

# SWOT-UK: Modelling, Calibration and Validation Activities in the second highest tidal range on the planet - the Severn Estuary

United Kingdom of Great Britain and Northern Ireland



<https://projects.noc.ac.uk/swot-uk/>

## **Team:**

**National Oceanography Centre:** Paul Bell, Christine Gommenginger, Dougal Lichtman, Simon Williams, Francisco Calafat, Jenny Brown, Adrien Martin, Laurent Amoudry, Marta Payo Payo, Geoff Hargreaves, Chris Balfour, Richard Cooke,

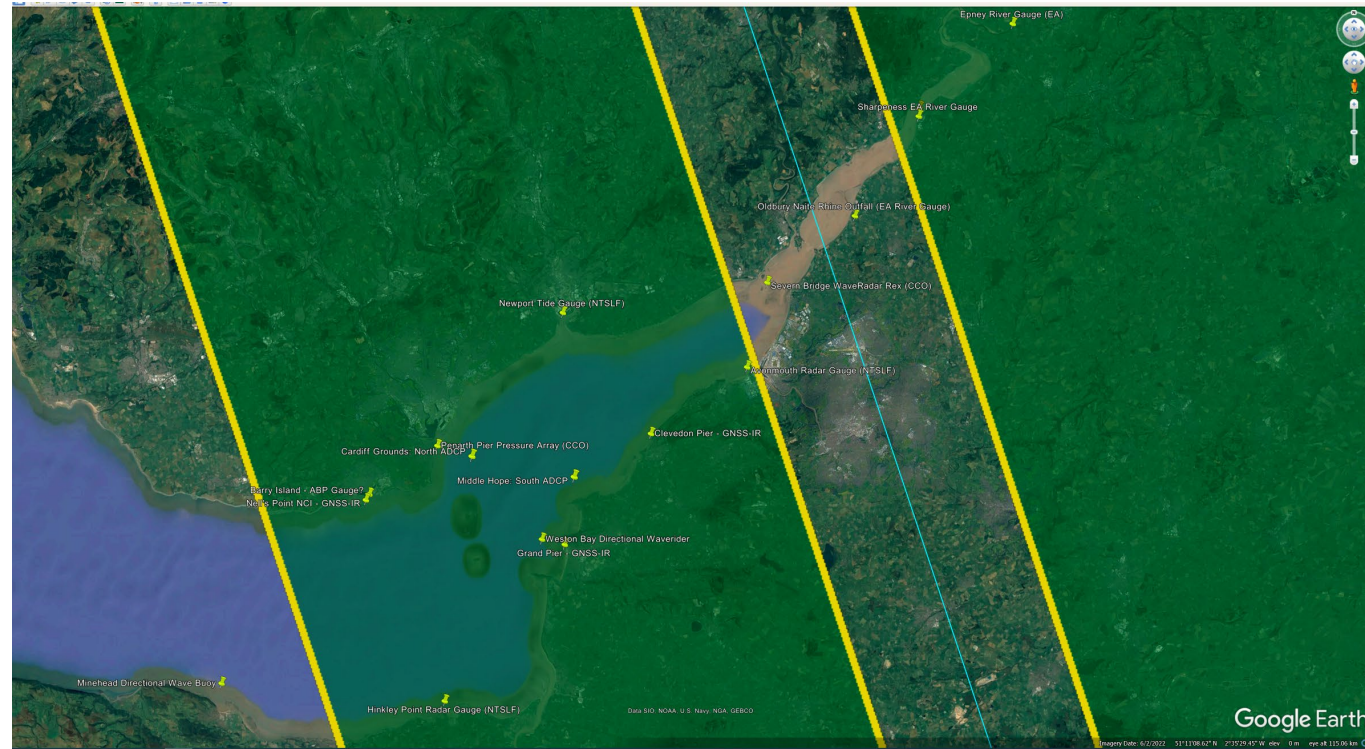
**University of Bristol:** Paul Bates, Jeff Neal

**Bangor University:** Simon Neill, Ben Powell

## **Funders:**

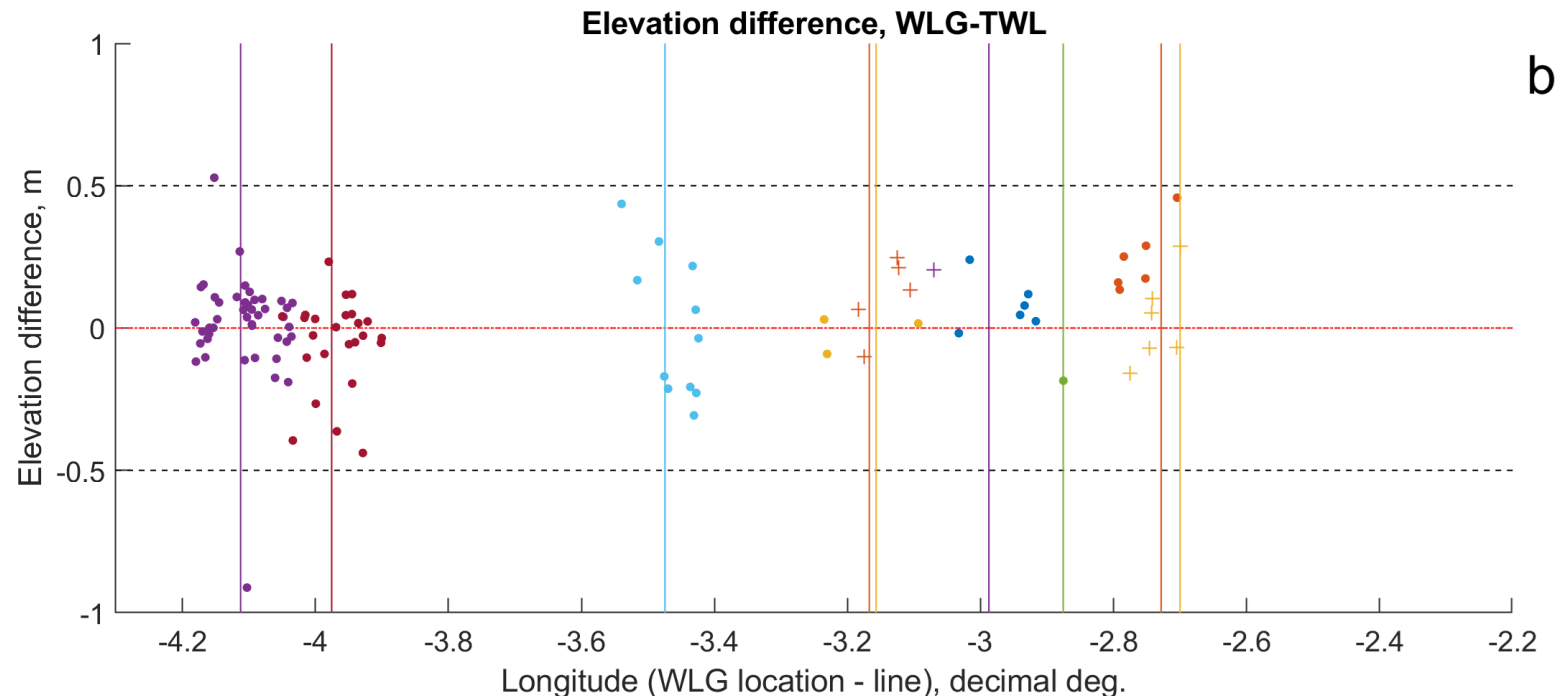
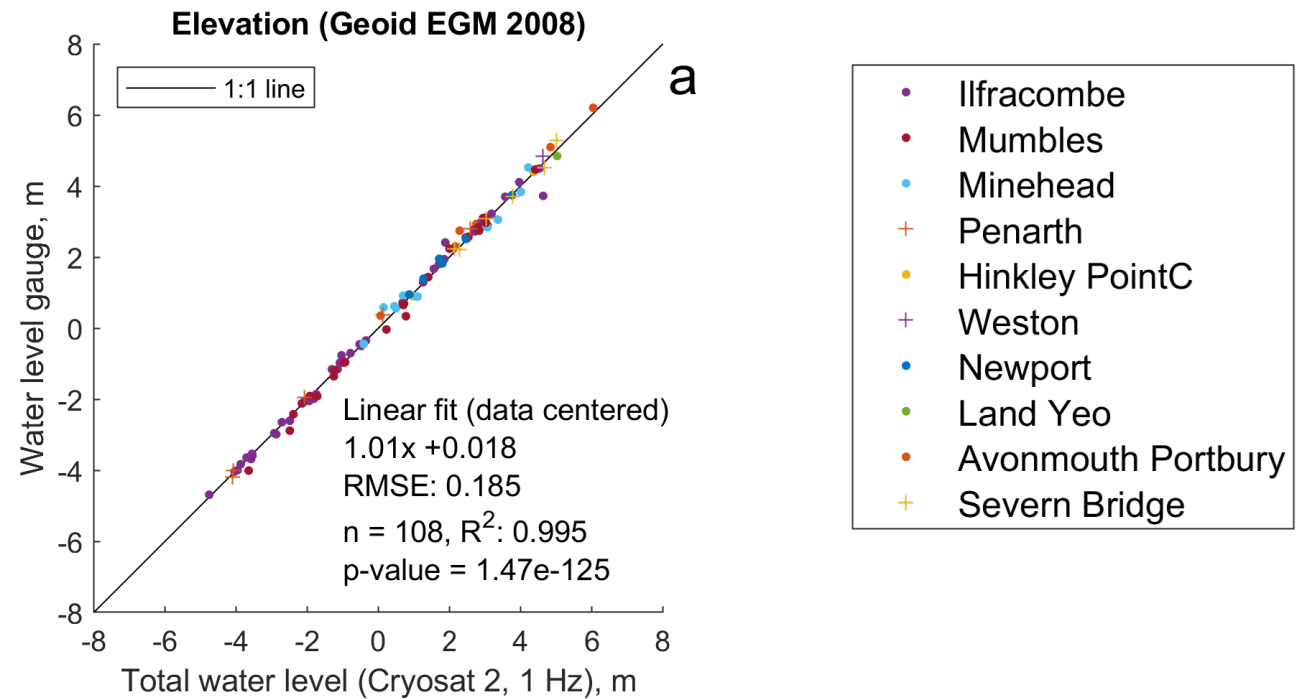


**Dates:** February 2021 to March 2025



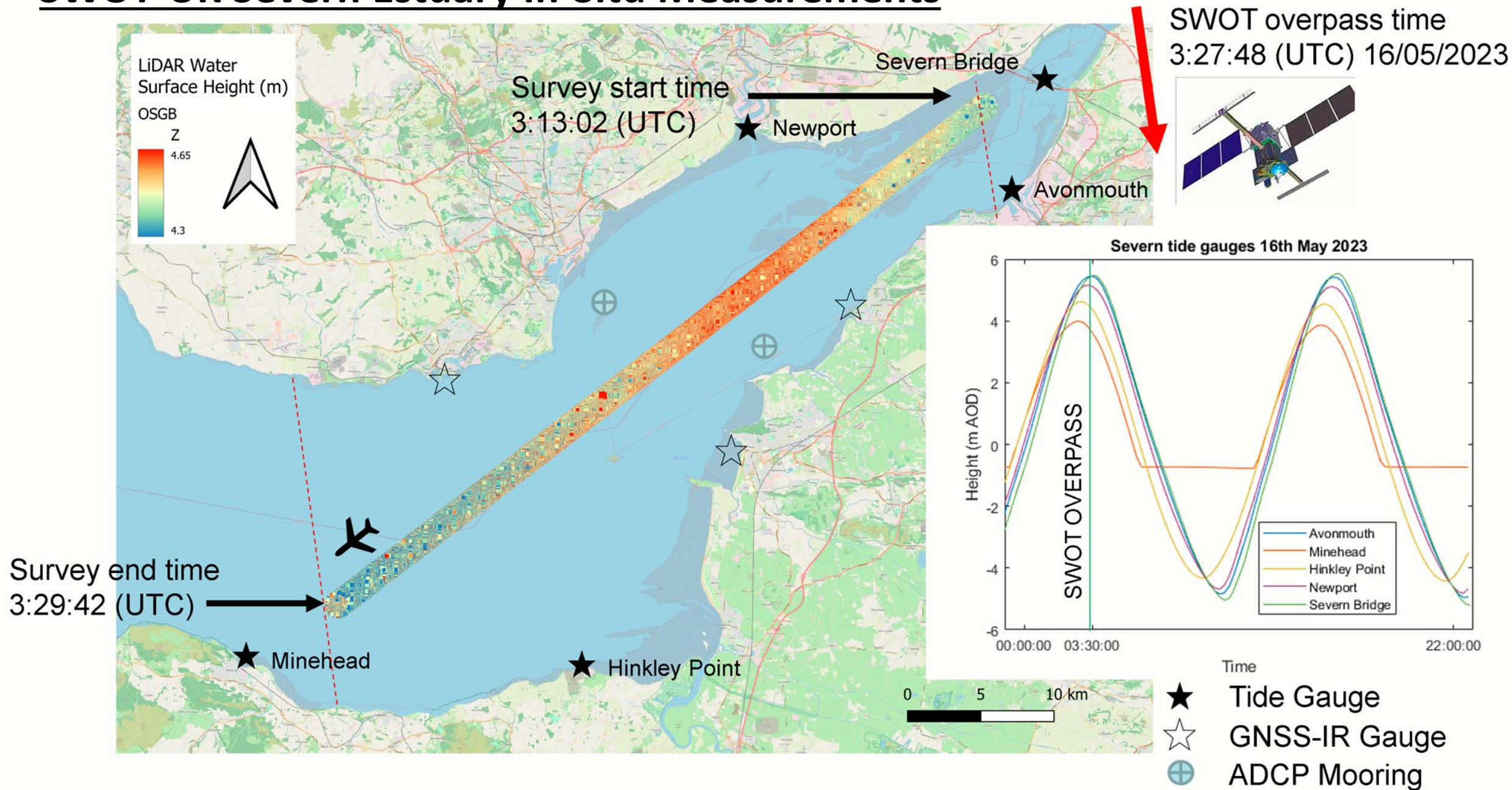
# Preparation for SWOT data by comparing tide gauges with Cryosat-2 data from past 12 years

- Tide gauge data were converted from local vertical datums (Chart Datum and Ordinance Datum Newlyn) to Spheroid
- Then converted from Spheroid to EGM2008 Geoid for comparison
- Cryosat-2 orbits do not coincide with tide gauge positions, so used a 6km radius for matching the two types of data – this will inevitably introduce some scatter
- Results show good linearity and demonstrate what we hope to see from SWOT data





# SWOT-UK Severn Estuary In-Situ Measurements





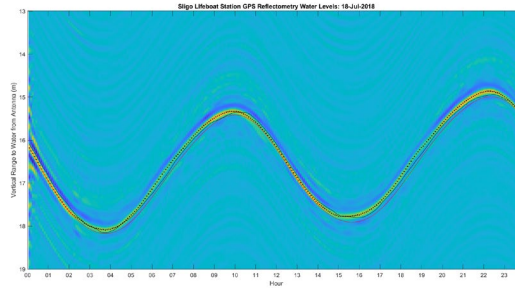
# GNSS Interferometric Reflectometry: Low-cost remote water level gauges to help fill in some of the gaps in tide gauge coverage

- GNSS-IR is providing water levels and sea state at key gaps in coverage of tide gauges
- Also provides an independent cross check of absolute elevations in the same global reference frame.

Simon Williams et al., 2020 **Demonstrating the potential of low-cost GPS units for the remote measurement of tides and water levels using interferometric reflectometry.** J.Atm & Ocean Tech 37 (10). 1925-1935. <https://doi.org/10.1175/JTECH-D-20-0063.1>



**GRAND PIER**  
WESTON-SUPER-MARE



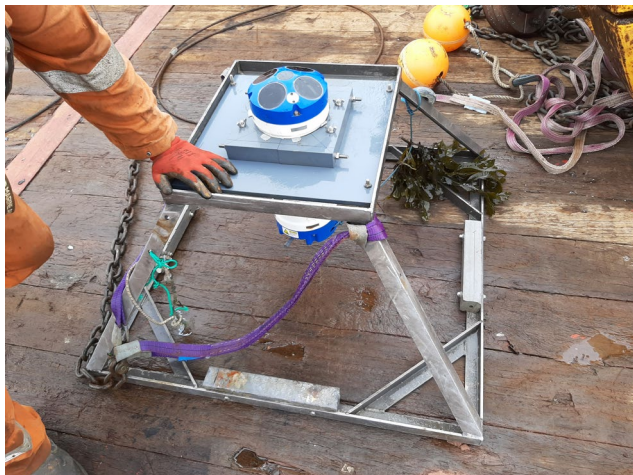
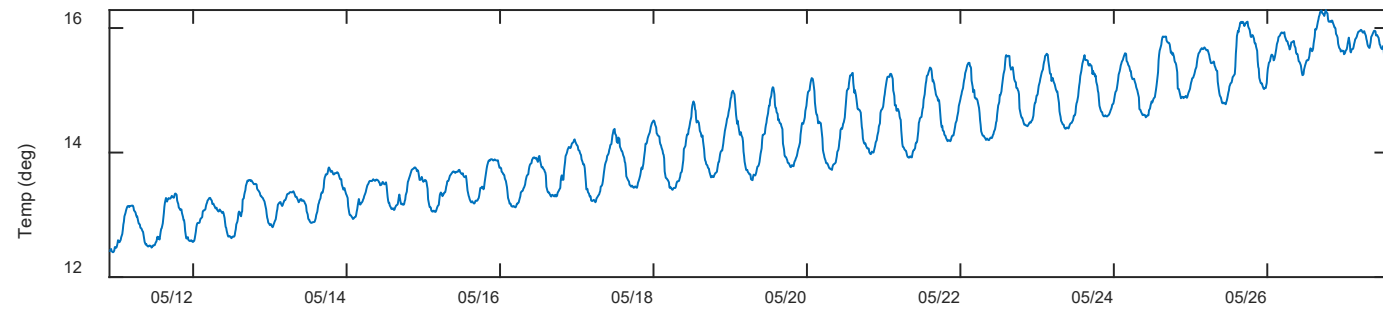
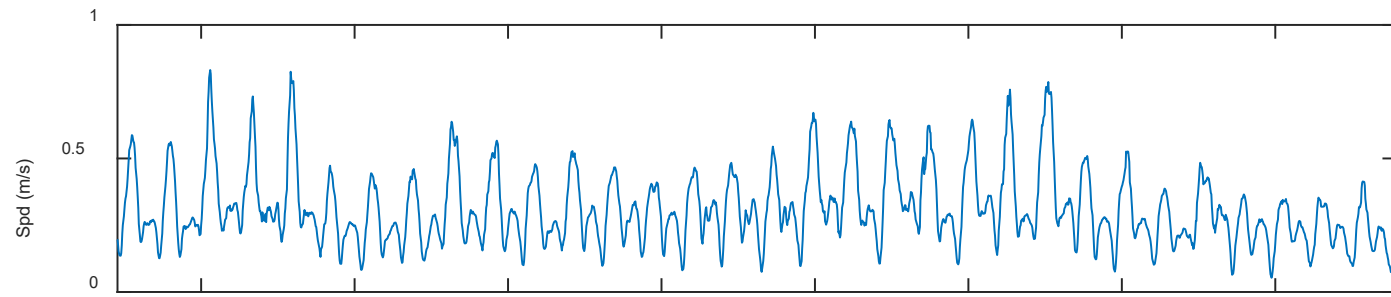
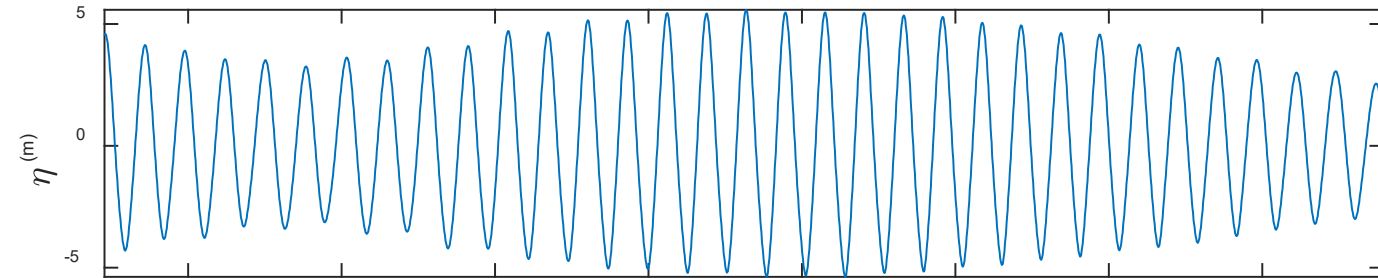
Nell's Point National  
Coastwatch Institution  
Station, Barry, South Wales



**National Coastwatch**  
25 YEARS 1994 - 2019  
EYES ALONG THE COAST

# SWOT-UK North ADCP mooring: 24/04/2023 - 11/6/2023

Sentinel V20 1 MHz 5-beam ADCP Vertical profiling, Waves





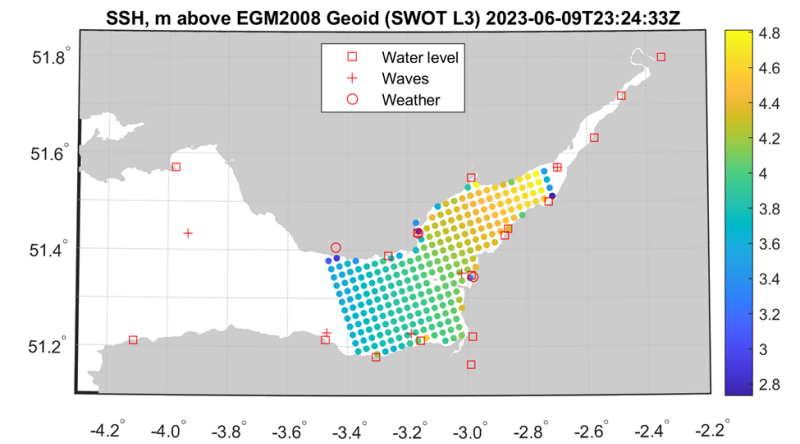
# L3 SWOT KaRIn 2km Unfiltered Sample Data

Here we have removed the tidal correction to allow comparison of water levels relative to the geoid height.

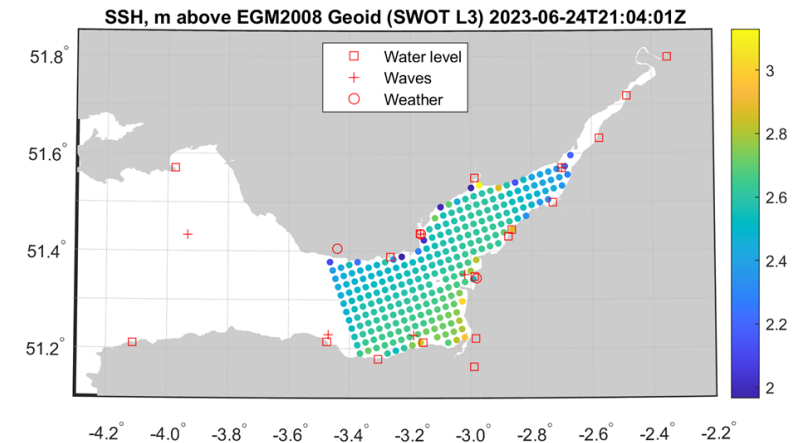
L3 KaRIn unfiltered data are compared with several tide gauges.

We do not yet have a correction for tidal slope so we expect some scatter due to distance of the SWOT data points from the tide gauge. SWOT data within a 6km radius of the gauge are included in the comparison.

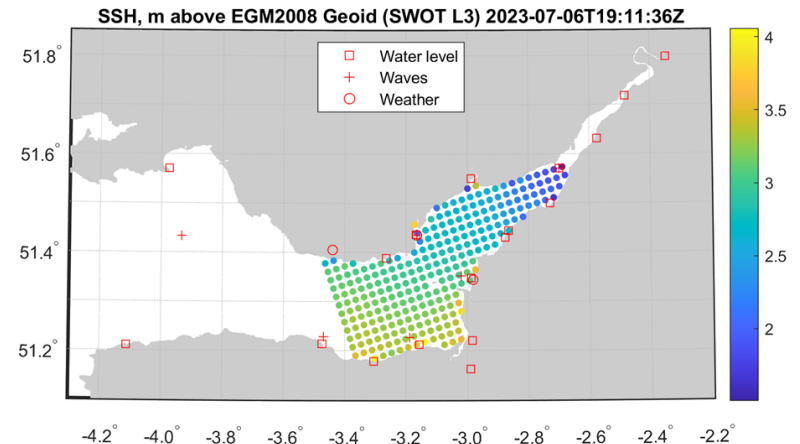
Flood Tide



High Water



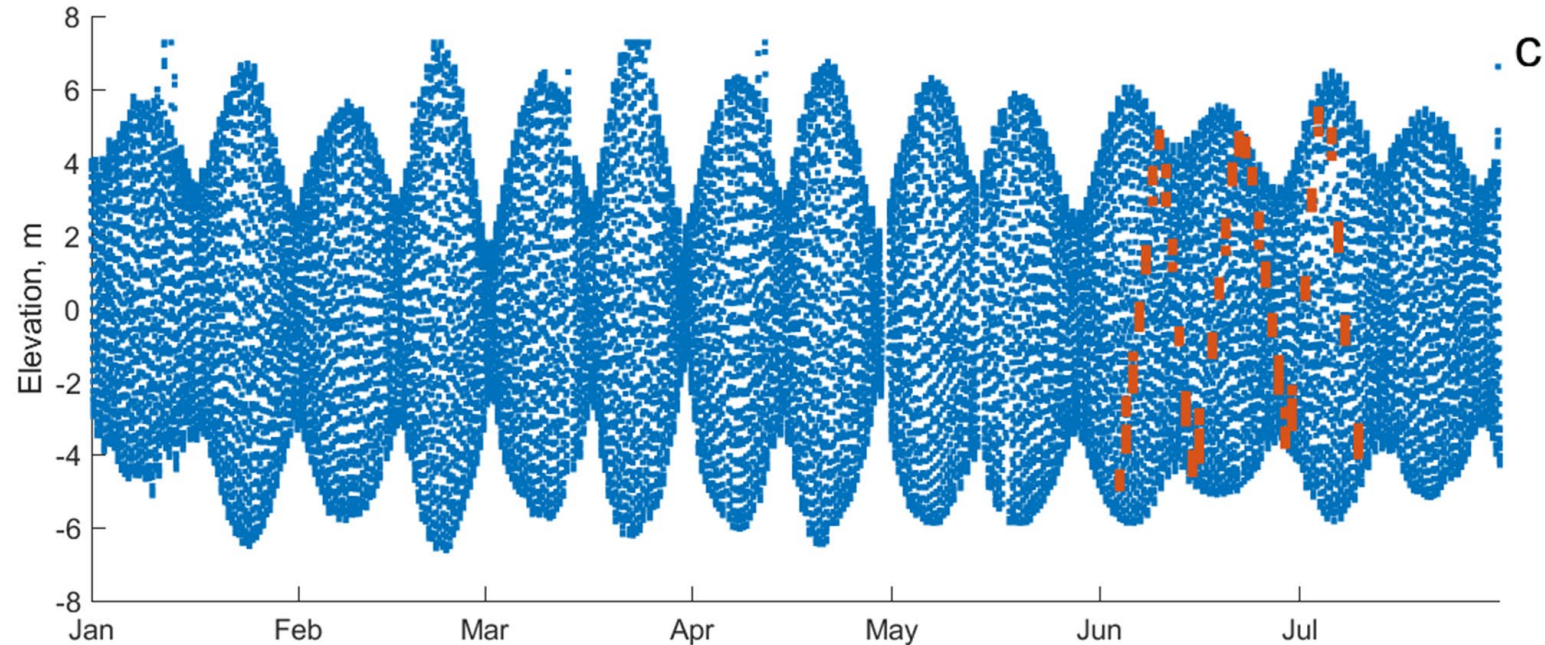
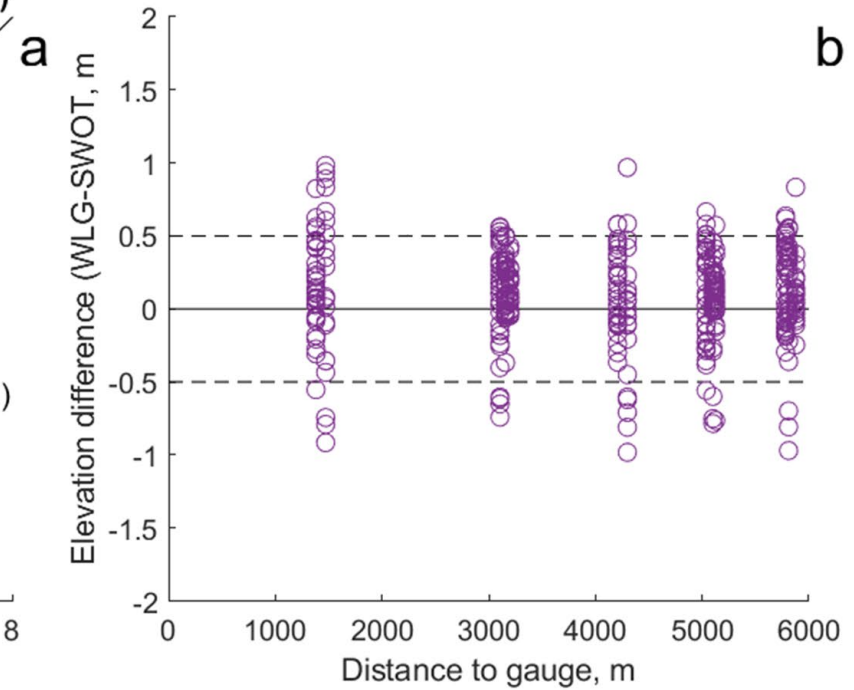
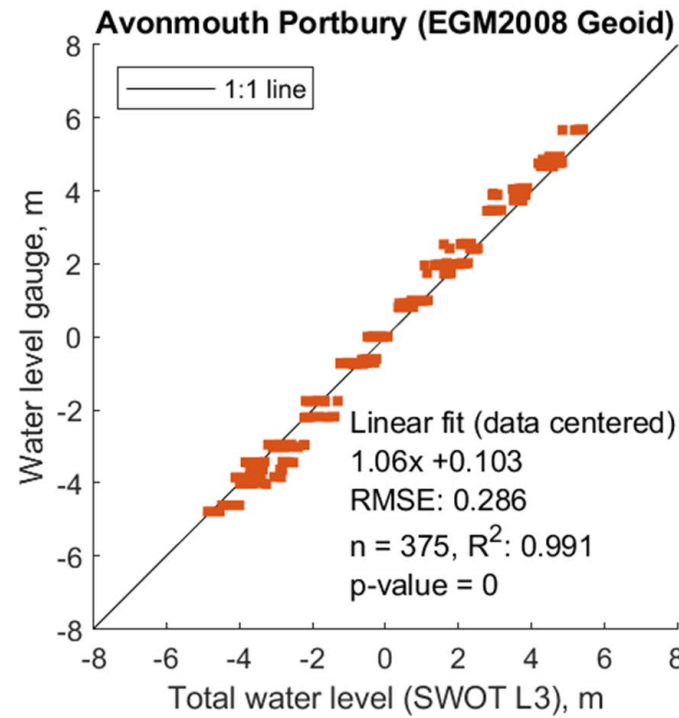
Ebb Tide



# SWOT KaRIn L3 2km Unfiltered Data Compared With Tide Gauge Data

The tide gauge data at Avonmouth are from a downwards-looking radar gauge – part of the National Tide Gauge Network

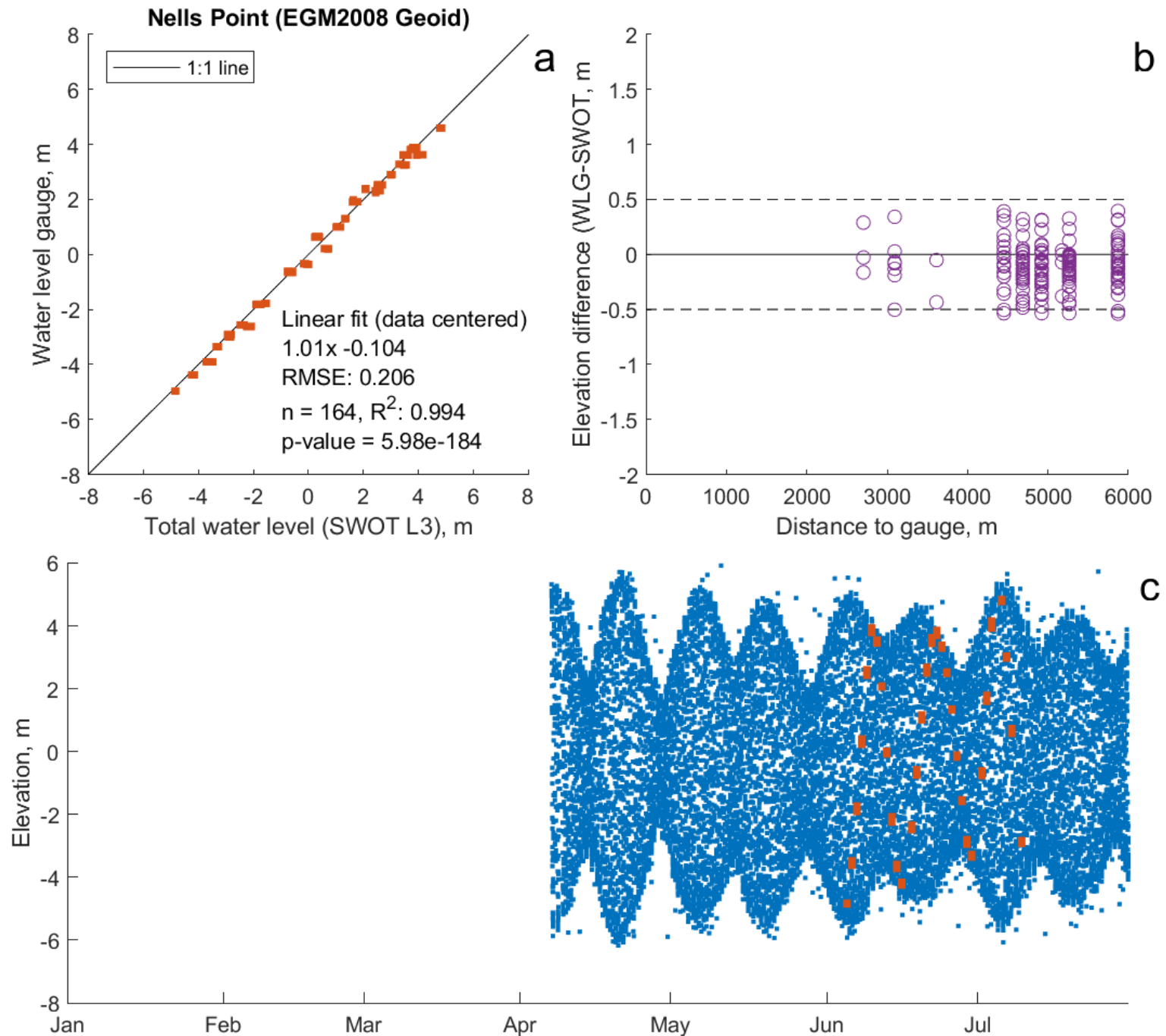
Note the distance between SWOT data points and the tide gauge in plot (b)



# SWOT KaRIn L3 2km Unfiltered Data Compared With GNSS-IR Tide Gauge Data

The tide gauge data at Nell's Point in South Wales are from a NOC GNSS-IR low-cost system installed in a day at a National Coastwatch Institution lookout station

Precise Antenna elevation derived from raw GNSS messages in post processing.

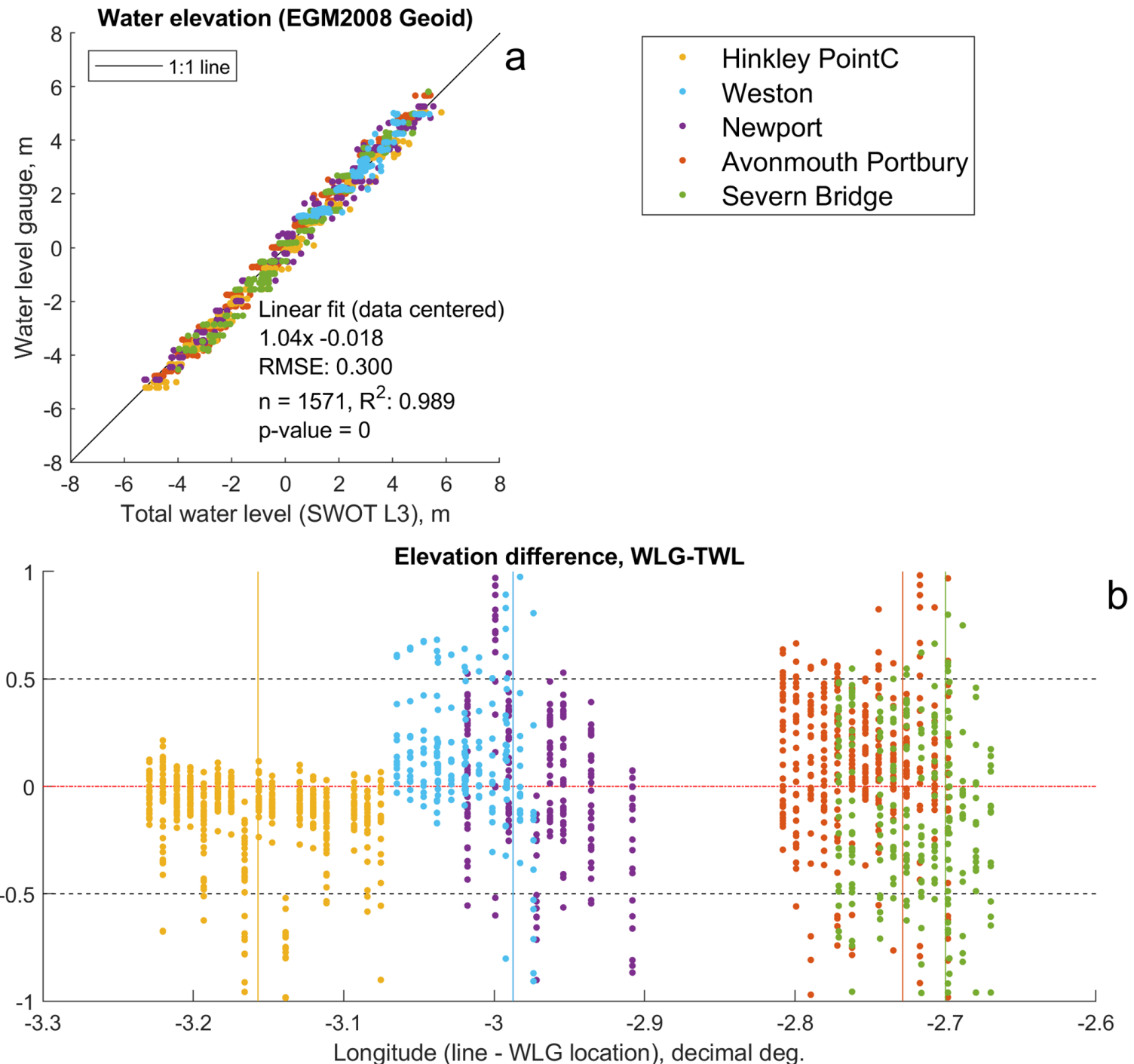




# SWOT KaRIn L3 2km Unfiltered Data Compared With Tide Gauge Data

In order to compare with Tide Gauge Data, we have discarded the SWOT Ocean Tide and Dynamic Atmospheric corrections, but kept all other applied L3 corrections. Then we have corrected the heights to EGM2008 Geoid. We have removed outliers over 1m difference between SWOT and gauge data – excluding approximately 12% points.

NOTE: This scatter still includes tidal slope between gauge position and SWOT data points – we are investigating tidal models and interpolation between gauge sites to reduce this scatter.



Thank you for listening

Team Members in person this week in Toulouse:

Paul Bell [psb@noc.ac.uk](mailto:psb@noc.ac.uk)

Christine Gommenginger [cg@noc.ac.uk](mailto:cg@noc.ac.uk)

Paul Bates [paul.bates@bristol.ac.uk](mailto:paul.bates@bristol.ac.uk)

Adrien Martin [adrien.martin@noveltis.fr](mailto:adrien.martin@noveltis.fr)

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