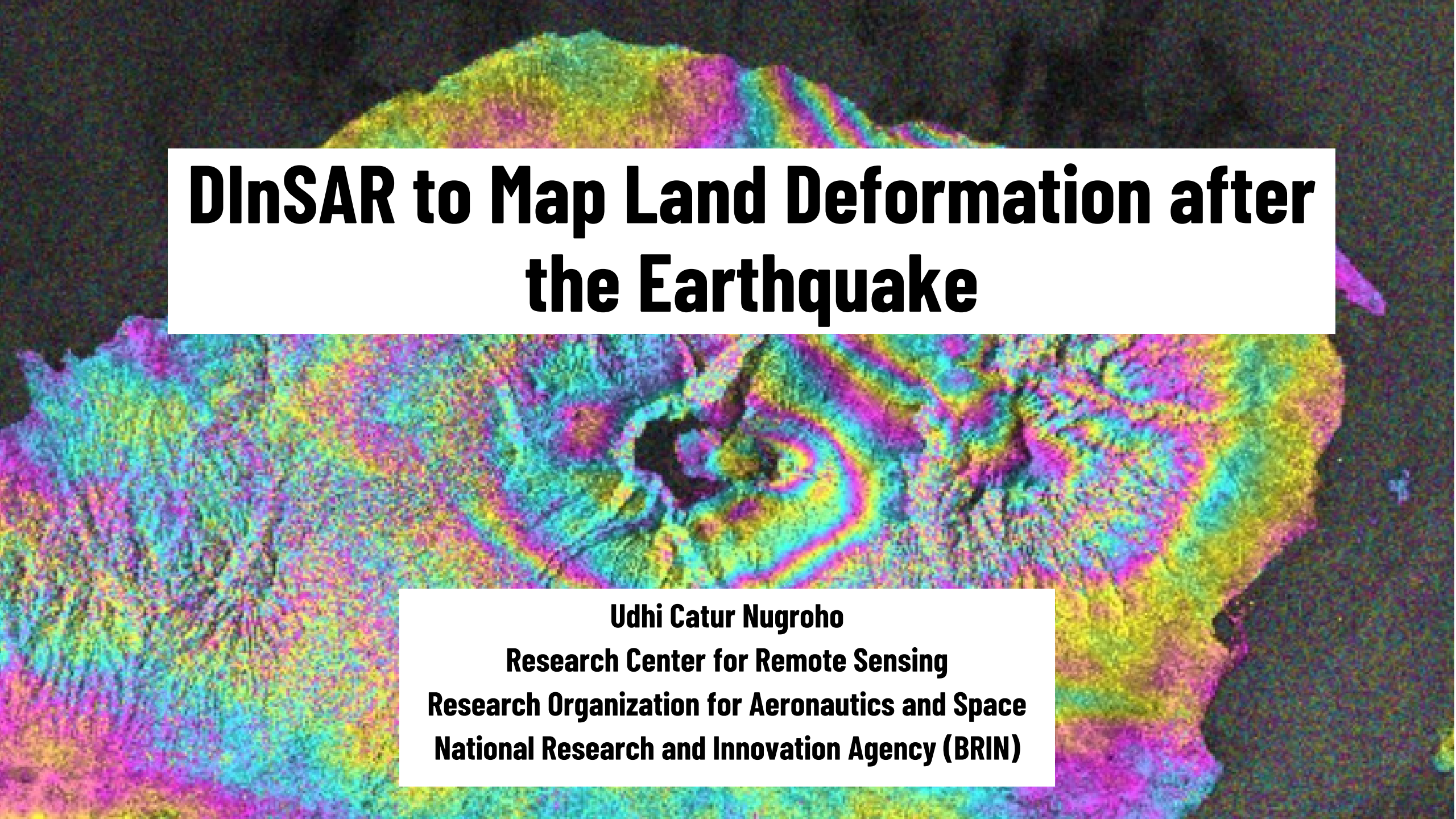

DInSAR to Map Land Deformation after the Earthquake

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Research Center for Remote Sensing
Research Organization for Aeronautics and Space
National Research and Innovation Agency (BRIN)

InSAR

Interferometry Synthetic Aperture Radar

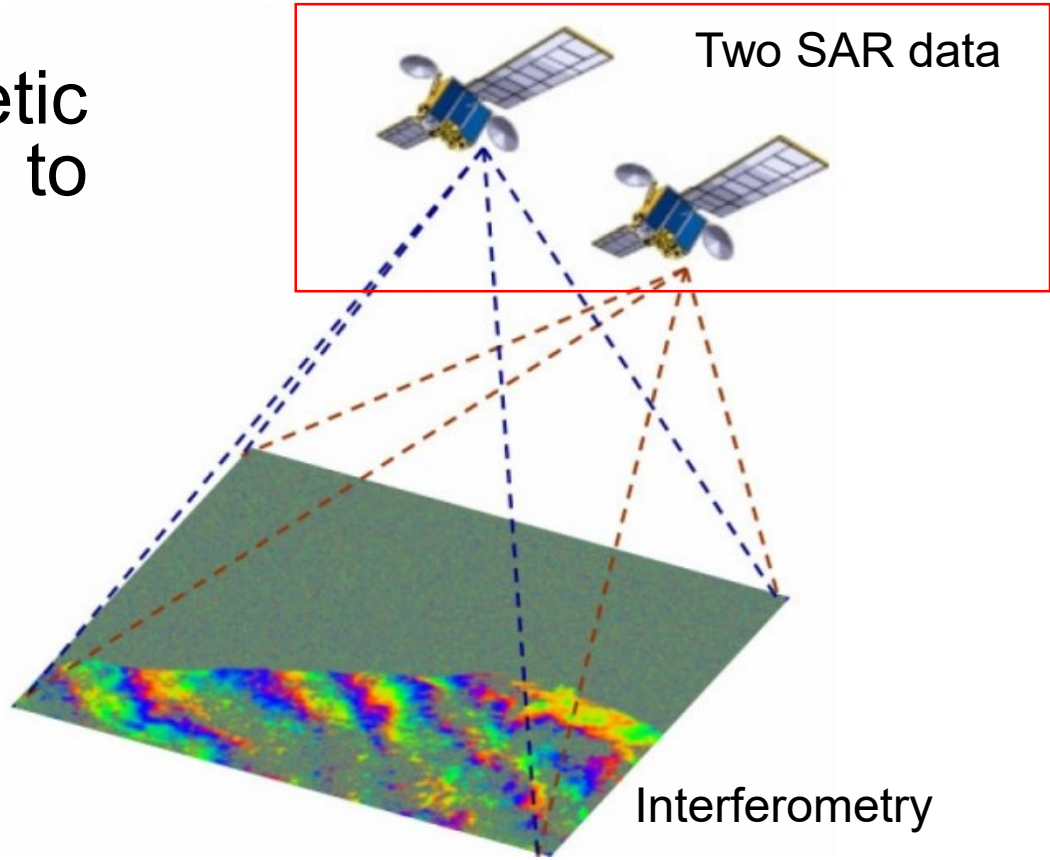
What Is Interferometry ?

- Is a technique in which electromagnetic waves are superimposed in order to extract information about waves.
- During InSAR process, minimum two SAR data are needed. It produce interferometry phase
- $\varphi_{intf} = \varphi_{flat} + \varphi_{topo} + \varphi_{def} + \varphi_{atm} + \varphi_{noice}$

$$-\frac{4\pi}{\lambda}\frac{B_n s}{R\tan\theta}$$

$$-\frac{\Delta q}{\sin\theta}\cdot\frac{B_n}{R_0}\cdot\frac{4\pi}{\lambda}$$

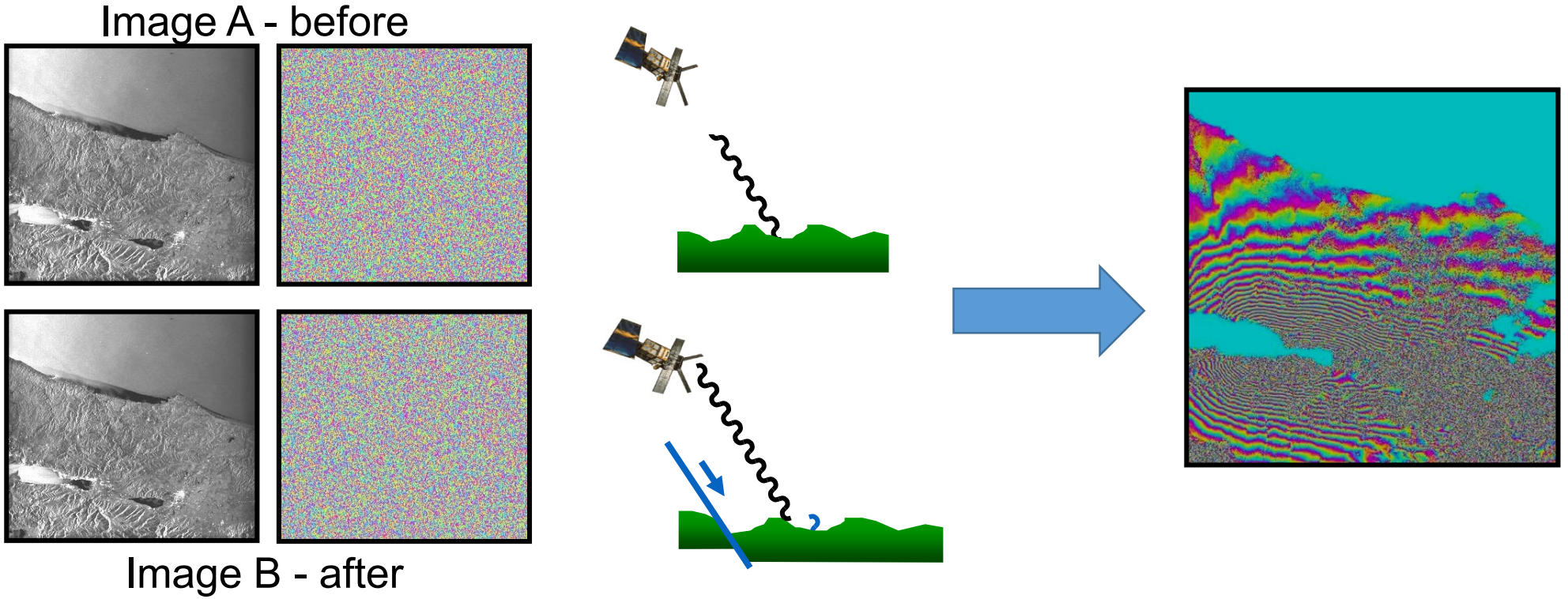
$$+\frac{4\pi}{\lambda}d$$



DInSAR

Differential Interferometry Synthetic Aperture Radar

- By comparing the difference of phase information between two SAR data that obtain at different observation date, the differential of wave interference can be measured.

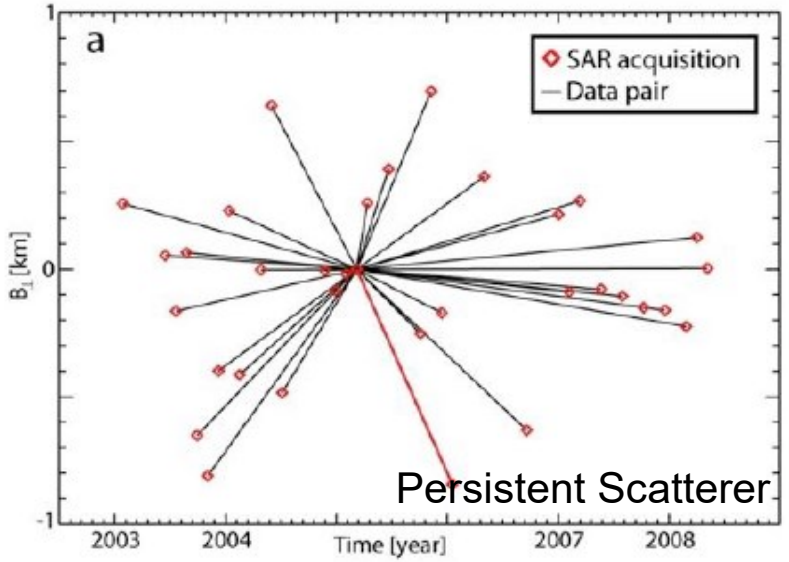


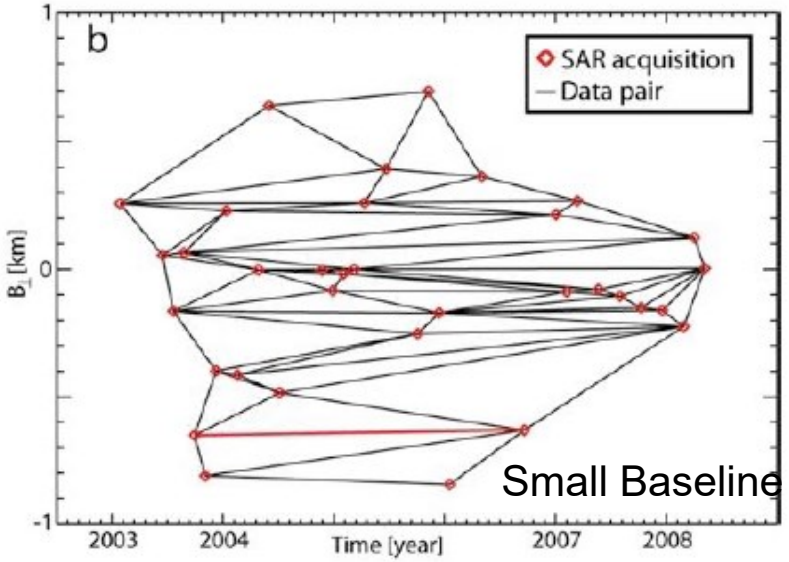
Methode of DInSAR

Conventional DInSAR

1 pair

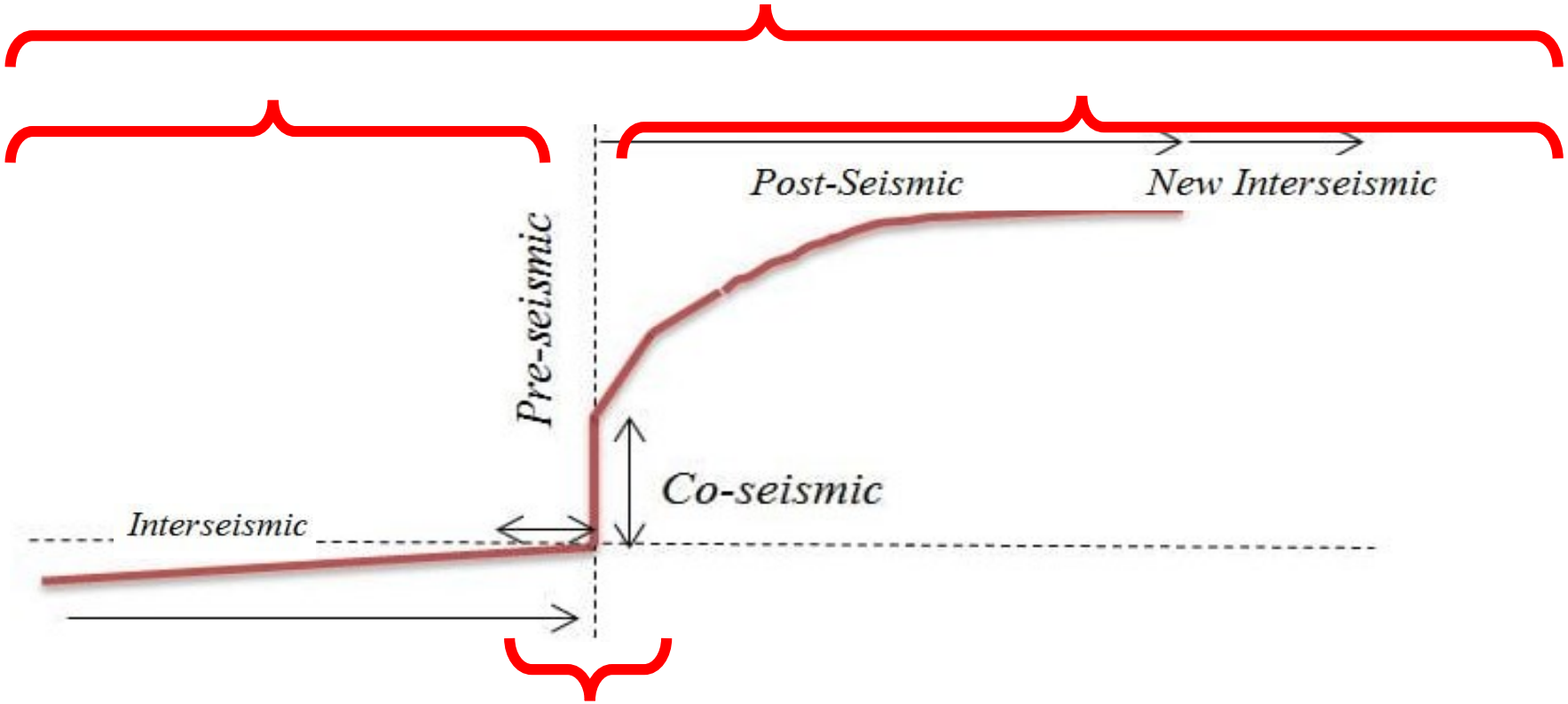
Timeseries DInsAR





Methode of DInSAR related to earthquake seismic cycle

Time Series DInSAR



Conv DInSAR

How to Process

Local Processing

SNAP

GMTSAR

GMTSAR

Cloud Processing

ASF Data Search Vertex

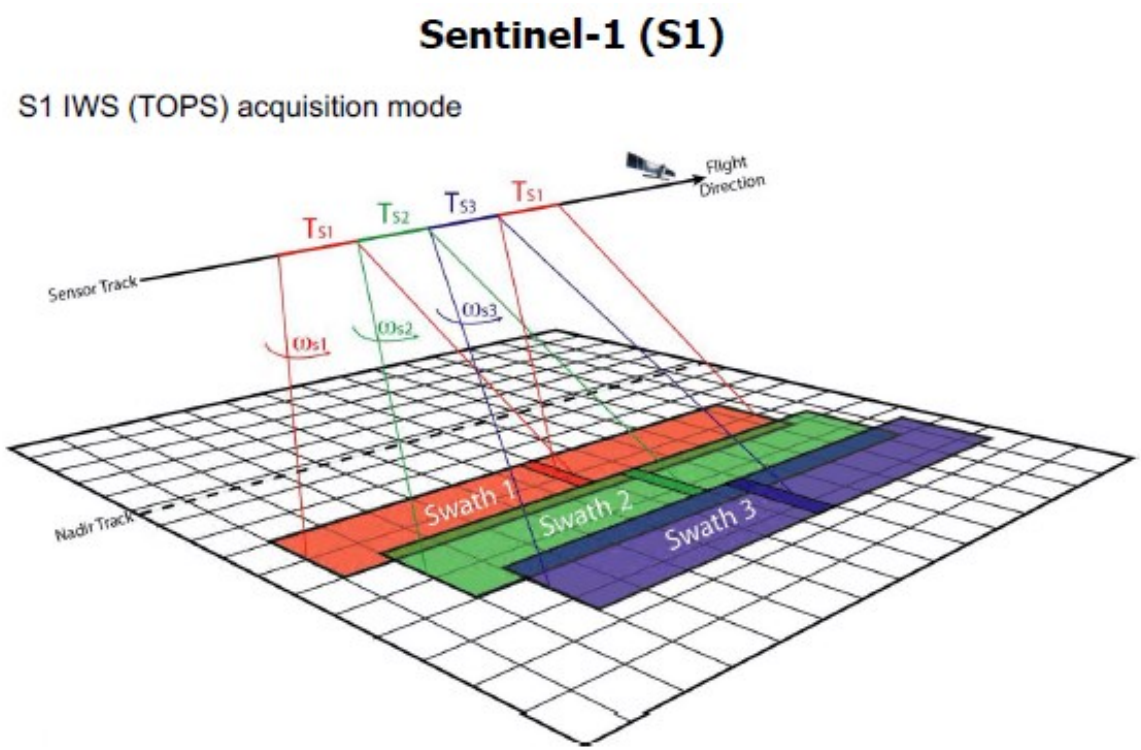
ASF platform

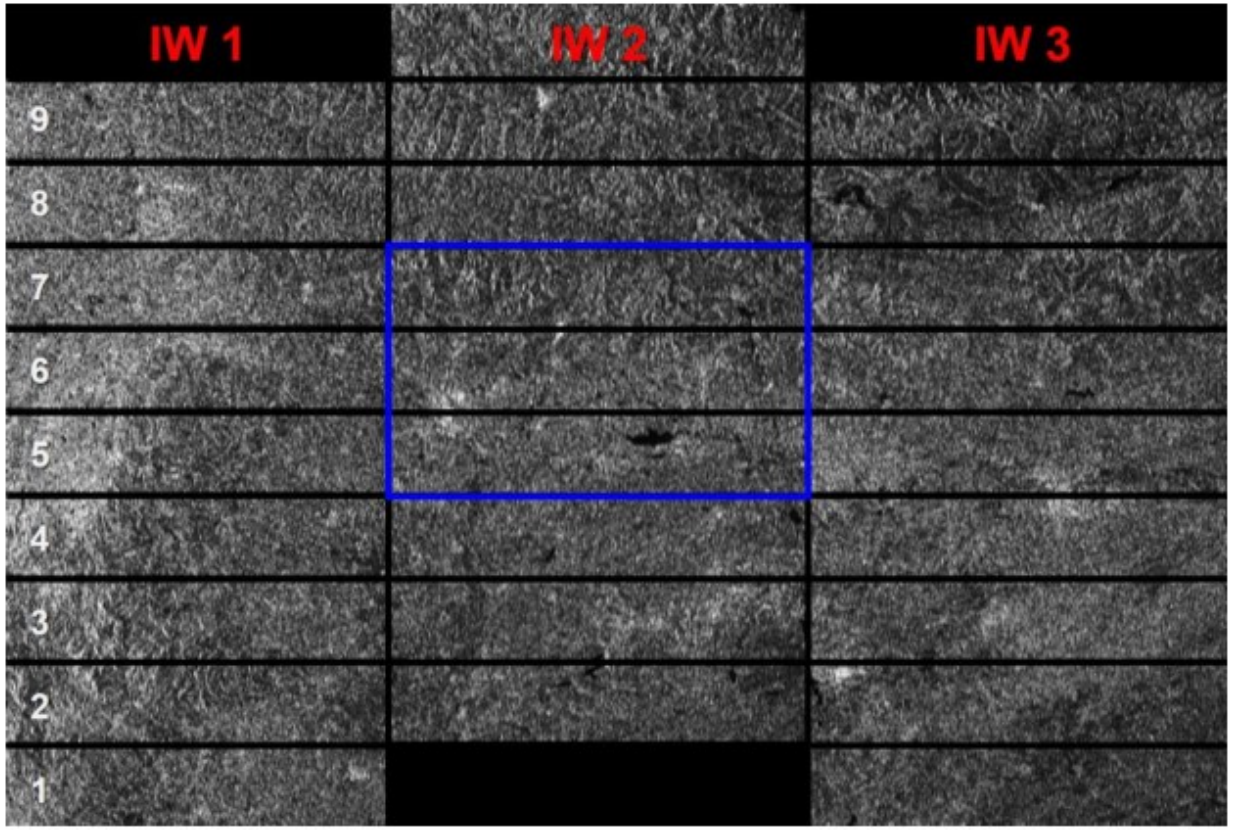
geohazards tep

Geohazards Exploitational Platform

Sentinel-1 Data

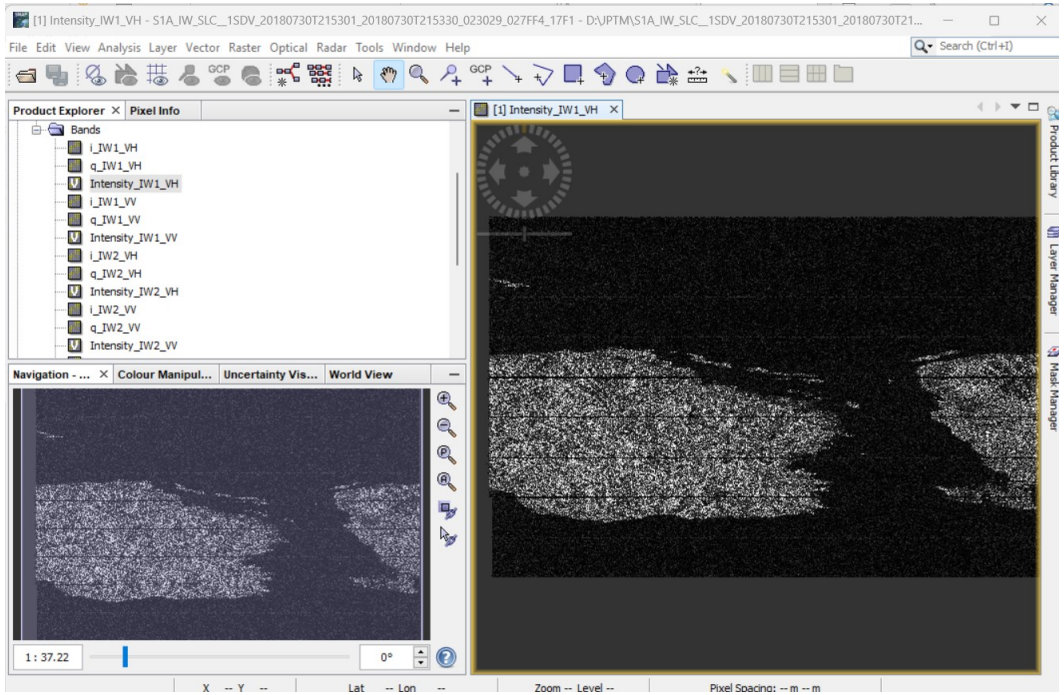
- Sentinel-1 Interferometric Wide (IW) Swath Product

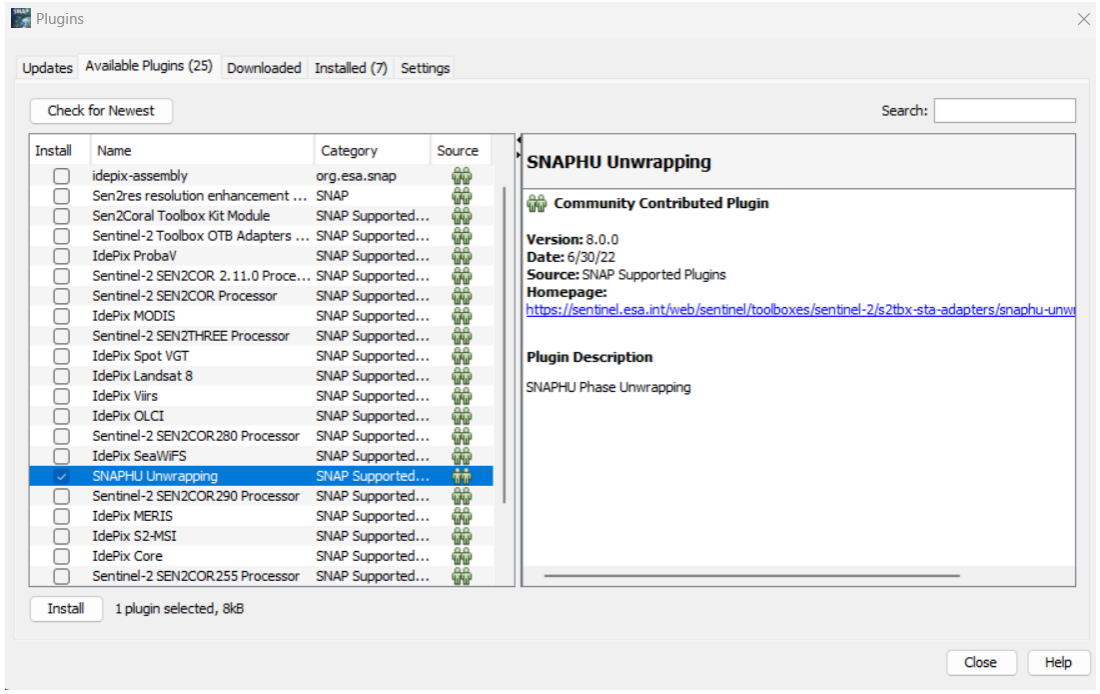




Preparation

1. Install SNAP (https://step.esa.int/main/download/snap-download/)
2. Install SNAPHU plugin
3. Download the Data (https://scihub.copernicus.eu/dhus/#/home)



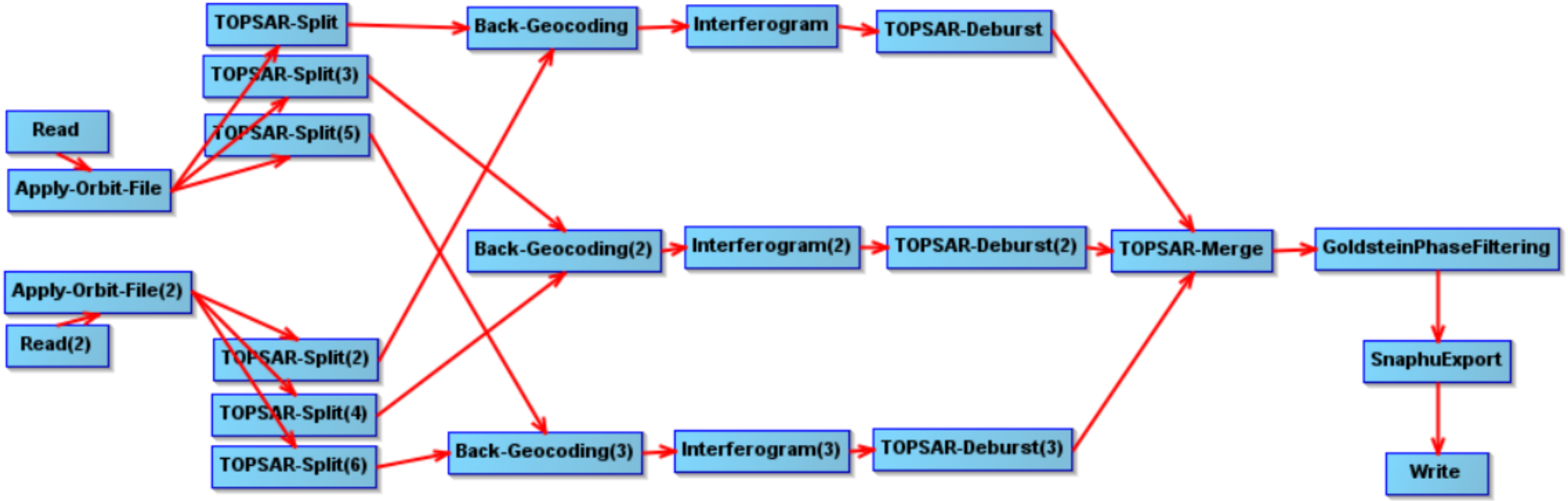


Processing DInSAR

1. Inteferometry (SNAP)
2. Unwrapping Interferogram (SNAPHU)
3. Unwrapped phase to Dissplacement (SNAP)

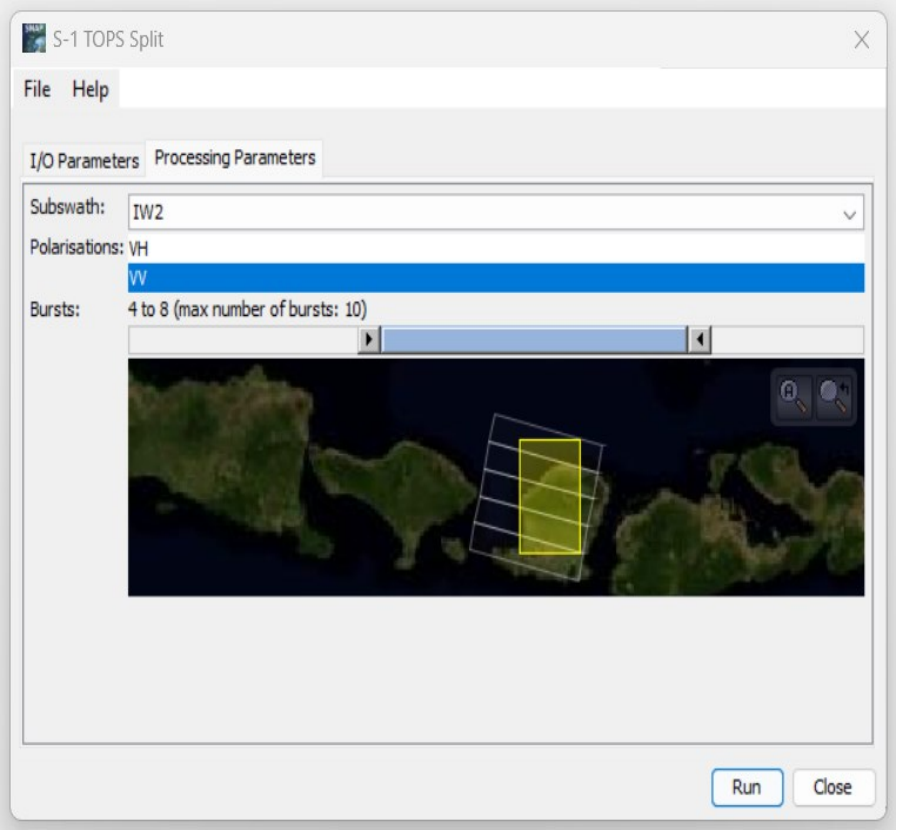
Processing DInSAR

- Interferometry (SNAP)

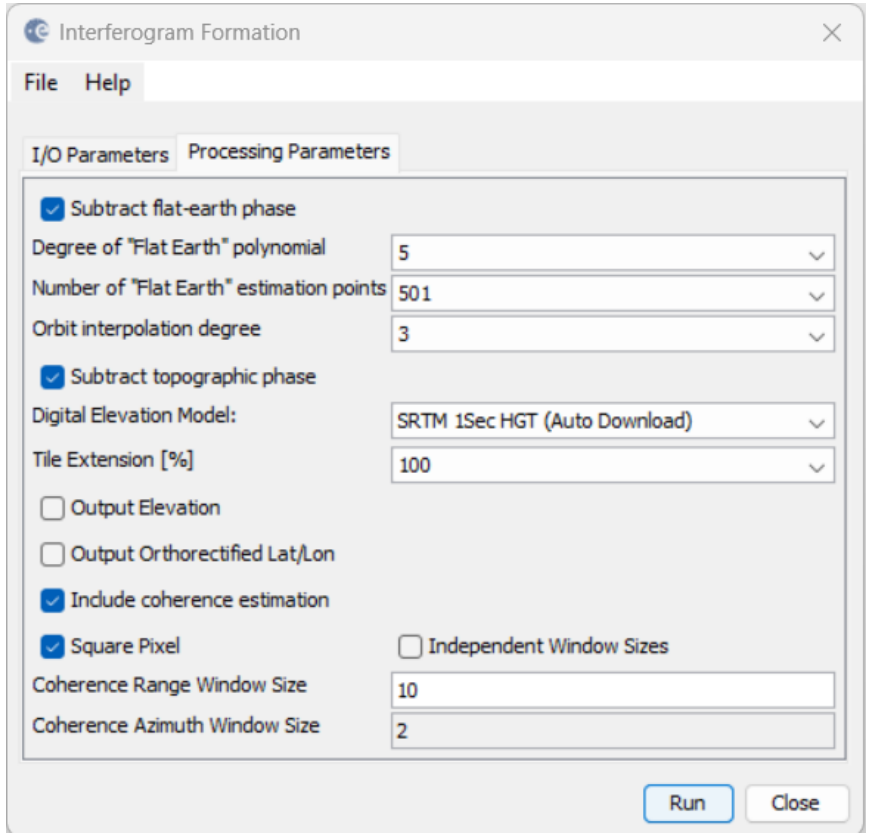


Produce wrapped Interferogram

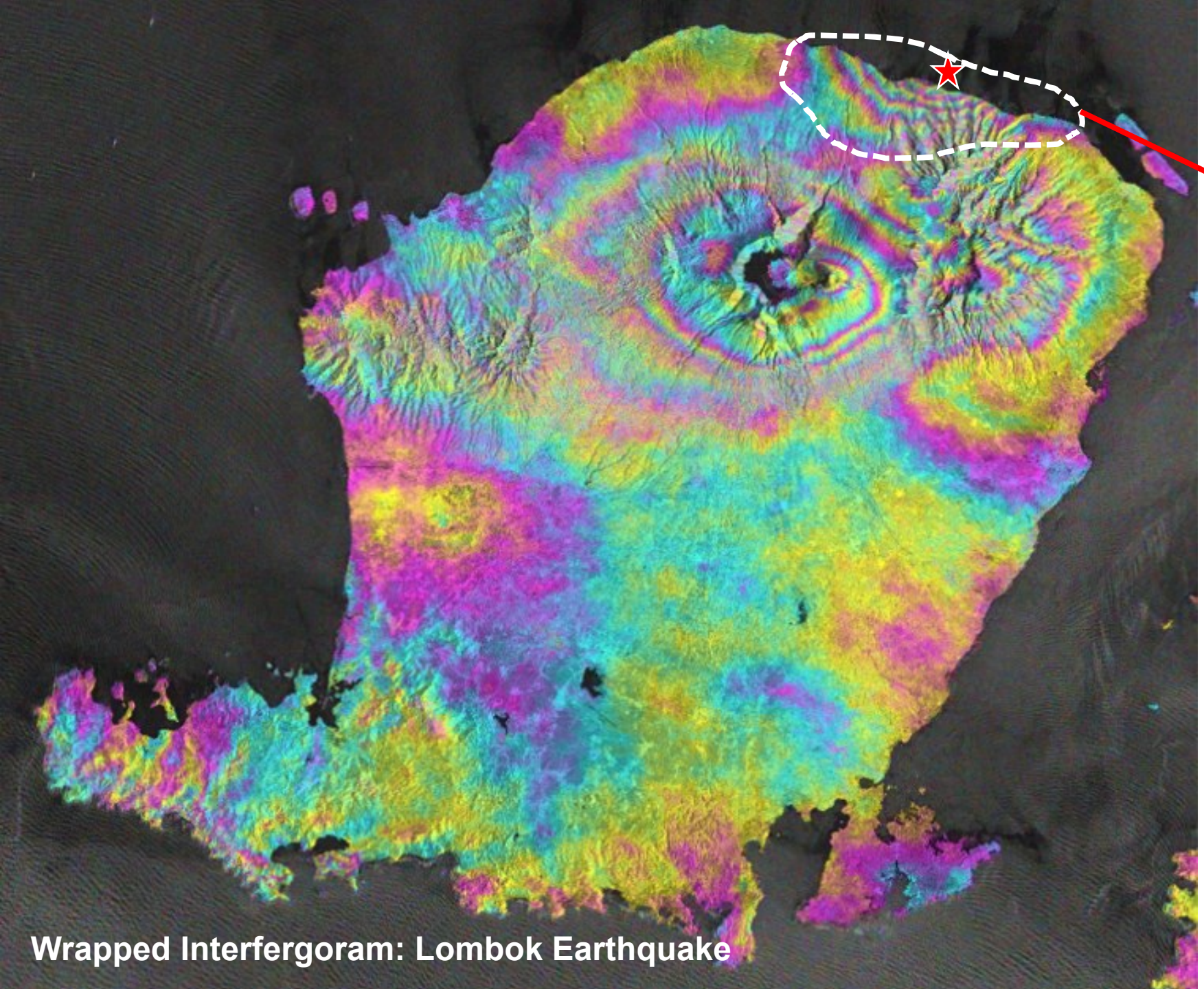
Some Important part



- Select subswatth and brust. Each subswath pair is processed separately. If use 1 pair subswath, it doesn't need TOPSAR merge



- Check substract flat-earth phase and topographic phase



Wrapped Interfergoram: Lombok Earthquake

Fringe : Repeating color patterns represent phase repetition

★ Earthquake : July 29th 2018

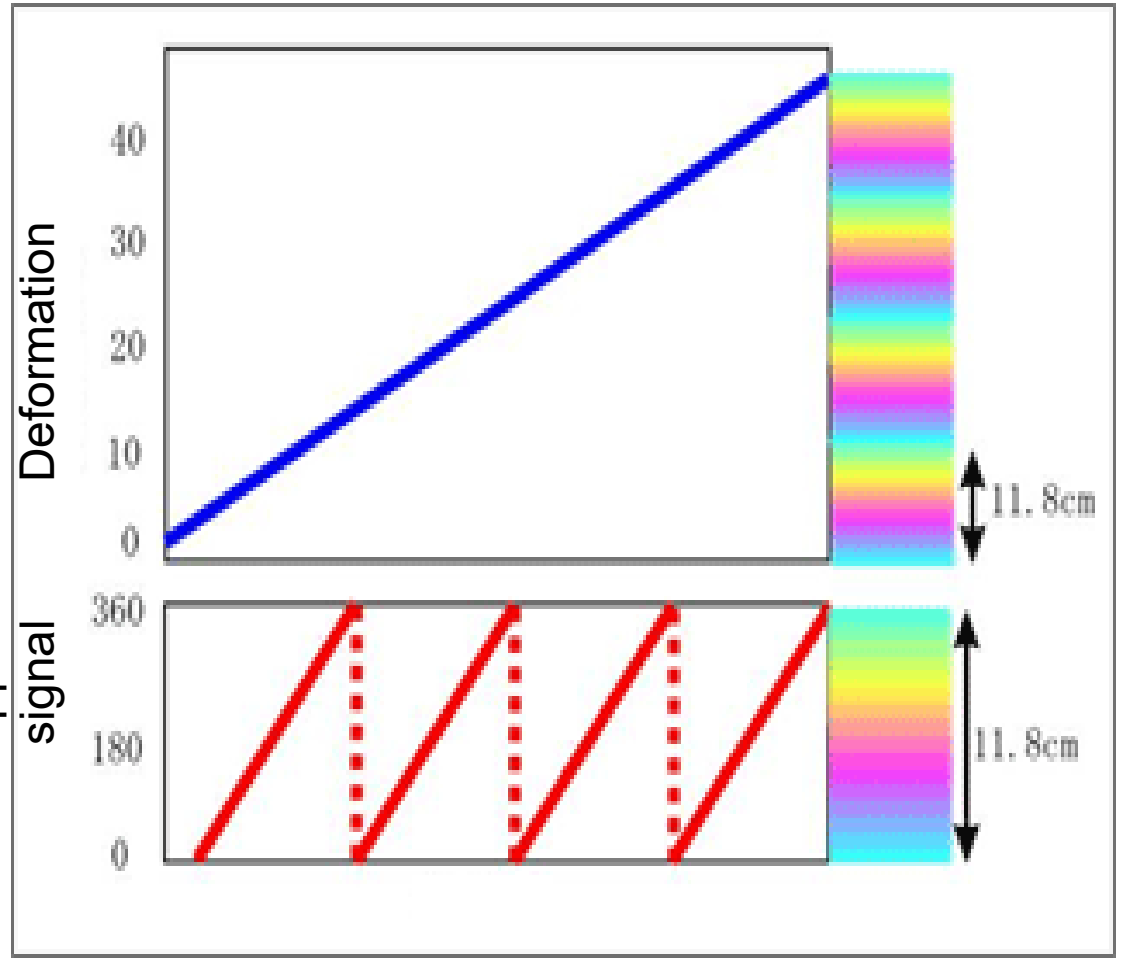
Pair :

July 25th 2018 – July 31th 2018

Descending direction

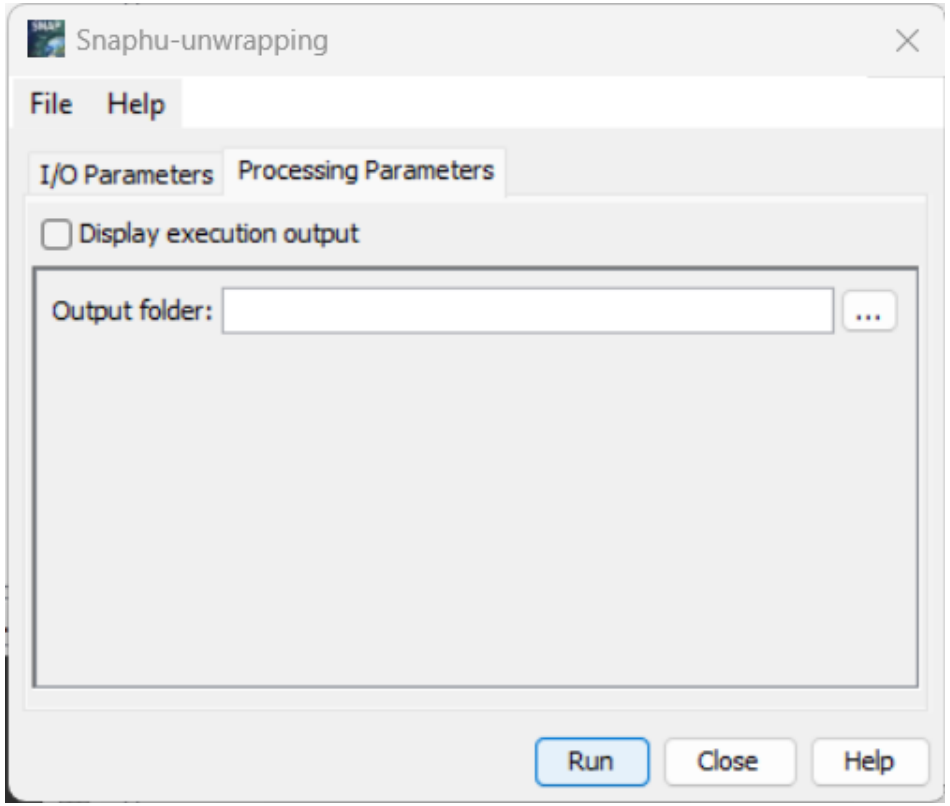
Why wrapped inteferogram need to unwrap

- InSAR doesn't produce absolute distance
- one cycle pattern = half of the wavelength
- If the deformation bigger than half of the wavelength, the cycle will repeated and creating wrapped deformation cycle. Usually the cycle displayed in color.

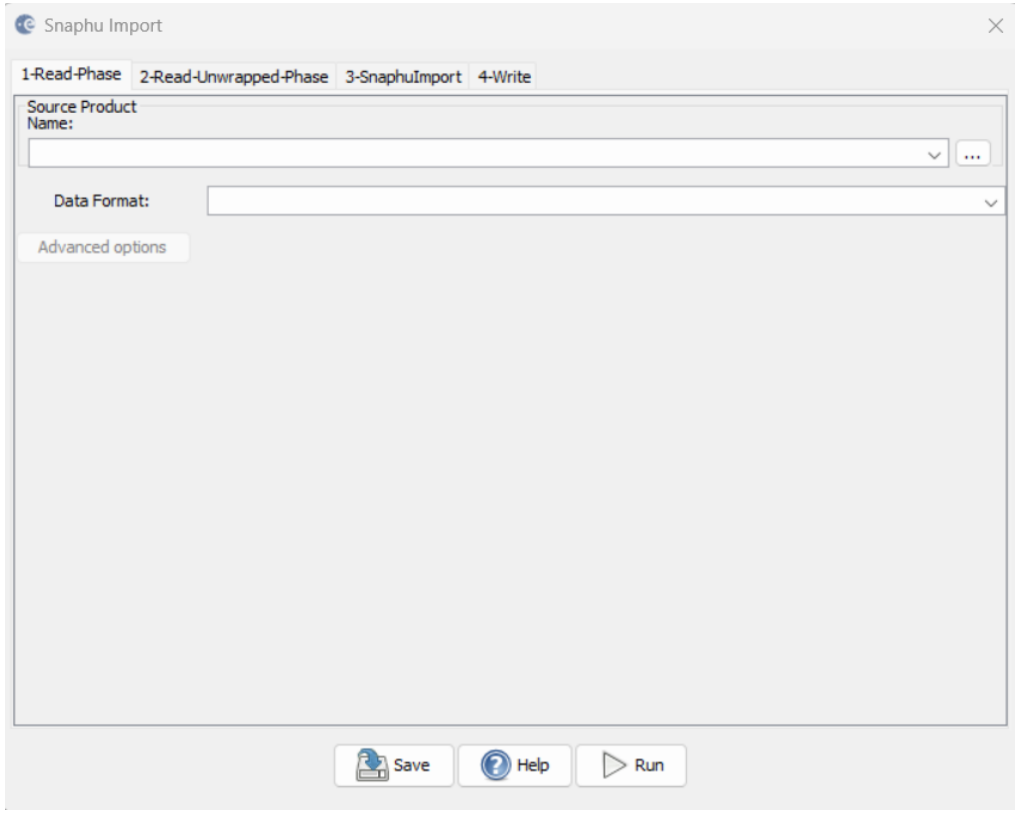


Processing DInSAR

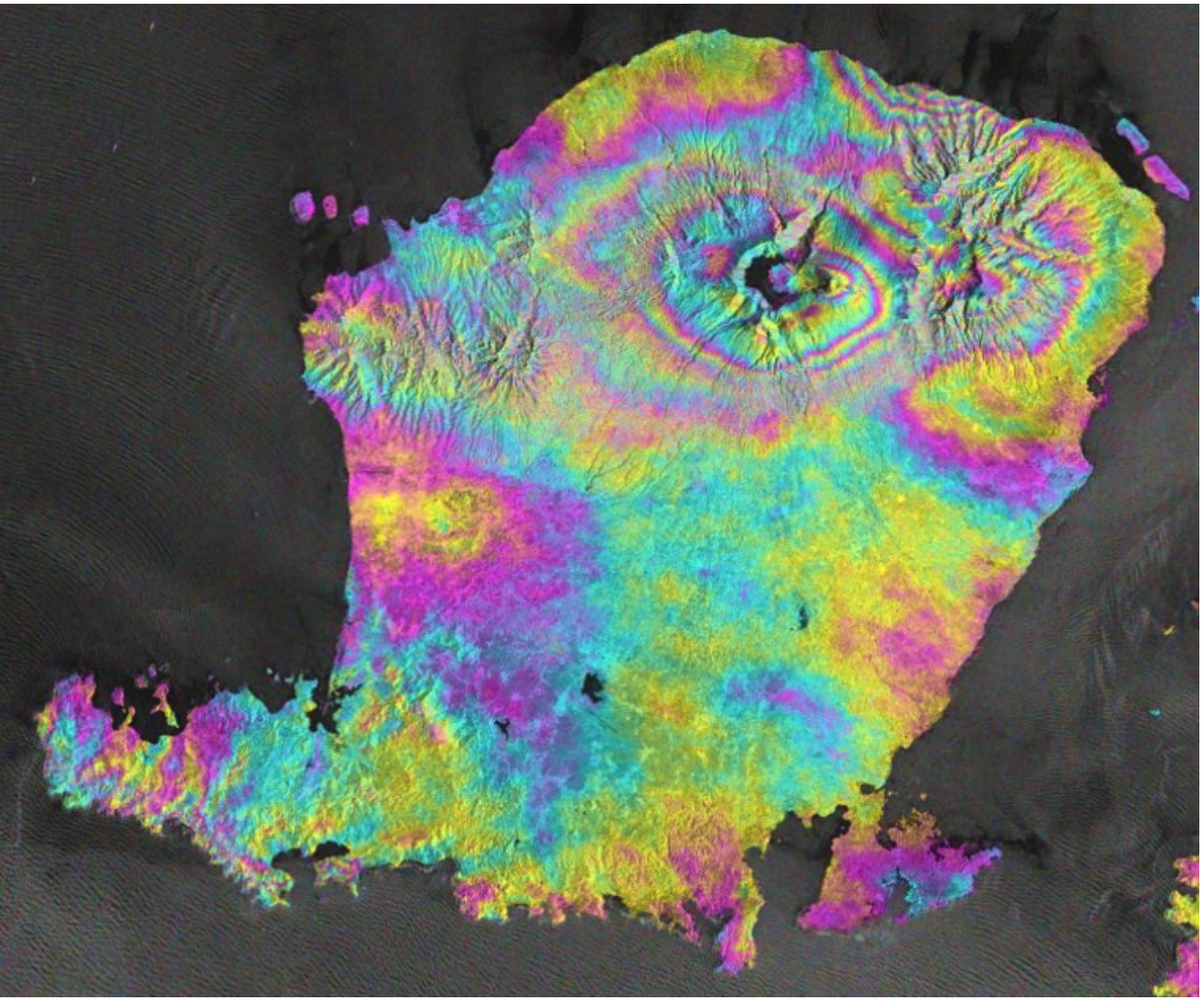
Unwrapping interferogram (SNAPHU tool)



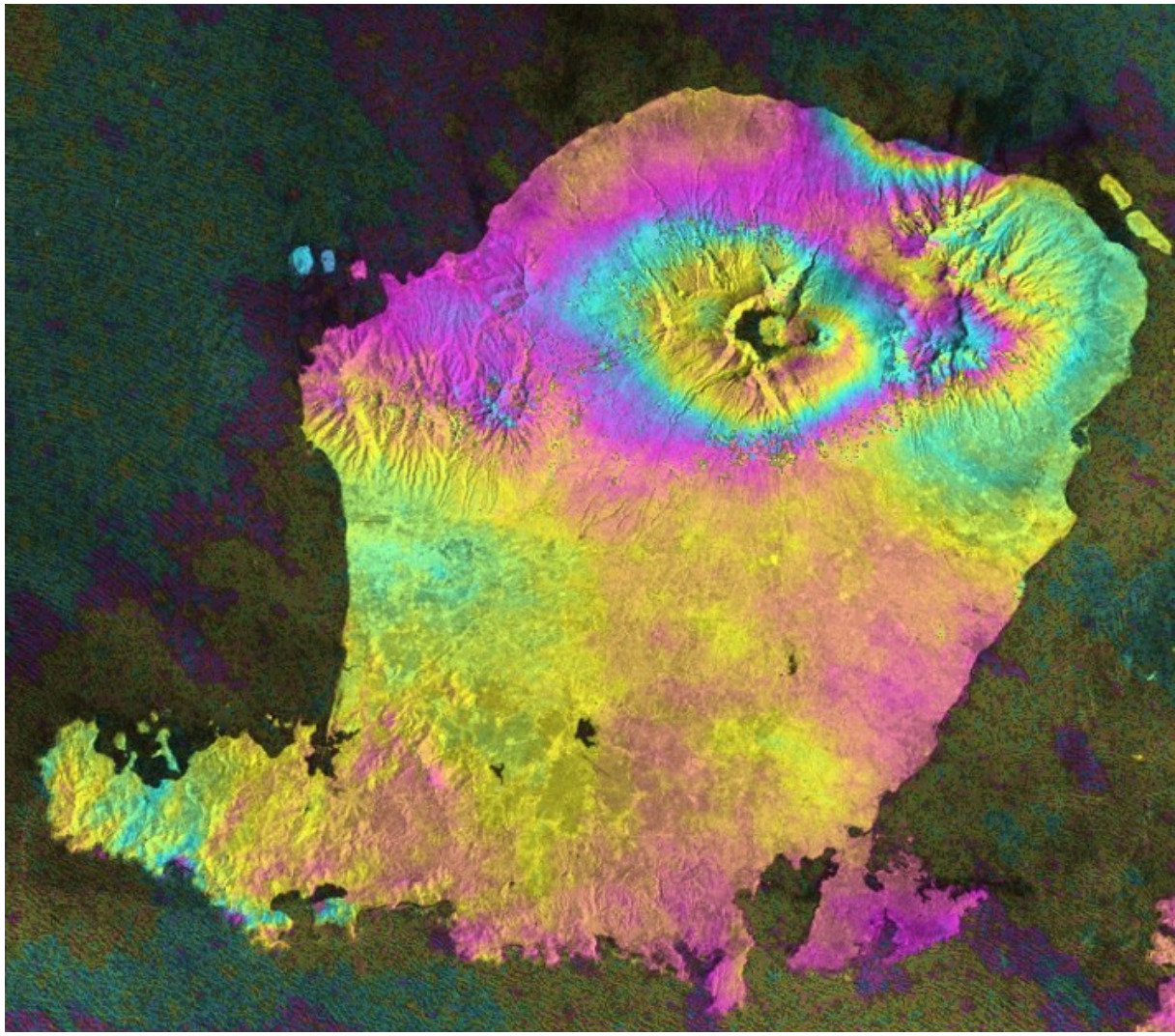
Unwrapping process on SNAPHU



Import unwrapped interferogram to SNAP



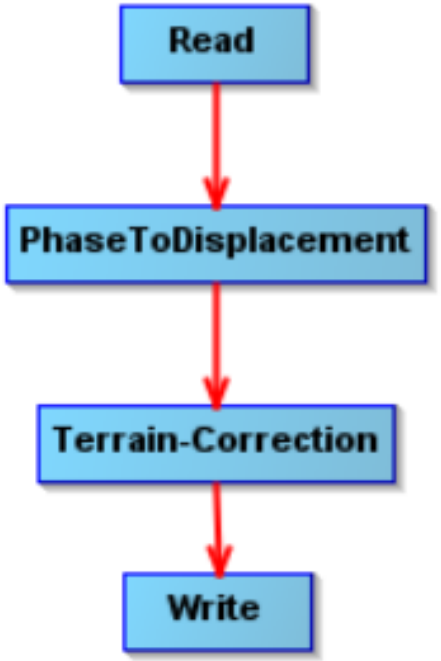
Wrapped Interferogram

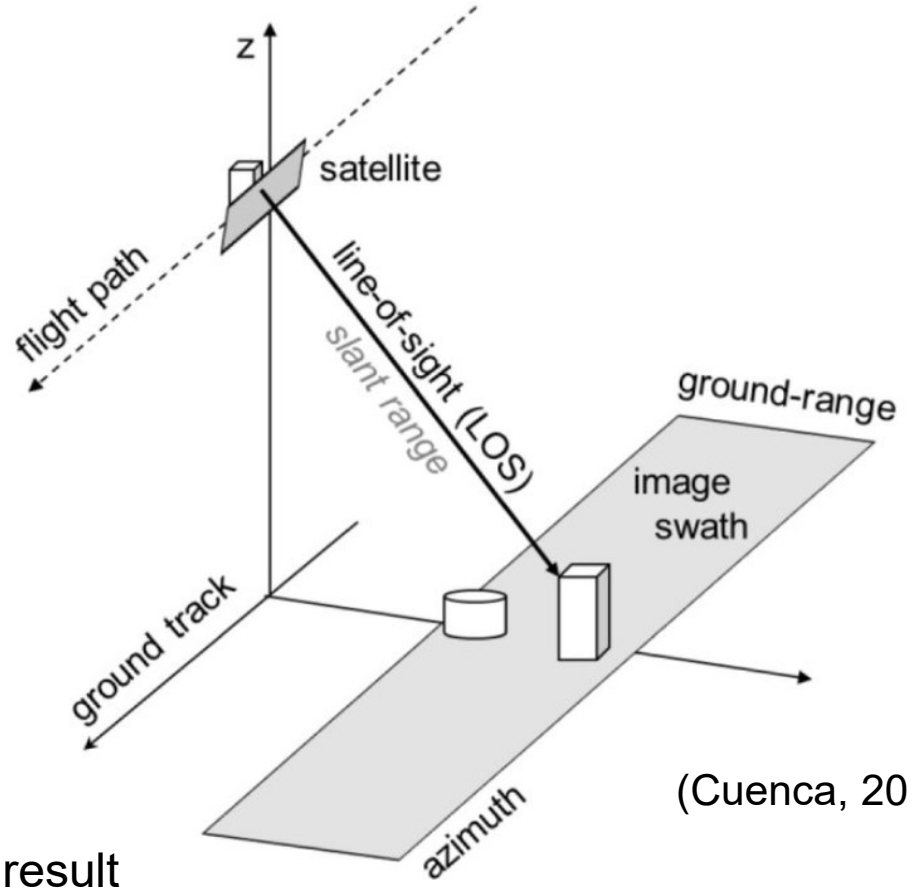


Unwrapped Interferogram

Processing DInSAR

- Phase to Dissplacement / Deformation





$$dv = \frac{d_{Los}}{Cos\ \theta}$$

(Cuenca, 2013)

Produce LoS deformation

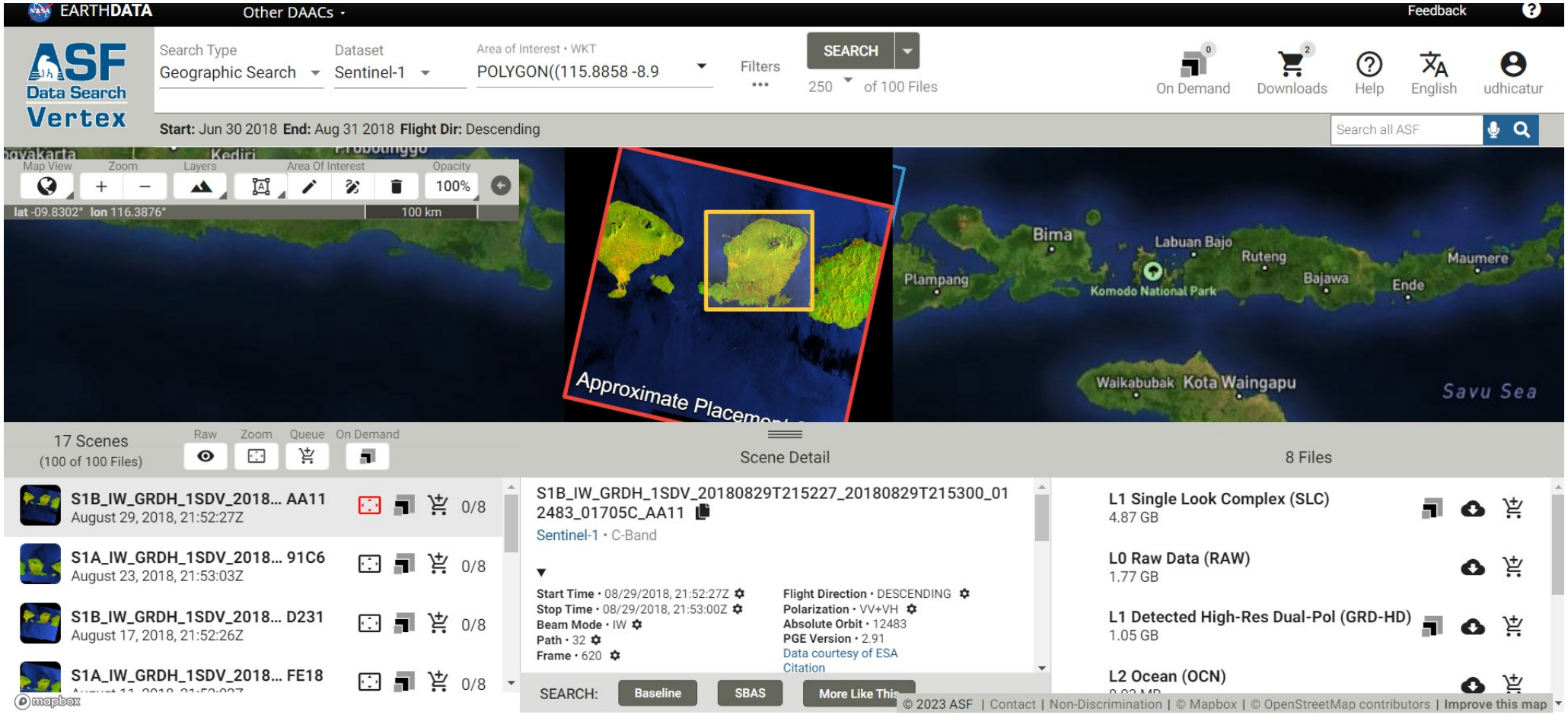
Need to coherence masking to mask out bad result

DInSAR Cloud Processing

- It doesn’t need download the data
- Doesn’t need high spec workstation
- Faster than local processing (depend on workstation)
- Free platfrom (Alaska Satellite Facility (ASF) Vertex)
- Paid platform (Geohazard Exploitational Platform)

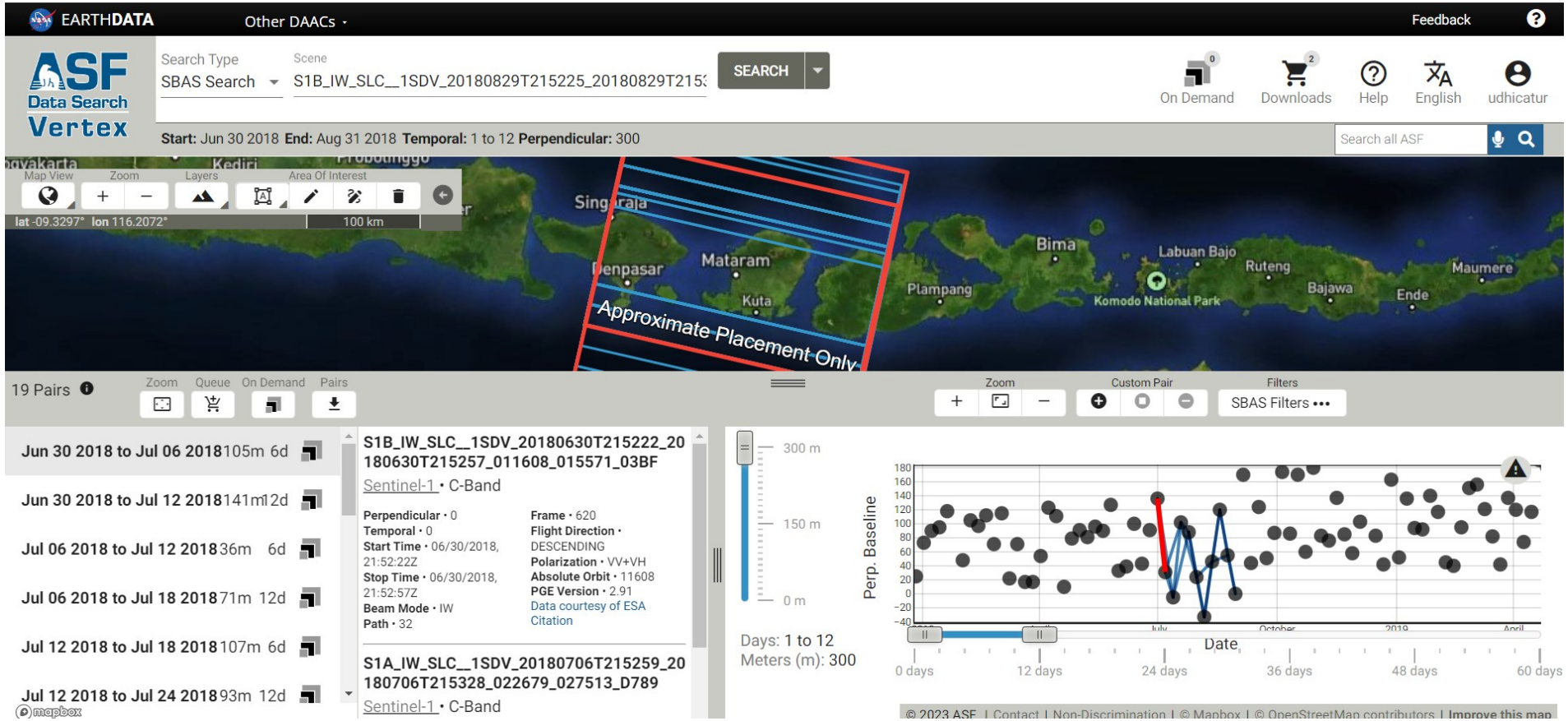
ASF Vertex

- Searching - Filtering



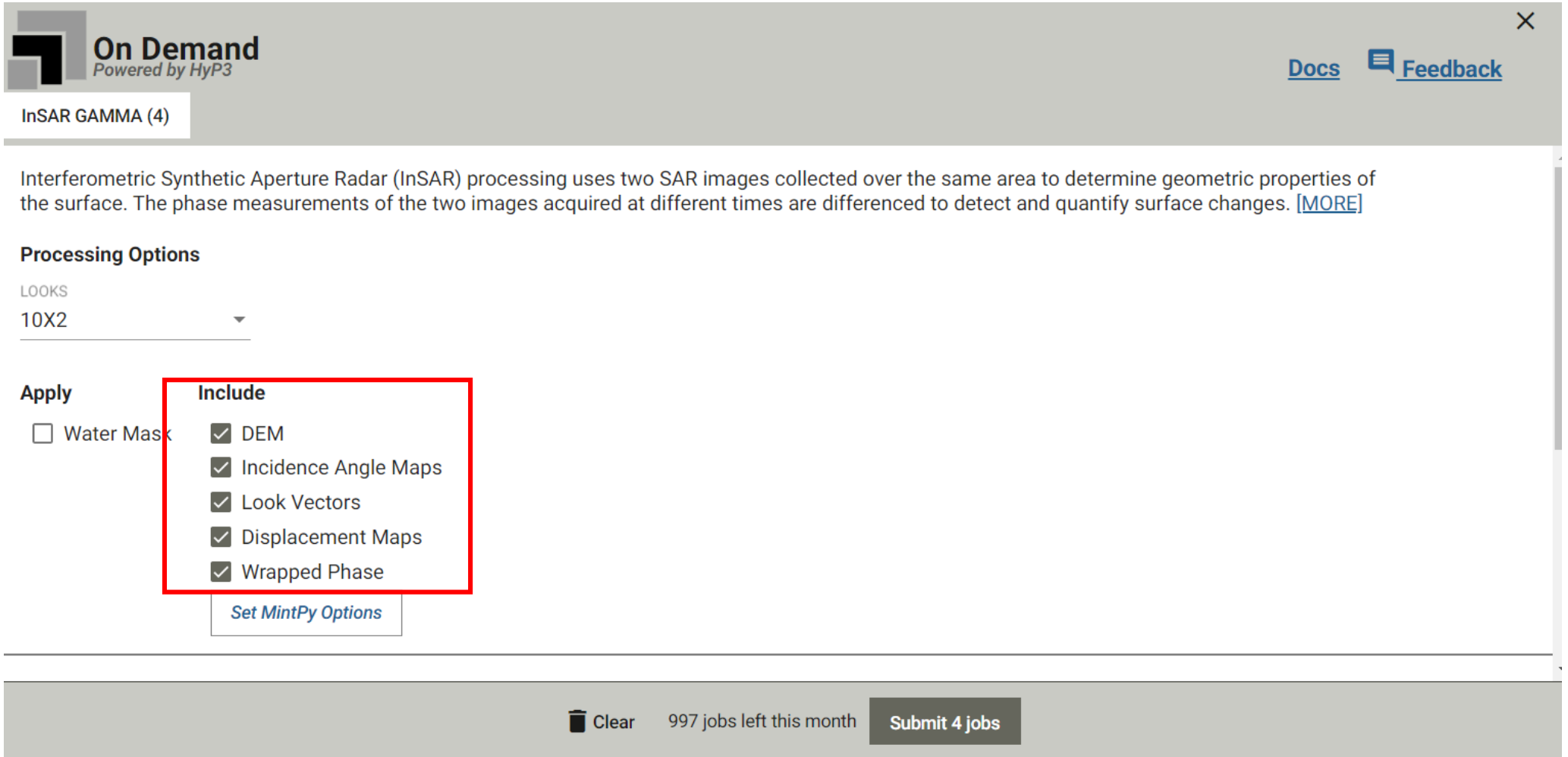
ASF Vertex

- Pair selection base on event date and/or baseline. Posible more than 1 pair



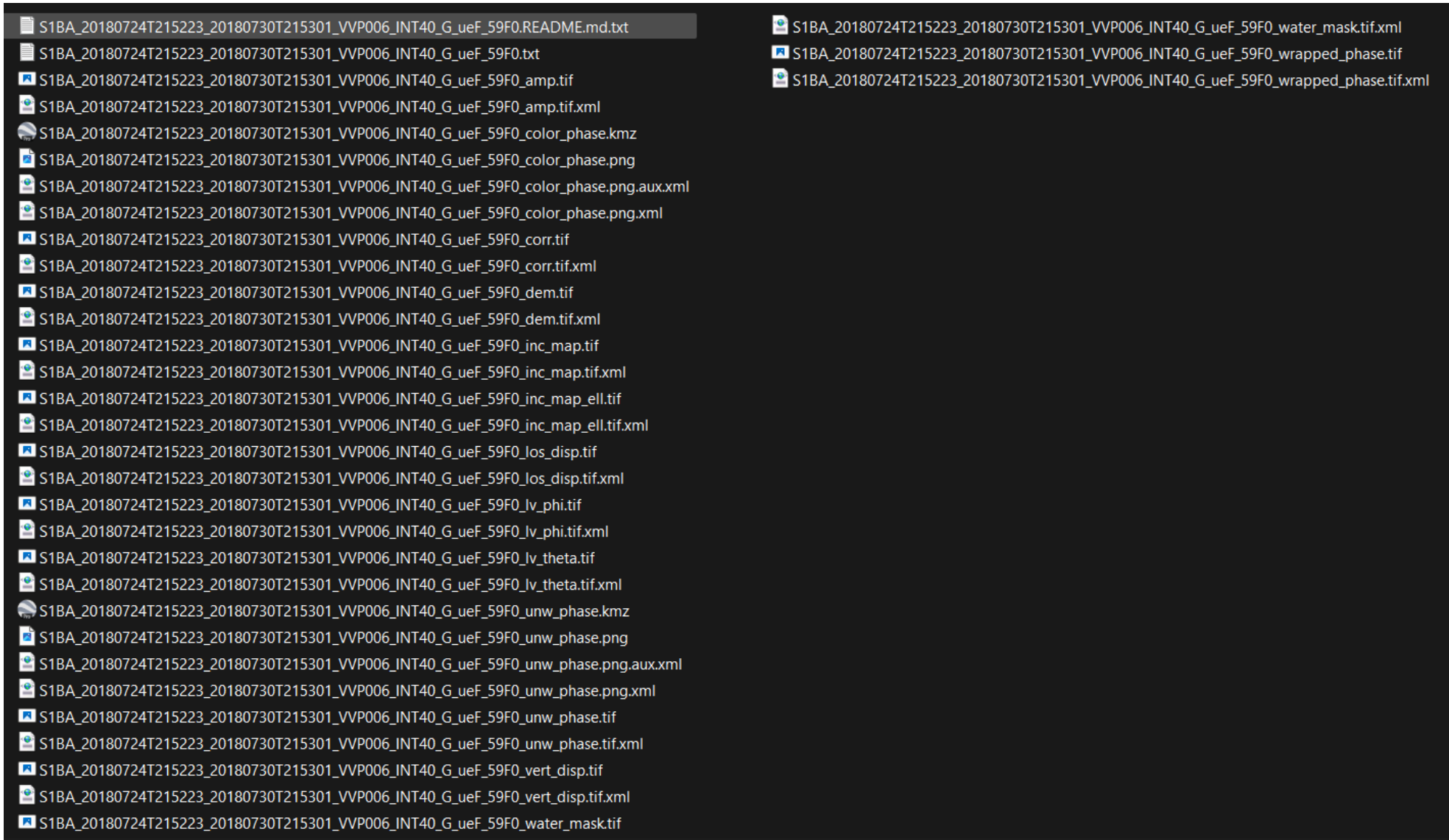
ASF Vertex

- InSAR on demand batch processing.



ASF Vertex

- List of result



THANK YOU