BROADVIEW RADAR ALTIMETRY TOOLBOX
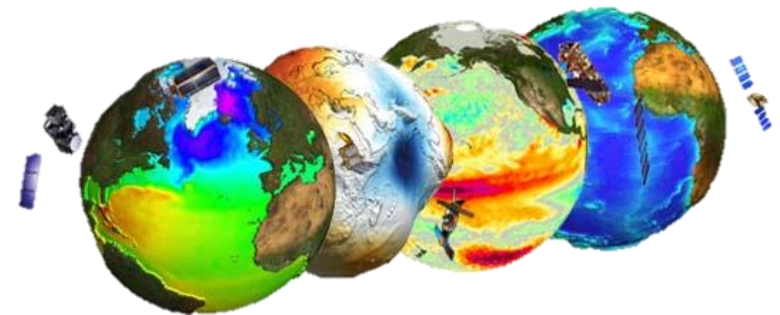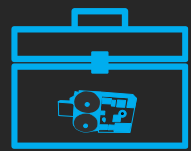
SAMOSA Retrackers Comparison in BRAT

Albert Garcia-Mondéjar (isardSAT)

- This presentation has been prepared to train and support the BRAT community.

- It shows the analysis of products provided by the **G-POD SARvatore for CryoSat-2 and Sentinel-3** web processing services accessible at:
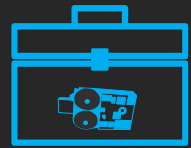
  https://gpod.eo.esa.int/services/CRYOSAT_SAR
  https://gpod.eo.esa.int/services/SENTINEL3_SAR

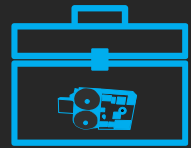- Products have been processed using two different retrackers (**SAMOSA2** & **SAMOSA+**).
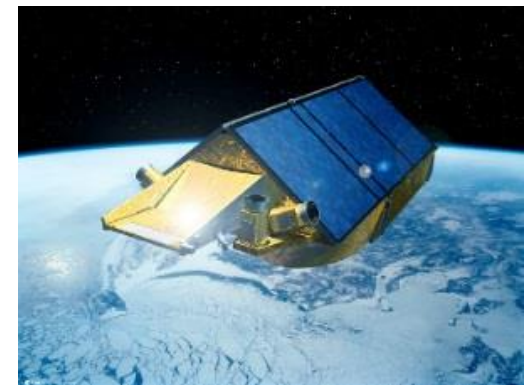
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The **SARvatore** processor is at gpod.eo.esa.int/services in the '**Marine**' section. **SARvatore for CS-2** or **S-3A** can then be selected and accessed. (EO-SSO ID user is required)

On the map, users can select the area of interest, and the date range.

Then, after querying the database, data files can be selected.

In this example, we have chosen the area of the Northern Sea and the Coast of the UK.

L2 Processor

- Restrict the re-tracking on specific surfaces
Flag to limit the processing on open sea or on water (open sea, coastal zone and inland water) or to process the full pass   `Process only water points ▼`

- PTR width alphap parameter
Use a LUT (Look-Up Table) or a constant for PTR (Point Tartet Response) alphap parameter   `LUT ▼`

- SAMOSA Model Generation
Flag to select the generation of the SAMOSA model to use in the re-tracking. SAMOSA3 is a truncated version (only zero order term) of SAMOSA2 (REF2), SAMOSA+ is the SAMOSA2 model tailored for inland water, sea ice and coastal zone domain   `Use SAMOSA2 ▼`

- Single-Look or Multi-Look Model
Flag to set the application of the Model Multilooking (Single-Look or Multi-Look). Single-Look option is indicated for quick look operations while Multi-Look is the most accurate   `Multi-Look ▼`

- Dump RIP in output
Flag to append Range Integrated Power (RIP) in the output netCDF data product   `No ▼`

- Dump SAR Echo Waveforms in output
Flag to append the SAR Echo Waveforms in the output netCDF data product   `No ▼`

REF1: Guidelines for the SAR (Delay-Doppler) L1b Processing
REF2: SAR Altimeter Backscattered Waveform Model (SAMOSA Model Paper), IEEE-TGARSS, Geoscience and Remote Sensing, IEEE Transactions on (Volume:53, Issue: 2)

For any question, bugs and support, please contact us at: altimetry.info@esa.int
For G-POD specific questions, please contact eo-gpod@esa.int

`Save in Workspace`   `Process it!`

The Level 2 processing parameters can be set as in the figure, although they are mostly the same as default values.

Most importantly, the SAMOSA retracking model can be set here (SAMOSA2, SAMOSA3, SAMOSA+).

Then, by clicking "Process it!", a request will be sent to process the file. The output product will be made available for download once processing has finished.
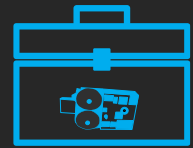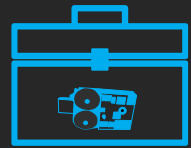
- The retracking processing (based in SARvatore on **SAMOSA2** & **SAMOSA+** models) aims at guaranteeing very accurate **Sea Surface Height (SSH)** and **Significant Wave Height (SWH)** retrievals.

- The retracking involves the fitting of the returned echo **(left panel)** to a waveform model corresponding to the observed target **(right panel)**.
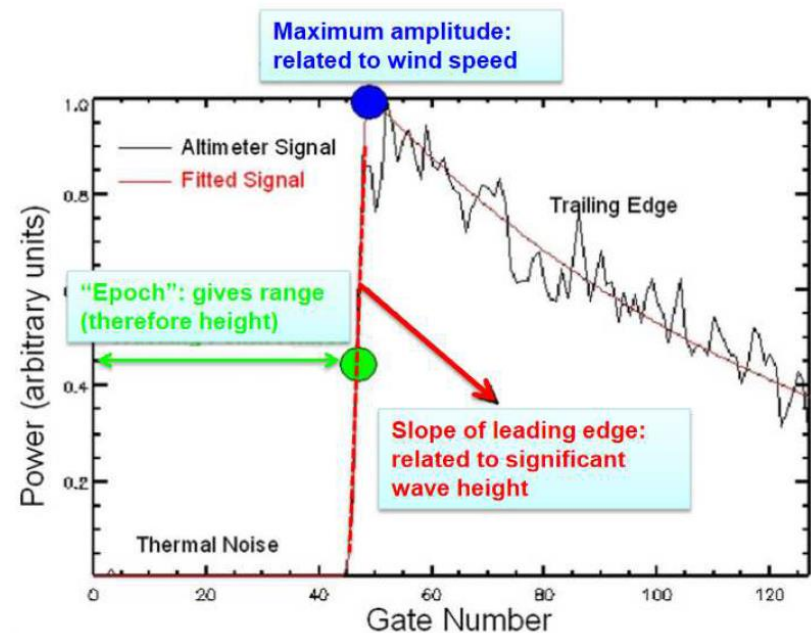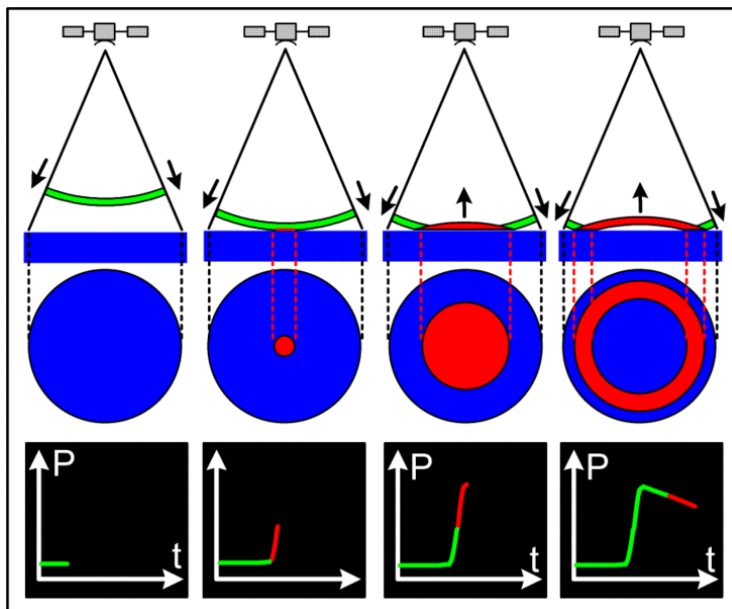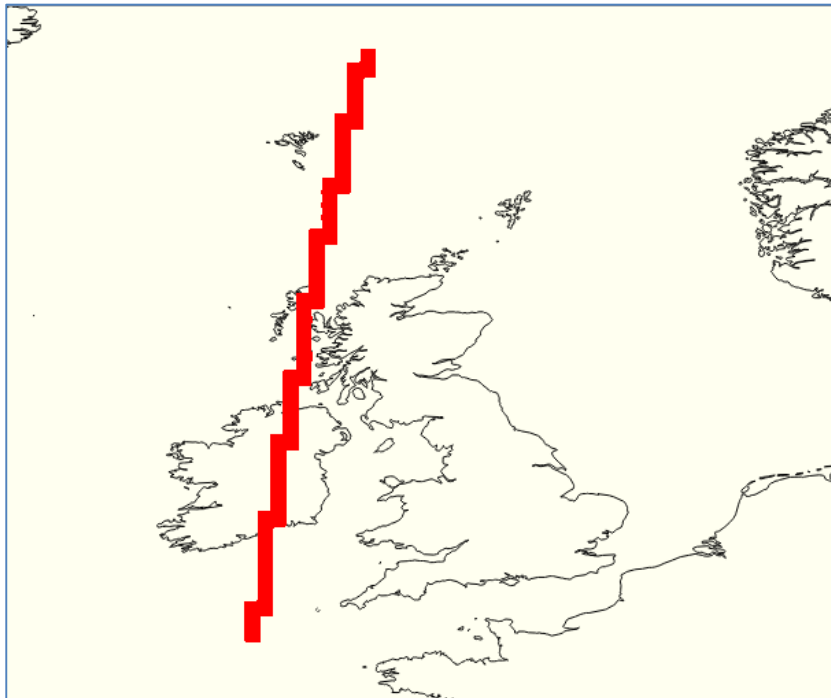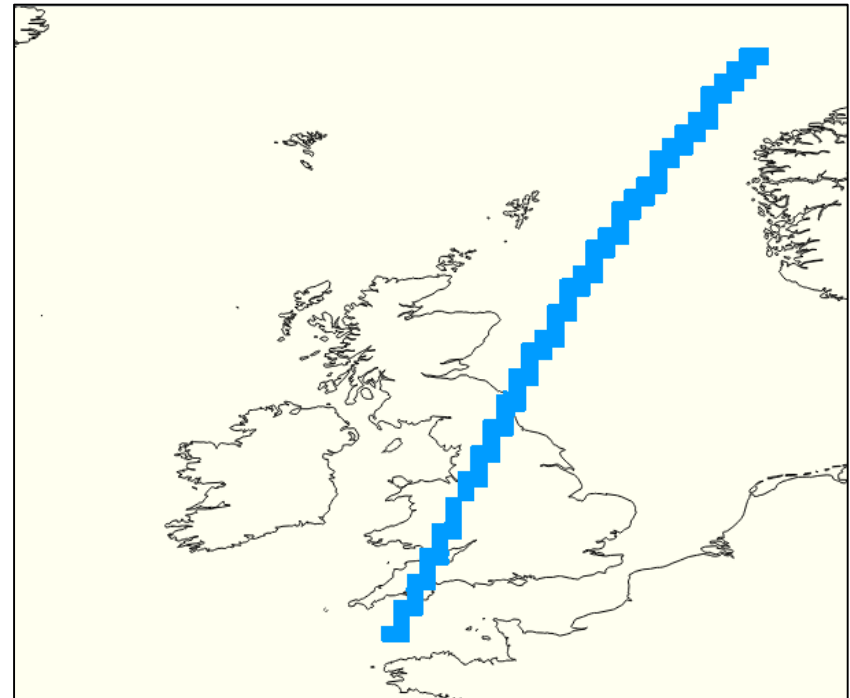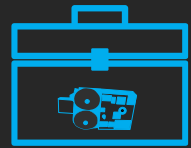
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Selected tracks: CryoSat-2 and Sentinel-3A
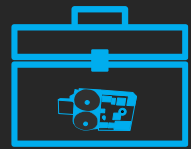
CS-2 2017/12/02

S3-A 2017/12/08
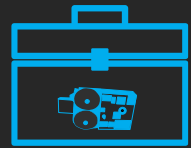
3. Comparing versions
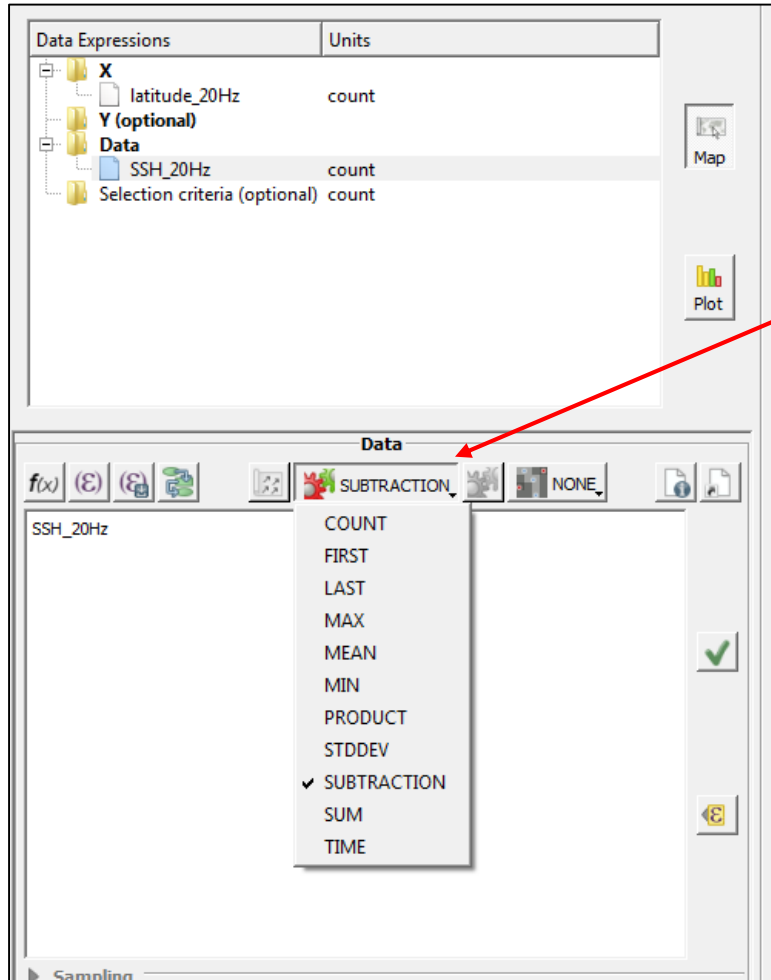
In **BRAT**, the difference between two data files can be plotted with the **Subtraction method** available in the **operations tab**.

We will visualise the differences of the computed sea surface height (SSH) and significant wave height (SWH) values from the **SAMOSA2** and **SAMOSA+** retrackers for a single pass.
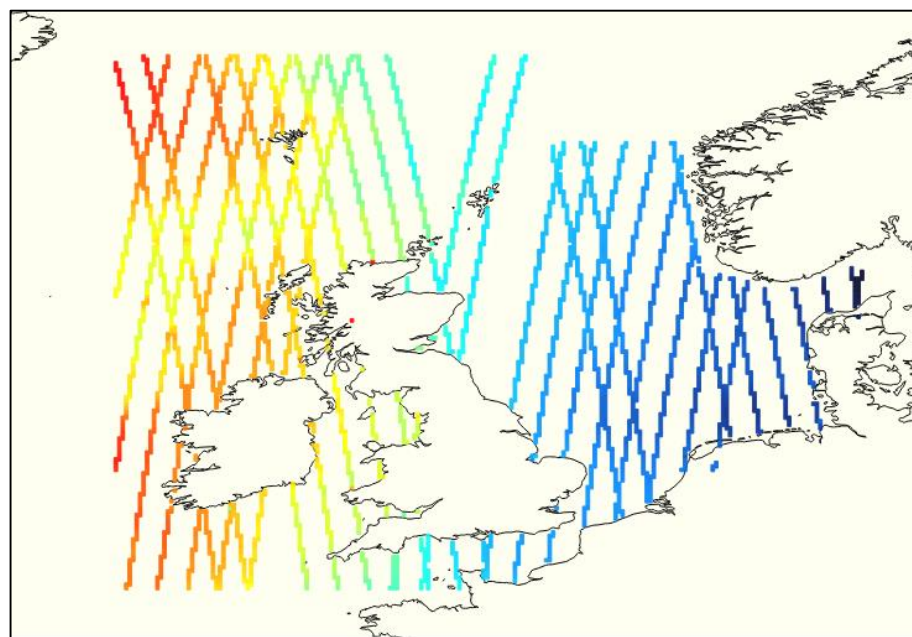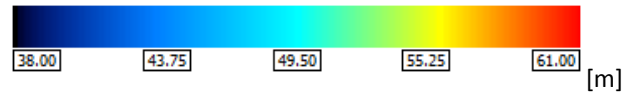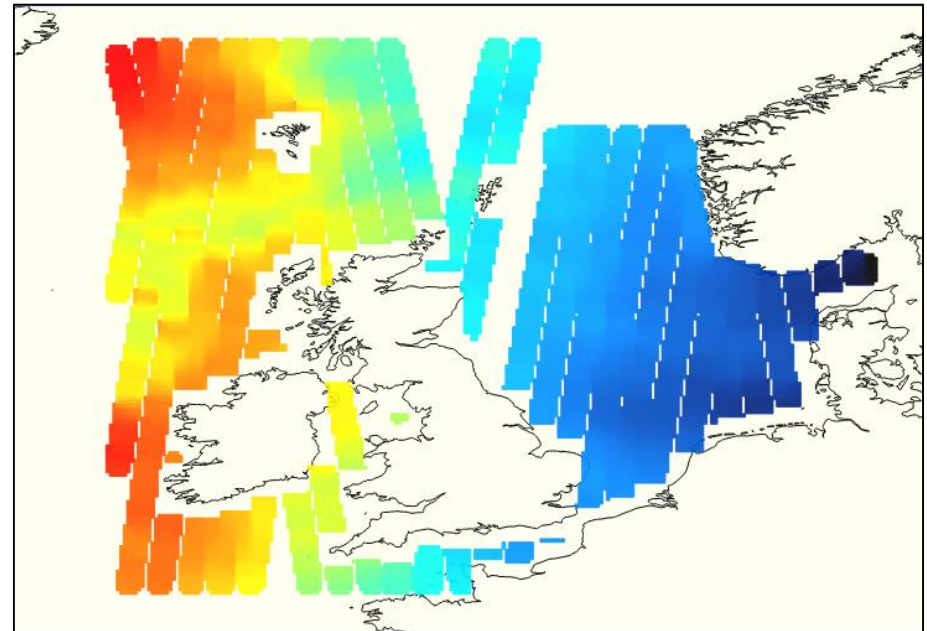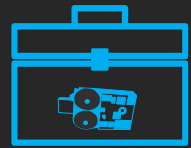
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BRAT Training Material - March 2018

CryoSat-2 SSH estimates from the **SAMOSA2** retracker (December 2017):

SAMOSA2, no smoothing
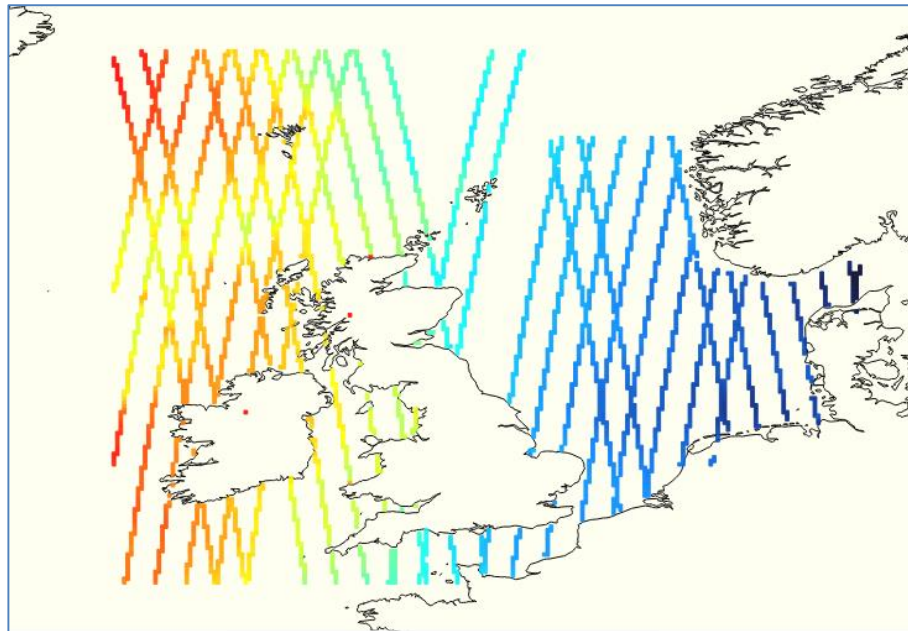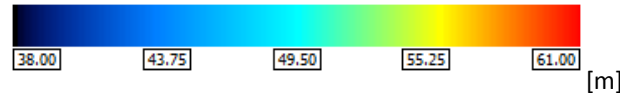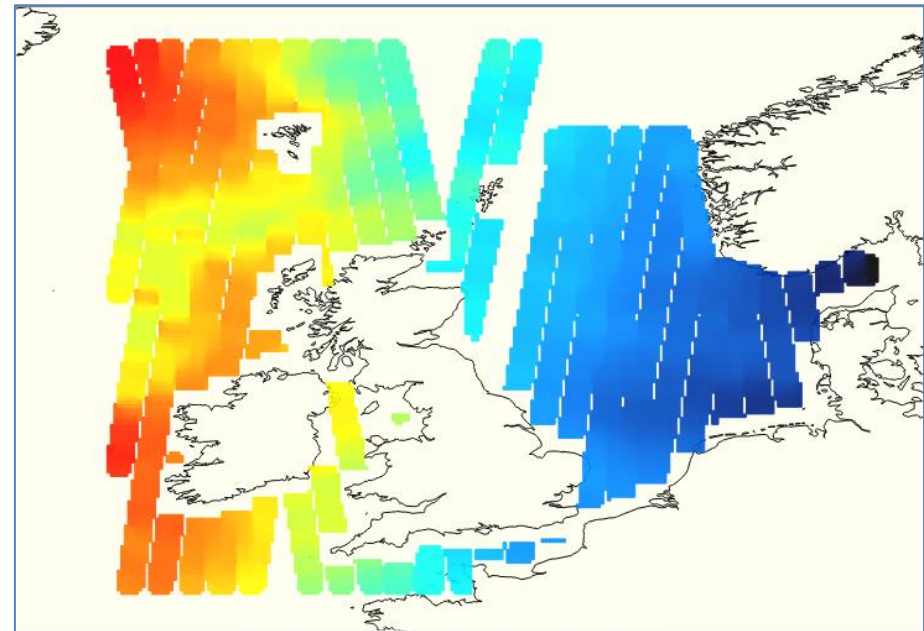
SAMOSA2, LOESS smoothing
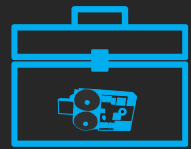
CryoSat-2 SSH estimates from the **SAMOSA+** retracker (December 2017):
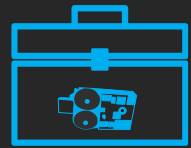

SAMOSA+, no smoothing

SAMOSA+, LOESS smoothing

The differences between SAMOSA2 and SAMOSA+ SSH estimates cannot be visually appreciated.

-> This is expected as the colormap range is too wide and the differences are lower than 1 meter and located in coastal areas.
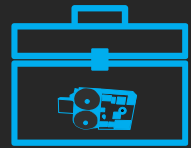
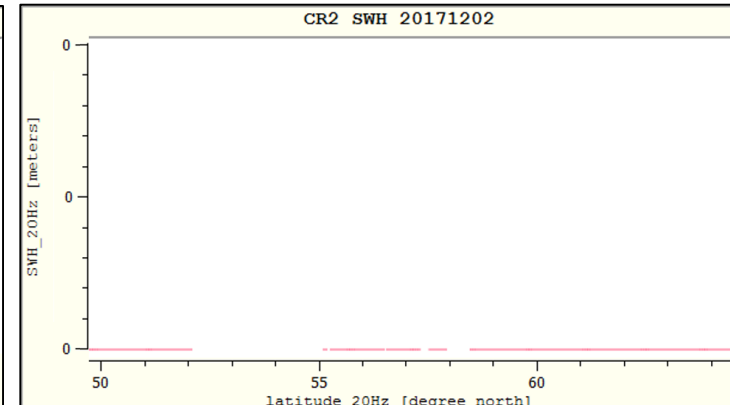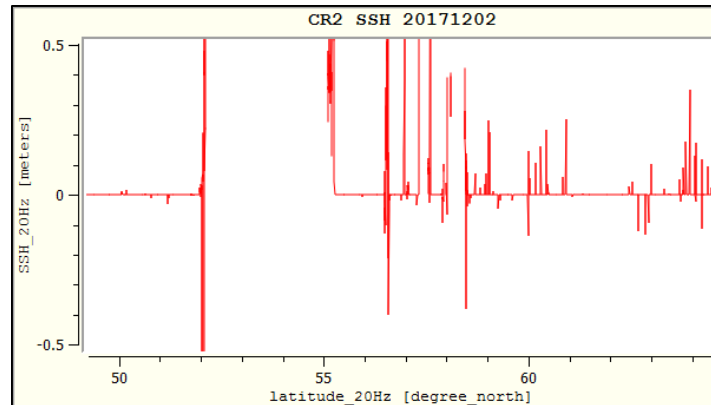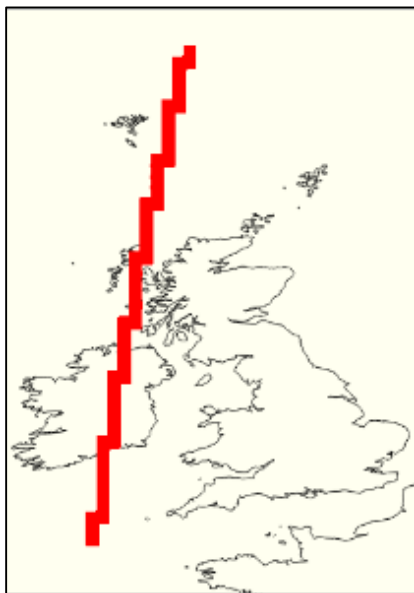# Contents

1. Data Acquisition

2. Plotting Variables

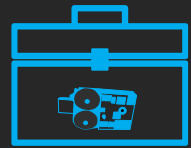3. **Comparing Versions (CryoSat-2)**

- The differences **(SAMOSA2 - SAMOSA+)** for **CryoSat-2 SSH** and **SWH** estimates for the 2017-12-02 pass are shown in the plots.

- The gaps in the plots are due to the pass crossing Ireland. In coastal regions, just before and after the gaps, SSH differences are higher indicating different results from the two retrackers (**SAMOSA+ is the SAMOSA2 model tailored and optimized for coastal domain investigations)**.

- The differences in the SWH are lower than the variable precision so the plot just shows a constant 0 value.
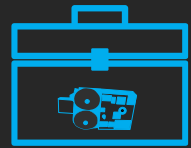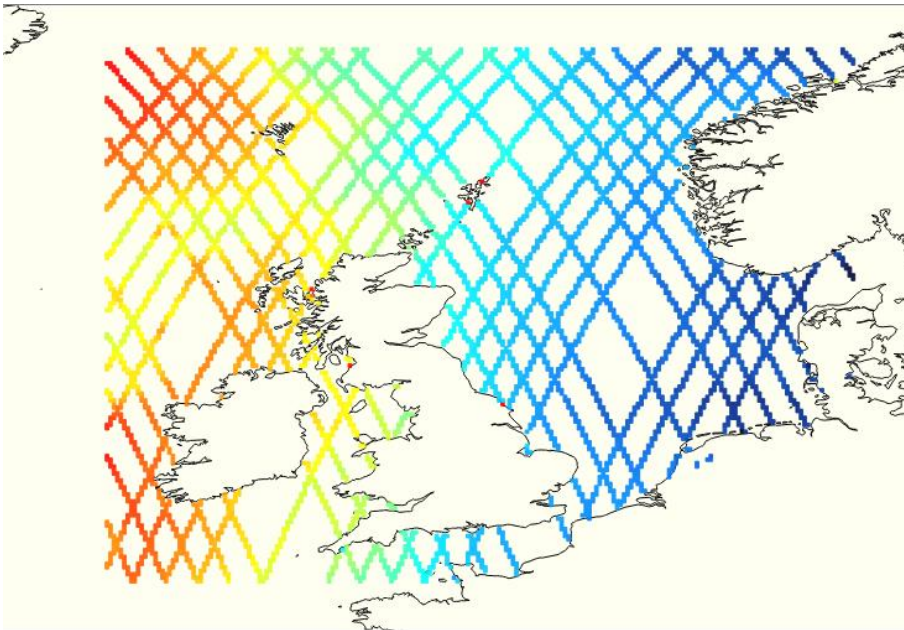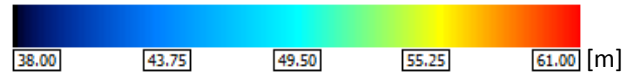
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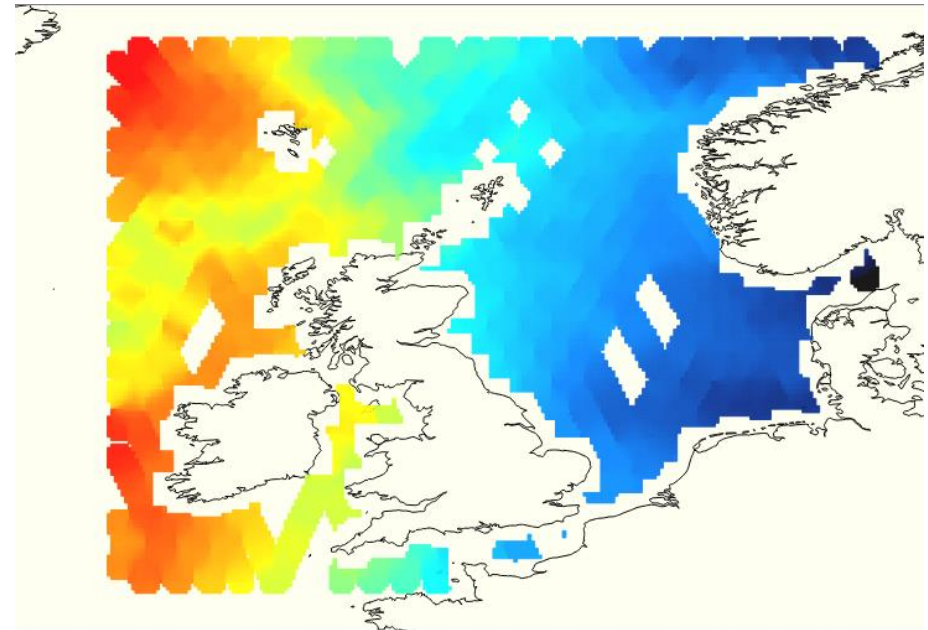
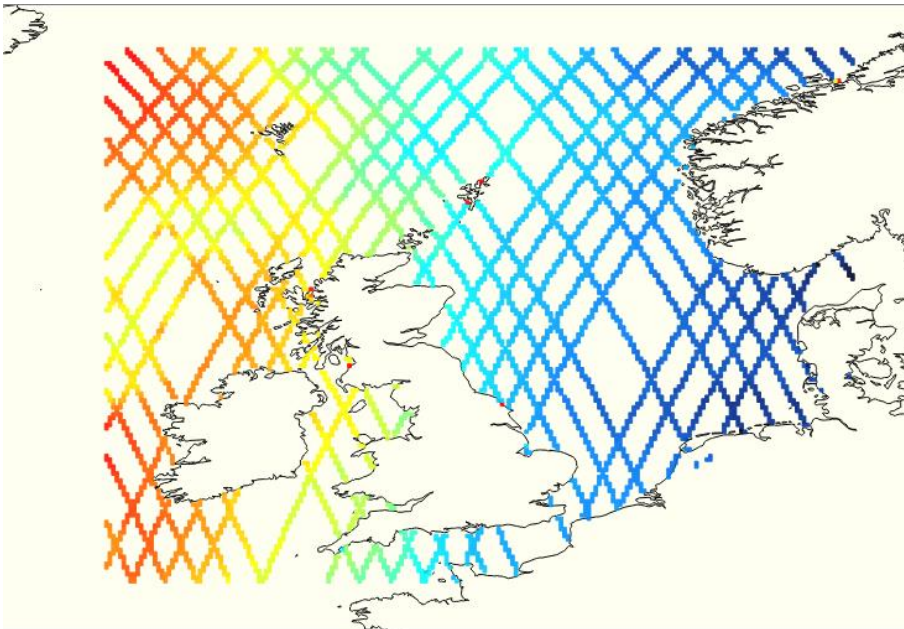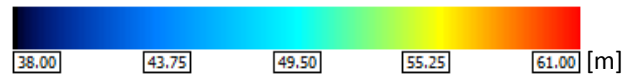Sentinel-3A SSH estimates from the **SAMOSA2** retracker (December 2017):

SAMOSA2, no smoothing

SAMOSA2, LOESS smoothing

Sentinel-3A SSH estimates from the **SAMOSA+** retracker (December 2017)::
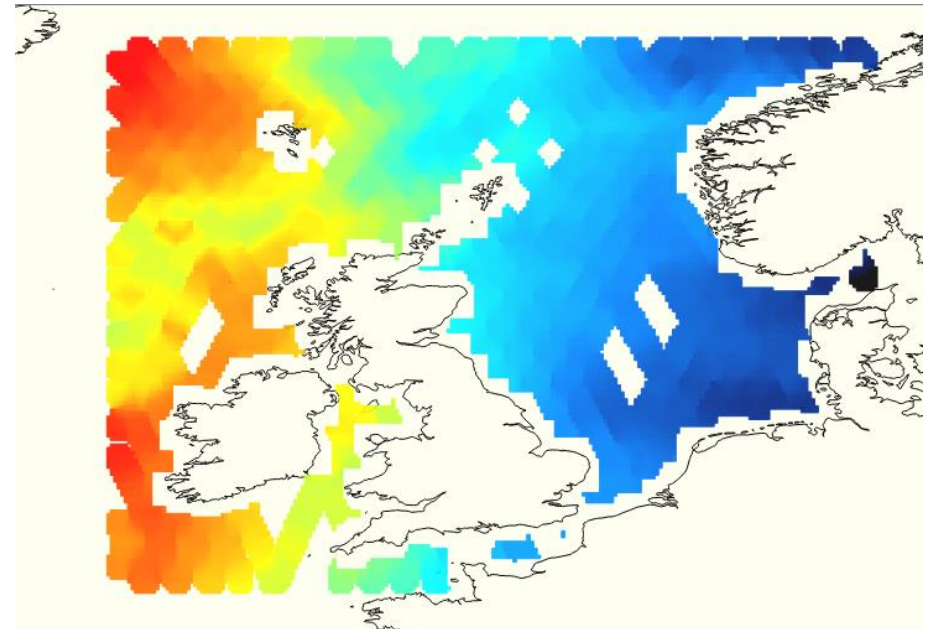

SAMOSA+, no smoothing
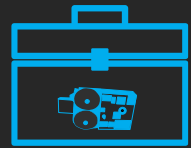
SAMOSA+, LOESS smoothing

The differences between SAMOSA2 and SAMOSA+ SSH estimates cannot be visually appreciated.

-> This is expected as the colormap range is too wide. Differences are lower than 1 meter and located in coastal areas.
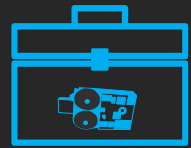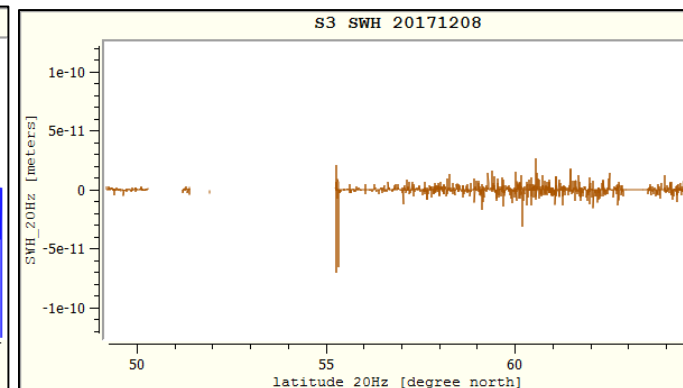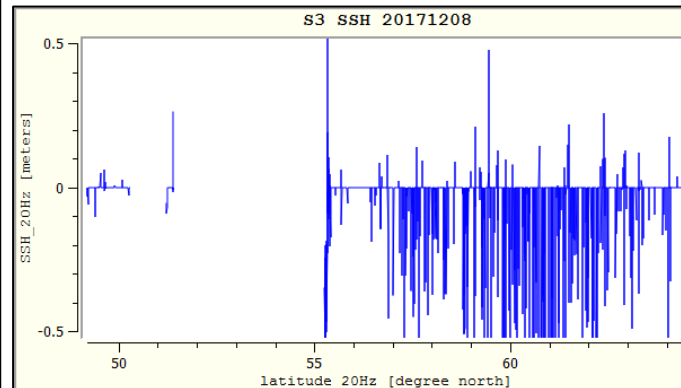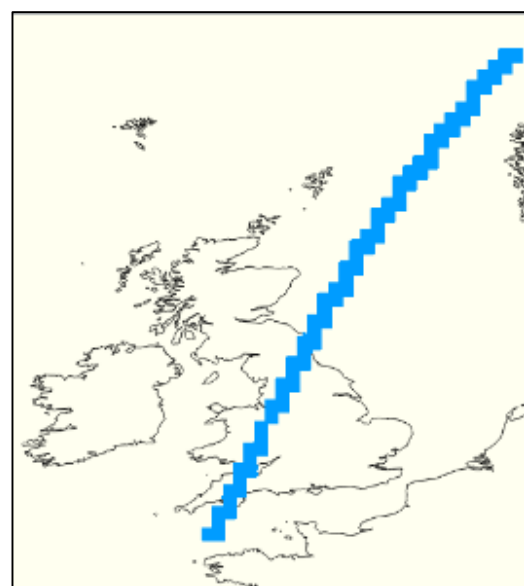
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1. Data Acquisition

2. Plotting Variables

3. **Comparing Versions (Sentinel-3A)**

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- The differences **(SAMOSA2 - SAMOSA+)** for **Sentinel-3A** **SSH** and **SWH** estimates for the 2017-12-08 pass are shown in the plots.

- Gaps in the plots are due to the pass crossing UK. In coastal regions, just before and after the gaps, SSH differences are higher indicating different results from the two retrackers (**SAMOSA+ is the SAMOSA2 model tailored and optimized for coastal domain investigations)**.

- Differences in SWH are negligible (around 10^{-11} meters).

Additional analyses adopting SAMOSA2 and SAMOSA+ retrackers can be found in:

- Salvatore Dinardo, Luciana Fenoglio-Marc, Christopher Buchhaupt, Matthias Becker, Remko Scharroo, M. Joana Fernandes, Jérôme Benveniste, Coastal SAR and PLRM altimetry in German Bight and West Baltic Sea, Advances in Space Research, 2017, https://doi.org/10.1016/j.asr.2017.12.018.

- Bonnefond, Pascal; Laurain, Olivier; Exertier, Pierre; Boy, François; Guinle, Thierry; Picot, Nicolas; Labroue, Sylvie; Raynal, Matthias; Donlon, Craig; Féménias, Pierre; Parrinello, Tommaso; Dinardo, Salvatore. 2018. "Calibrating the SAR SSH of Sentinel-3A and CryoSat-2 over the Corsica Facilities." Remote Sens. 10, no. 1: 92. https://doi.org/10.3390/rs10010092

The *Radar Altimetry Tutorial (RAT)*, including training material, is available here: http://www.altimetry.info/radar-altimetry-tutorial/
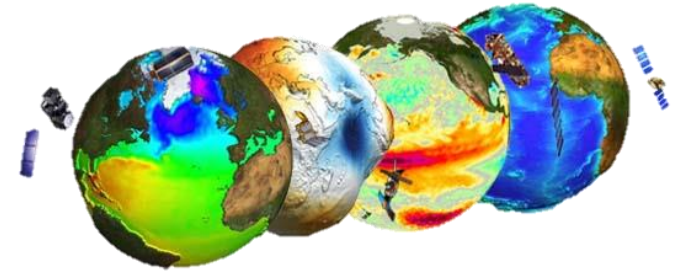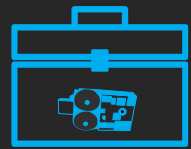
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...*read the **R**adar **A**ltimetry **Tutorial**!*