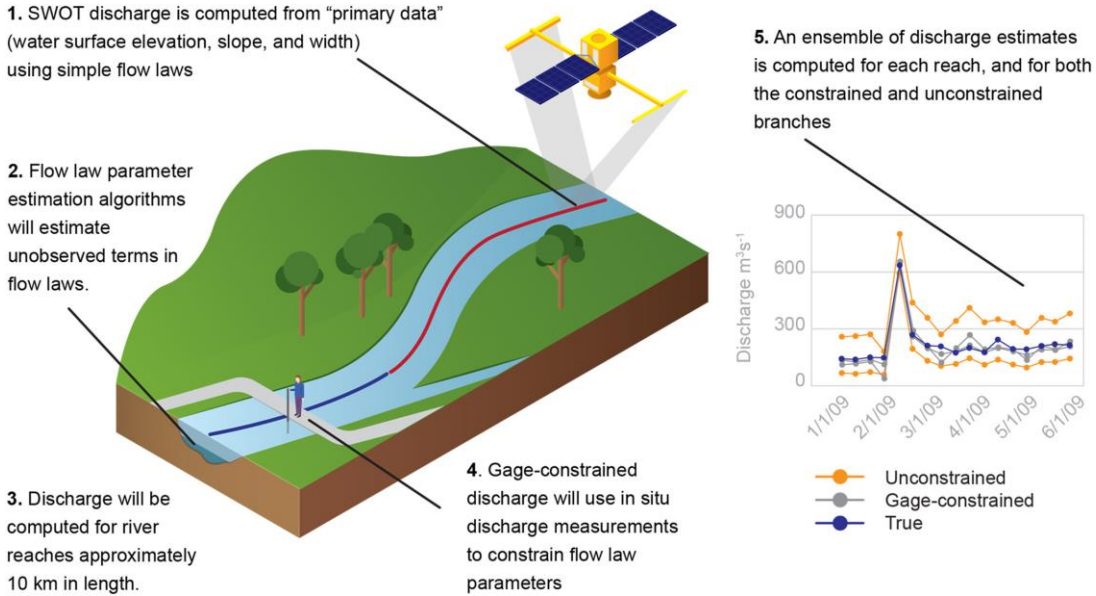
[4] Bjerklie et al., "Satellite Remote Sensing Estimation of River Discharge: Application to the Yukon River Alaska," Journal of Hydrology, 2018, https://doi.org/10.1016/j.jhydrol.2018.04.005

[5] Andreadis et al., "Constraining the assimilation of SWOT observations with hydraulic geometry relations," Water Resources Research, 2020, https://doi.org/10.1029/2019WR026611

[6] Oubanas et al., "Discharge Estimation in Ungauged Basins Through Variational Data Assimilation: The Potential of the SWOT Mission," Water Resources Research, 2018; https://doi.org/10.1002/2017wr021735

L2_HR_RiverSP

Chacun de ces algorithmes est exécuté avec deux ensembles différents de paramètres (de la PRD), qui intègrent et n'intègrent pas les contraintes des informations historiques des jauges de débit externes, respectivement

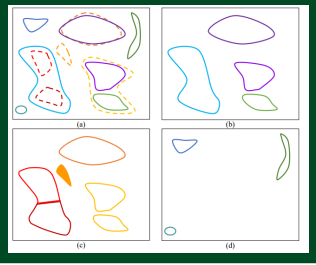


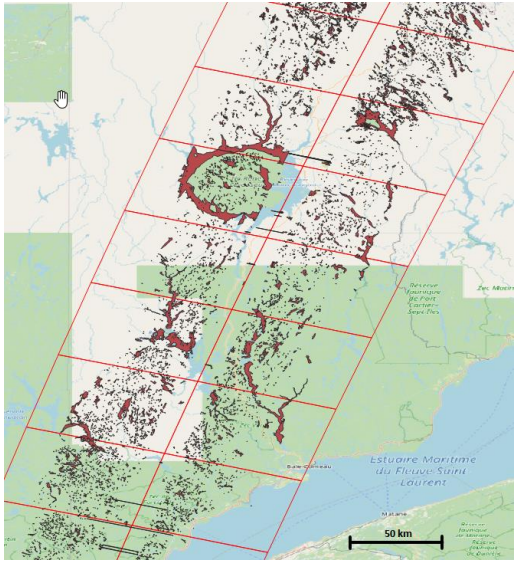
Durand et al. (2023). A framework for estimating global river discharge from the surface water and ocean topography satellite mission. Water Resources Research, https://doi.org/10.1029/2021WR031614

L2_HR_RiverSP

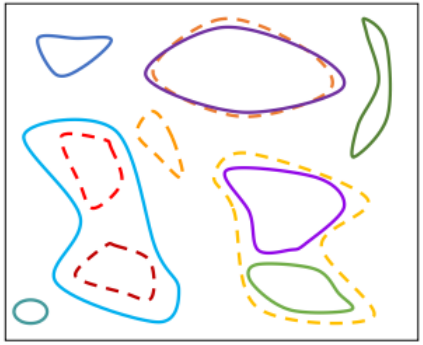
“Note that discharge estimates are not provided in the PID0 and PGD0 products. They will be provided after the reprocessing of Version D products is complete. The reprocessed Version D products will be used to compute discharge parameters that are consistent with the Version D products.”

L2_HR_LakeSP

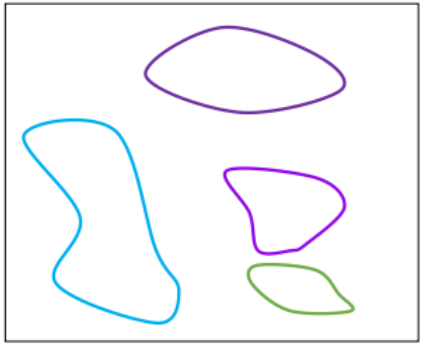
	LakeSP
File Name	SWOT_L2_HR_LakeSP_<FileIdentifier>_<Cycle>_<Pass>_<Continent>_<BeginningDateTime>_<EndingDateTime>_<CRID>_<ProductCounter>.<extension>
Format	Shapefile (.shp) (and other extensions : .shx, .dbf, .prj, or .shp.xml)
Time	UTC
Latency from data collection	At most 45 days
File organization	3 Shapefiles (and their associated extensions) : Obs (observation-oriented lake shapefile), Prior (PLD-oriented lake shapefile), Unassigned (unassigned features)
Included informations 	• Ids (lake, obs, reservoir, name, …) • Wse (water surface elevation) • area_total • xtrk_dist (distance to the nadir track) • Water_frac • Quality flags (ice, …) • geoid_hght (height for the geoid model EGM2008) • …



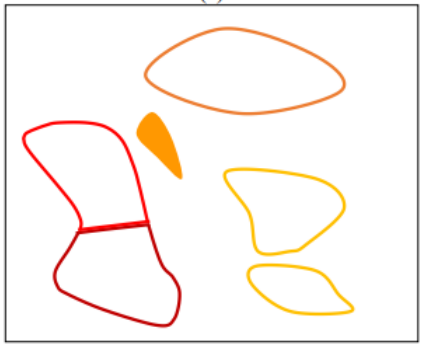
L2_HR_LakeSP



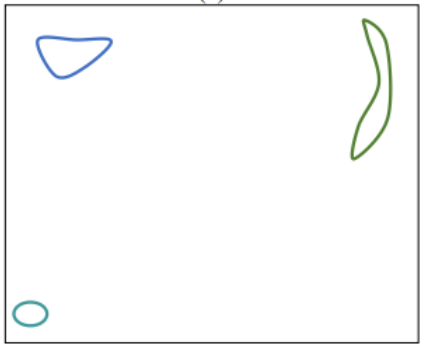
(a)



(b)

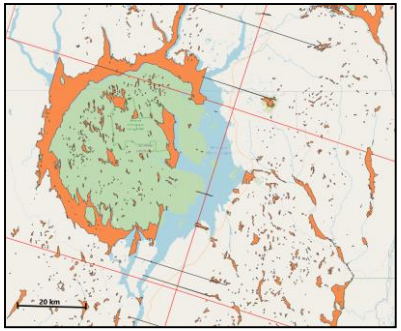


(c)

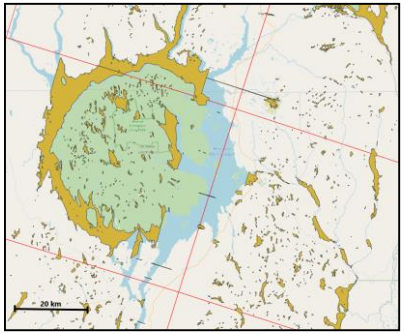


(d)

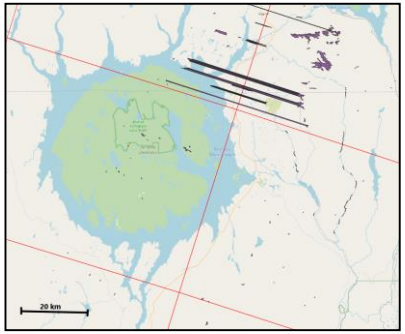
(a) All
(b) Obs
(c) Prior
(d) Unassigned



(b)



(c)



(d)

(a) All observed features (solid polygons) and PLD lakes (dashed polygons) in an area. Different colors = different observation ids or PLD ids.
(b) Polygons of the observation-oriented lake shapefile.
(c) Polygons of the PLD-oriented lake shapefile (where the unobserved PLD lake is an empty shape).
(d) Polygons of the observation-oriented unassigned features shapefile.

L2_HR_LakeSP

PIC2

Bit	Decimal	Hex	Flag meaning
0	1	1	classification_qual_suspect
1	2	2	geolocation_qual_suspect
2	4	4	
3	8	8	few_open_water_suspect
4	16	10	
5	32	20	wse_std_suspect
6	64	40	diff_from_pld_area_suspect
7	128	80	
8	256	100	xovr_cal_suspect
9	512	200	
10	1024	400	no_prior_suspect
11	2048	800	water_false_detection_rate_suspect
12	4096	1000	
13	8192	2000	
14	16384	4000	
15	32768	8000	classification_qual_degraded
16	65536	10000	geolocation_qual_degraded
17	131072	20000	
18	262144	40000	low_coh_degraded
19	524288	80000	specular_ringing_degraded
20	1048576	100000	
21	2097152	200000	
22	4194304	400000	
23	8388608	800000	low_coh_bad
24	16777216	1000000	xovr_cal_bad
25	33554432	2000000	
26	67108864	4000000	specular_ringing_bad
27	134217728	8000000	
28	268435456	10000000	

Prefix and suffix meaning :

- **p_** : information taken from the PLD
- **_c** : correction
- **_f** : flag
- **_q** : quality flag
- **_u** : uncertainty
- **_std** : standard deviation within the lake

PIC0

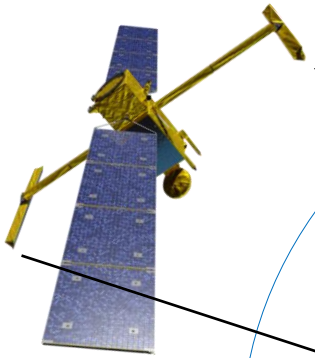
Bit (from LSB)	Decimal	Hex	Quality_f	ice_clim_f	ice_dyn_f	partial_f	xovr_cal_q
0	1	1	good	no_ice_cover	no_ice_cover	covered	good
1	2	2	bad	uncertain_ice_cover	partial_ice_cover	partially_covered	suspect
2	4	4		full_ice_cover	full_ice_cover		bad

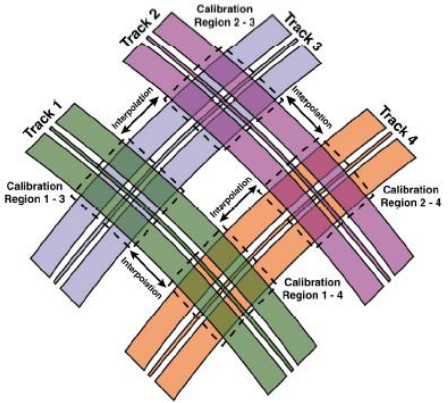
Additionnal data : quality flags

C) ENJEUX et OPPORTUNITÉS

SWOT ERROR BUDGET

→ **Satellite's position (*cross-over*)**



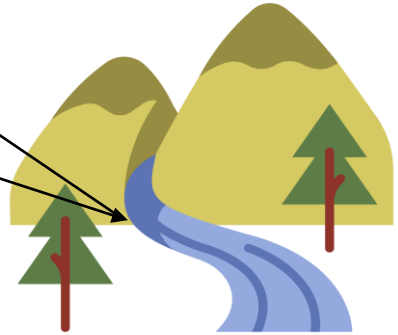


→ *Speckle*

Ionosphere

Troposphere

→ Ionosphere and troposphere



→ *Layover*

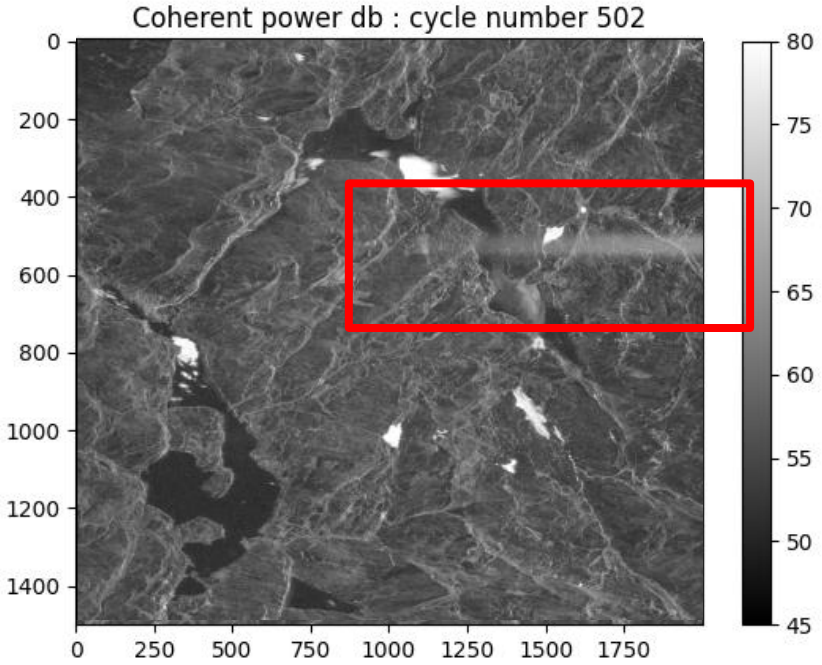
→ *Dark Water* : pas de retour de signal (faible vent ou atténuation)

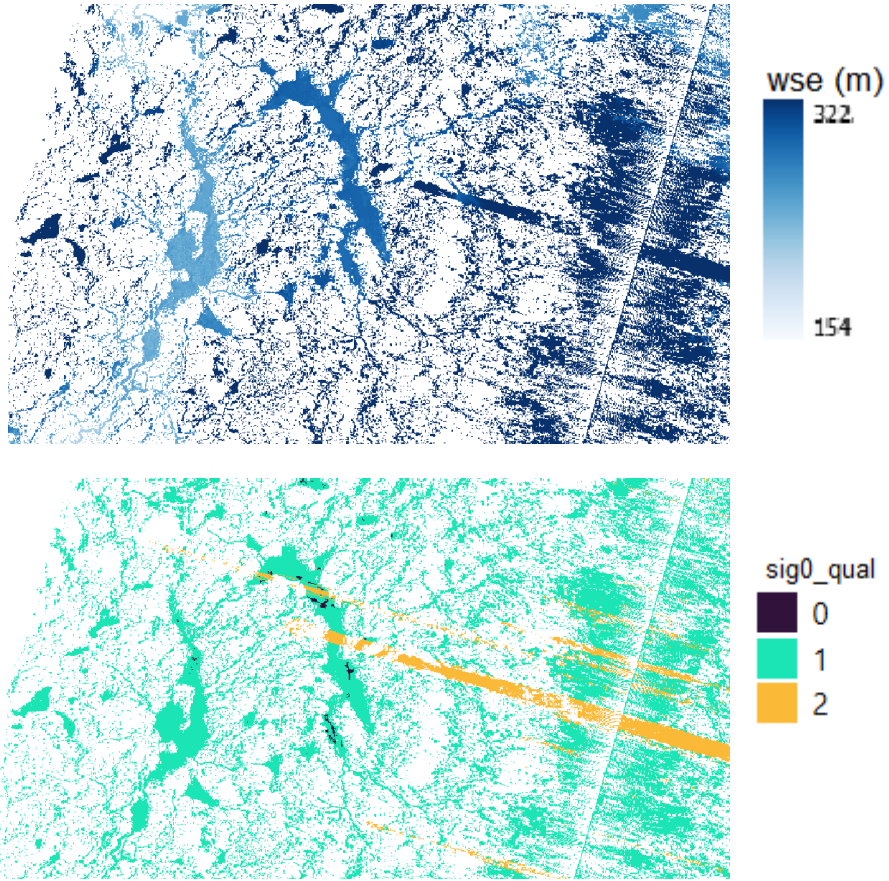
→ Classification

→ Geolocation

ENJEUX

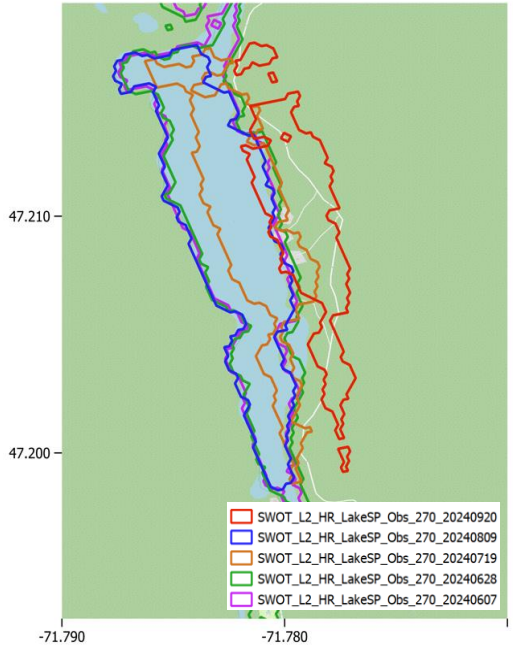
- Specular ringing





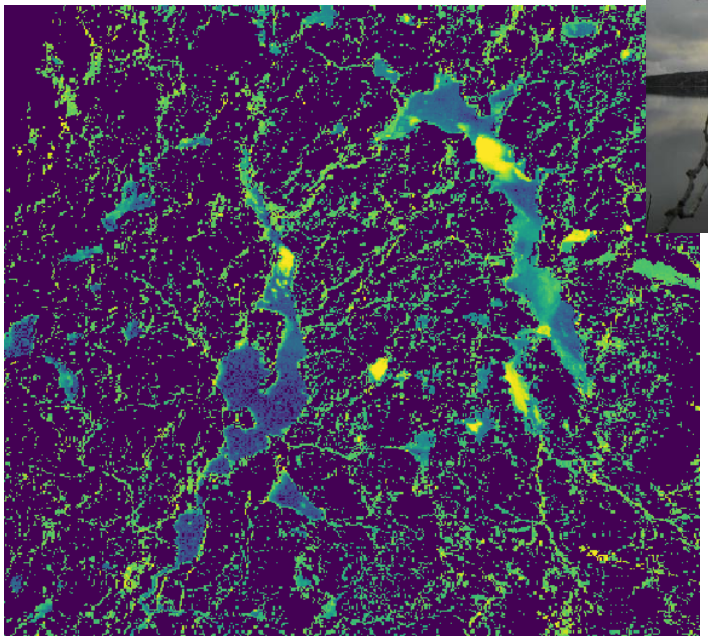
ENJEUX

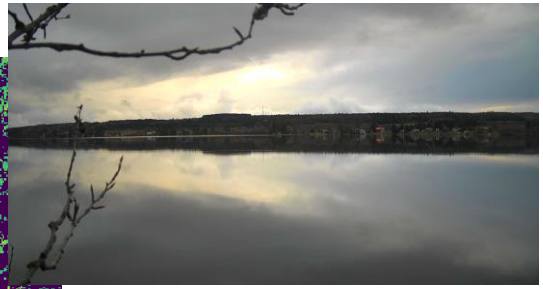
- Geolocalisation



ENJEUX

- Dark Water





Attention, la version PIC0 présente plusieurs enjeux pour les zones avec Dark Water – voir le Release Note

https://podaac.jpl.nasa.gov/SWOT?tab=datasets-information&sections=about

ENJEUX

- Bases de données a Priori (PLD)

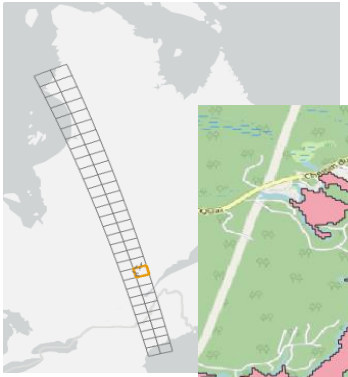
Témiscaming lake in PLD

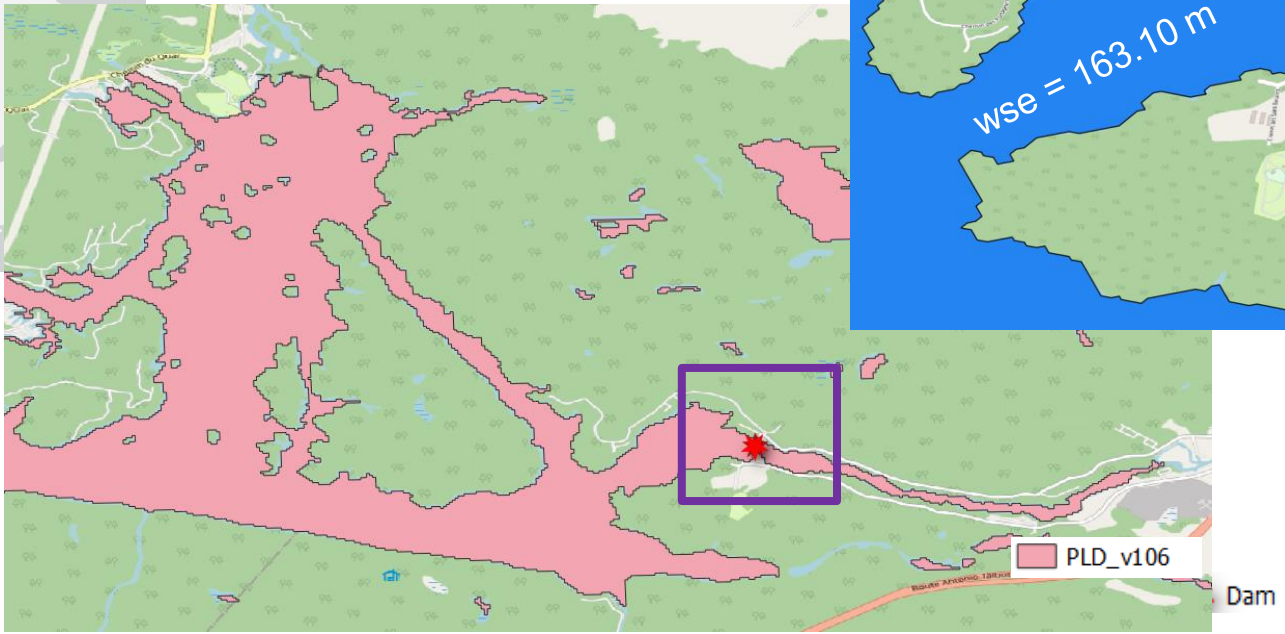
Modified Témiscaming lake

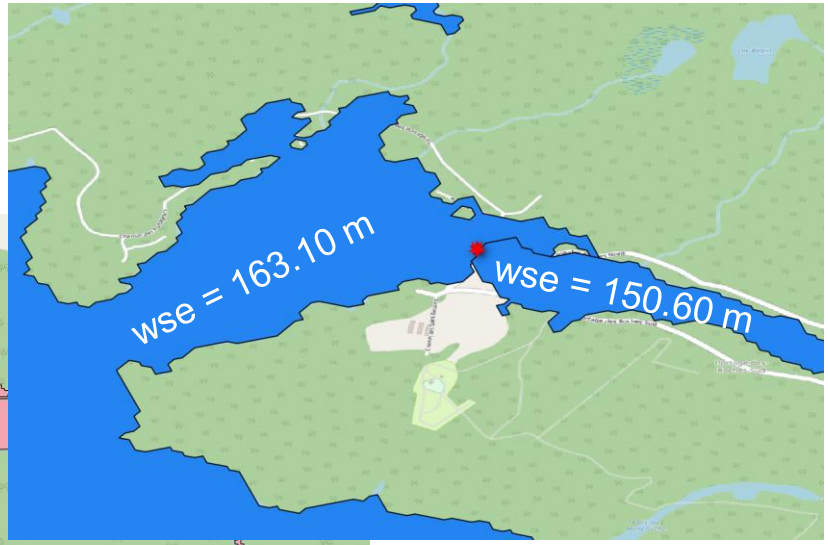
ENJEUX

- Bases de données a Priori (PLD)

Pass 548



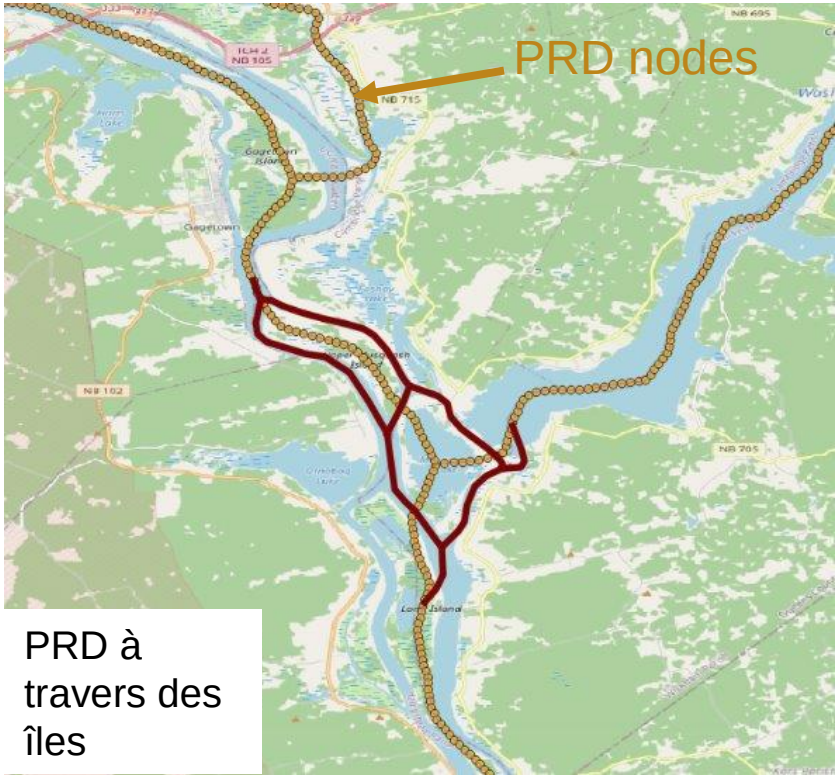




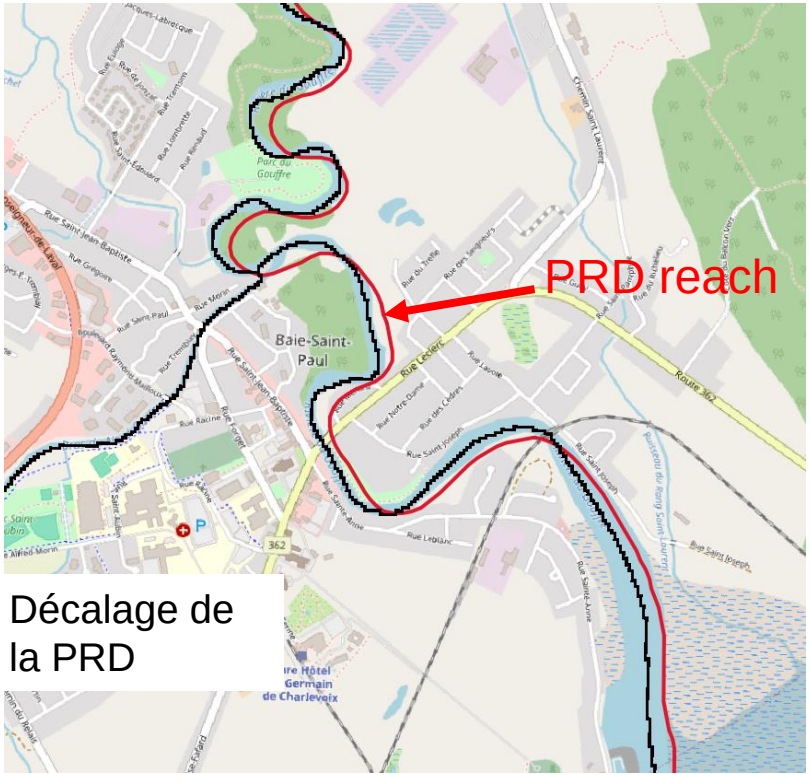
LakeSP_Obs

ENJEUX

- Bases de données a Priori (PRD, SWORD)



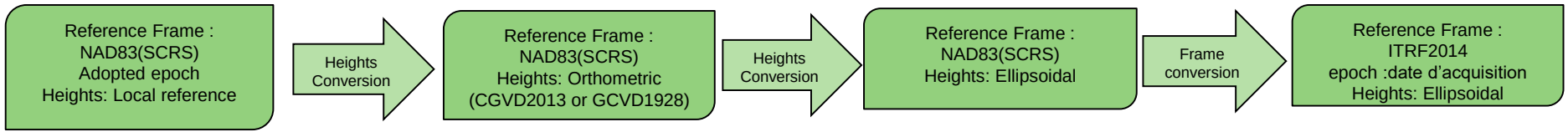
PRD à travers des îles



Décalage de la PRD

ENJEUX

- UTC vs local time
- Datum conversion:
  - WGS84 (ITRF 2014) vs NAD83(CSRS) (with TRX, https://webapp.csrs-scrs.nrcan-rncan.gc.ca/geod/tools-outils/trx.php)
  - EGM08 vs CGVD1928, CGVD2013 (with GPS-H, https://webapp.csrs-scrs.nrcan-rncan.gc.ca/geod/tools-outils/gpsh.php?locale=fr)



L'époque de SWOT est la date d'acquisition

ENJEUX

	Station (Québec)	Station (Canada)	SWOT
Datum	NAD83 SRCS	NAD83 SRCS	ITRF2024
Époque	1997	2010	Date d'acquisition (now)
Géoïde	CGVD1928 (HT2)	CGVD2013	EGM08
Marée	Tide-free	Tide-free	Mean-tide

SWOT définie l'altitude ellipsoïdale (h) comme height et l'altitudes orthométriques (géoïde, H) comme WSE. L'équation générale de conversion est :

$$H = h-N$$

Le champ geoid_hght des produits SWOT comprend une ondulation du géoïde $EGM08_{mt}$ (N). Ce géoïde est mean-tide, c'est-à-dire qu'il inclut la marée permanente. Il est donc possible de transformer le WSE_{SWOT} en height avec l'équation :

$$height_{SWOT} = WSE_{SWOT} + geoid\_hght$$

Le height ainsi obtenu est tide-free puisque le geoid_hght inclut la correction de marée permanente. Si un géoïde EMG08 est utilisé par exemple de GPS-H, il sera tide-free et il faut donc également tenir compte de la marée permanente.

Il faut ensuite convertir le $height_{SWOT}$ vers le h de la station, soit de $h_{ITRF2014\_now}$ vers $h_{NAD83SCRS\_1997}$. Cette conversion se fait à partir de TRX ou du code python csrspy.

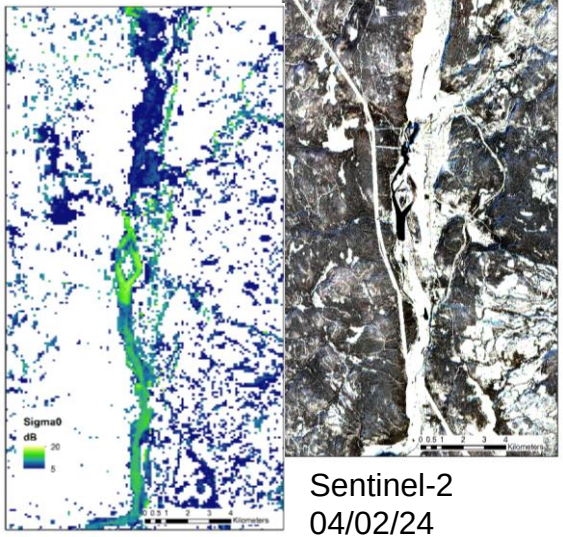
Enfin, on enlève le géoïde de la station, ici CGVD1928 (HT2_1997).

$$H_{station} = h_{NAD83SCRS\_1997} - N_{CGVD1928}$$

ENJEUX/OPPORTINUTÉ

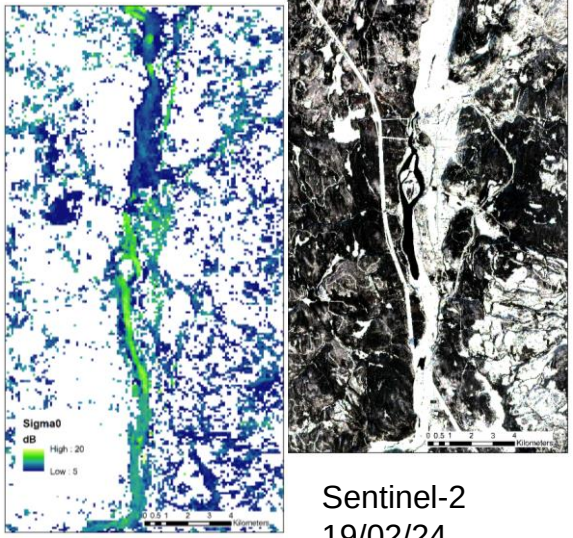
- Glace de rivière

SWOT – 27/01/24



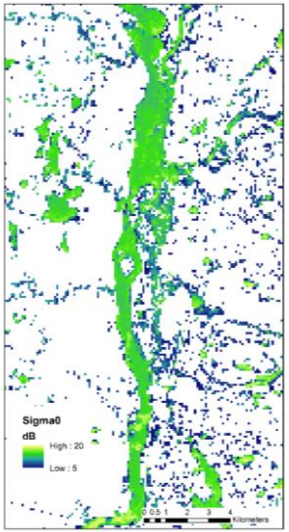
Sentinel-2
04/02/24

SWOT – 17/02/24



Sentinel-2
19/02/24

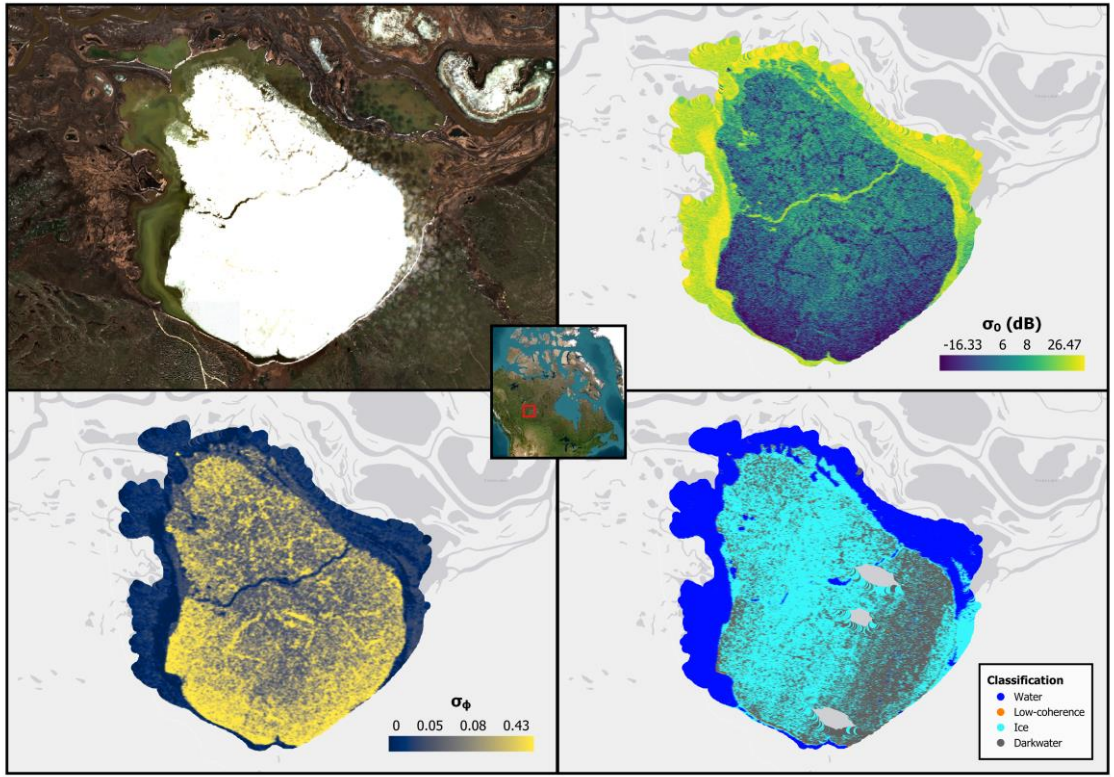
SWOT – 19/04/24



Sentinel-2
09/04/24

ENJEUX/OPPORTINUTÉ

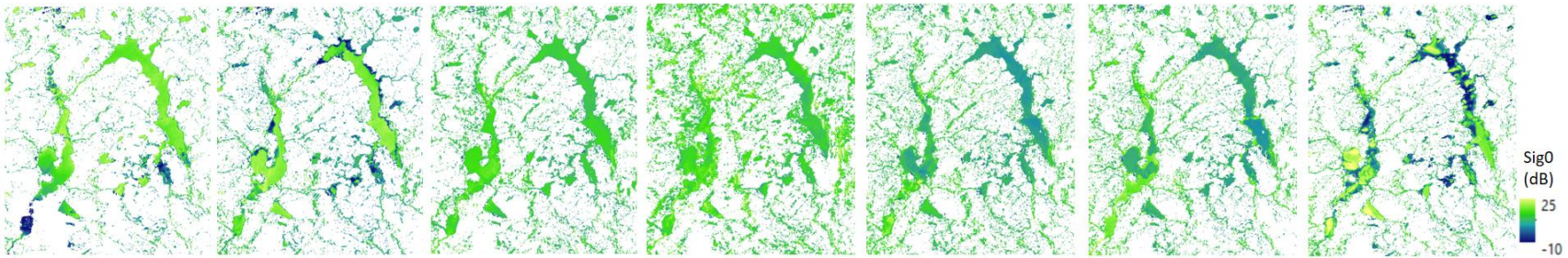
- Glace de lac



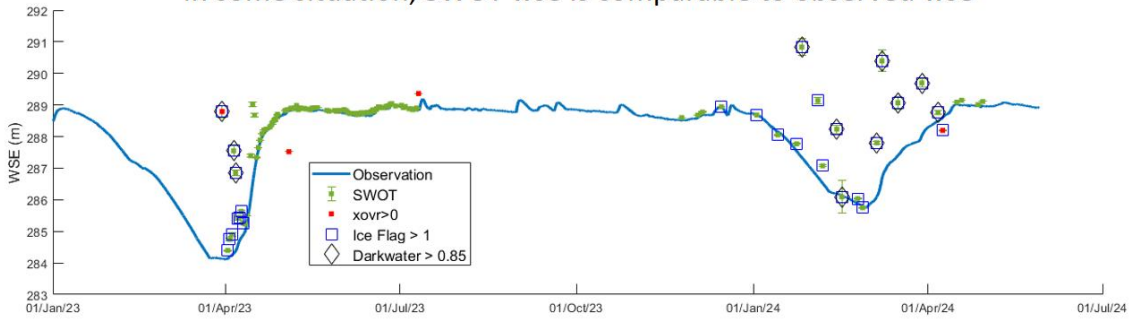
ENJEUX/OPPORTINUTÉ

- Glace de lac

Pass 270



In some situation, SWOT wse is comparable to observed wse

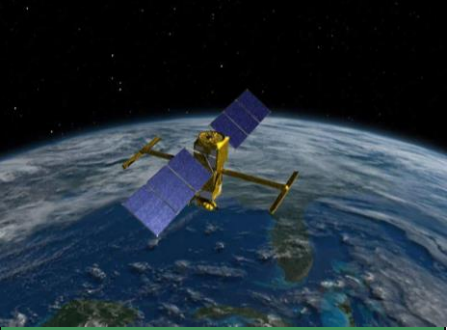


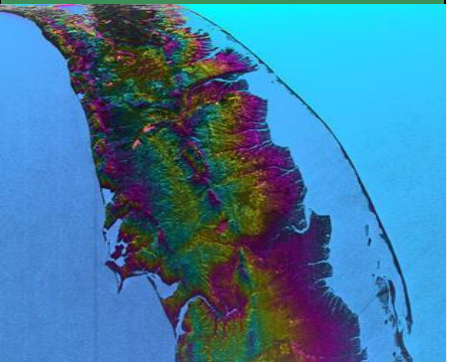
RÉFÉRENCES

Liens et documents importants:

- All technical notes for SWOT data products : https://podaac.jpl.nasa.gov/SWOT?tab=datasets-information&sections=about
- Earthdata Search : search.earthdata.nasa.gov/search?q=SWOT_*_2
- To download the KMZ file, for the science 21-day orbit, click here.
- For the Beta Pre-validated data KMZ that used the cal/val 1-day orbit, click here.
- More data on SWOT : Home – NASA SWOT
- How to find the number of the pass/tile and see an animation : SWOT in Space and Time | Mission – NASA SWOT
- Présentation Science Teams (ST) : https://swot.jpl.nasa.gov/events/63/2024-swot-science-team-meeting/

D) Exemple sur un site d’étude

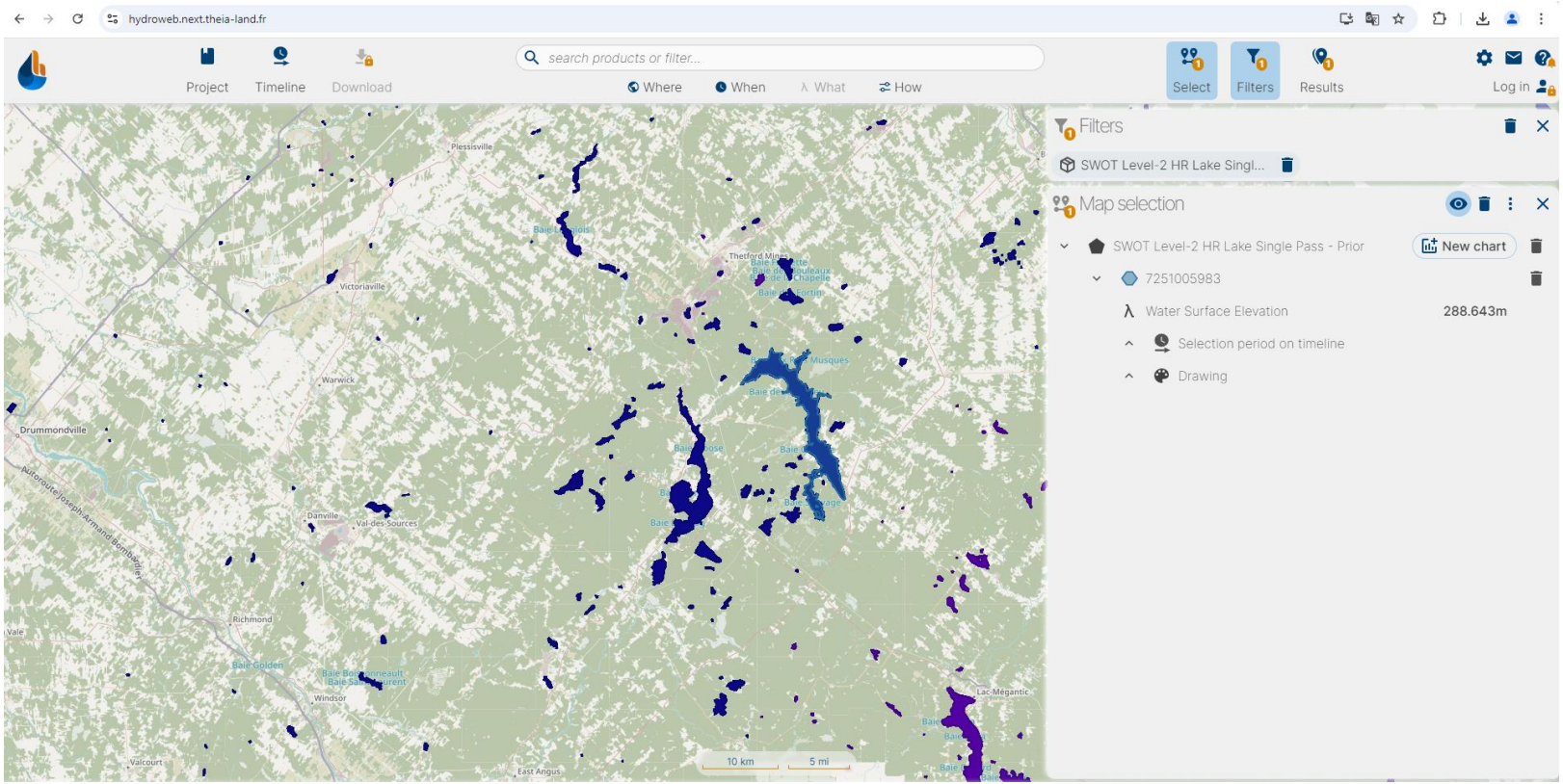




CE QUE VOUS AVEZ BESOIN?

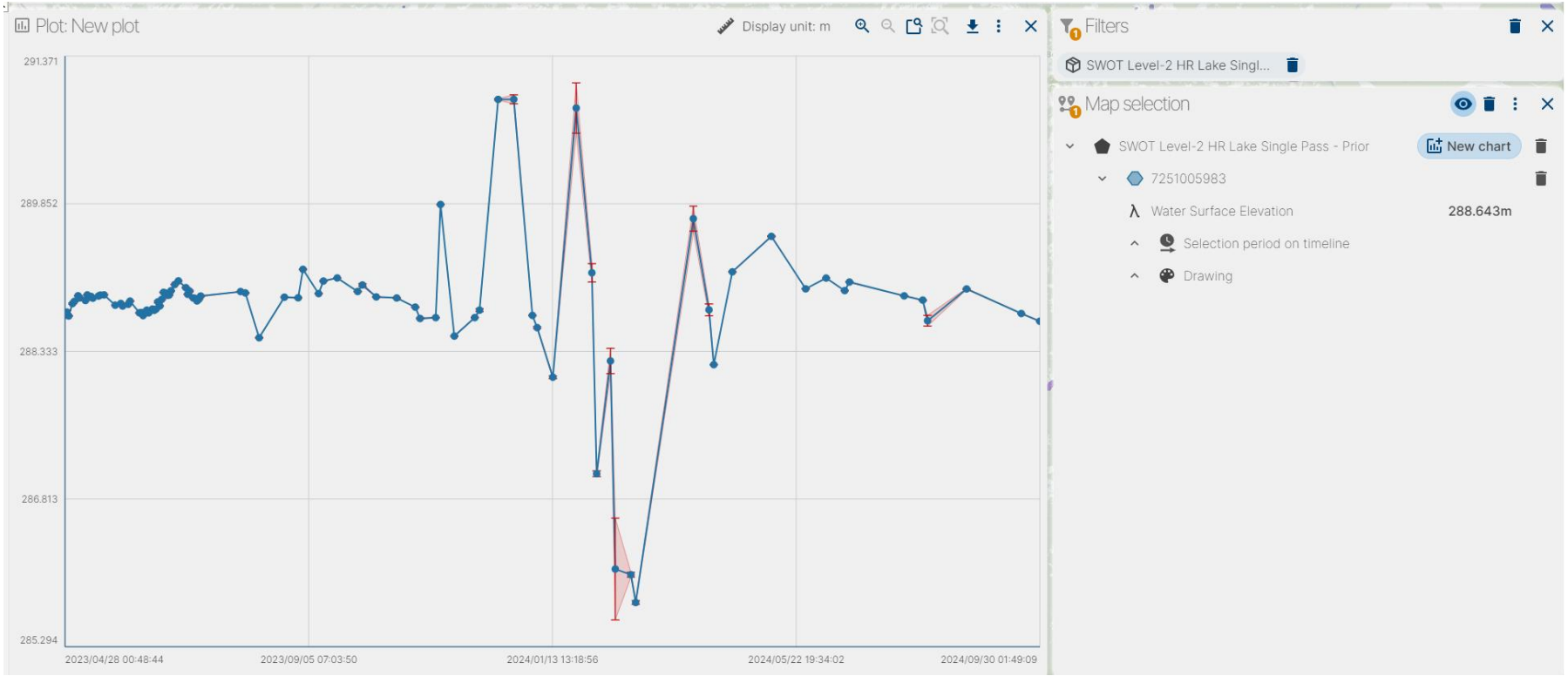
- EARTHDATA ACCOUNT
- GOOGLE COLAB
- QGIS

Accès aux données



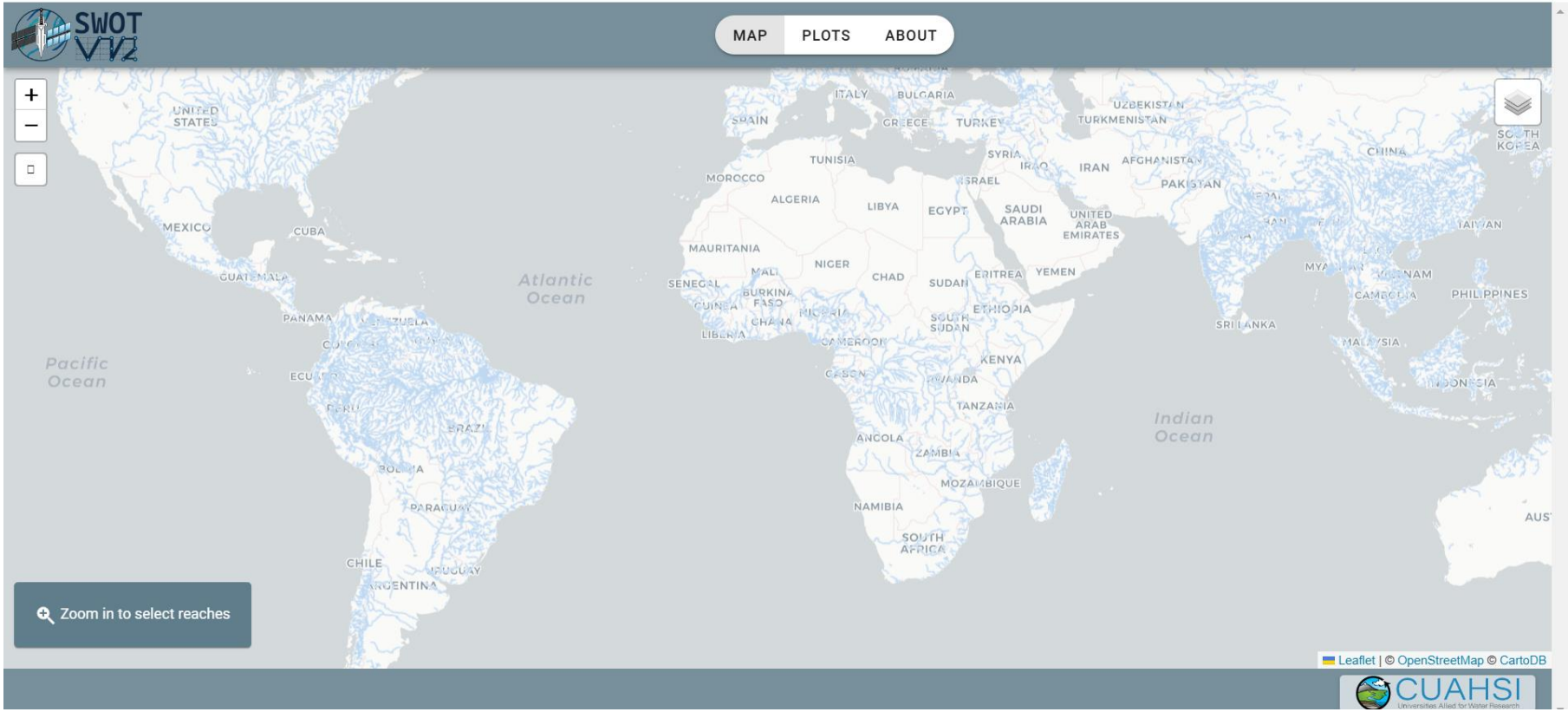
https://hydroweb.next.theia-land.fr/

Accès aux données



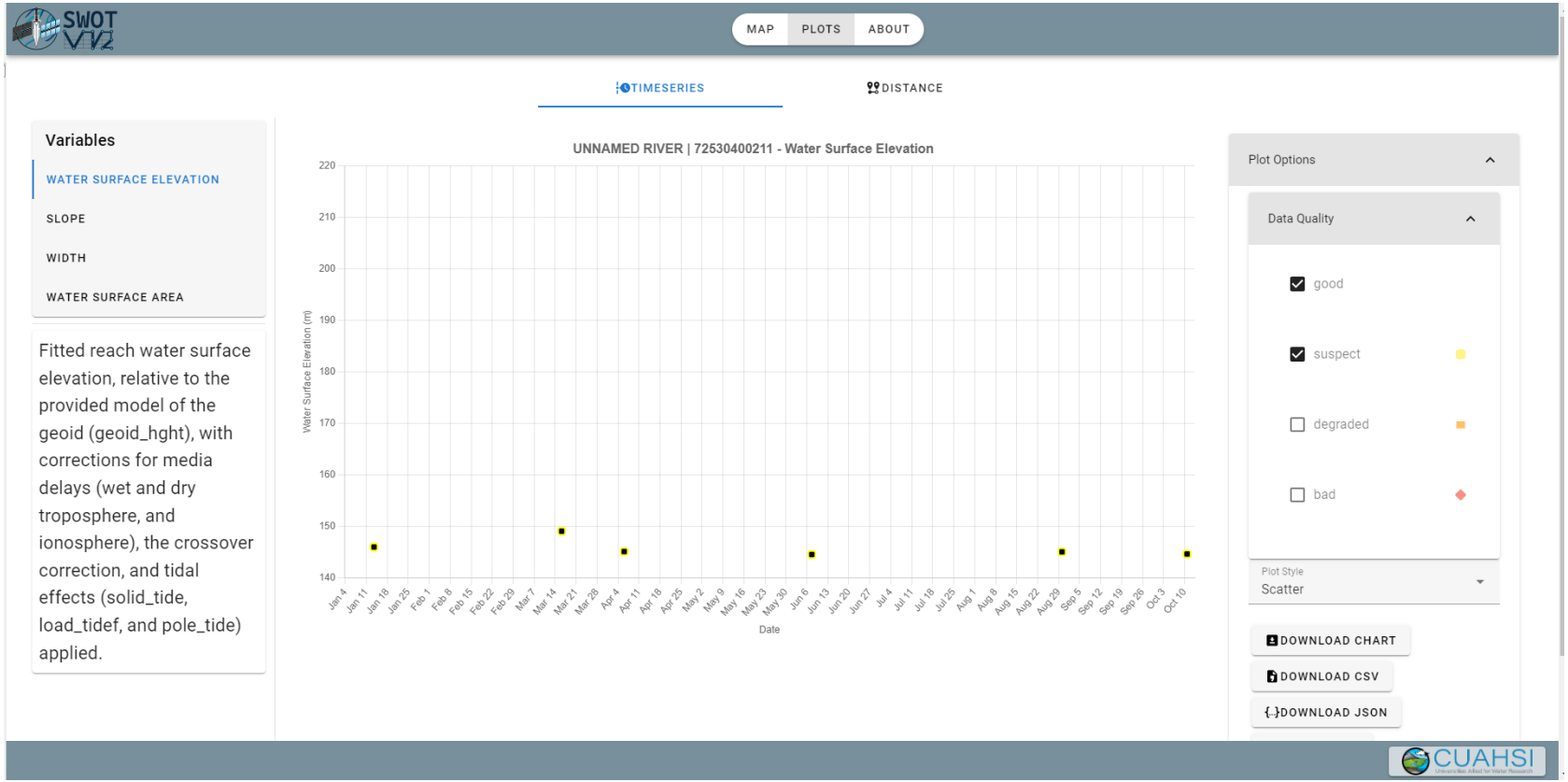
https://hydroweb.next.theia-land.fr/

Accès aux données



https://swotvis.cuahsi.io/#/

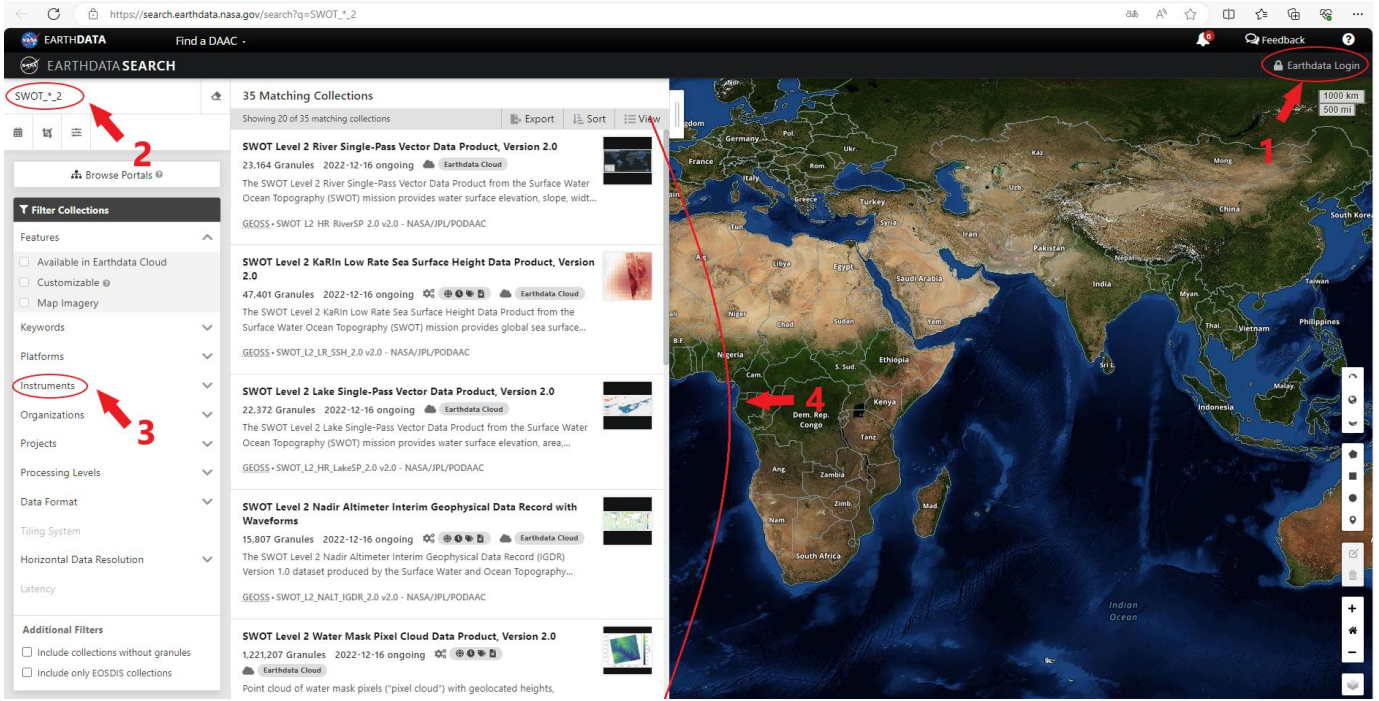
Accès aux données



https://swotvis.cuahsi.io/#/

Accès aux données

Earthdata Search : search.earthdata.nasa.gov/search?q=SWOT_*_2

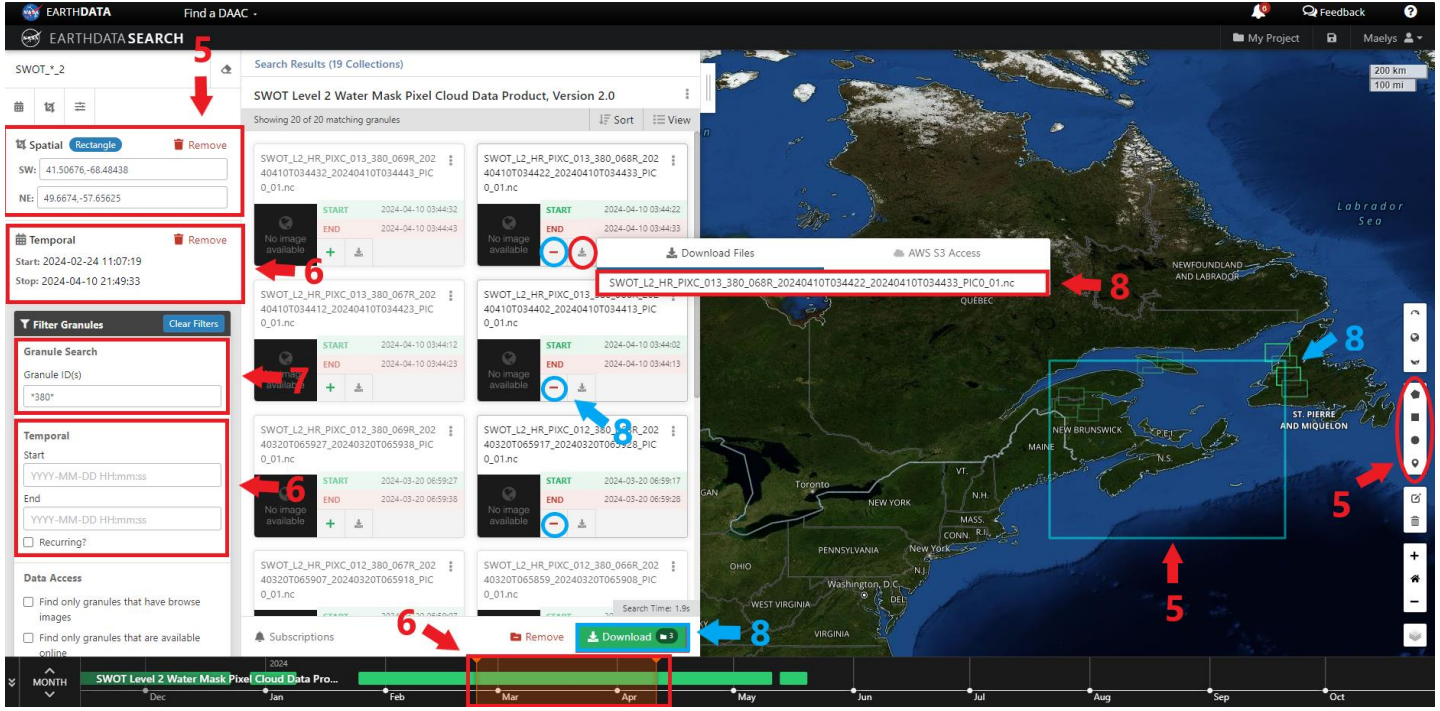


1 - Create an account and log in
2 - Type « SWOT_*_2 » in the search bar
3 - Choose KaRIn Instrument
4 – Choose the data product you want to extract

This method enables only extracting files from the same data product. For extractions of many products, use the next method with code.

Accès aux données

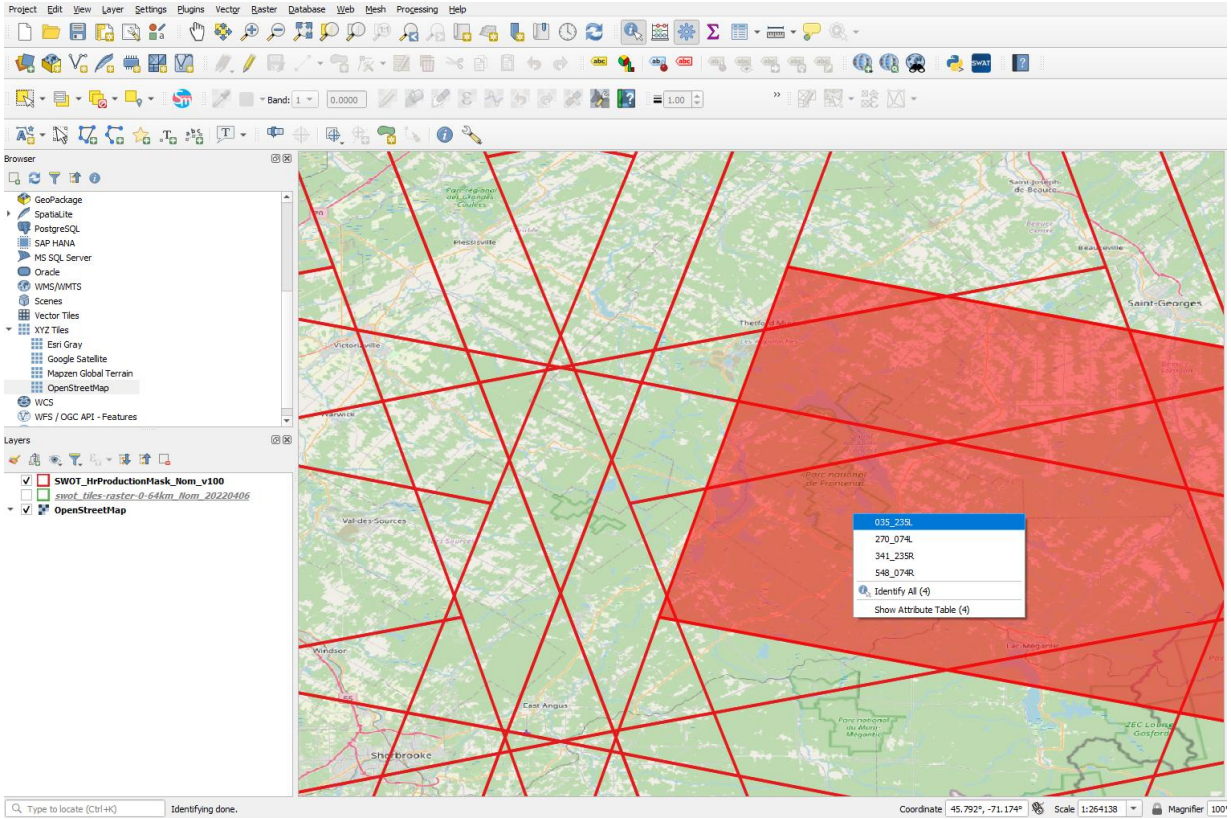
Earthdata Search : [Earthdata Search | Earthdata Search (nasa.gov)]



5 - Spatial selection (many methods)
6 - Temporal selection (many methods)
7 – Name filtering (put an *cycle(or tile or pass)* to select one particular cycle, tile or pass)
8 – Download the data (one fil in red, all the selection in blue)

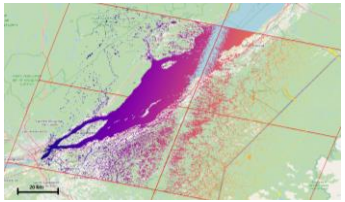
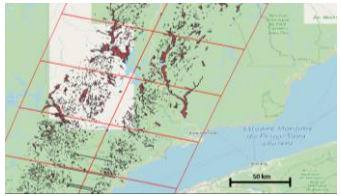
Accès aux données

- Trouver la tuile ou la scène, https://github.com/sfoucher/SWOT-Canada/tree/main/Data

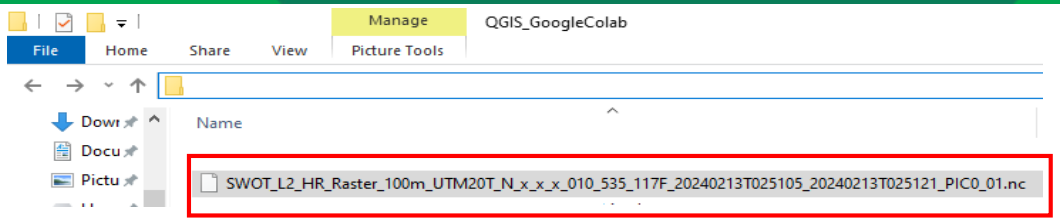


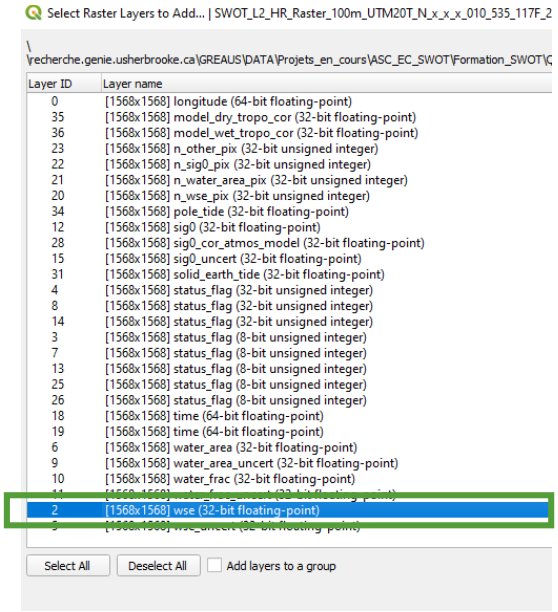
QGIS

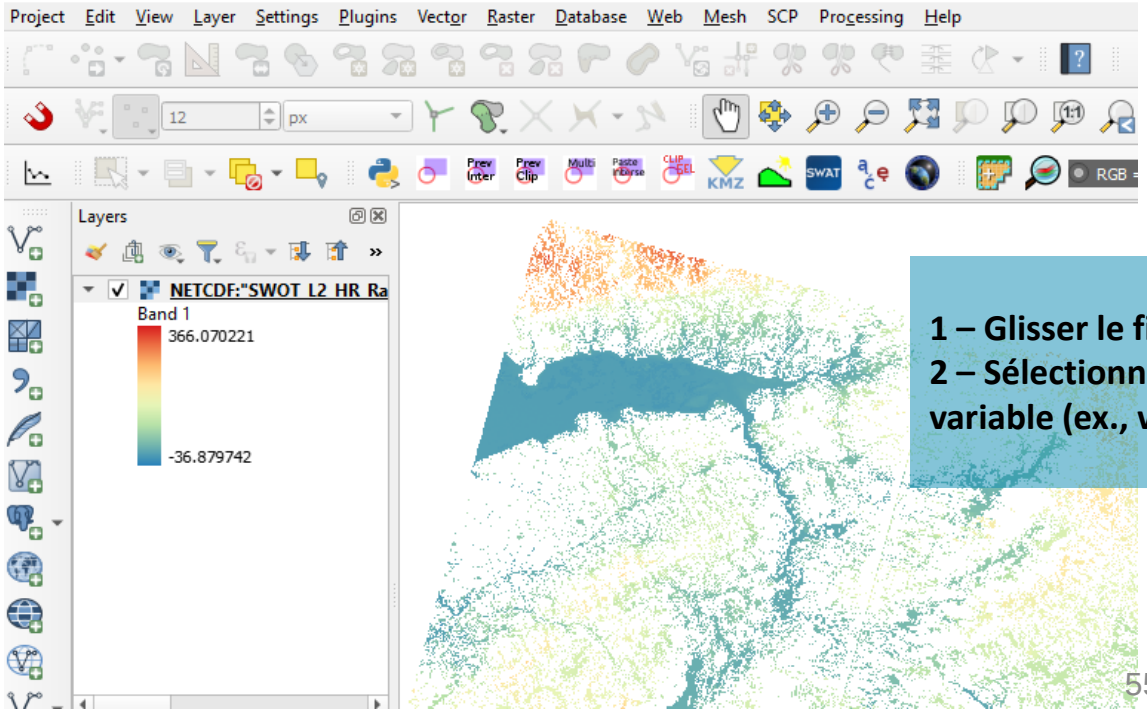
QGSI : a simple open-source software to visualize data (and other actions)

Raster	✓	
PIXC	✗	A code treatment is needed before opening it in QGIS
LakeSP	✓	
RiverSP	✓	
SLC	✗	A code treatment is needed before opening it in QGIS

QGIS

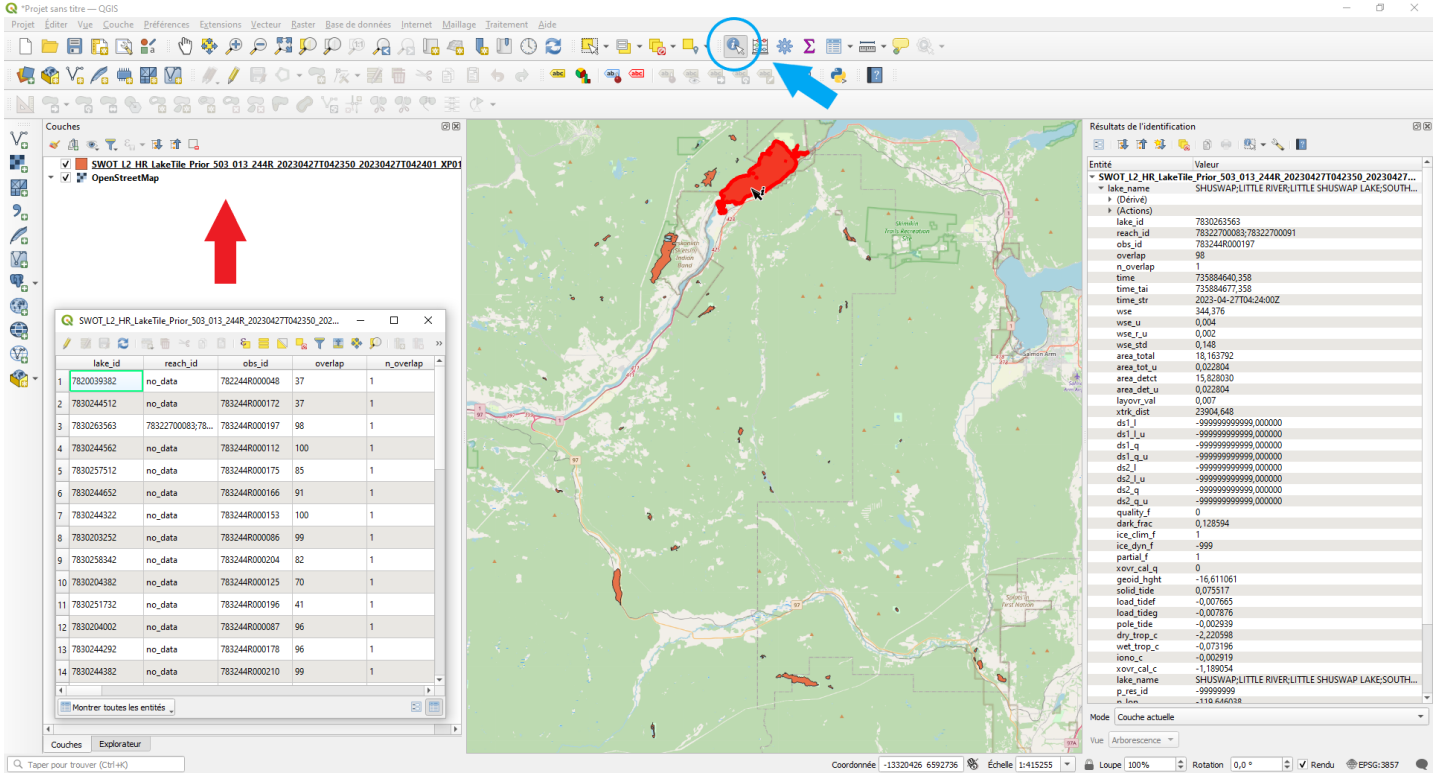






1 – Glisser le fichier .nc
2 – Sélectionner la variable (ex., wse)

QGIS


Couches
SWOT_L2_HR_LakeTile_Prior_503_013_244R_20230427T042350_20230427T042401_XP01
OpenStreetMap
Résultats de l'identification
Entité
Valeur
Couches
Explorateur

Code Python

Google collab

Google collab link : https://colab.research.google.com/drive/1_eaI3c79OTsIaii7GLCp3J6WgfV9_8Q1?usp=sharing

Faire une copie du projet

GitHub pour ceux qui n’ont pas Google collab

https://github.com/sfoucher/SWOT-Canada/tree/main/Workshops