scientific exploitation
of operational missions

European Space Agency

InSARap at a glance

Team B

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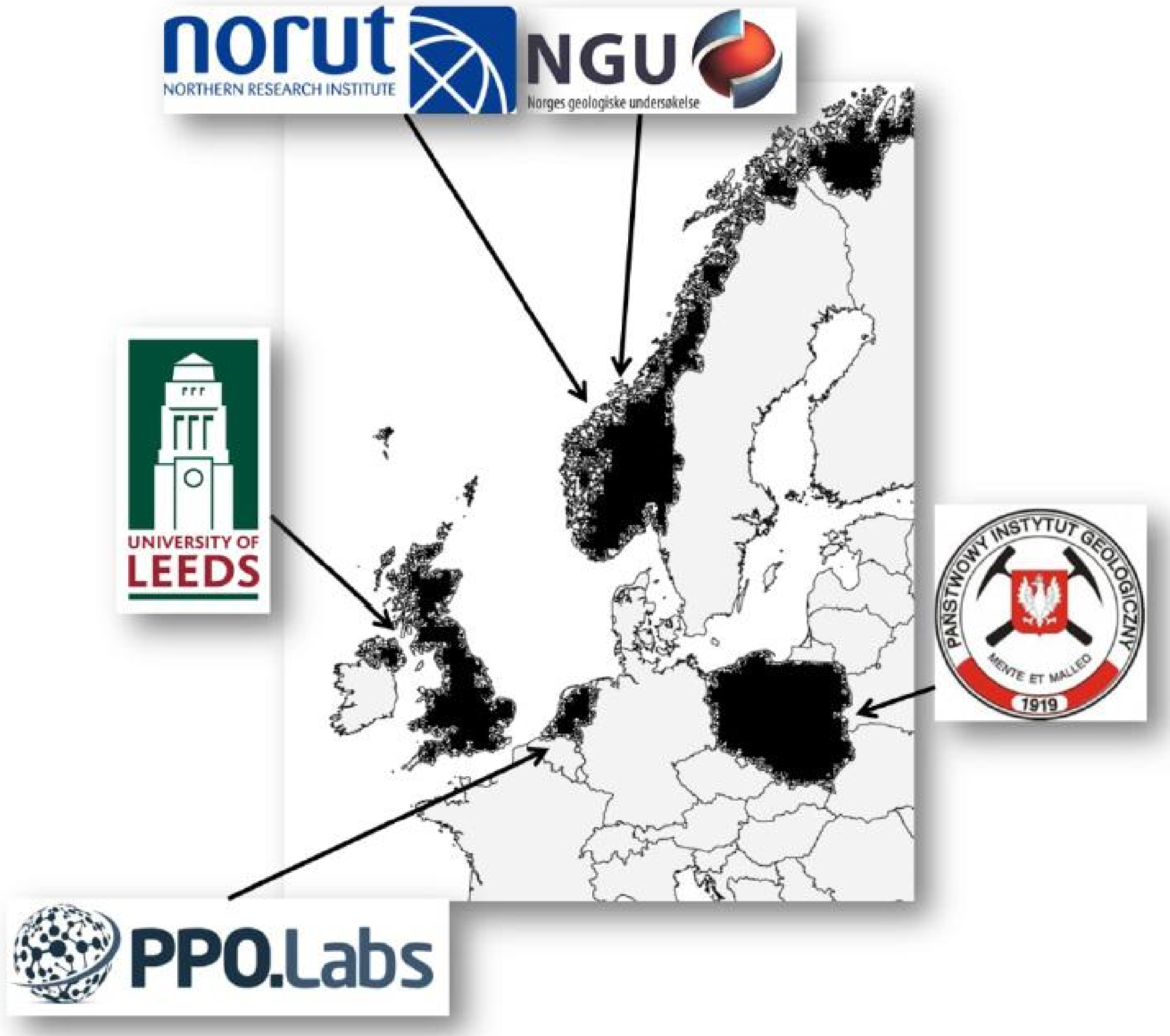
1919
NATIONAL RESEARCH INSTITUTE

Consortium overview



Presentation Setup [1/2]

- **InSARap at a glance (this talk)**
  - Consortium overview
  - Our approach to TOPS InSAR
  - Scientific objectives
  - Presentation of the pilot sites

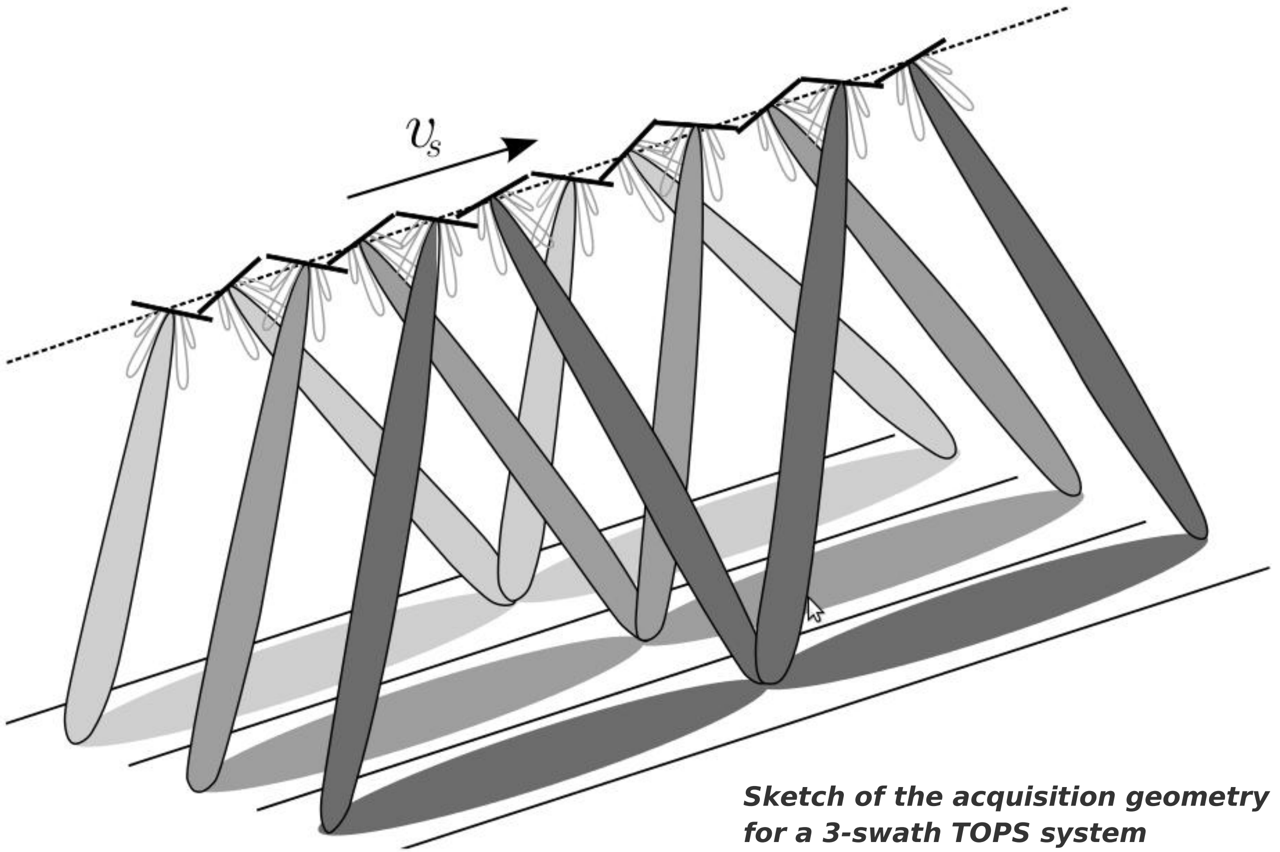
- **TOPS InSAR technical challenges**
  - Overview: lessons learned from prior state-of-the-art
  - Coregistration: an integrated geometric approach
  - Time-series analysis: a preliminary assessment and initial results
  - Digressions on data volume considerations

Presentation Setup [2/2]

- **Sentinel-1 for InSAR based scientific application**
  - Sentinel-1 InSAR quality control: Ideas and plans
  - Landslides
  - Tectonics and volcanoes
  - Non-stationary scenarios: Ice and Glaciers

- **Summary and Final remarks**
  - Interpretation challenges
  - Open questions

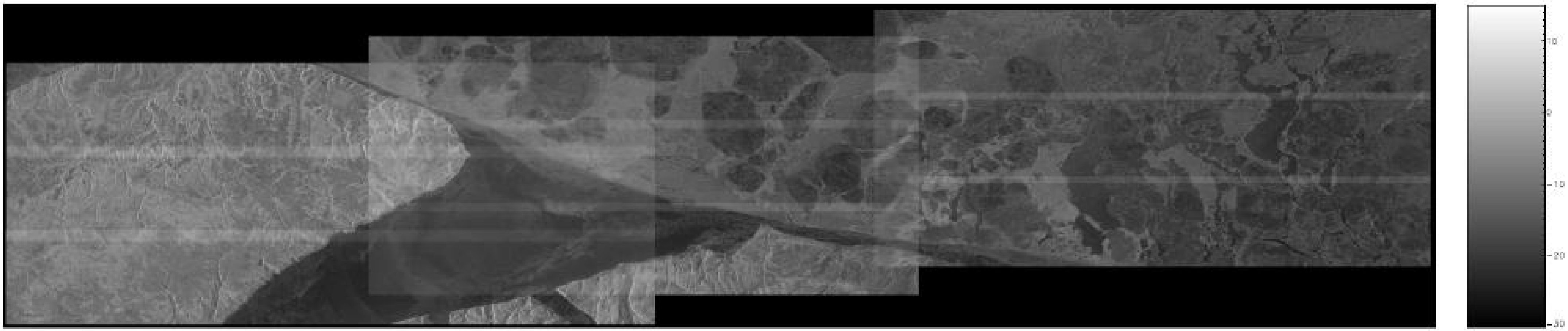
TOPS SAR mode: general terms

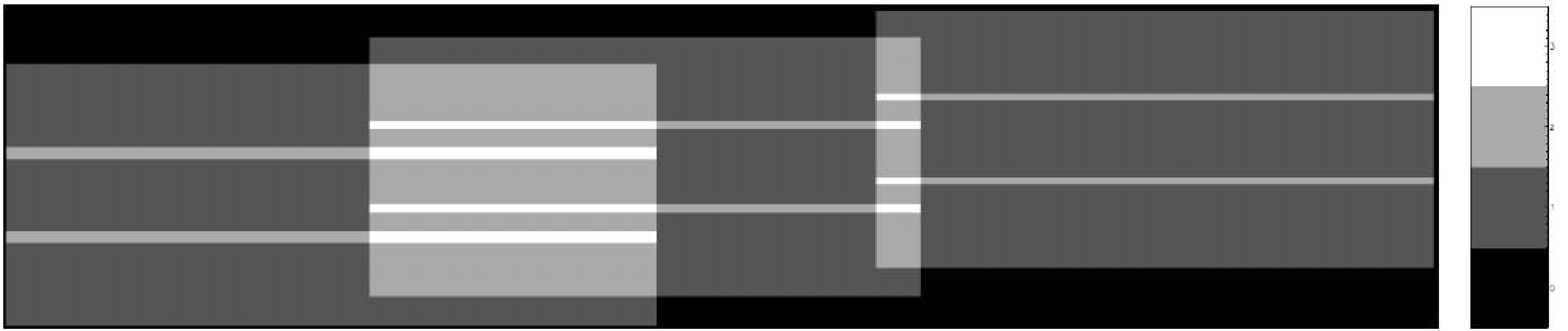


Sketch of the acquisition geometry for a 3-swath TOPS system

“The TOPS is a wide swath mode that has the same coverage and resolution as of the ScanSAR mode, but without scalloping effect”

Bursted nature of TOPS data





Our approach to TOPS InSAR

It's all about knowing how to answer these technical questions/challenges:

- **Doppler sweep**
- **Burst mode**
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- **Doppler sweep → use SpotLight algorithms**
- **Burst mode → how to coregister**
- **Burst mode → when to stitch**
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- **Burst mode → what can be corrected by exploiting the small burst overlap**

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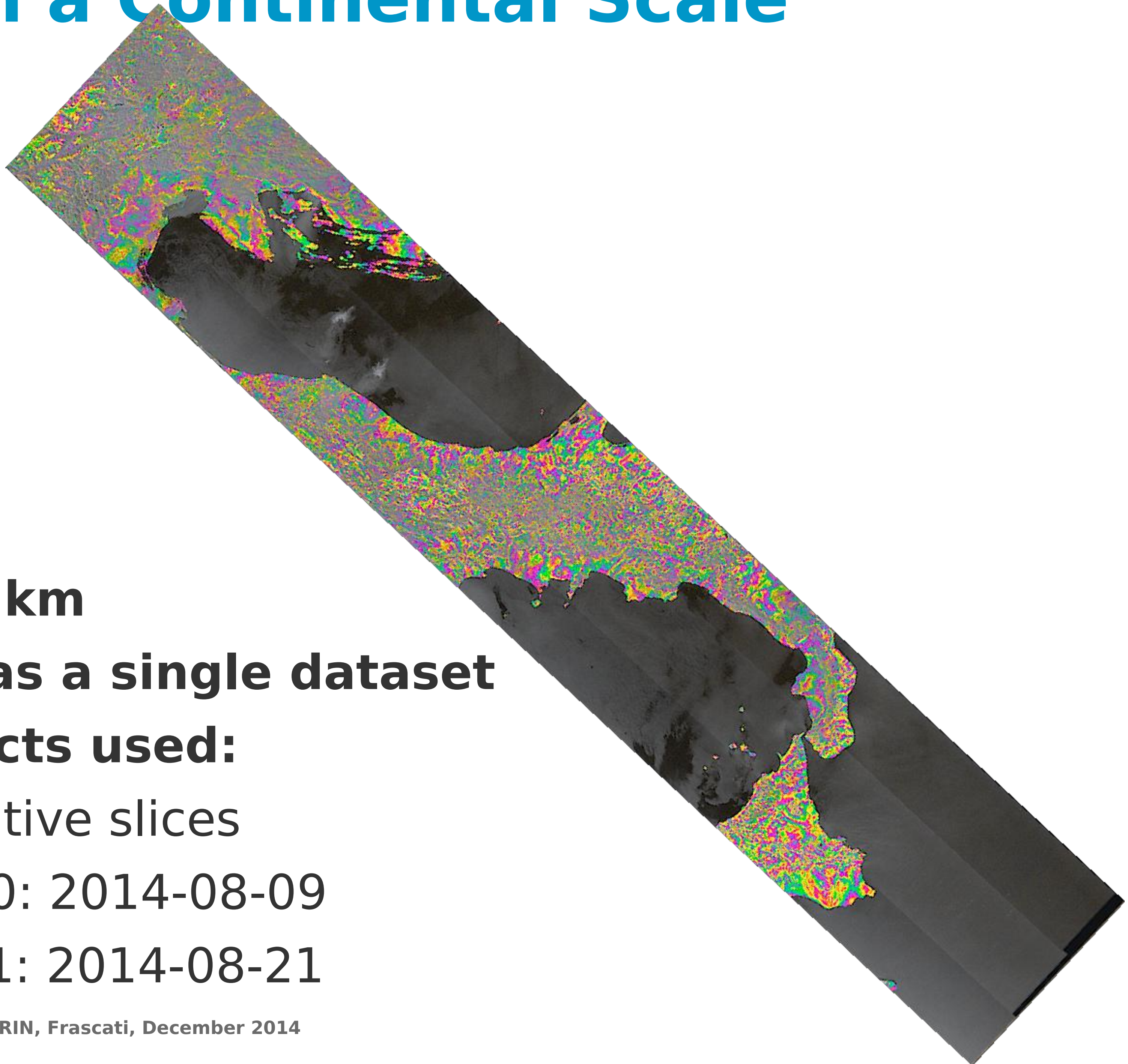
...and how to interpret TOPS InSAR signals:

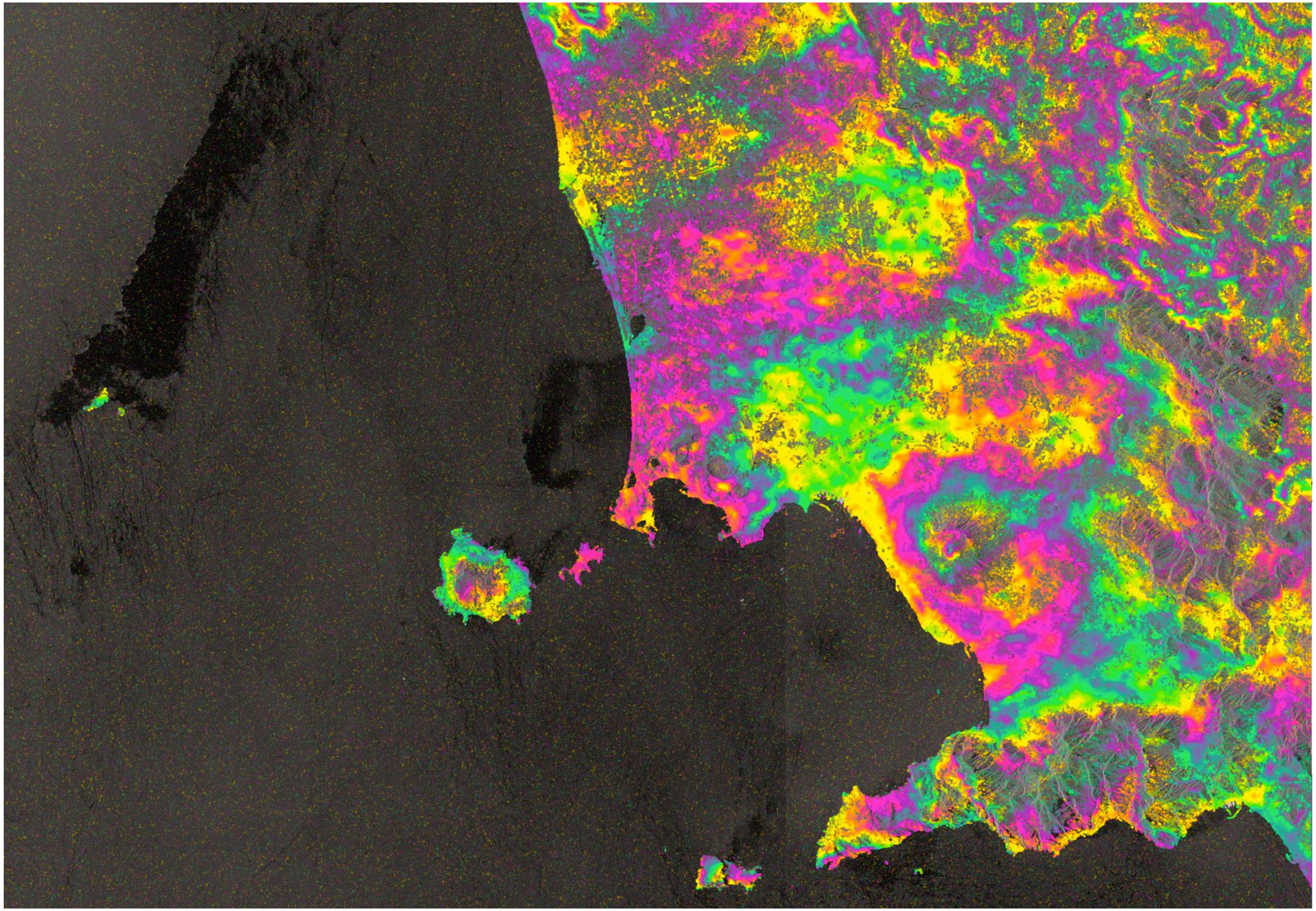
- **XXXX x 250km coherent interferograms**

InSAR on a Continental Scale



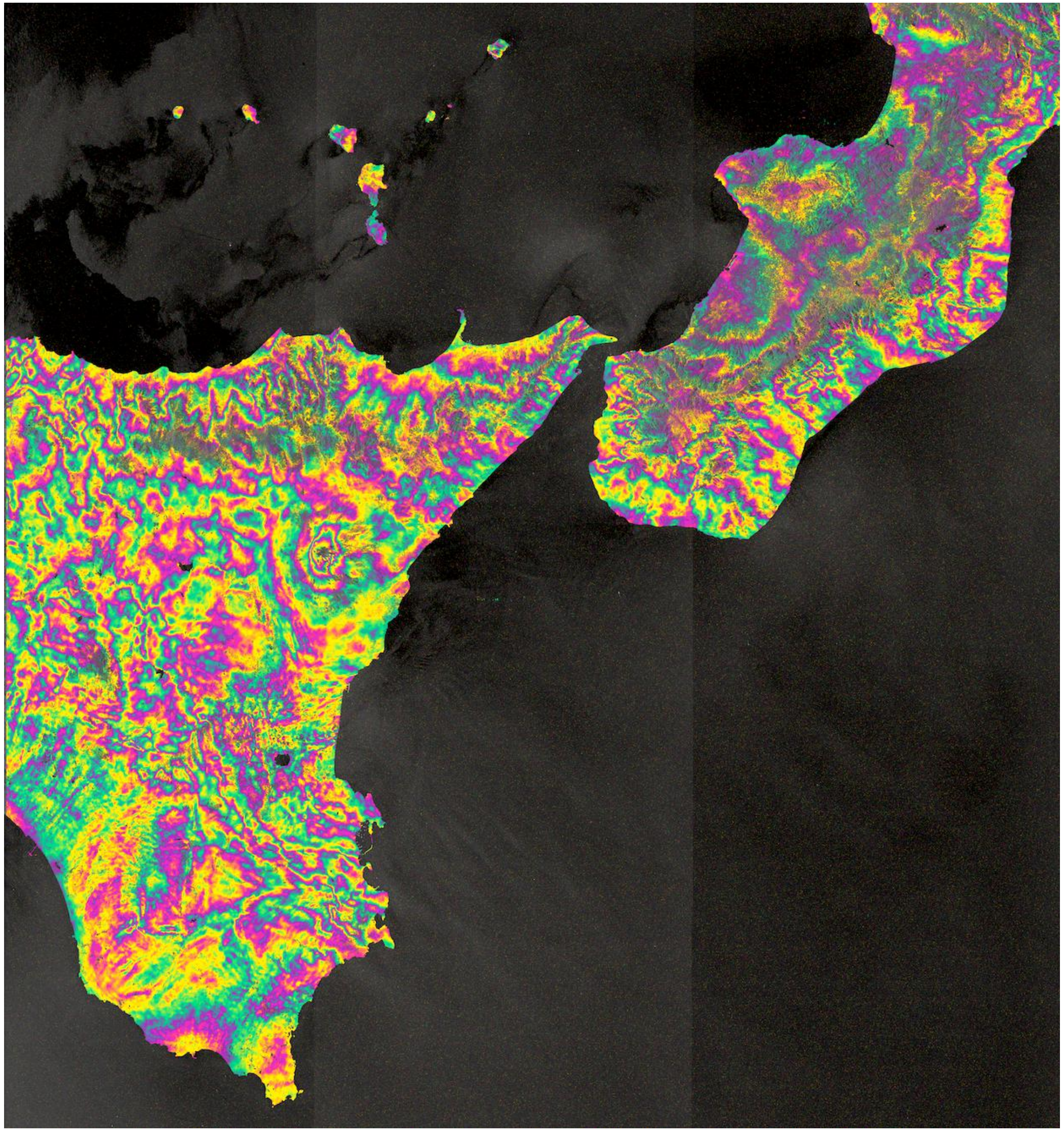
- **1400 x 250 km**
- **Processed as a single dataset**
- **Data products used:**
  - 8 consecutive slices
  - DTID 1C20: 2014-08-09
  - DTID 1FC1: 2014-08-21

Zoom-in to familiar scale



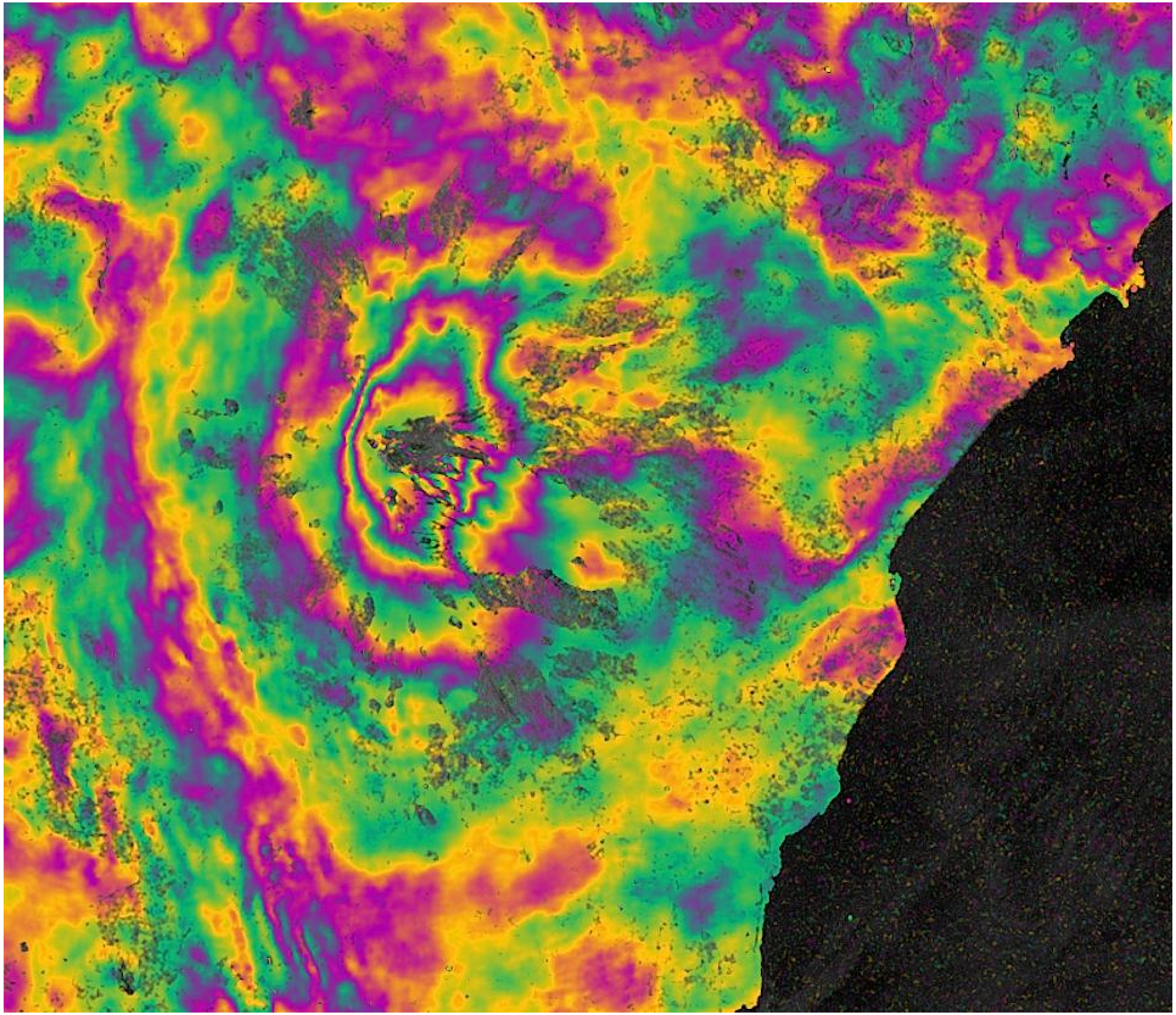
Golfo di Napoli

Zoom-in to familiar scale



Sicily

Zoom-in to familiar scale



Mt. Etna

Scientific Objectives

Grouped into three interlinked themes:

1) Algorithms

2) Quality Control

3) Monitoring Applications

Scientific Objectives: Algorithms

- **End-to-end algorithmic understanding of the complete TOPS InSAR processing chain**
  - Geometric coregistration
  - Nonstationary scenarios
  - Wide-area processing / Stacks of Stacks
  - Improving understanding of APS

- **Full exploitation of view angle diversity**

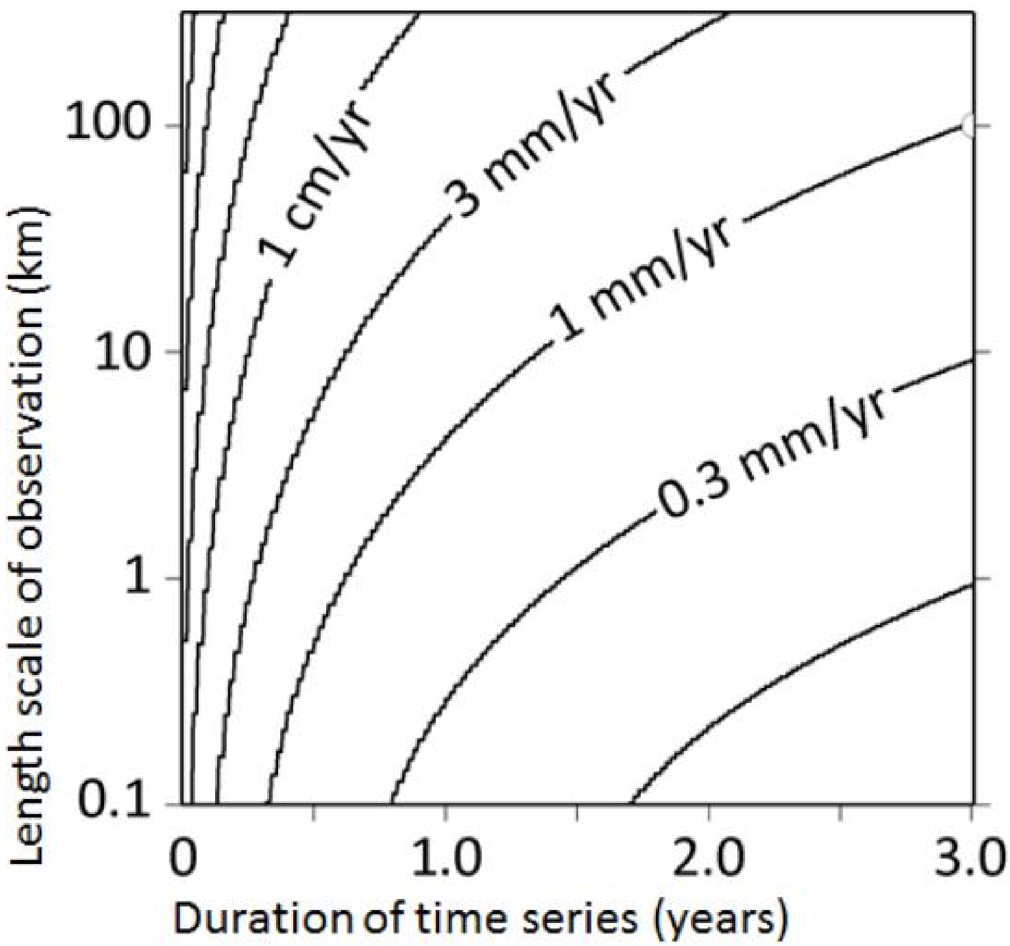
Science Objectives: InSAR QC

- **Estimating an overall quality measure for S-1 TOPS deformation estimates (“error bars”)**
- **Complete geometric and interferometric error model**
- **Data based quality comparison of S-1 TOPS wrt other SAR sensors and conventional in-situ techniques**

Science Objectives: Applications

- Preparing ground for better geophysical models
- Assessing applicability of S-1 InSAR data as an alternative source of information for e.g. constraining numerical weather models (new products?)
- Understanding and addressing data volume related operational challenges

Test Sites: Signal Considerations



[Emardson et al, JGR, 2003].

All sites have **enough deformation** signal to observe by InSAR within the Project time-frame:

- Special case Poland CR sites
- Considerations due to commissioning delays

Of relevance for all sites:

Error in the rate of deformation measured by InSAR time series analysis (PS or SBAS) as a function of the duration of observation and length scale of observation, assuming regular acquisitions every 12 days.

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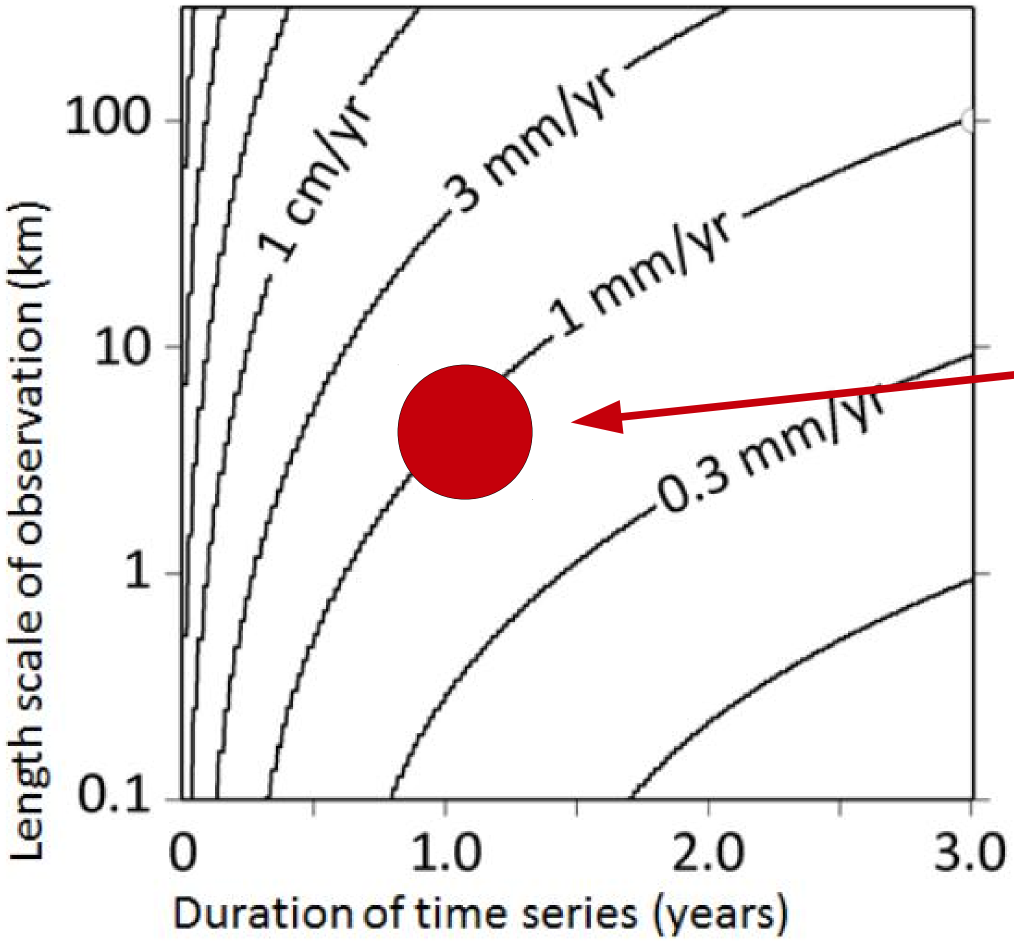

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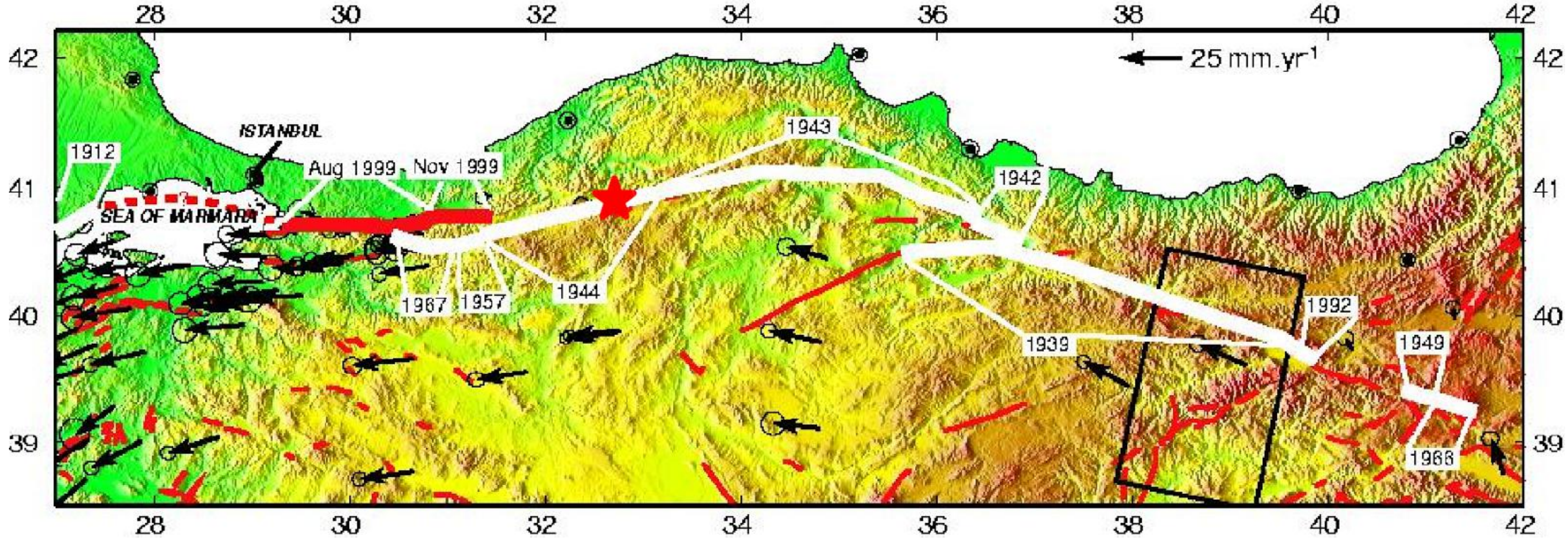
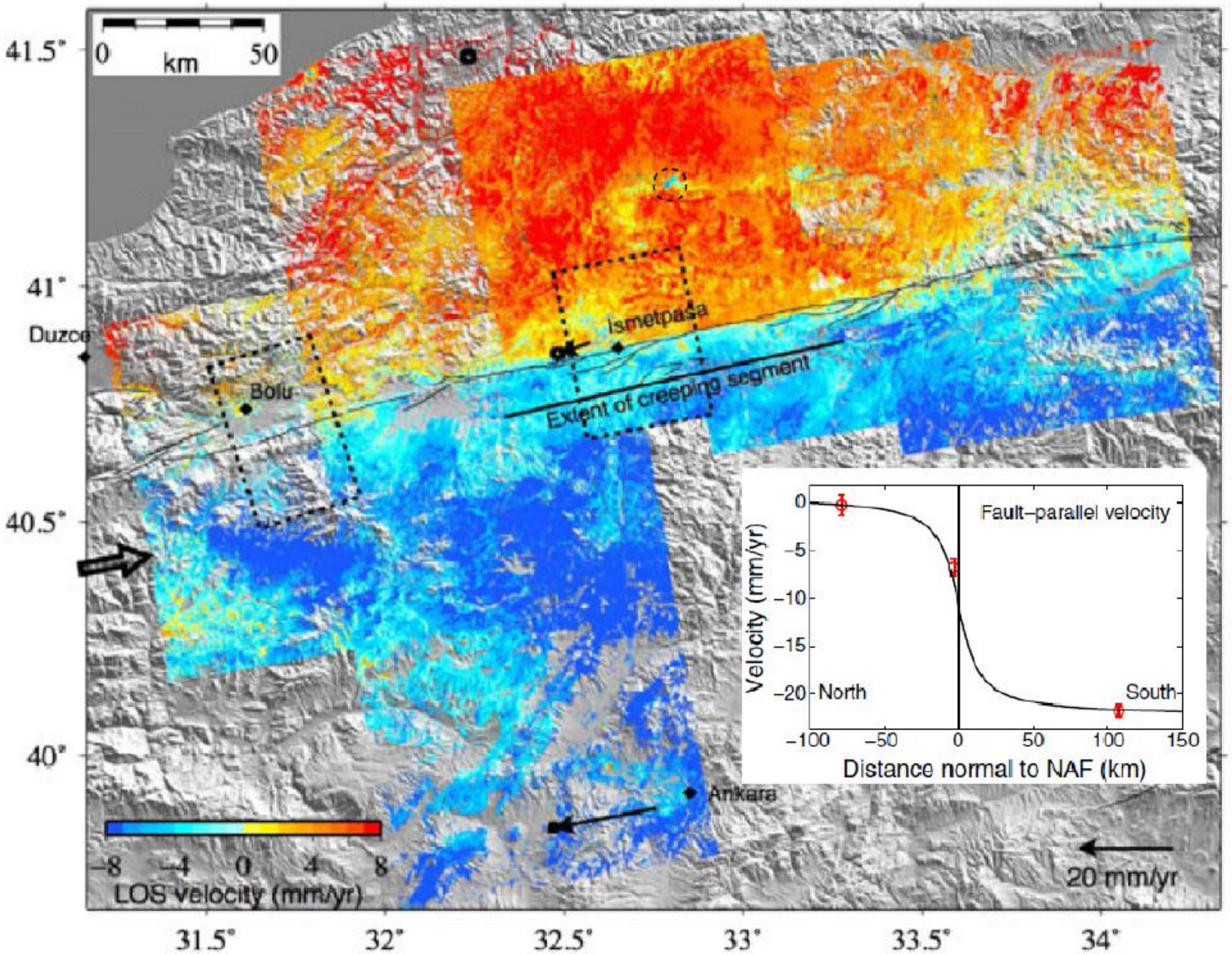


Map of the North Anatolian Fault Zone.
20th century earthquakes are marked. The GPS data show the motion of Anatolia relative to Eurasia. The creeping section at Ismetpasa is marked by the red star.

NAFZ, Turkey



Demonstration of the signal we expect to see

LOS velocity at the tectonic test site in Turkey from ALOS interferometry, after Kaneko et al. [2013]. The sharp discontinuity at the fault will be our primary target in this project.

Corner Reflector Test Sites, PL

Corner Reflector Test Sites, PL

2(+1) test sites:

Each site:

15 TSX CRs
5 S-1/R2 CRs

Systematic consolidation with in-situ and conventional techniques

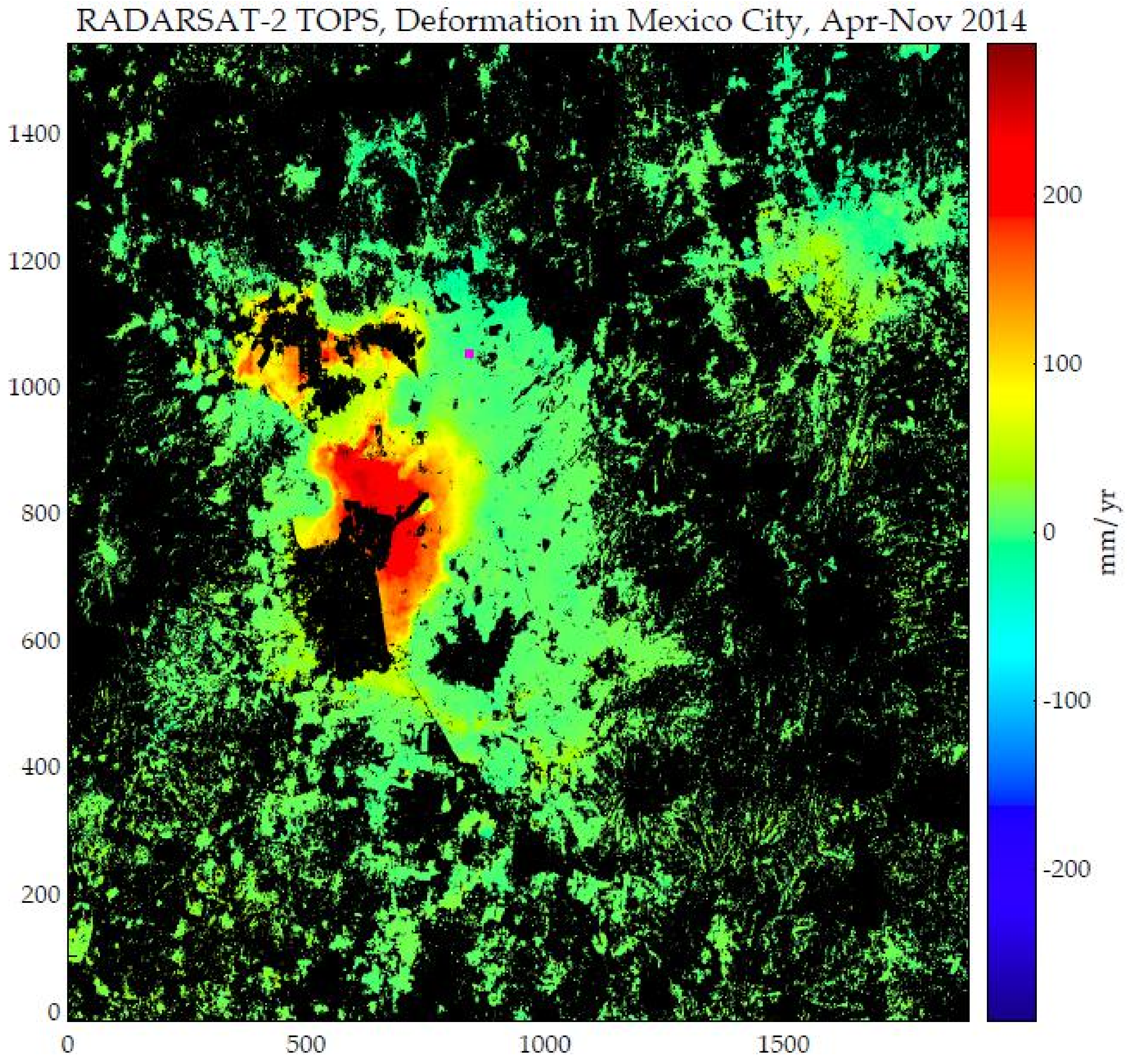
As of mid-July all sites operational

Baseline site for S-1 is ‘Babiak'

Displacement signal to be simulated by controlled CR movement.

Nordnes, Norway

Urban subsidence: Mexico City



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