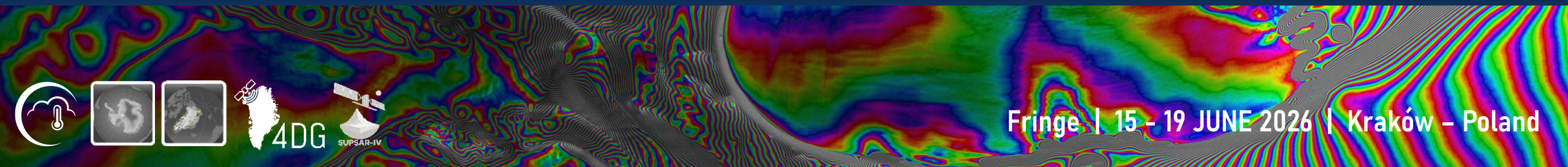


Enhanced Observations of Ice Sheet Dynamics by means of Sentinel-1 Short-Repeat Pass Interferometry

Thomas Nagler, Helmut Rott, Jan Wuite, Markus Hetzenecker,
Bryan Cantal, Raul Lezameta, and Nuno Miranda

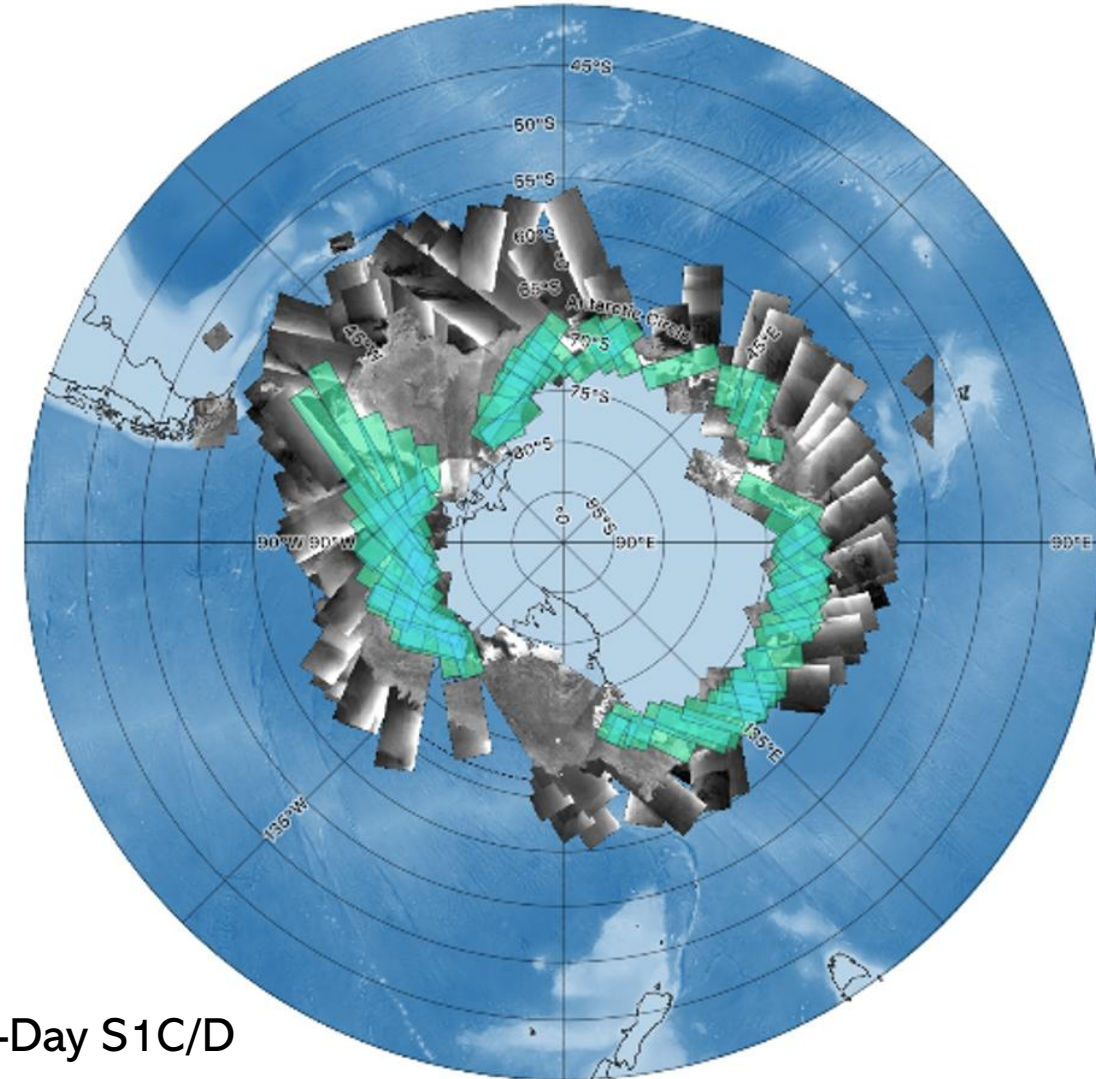


Fringe | 15 - 19 JUNE 2026 | Kraków - Poland

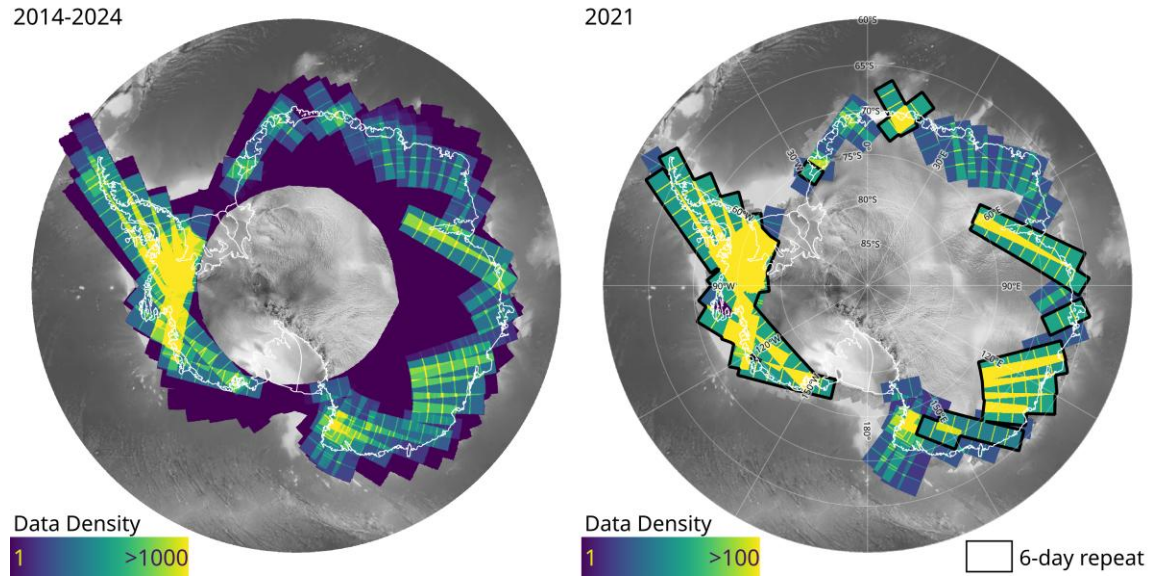


- Status of monitoring ice sheet dynamics of Antarctica and Greenland using Sentinel-1
- Enhanced observations of Ice sheet dynamics using S-1C/D 1 day repeat pass data

Sentinel-1 C/D 1-Day Repeat Pass Data
January to June 2026

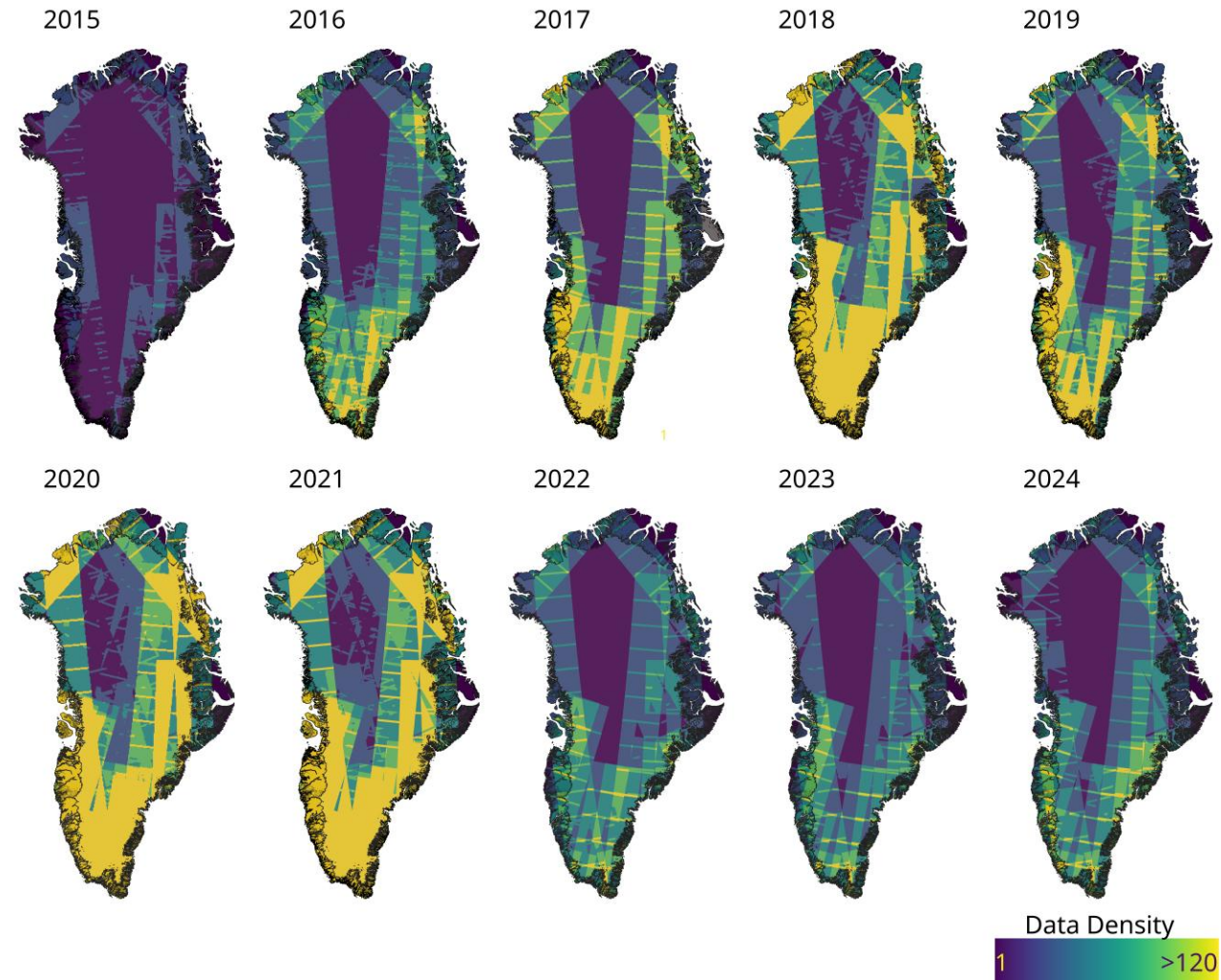


Antarctica



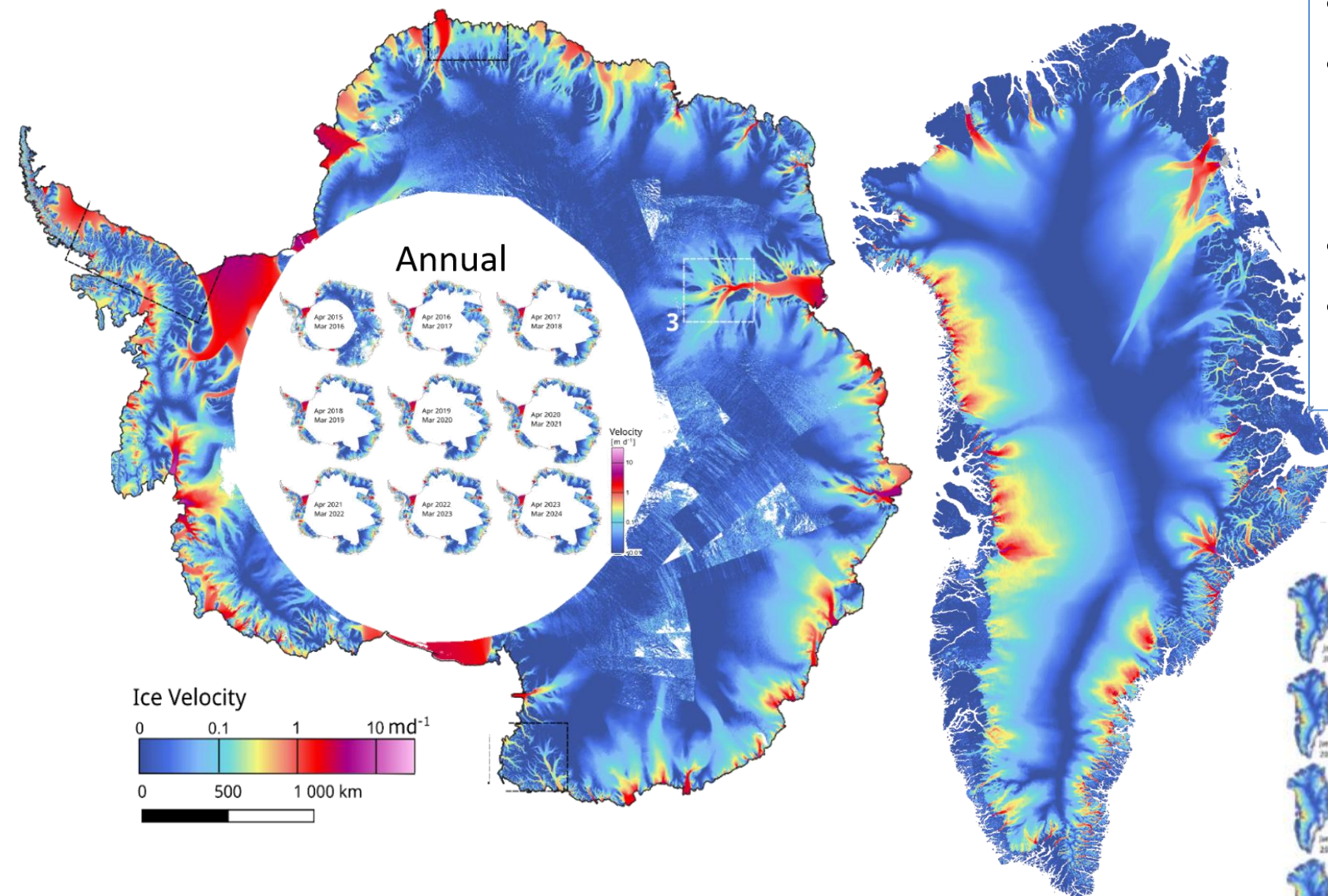
Repeat Pair Coverage of Sentinel-1 IW

Greenland

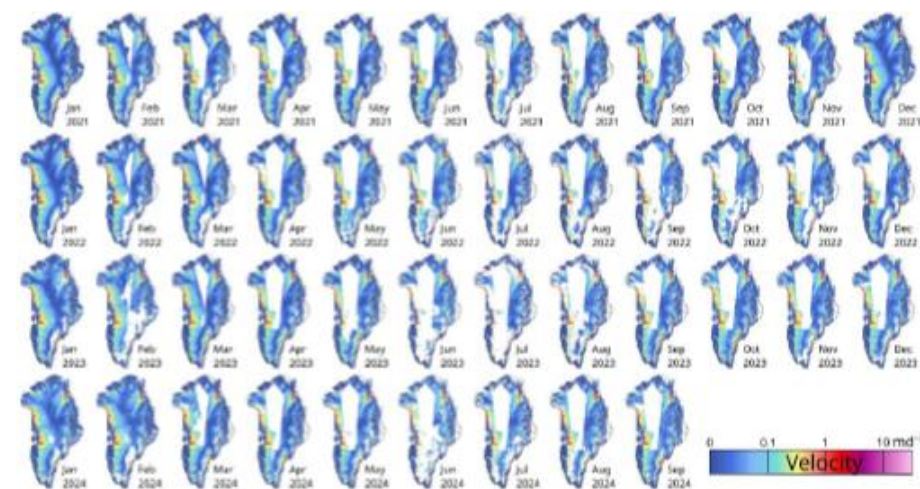


Sentinel-1 Ice Velocity Product Portfolio

- Using S1A+S1B+S1C+S1D
- Multi-annual map continuously updated with new acquisitions
- Annual Maps (since 2015)
- Monthly Maps and 6/12 days (since 10/2014)

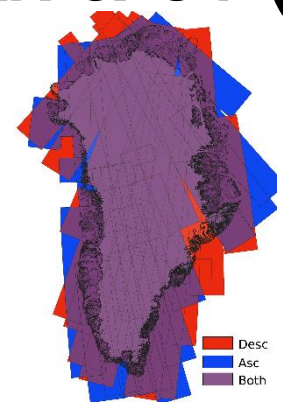


Monthly

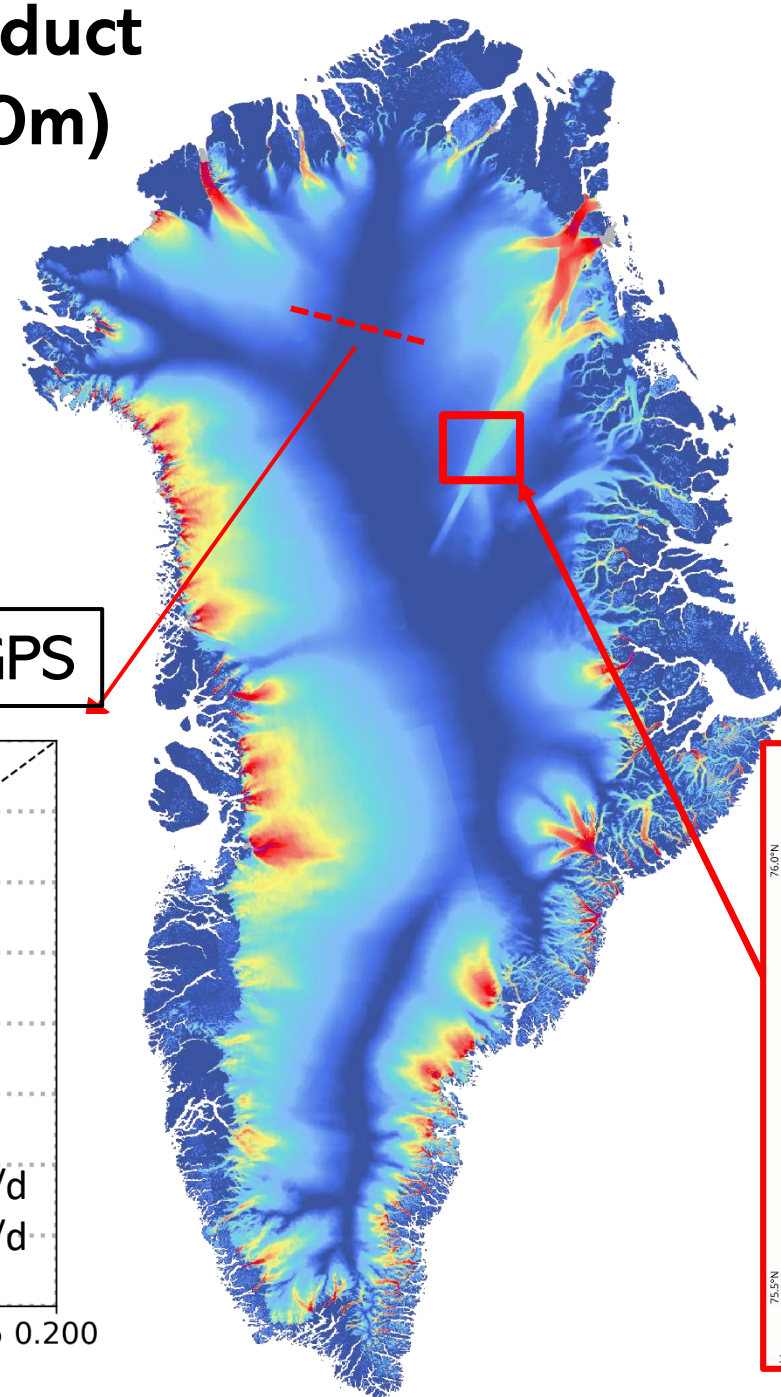
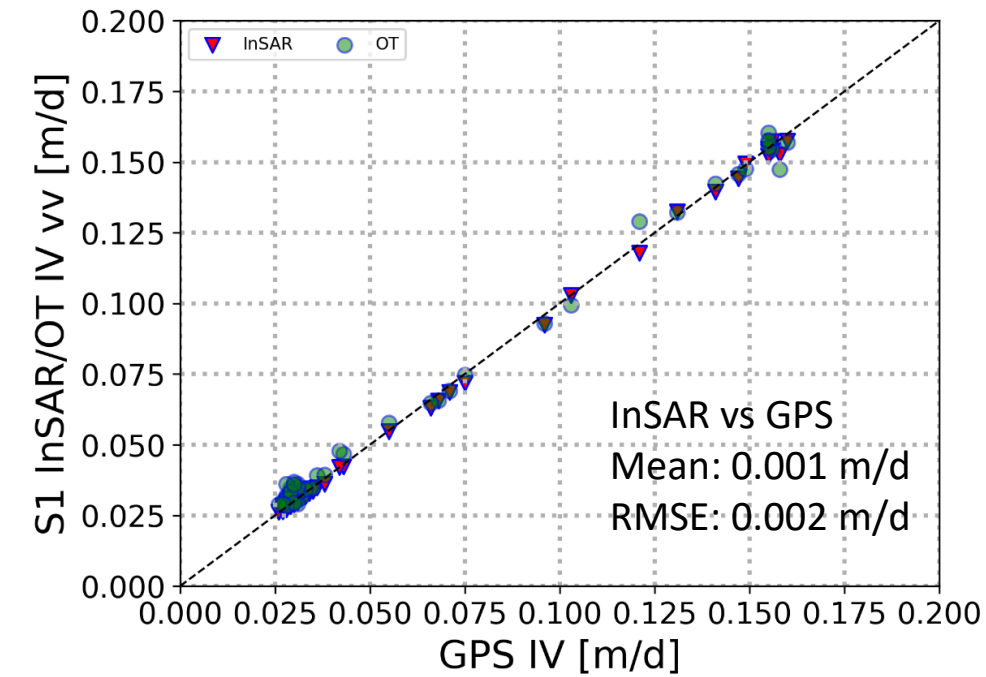


Advanced High-Res IV product combining INSAR & OT (50m)

One Winter Campaign with coverage with crossing orbits (purple): Dec 2020 – Feb 2021



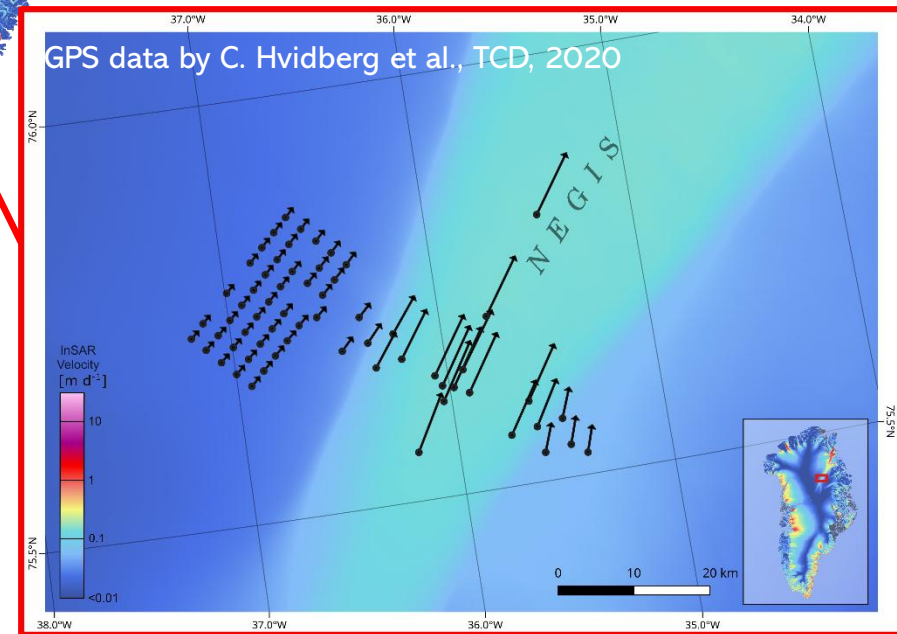
Validation against Eastgrip GPS



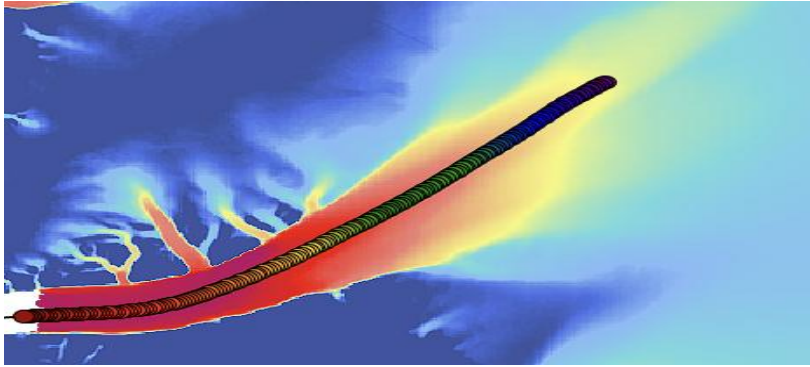
INSAR
Crossing Asc/Desc

INSAR
+ Flow direction from OT

INSAR crossing Asc/Desc
+ INSAR with OT flow dir.
+ Offset-tracking

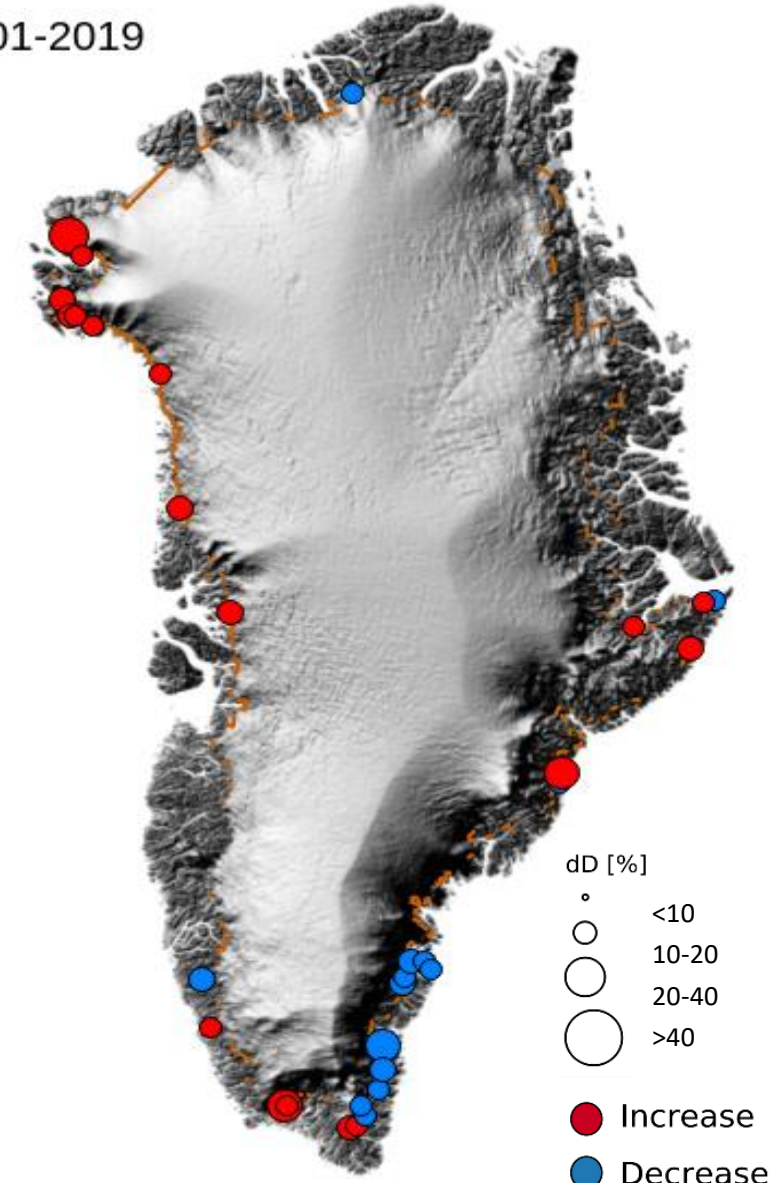


Monthly Variability of Ice velocity and Ice Discharge



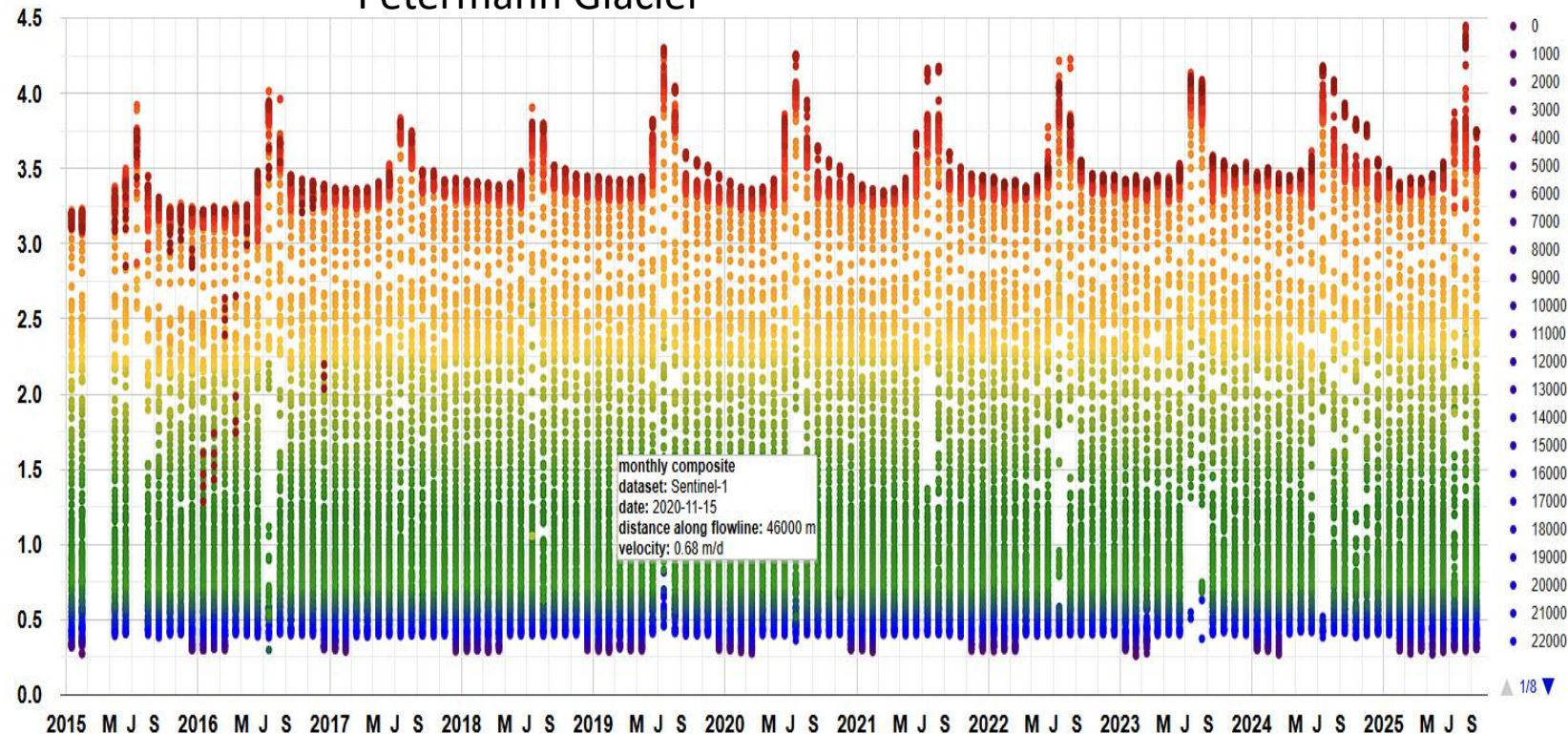
Fluxgates for more than 200 glaciers in Greenland for continuous automatic ice discharge monitoring at various time scales

01-2019

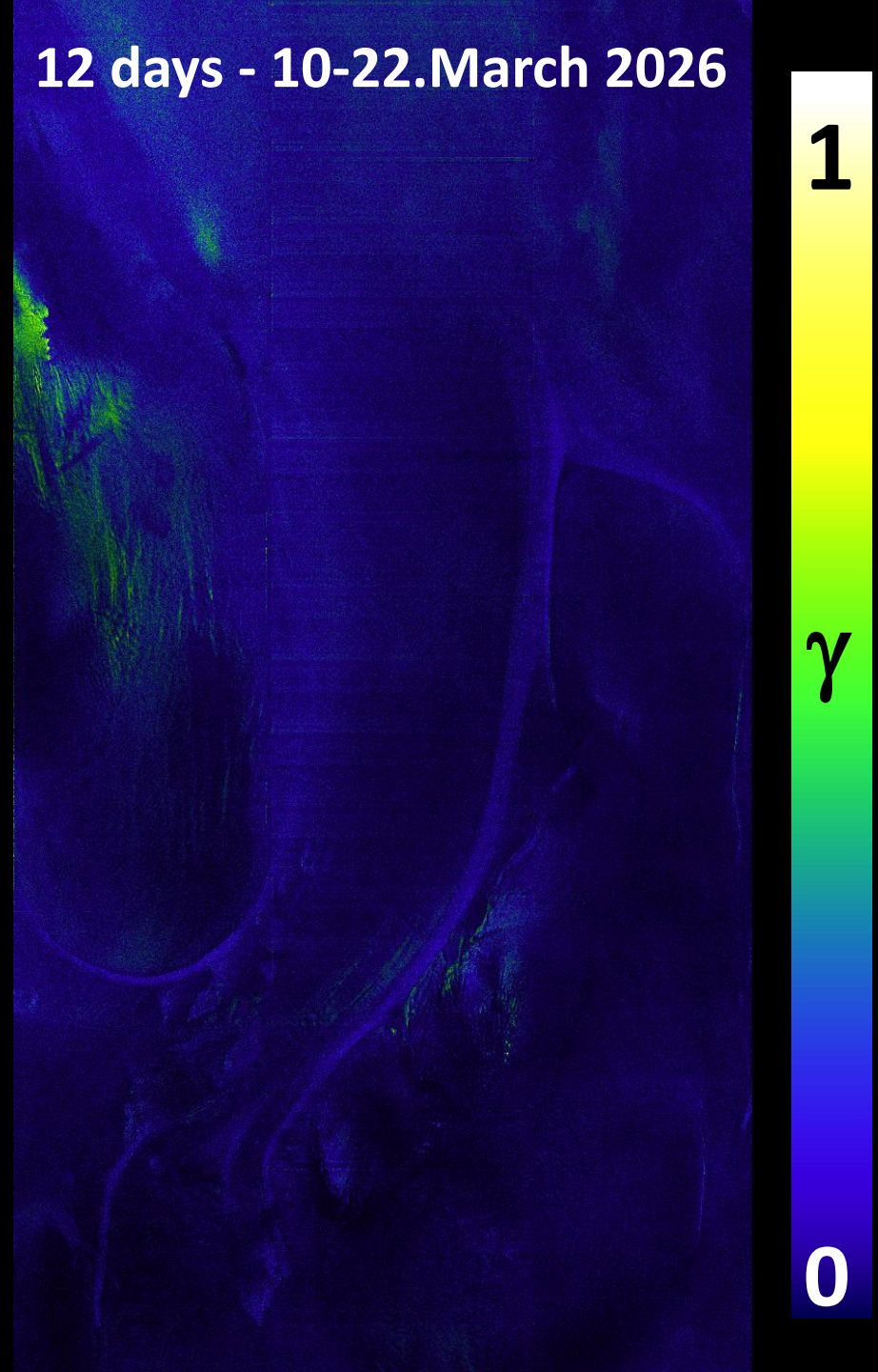
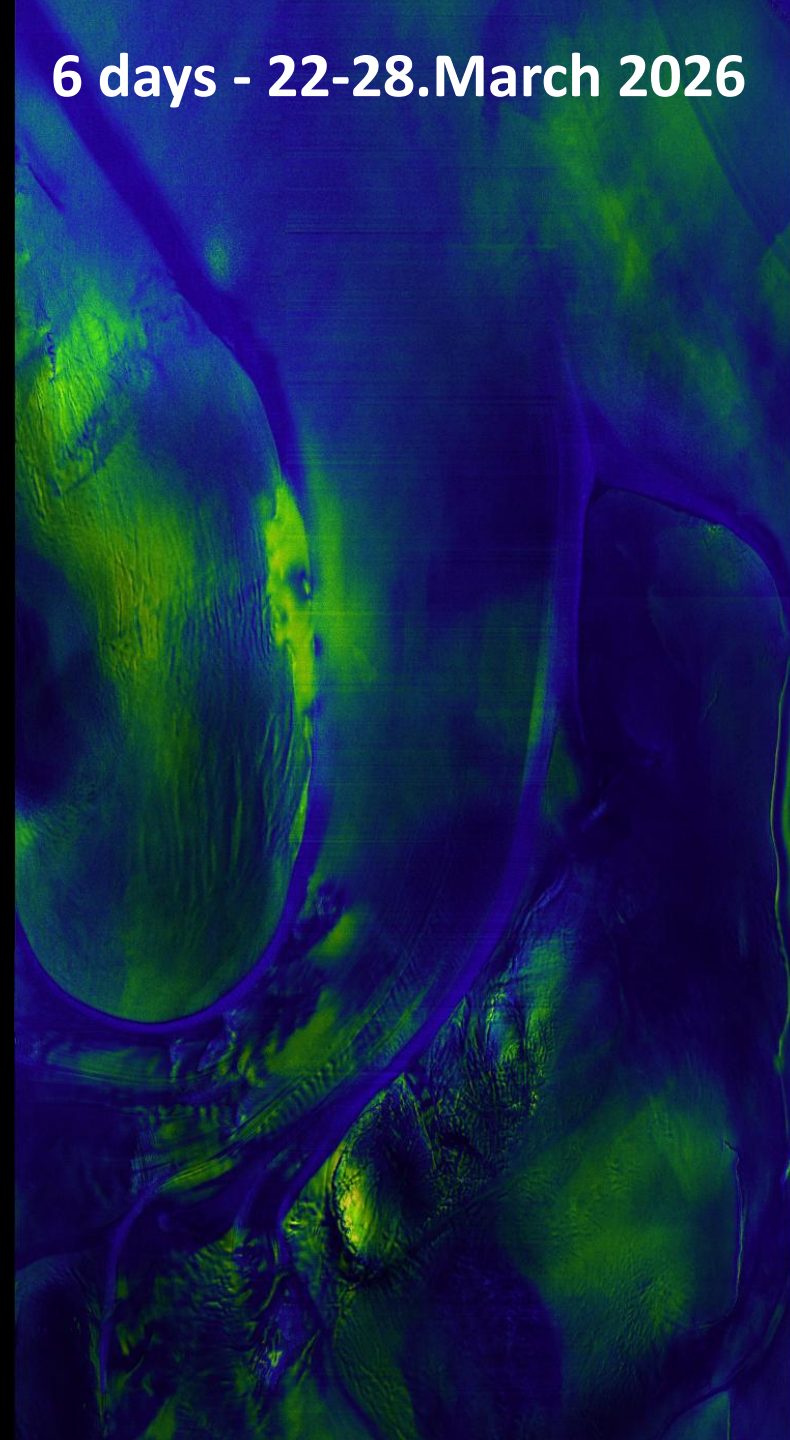
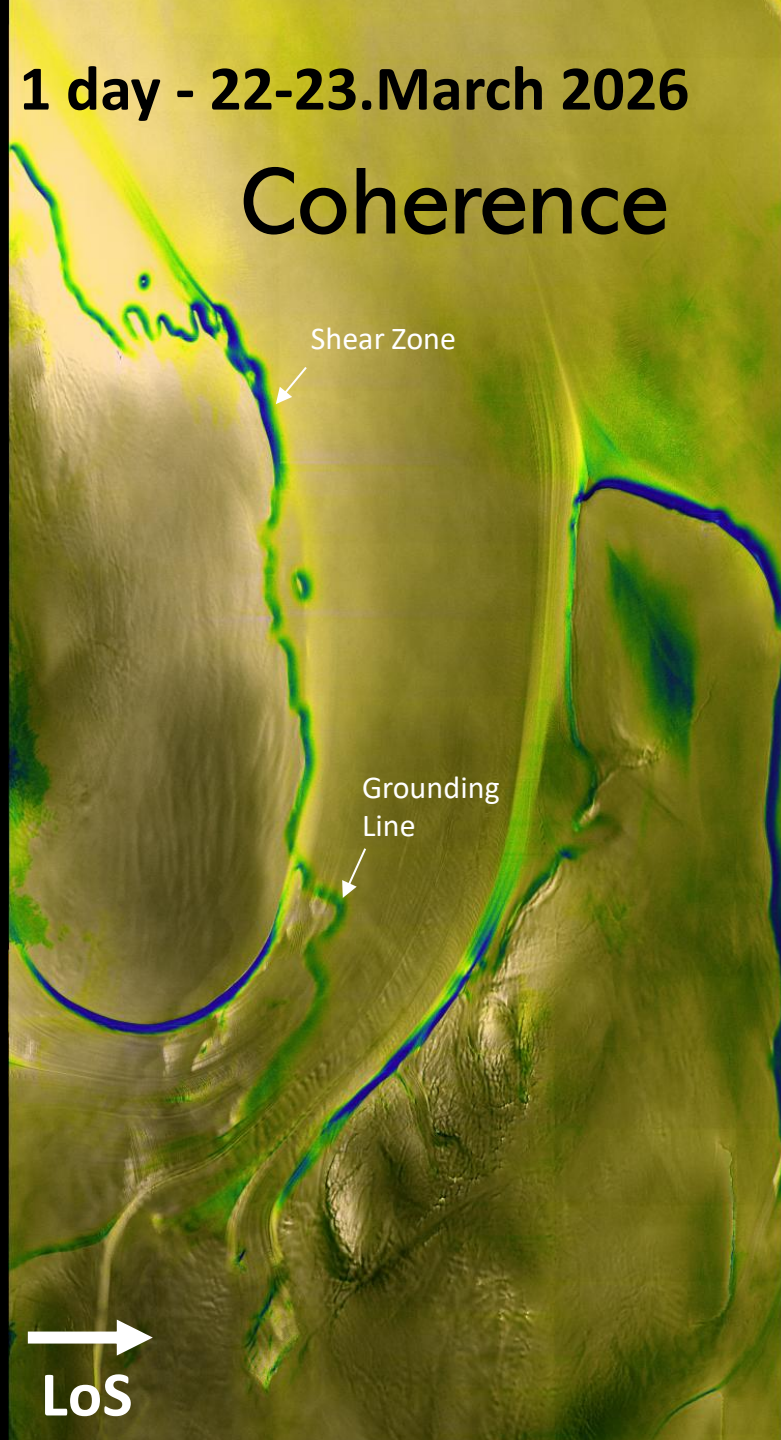


Petermann Gletsjer

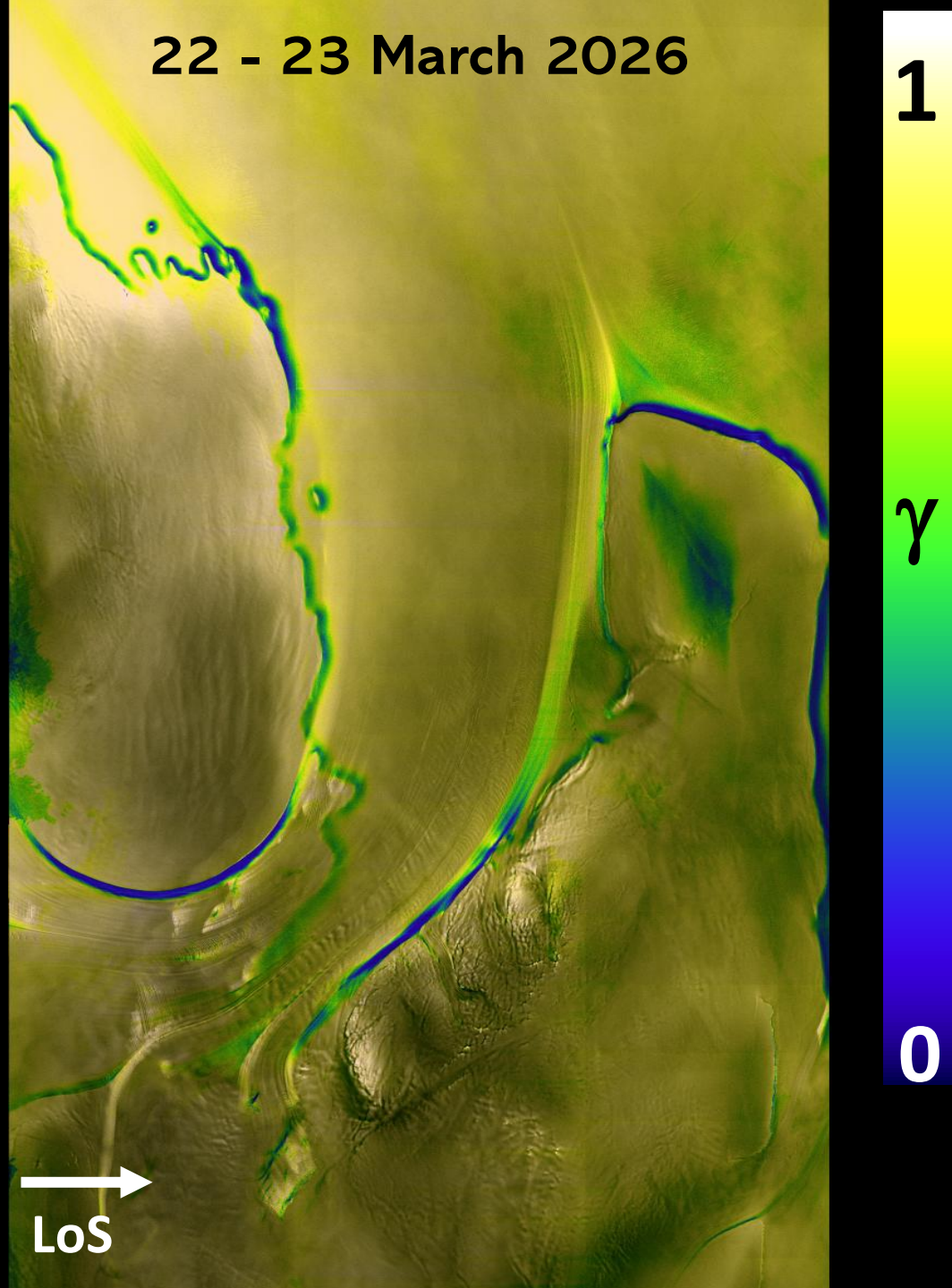
Petermann Glacier



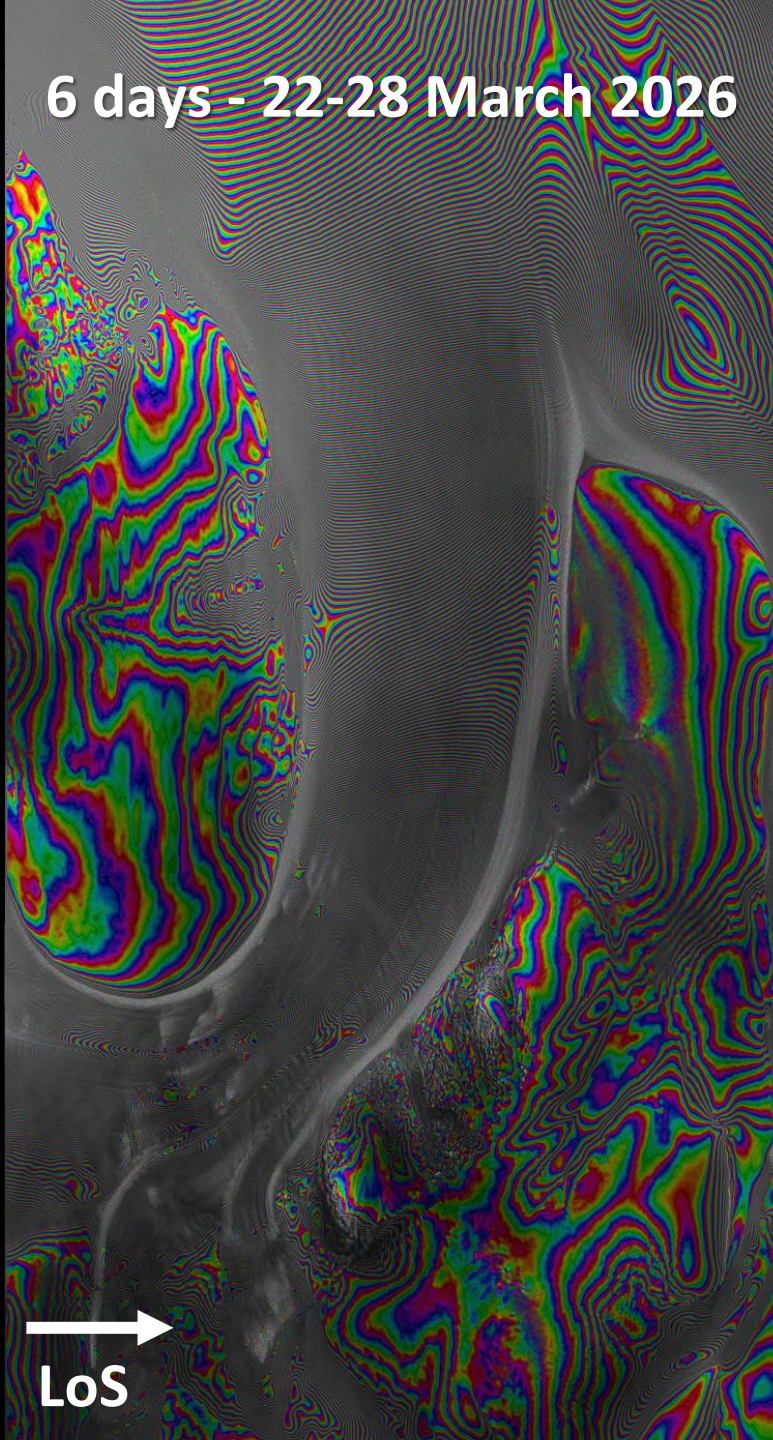




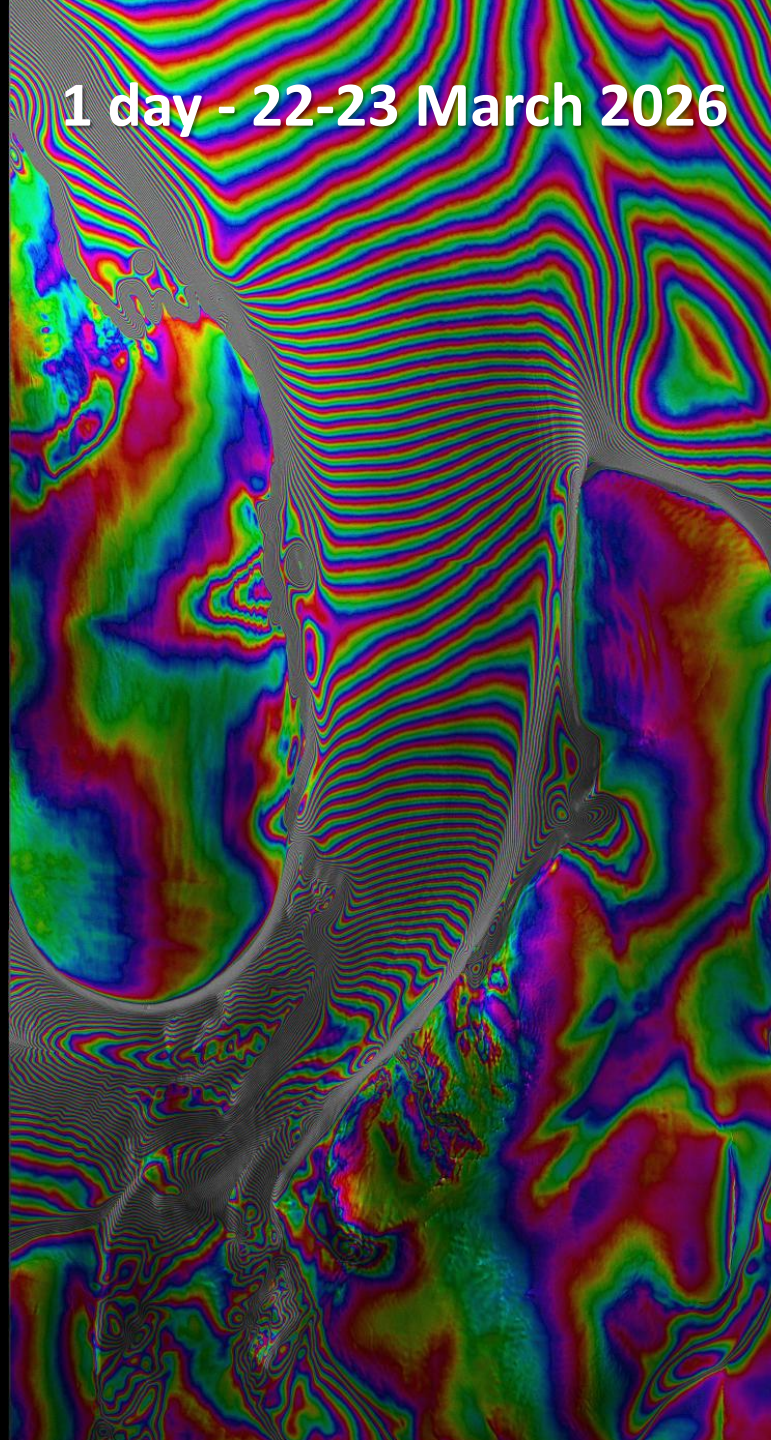
Evans Icestream
S1 C/D
1-day Coherence
Jan-March 2026



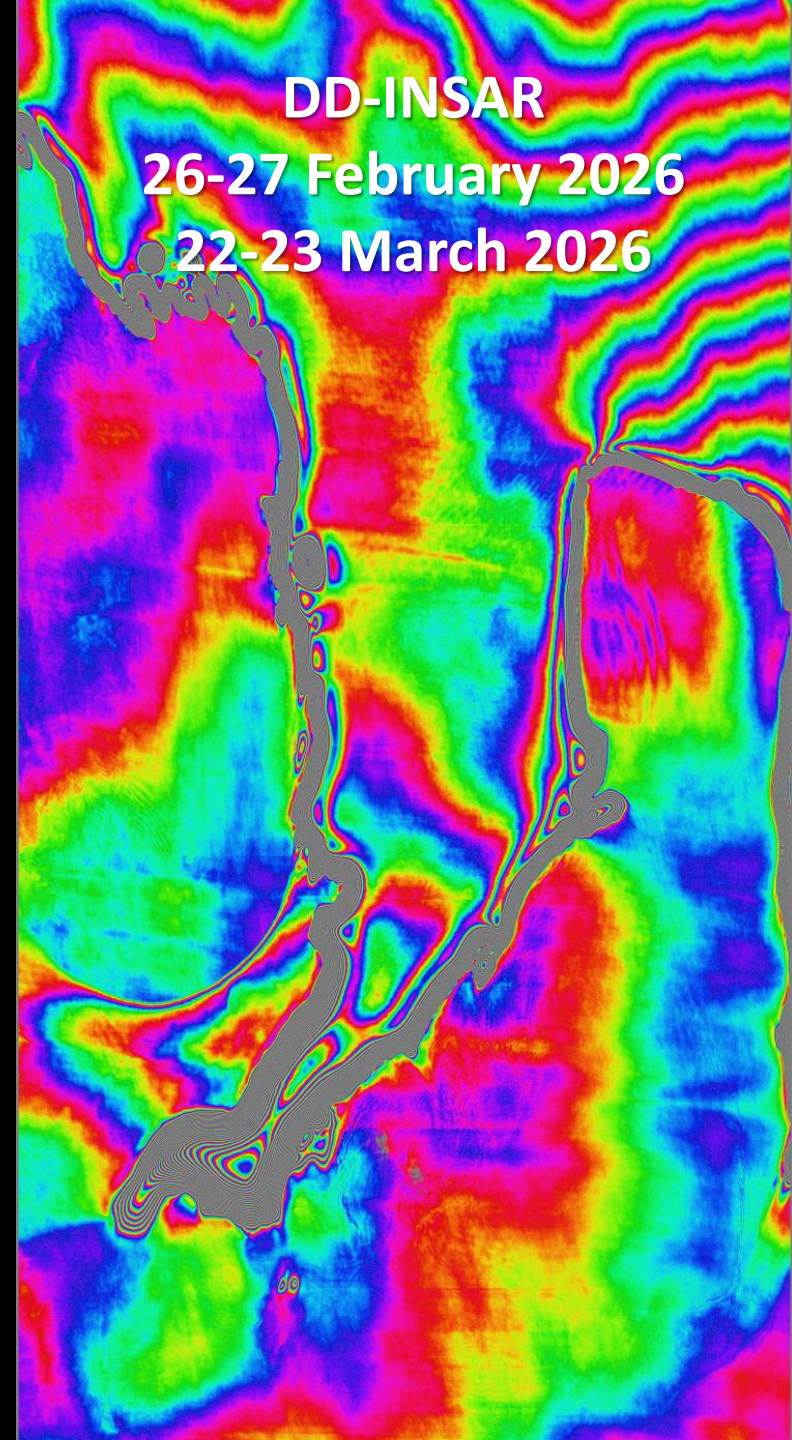
6 days - 22-28 March 2026



1 day - 22-23 March 2026



DD-INSAR
26-27 February 2026
22-23 March 2026

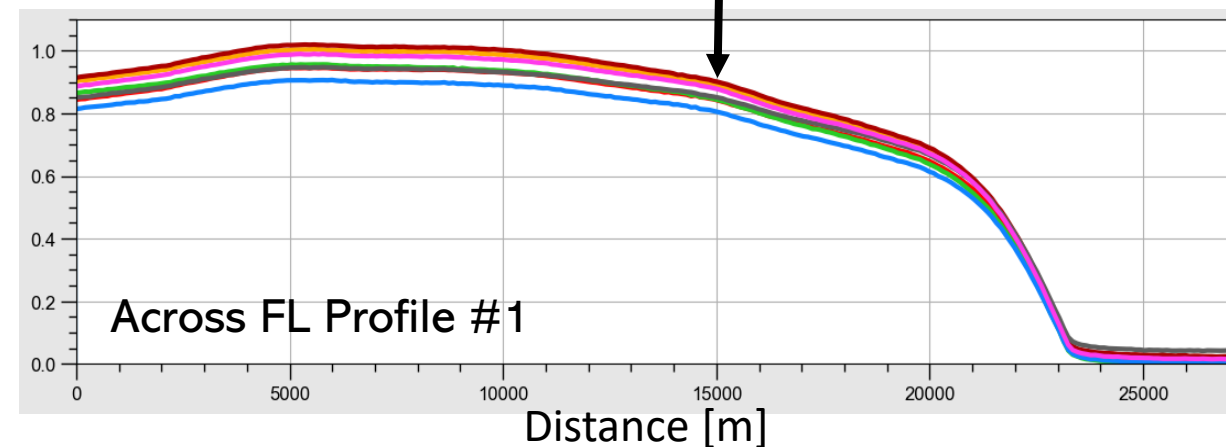
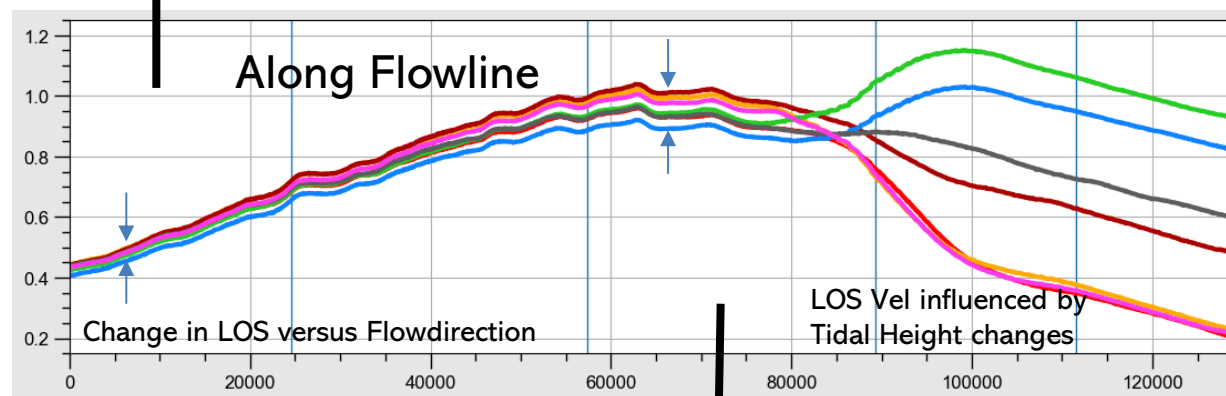
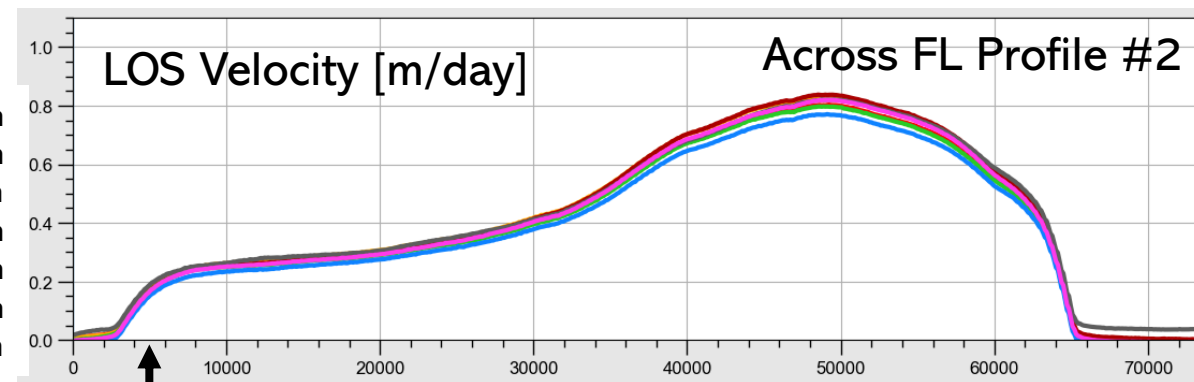
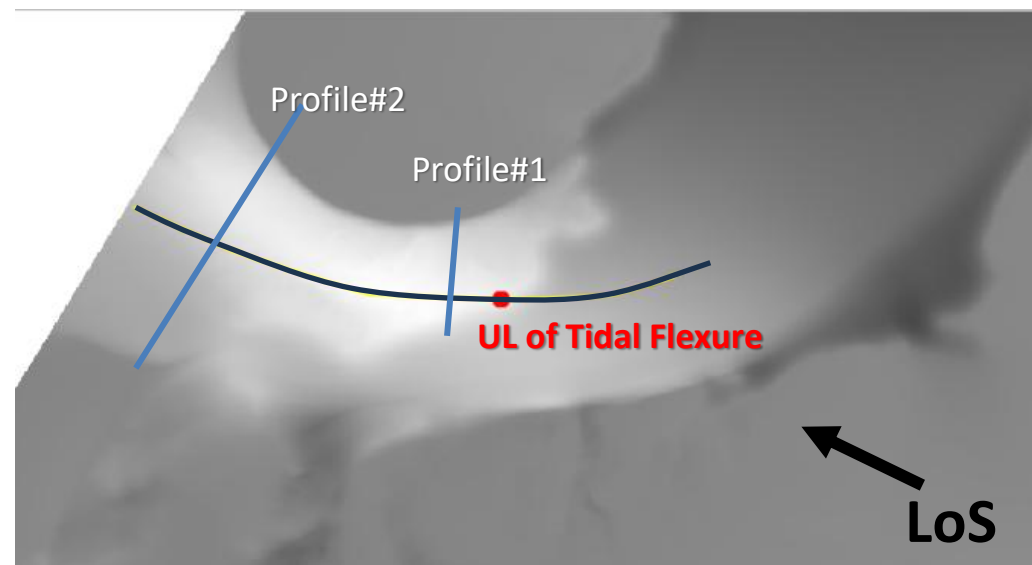
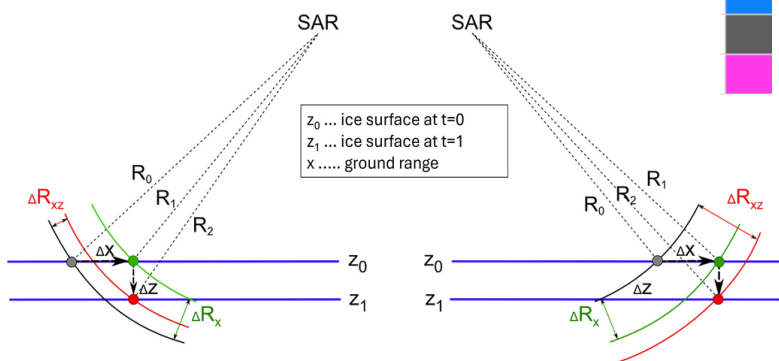


Velocity Changes at Evans Glacier Induced by Tides

Ice shelves: tides influence LOS velocity – depend on SAR look direction versus ice flow direction

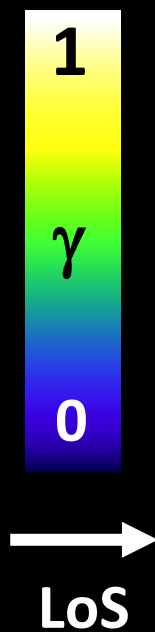
	9 – 10 Jan 2026	$\Delta t_h = -0.42$ m
	21 - 22 Jan 2026	$\Delta t_h = -0.22$ m
	2 - 3 Feb 2026	$\Delta t_h = 0.49$ m
	14 - 15 Feb 2026	$\Delta t_h = -0.40$ m
	26 - 27 Feb 2026	$\Delta t_h = -0.04$ m
	10 - 11 Mar 2026	$\Delta t_h = -0.41$ m
	22 – 23 Mar 2026	$\Delta t_h = 0.27$ m

Tidal Height from
CATS-2008v2023

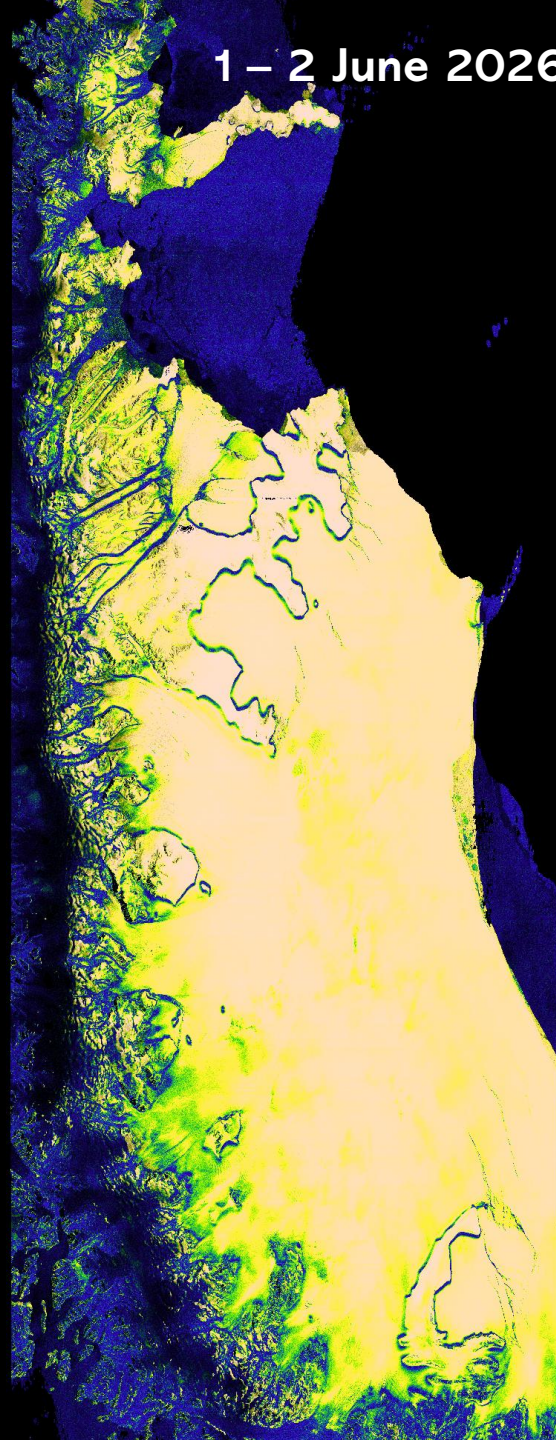


Antarctic
Peninsula

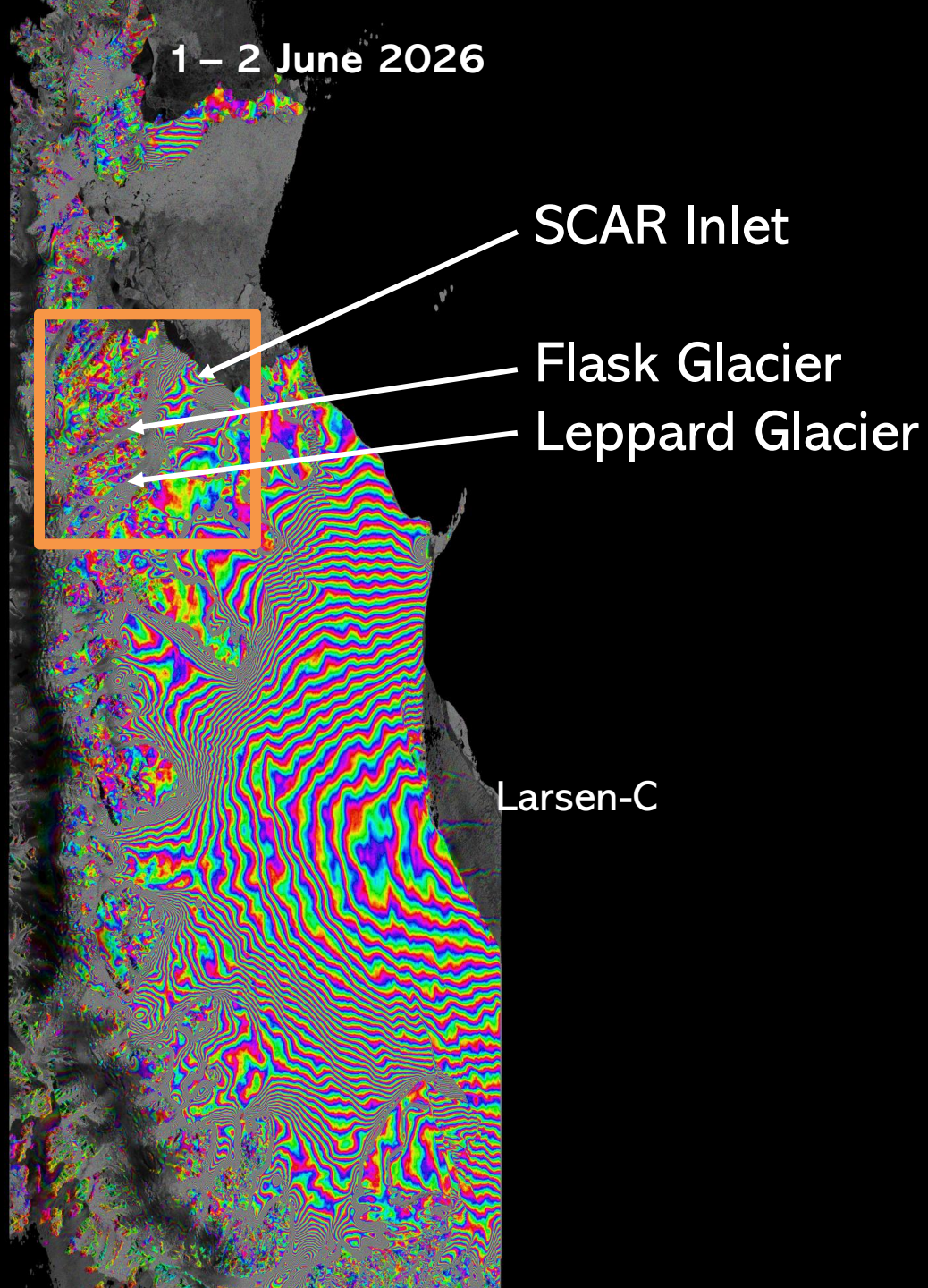
Larsen Ice shelf



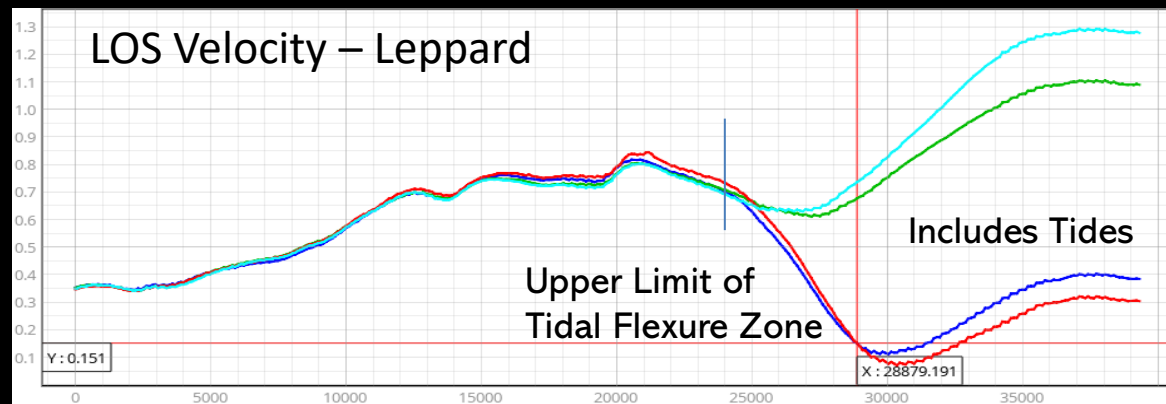
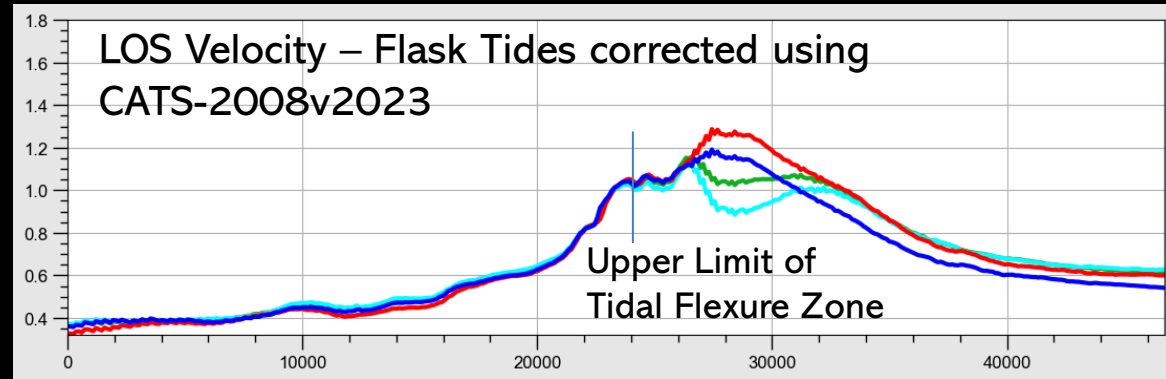
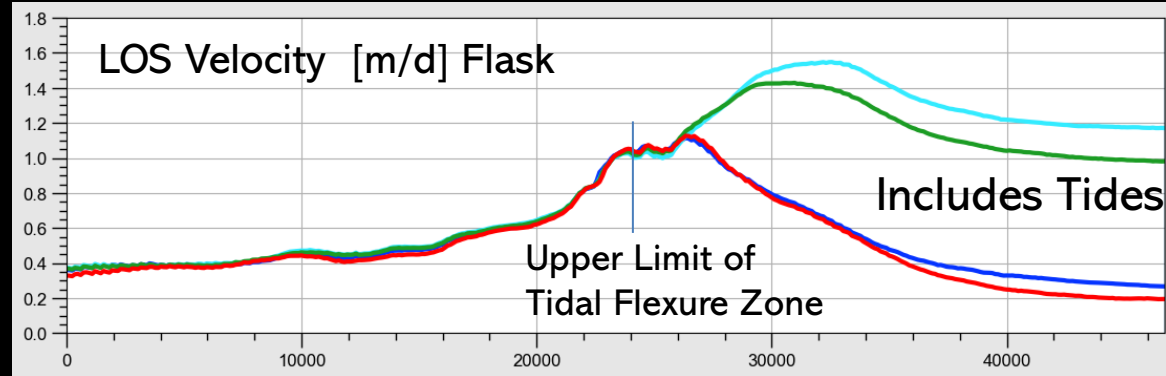
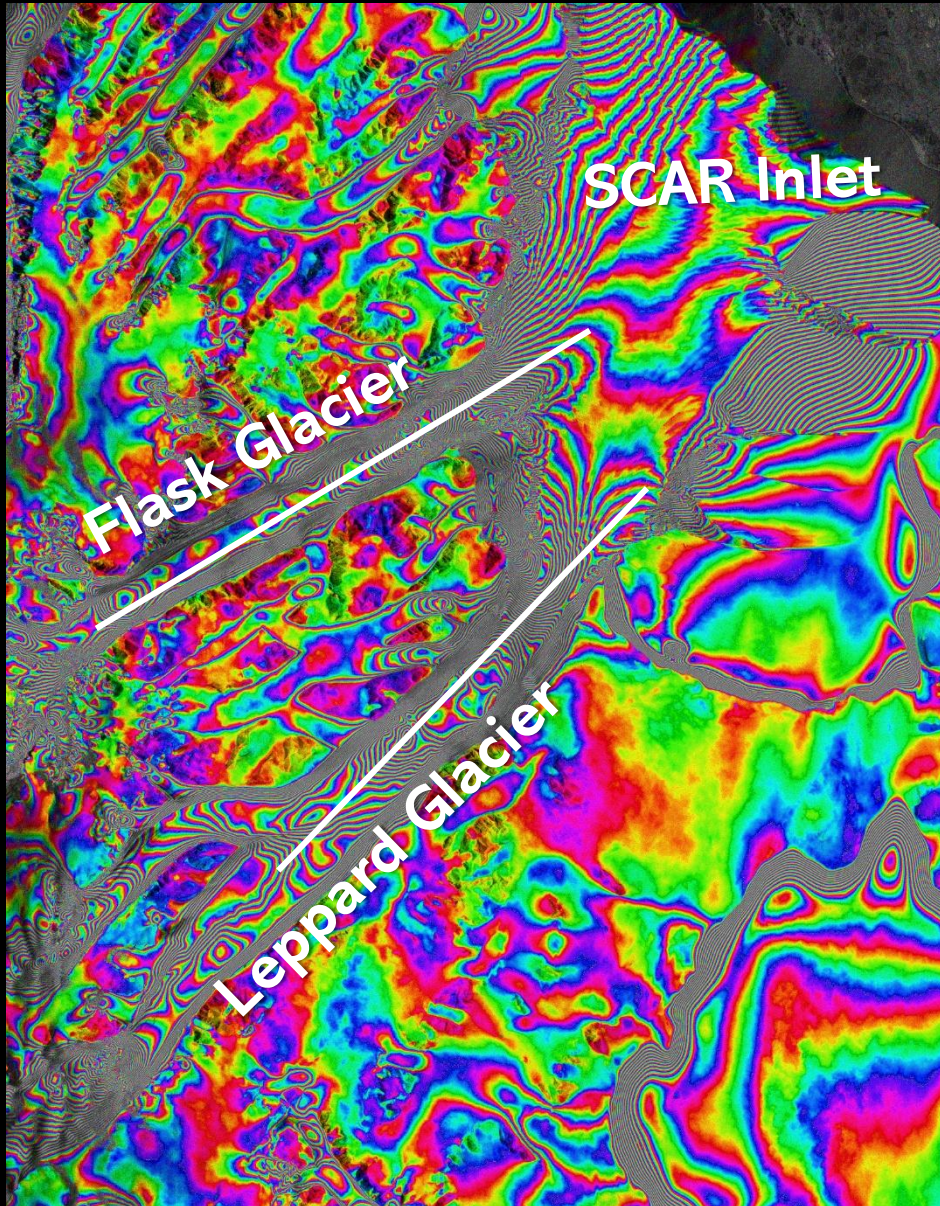
1 – 2 June 2026



1 – 2 June 2026

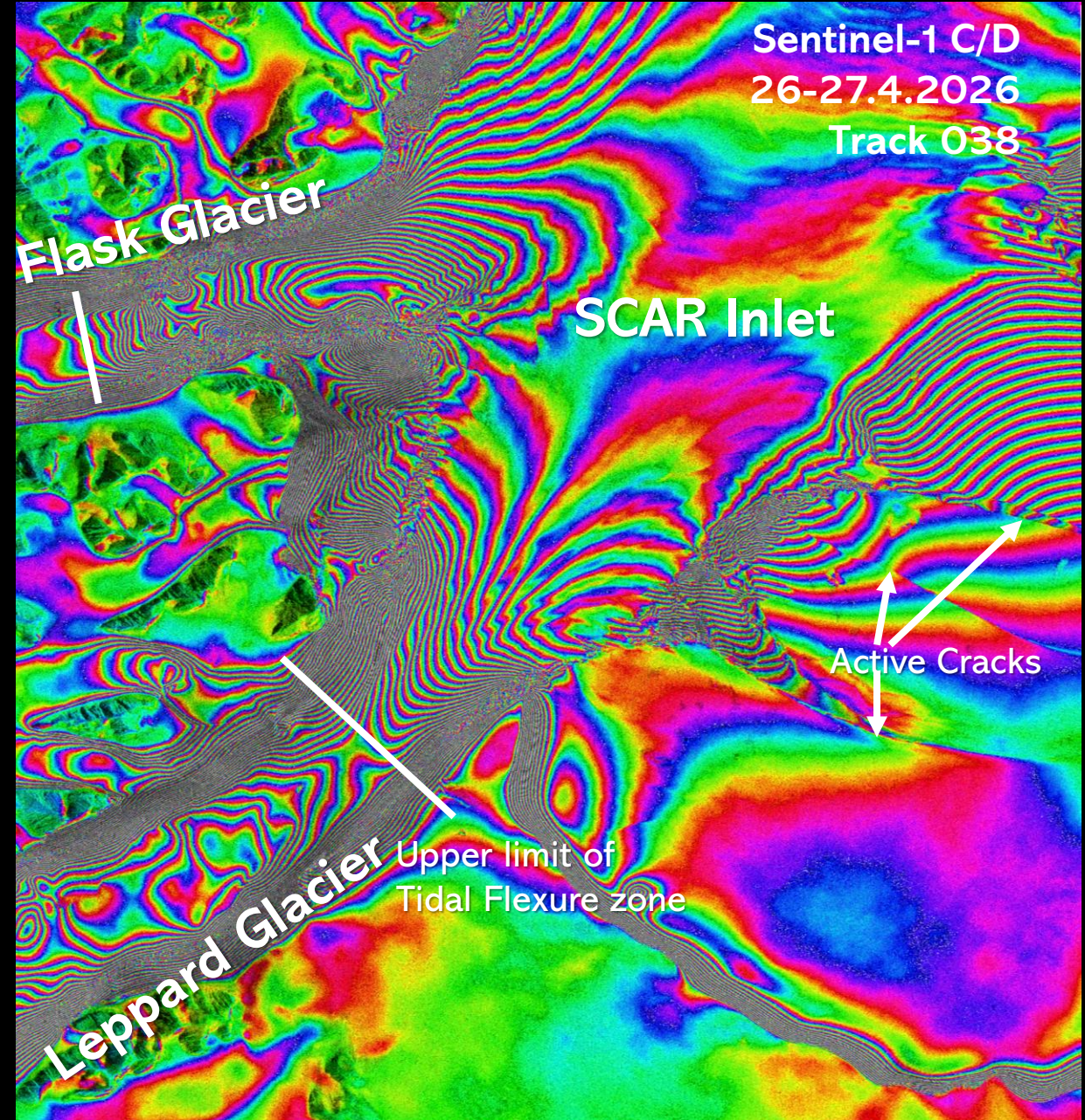
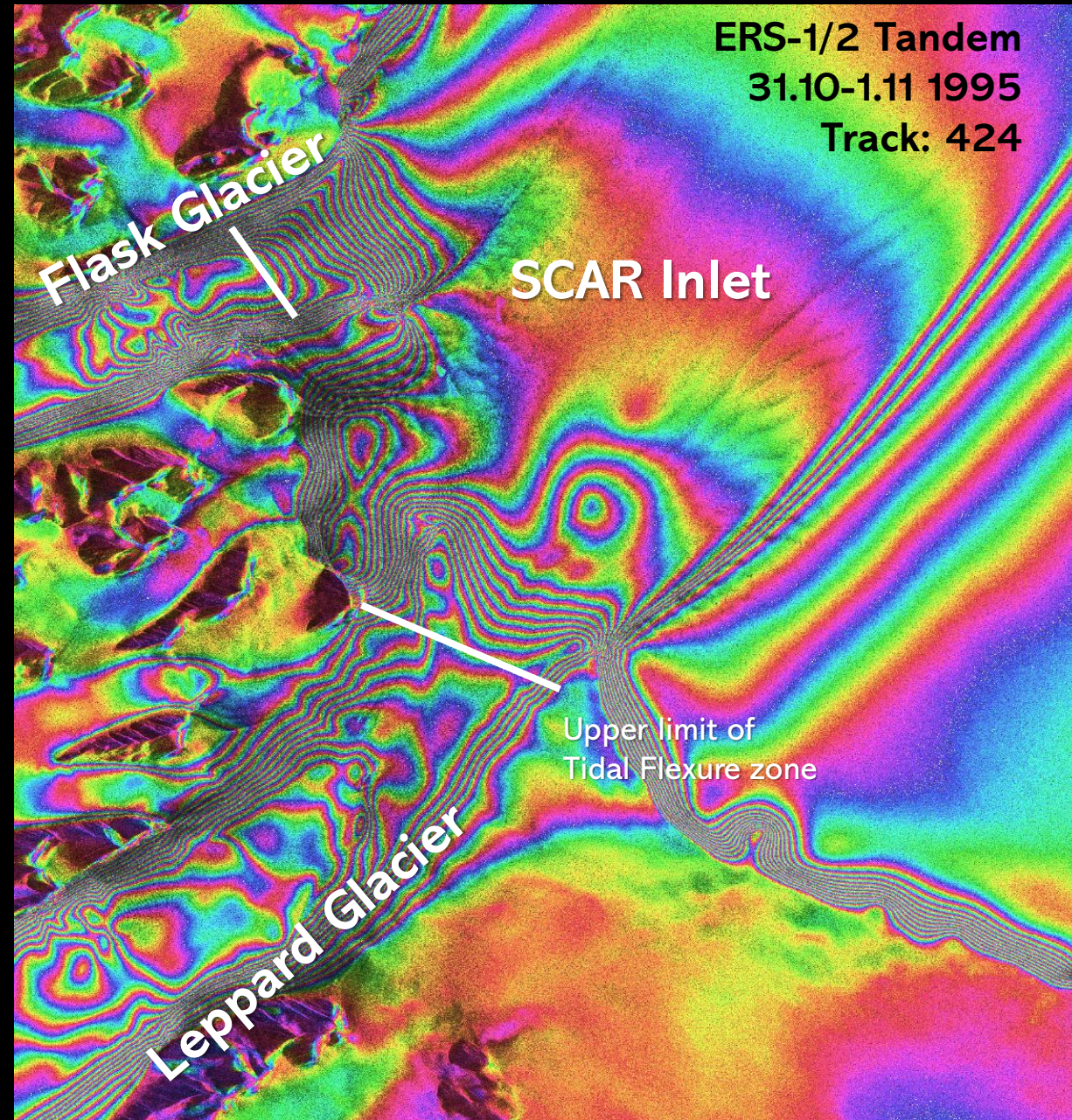


Antarctic Peninsula – SCAR Inlet

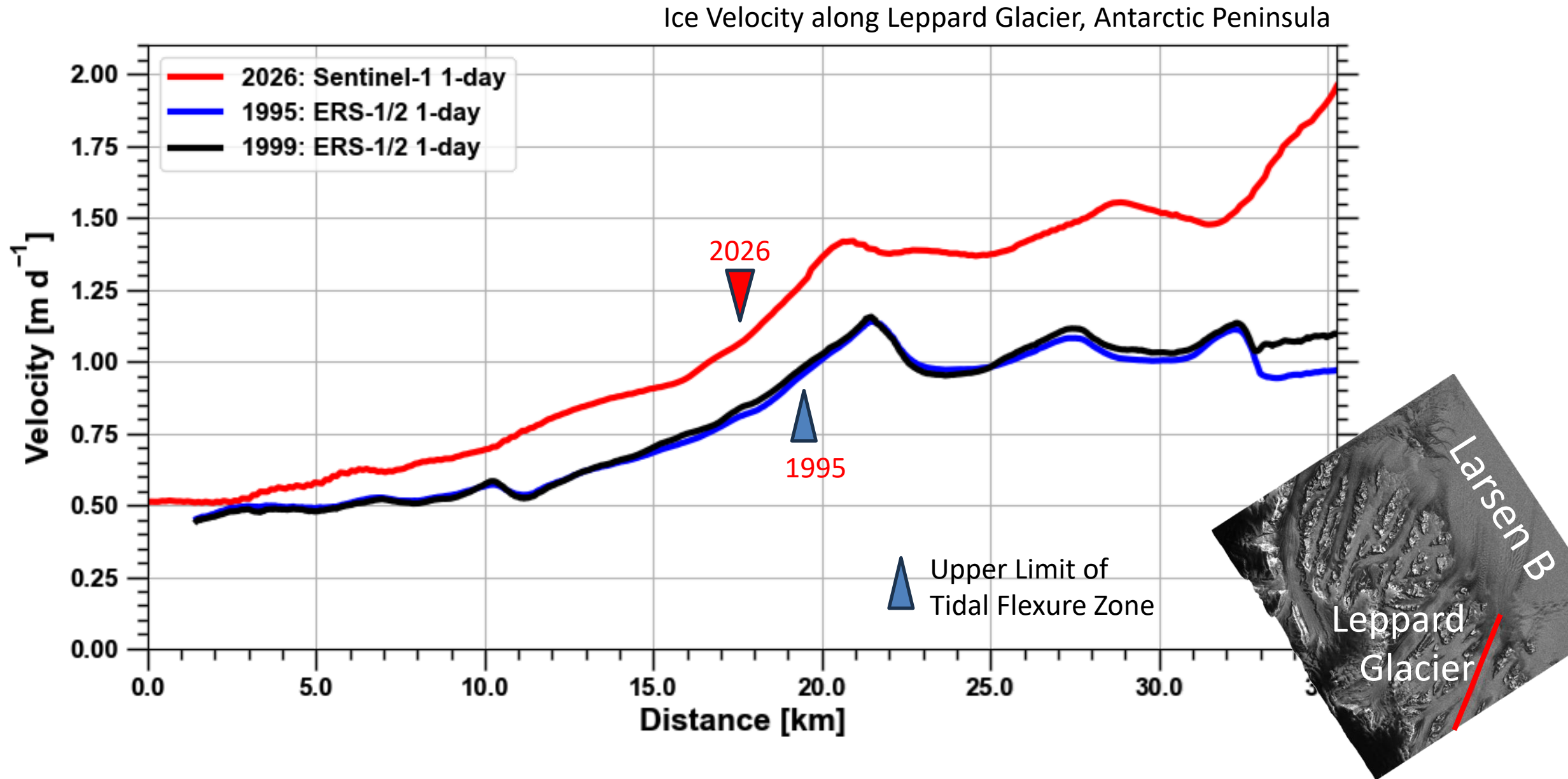


21-22 March
14-15 April
26-27 April
1-2 June
2026

30-Year 1-Day Interferogram Comparison: ERS-1/2 1995 to Sentinel-1 2026



Leppard Glacier Ice Velocity — 30 Years of Change



- Sentinel-1 is a key component of the Earth observation system for polar regions, providing systematic acquisitions since more than 10 years at continuous coverage over Greenland, Antarctica and other polar ice bodies.
- The standard operation mode of Sentinel-1 provides revisit cycles of 12 days for a single satellite and 6 days for a two-satellite constellation. These time spans enable the use of the offset tracking method for ice velocity retrievals all-over but impede the use of the InSAR method on fast moving sections and in deformation zones.
- One-day repeat-pass time spans reduce the loss of coherence significantly, enabling the application of the InSAR method also in these sections. This results in velocity and surface deformation products at higher accuracy and spatial resolution.
- The one-day repeat-pass constellation of Sentinel-1C and 1D operates during a period of about 5 months. This provides excellent opportunities for exploring features in highly dynamic ice sheet sections such as tidal deformation zones and shear margins.
- The synergy of 1-day InSAR and 6- and 12-day offset tracking products provides new insights into ice flow dynamics and deformation at different temporal scales.

