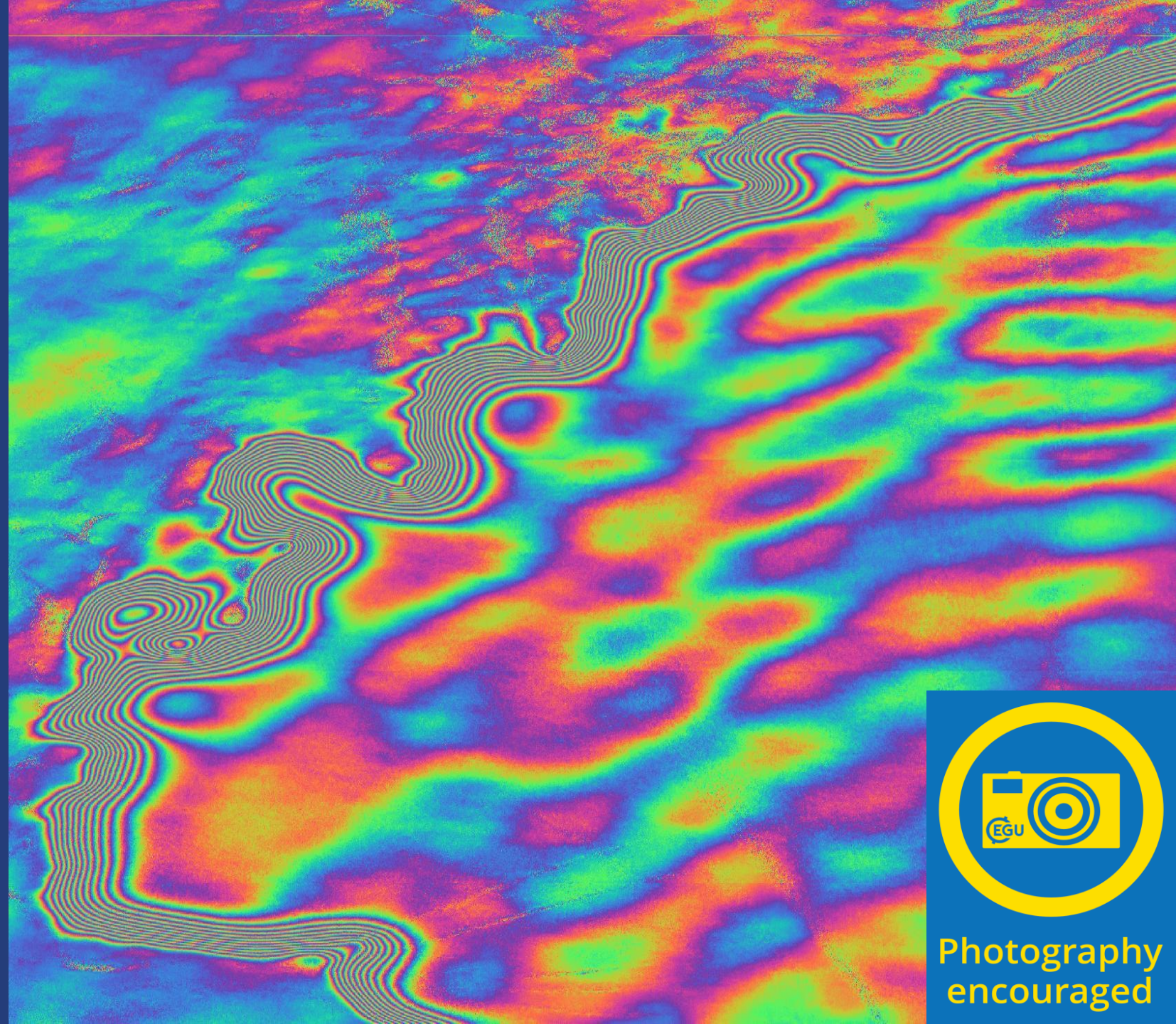
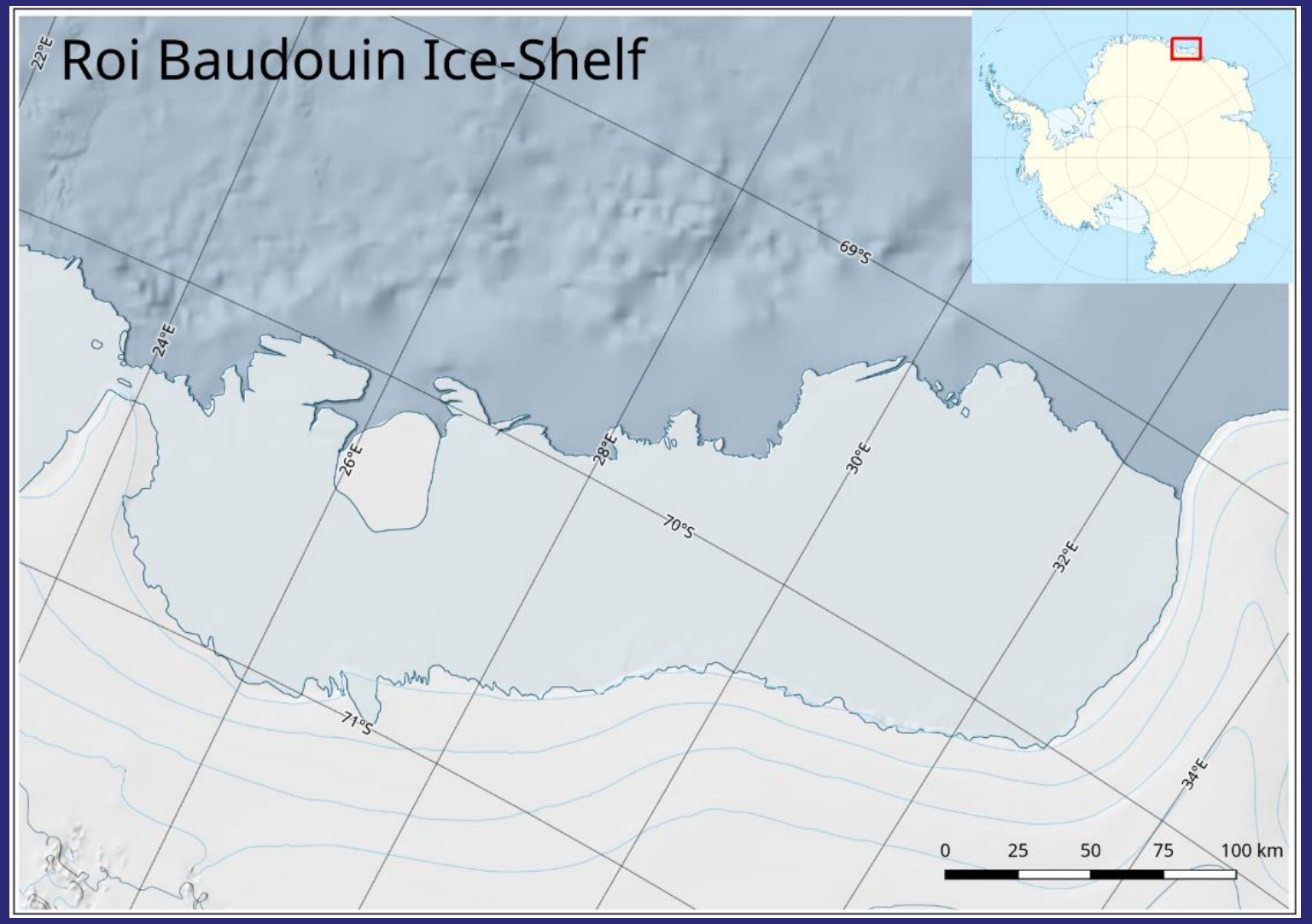
Removing Tides and **Inverse Barometer Effect** on **DInSAR** of **Antarctic Ice Shelves**

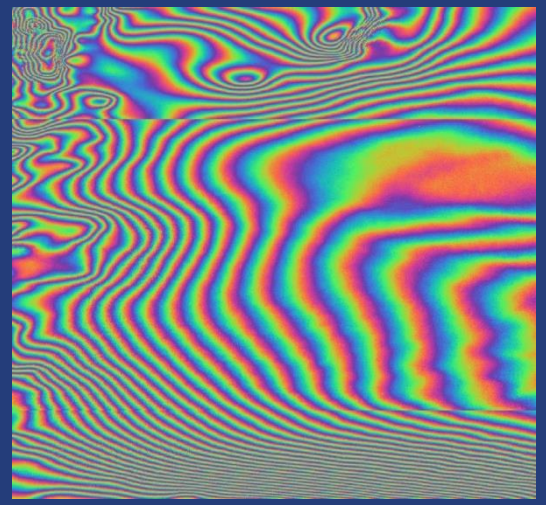
Q. **Glaude**, S. **Berger**, C. **Amory**, F. **Pattyn**, C. **Barbier** and A. **Orban**

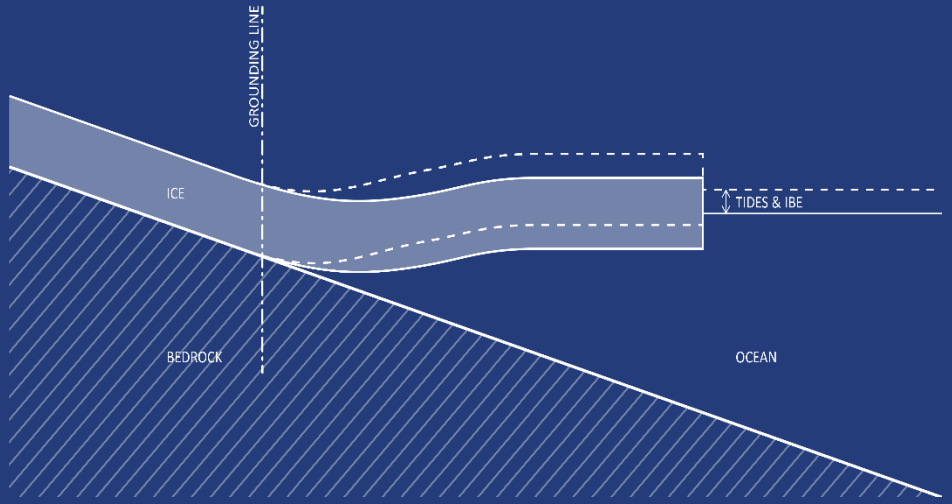


Methodology applied in Dronning Maud Land – Antarctica, but applicable elsewhere

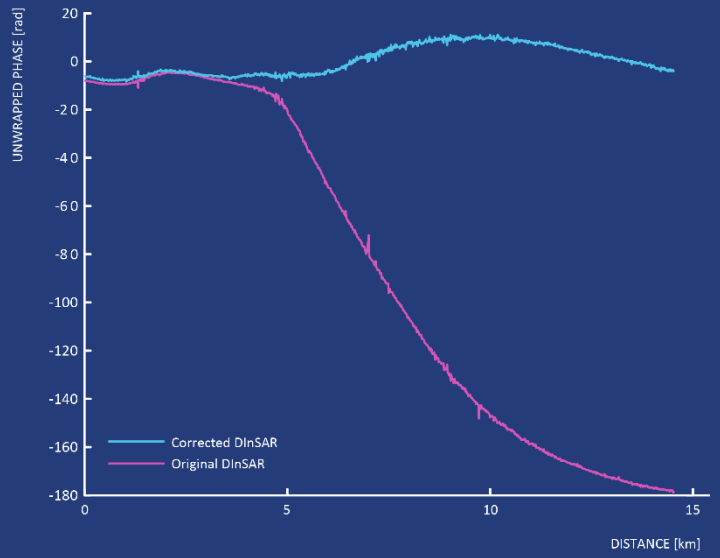


Displacement from DInSAR



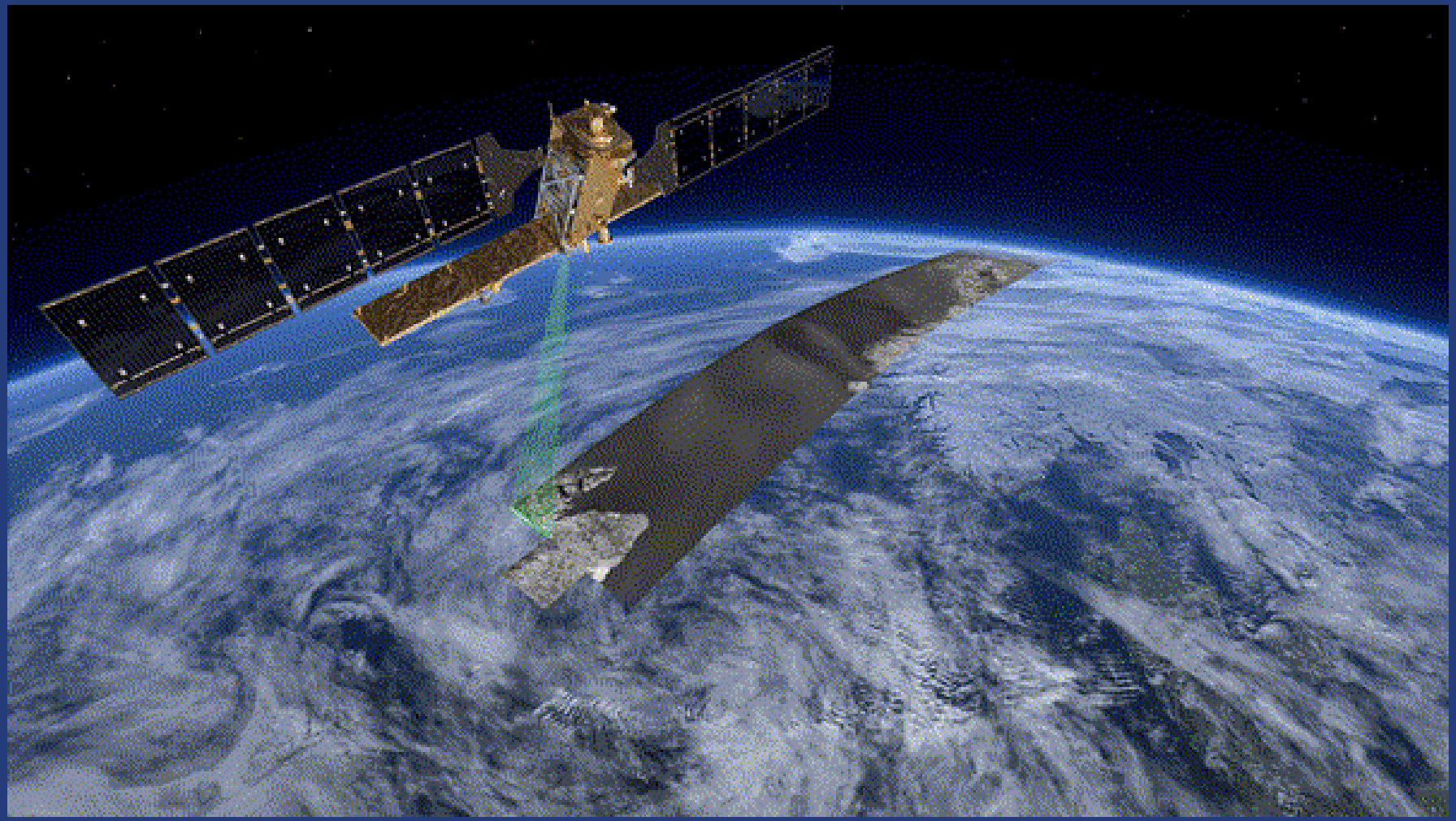


Results



Correction of vertical bias

SAR is an imaging technique where a spaceborne sensor emits an electromagnetic wave and captures its return



[Copernicus, 2019]

By subtracting the phase of 2 SAR images taken from different dates and slightly different points of view, we make an interferogram

PHASE MASTER

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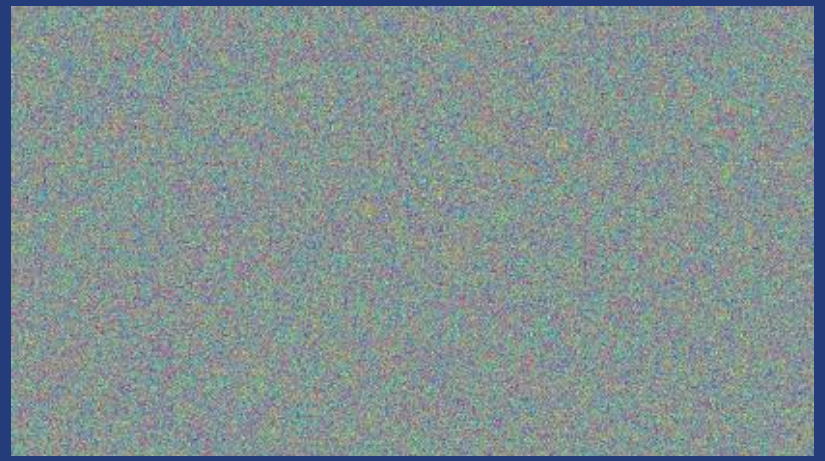
PHASE SLAVE



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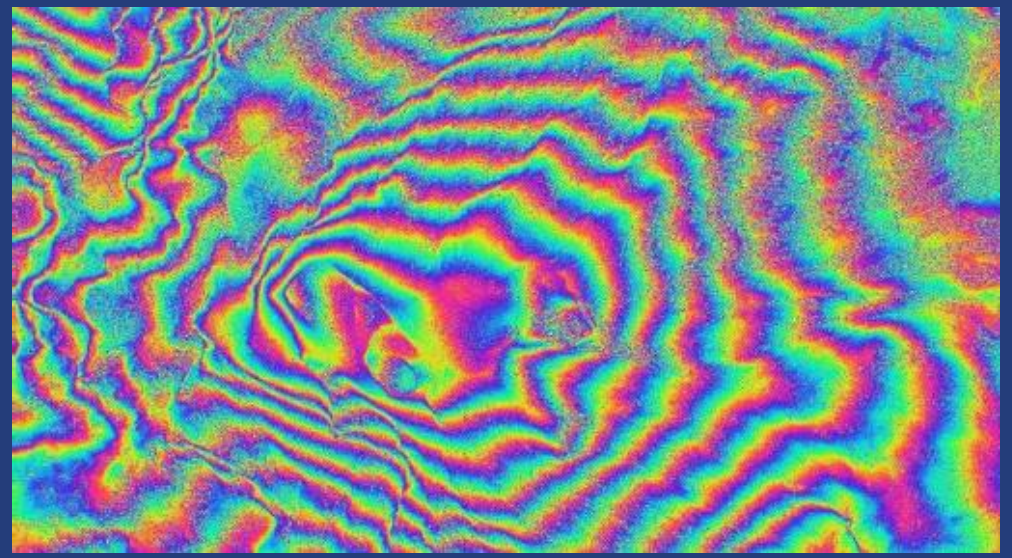
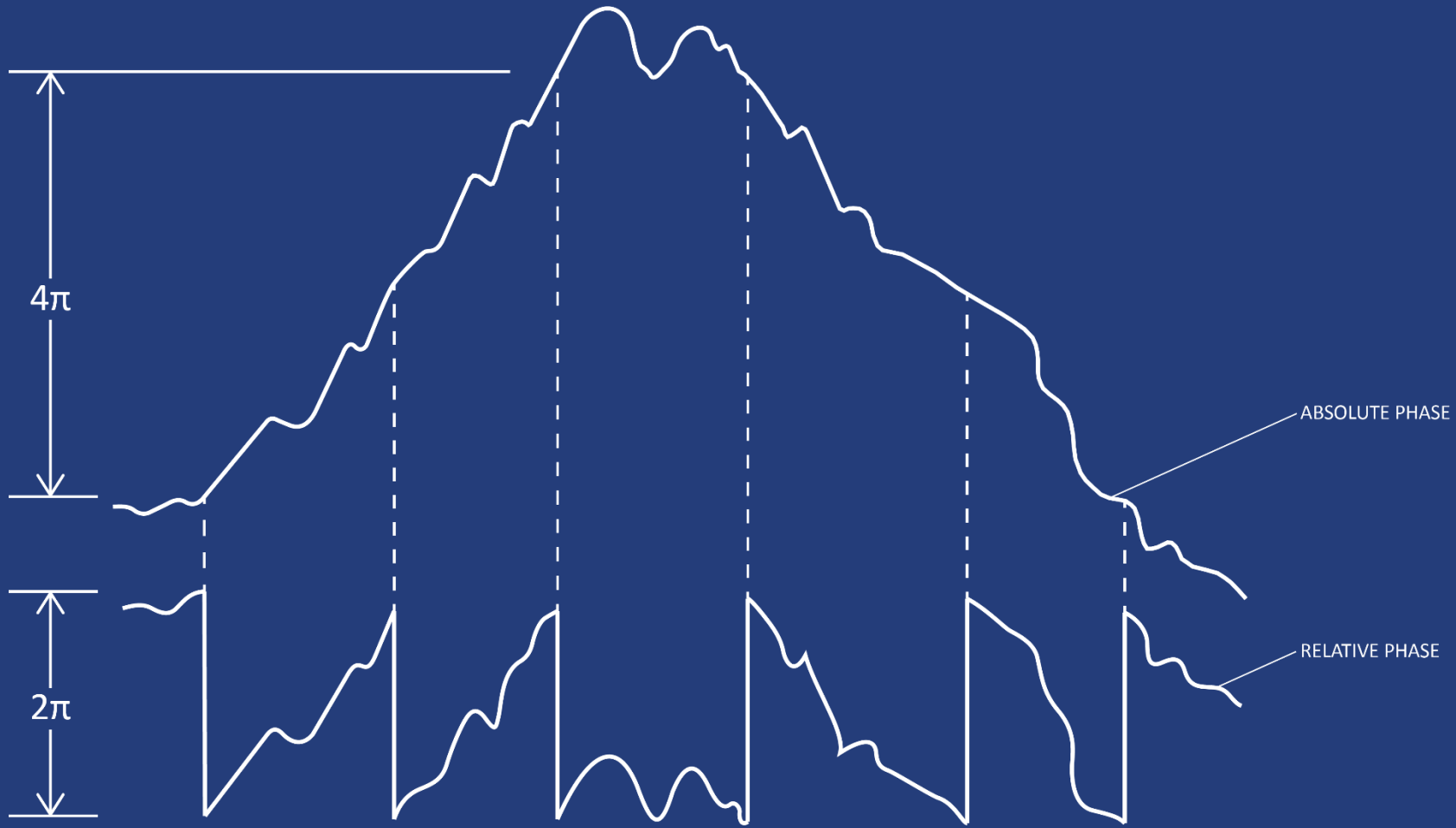


[TanDEM-X – Copahue volcano, i.e.]

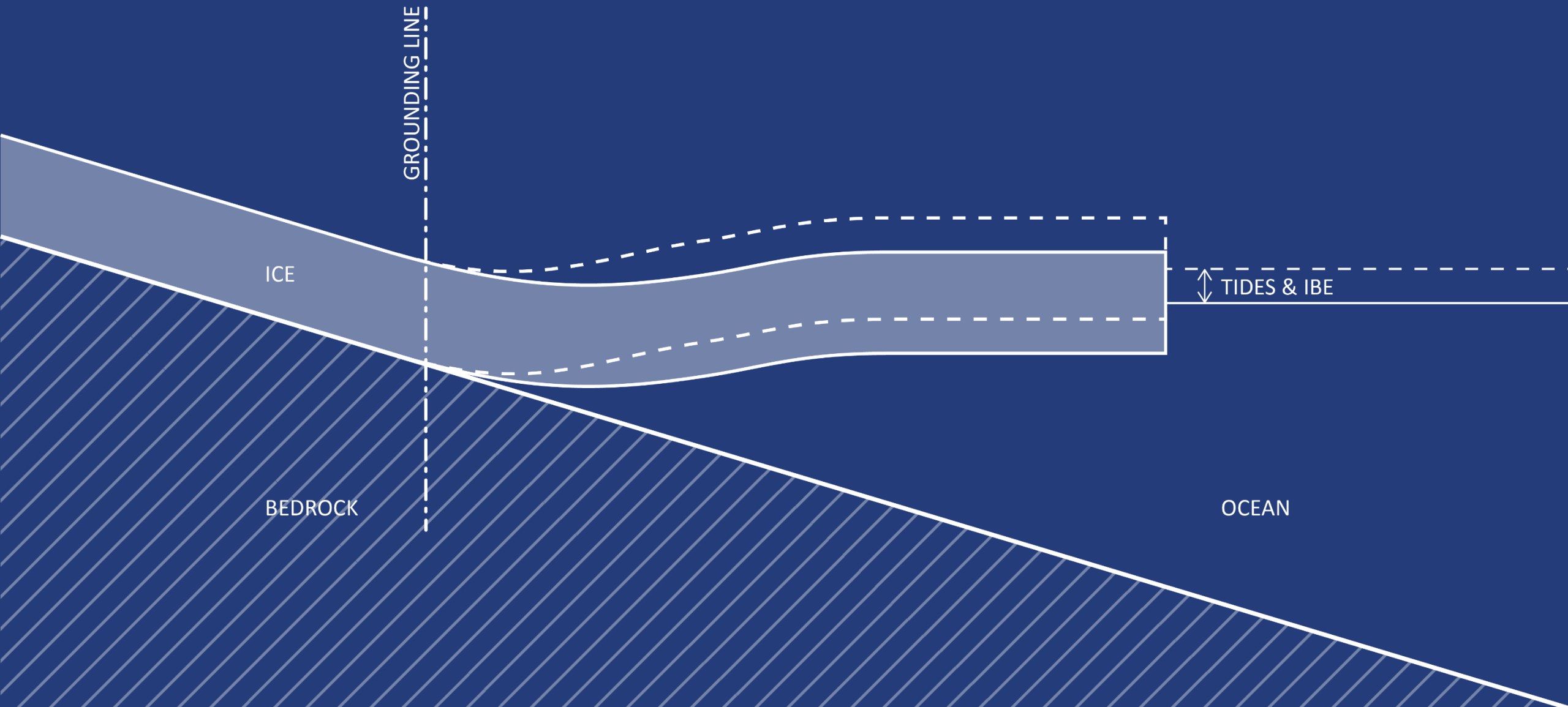
Many components are influencing the interferogram
DInSAR consists in retrieving the phase term related to displacement

$$\varphi_{intf} = \varphi_{orb} + \varphi_{topo} + \varphi_{atm} + \varphi_{mvt}$$

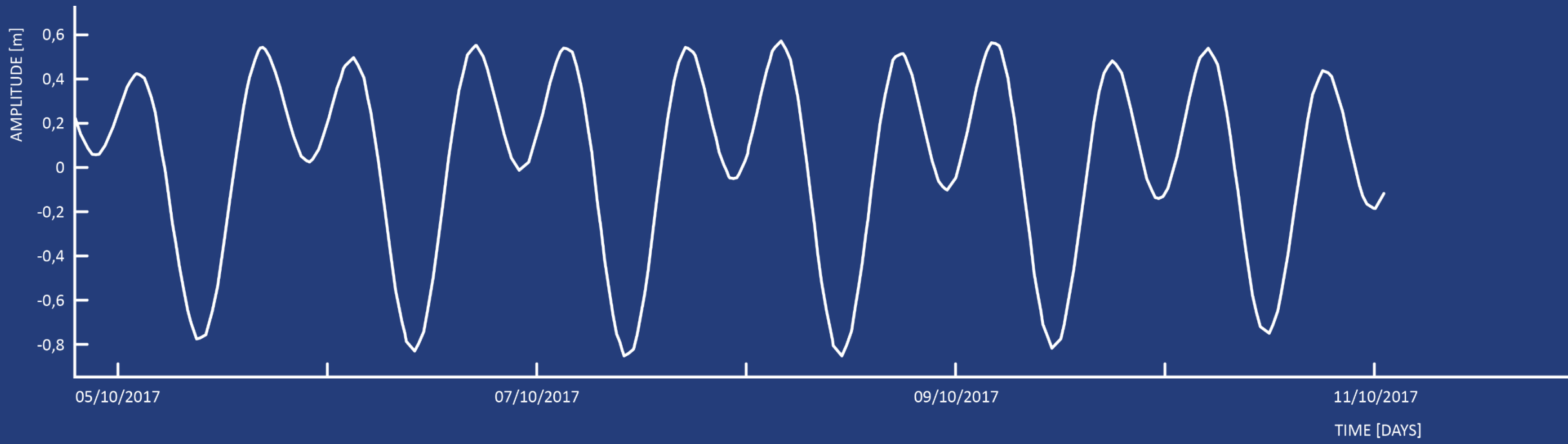
The phase is ambiguous because only known between –π and +π.
Phase unwrapping is necessary to retrieve the absolute phase



Ice shelves are sensitive to variation of the sea level, mostly due to tides and inverse barometer effect (IBE)

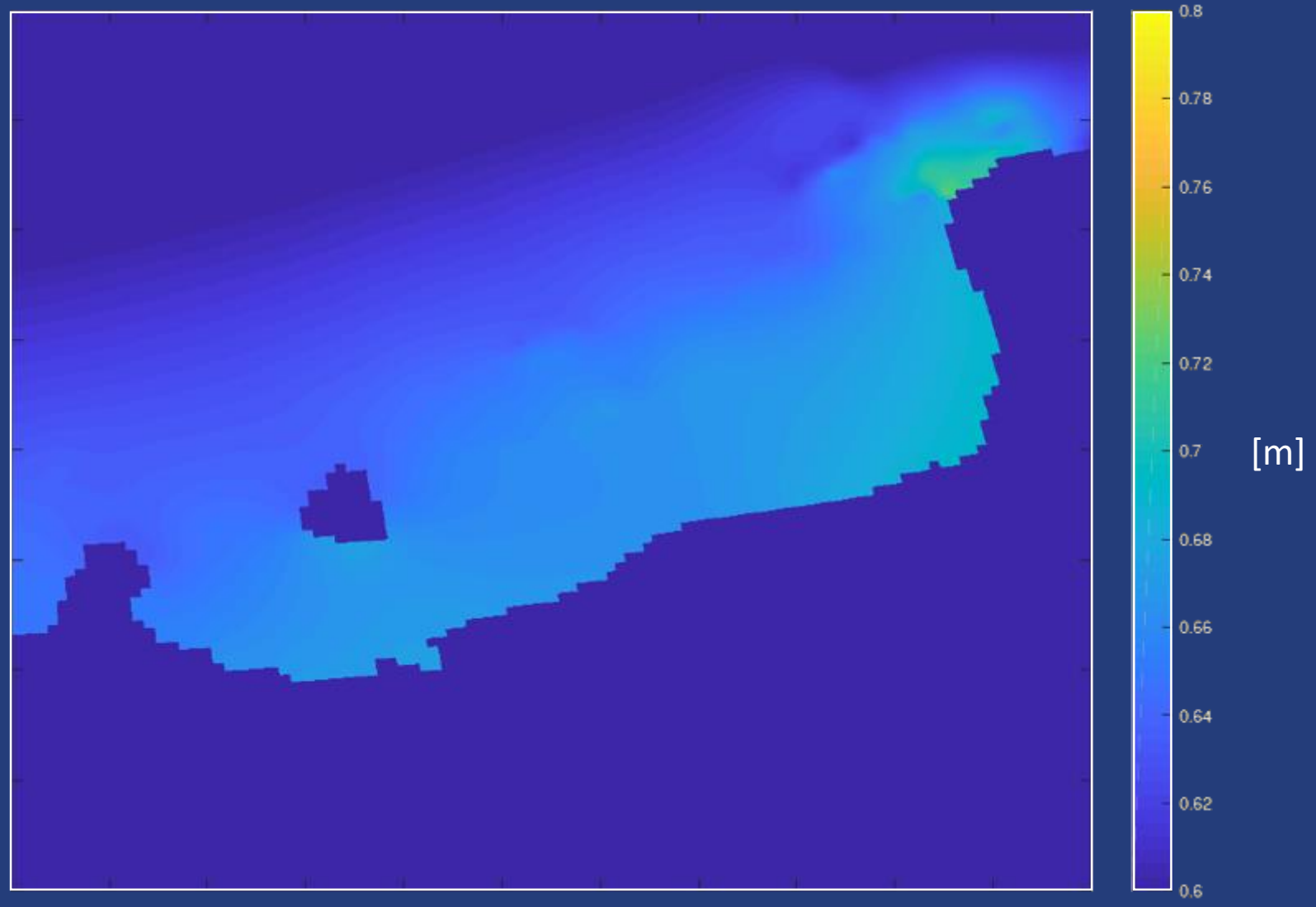


Between two close DInSAR (12 days), we can consider horizontal velocity as stationary, whereas vertical displacement is highly variable

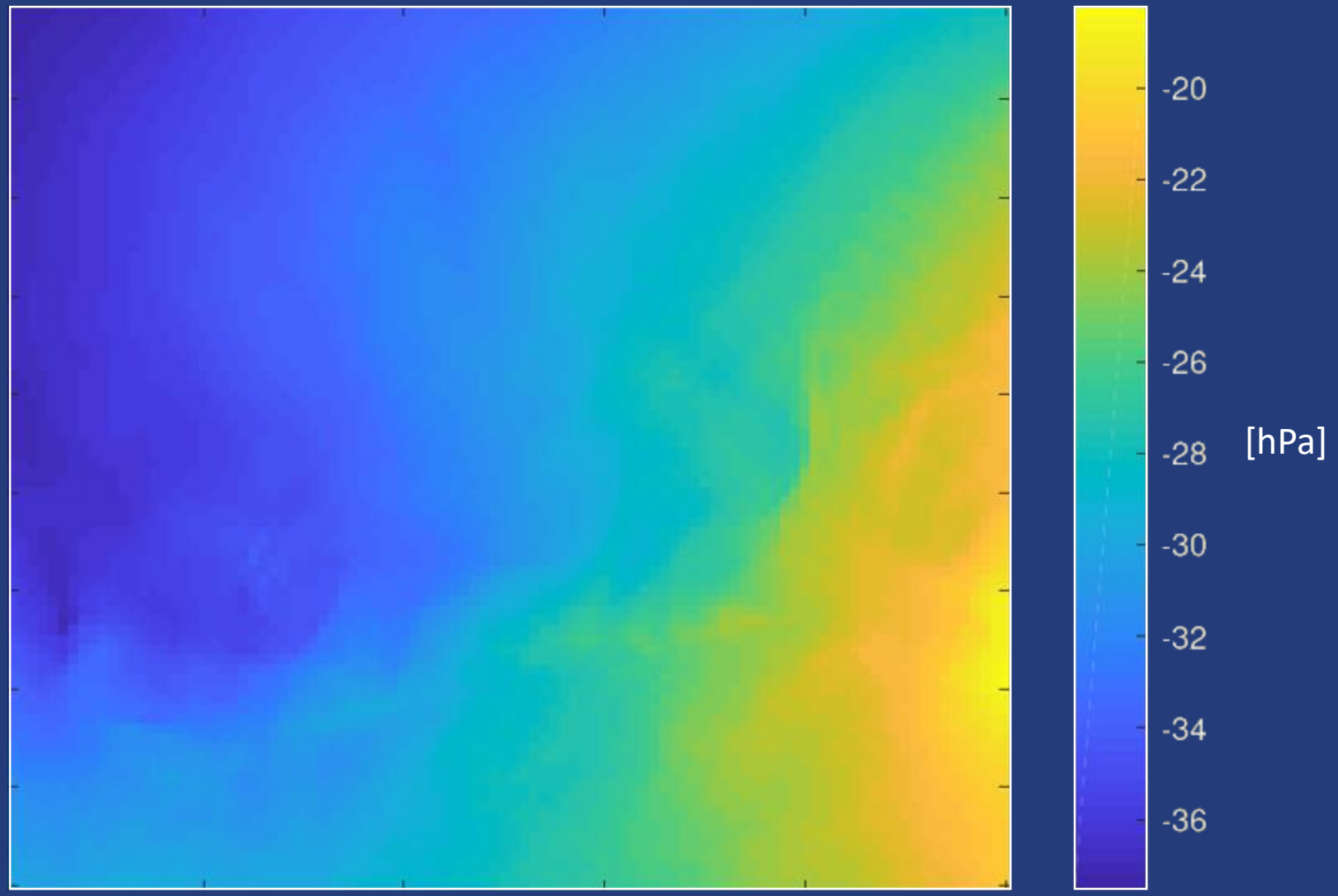


$$A_i(x, y) = \Delta tides_i(x, y) - \Delta pressure_i(x, y)$$

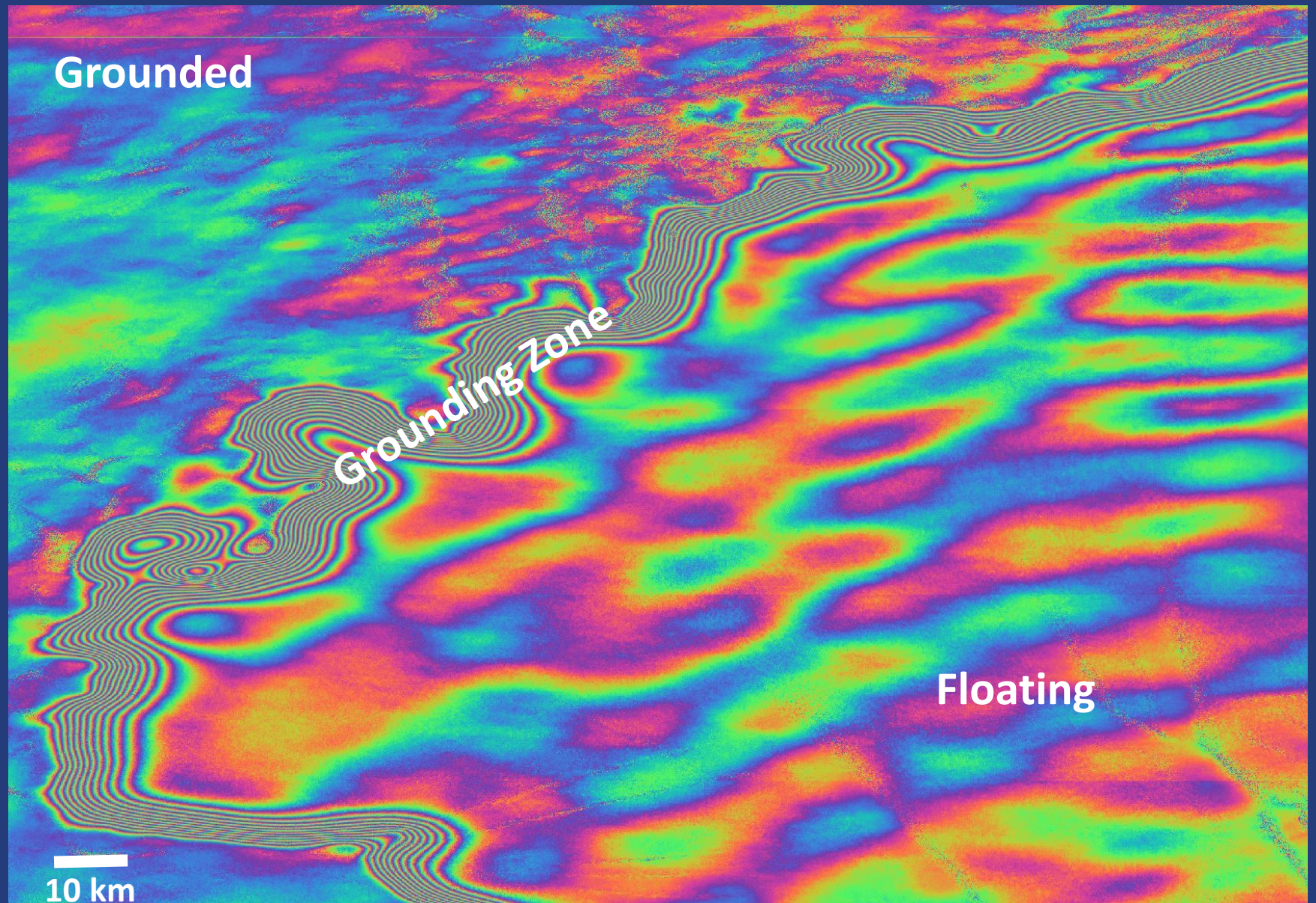
Tides’ amplitudes are computed using the Padman model



Similarly, surface atmospheric pressure are computed using the regional atmospheric MAR model



A double differential interferogram (DDInSAR) consists in subtracting two consecutive interferograms. DDInSAR only accounts for vertical displacements

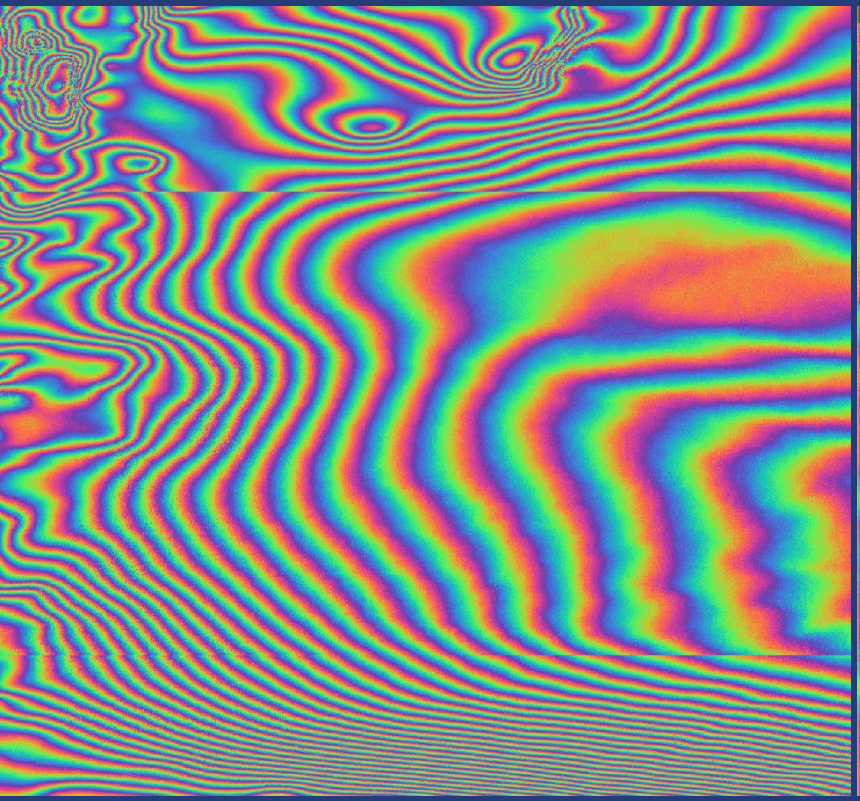


← Roi Baudouin Ice Shelf

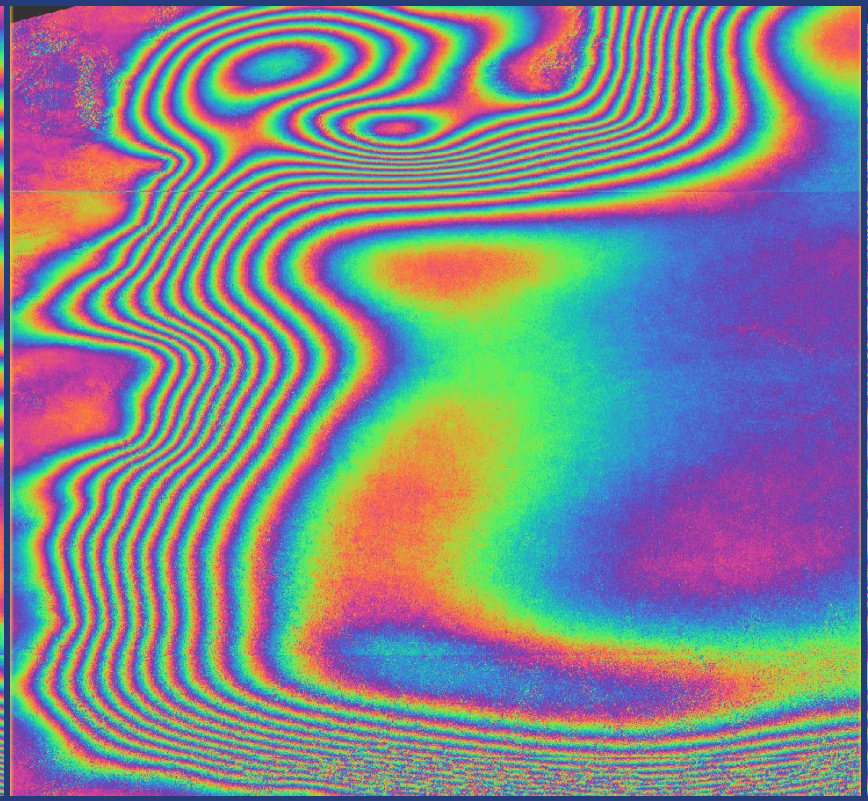
The DInSAR is corrected by scaling the DDInSAR to the DInSAR vertical bias

$$\Phi_{displ_{H_1}} = \Phi_{DInSAR_1} - \frac{A_1}{A_2 - A_1} \cdot \Phi_{DDInSAR}$$

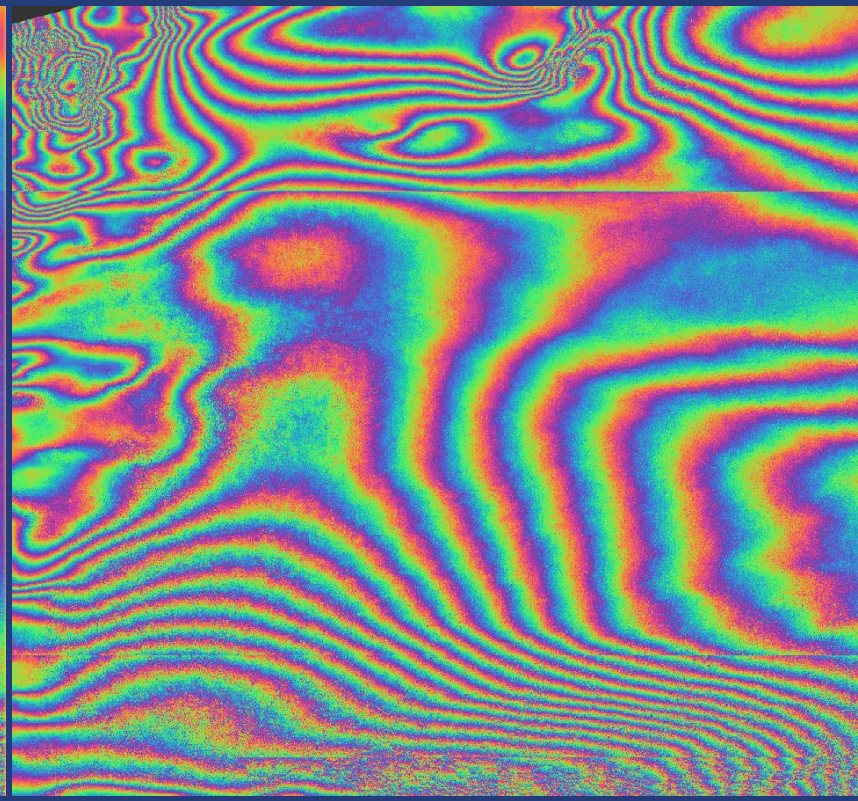
Results showed a strong decrease of the fringe rate in the grounding zone



Original DInSAR

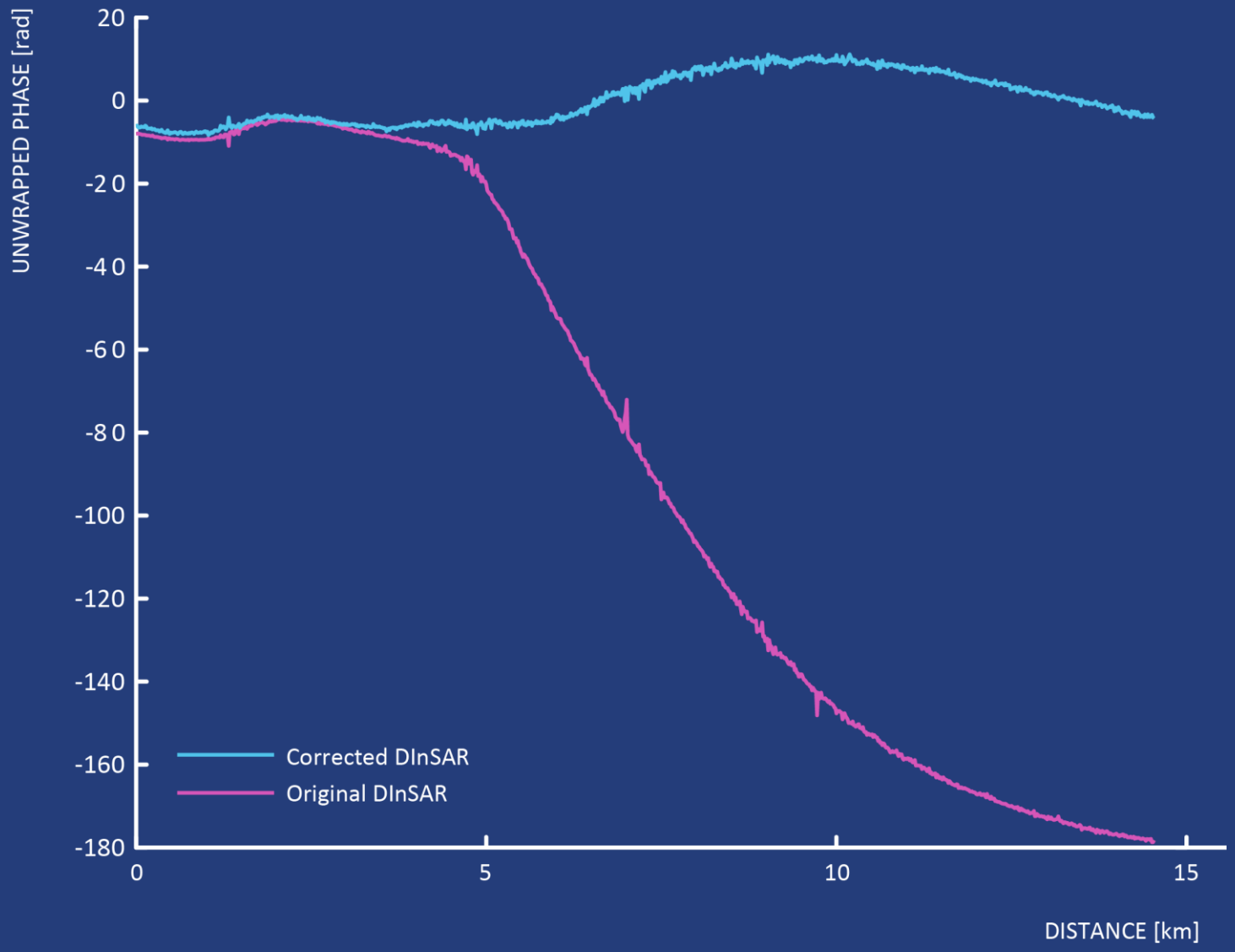


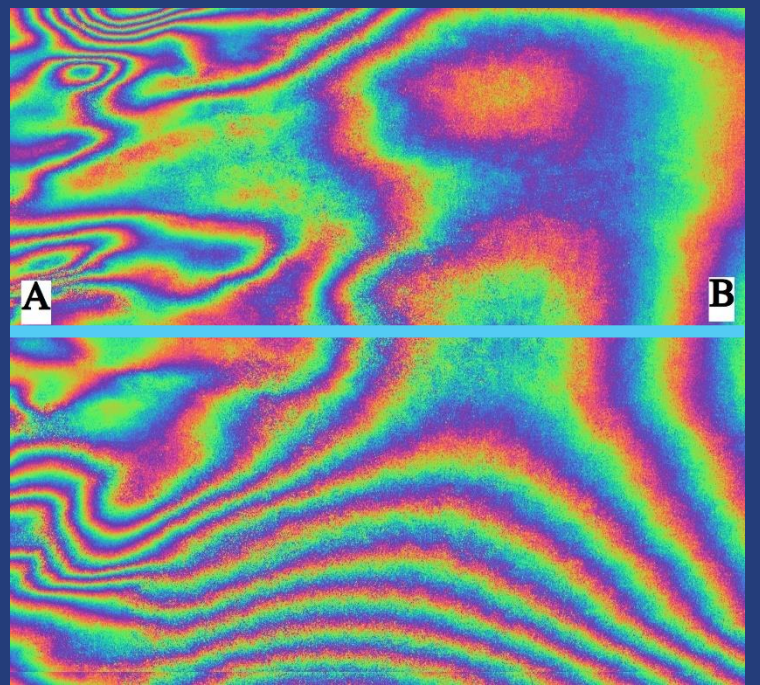
Vertical Bias



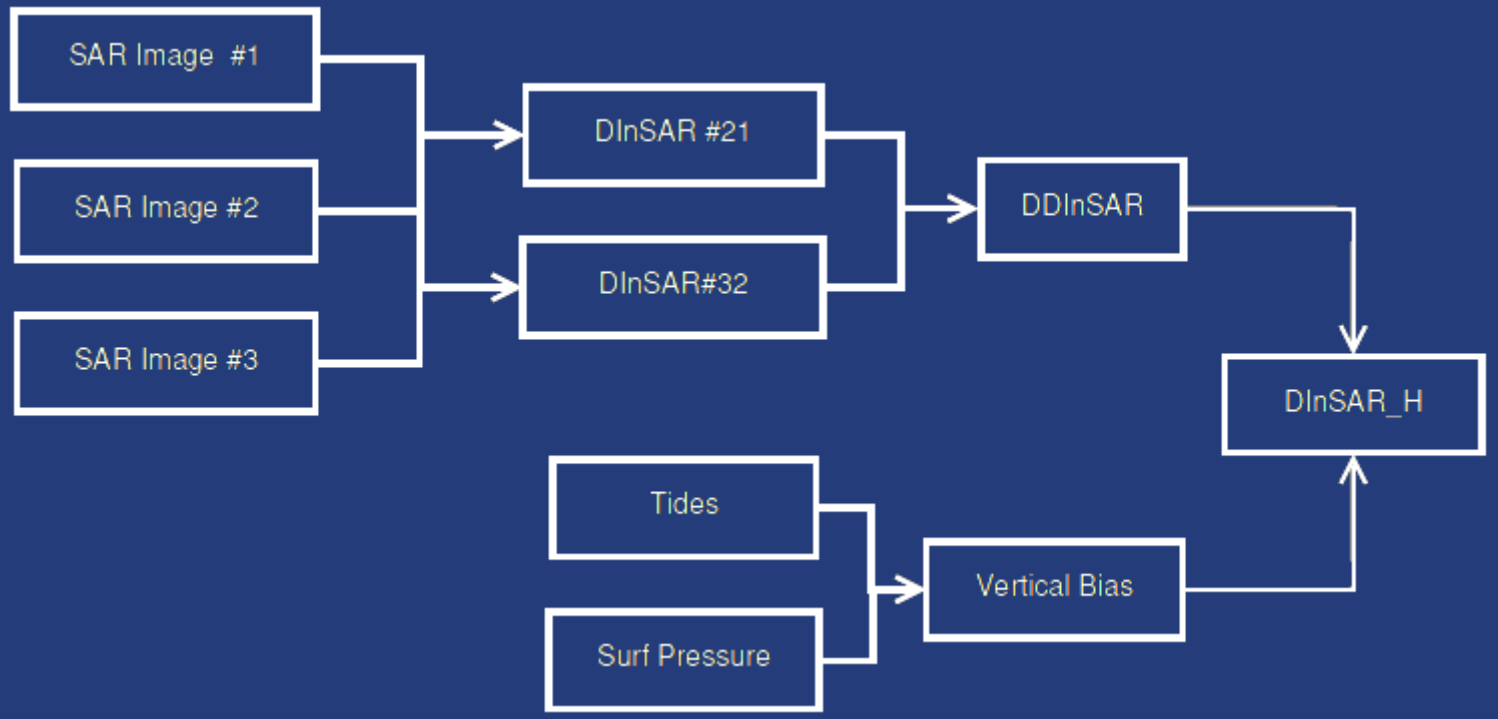
Corrected DInSAR

Results showed a strong decrease of the fringe rate in the grounding zone





In conclusion, we developed a simple algorithm to remove vertical bias from DInSAR for the retrieval of horizontal displacement



Questions ?