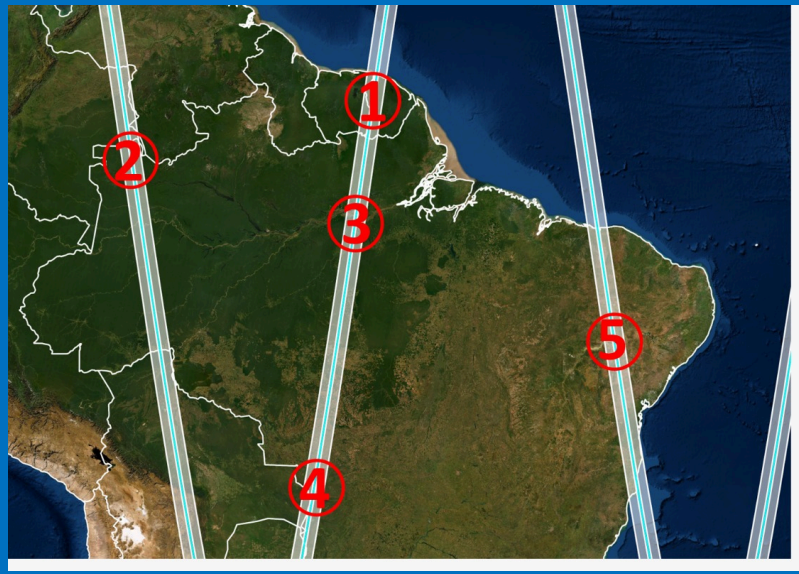
Hydrology Validation activities

Tropical rivers

Daniel Medeiros Moreira, Stéphane Calmant, Fabrice Papa, Adrien Paris, Jean-Francois Cretaux and with contribution of many others

SWOT "CAL/VAL" FOR SOUTH AMERICA



CAL/VAL SITES
(ALREADY SURVEYED AND IN OPERATION)

1- MARONI RIVER (FRENCH GUIANA)

2-NEGRO RIVER (BRAZIL)

3-AMAZON & TAPAJÓS RIVER (BRAZIL)

4-PARAGUAY RIVER (BRAZIL)

5-SÃO FRANCISCO RIVER (BRAZIL)

Daniel Medeiros, Fabrice Papa, Moreira, Stéphane Calmant Adrien Paris, Jean-Francois Cretaux, Felix Perosanz , Jefferson Melo, Fabien Durand, Leandro Guedes, Ricardo Duarte, Pauline Brossat, Robson Azevedo, and many others

SERVIÇO GEOLÓGICO DO BRASIL - CPRM

Institut de Recherche pour le Développement FRANCE

cnes

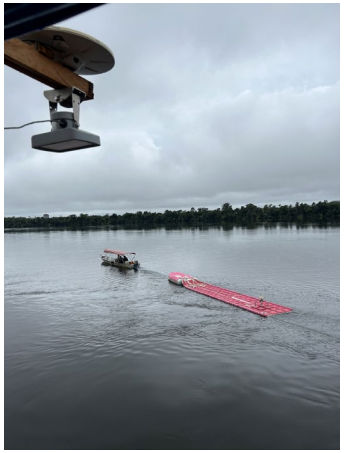
LEGOS

GET

Hydromatters

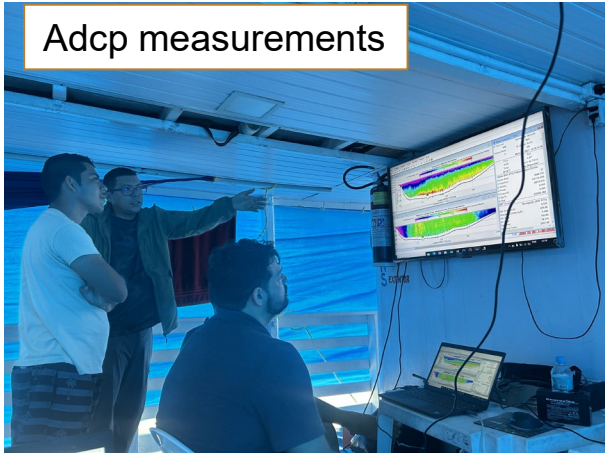
...., UFRJ, UEA, UFAM, UFPE, IPH, UFOPA, UNB, ANA and many other institutions are giving support

Boat and Nappe GNSS survey



Gauge data collection

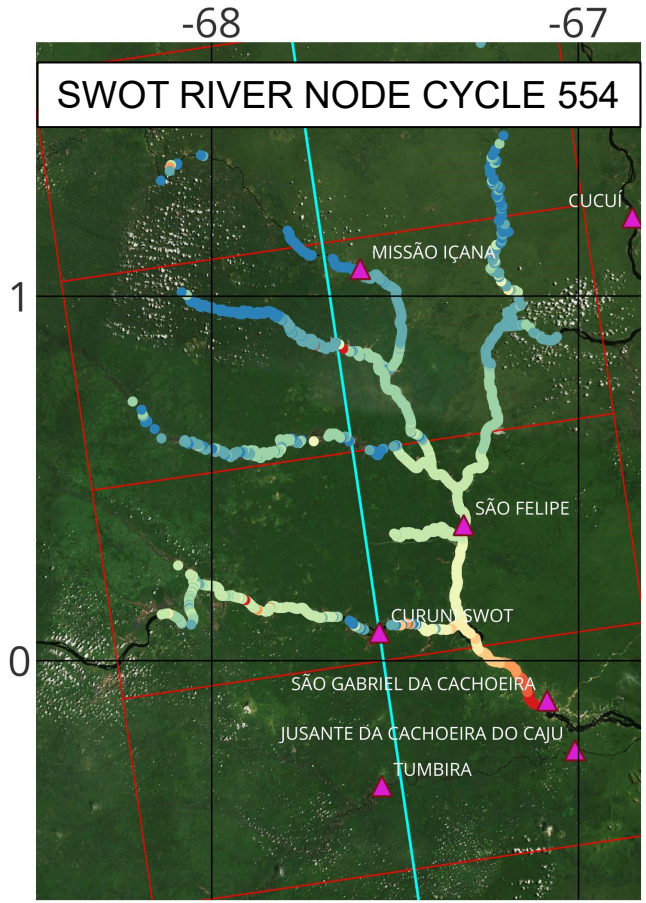
Adcp measurements

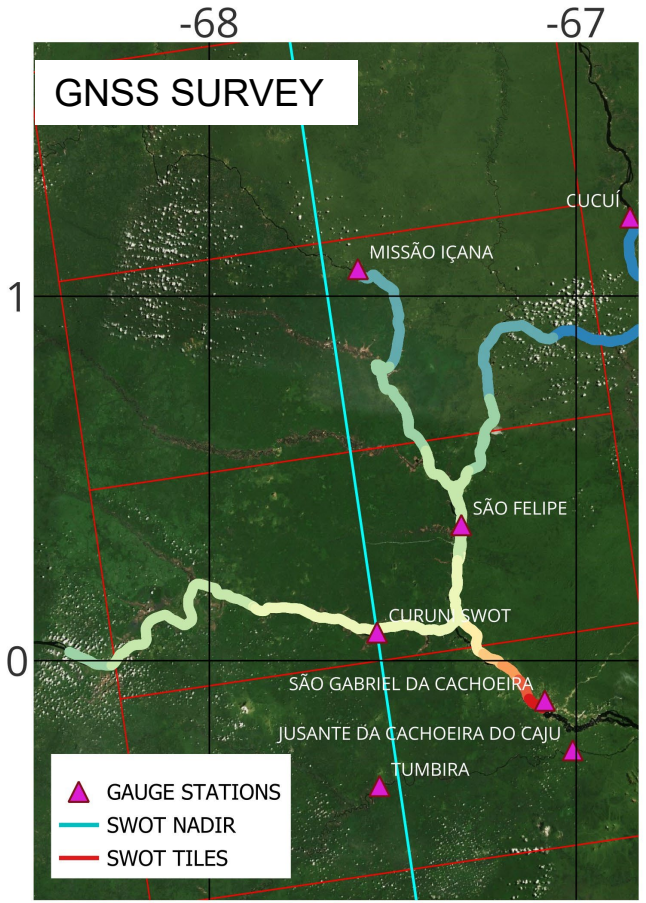


Drone survey

NEGRO CAL/VAL SITE SURVEY FROM 06th to 18th of June - 2023

Team : Daniel Moreira, Fabrice Papa, Pauline Brossat, Jefferson Melo, Ricardo Oliveira, Robson Azevedo, Daniel Garcia, Malika, Arthur Abreu, Taina Conchy, Jacques Verron, Marquinho, Fábio Viveros, Ramos.





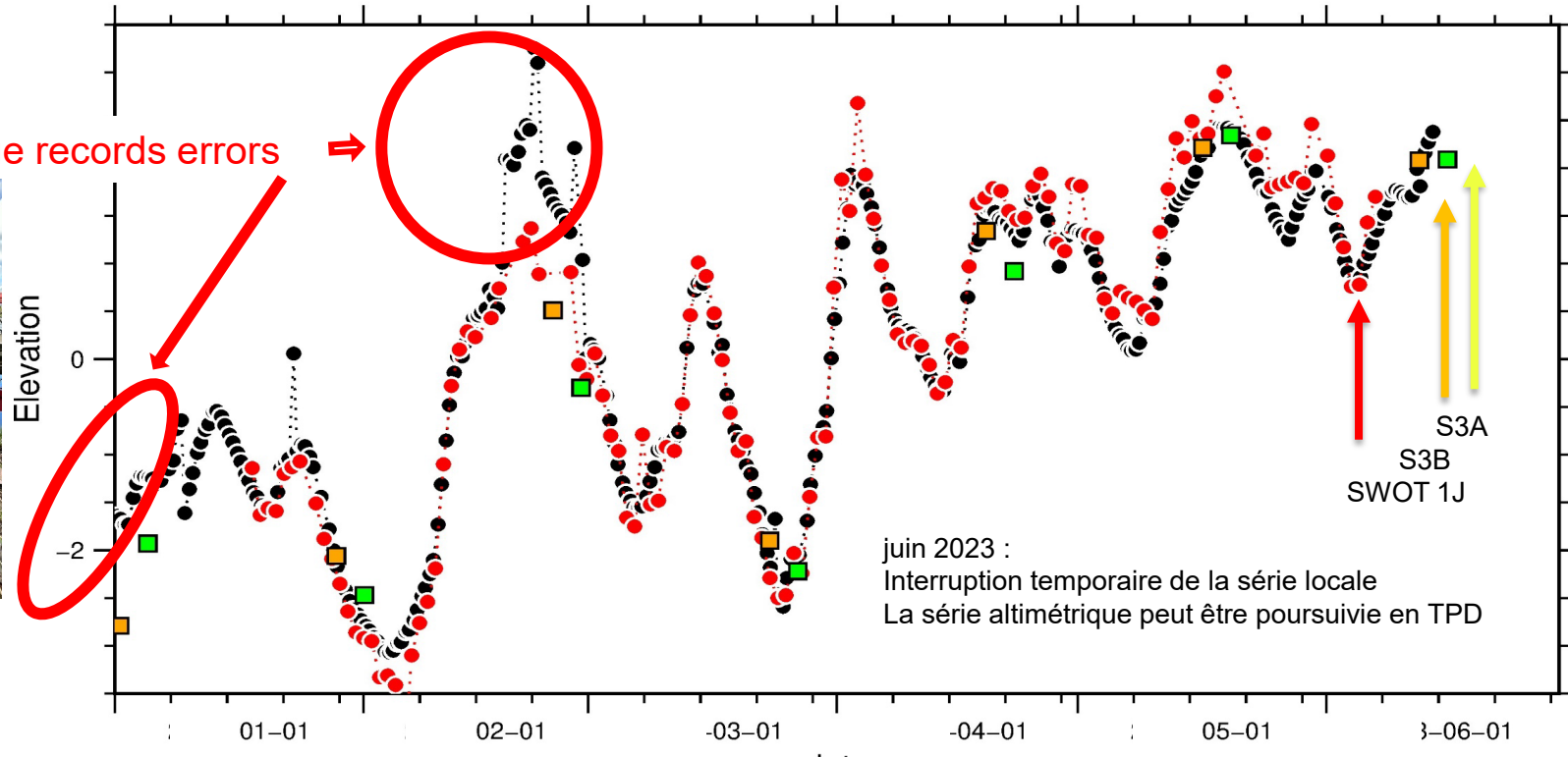
WATER SURFACE ELEVATION (EGM08) in meters

56.1 - 58.3
58.3 - 60.4
60.4 - 62.6
62.6 - 64.7
64.7 - 66.9
66.9 - 69
69 - 71.2
71.2 - 73.3
73.3 - 75.4
75.4 - 77.6

1000 km en amont du Negro à Manaus, la rivière Içana

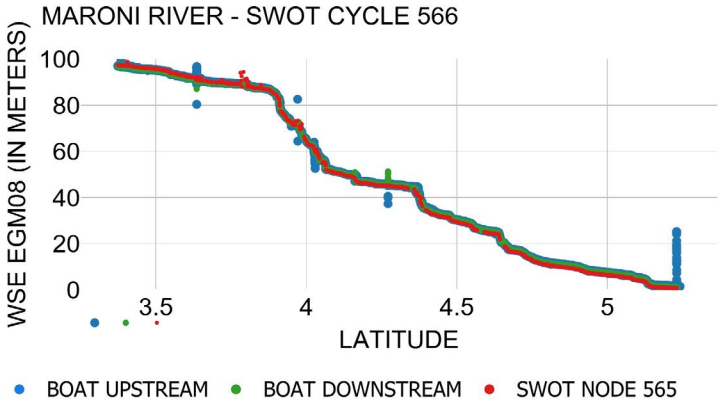
Credits : Stéphane Calmant, Adrien Paris and Hydromatters team

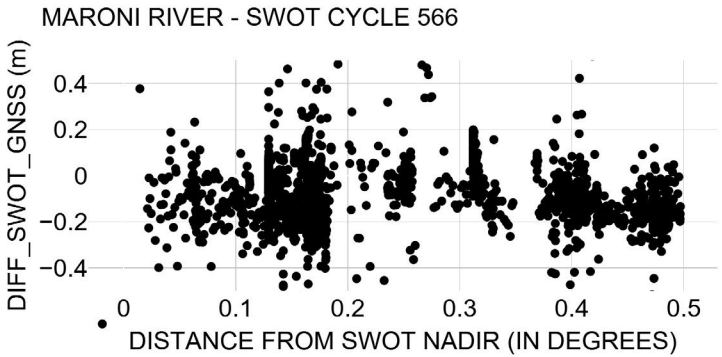
Rotation CPRM/IRD pour collecter les mesures in-situ dans le haut Negro

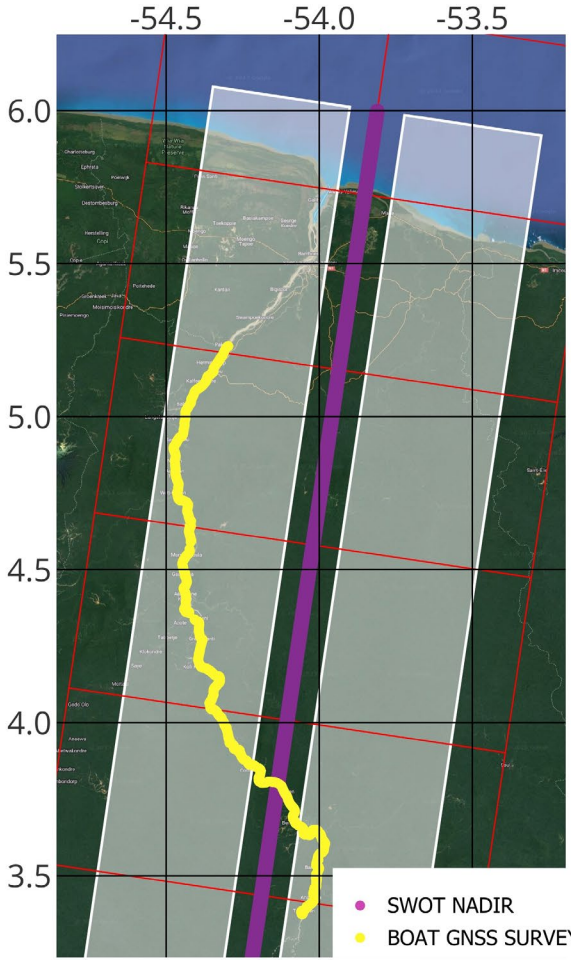


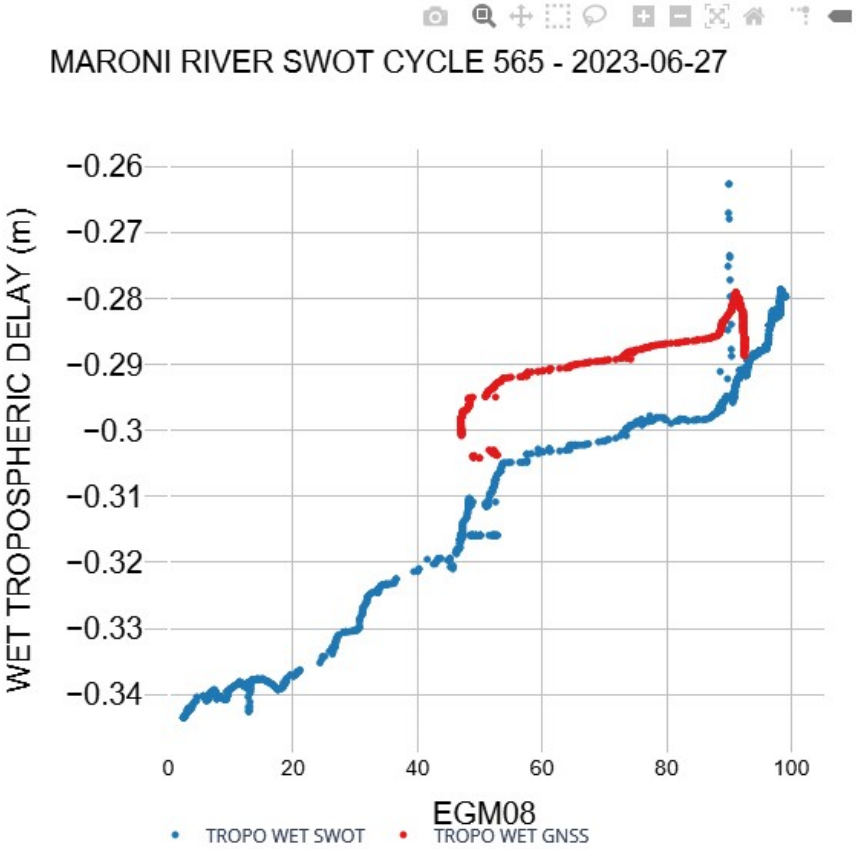
MARONI CAL/VAL SITE SURVEY FROM 06th to 18th of June - 2023

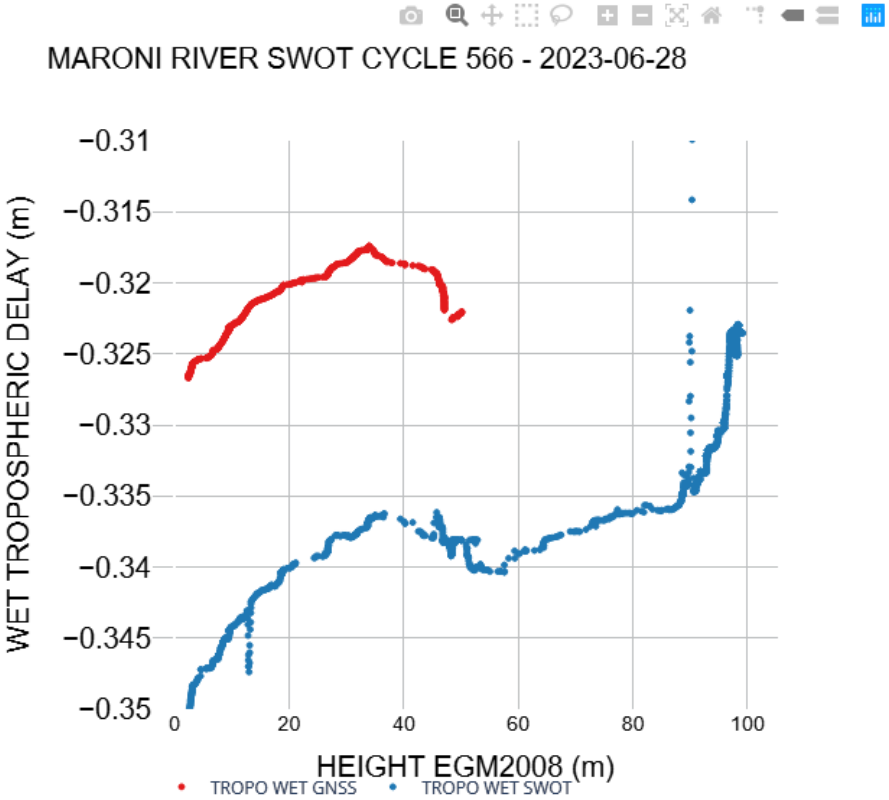
Team : Stéphane Calmant, Adrien Paris, Pauline Brossat, Malika, Pierre Andre Garambois, Jacques Verron and many others.





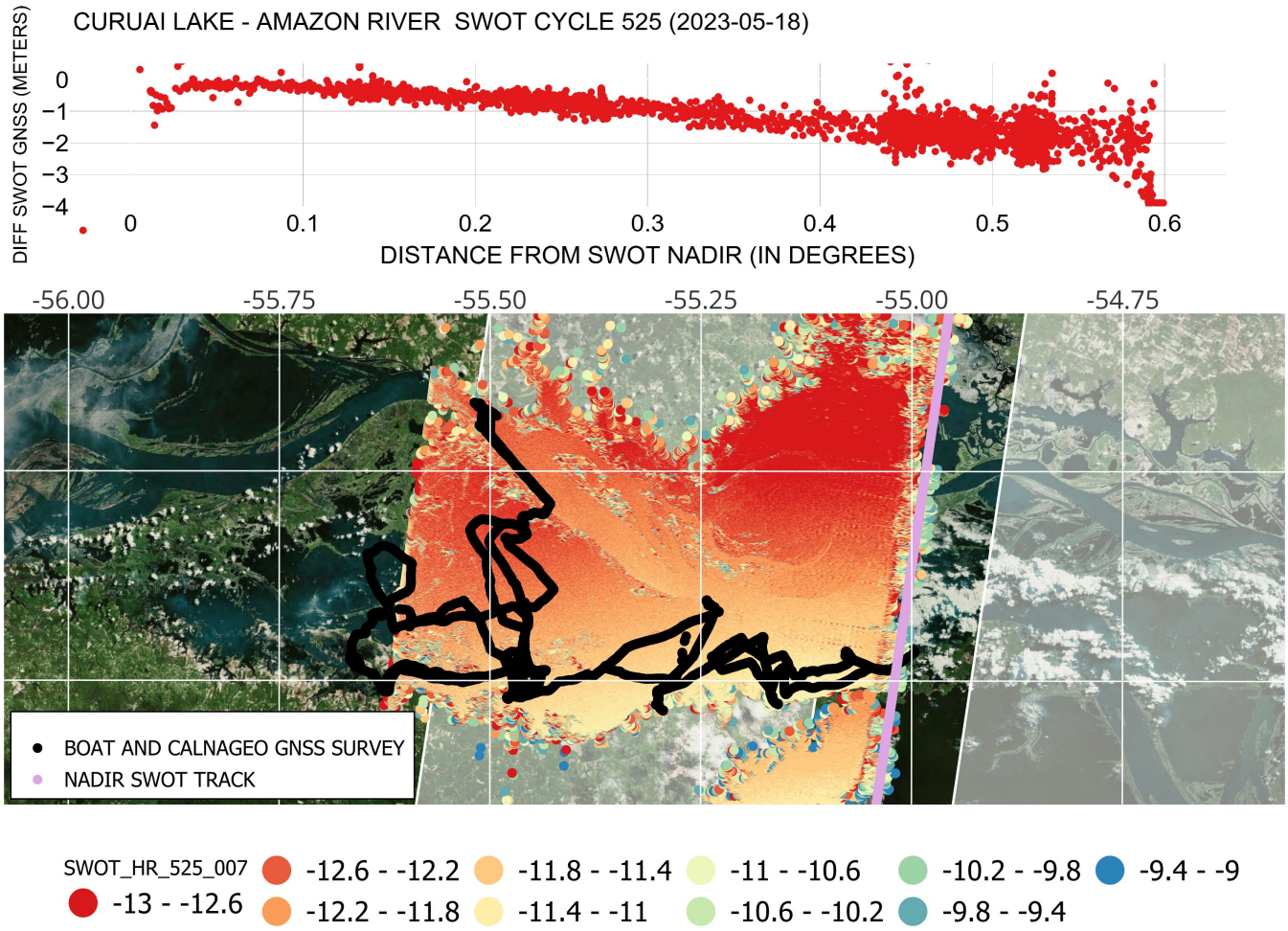


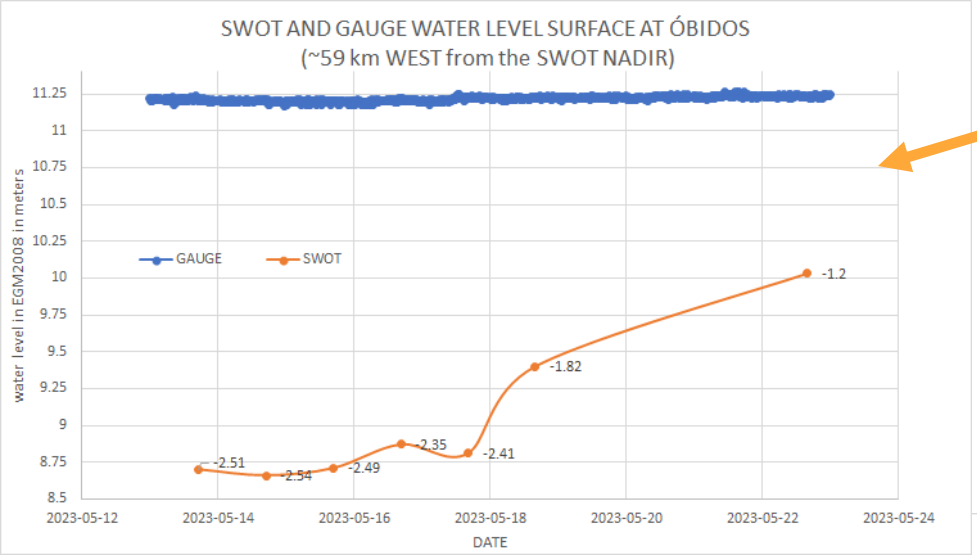

MARONI RIVER SWOT CYCLE 565 - 2023-06-27
WET TROPOSPHERIC DELAY (m)
−0.26
−0.27
−0.28
−0.29
−0.3
−0.31
−0.32
−0.33
−0.34
0
20
40
60
80
100
EGM08
TROPO WET SWOT
TROPO WET GNSS

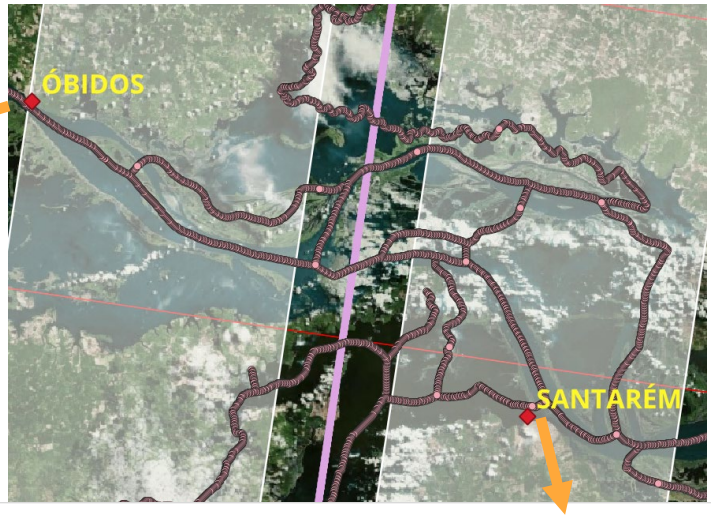

MARONI RIVER SWOT CYCLE 566 - 2023-06-28
WET TROPOSPHERIC DELAY (m)
−0.31
−0.315
−0.32
−0.325
−0.33
−0.335
−0.34
−0.345
−0.35
0
20
40
60
80
100
HEIGHT EGM2008 (m)
TROPO WET GNSS
TROPO WET SWOT

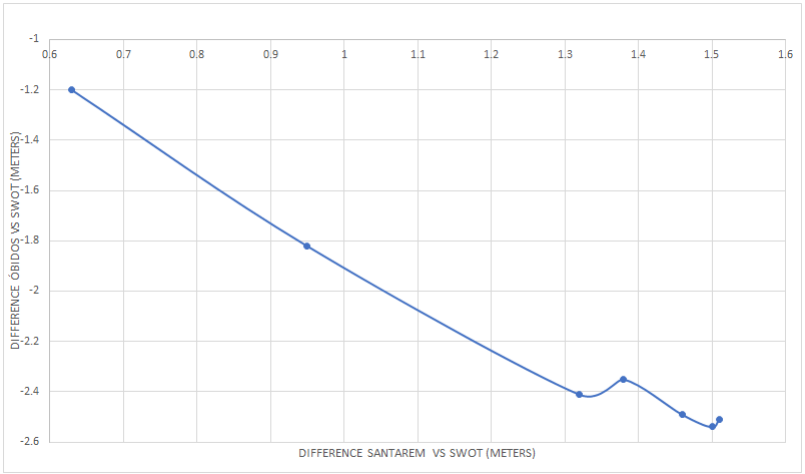
AMAZON CAL/VAL SITE SURVEY FROM 14th to 22th of May - 2023

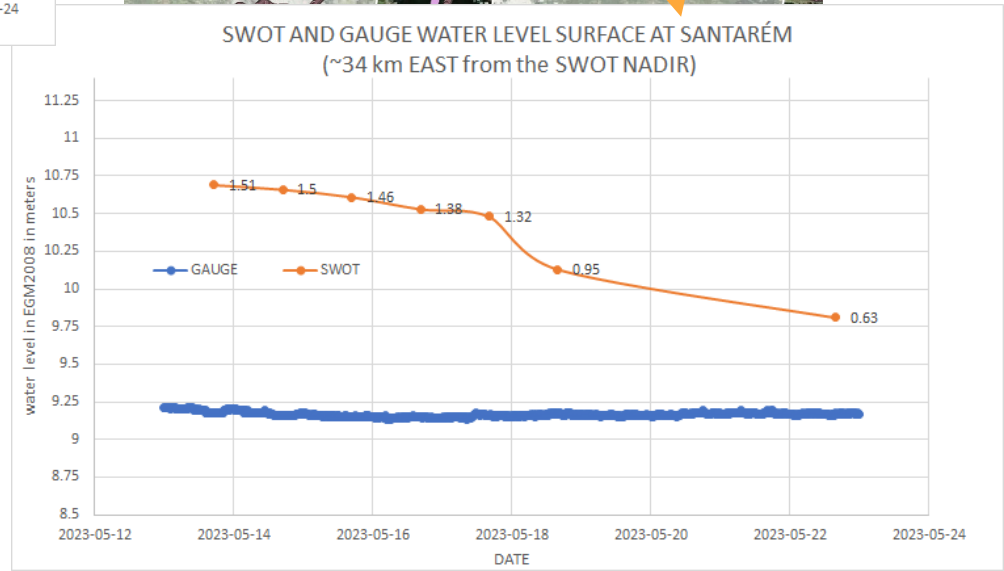
Team : Daniel Moreira, Fabrice Papa, Pauline Brossat, Jefferson Melo, Leandro Guedes, Ricardo Oliveira, Marielle Gosset, Homero Reis, Andre Santos, Malika, Taina Conchy, Avner Gaspar, Silvert.



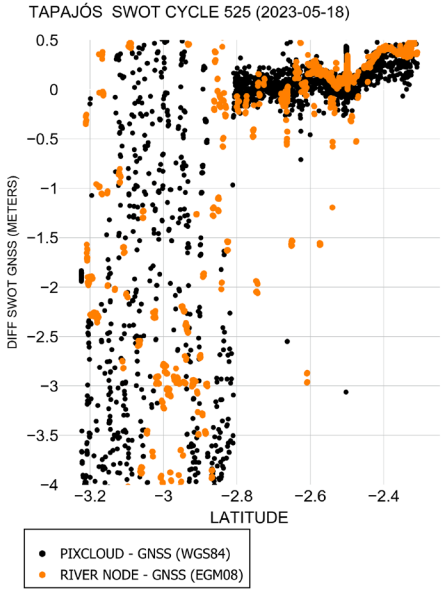

SWOT AND GAUGE WATER LEVEL SURFACE AT ÓBIDOS
(~59 km WEST from the SWOT NADIR)
water level in EGM2008 in meters
11.25
11
10.75
10.5
10.25
10
9.75
9.5
9.25
9
8.75
8.5
GAUGE
SWOT
-2.51
-2.54
-2.49
-2.35
-2.41
-1.82
-1.2
2023-05-12
2023-05-14
2023-05-16
2023-05-18
2023-05-20
2023-05-22
2023-05-24
DATE

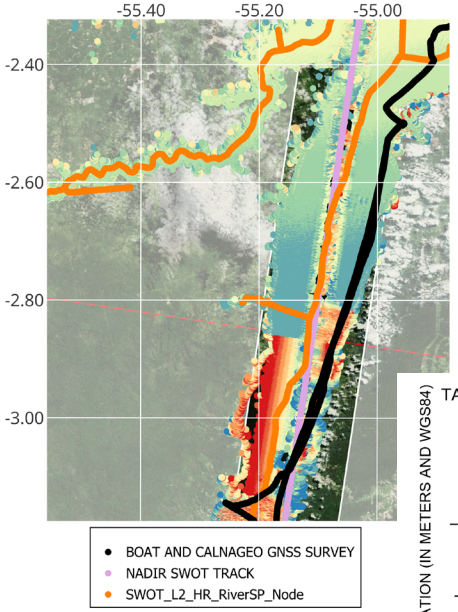

ÓBIDOS
SANTARÉM

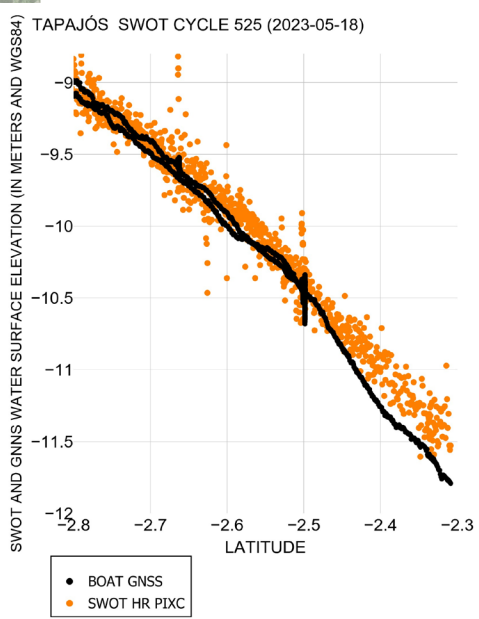

DIFFERENCE ÓBIDOS VS SWOT (METERS)
-1
-1.2
-1.4
-1.6
-1.8
-2
-2.2
-2.4
-2.6
0.6
0.7
0.8
0.9
1
1.1
1.2
1.3
1.4
1.5
1.6
DIFFERENCE SANTAREM VS SWOT (METERS)

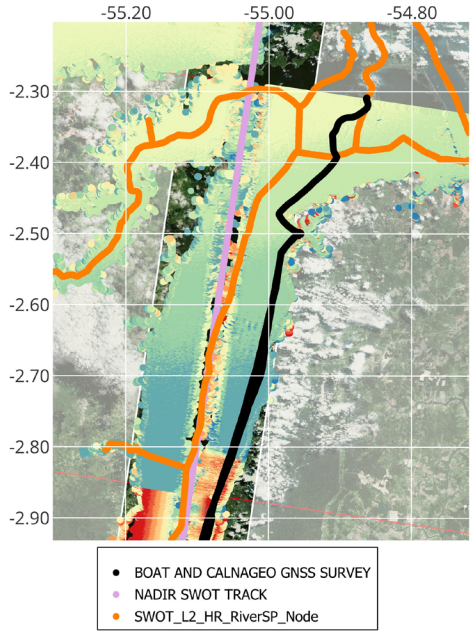

SWOT AND GAUGE WATER LEVEL SURFACE AT SANTARÉM
(~34 km EAST from the SWOT NADIR)
water level in EGM2008 in meters
11.25
11
10.75
10.5
10.25
10
9.75
9.5
9.25
9
8.75
8.5
GAUGE
SWOT
1.51
1.5
1.46
1.38
1.32
0.95
0.63
2023-05-12
2023-05-14
2023-05-16
2023-05-18
2023-05-20
2023-05-22
2023-05-24
DATE

SWOT DATA CLOSE TO NADIR ZONES







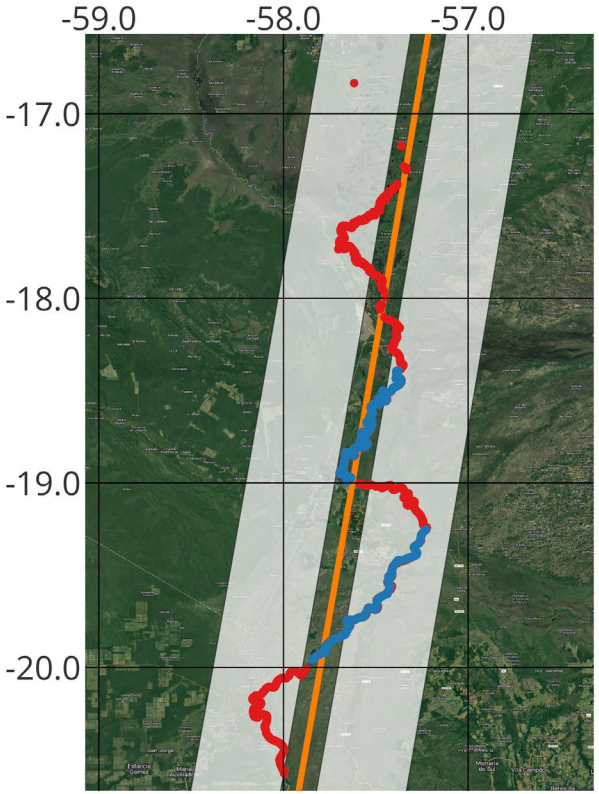


SWOT_L2_HR_PIXC_525_007
-16 - -15.2
-15.2 - -14.4
-14.4 - -13.6
-13.6 - -12.8
-12.8 - -12
-12 - -11.2
-11.2 - -10.4
-10.4 - -9.6
-9.6 - -8.8
-8.8 - -8

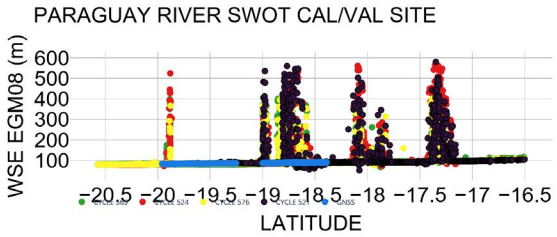
FOR THE QUESTION OF SWOT HR DATA OVER NADIR ZONES

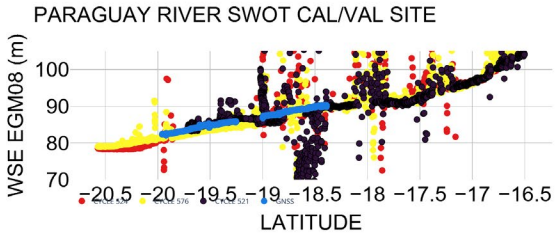
PANTANAL CAL/VAL SITE SURVEY FROM 14th to 22th of May - 2016

Team : Daniel Moreira, Jean-François Cretaux, Pierre-Andre Garambois, Amanda Montazem, Mauro Campos.



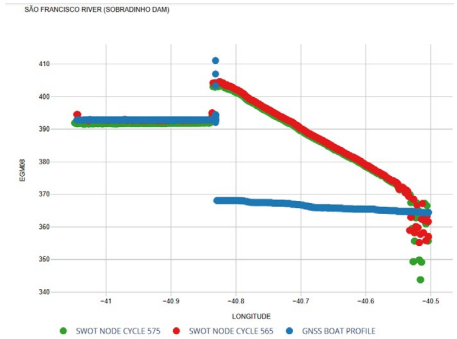
*GNSS blue swot all other colors

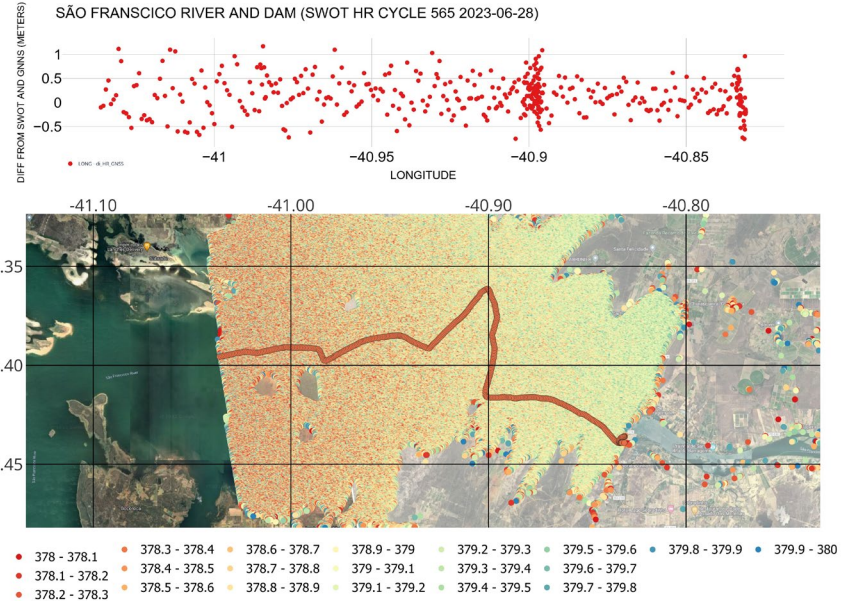


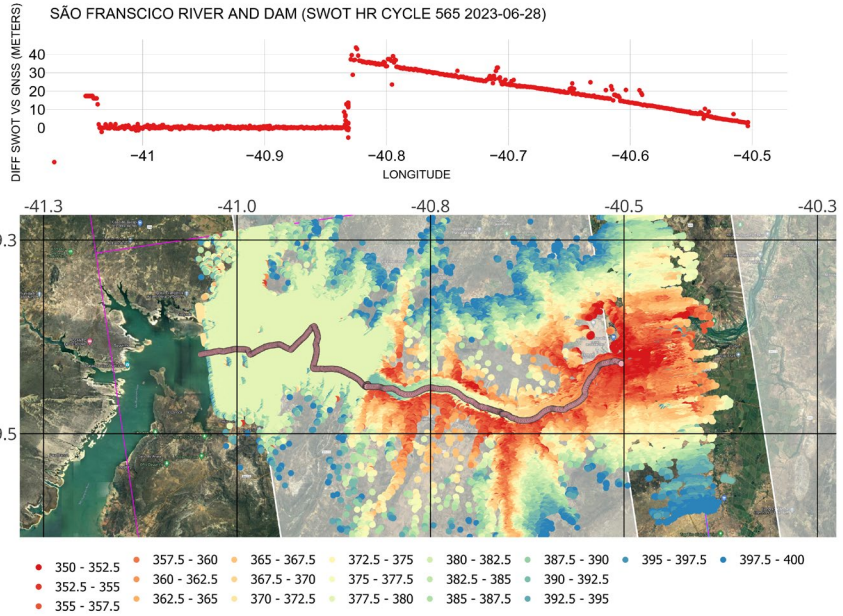


SÃO FRANCISCO CAL/VAL SITE SURVEY FROM 05h to 11th of December - 2018

Team : Daniel Moreira, Jean-François Cretaux, Adrien Paris, Jefferson Melo, Muriel Bergé-Nguyen, Fábio Araujo, Adriano Santos, George Araujo, Alfredo Neto.







Ganga River Field Campaign using Hydrological Instruments

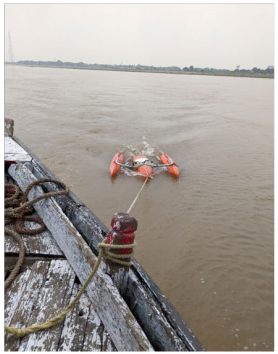
India Team : Pankaj R. Dhote (1,2), Ankit Agarwal (2), Praveen K. Thakur (1), Raghvendra Pratap Singh(1)
(1) Indian Institute of Remote Sensing, ISRO, Dehradun, India
(2) Indian Institute of Technology, Roorkee, India

Foreign team : Stéphane Calmant, Pauline Brossat, Adrien Paris, Laetitia Gal , Daniel Moreira, Jacques Verron

A field campaign was carried out on the Ganga River, spanning from Prayagraj to Varanasi. Two field campaigns were conducted during monsoon (October 02-05, 2022) and non-monsoon (April 23-26, 2023) seasons to account for seasonal variability of river dynamics. The survey was a collaborative effort between India (IIRS, ISRO Dehradun; IIT Roorkee,) and France (IRD; Hydro-Matters; LEGOS;INRAE).

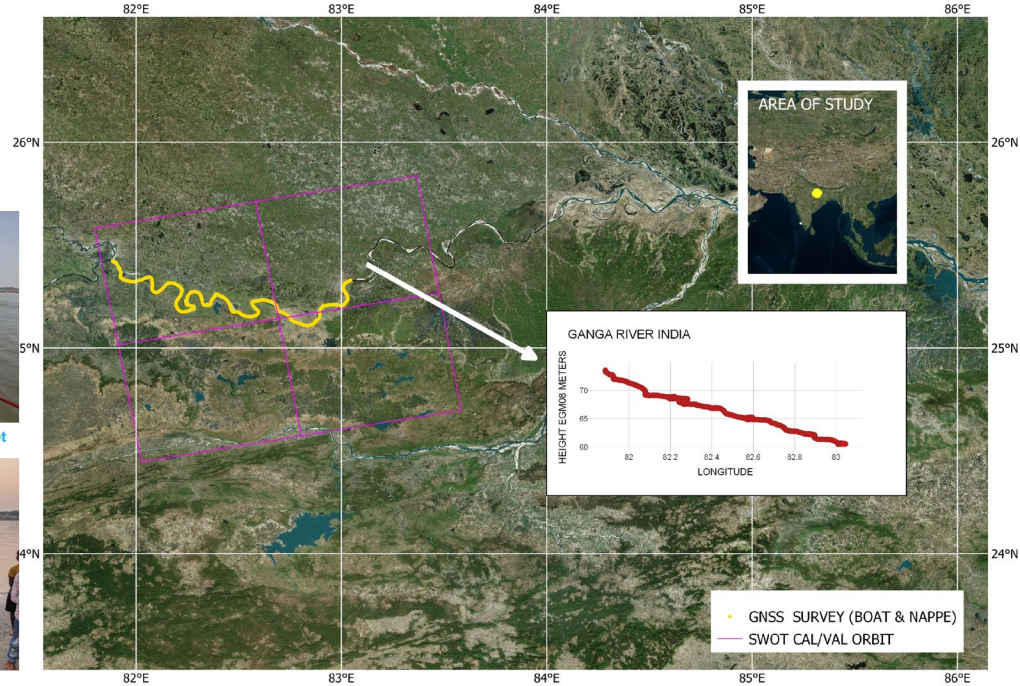

River WL GCPs using GNSS System


Floodplain GCPs using GNSS System


Demonstration of ADCP

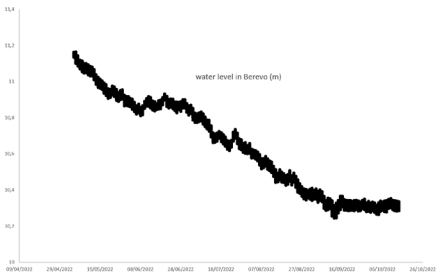

River WL GCPs using GNSS Carpet


Team Members



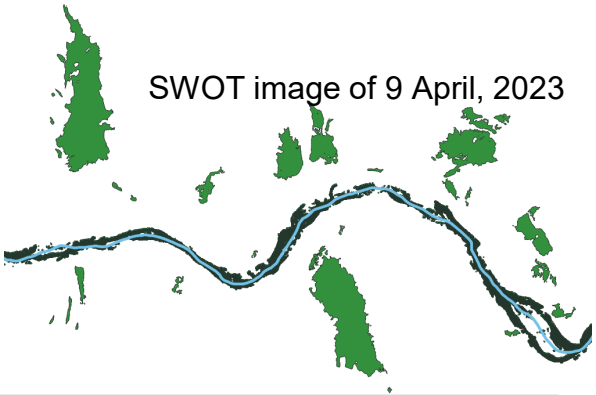
Preliminary results on the Tsiribihina Tier-1 site (Madagascar)

Two field campaigns were carried out (May 2022 and April 2023 during the 1-D fast sampling phase)

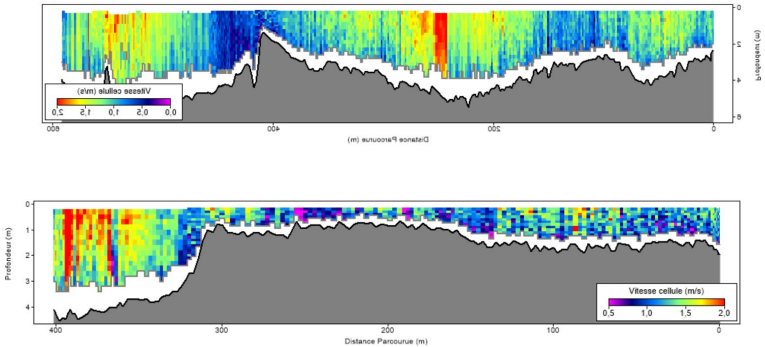


Objectives:

validation of SWOT measurements on height / Slope, width and water mask along a tropical river



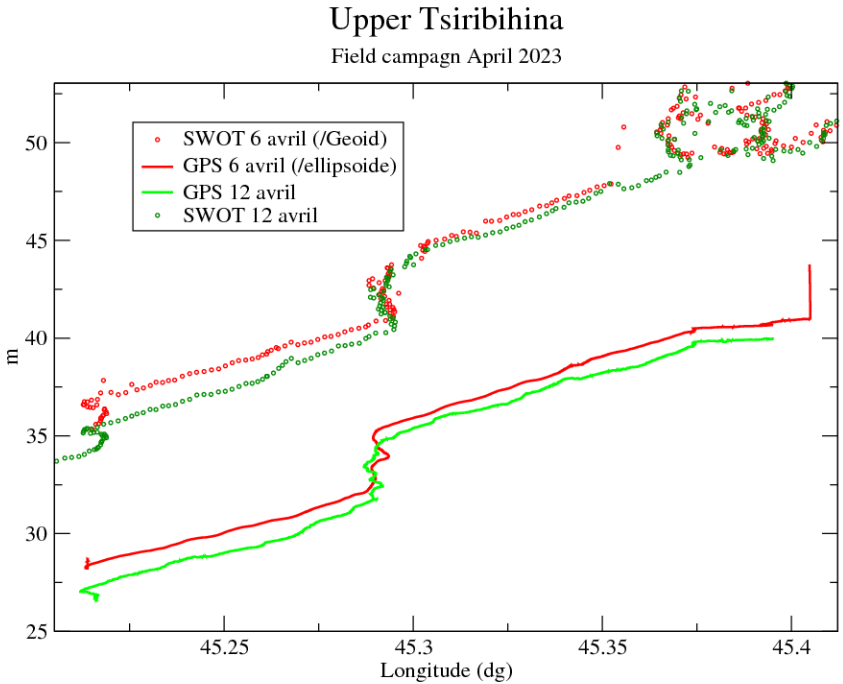
Green: observed lakes that were referenced in the PLD
Blue: river reaches along the river
Dark green: SWOT pixel classified along the river

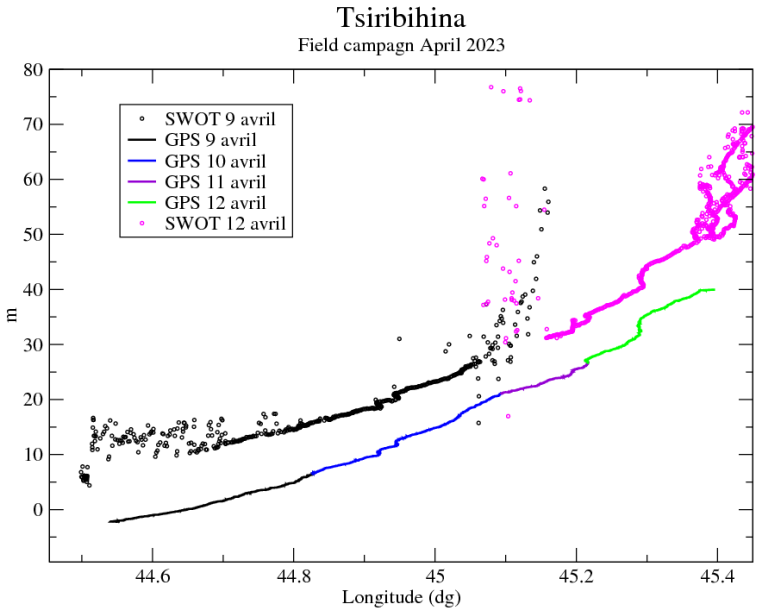


French Team: S. Calmant, J-F Cretaux, M. Bergé-Nguyen, D. Moreira, P. Brossat, M. Calzas, A. Paris, J. Verron, P Gbetkom, H. Yesou, S. Pena Luque
Malagasy team: J. Andriambeloson, L. Robison, S. Rakotondraompiana, T. Ramanakoto

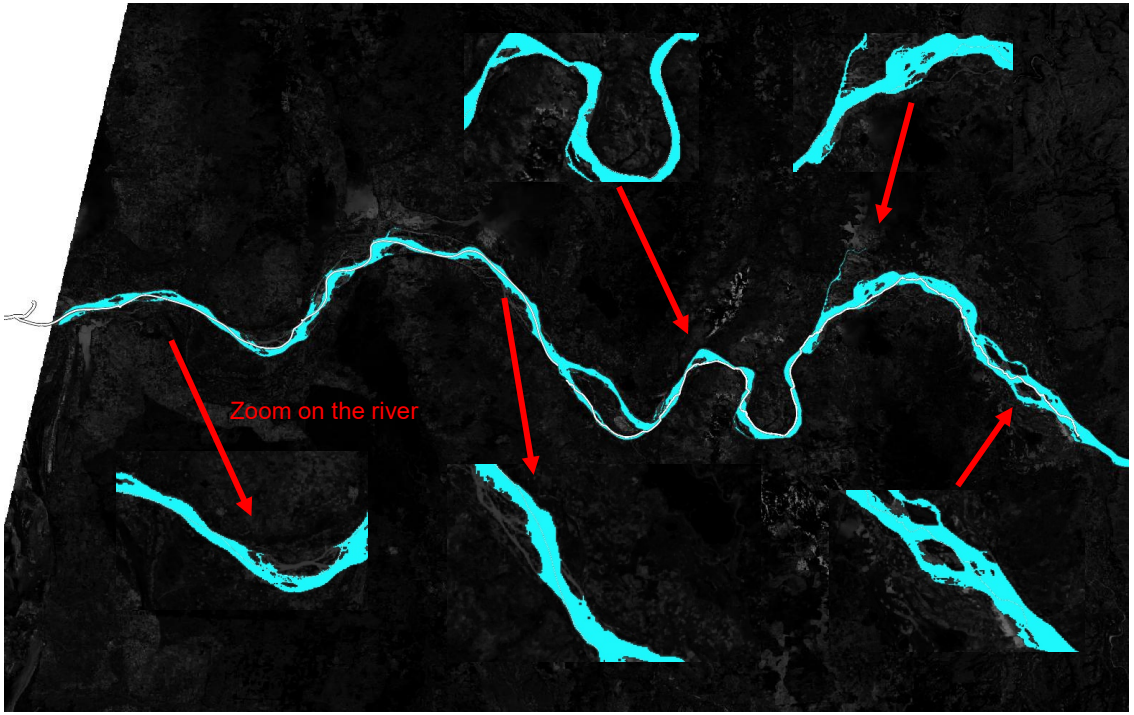
Preliminary intercomparison between SWOT & GNSS

Darkwater not filtered out
Slope looks fine
Remains bias not yet understood
The river level between April 6 and April 12 has declined rapidly (~1 m: well visible)

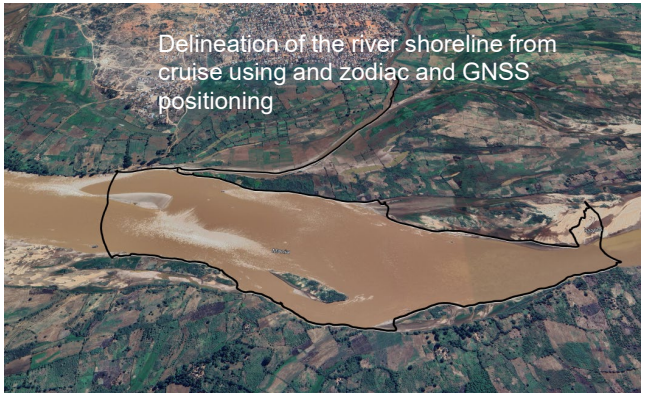




Profile on ~100 km along the river
& mask of the river compared to In situ & landsat / S2 imageries



Landsat image with water detection using NDWI index. White line corresponds to the ship cruise
The segments along the shoreline of the rivers have been identified and positioned during the campaign



Ongoing work

1) Compare in situ mask (from GNSS data & field work notes), Landsat & Sentinel-2

2) Use calibrated Sat image as ground truth for comparison with SWOT Mask

Field work notes

CONCLUSIOS AND FUTURE WORK

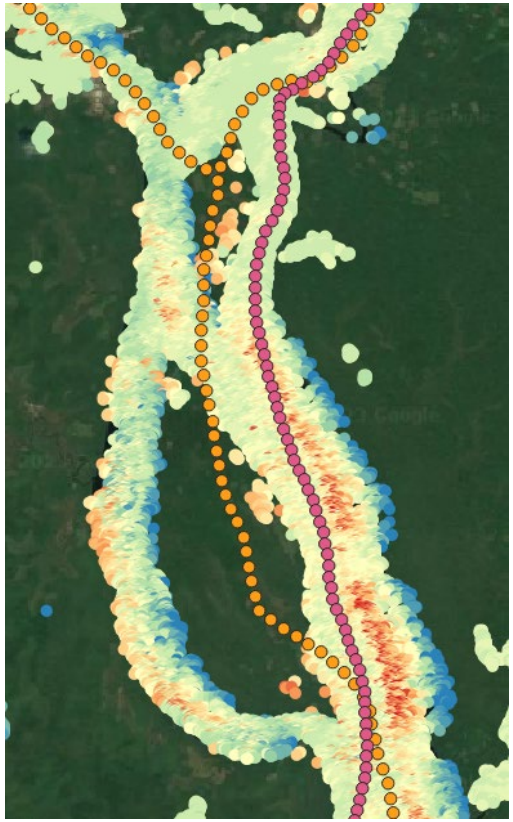
Many work remains to be done

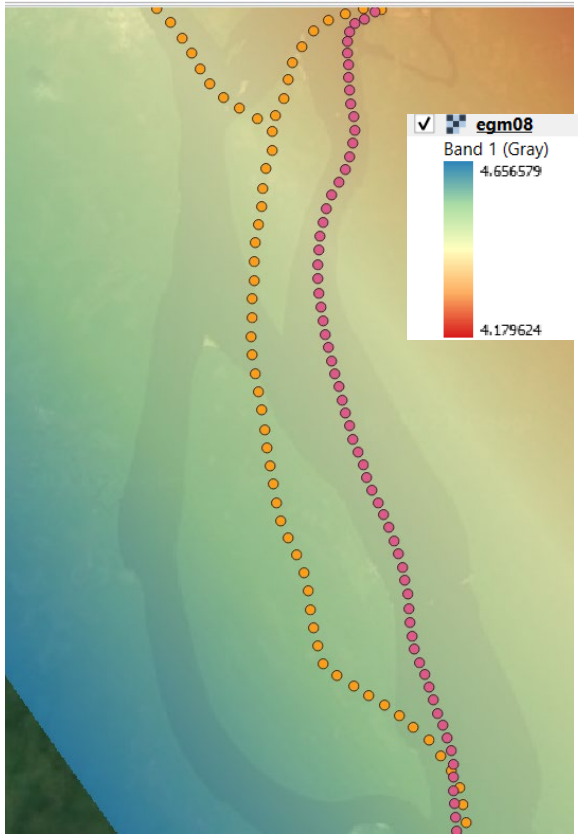
FROM DATA AT CAL/VAL ORBITS

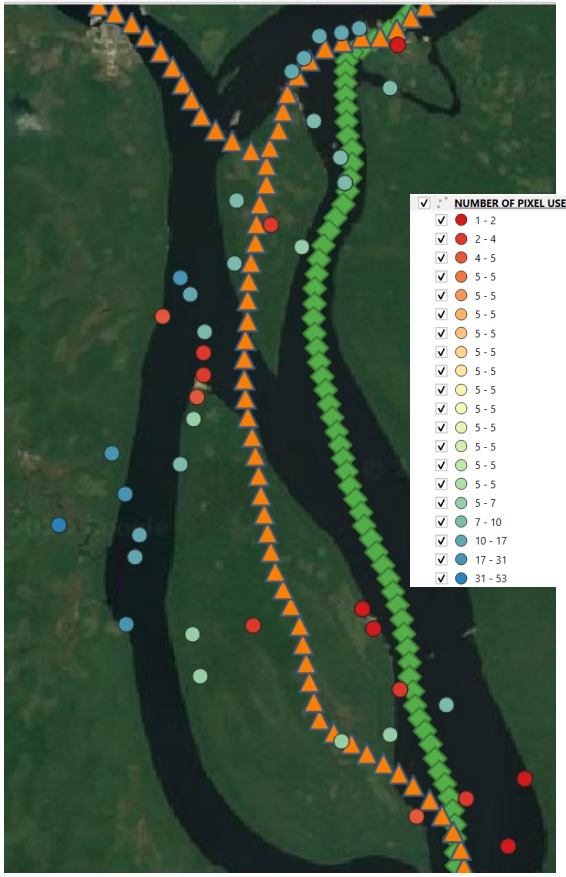
- Better statics analysis of SWOT and GNSS slopes using new versions of reprocessed SWOT data
- Analyse time séries of SWOT water level over cal/val sites and compare to in situ gauges
- Wet tropo correction evaluation
- Model Hydrological loading effects over Amazon

NOMINAL SCIENCE ORBITS

- Prepare new Cal / Val international campings in 2024 and 2025







SWOT_L2_HR_PIXC_555_022_NEGRO

- 57 - 58.9
- 58.9 - 60.7
- 60.7 - 62.6
- 62.6 - 64.5
- 64.5 - 66.3
- 66.3 - 68.2
- 68.2 - 70.1
- 70.1 - 71.9
- 71.9 - 73.8
- 73.8 - 75.7
- 75.7 - 77.5
- 77.5 - 79.4
- 79.4 - 81.3
- 81.3 - 83.1
- 83.1 - 85