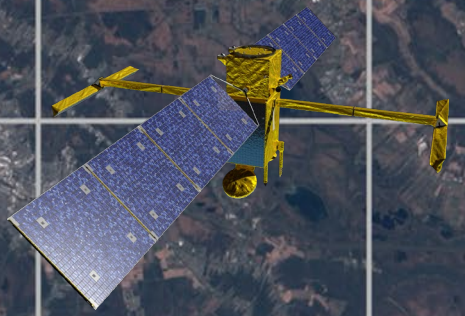
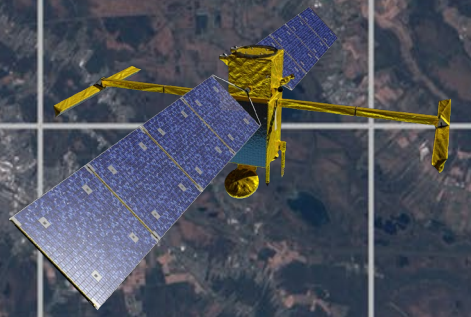


SWOT & The Coast

Deltas, Estuaries and Coastal Working Group



Outline

Is SWOT meeting requirements, pre-launch expectations?

- LR vs HR products
- Estuaries vs nearshore/shelf

New results being revealed

Challenges remaining: steps forward

Recommendations

Is SWOT meeting requirements, pre-launch expectations?

LR products SSH - Shelf

Liverpool Bay, Cal/Val phase P. Bell et al.

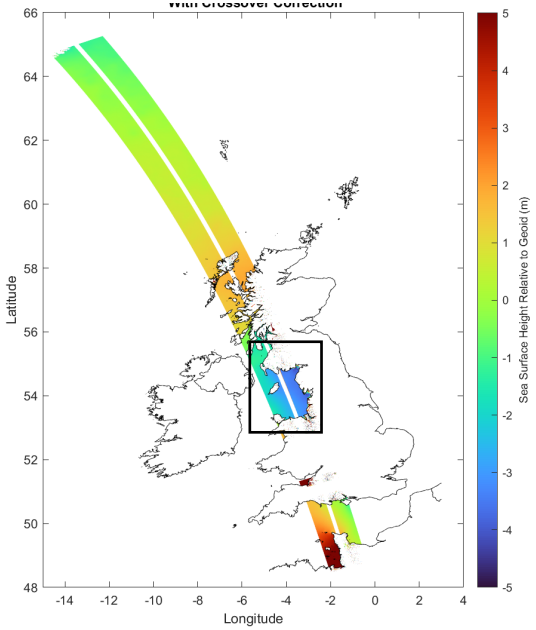
LR SWOT Data versions P1B0_01 and PGC0_02 compared with

9 tide gauges across Liverpool Bay : 10m Tidal Range

RMS Errors are calculated after removal of mean bias levels at each tide gauge site.

	LR Data Version P1B0_01		LR Data Version PGC0_02	
Tide Gauge	**Mean Bias (m)**	**RMS Difference (m)**	**Mean Bias (m)**	**RMS Difference (m)**
Gladstone	0.151	0.057	0.121	0.069
Eastham	0.112	0.065	0.104	0.069
Alfred	0.024	0.063	-0.016	0.083
Garston	0.309	0.091	0.292	0.078
Heysham	0.139	0.083	0.079	0.082
Workington	0.072	0.064	0.149	0.063
Llandudno	0.221	0.056	0.218	0.066
Port Erin	0.345	0.076	0.355	0.056
Portpatrick	0.194	0.083	0.181	0.057
Gauge Averages	**0.174**	**0.071**	**0.165**	**0.069**

Unsmoothed data with crossover calibration

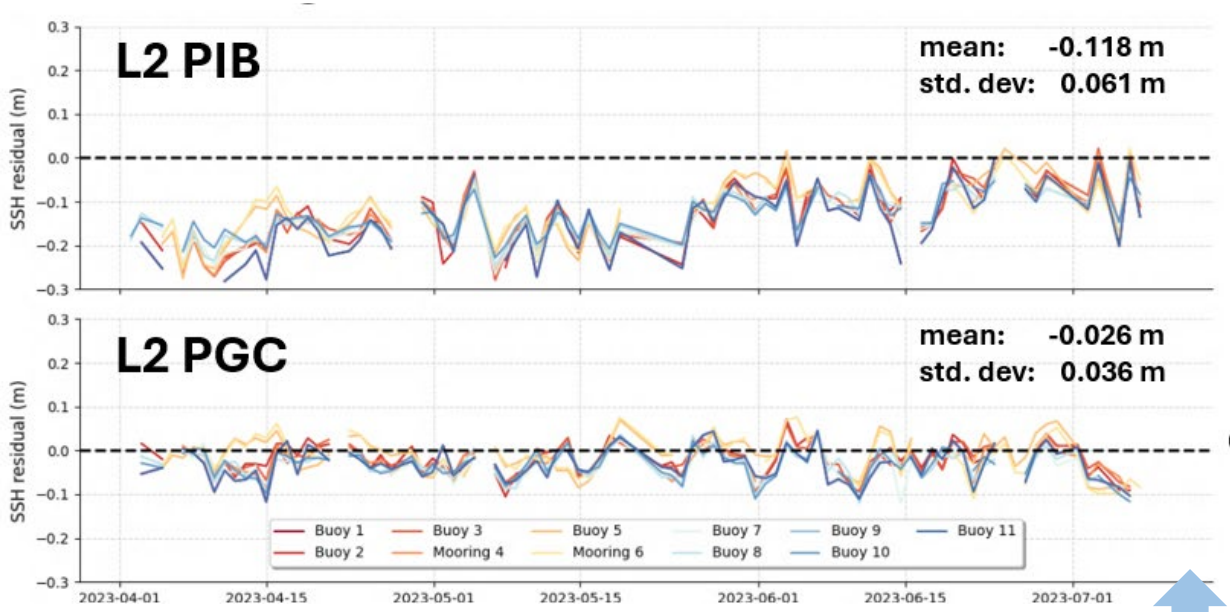


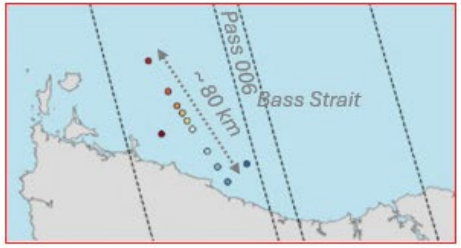
"Average 7cm RMSE is amazing!!
I am already using this data for applications!"

Is SWOT meeting requirements, pre-launch expectations?

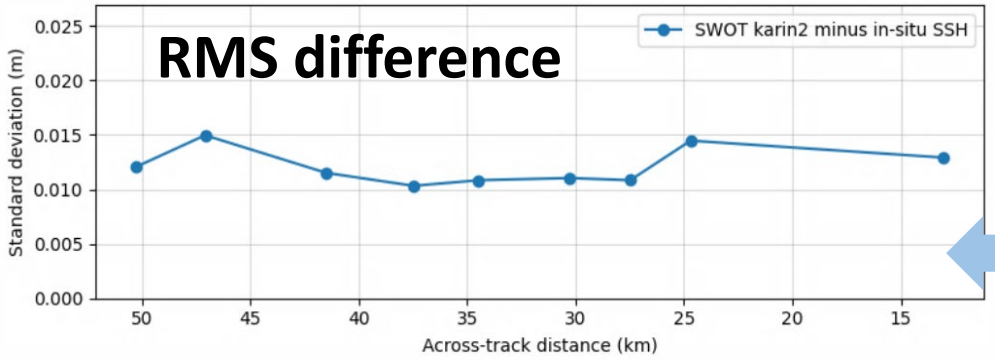
LR products SSH nearshore

Bass Strait
Cal/Val orbit
Hay, Legrésy et al.





GNSS buoy and CWPIES mooring locations made 11comparison points within the FSP swath



Bass Strait: 2.6 cm (std: 3.6 cm)
Version C : significant improvement

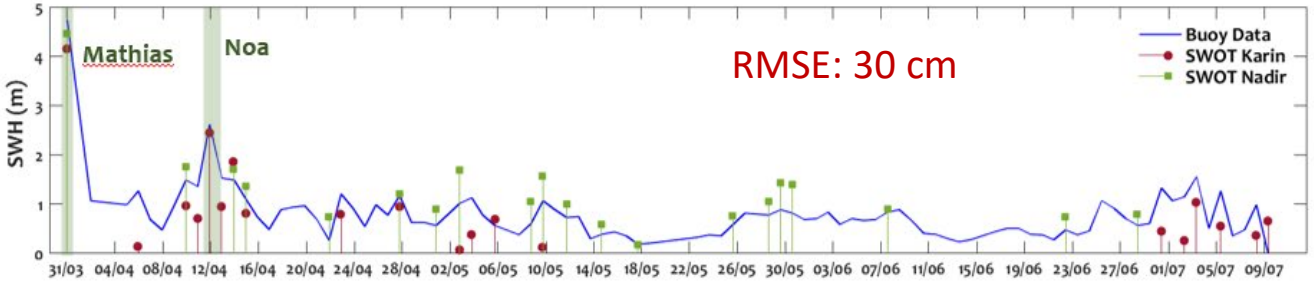
No clear across track signal in SSH residuals, with a noise level likely under detectability

Is SWOT meeting requirements, pre-launch expectations?

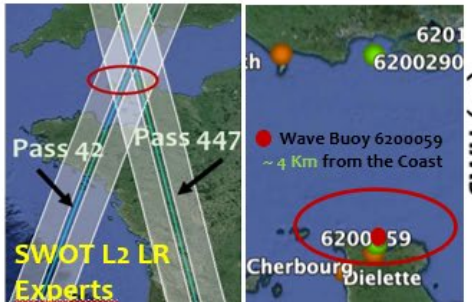
LR products SWH nearshore

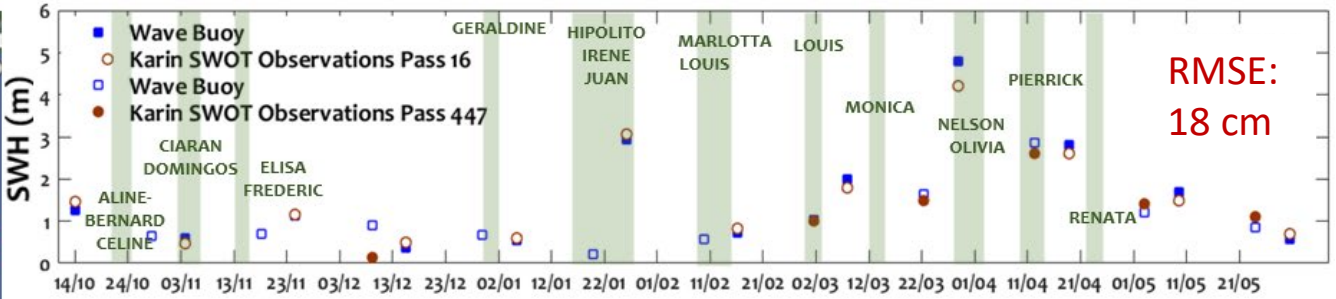
English Channel
Cal/Val and science orbits
Turki, Salameh et al.

CAL/VAL



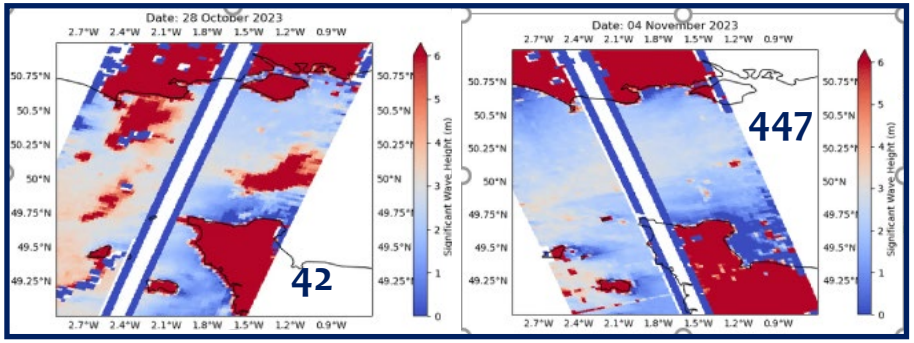
Science





Good agreement between SWOT SWH and wave buoys data for both orbits during high energetic period (winter 2023-2024) with more than 20 storms.

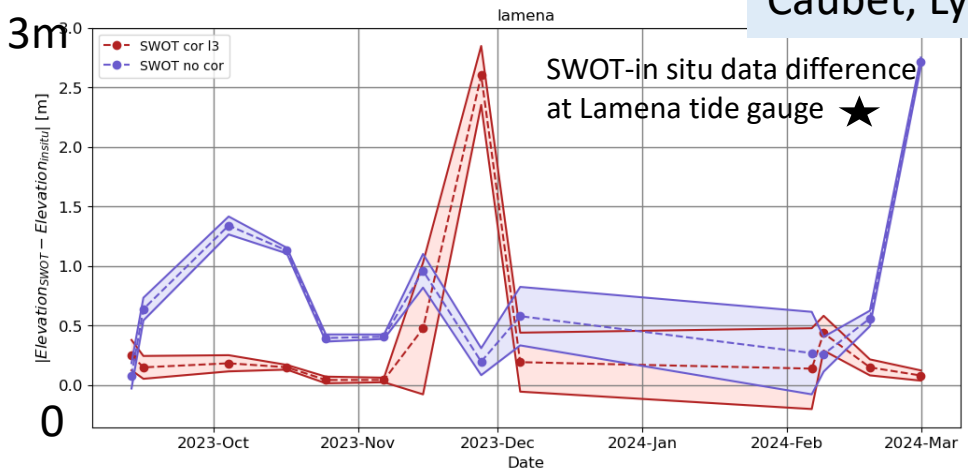
Validation performed with buoys located at 4 (Cherbourg) to 8 km (Weymouth) from the coast



Is SWOT meeting requirements, pre-launch expectations?

LR products SSH - Estuary

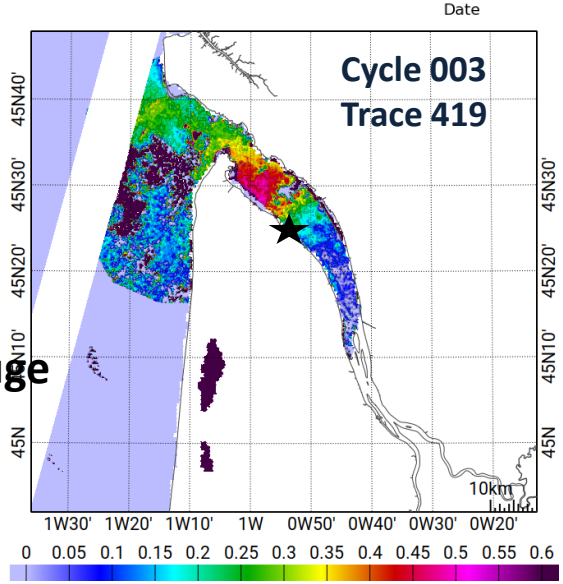
Gironde estuary
Science orbit
Caubet, Lyard, Ayoub

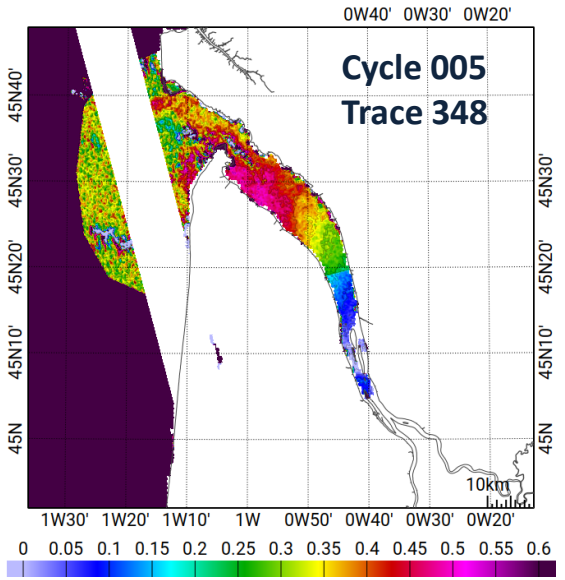


20 cm
mean bias

Unsmoothed SSH with
L3 crossover calibration
Comparison with tide gauge data and numerical simulations (TUGO + assimilation of tide gauge data)

| SSHA_SWOT – SSHA_model | [m]





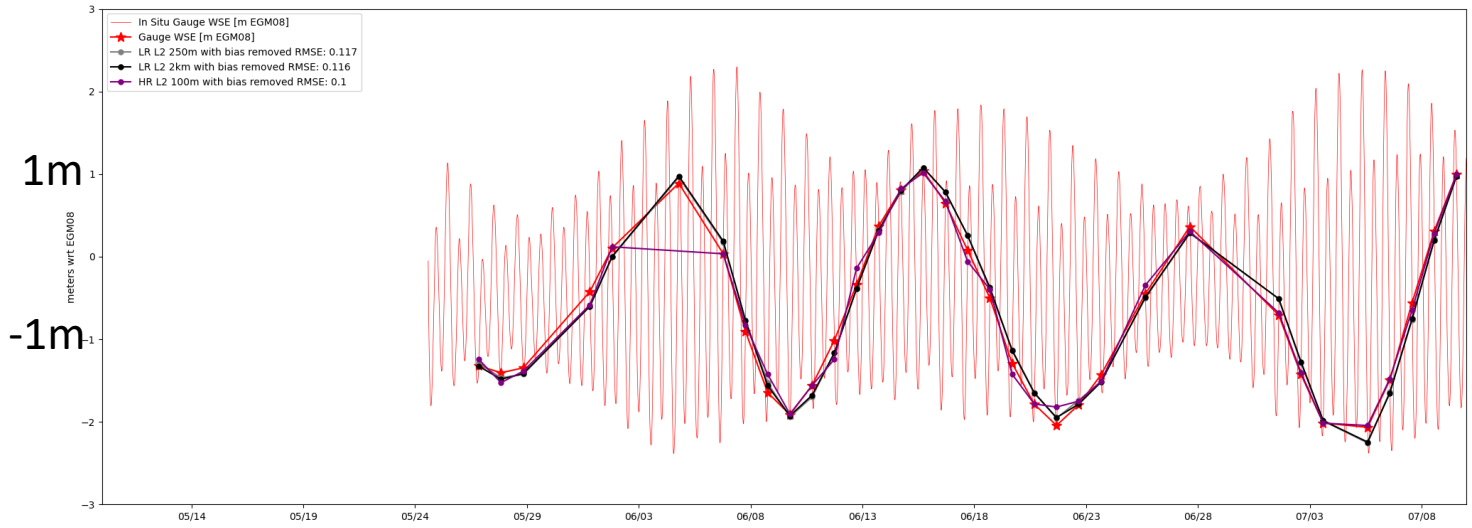
Is SWOT meeting requirements, pre-launch expectations?

HR products SSH Estuaries

Comparison btw tide gauge, LR 2km, LR 250m and raster 100m

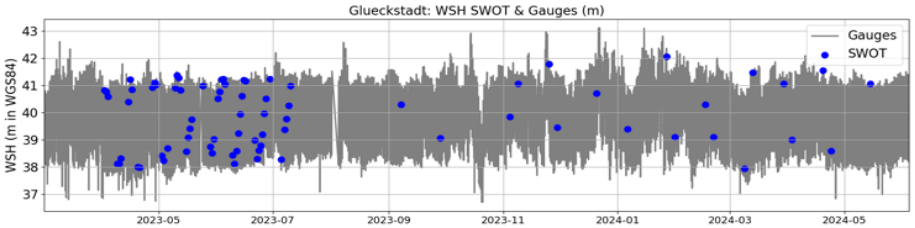
good agreement

St Lawrence estuary – CAL/VAL phase - Simard, Christensen, Matte



Elbe River estuary, Cal/Val & Science orbits, Fenoglio et al.

We find WSE accuracy of **30 cm downstream** in the Elbe tidal river



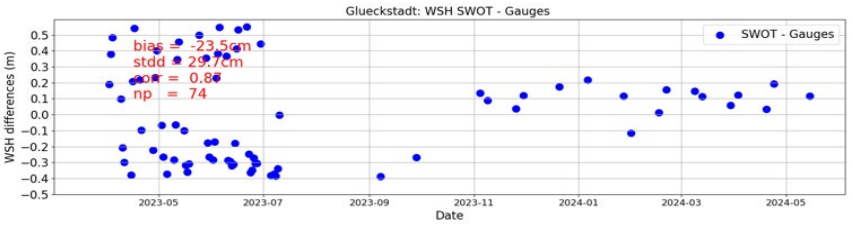
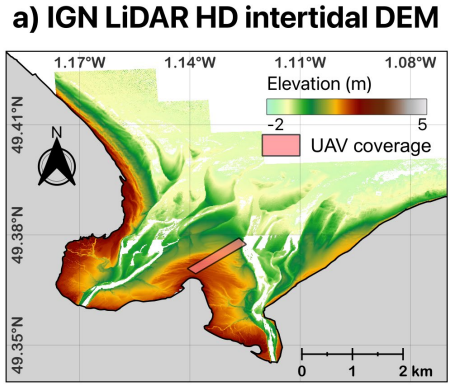
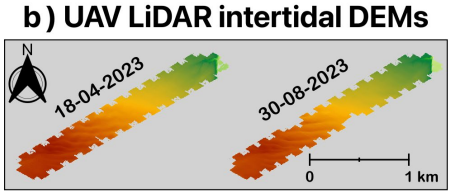
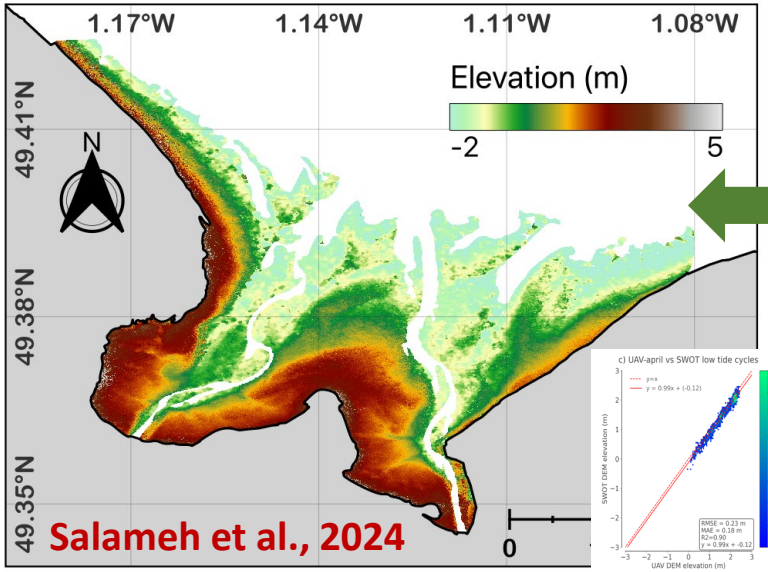


Fig. 4. WSE time-series downstream Hamburg – lower accuracy in cal/val phase

New results being revealed



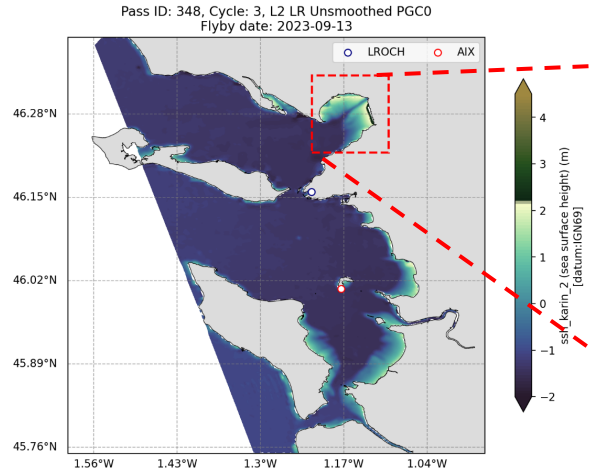


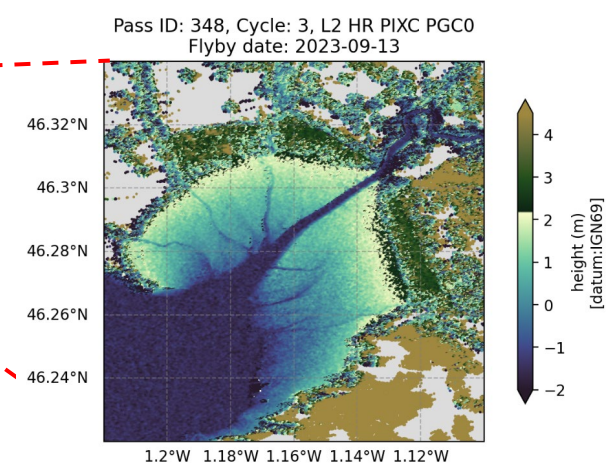


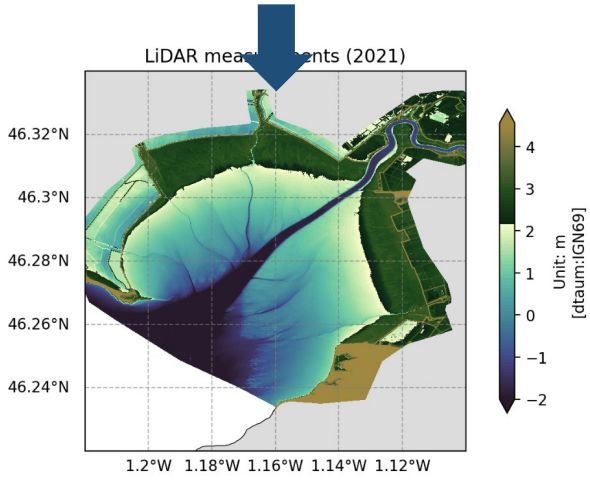
Intertidal topography from SWOT PIXC

Daily Monitoring during CAL/VAL orbit in the Bay of Veys validation with Lidar and UAV data – Salameh, Turki, Froideval

Science orbit in the Pertuis Charentais (in progress) Yeasmin & Testut





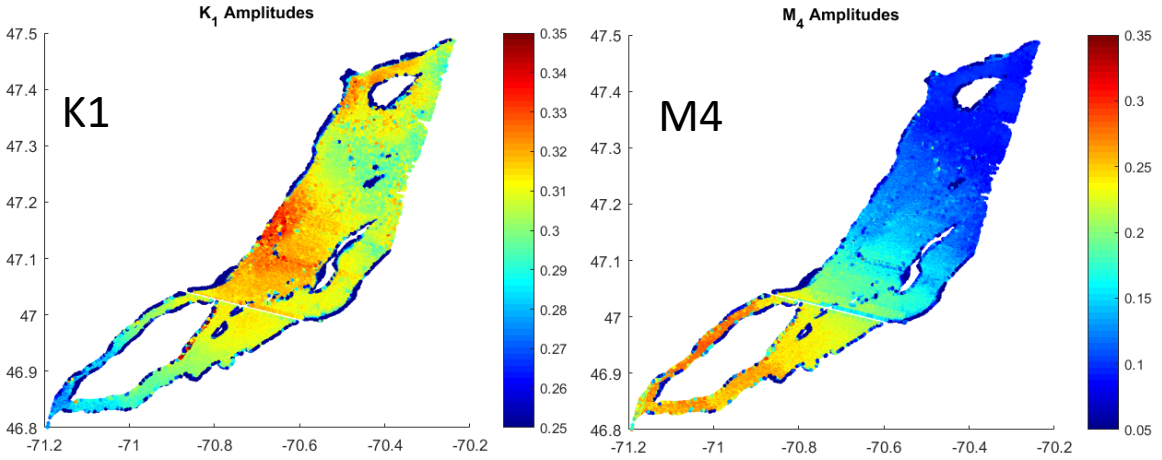


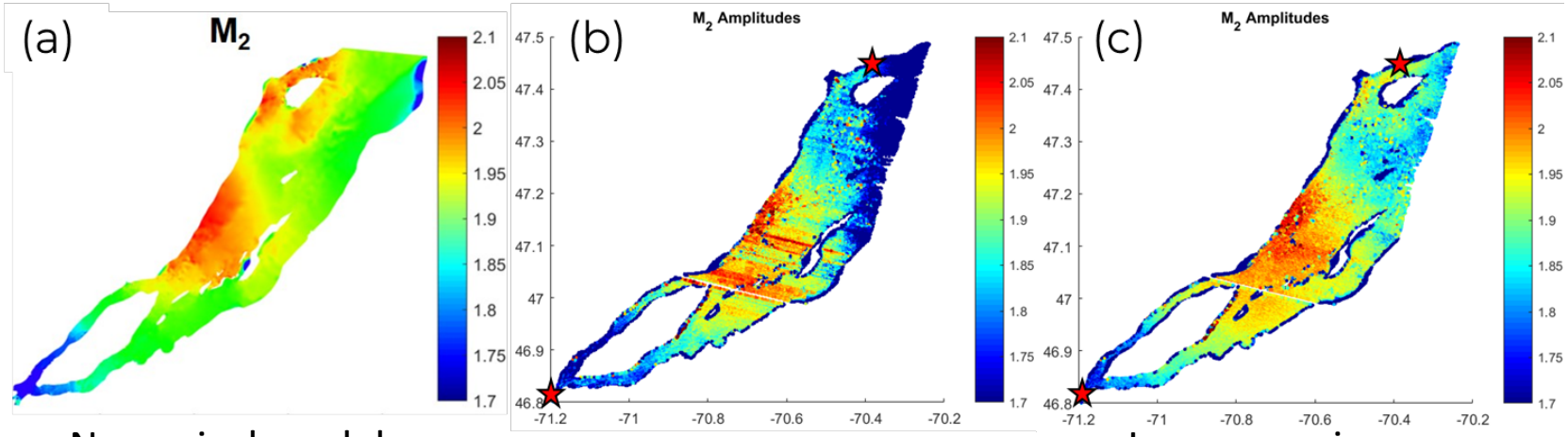
New results being revealed

Resolving “unresolvable” tides from 1-day SWOT data in the St. Lawrence Estuary

Matte et al.

Results: HR L2 Raster 100m (v1.0)





Numerical model

Direct harmonic analysis

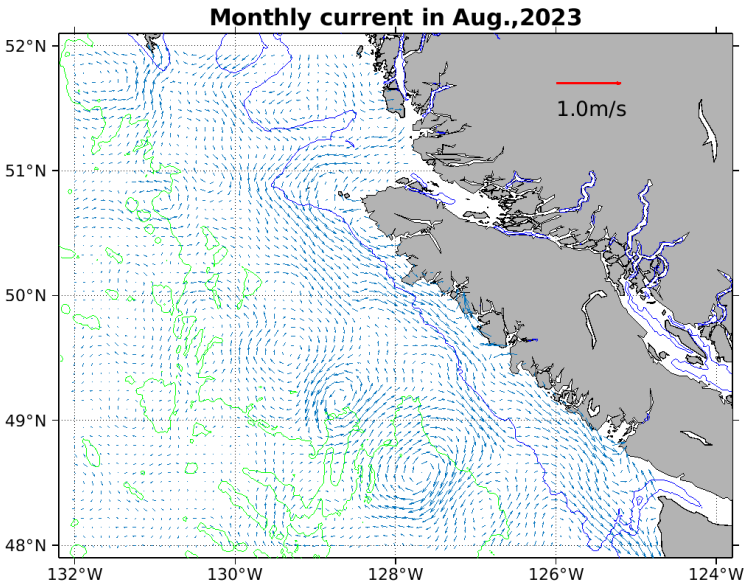
Lag regression

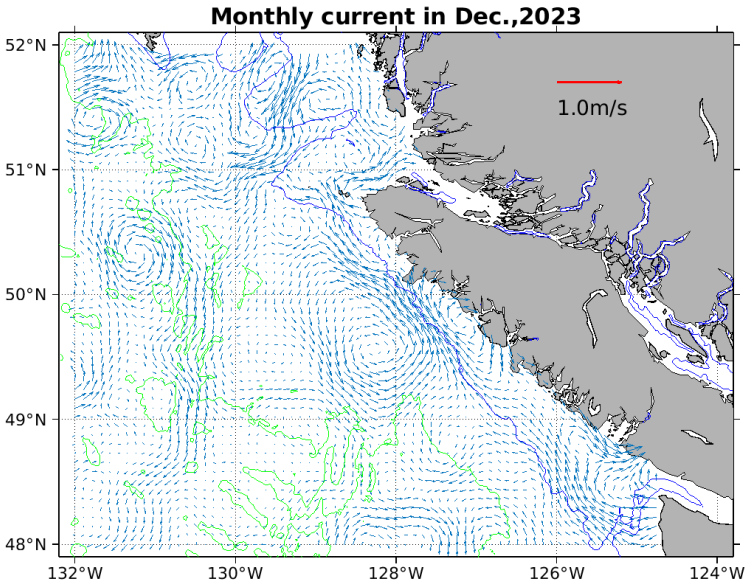
New results being revealed

SWOT Coastal and Shelf Currents

Guoqi Han, Fisheries and Ocean Canada

- SWOT SSH anomalies are mapped daily off Canada's west coast from Aug 2023 to Jan 2024. Working on improving mapping method.
- **Weekly and monthly SSH maps** and **geostrophic current anomalies** are calculated.
- SWOT monthly results show expected seasonal changes in the major coastal and shelf edge currents. Weekly results are to be evaluated.
- Need improved coastal/shelf MSS/Geoid for absolute currents.





Challenges remaining: steps forward

Assessment and mitigation of :

- residual errors due to inaccurate **crossover corrections**
- **wet tropospheric errors**, and their dependance across the swath.
- **SSB correction errors**.

→ **contrasted sites** should provide complementary information

Comparing HR and LR data for different coastal/estuarine systems at several locations.

Intertidal areas:

- monitoring the muti-timescale changes of the intertidal topography to infer morphological processes (erosion, sediment transports, etc.)
- development of algorithms for systematic detection of wet/dry sand (tidal flats)

Assessment and prediction of **tides in estuaries**

Exploration/Quantification of **2D Hs (Swell/Sea) and wind fields** in nearshore and coastal zones (exploring 1 to 10 km scales)

Use of **models** to address the aforementionned SWOT challenges

Recommendations

First results: beyond expectations but need to continue the validation effort of measurements and of errors at multiple sites / contrasted areas

@Project :

- please reprocess data to **provide measurements in areas where the reference surface is currently missing**
- improve the **correction on the roll/phase errors** in coastal regions and estuaries
- improve the **MSS** product in coastal regions and estuaries

Products:

- develop tools and products to ease the **comparison between LR and HR** products, and the switch from one product to the other
- **provide all individual corrections** (for instance ocean tides + LSA + polar tides separately)

Maintain the DEC group in the new ST and develop synergies with other groups

Projects of the Science Team

1. **L. Fenoglio-Marc** (Germany): CONtinuum of Water from ESTuaries to coastal Dynamics (CONWEST-DYCO2)
2. **P. Bell** (UK): SWOT in the Severn Estuary (VORTICES)
3. **S. Nerem & JT Minear** (US): Using SWOT Data to Assess the Impact of Ocean Tides and Sea Level Change on Upstream Rivers and Estuaries
4. **P. Passalacqua et al.** (US): Predicting flux partitioning in river delta networks using SWOT to produce global delta products and quantify the response of deltas to climate and human induced change
5. **S. Giddings & A. Rodriguez** (US): Exploring Estuarine Sea Level Fluctuations and Dynamics Using the Surface Water and Ocean Topography Mission: A Multi System, Multi-Timescale Analysis
6. **L. Testut and N. Yeasmin** (France): Intertidal Topography: Aiguillon Bay, Pertuis Charentais (France)
7. **I. Turki & B. Laignel** (France) SWOT 4 COST
8. **M. Simard** (US): SWOT in deltas, estuaries and coasts
9. **P. Matte** (Canada): SWOT in the St-Lawrence Estuary
10. **G. Han** (Canada): Integration of SWOT Measurements in Canadian Oceanographic Research and Operation (SORAC)
11. **B. Legresy & Watson** (Australia): SWOT validation in BASS Strait
12. **N Ayoub & F. Lyard** (France): Swot Coastal Ocean and Estuarine Products Usability Study (SCOEPUS)
13. **T. Izumo** (France/Polynesia) From large-scale FORcing to fine-scale coastal impacts on South Pacific Islands - FORSPI
14. **M. Hart-Davis** (Germany) SWOT data Integration For Tide modelling in Complex coastal Regions
15. **M. Passaro** (Germany) Integration of SWOT Observations into a DAta-driven GRIdded Product
16. **Merkitas** (Greece) Calibration and validation of SWOT altimetric and radiometric products using the ESA Permanent Facility for Altimetry Calibration in Crete, Greece (LISSOS)