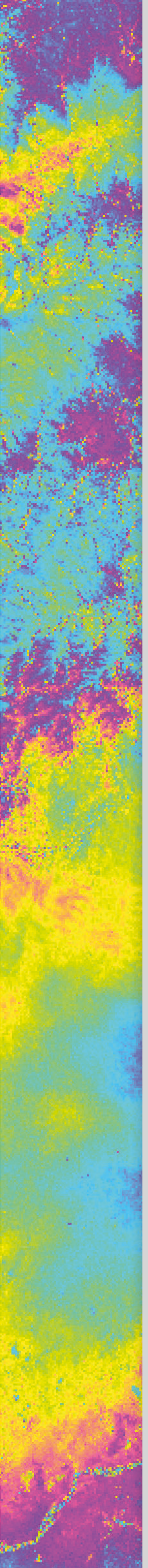

Can we observe the **North Andean Sliver** motion using **InSAR time-series** analysis?

Léo Marconato, M-P. Doin, L. Audin, L., J-M. Nocquet,
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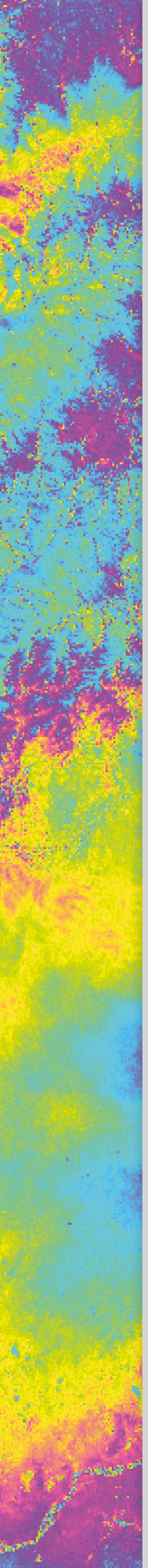


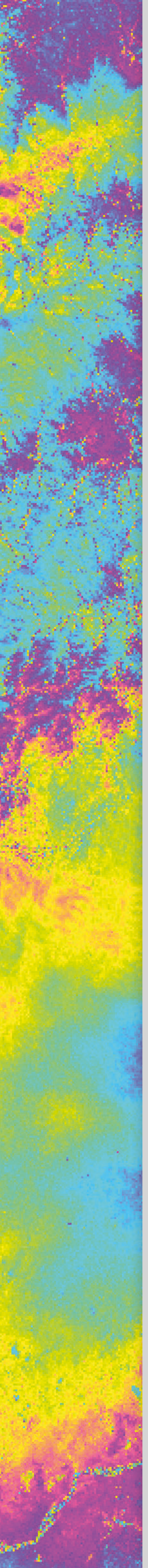

Costa Rica
Panama
Colombie
South American Plate
55 mm/yr
Équateur
Nazca plate
Pérou


Costa Rica
Panama
NAS
Colombie
South American Plate
55 mm/yr
Équateur
NAS
SAP
Nazca plate
Pérou


Costa Rica
Panama
NAS
Colombie
55 mm/yr
South American Plate
Équateur
CCPP
fault system
NAS
SAP
Nazca plate
Pérou

Block model derived from GNSS

(Jarrin et al., 2023)

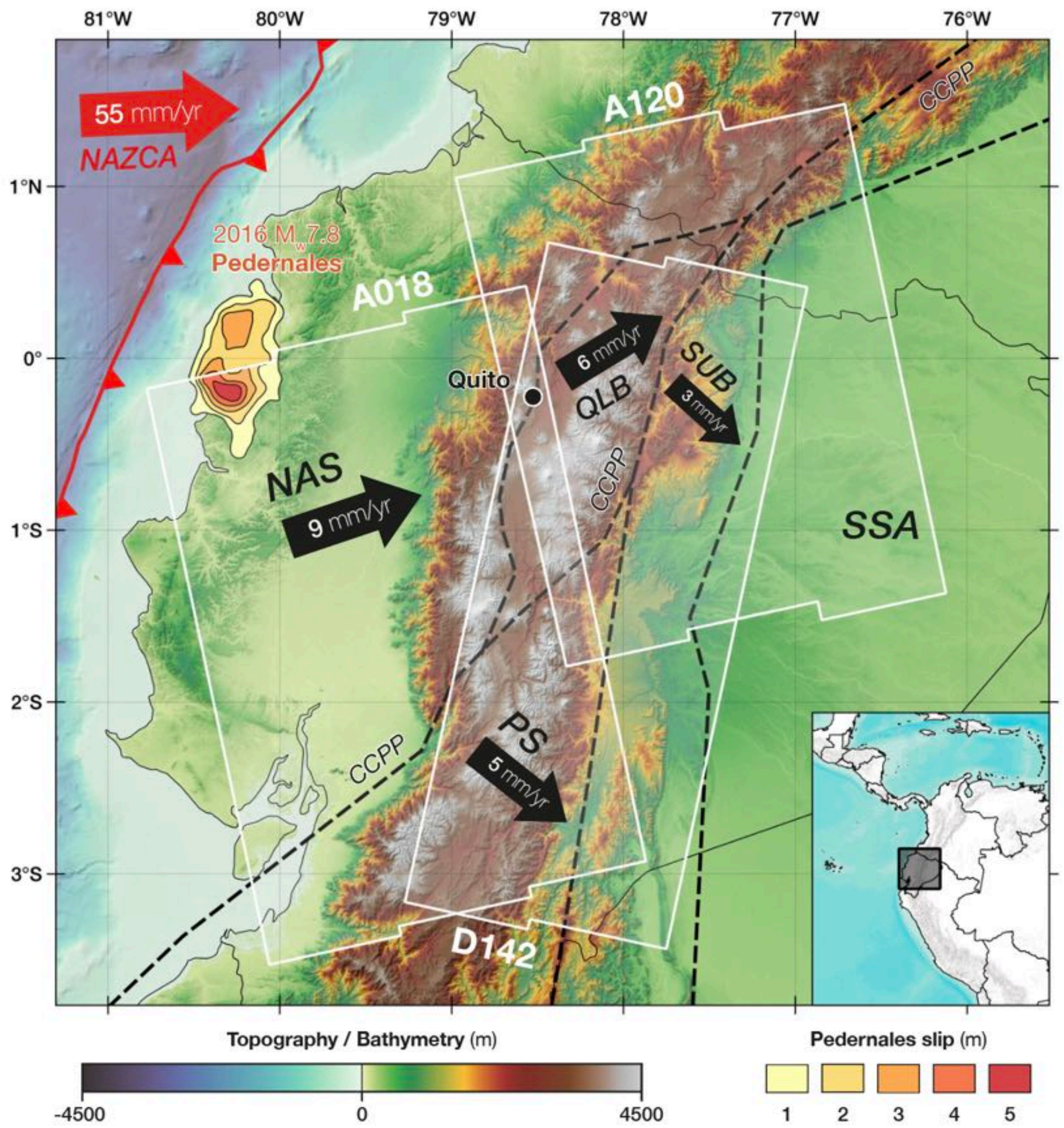


A challenging question…

Can we observe the North Andean Sliver motion with InSAR?

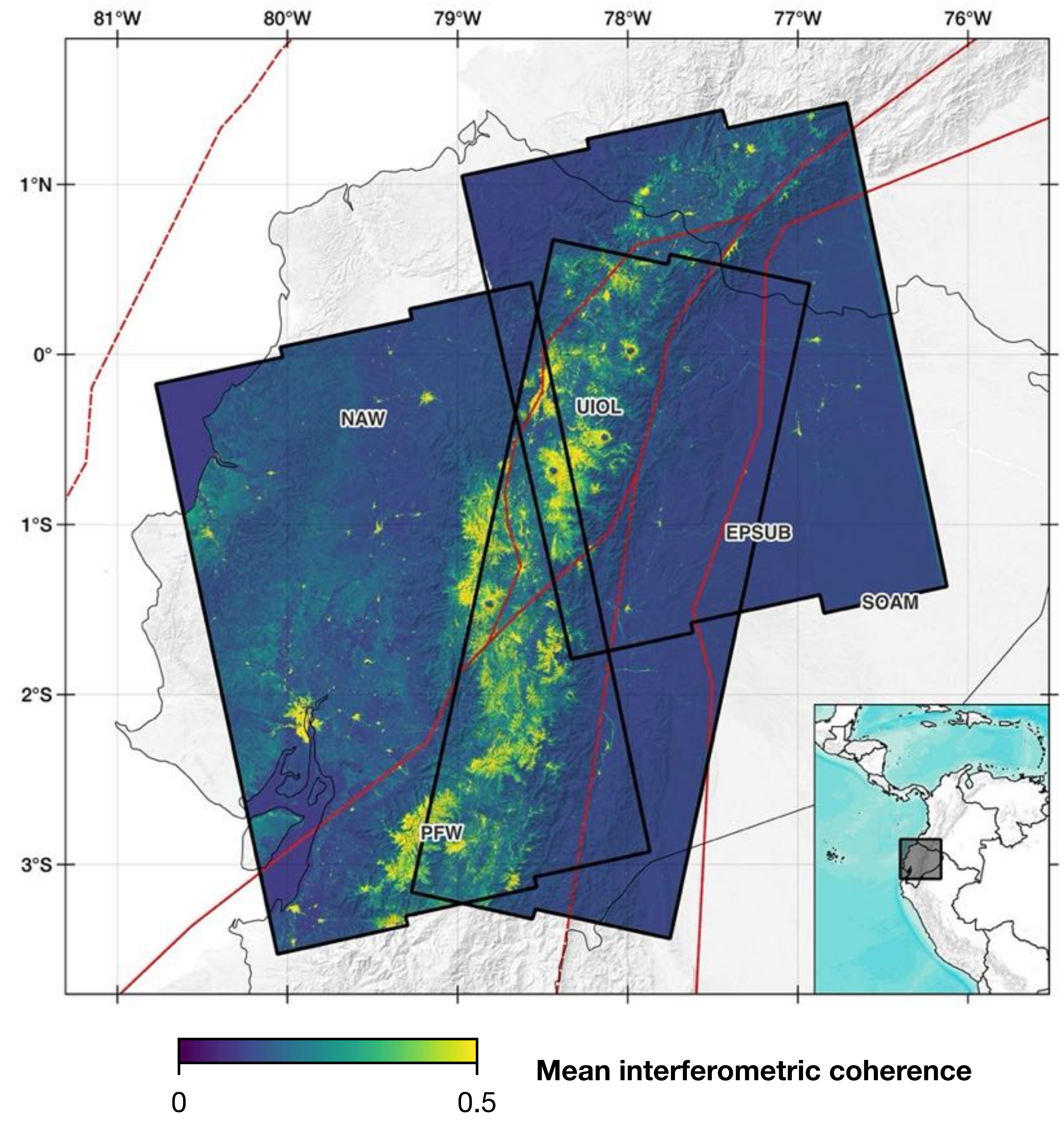
- Strong **topography** and elevation gradients
- **Dense vegetation** in lowlands: Equatorial forest
- **Cultivated lands** even at high altitudes
- **Subduction events**
- **Small deformation rates:** ~3-5 mm/yr expected in the Line-Of-Sight

Sentinel-1 Data

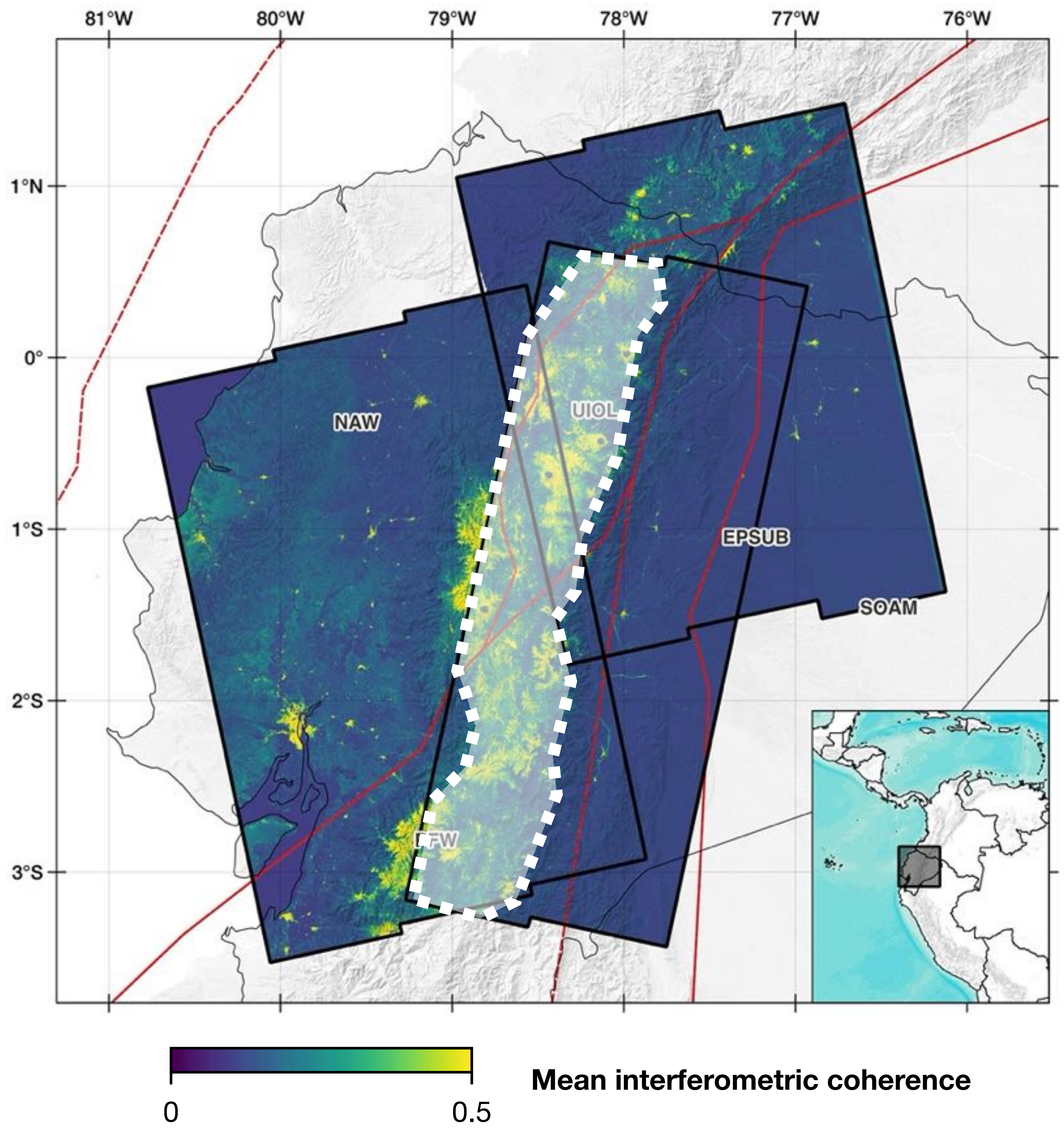


- **3 tracks processed:**
  - 2 ascending
  - 1 descending
- **Full archive:**
  - 2014-2022
  - ~ 8 years
  - 200-300 acquisitions

Sentinel-1 Data



Sentinel-1 Data



- **Area with results:**

  2 viewing geometries

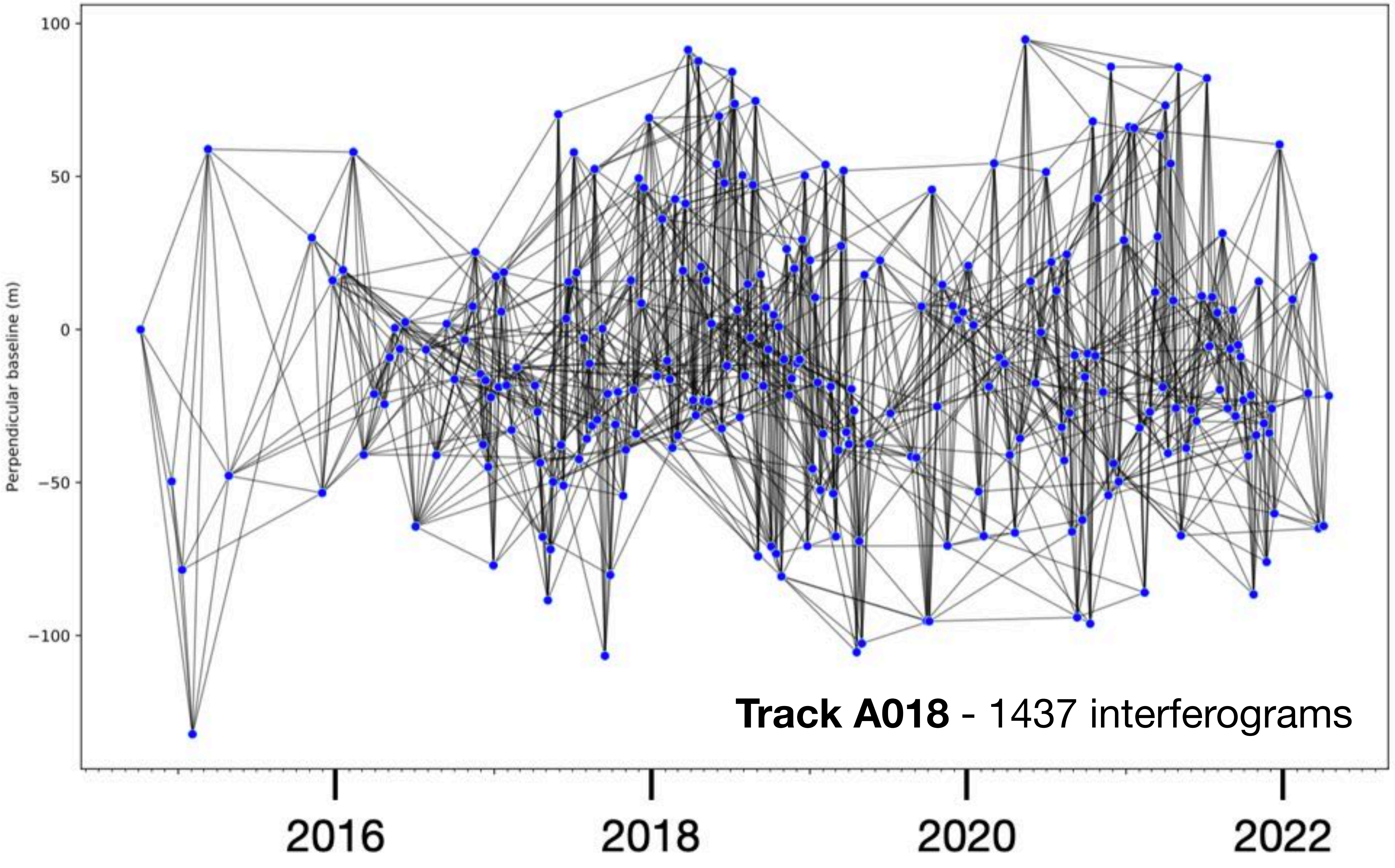
  + sufficient coherence to unwrap 1 year interferograms

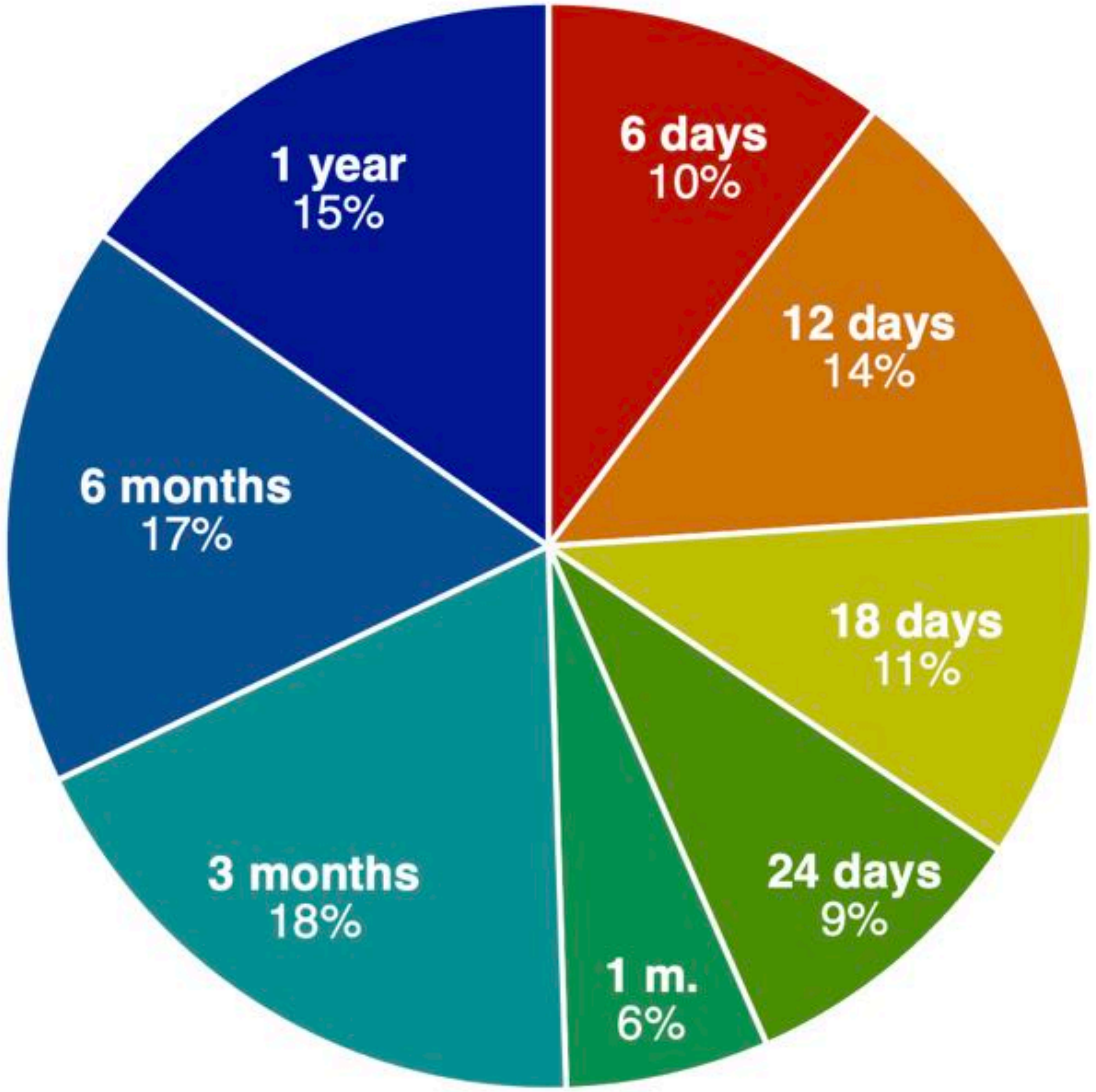
  (⇔ *elevation > 2000-2500 m*)

- **100 x 400 km area**

Interferogram networks

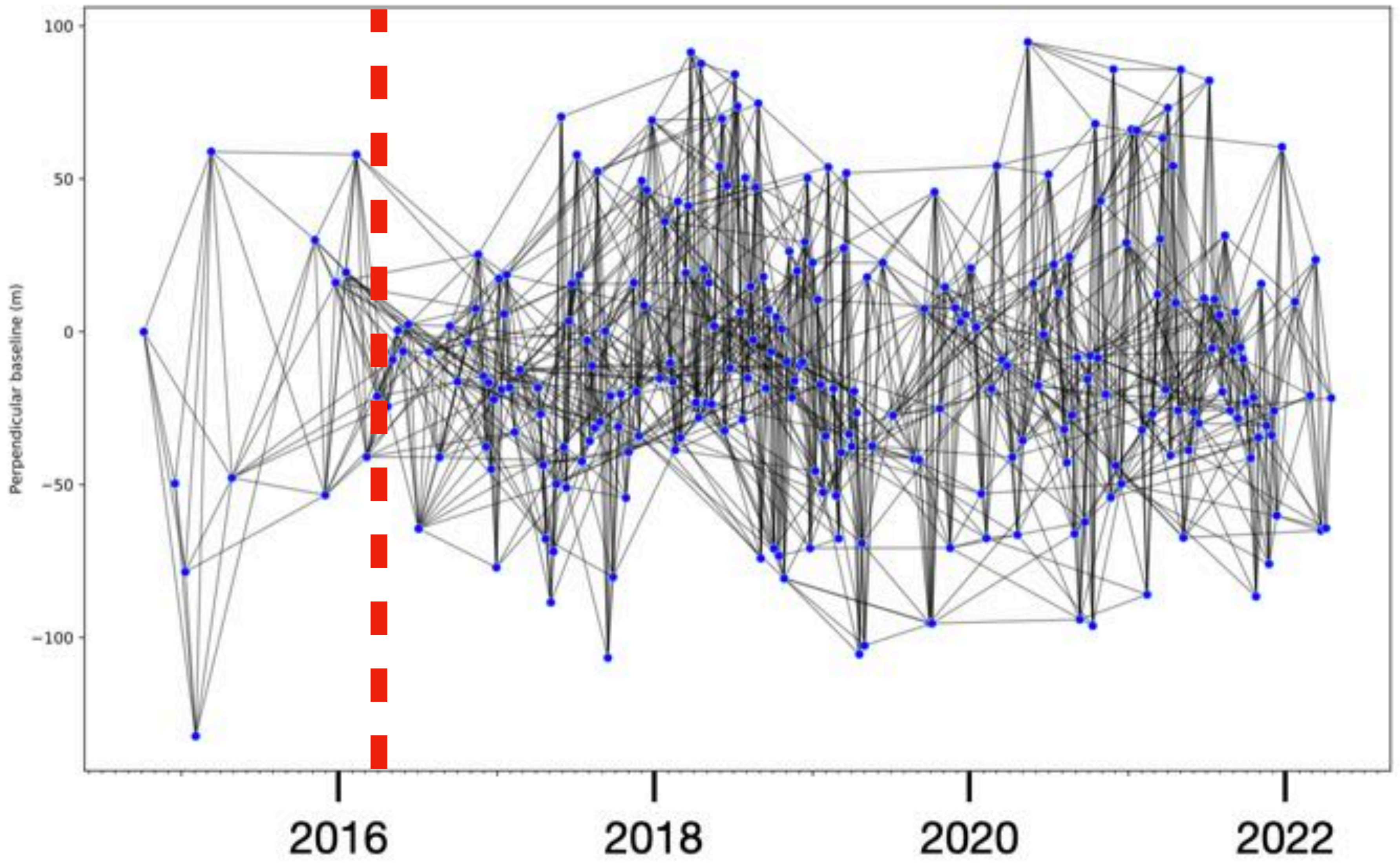
- SBAS strategy: NSBAS processing chain *(Doin et al., 2011)*
- About half of *long temporal baseline* interferograms to reduce fading signals



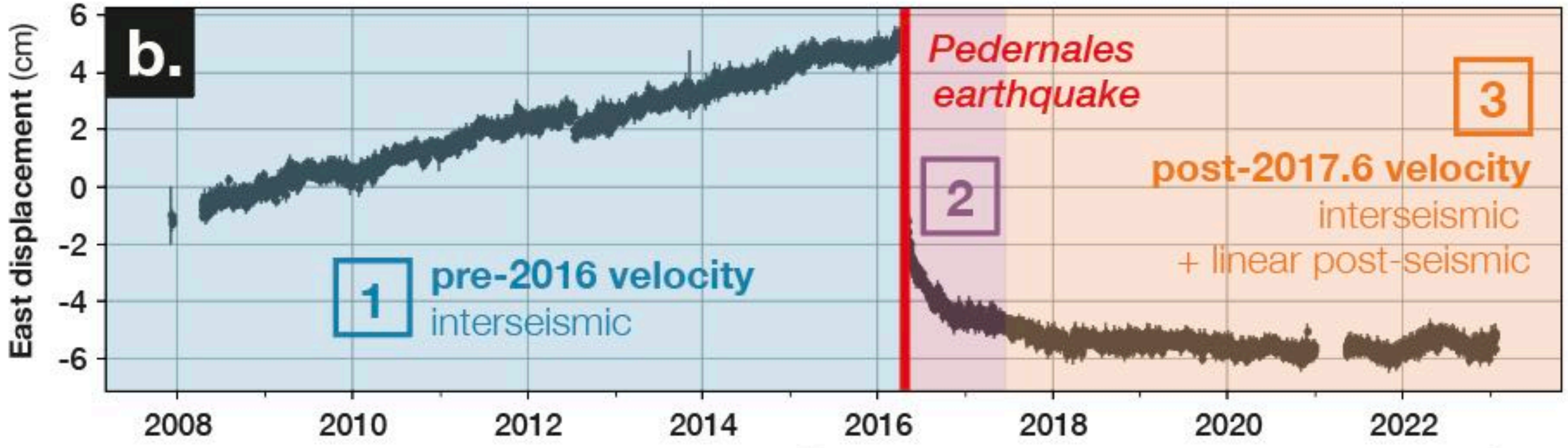


Impact of a megathrust earthquake

- **Pedernales earthquake** (2016, Mw7.8) during the period of acquisition of Sentinel-1



GNSS time-series in Quito (180 km from the coast):



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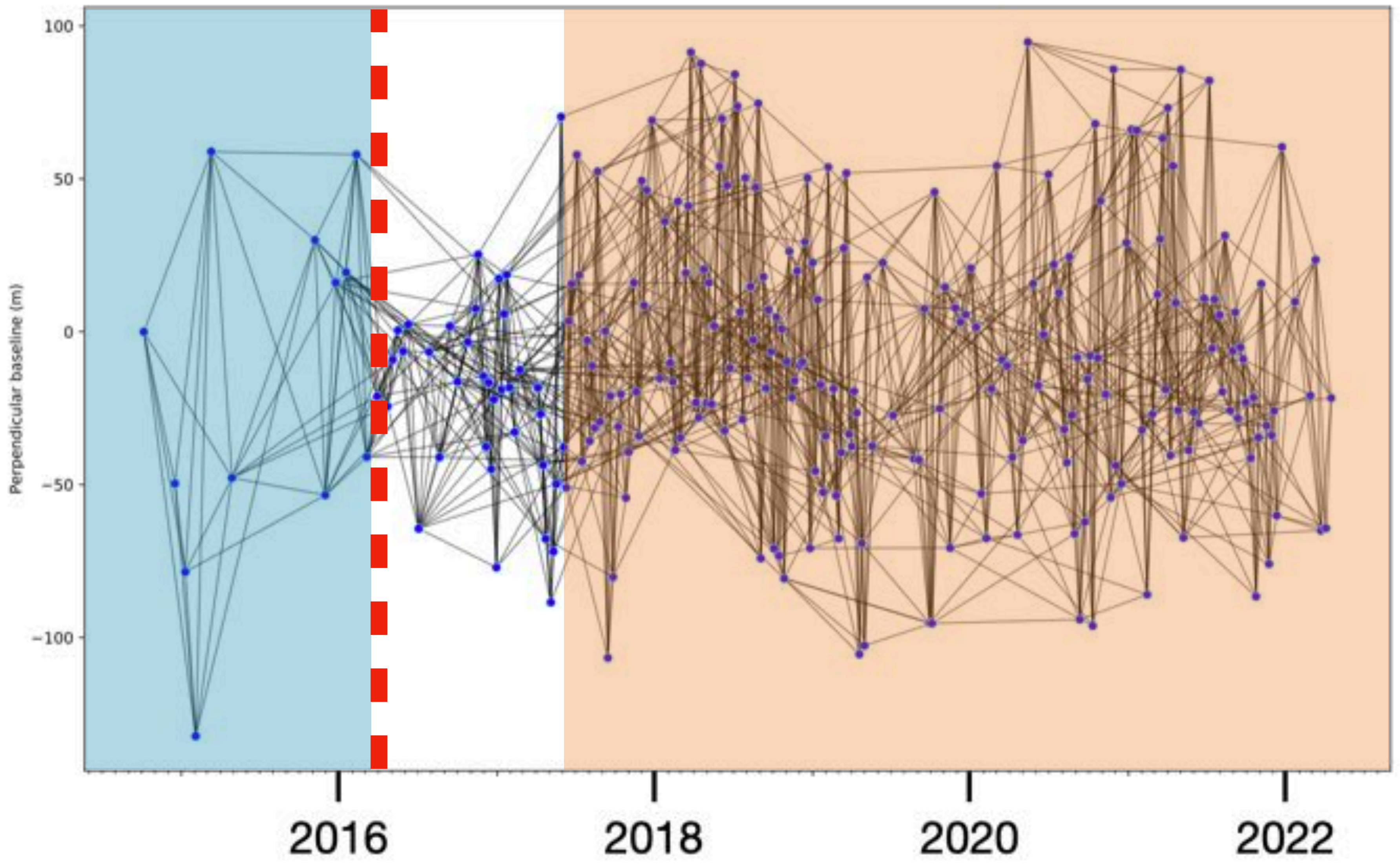

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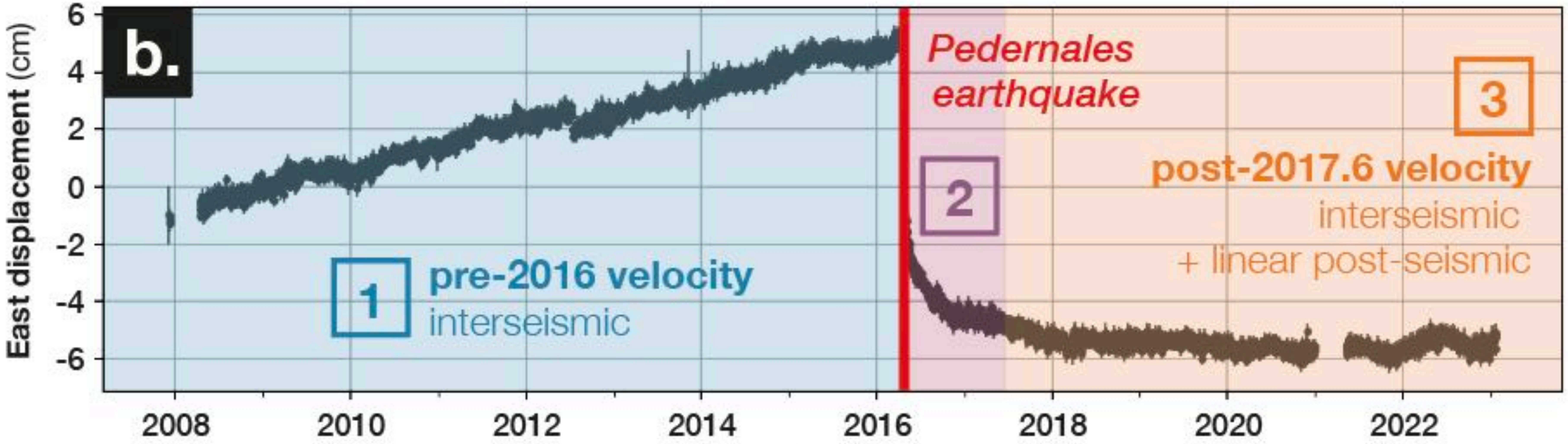
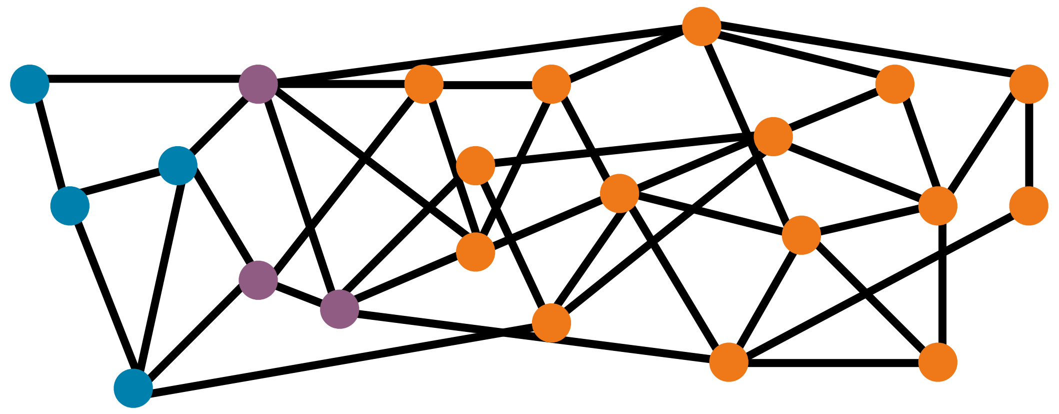


Workflow



Interferogram generation

ERA5 tropospheric correction

Optimized weighting during multilooking

Workflow

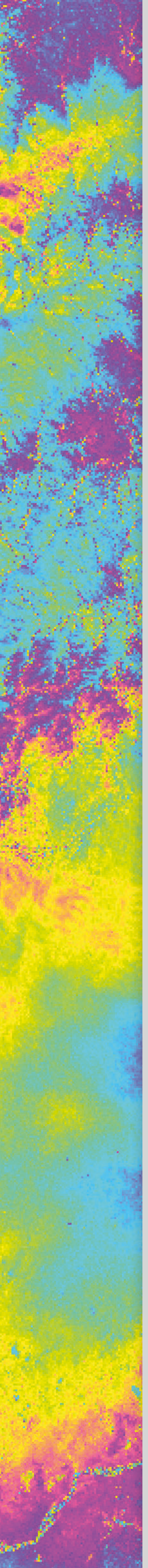
Interferogram generation

ERA5 tropospheric correction

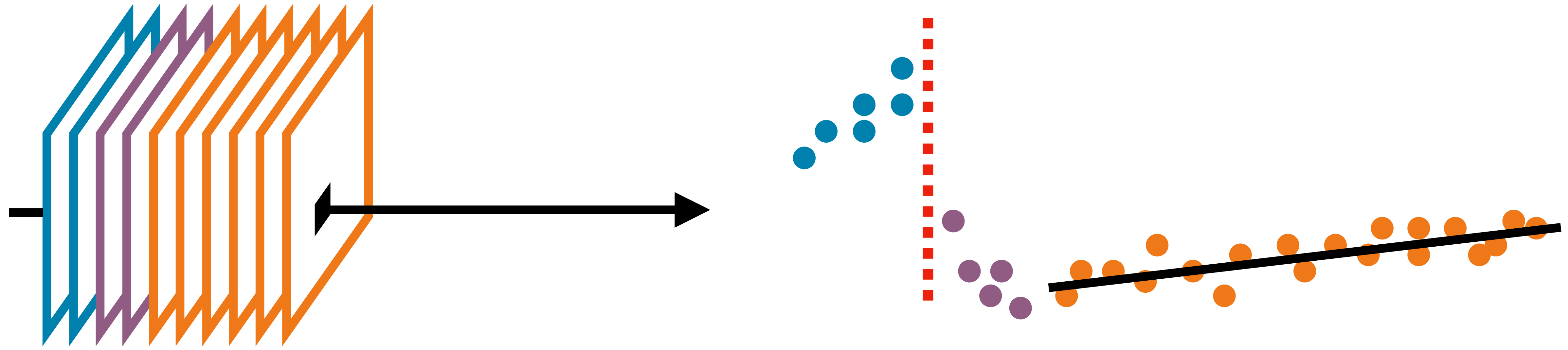
Optimized weighting during multilooking

Time-series inversion

From detrended and referenced interferograms



Workflow



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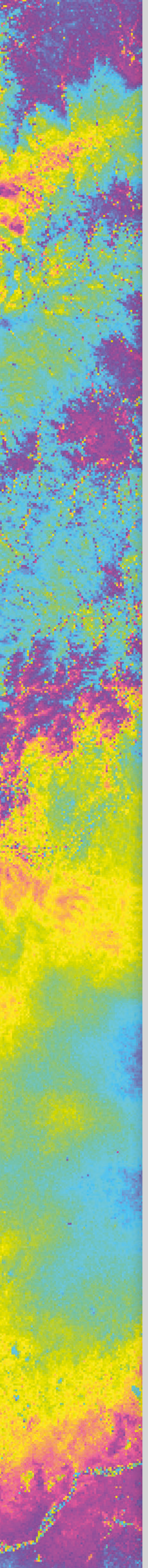
Extraction of a linear velocity

on 2017.6+ time-span

Using linear + seasonal time-fonction



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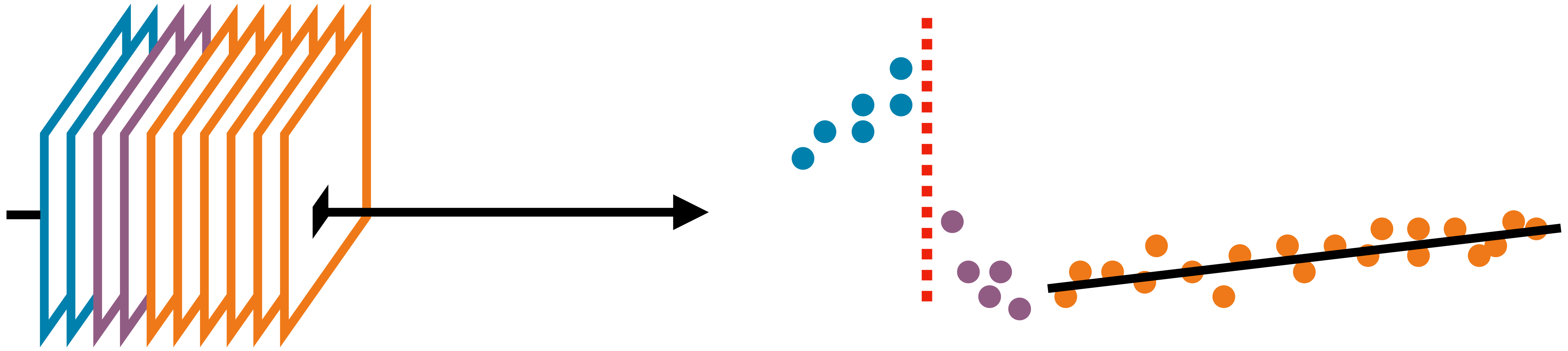

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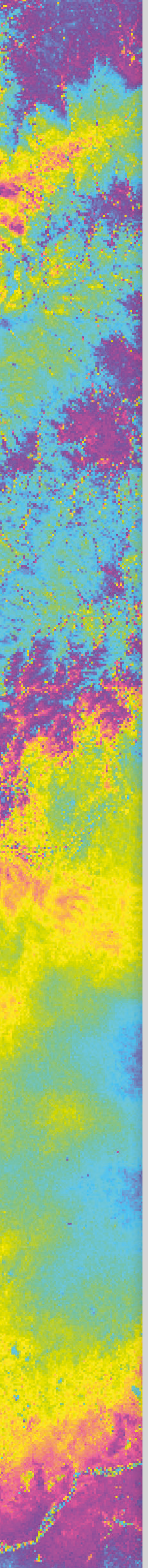

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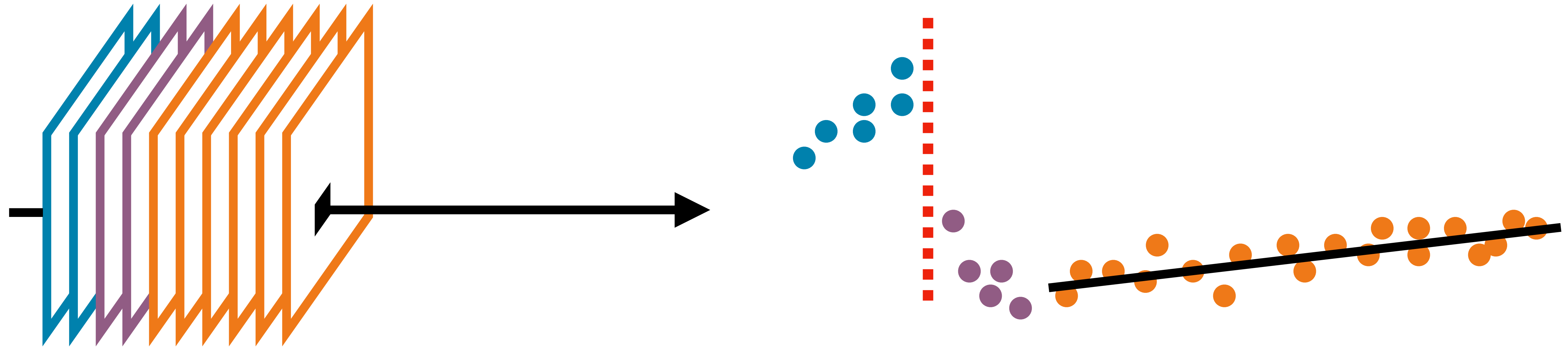

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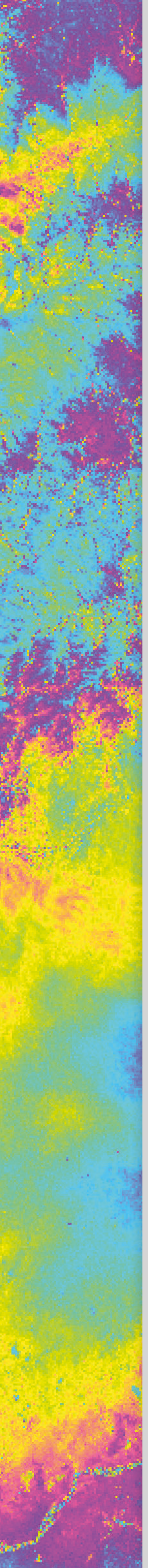
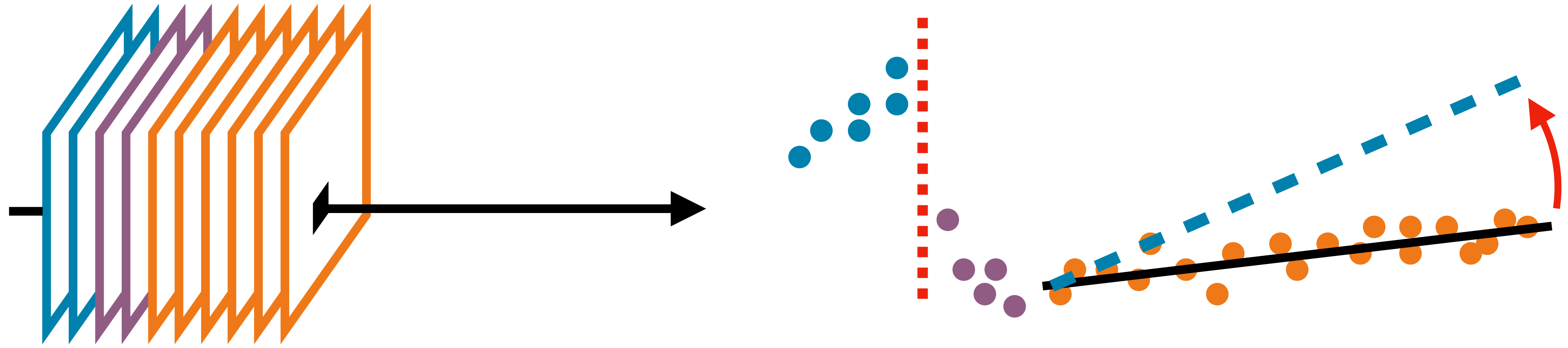
Decomposition into East+Up components

After removal of GNSS North component projected into LOS



Workflow



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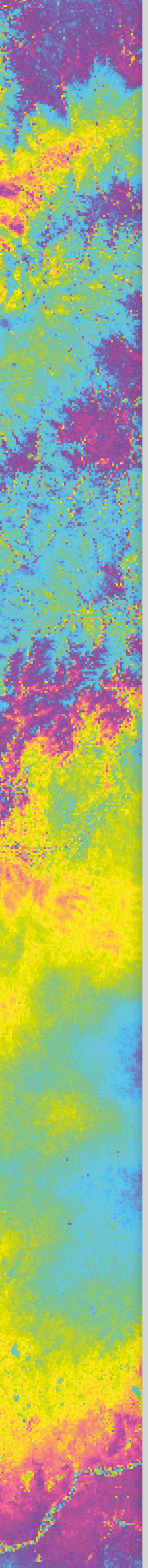
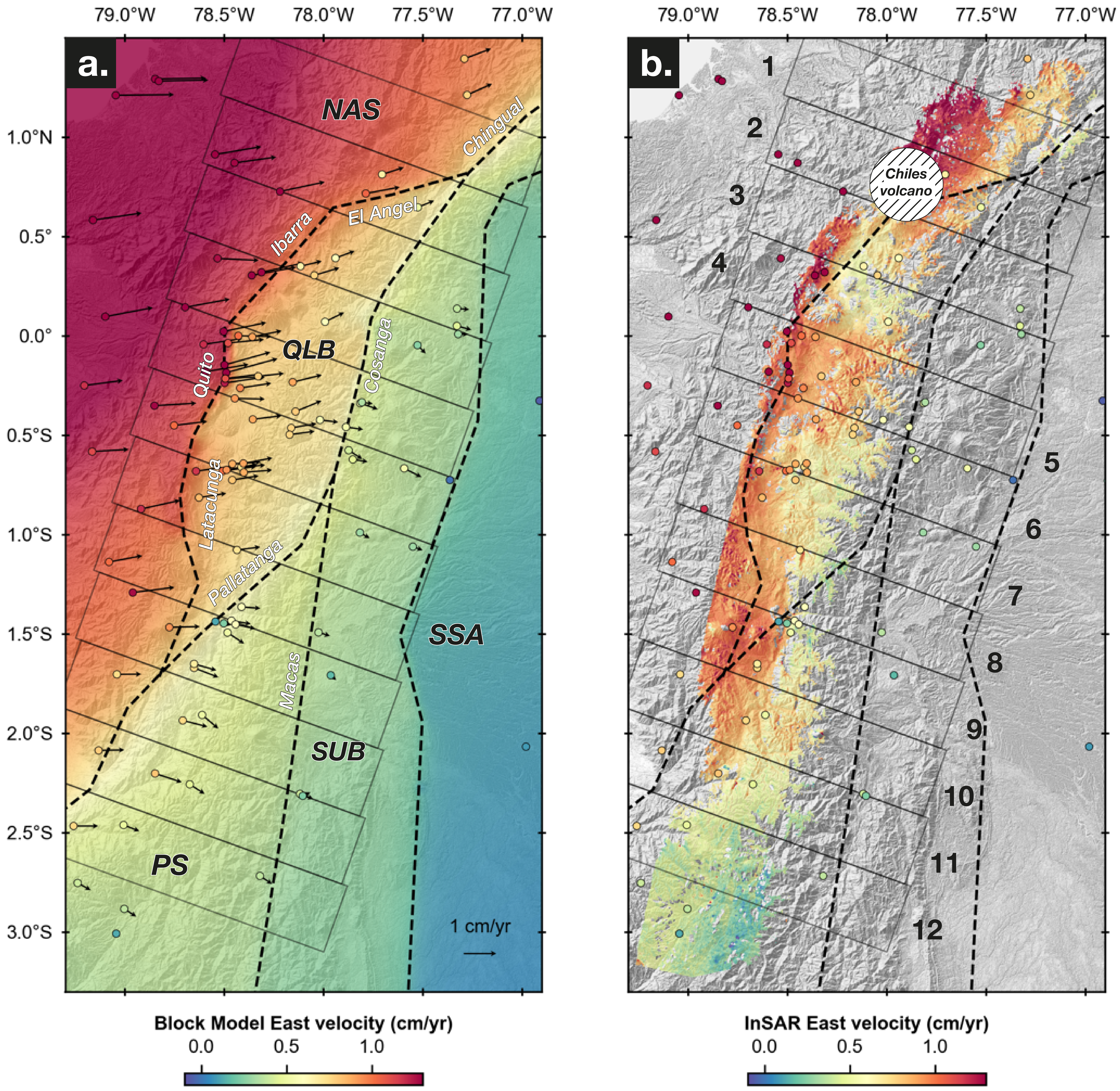
Correction of post-seismic deformation

Using interpolated GNSS post-seismic velocity field



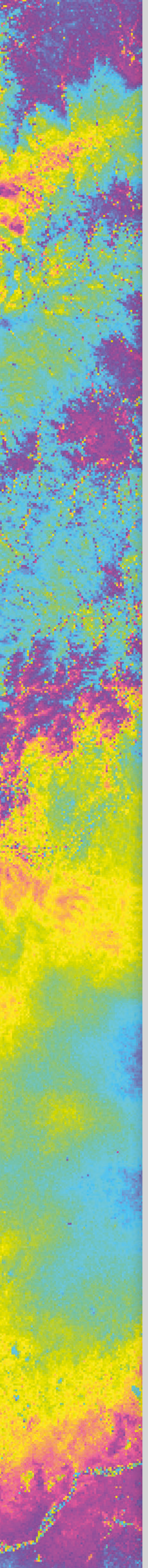
Results



Block model prediction

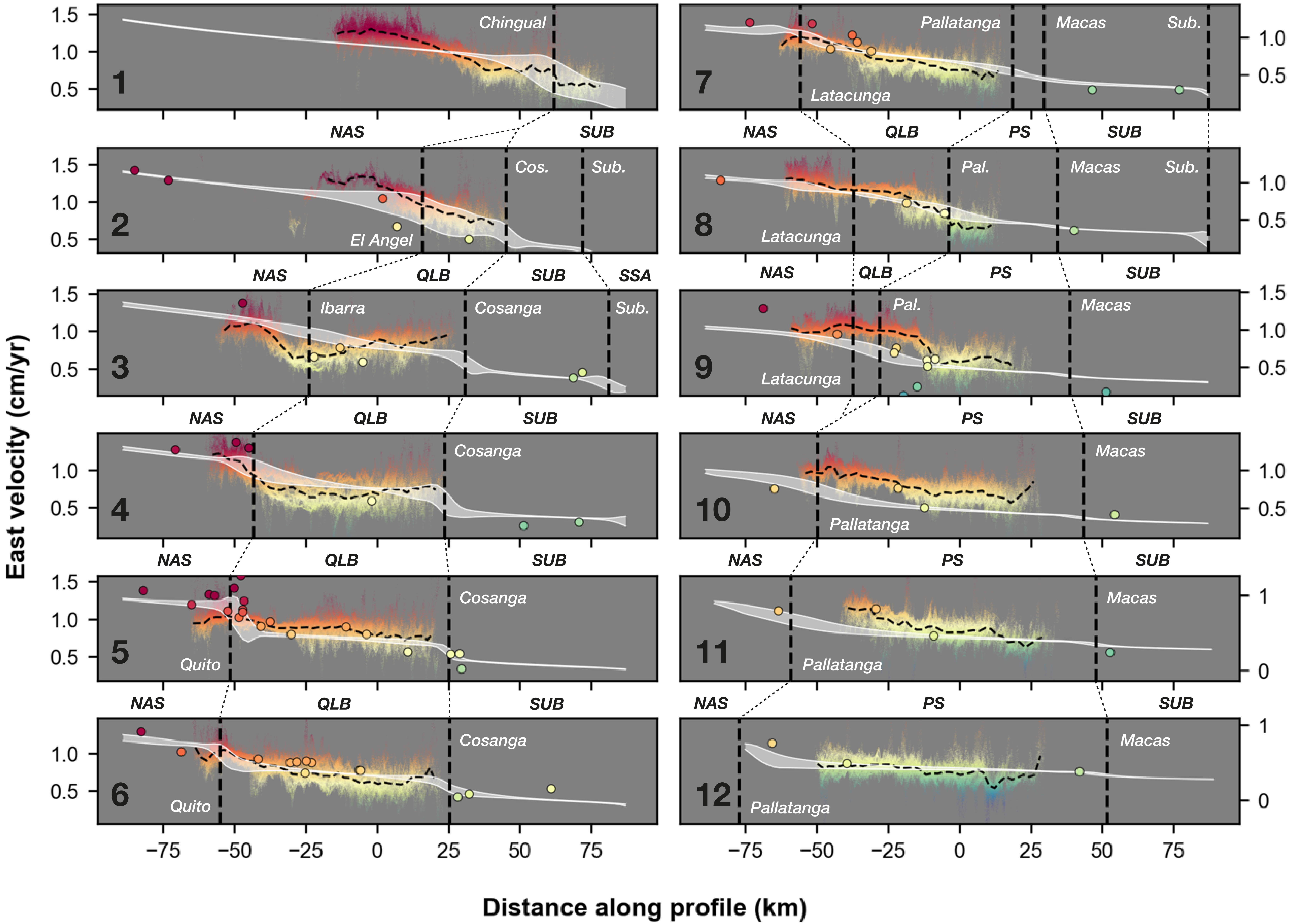
(Jarrin et al., 2023)

Our East velocity map



Results

- Overall good agreement
- Some inconsistencies reveal the too simplistic faults geometries used in the block model, or the lack of knowledge on their coupling



Conclusion

- We produced the first InSAR velocity map of the Ecuador-Colombia cordilleras using Sentinel-1 data.
- We developed a strategy to correct the velocity maps from the post-seismic effect of the 2016 Mw7.8 Pedernales earthquake using interpolated GNSS data
- The results show a good consistency with GNSS velocities over the whole area, such as with predictions of block modeling, but call for a refinement of the latter

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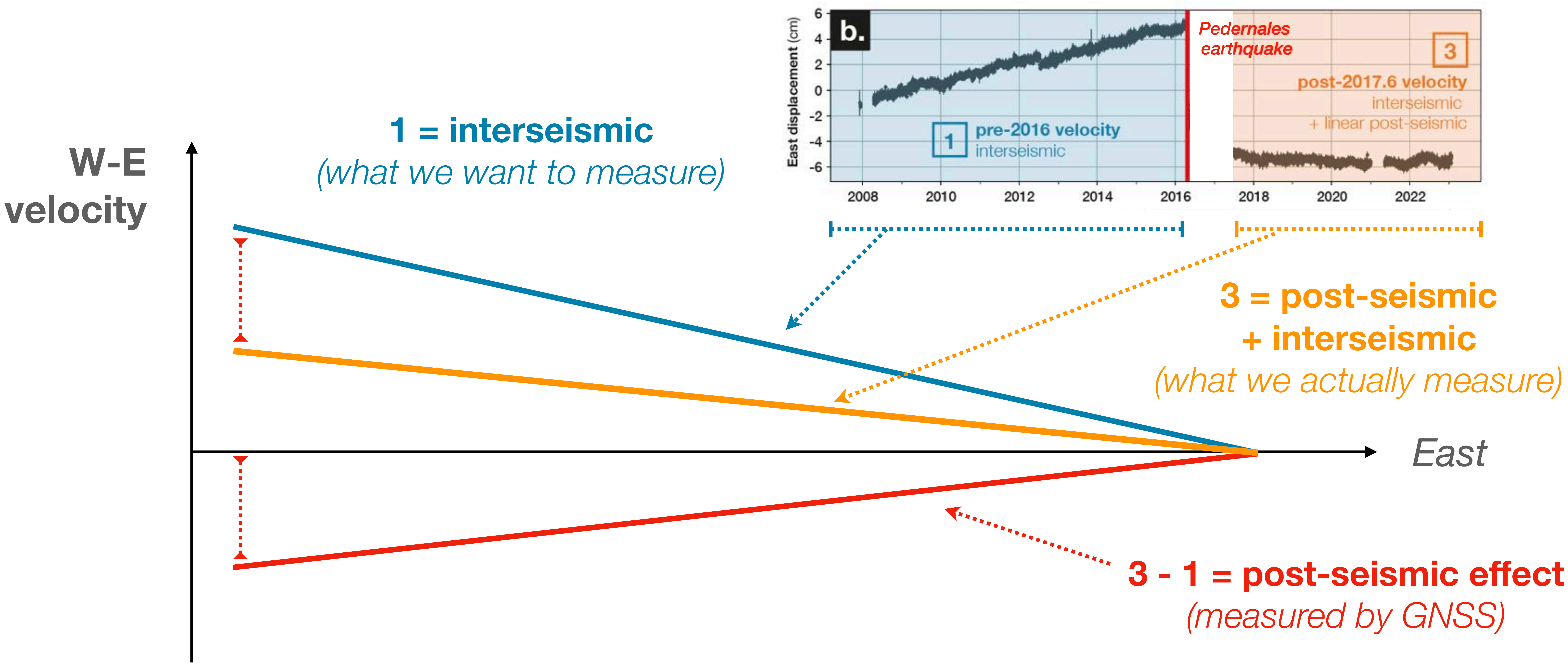
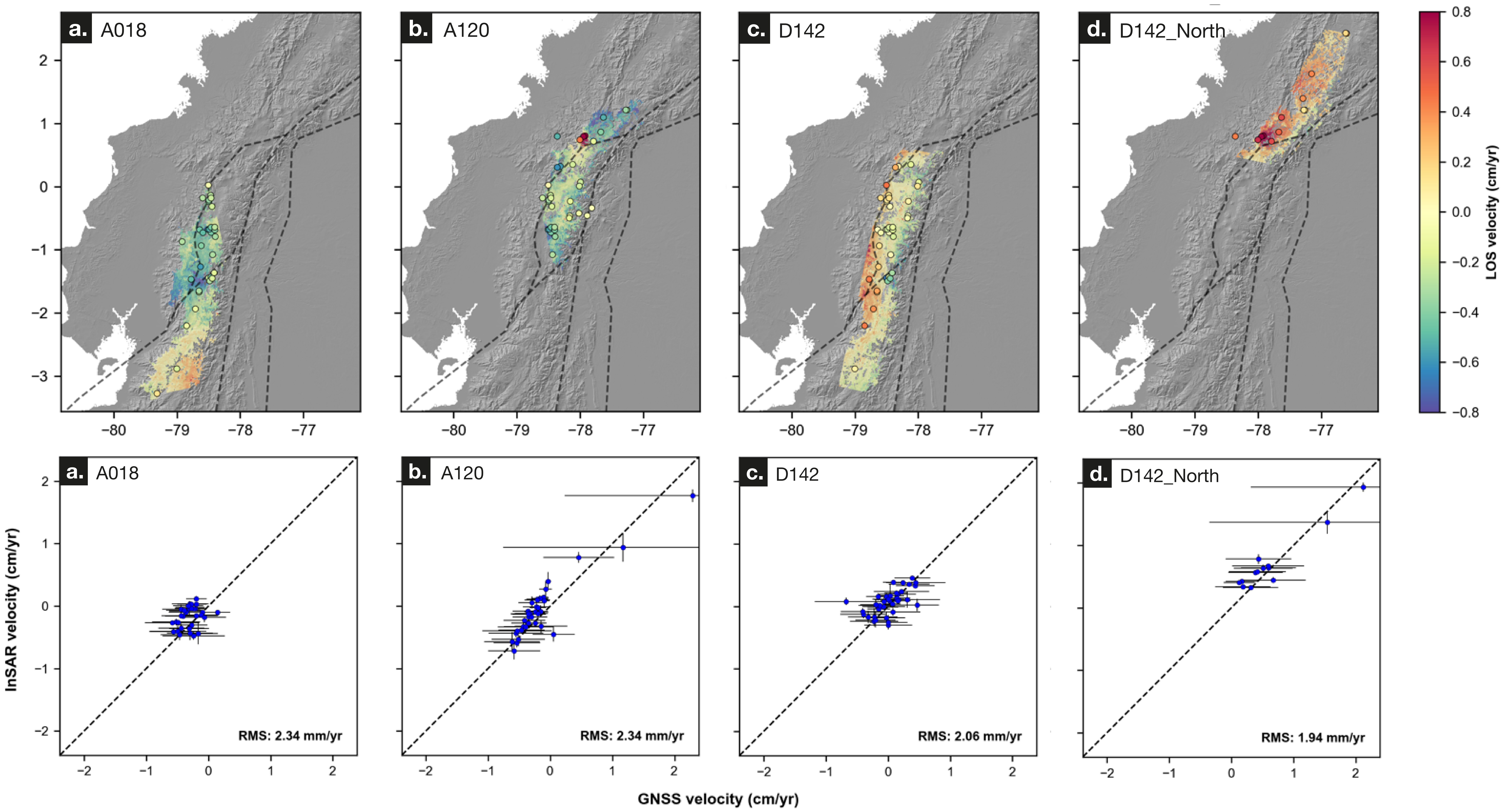
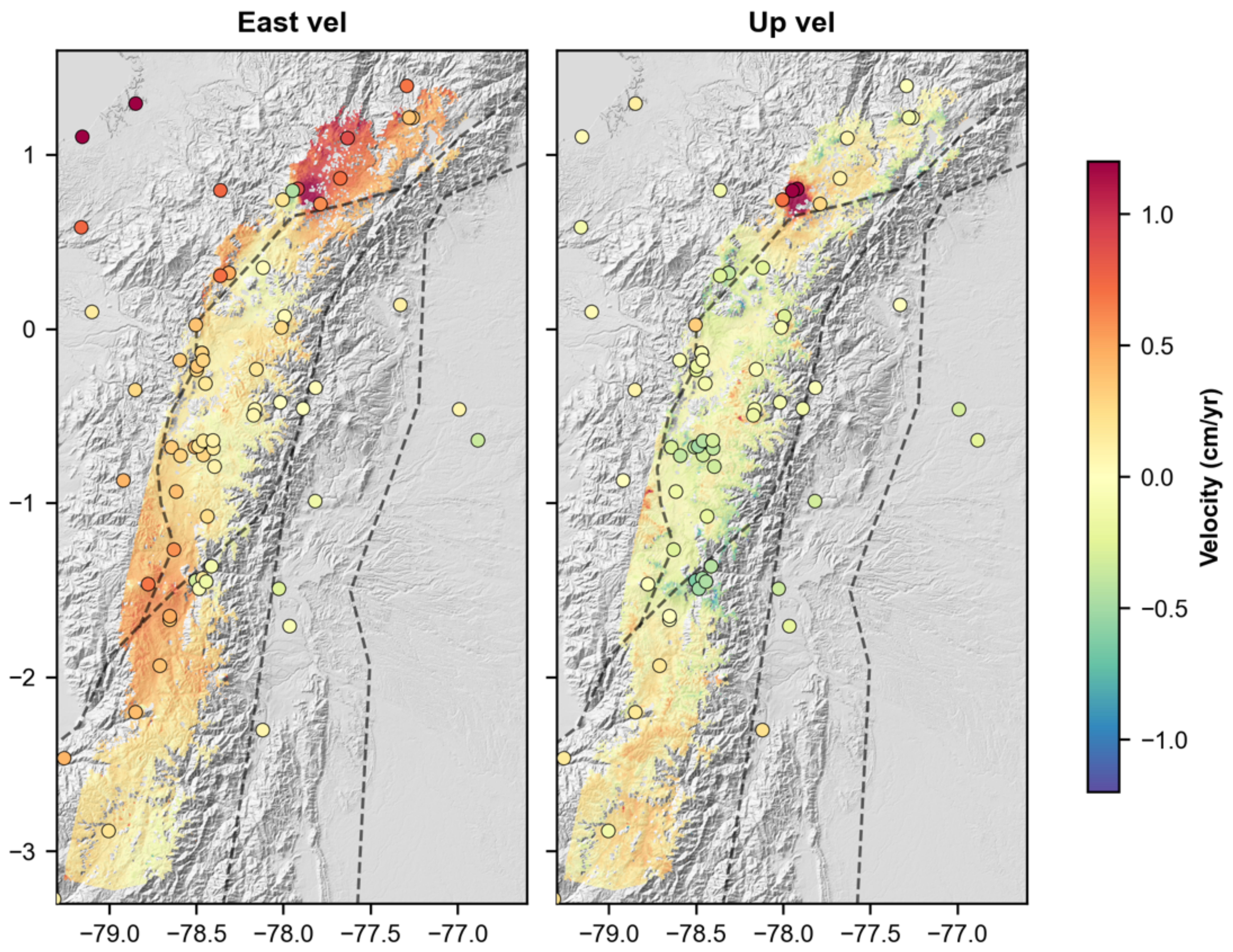


➡ *EXTENSION : reduces the inter-seismic gradient of deformation*

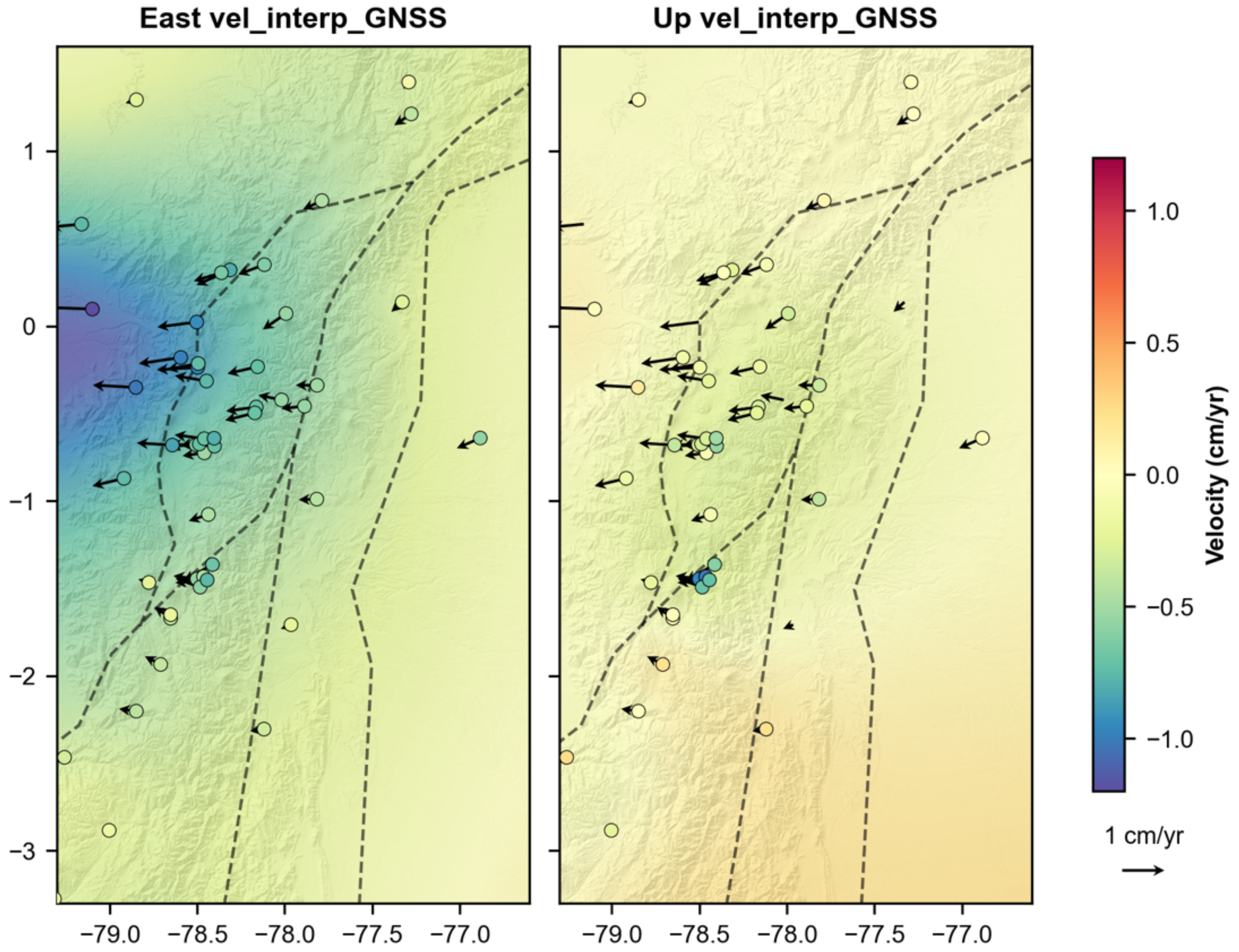
Referencing in SSA reference-frame



Decomposition after removal of North component



Correction of post-seismic deformation



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