Introduction to ESA's Altimetry Virtual Lab on the EarthConsole Platform

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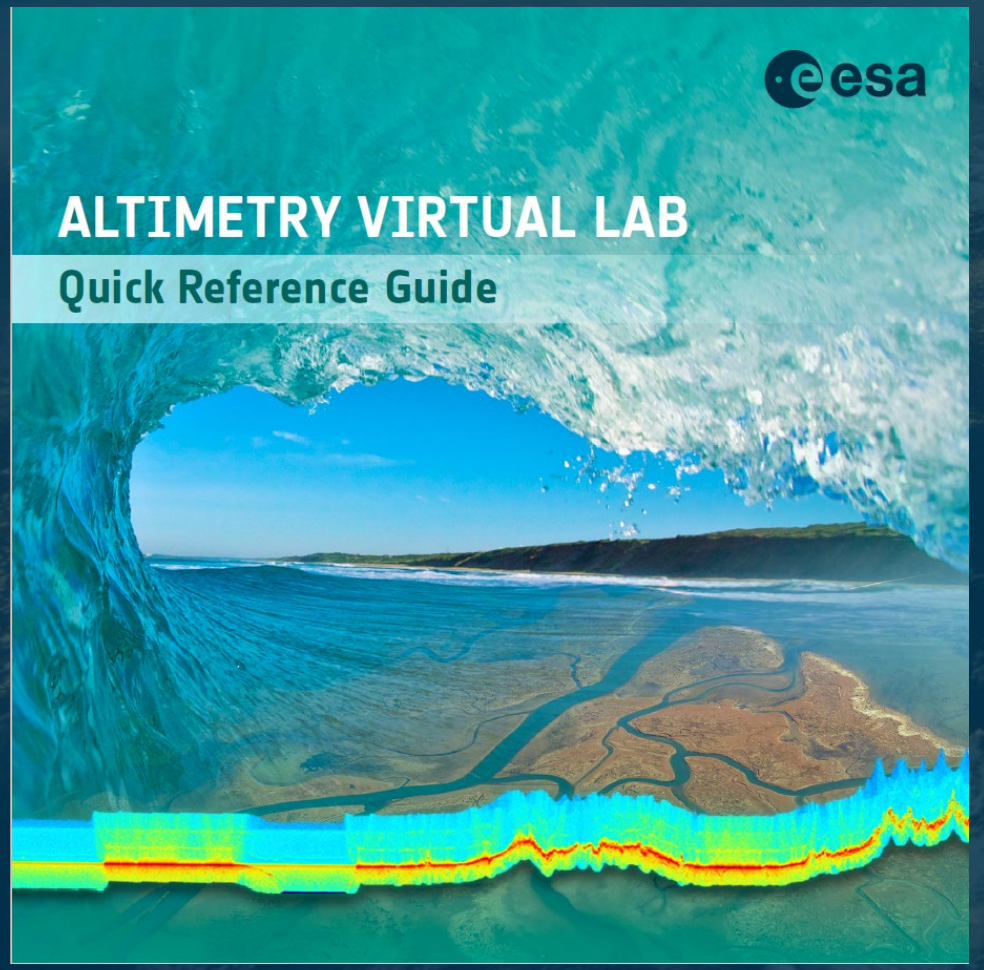
Altimetry Virtual Lab – SAR & FF-SAR Processors

Brochure available at: https://earthconsole.eu/knowledge-base/



THE ALTIMETRY VIRTUAL LAB SERVICES VIA THE ESA NoR

All Altimetry Virtual Lab services are available via the **Network of Resources (NoR)**, an ESA initiative aiming at facilitating the use of cloud environments. Research, development, or pre-commercial project may be eligible to receive a voucher to exploit the EarthConsole® Altimetry Virtual Lab services free of charge or at very competitive prices.

If you will select the option **ESA NoR Sponsorship=yes** in the service request form, EarthConsole® operators will prepare the NoR sponsorship form and share it with you for review and approval. To learn more about the NoR mechanism, please click on the ESA Sponsorship page of the EarthConsole® website.

CONTACTS & ACKNOWLEDGING

For any further information on the Altimetry Virtual Lab, please contact **info@earthconsole.eu** with **support@earthconsole.eu** and **altimetry.info@esa.int** in cc. In case of technical assistance with any of the services, please contact **support@earthconsole.eu** with **altimetry.info@esa.int** in cc

Acknowledging the Altimetry Virtual Lab/SARvatore services and EarthConsole® when showing or publishing results obtained through their use is recommendable and appreciated. Users can contact **altimetry.info@esa.int** with **support@earthconsole.eu** in cc to share and discuss results and agree on a proper citation.

The SARvatore Altimetry Virtual Lab Software User Manual can be downloaded from:
https://earthconsole.eu/wp-content/uploads/2021/10/SARvatore-AVL-EarthConsole-AVL_Software_User_Manual.pdf

Introducing the
The Aresys FF-SAR Service for Cryosat-2
at ESA's Altimetry Virtual Lab
(LPS2022 poster)

Elbe estuary and river

- This case study analyses the CryoSat-2 FF-SAR data over the Elbe estuary and river (Fig. 1). The time period from 2019-01 and 2020-02 includes a full CryoSat-2 geodetic orbit.

- The selected setting for FFSAR is: multi-look posting rate 200 Hz, zero padding applied (set to 2), bandwidth factor 0.5, Threshold retracker.

  → First goal is to investigate the quality of the FF-SAR data, final goal is to extract time-series of water surface elevation and the elevation mean profile.

The river Elbe has about 300-400m width between Geerstacht and Neue Darchau and is larger in the estuarine part which is affected by ocean tides.

It ends in the German Bight at Ottendorf. The studied section is a downstream reach of ~150km long where gauge stations are available.

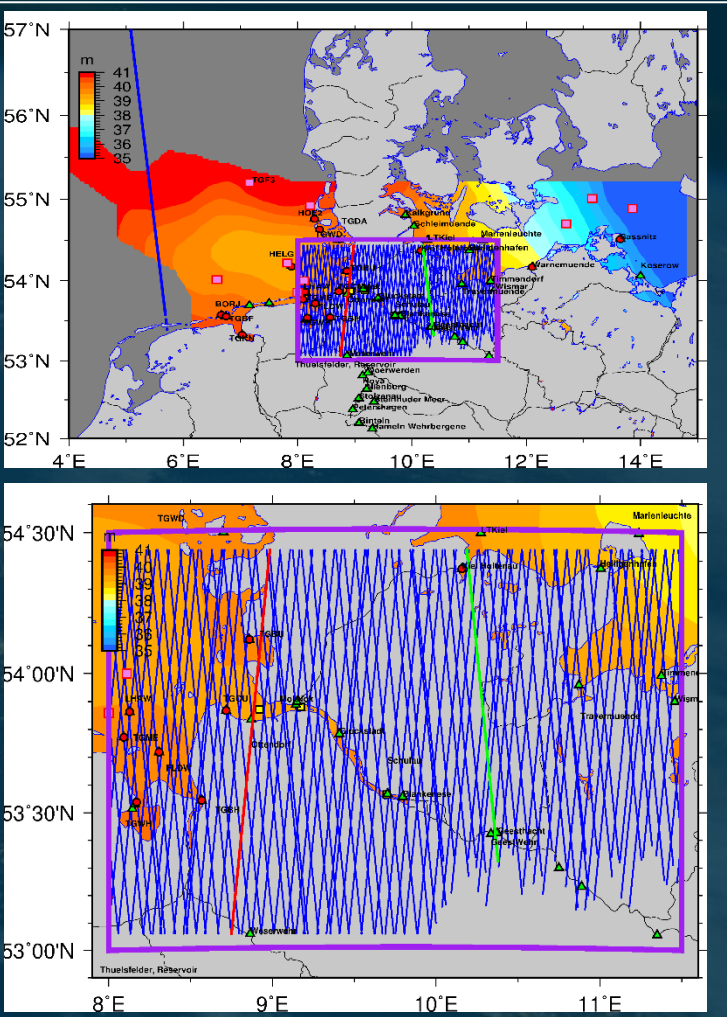


Figure 1. (top) CryoSat-2 ground-tracks is open sea and in Elbe estuary and river, (bottom) zoom in the Elbe region

Elbe estuary and river (2)

- From an along-track comparison in coastal and open ocean of FFSAR with EarthConsole (former GPOD) SARVatore and TUDaBo data (Fig. 2), FF-SAR data look noisier than the other products.

- In the estuarine intertidal and in river parts FF-SAR provides a smooth surface and more data due to its higher sampling.

- Figs. 3 and 4 show the results in Otterndorf, where the along-track section width is 13 km and in Geerstacht.

Figure 2. Uncorrected heights in open sea from FF-SAR (blue), unfocused SAR (red) and reduced SAR (violet) along open sea ground-track location in Fig. 1 →

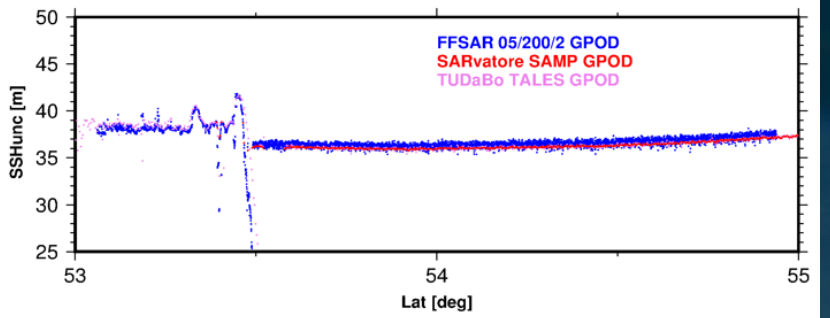


Figure 3. Water heights from FF-SAR at Ottendorf (red track in Fig. 1). →

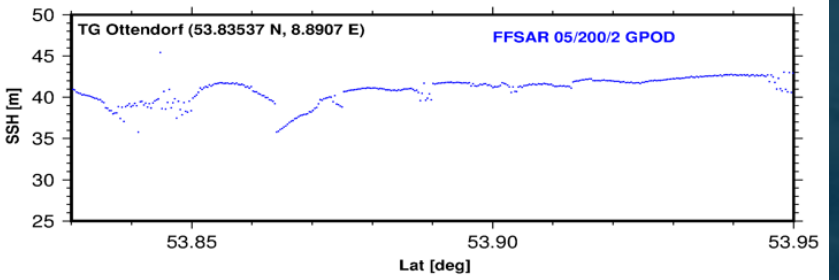
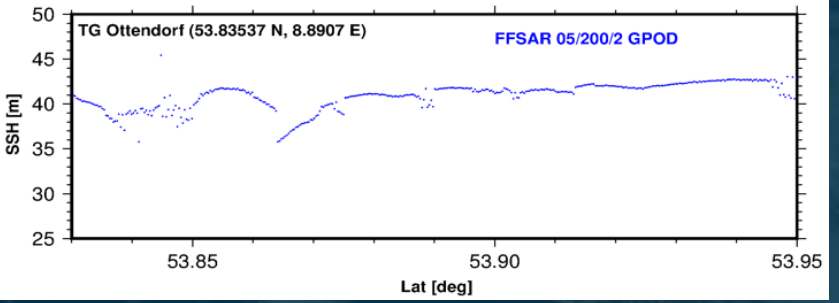


Figure 4. Water heights from FF-SAR at Geerstacht (green track in Fig. 1). →



Cryosat-2 FF-SAR data over the Canadian River

- In this case study, Cryosat-2 FF-SAR data over the Canadian River in the Mississippi basin was evaluated. This river has a width of a few hundred meters.
- The FF-SAR derived water levels were evaluated using ICESat-2 laser altimetry data and gauge data from the USGS .https://maps.waterdata.usgs.gov/mapper/index.html
- In the study we considered water levels based on different retrackers including the ALES+ and threshold retrackers. To enhance the amount of data we selected a *posting rate of 500* and the *band width of 0.5.*
- To compare the altimetry data to the gauge data we need to create a water level time series at the location of the gauge. We use the C2 FF-SAR data and ICESat-2 data to compile a time series.
- The time series is constructed using data available along a reach of approximately 200 km (see Figure 1 and 2)

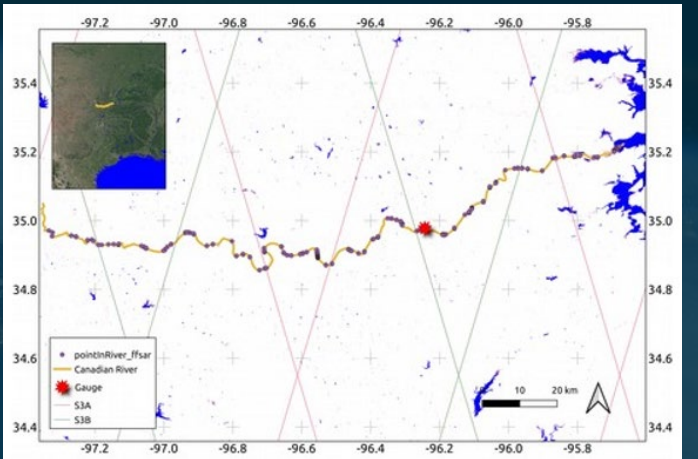


Figure 1: Study area

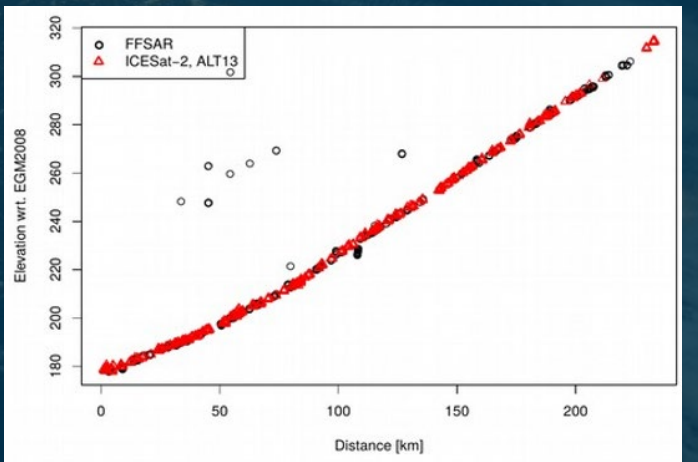


Figure 2: FF-SAR and ICESat-2 water levels plotted against distance along the reach.

Cryosat-2 FF-SAR data over the Canadian River (2)

- The time series is constructed using data available along a reach of approximately 200 km.
- ‘Firstly, the data is projected to the centreline of the river. Providing the data as a function of space and time
- The data is then combined via a state-space model (https://doi.org/10.1016/j.rse.2021.112876).
- As seen on Figure 3, we are able to identify the main water level signal. We find RMSE values of approximately 30 cm and a correlation of 0.6.
- The result is similar for all the retrackers.

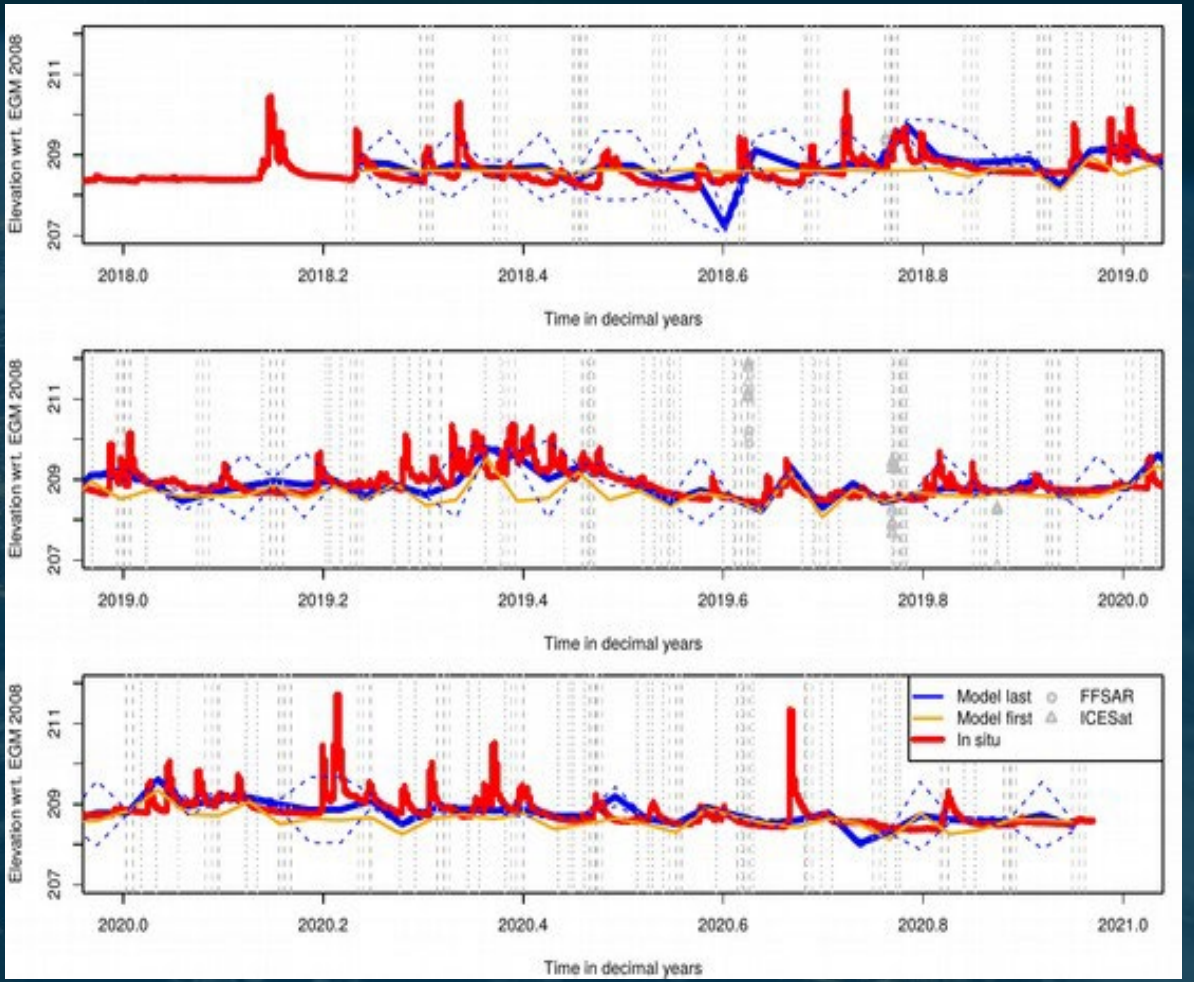


Figure 3: The reconstructed water level time series (blue) compared to the gauge water levels (red). The grey lines indicates the times where data is available