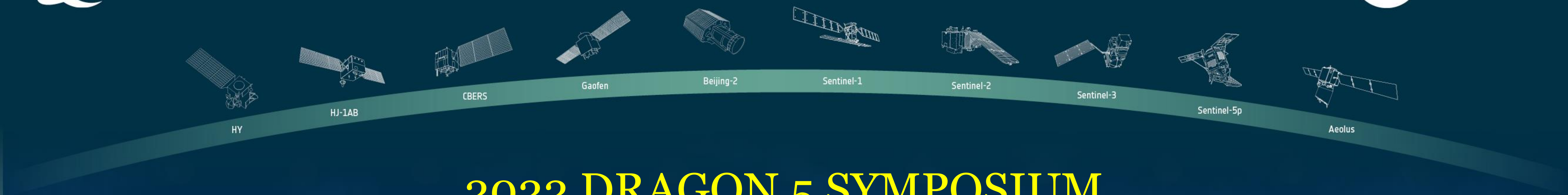

2022 DRAGON 5 SYMPOSIUM

MID-TERM RESULTS REPORTING

17-21 OCTOBER 2022

PROJECT ID. 59295

MONITORING AND INVERSION OF KEY ELEMENTS OF CRYOSPHERE DYNAMIC IN THE PAN THIRD POLE WITH INTEGRATED EARTH OBSERVATIONS AND SIMULATION

OCT 20TH

ID. 59295

PROJECT TITLE: MONITORING AND INVERSION OF KEY ELEMENTS OF CRYOSPHERE DYNAMIC IN THE PAN THIRD POLE WITH INTEGRATED EARTH OBSERVATIONS AND SIMULATION

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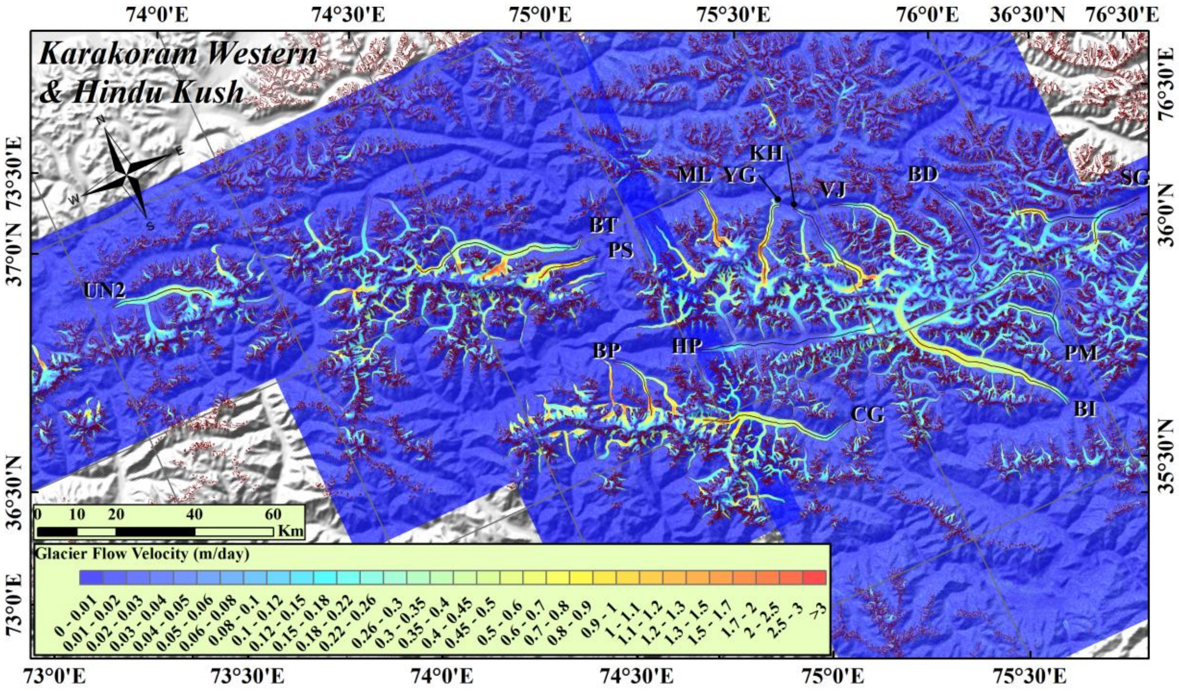
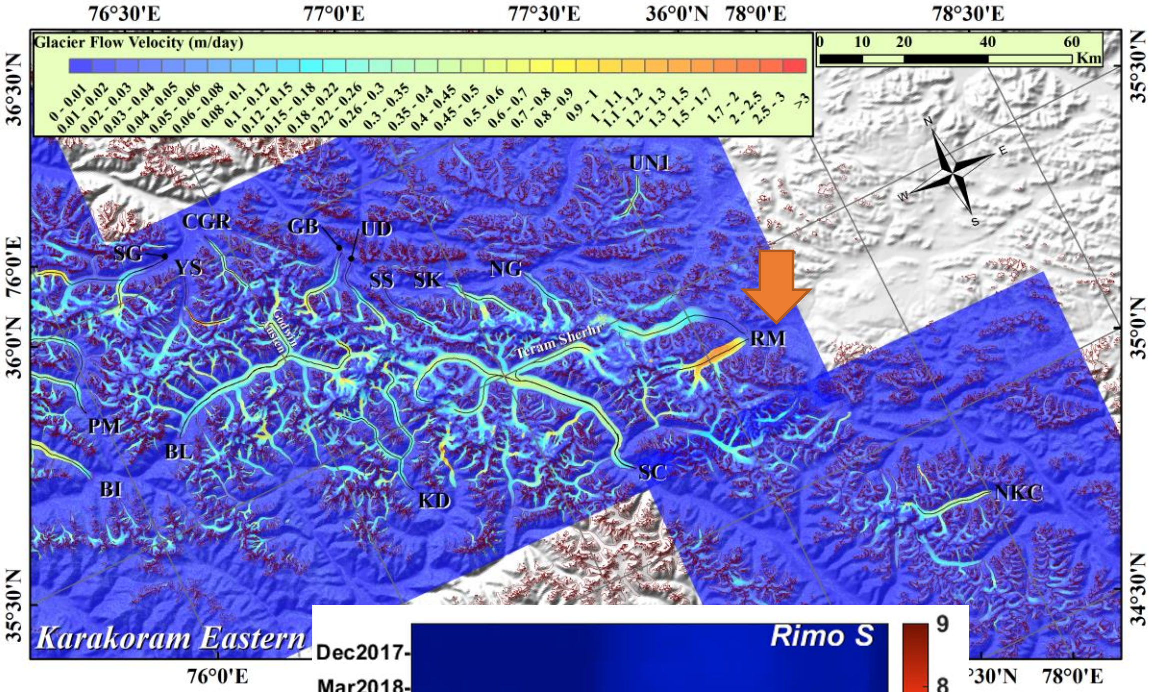
Project Objects

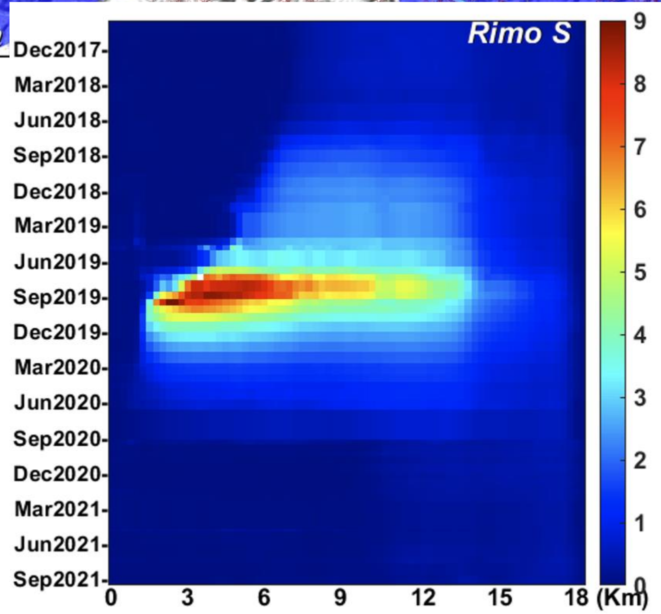
The main objective of this project to investigate glacier and frozen ground dynamics in the Pan Third Pole (PTP) in an integrated Open Virtual Geographic Environment (OVGE) system by the synergistic use of multi-mission remote sensing datasets, ground measurements and by developing physical and/or empirical models.

1, Develop algorithms and methods that employing new generation of European, Chinese and TPM satellites
2, Modify and develop physical and/or empirical models that employ satellite data and Forecasting future fate of the glaciers and frozen ground in the PTP.
3, Evaluating quality of earth observation data from ESA, China and TPM.

Glacier velocity at Karakoram derived by S2



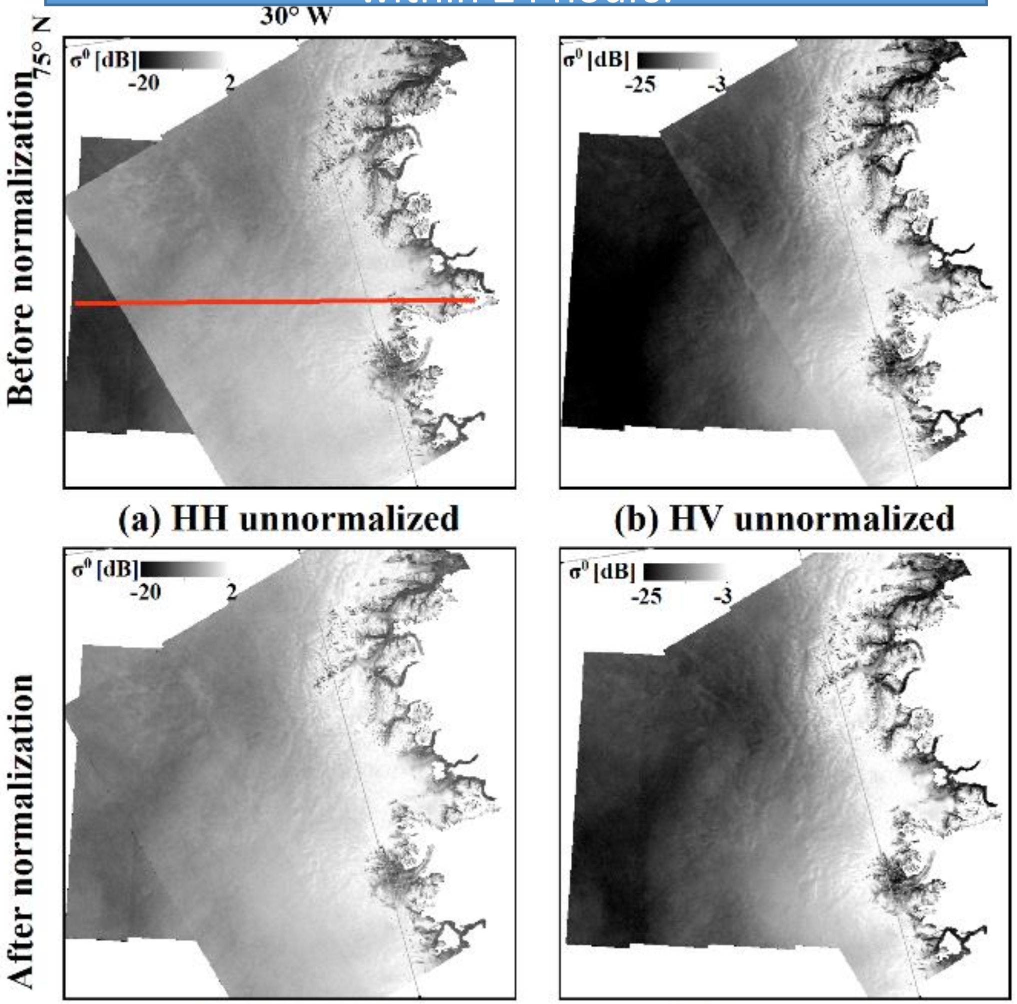




During Oct 2017 to Sep 2021, plenty of surged glaciers start and/or end their surging phases. Rimo south glacier experienced a full surging phase during our study period and last for about two years, the maximum speed exceeded 9m/day.

Incidence angle normalization of S1 at GrIS

Ascending and descending images obtained within 24 hours.



(a) HH unnormalized (b) HV unnormalized

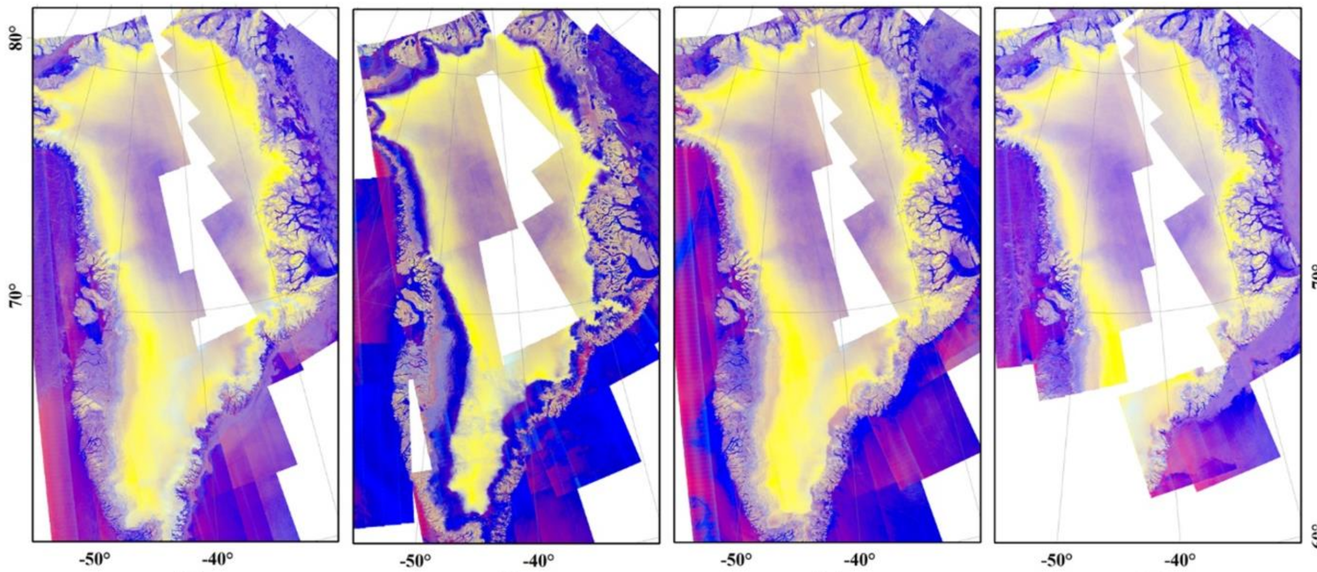
(c) HH normalized (d) HV normalized

We introduced an algorithm that presumes that backscatter coefficient differences is linear to incidence angle differences.

$$\sigma_a^0 - \sigma_d^0 = \frac{d\sigma^0}{d\theta} * (\theta_a - \theta_d) + r \ [\mathrm{dB}]$$

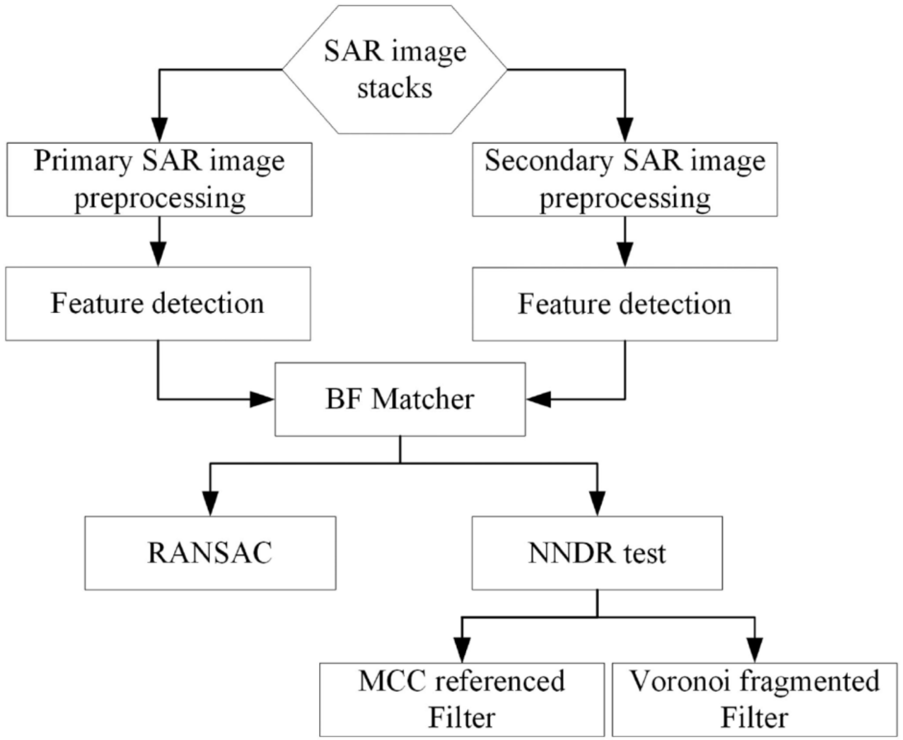
Depends on surface feature, which is modelled lon, lat, height and acquisition date.

Apr Jul Oct Jan

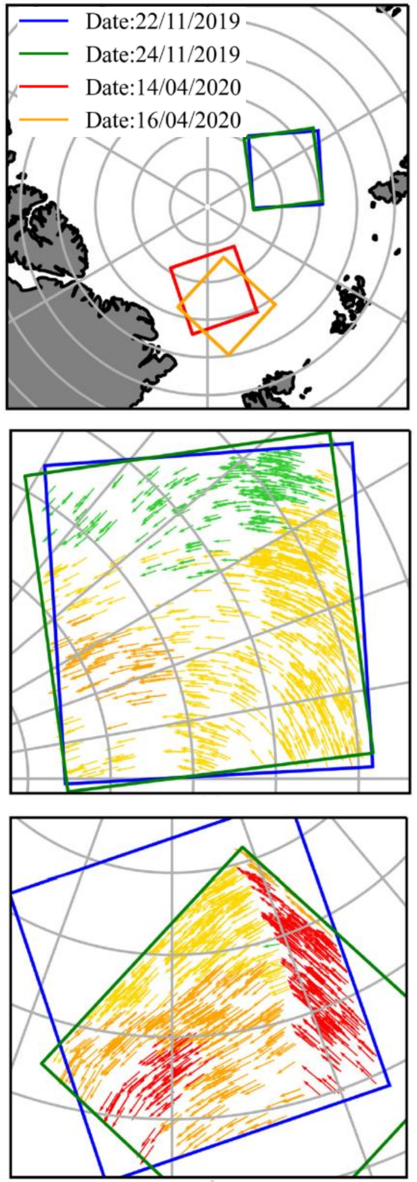


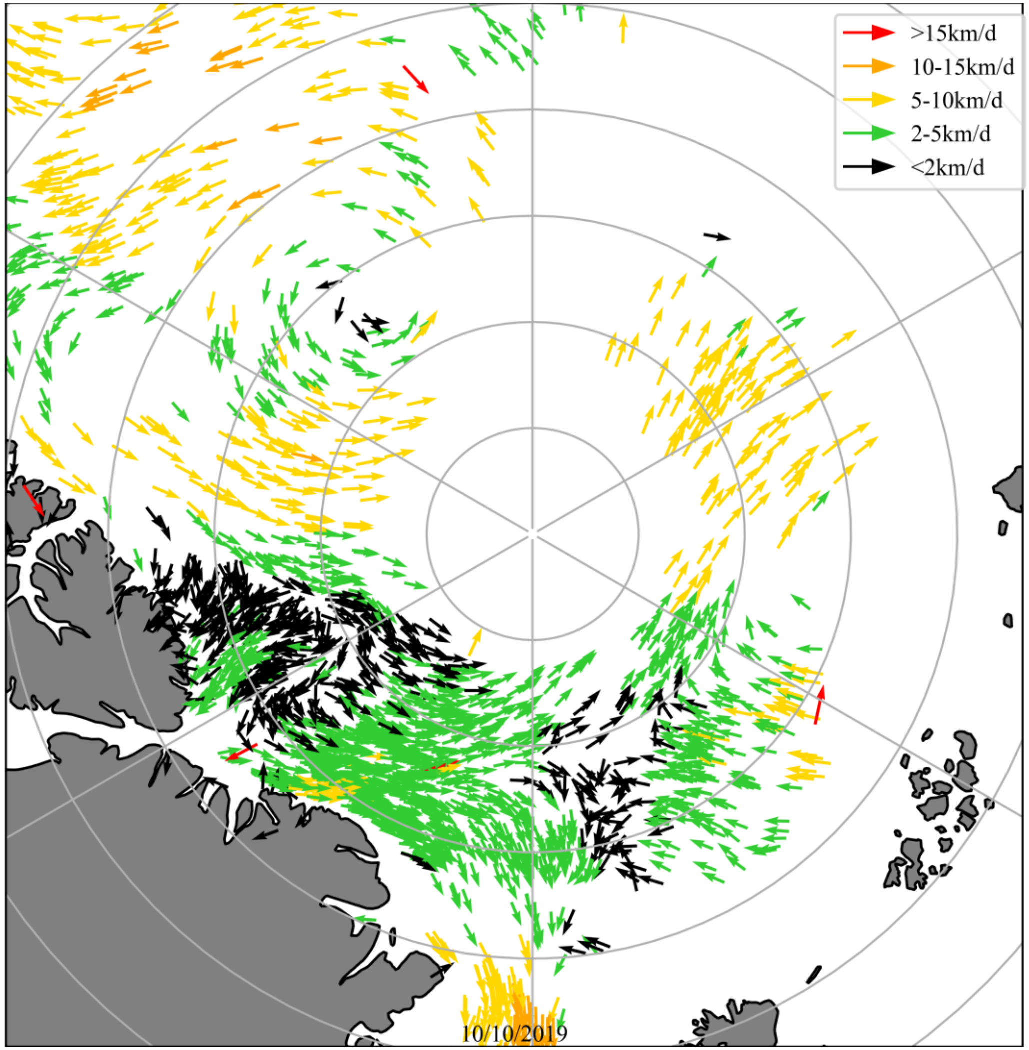
(e) (f) (g) (h)

Sea ice motion detection using S1 feature tracking



A working flow of derive sea ice motion vector with Sentinel-1 Imagery

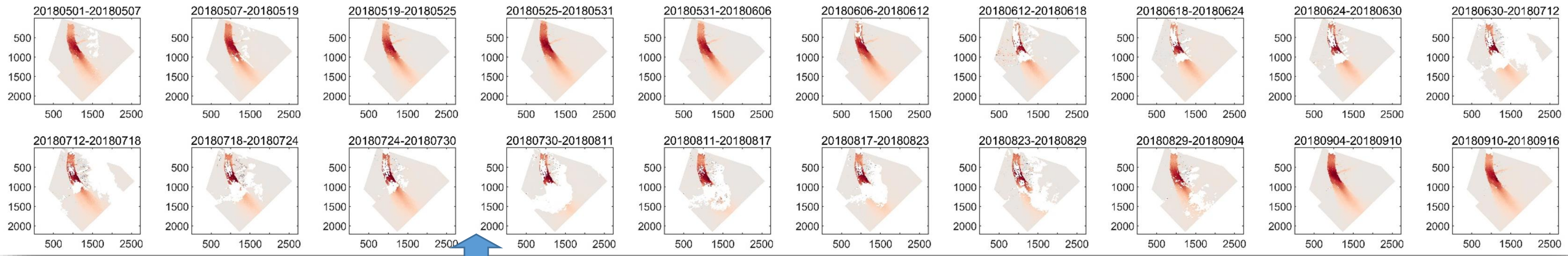




Daily sea ice motion derived by Sentinel-1 in Oct,2019

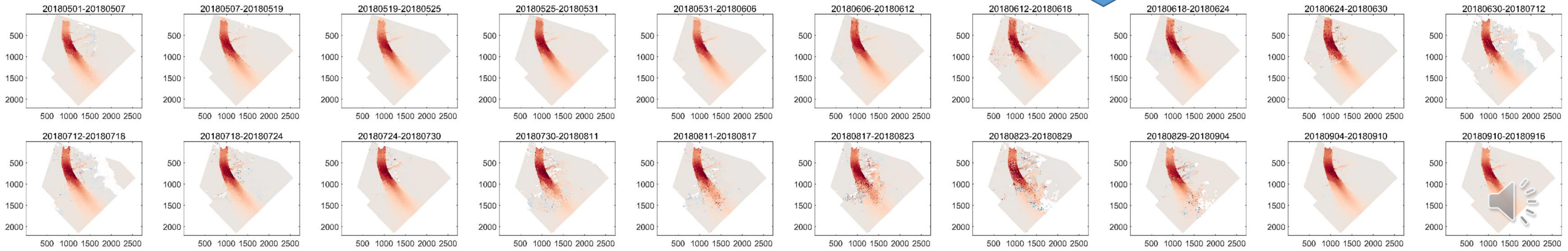
Glacier motion detected combined by S1 & S2

- Almost all glaciers velocity products for GrIS is produced by SAR images, but it still suffered from decorrelation in summer.
- Combining S1 and S2 to derived glacier velocity with a method based on connected component and least square adjustment.
- All S1 images with 6-day interval and cloud-free S2 images in summer.



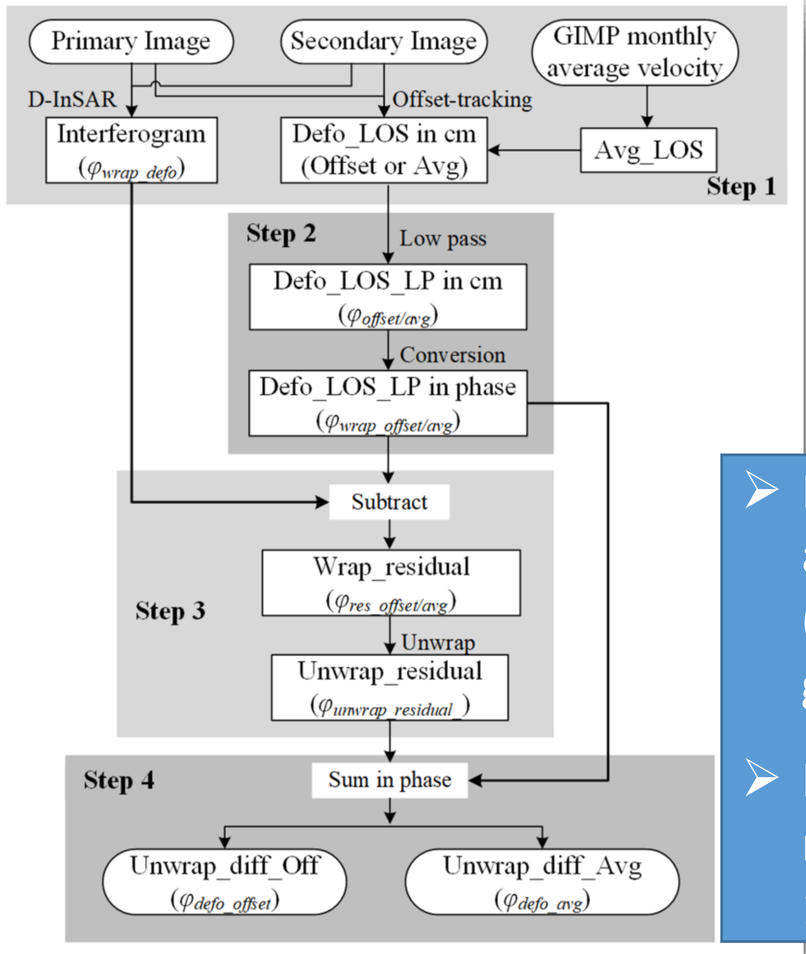
Petermann glacier’s velocity only by S1

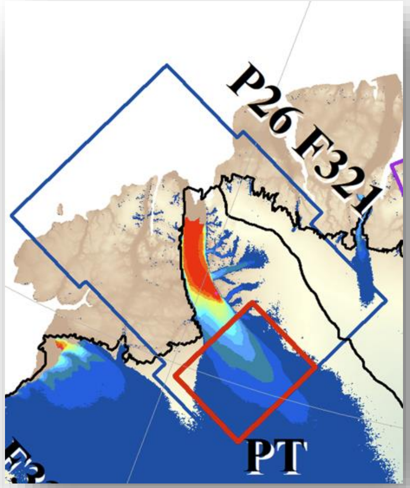
Petermann glacier’s velocity by S1 & S2



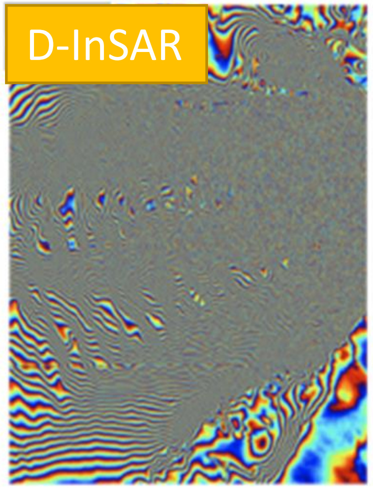
Offset-tracking assisted phase unwrapping for the Sentinel-1 observes the GrIS

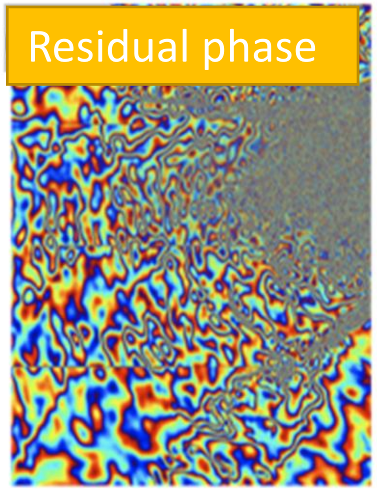
1, Despite the good coherence of 6/12 days interferograms of S1 on Glaciers at polar area, large phase gradient prevent its application due to the difficulty in phase unwrapping.
2, We combined offset-tracking technique to D-InSAR and unwrap the residual phase of deformation, which extend the area that with larger flow rates.





Petermann glacier at northern GrIS

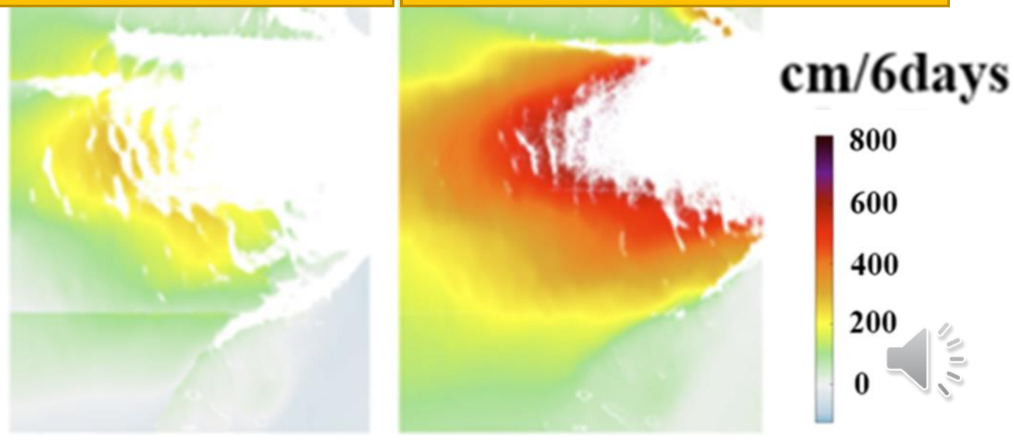




- Differential operates to D-InSAR and offset-tracking deformation (slant range) reduced the phase gradient.
- Maximum deformation can be monitored increases from 140cm to 360cm.

D-InSAR unwrap

Unwrap by our method



EO Data Delivery

Data access (list all missions and issues if any). NB. in the tables please insert cumulative figures (since July 2020) for no. of scenes of high bit rate data (e.g. S1 100 scenes). If data delivery is low bit rate by ftp, insert “ftp”

ESA Third Party Missions	No. Scenes
1.	
2.	
3.	
4.	
5.	
6.	
Total:	
Issues:	

ESA Third Party Missions	No. Scenes
1. Sentinel-1	>5000
2.Sentinel-2	>1000
3.	
4.	
5.	
6.	
Total:	>6000
Issues:	

Chinese EO data	No. Scenes
1.	
2.	
3.	
4.	
5.	
6.	
Total:	
Issues:	

Thank you!