Correcting InSAR ALOS data using the atmospheric delay estimated by GPS signals to constrain the surface deformation in the Longitudinal Valley of the Taiwan Island.

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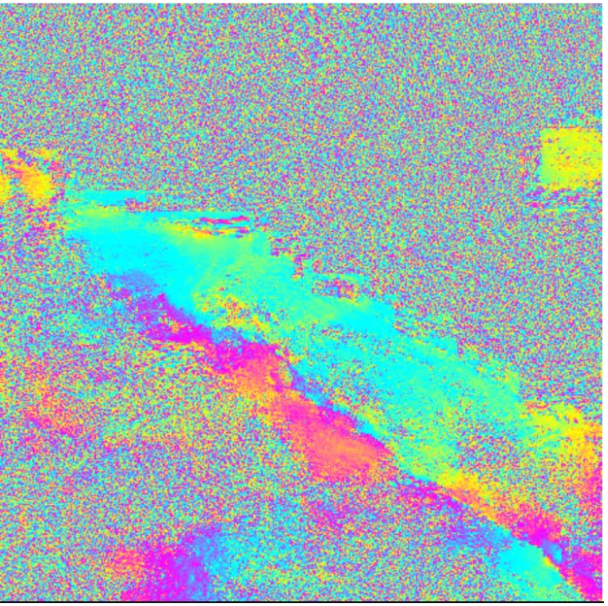
NSBAS Interferograms

We processing 14 radar images that exist during the 2007-2010 period by using NSBAS (New Small temporal and spatial BASelines) chain NSBAS image

070616_100624



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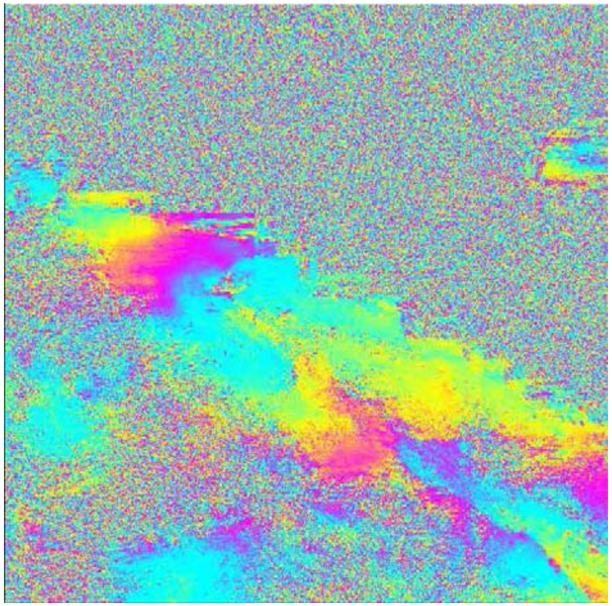

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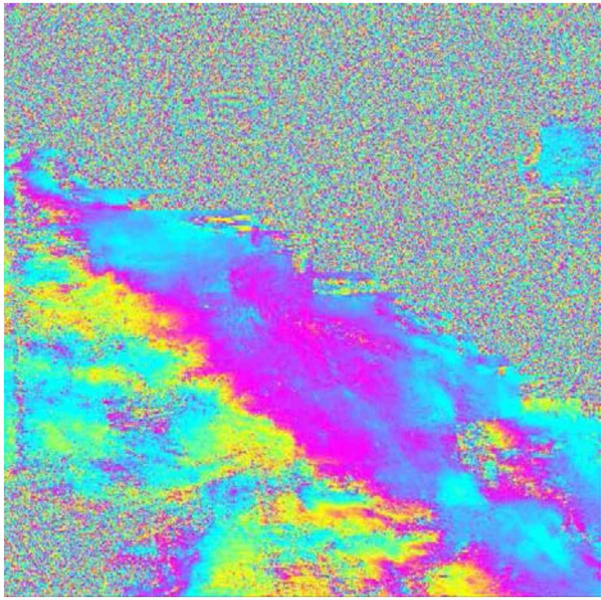
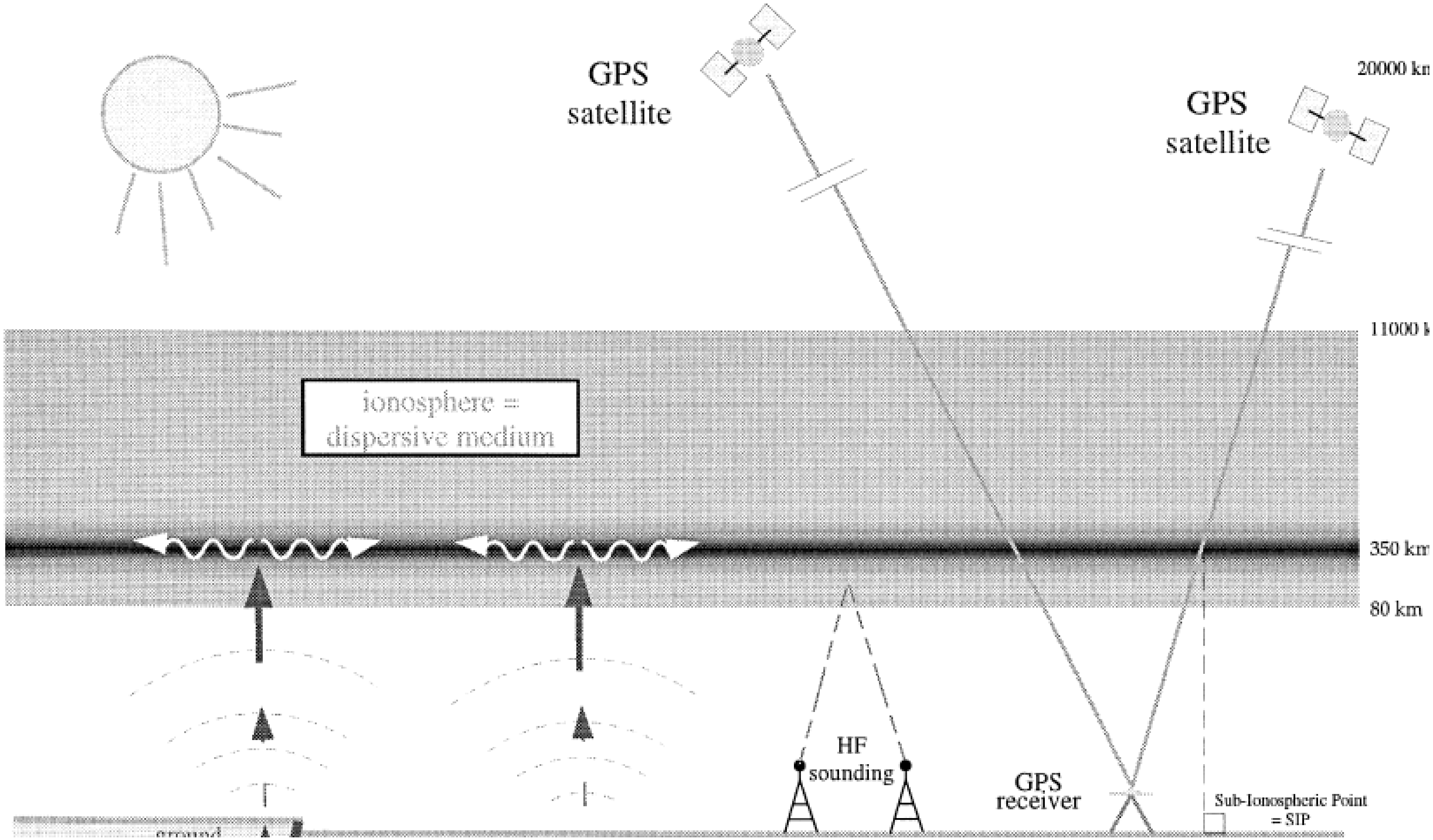
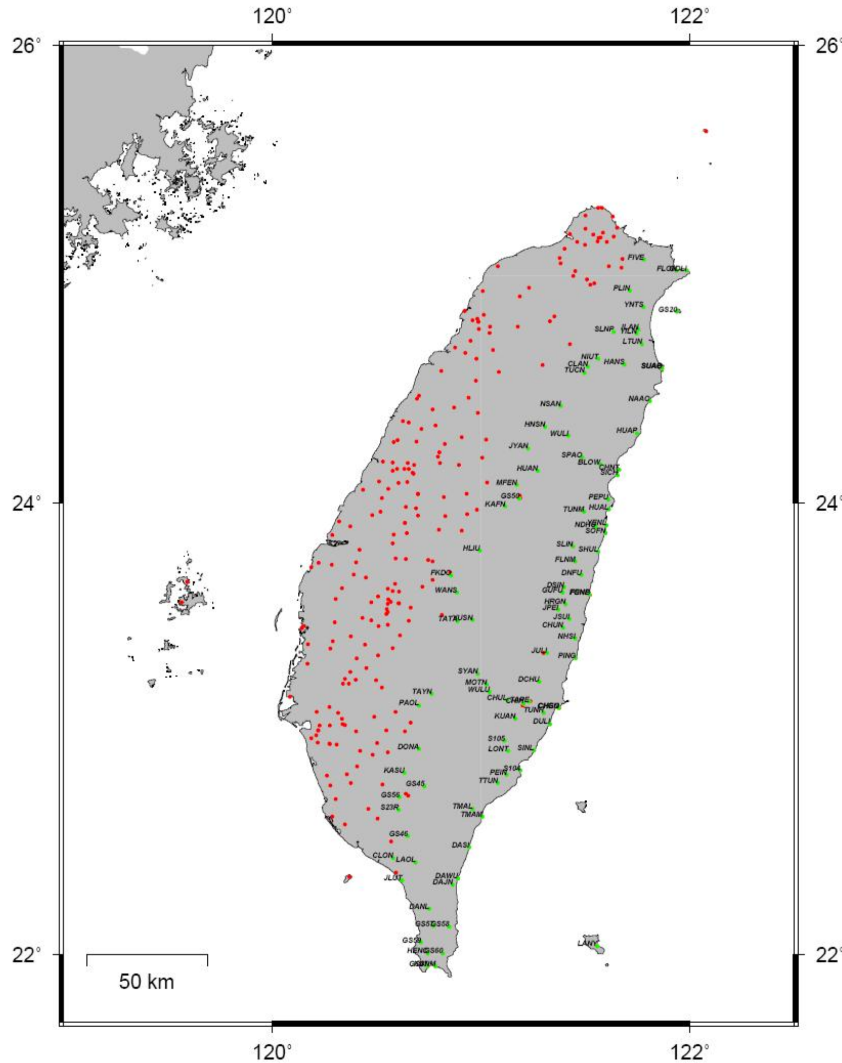


Why GPS?


GPS
satellite
20000 km
GPS
satellite
11000 km
ionosphere =
dispersive medium
350 km
80 km
HF
sounding
GPS
receiver
Sub-Ionospheric Point
= SIP

Why Taiwan?

- \> 300 permanent GPS stations
- 100 chosen stations
- Between 30 and 50 station/ date



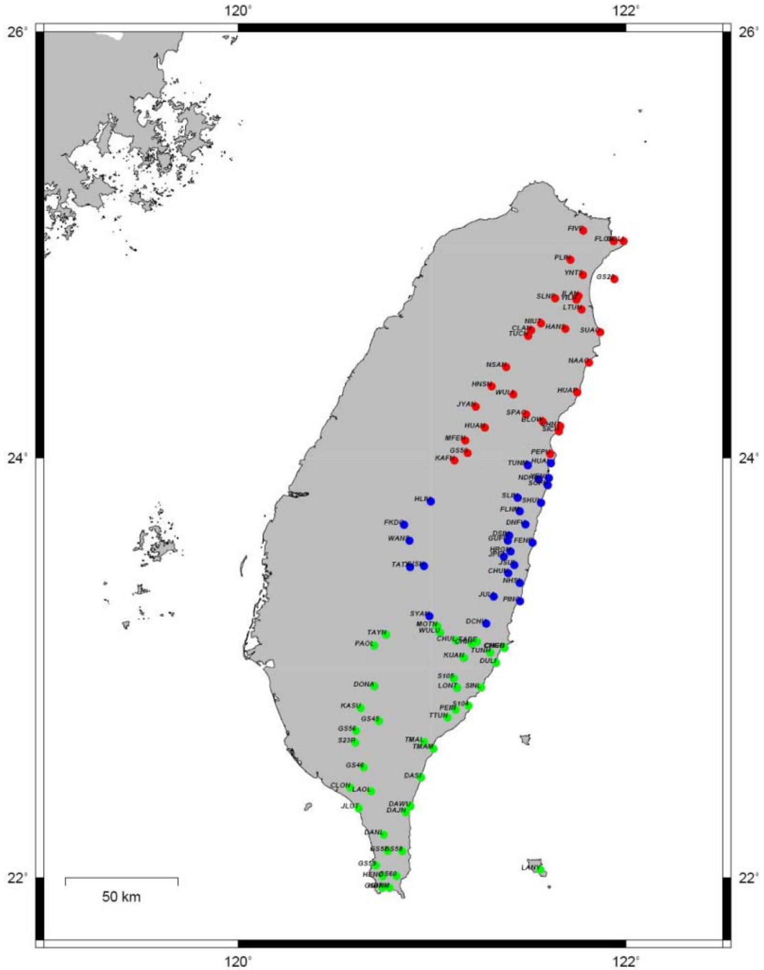
GPS Data processing

Processing the GPS data by using GAMIT-GLOBK 10.35 software developed by MIT to accurately estimate the position of each GPS site following the strategy used for tectonic applications.

•19 IGS stations were included to the data set

•Processing every 2 hours

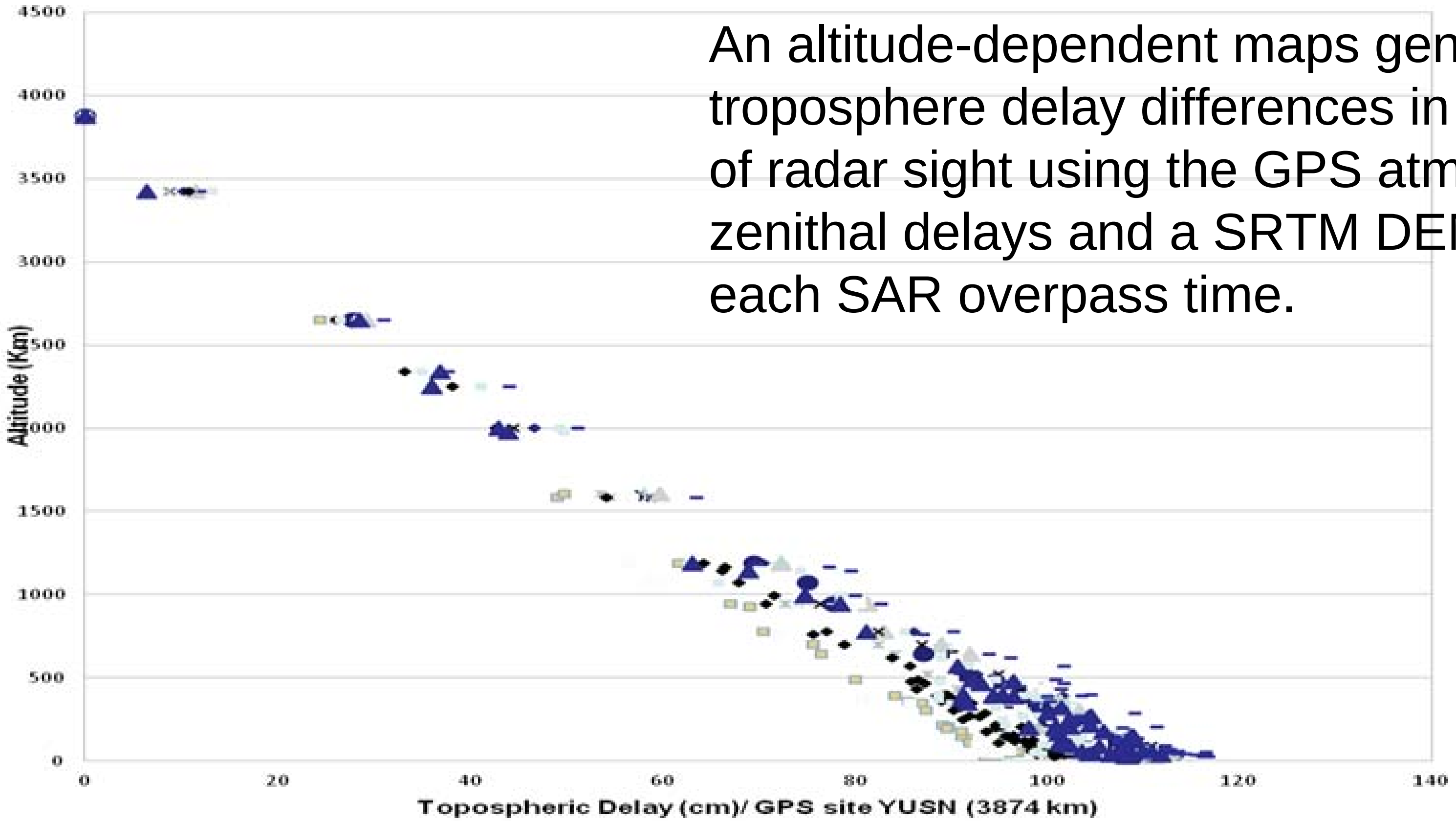
The difficulty residing in the number of available GPS stations that require to divide the network in several sub-networks and to realize a combination of these sub-networks to obtain consistent positions over the whole network.



Troposphere

Based on the calculated positions, we estimate the tropospheric zenithal delays for each date of ALOS image was acquired following the method developed in Champollion et al. (2004) and Walpersdorf et al. (2007),

An altitude-dependent maps generate of troposphere delay differences in the line of radar sight using the GPS atmospheric zenithal delays and a SRTM DEM at each SAR overpass time.



Predicted tropospheric GPS delay

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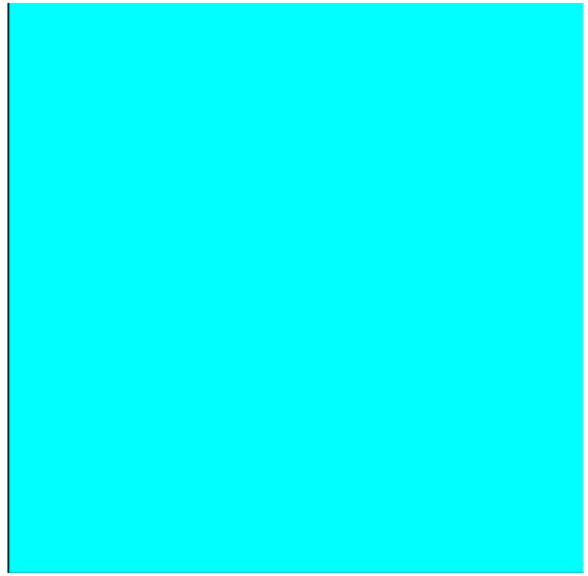

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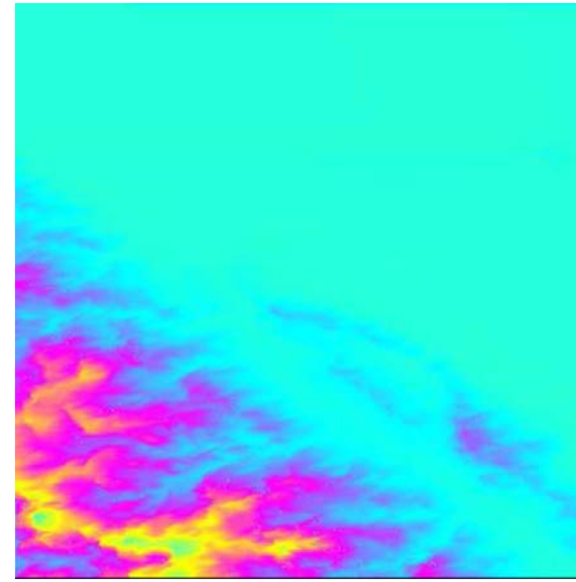


1) $D_s = [D - D_{rs}]_i$

2) Interpolation by using SRTM DEM

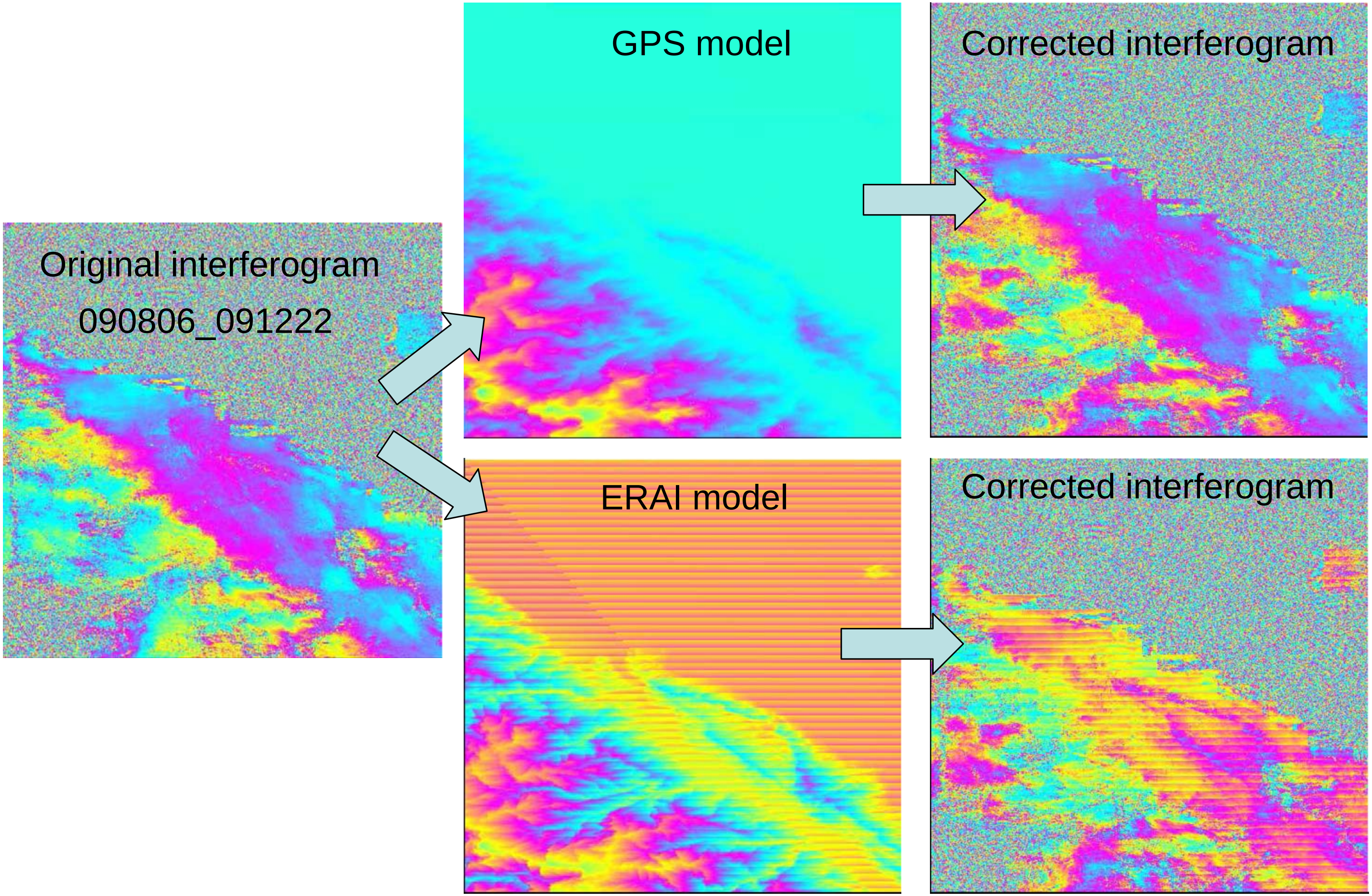
3) $D^i_s = [D_s - D^{ri}_s]$

D: Delay

s: station — rs: reference station

i: image — ri: reference image

Tropospheric delay correction



Iononospheric delay

We estimated the total electron content (TEC) along the path satellite-receiver (Calais,1996) to calculate the ionospheric zenithal delays

GAMIT calculate the carrier phase delays *L1 and L2* and the group delays *P1 and P2.*

We then computed the linear combinations,

$$L_G = \frac{L_2 - L_1}{\lambda_2}$$

Precise and smooth
ambiguous

$$P_G = \frac{P_2 - P_1}{\lambda_2}$$

Noisy and less presice
But no ambiguous

$$\boxed{B = \frac{1}{\rho} \sum_{i=1}^{\rho} (P_{Gi} - L_{Gi})}$$

Iononospheric delay

The absolute TEC is then given by

$$\mathrm{TEC} = \frac{\lambda_2}{A} \frac{(f_1^2 f_2^2)}{(f_1^2 - f_2^2)} (B - L_G) \qquad A = 40.3\ \mathrm{m}^3\ \mathrm{s}^{-2}$$

then applied an elevation mapping function:

$$emf_\theta = {H_{ion}}/{L_\theta}$$

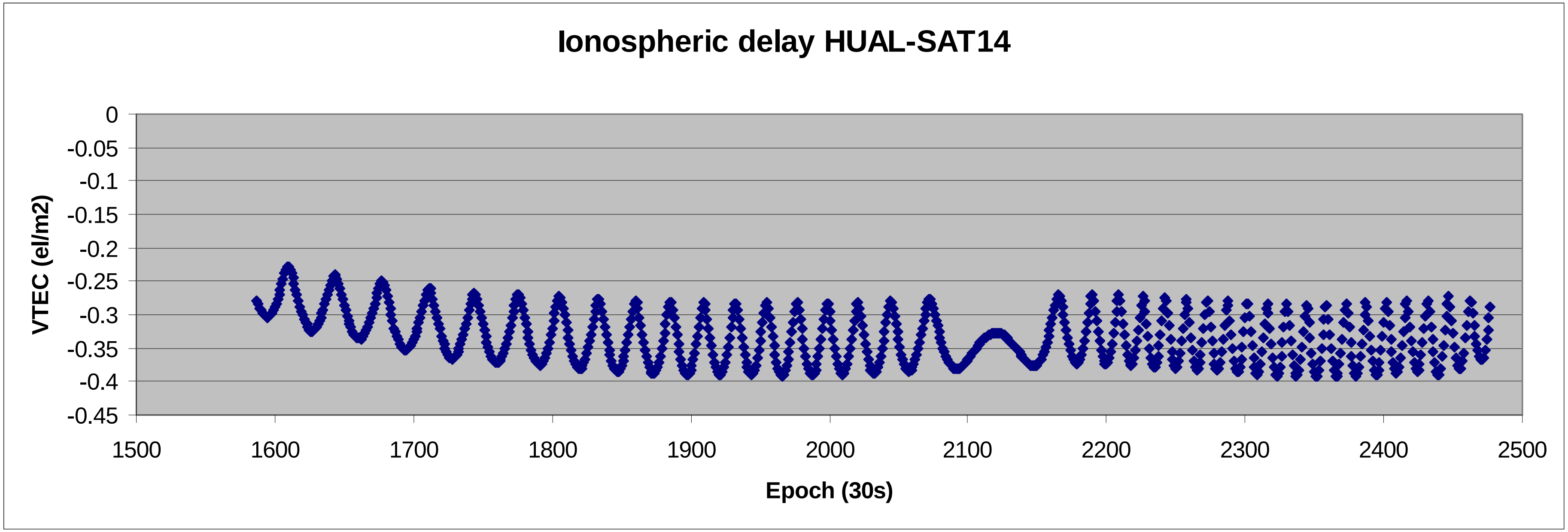
Hion : the mean ionospheric thickness

L_θ *: the ray path length through the ionosphere*

$$L_\theta = \sqrt{(R + H_t)^2 - R^2 \cos^2(\theta)} - \sqrt{(R + H_b)^2 - R^2 \cos^2(\theta)}$$

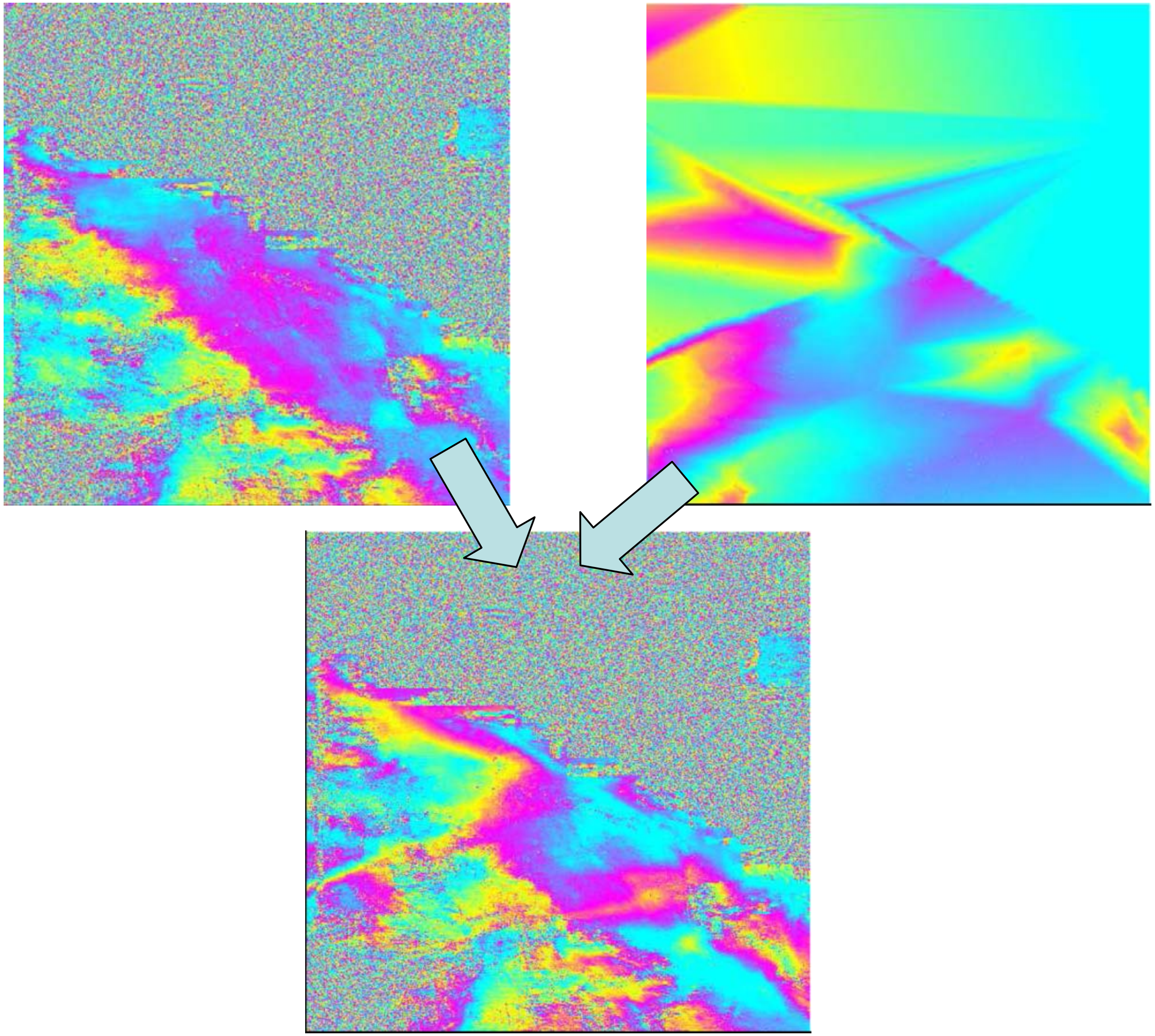
$$VTEC = TEC \times emf_\theta$$

Iononospheric delay



We Calculate the Mean delay for each station at image acquisition

Ionospheric delay correction



Thank you for your attention!