Deutsches Geodätisches Forschungsinstitut
TUM School of Engineering and Design
Technische Universität München

SWIFT-CORE: SWOT data Integration For Tide modelling in COmplex coastal REgions

Michael Hart-Davis[1], Richard Ray[2], Ole Andersen[3], Edward Zaron[4], Antonio Bonaduce[5], Christian Schwatke[1], Denise Dettmering[1]

[1] Deutsches Geodätisches Forschungsinstitut, Technische Universität München (DGFI-TUM), Germany
[2] Geodesy and Geophysics Lab., NASA Goddard Space Flight Center, USA
[3] National Space Institute, Technical University of Denmark, Denmark
[4] College of Earth, Ocean, and Atmospheric Sciences, Oregon State University, USA
[5] Nansen Environmental and Remote Sensing Center, Bergen, Norway

Contact: Michael.hart-davis@tum.de

SCAN ME

Project objectives:

- Exploit the KaRIn data from SWOT to investigate tidal dynamics in fjords and coastal inlets compared to conventional altimetry products as well as state-of-the-art tide models.
- Incorporate the SWOT data into altimetry-derived ocean tide models by harmonizing the geophysical corrections towards estimating a consistent SLA.
- Evaluation of newly developed empirical ocean tide models based on SWOT data with in-situ measurements.

The Bristol Channel

- The M_2 tide derived from the 250m and 2 km product are compared to a FFSAR S3 pass across the Bristol Channel.
- Tide gauges from TICON-3 (Hart-Davis et al 2021) and Lichtman pers. comms. were used for validation.
- The 2km product showed mean differences of **2.58 cm** and **2.72 degrees** for the **amplitude and phase lag**, respectively.
- For the 250m product, the differences were **2.72 cm and 4.03 degrees**, respectively.

Long Island Sound

- Modern day global models cannot resolve these fine scale variability as seen within the bay.
- The **tide gauges** are found on the **inside of the Bay**, and thus this variability needs to be captured.
- The **250m product shows 1.75 cm amplitude and 3.36 degrees phase lag differences.**
- For studies with SWOT, in regions such as this, the tidal corrections require special attention to help make SWOT more usable.

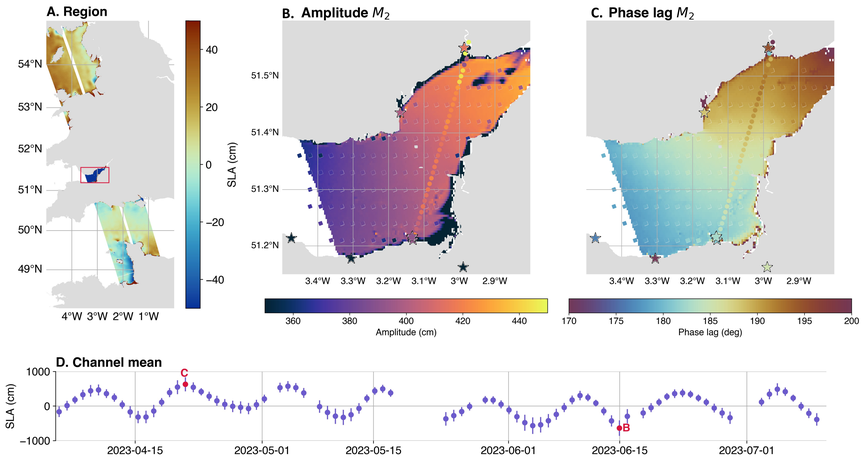

Fig 1. (B) Amplitude and (C) phase lag of M2 tidal constituent based on the 250 m and 2 km SWOT data within the Bristol Channel. Along-track circles are estimations of a Sentinel-3B FFSAR pass. (D) is the cross Channel SLA mean.

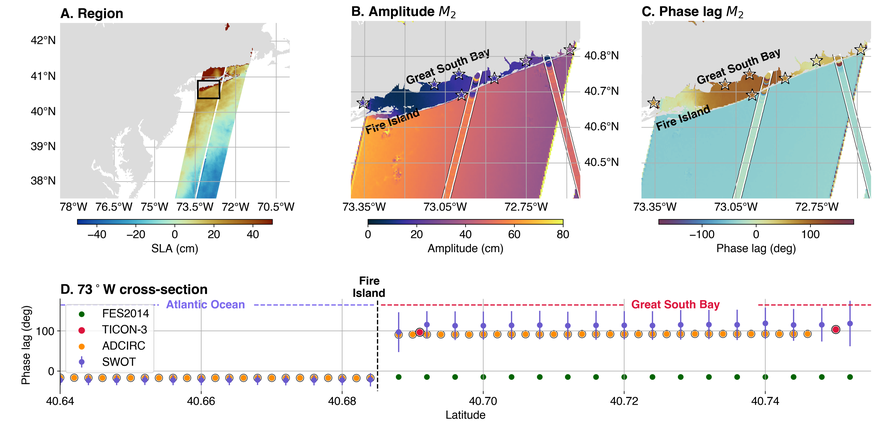

Fig 2. M_2 amplitude (B) and phase lag (C) derived in the Long Island region from the 250m product. Tides derived from a high frequency ENVISAT pass are shown. (D) presents a cross-section of the resultant phase lag estimations at 73W across the Great South Bay compared to available TICON-3 tide gauges, a global (FESS2014) and ADCIRC.

Looking towards fjords

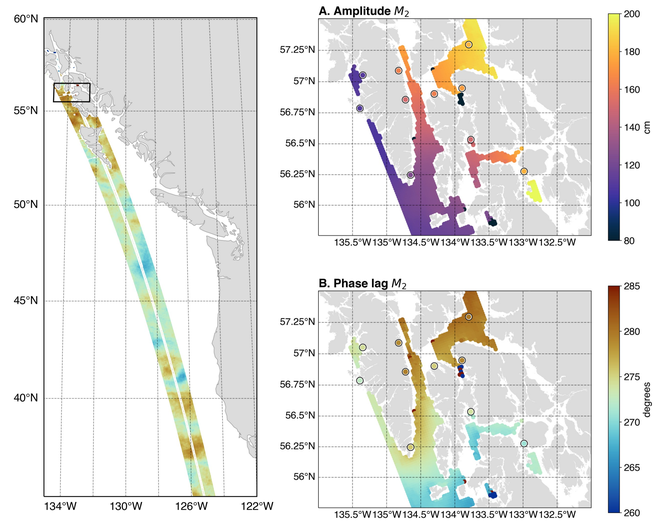

Fig 3. Tides along the southeast coast of Alaska from SWOT and tide gauges (circles)

- Despite the challenging coastline filled with inlets and bays, SWOT matches well the in situ tidal measurements.
- **Median amplitude differences of 1.43 cm and median phase lag differences of 0.35 degrees** are seen in this region.

Conclusions and perspectives

- Tides are clearly retrievable from the KaRIn data, with initial results on several constituents (only showing M_2) showing very positive estimations at great spatial scales. High accuracy is obtained with respect to gauges!

For more information:

Preprint of first results : Hart-Davis M., Andersen O.B., Ray R., Zaron E., Schwatke C., Arildsen R., Dettmering D. Tides from SWOT: Insights into complex coastal regions. *Geophysical Research Letters (in review)*. Preprint: **https://doi.org/10.22541/essoar.171770548.88858218/v1**