

# ***Measuring rifting processes in Iceland between 1957-2002 from combinations of different optical datasets***

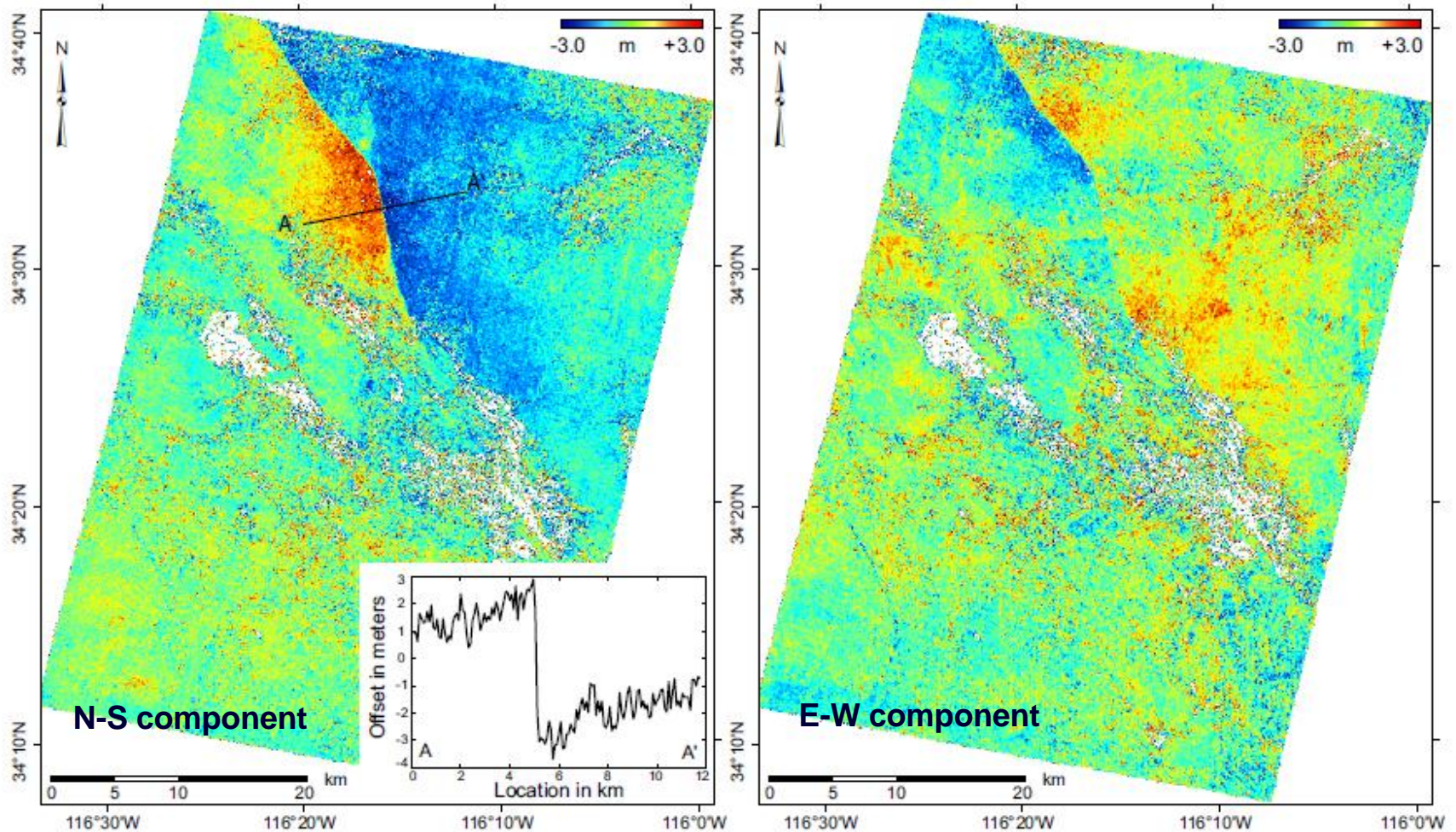
1. Introduction
2. Tectonics of NE Iceland
3. 1975-1984 Krafla rifting crisis  
*(constraints from spy image matching)*
4. 1975-1984 Krafla rifting crisis  
*(constraints from aerial photos)*
5. Conclusions



***James Hollingsworth, Sebastien Leprince,  
Francois Ayoub and Jean-Philippe Avouac***

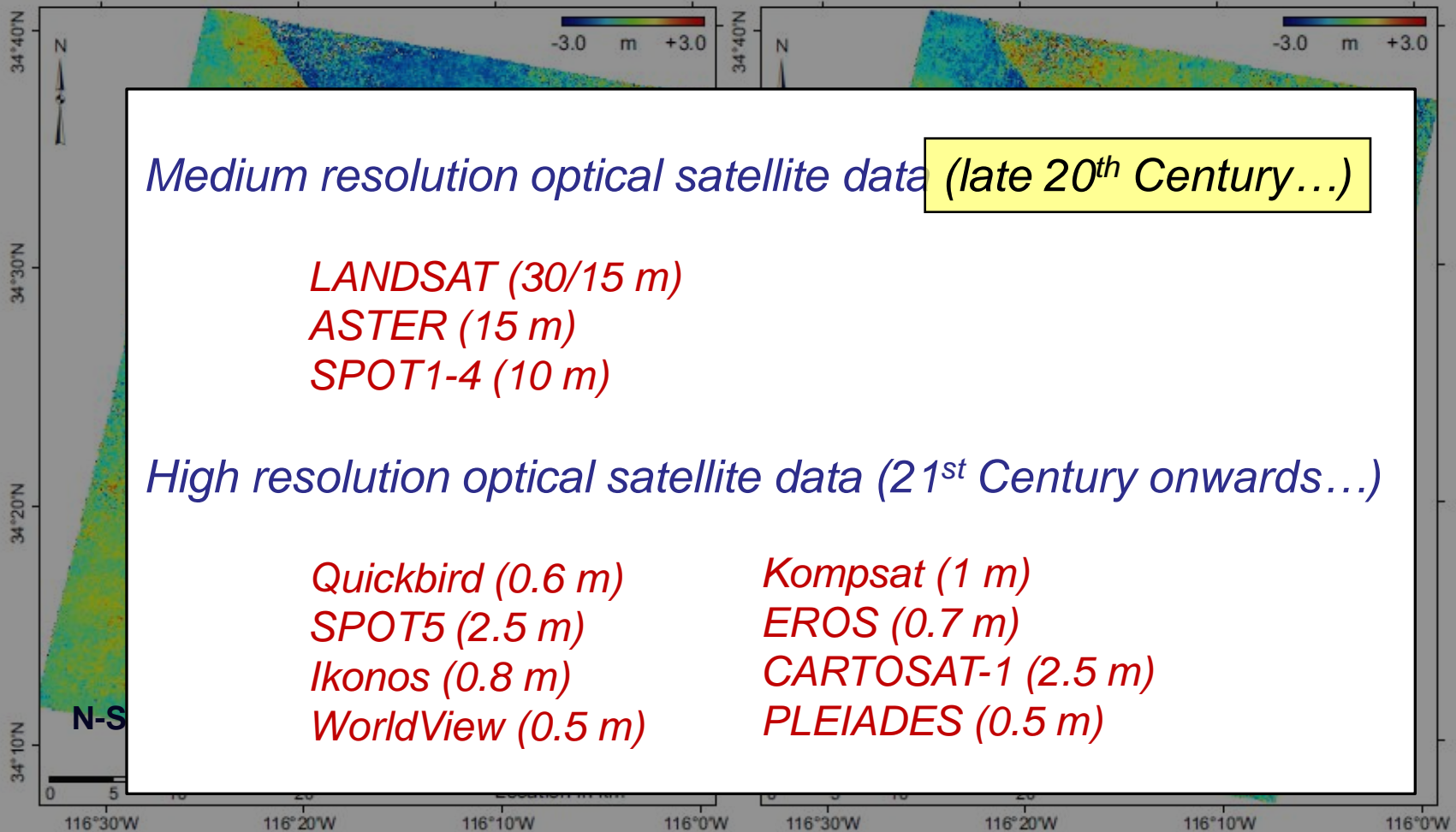


# The 1999 Mw 7.1 Hector Mine Earthquake



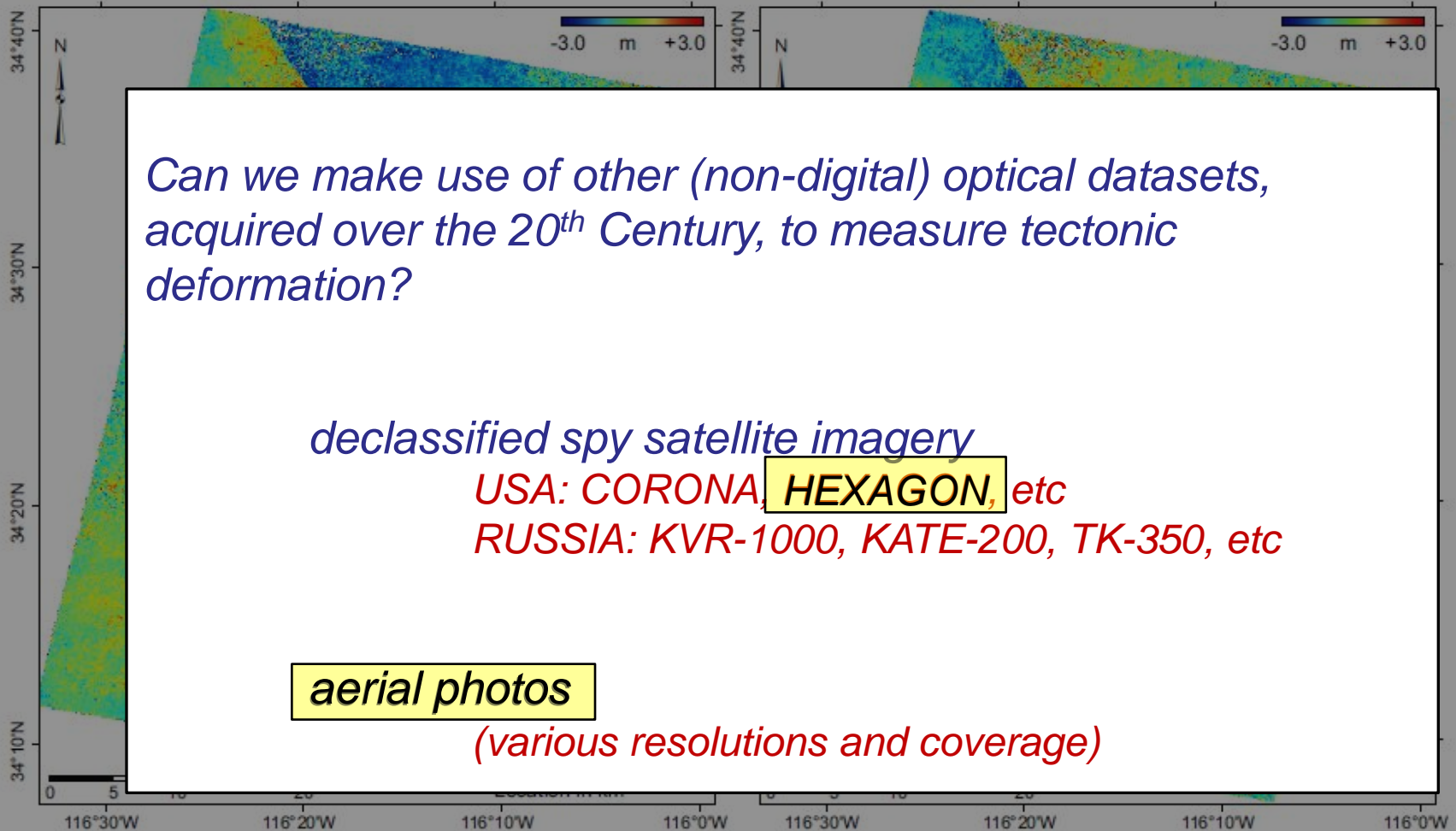
The Hector Mine horizontal coseismic field (NS and EW) derived from 10m SPOT4 1998 and 10m SPOT2 2000 images.

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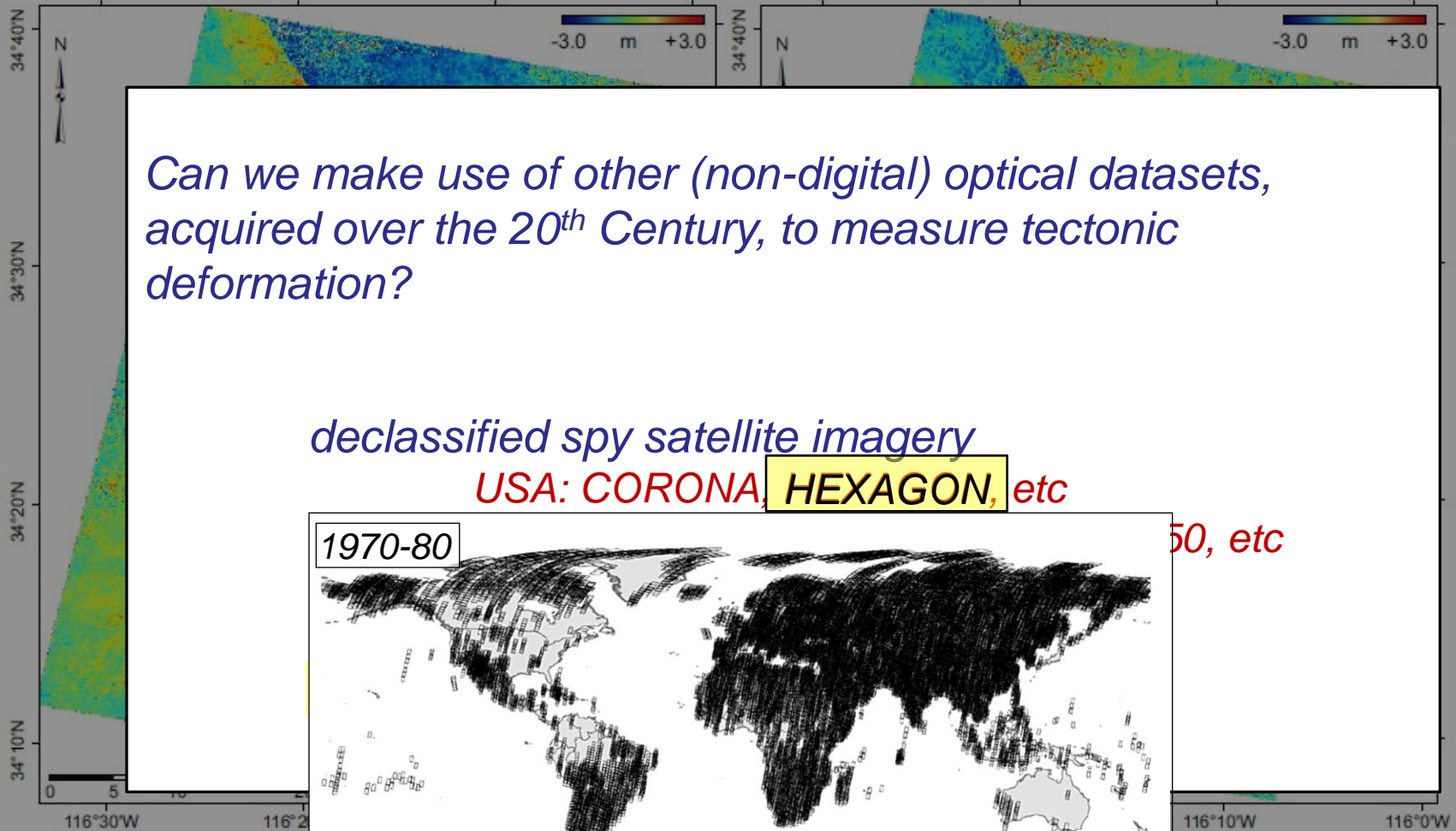
The Hector Mine horizontal coseismic field (NS and EW) derived from 10m SPOT4 1998 and 10m SPOT2 2000 images.

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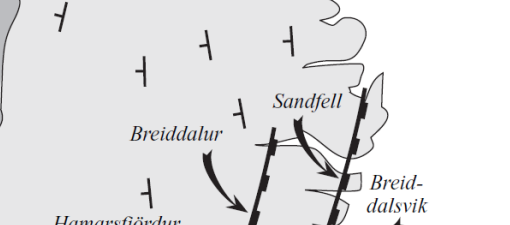
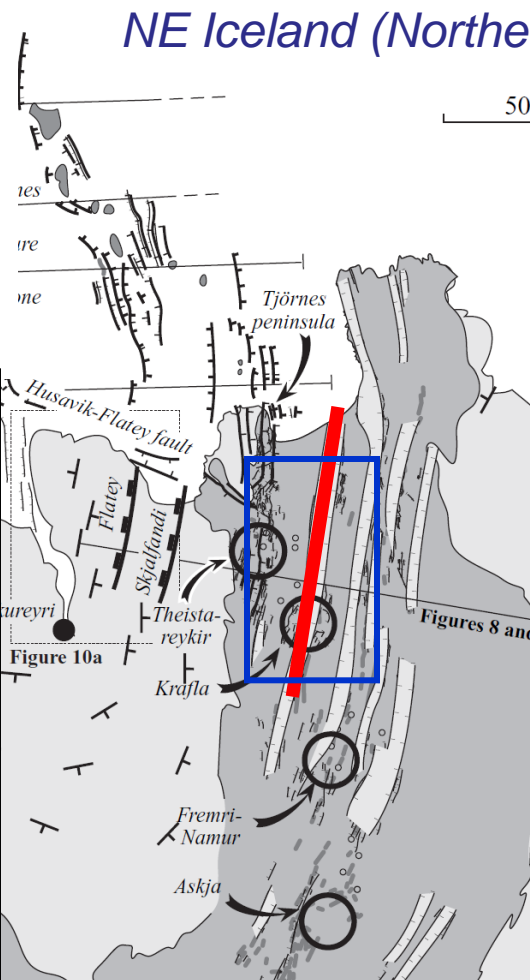
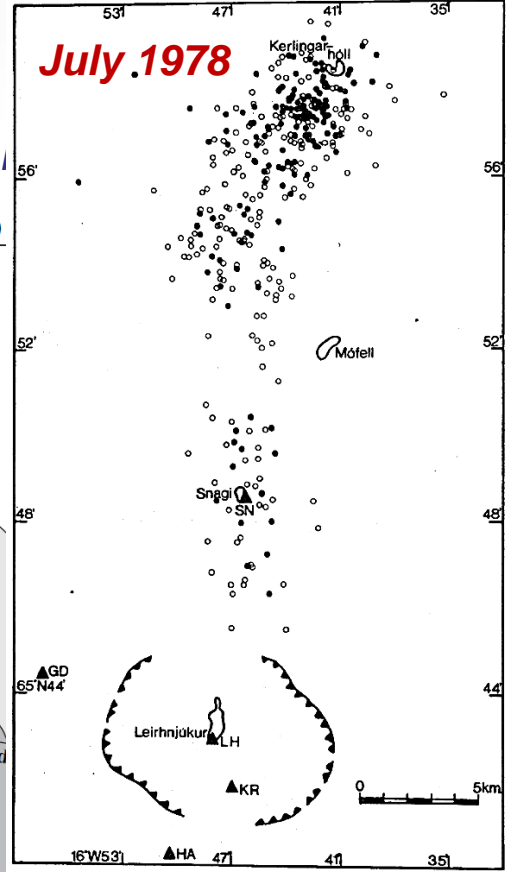
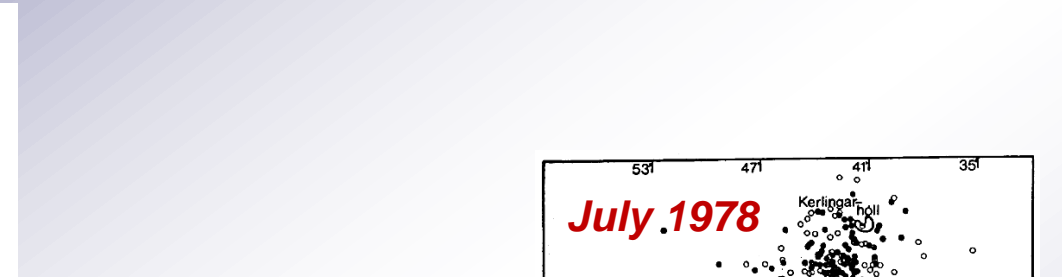
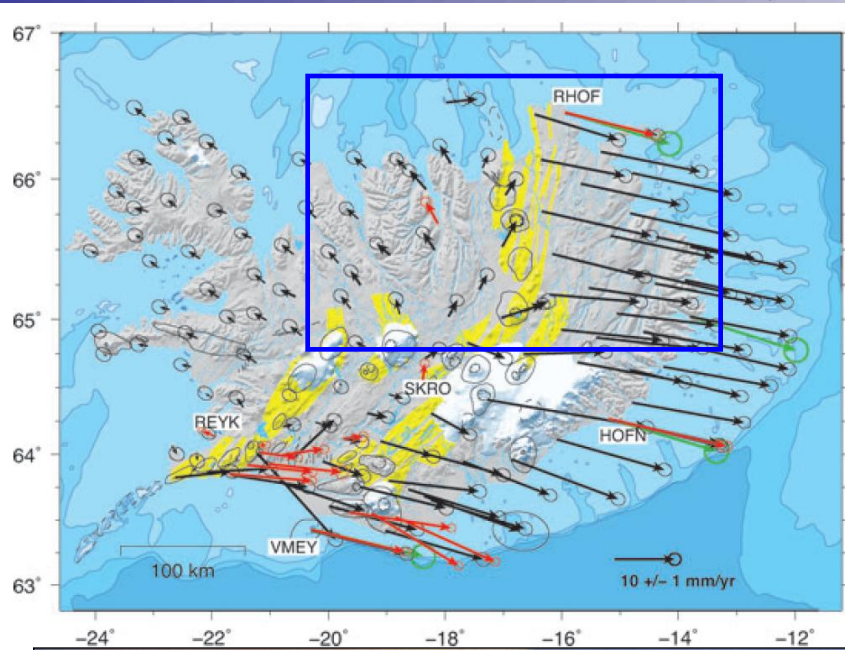
The Hector Mine

SPOT4 1998 and 10m SPOT2 2000 images.

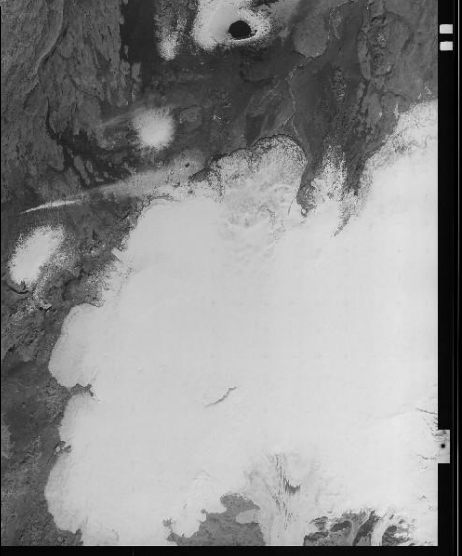
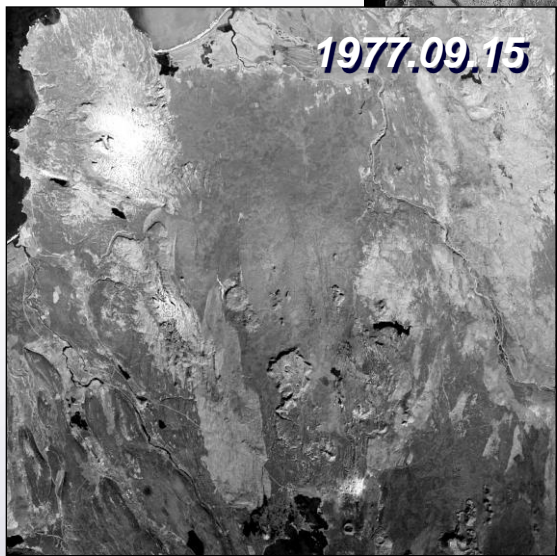
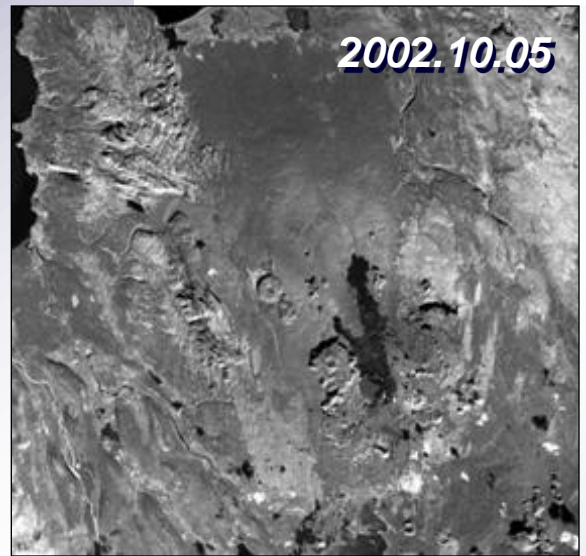
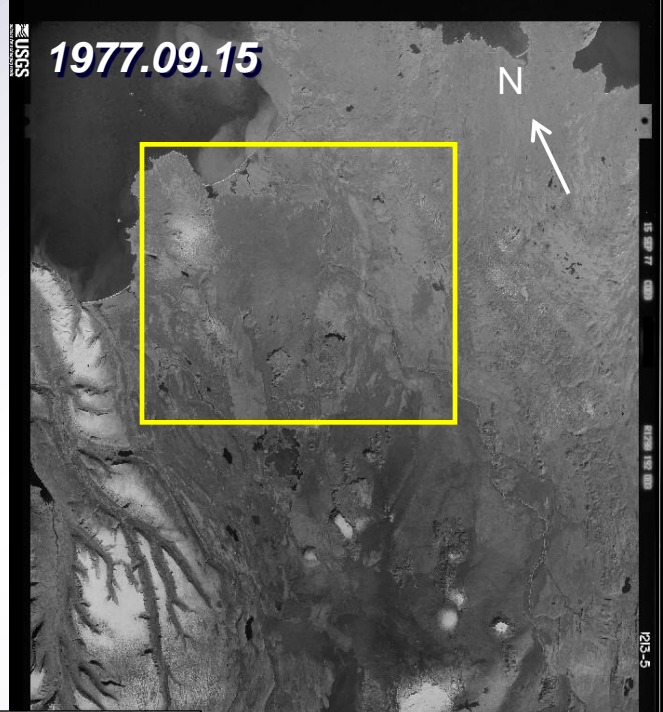
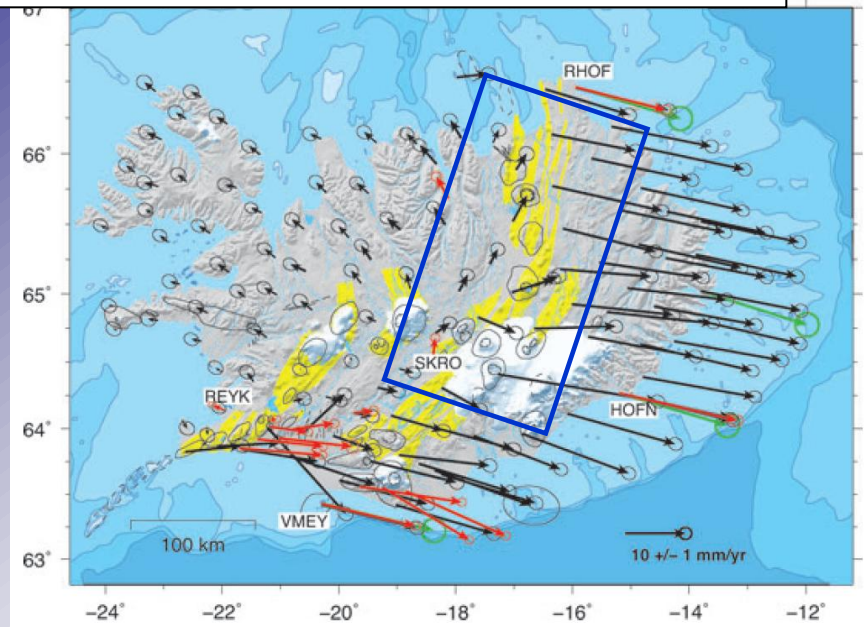
ed from 10m

• Plate Spreading rate = 20 mm/yr

Extension in the Krafla rift crisis (1975-84):

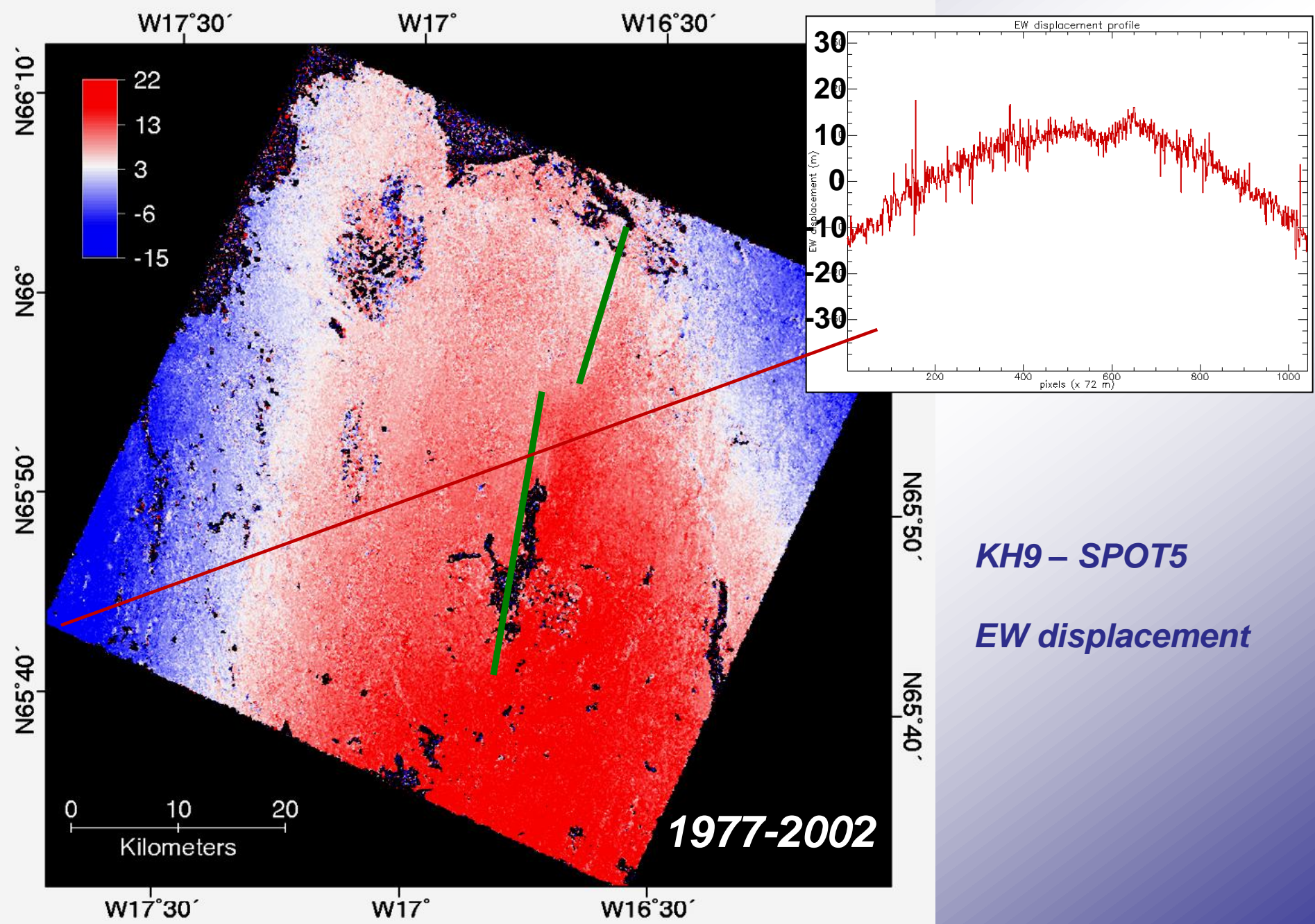


# Extension in the Krafla rift crisis (1975-84):



SPOT5 (2.5 m)  
PUSHBROOM SENSOR

KH-9 Hexagon (9 m)  
FRAME CAMERA SYSTEM



1. Introduction

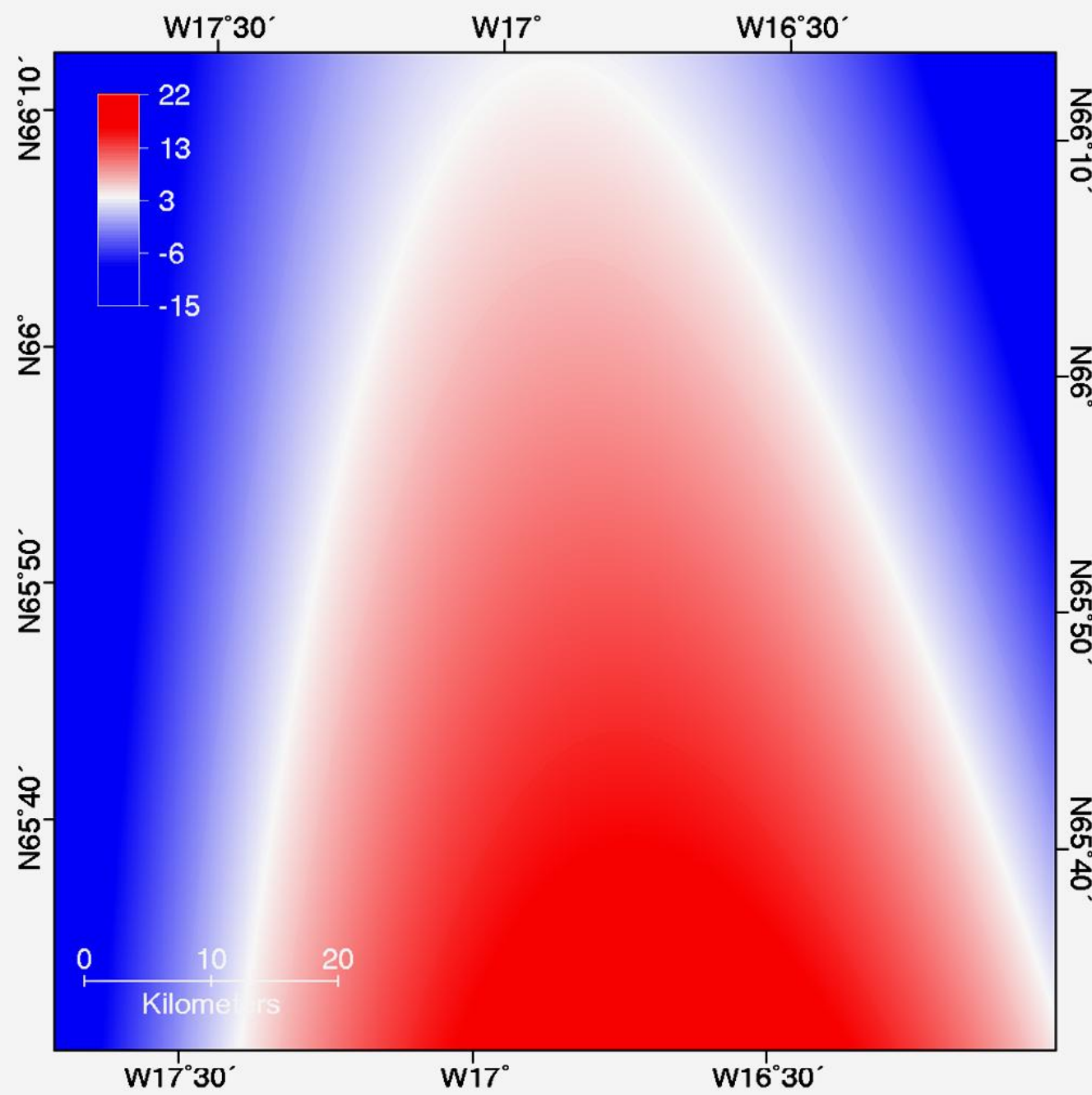
2. Iceland tectonics

3. Krafla - KH9/SPOT

4. Krafla - airphotos

5. Conclusions

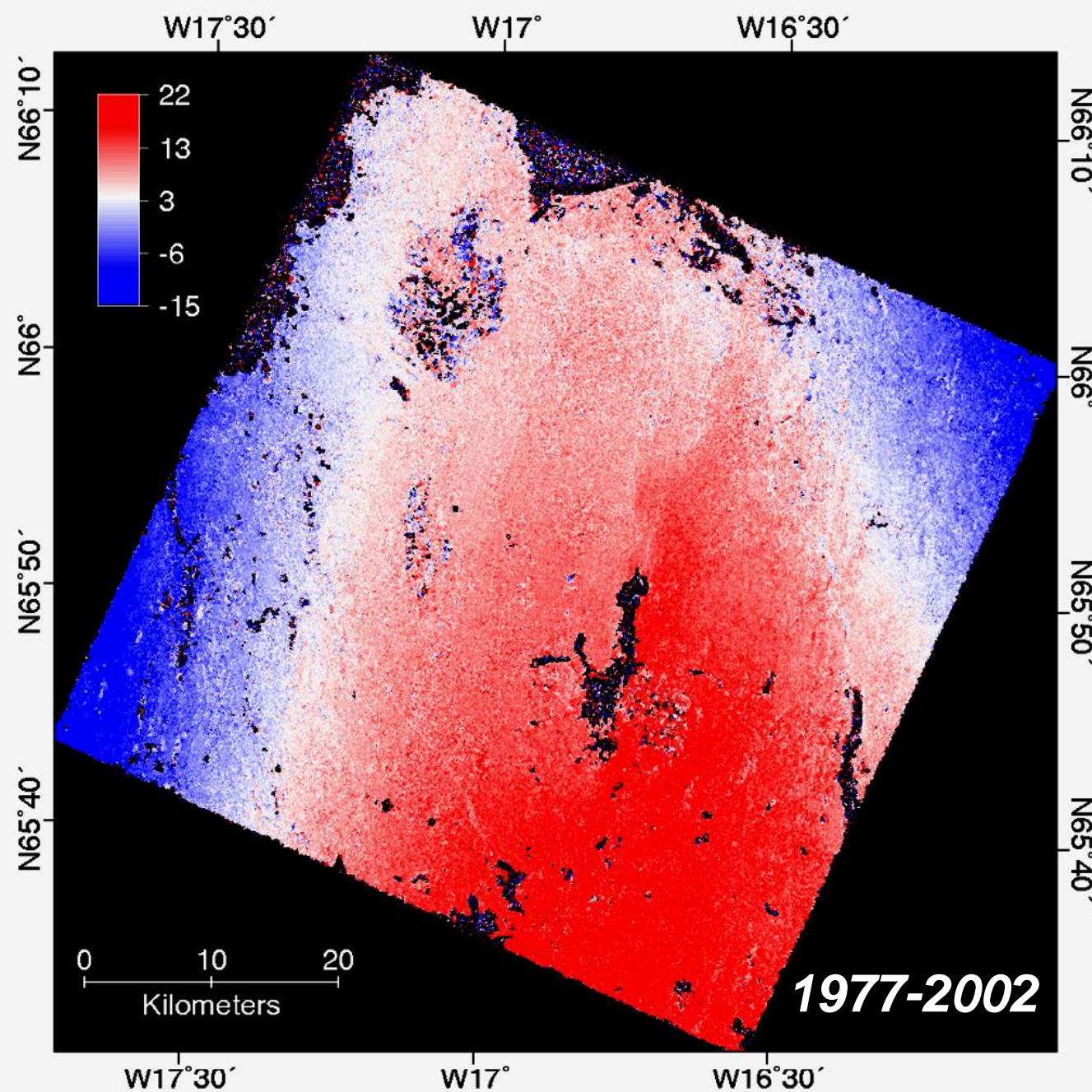




Best fitting  
2<sup>nd</sup> order polynomial

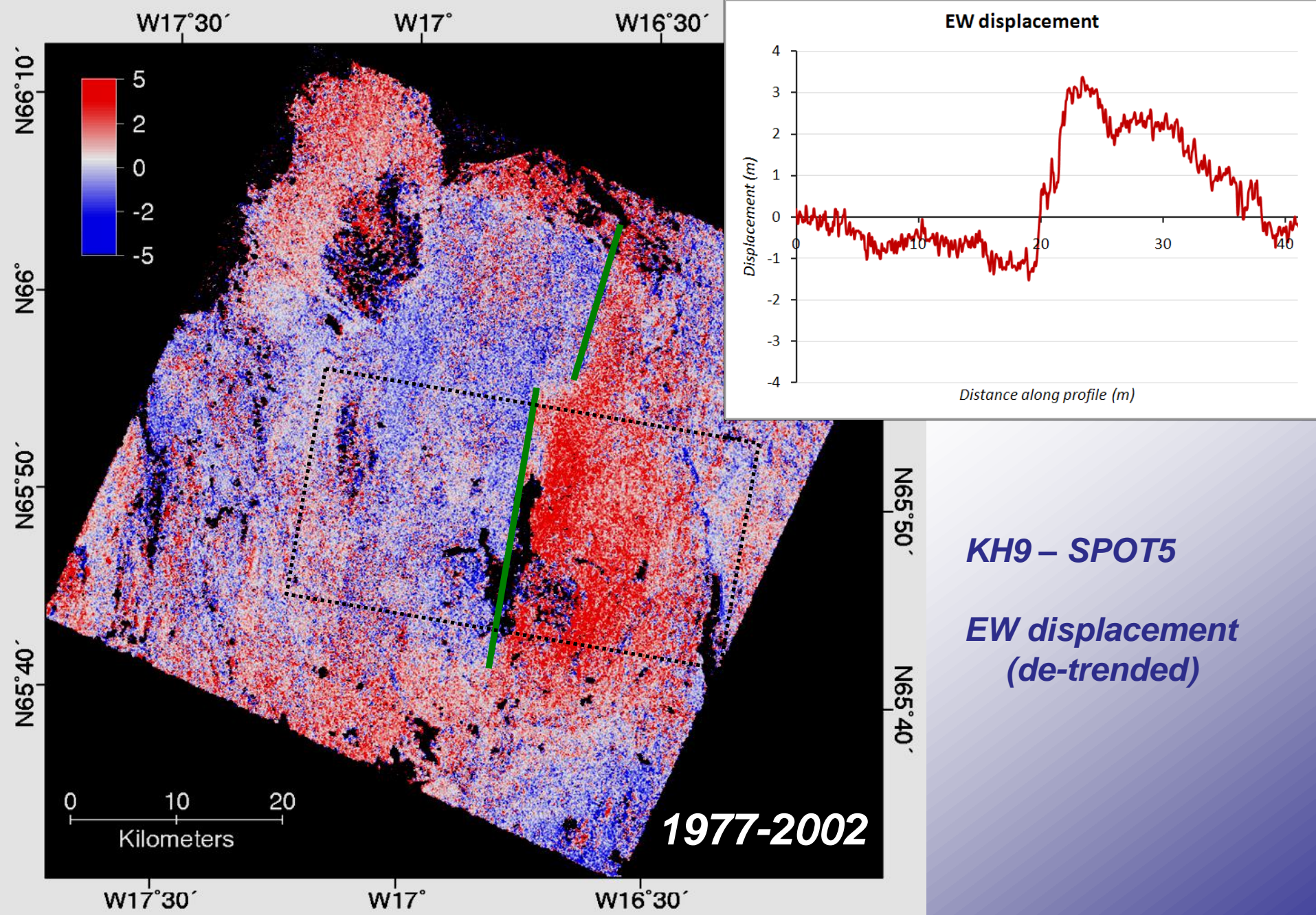
coefficients =

-8.02e-005  
9.15e-007  
1.59e-005  
8.74e-002  
4.62e-003  
-2.05e+001



*KH9 – SPOT5*

*EW displacement*



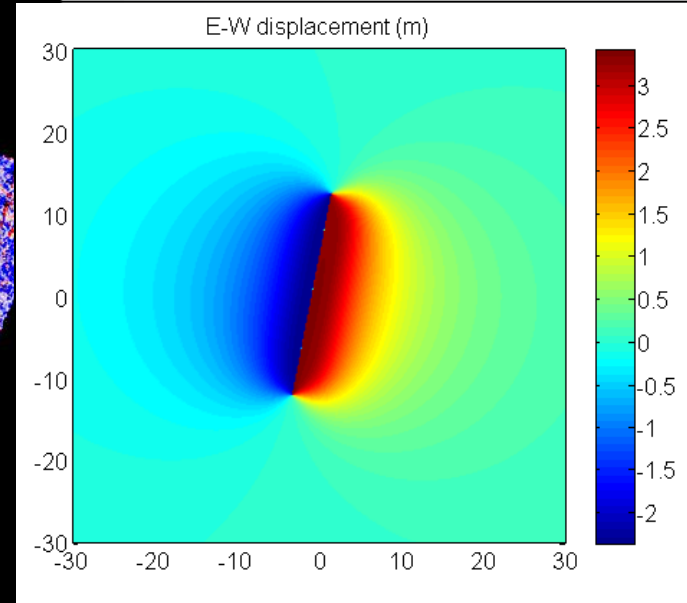
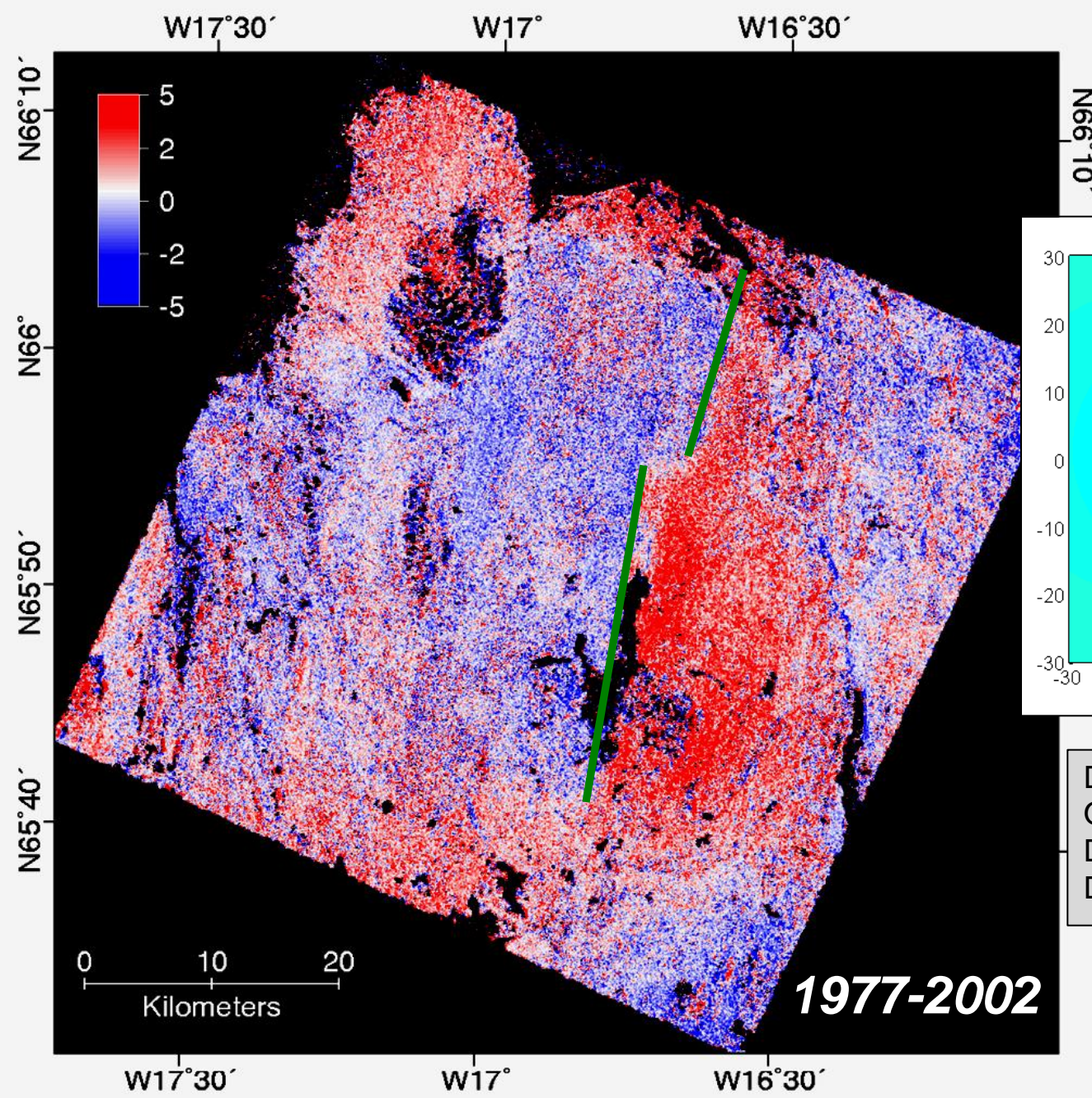
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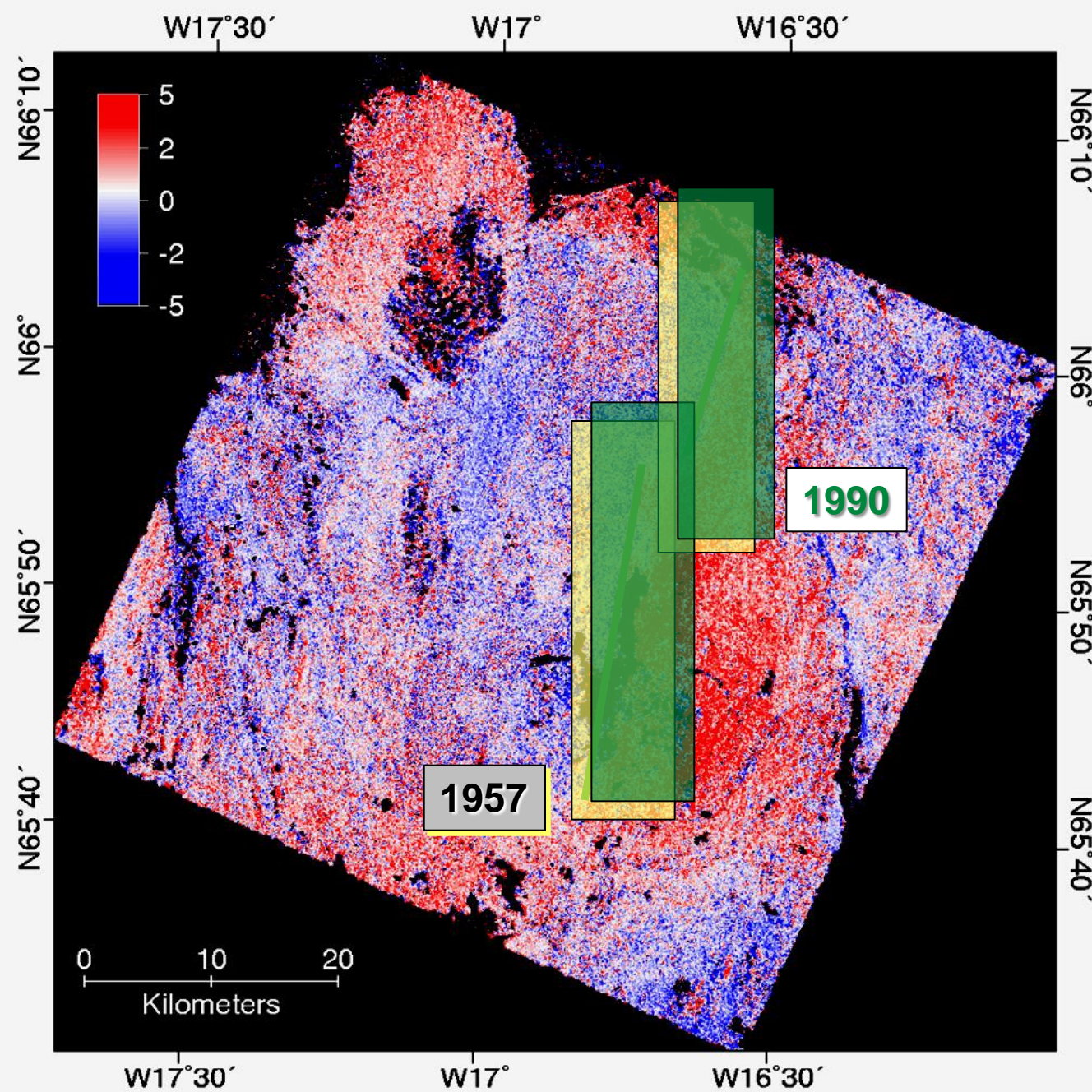
3. Krafla - KH9/SPOT

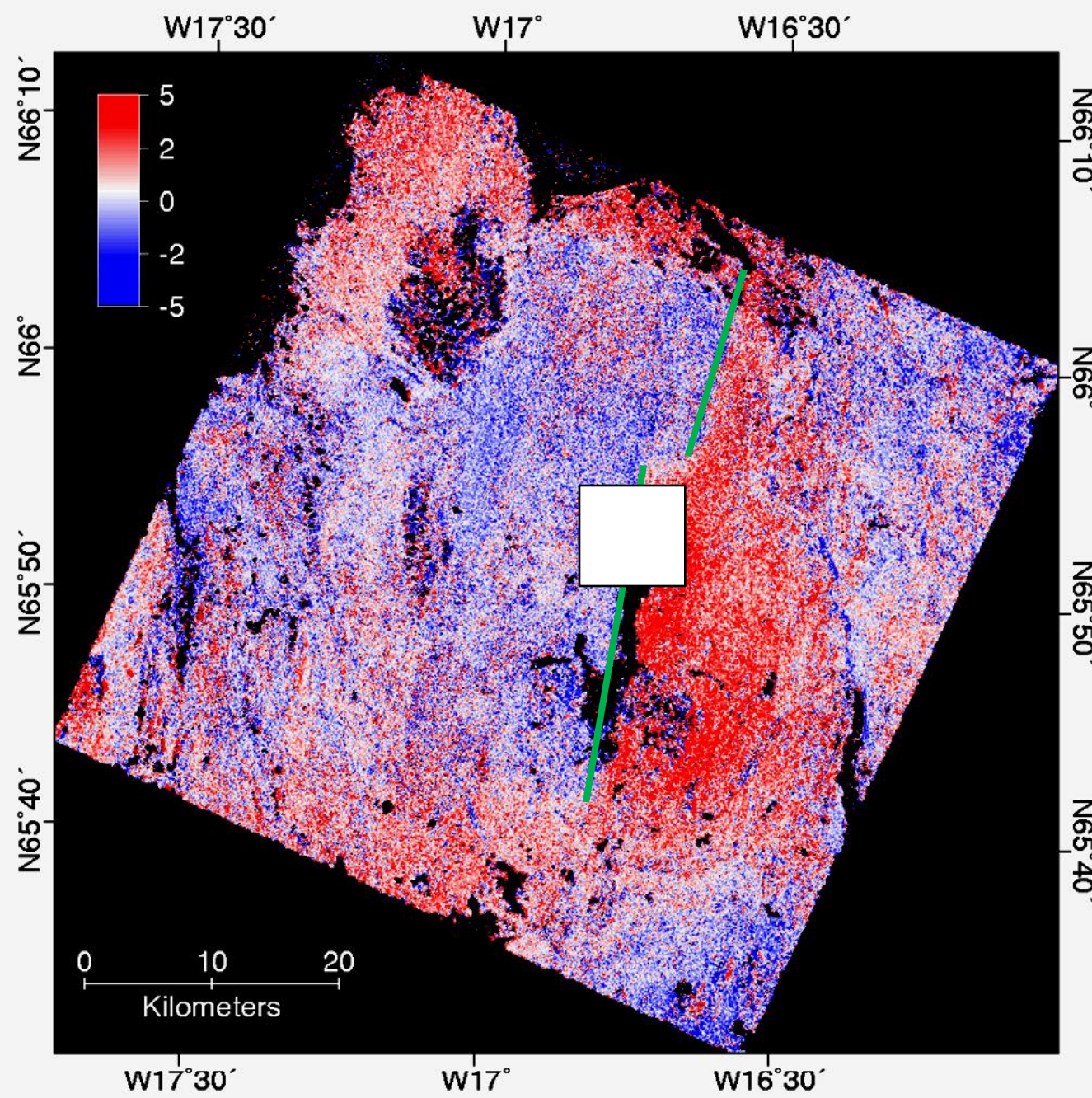
4. Krafla - airphotos

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Dip = 75°, length = 25 km  
 Opening = 6 m, strike = 011°  
 Depth to dike top = 0.3 km  
 Depth to dike bottom = 3.5 km

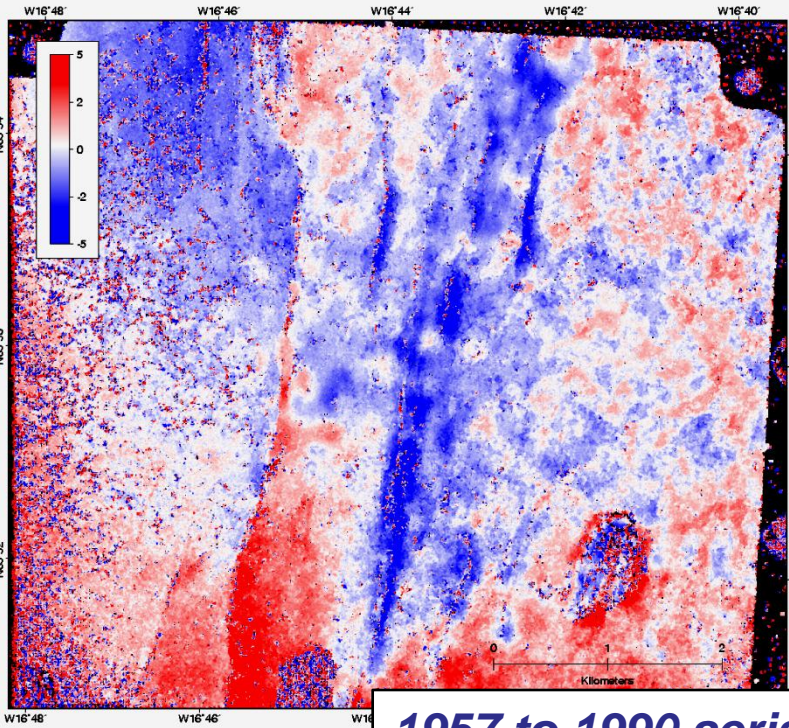




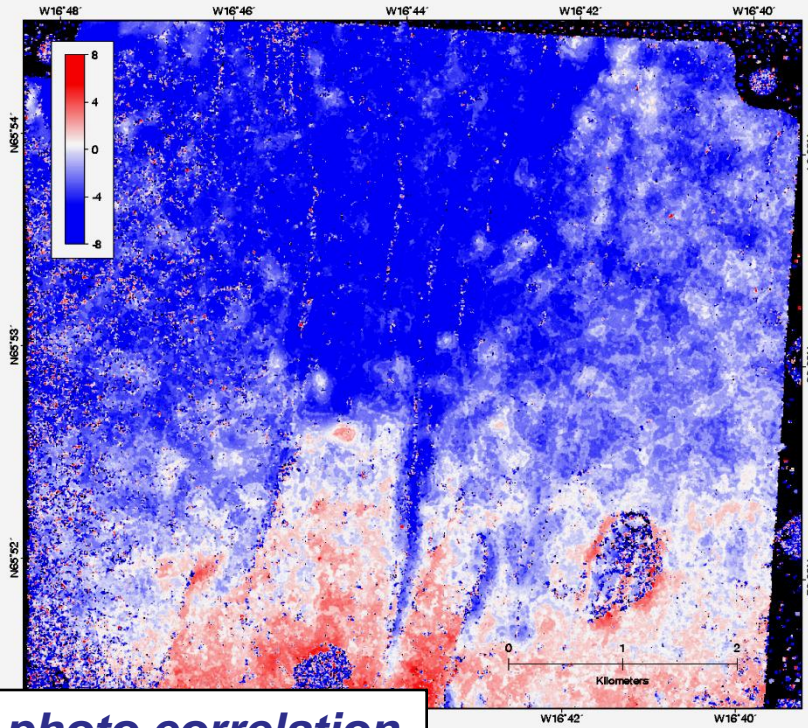
**1957-1990 aerial  
Photo correlation**

**(to obtain the total EW  
extension, and see  
which faults and  
fissures it occurred on)**

EW



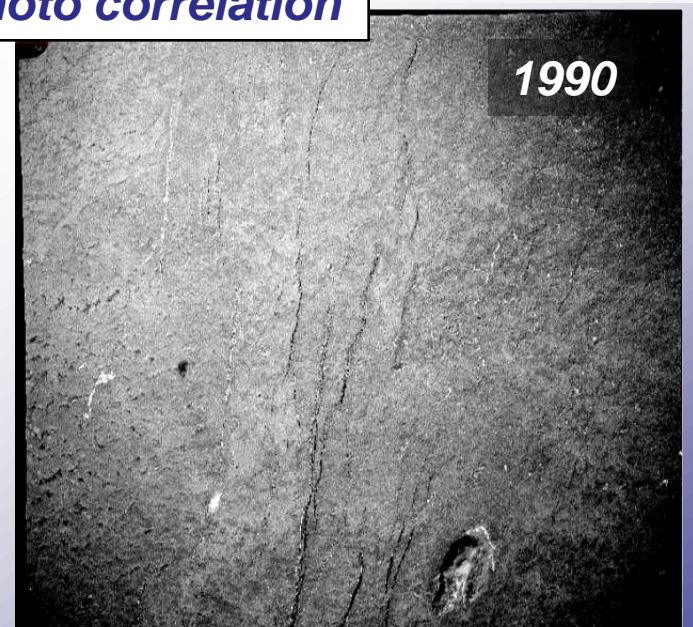
NS



**1957 to 1990 aerial photo correlation**



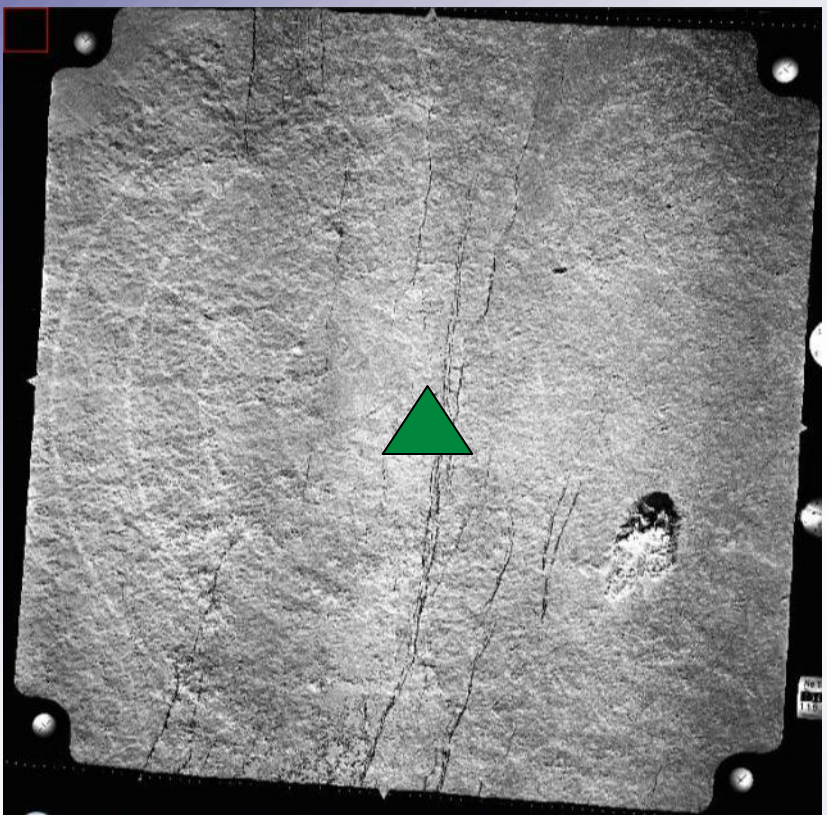
1957



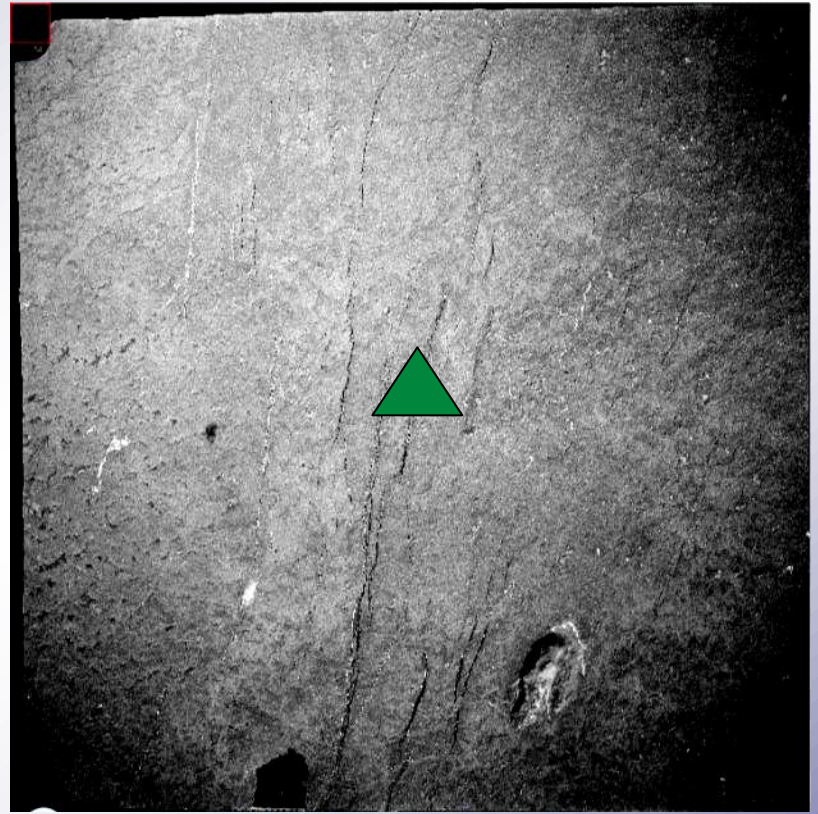
1990

*Extension in the Krafla rift crisis from aerial photos (1957-1990):*

1957



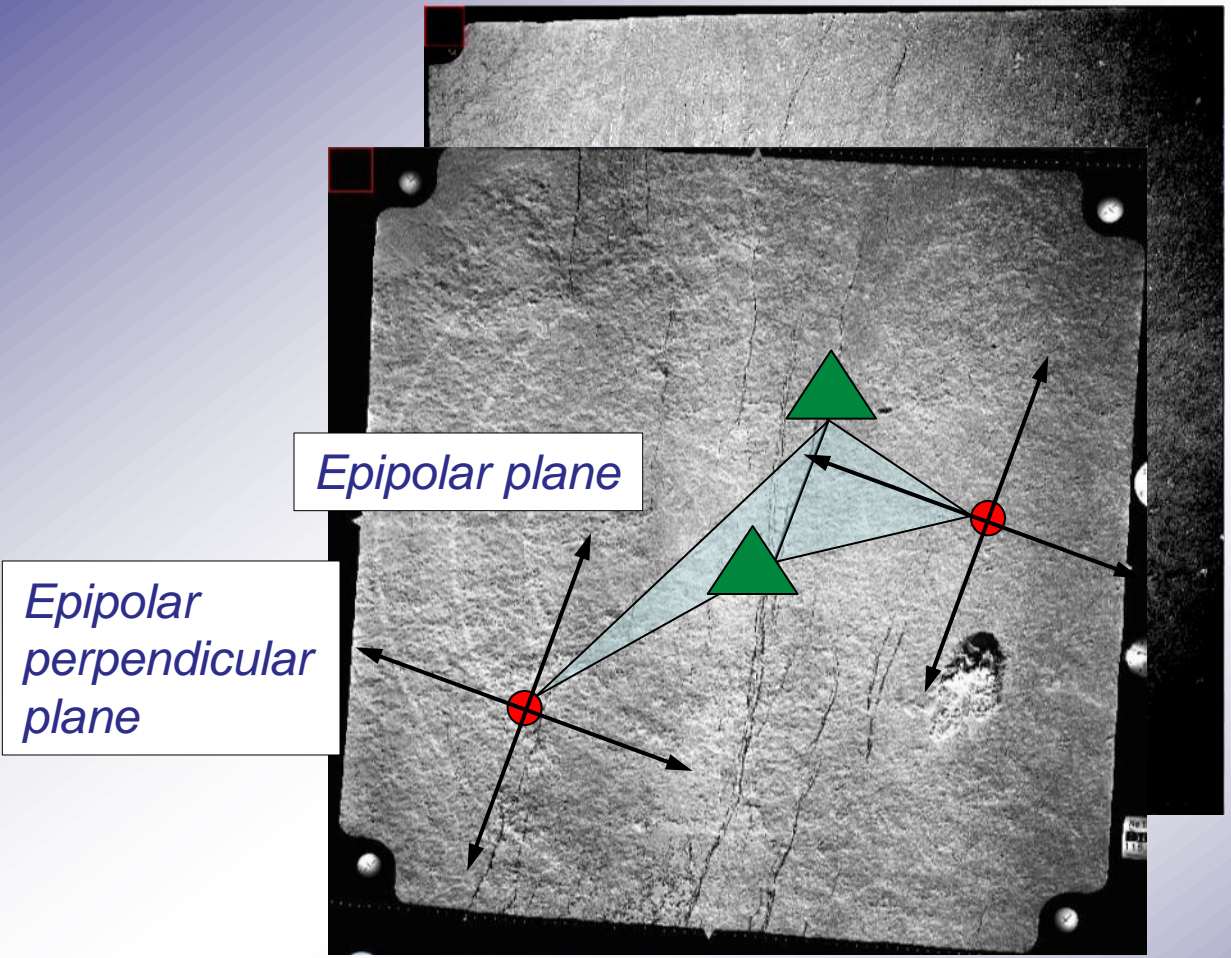
1990

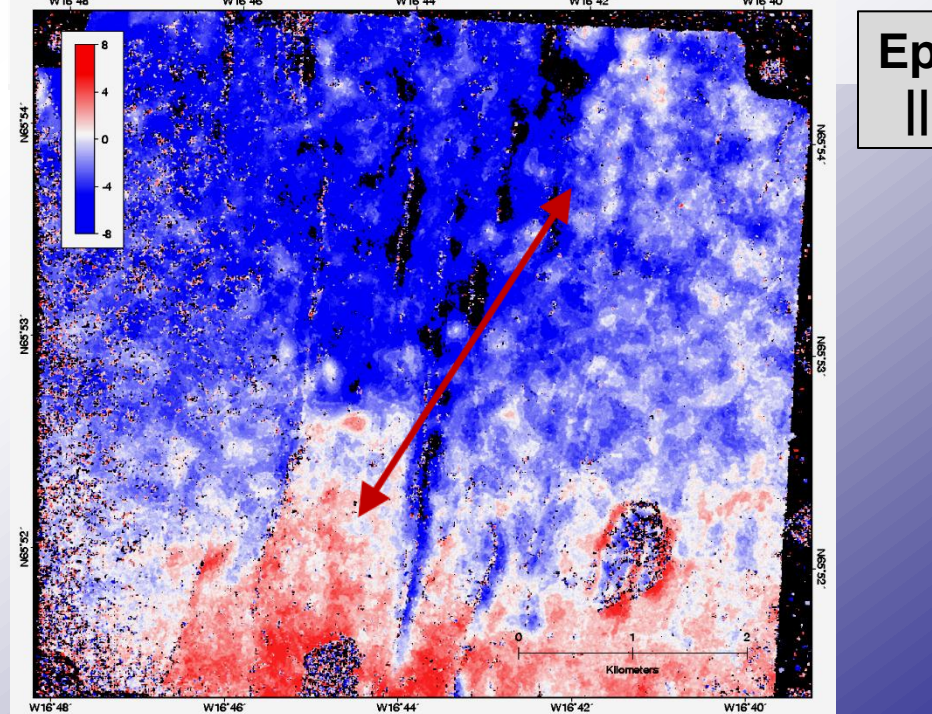
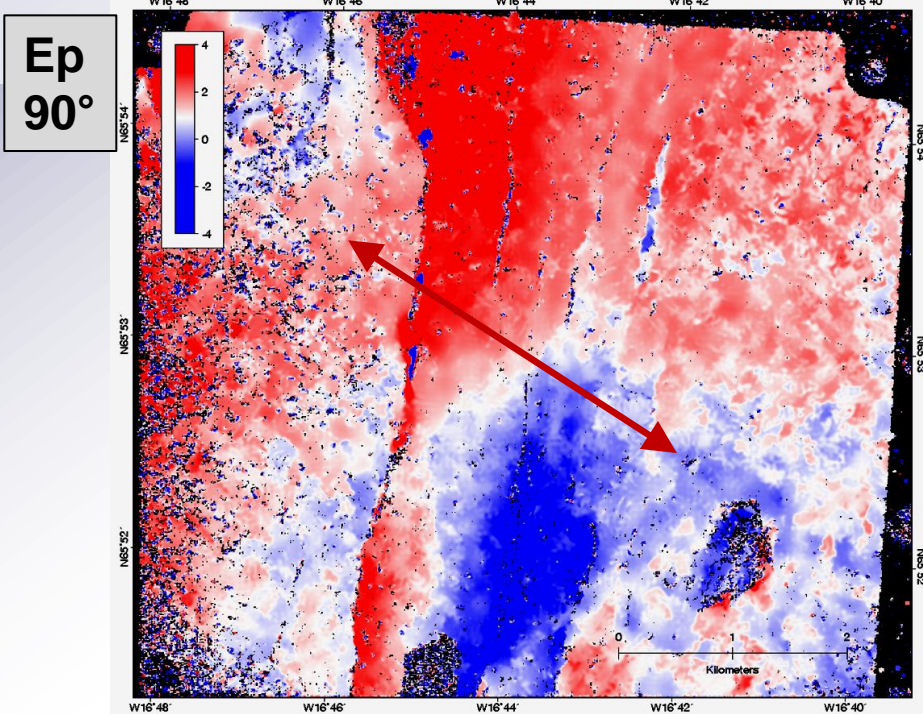
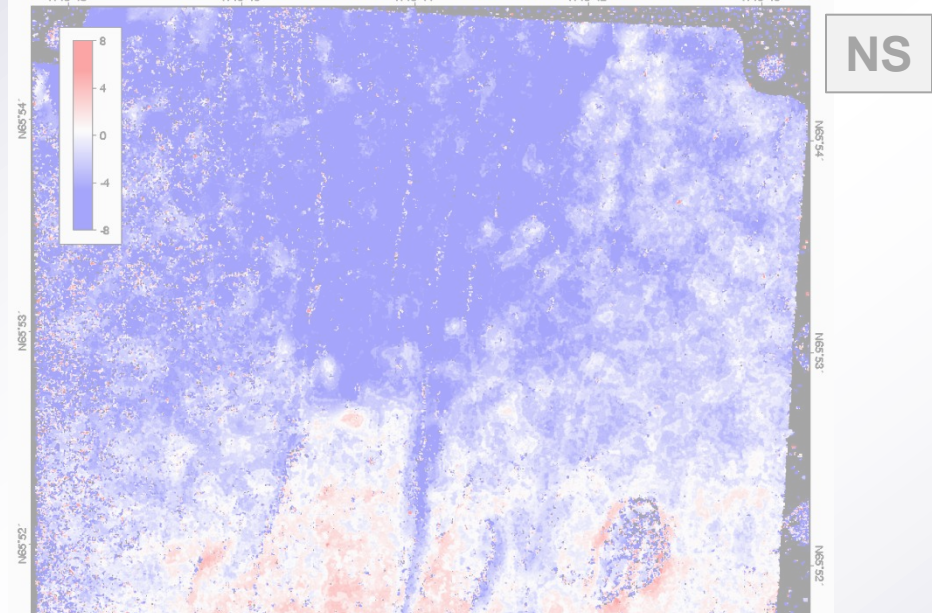
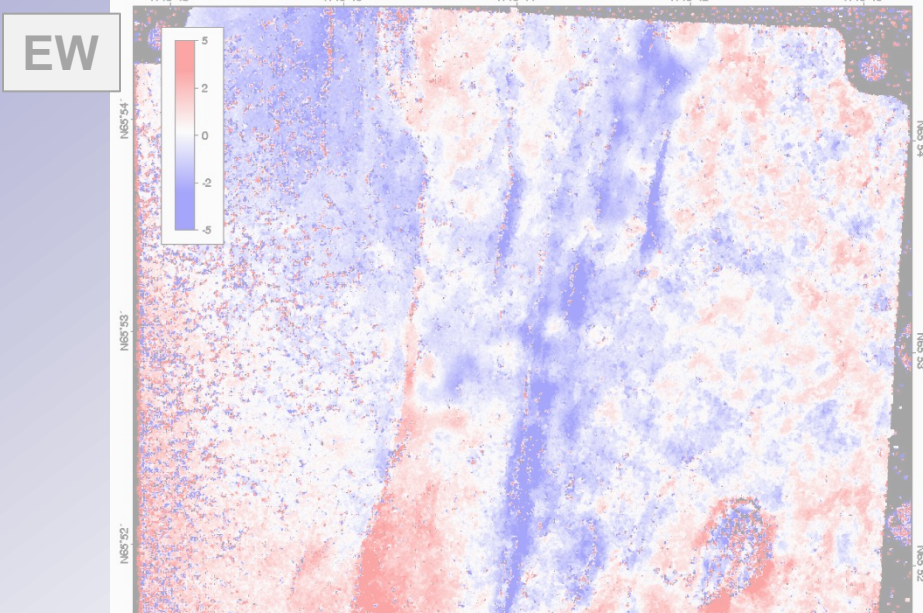


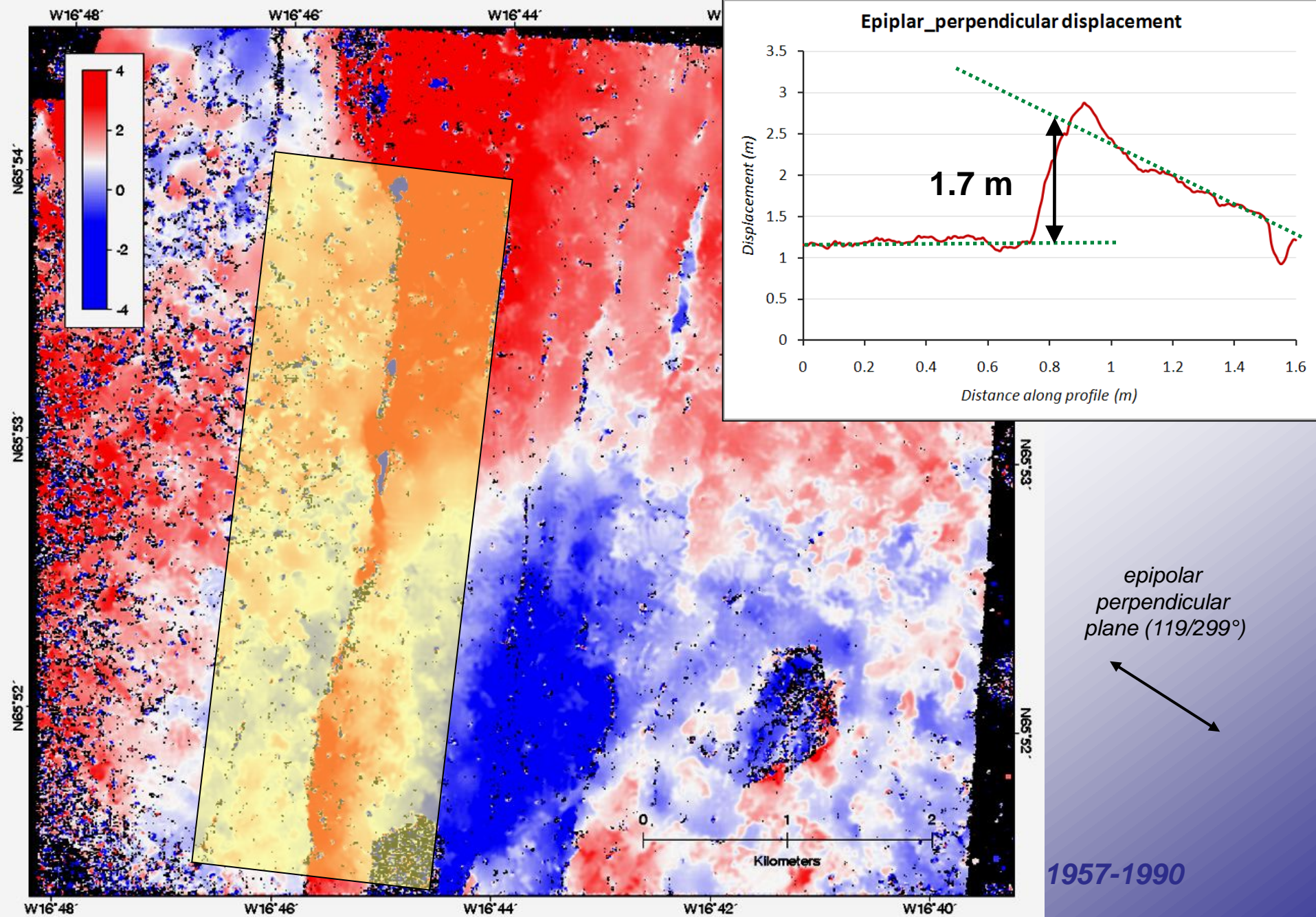
*Correlation time difference = 33 years*



*Extension in the Krafla rift crisis from aerial photos (1957-1990):*







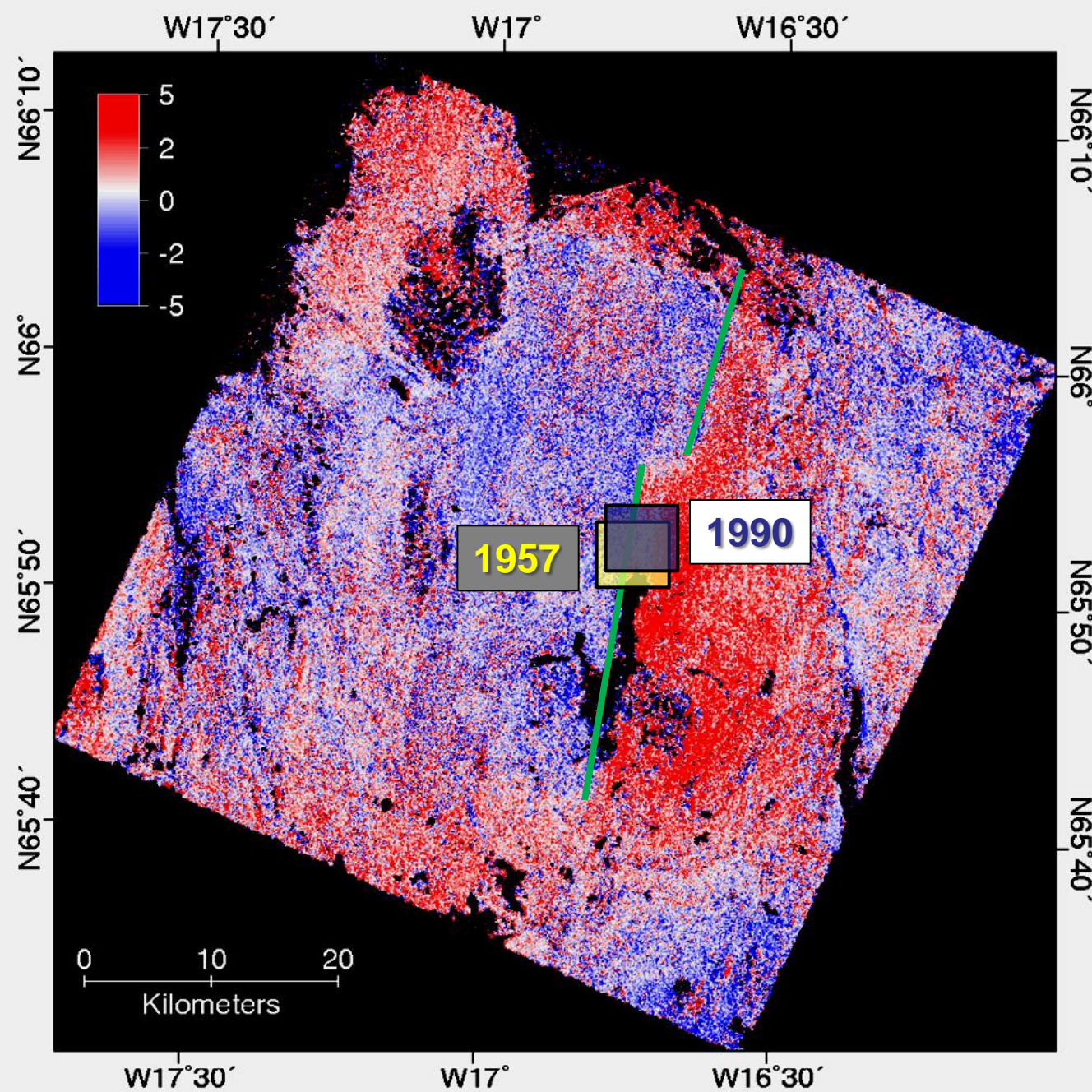
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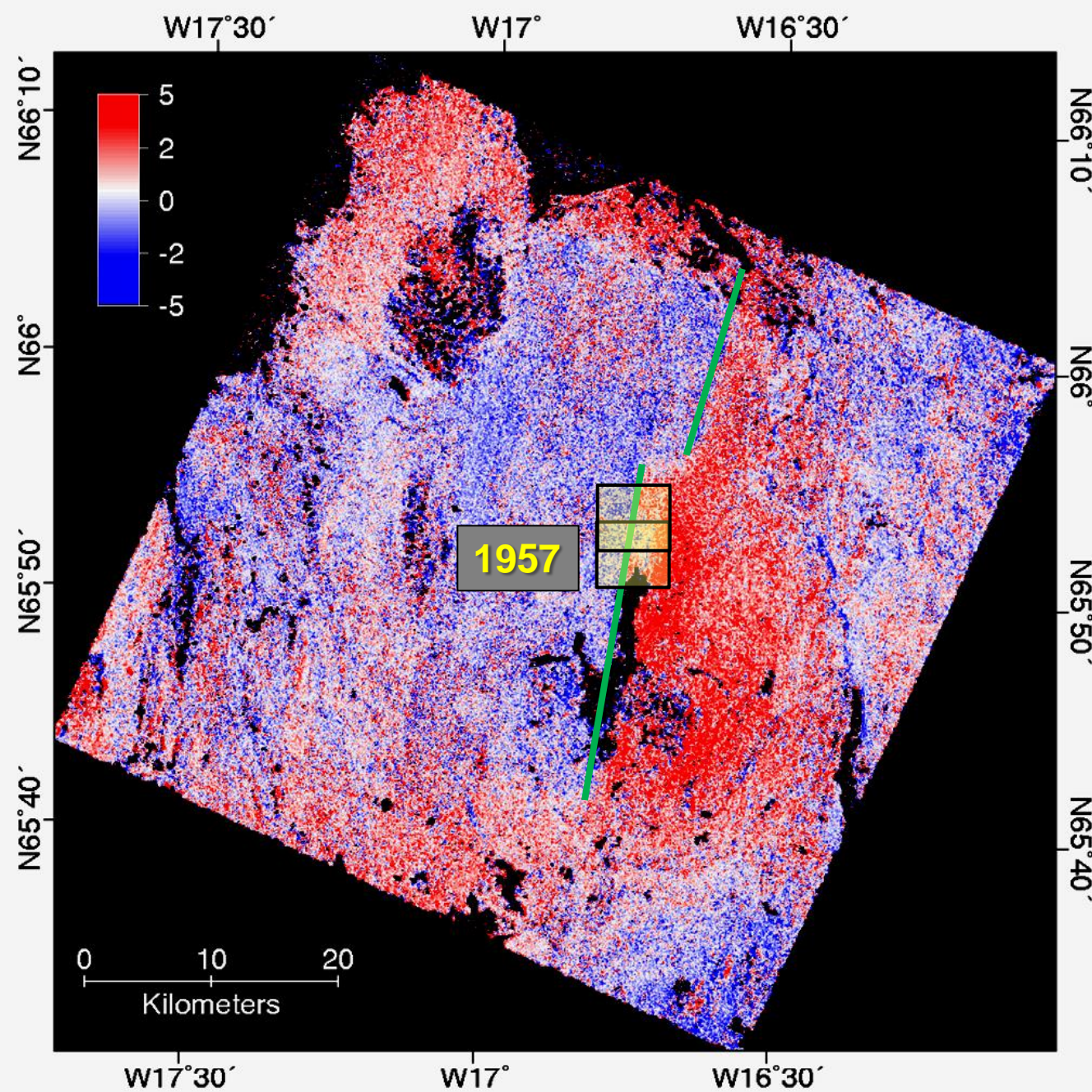
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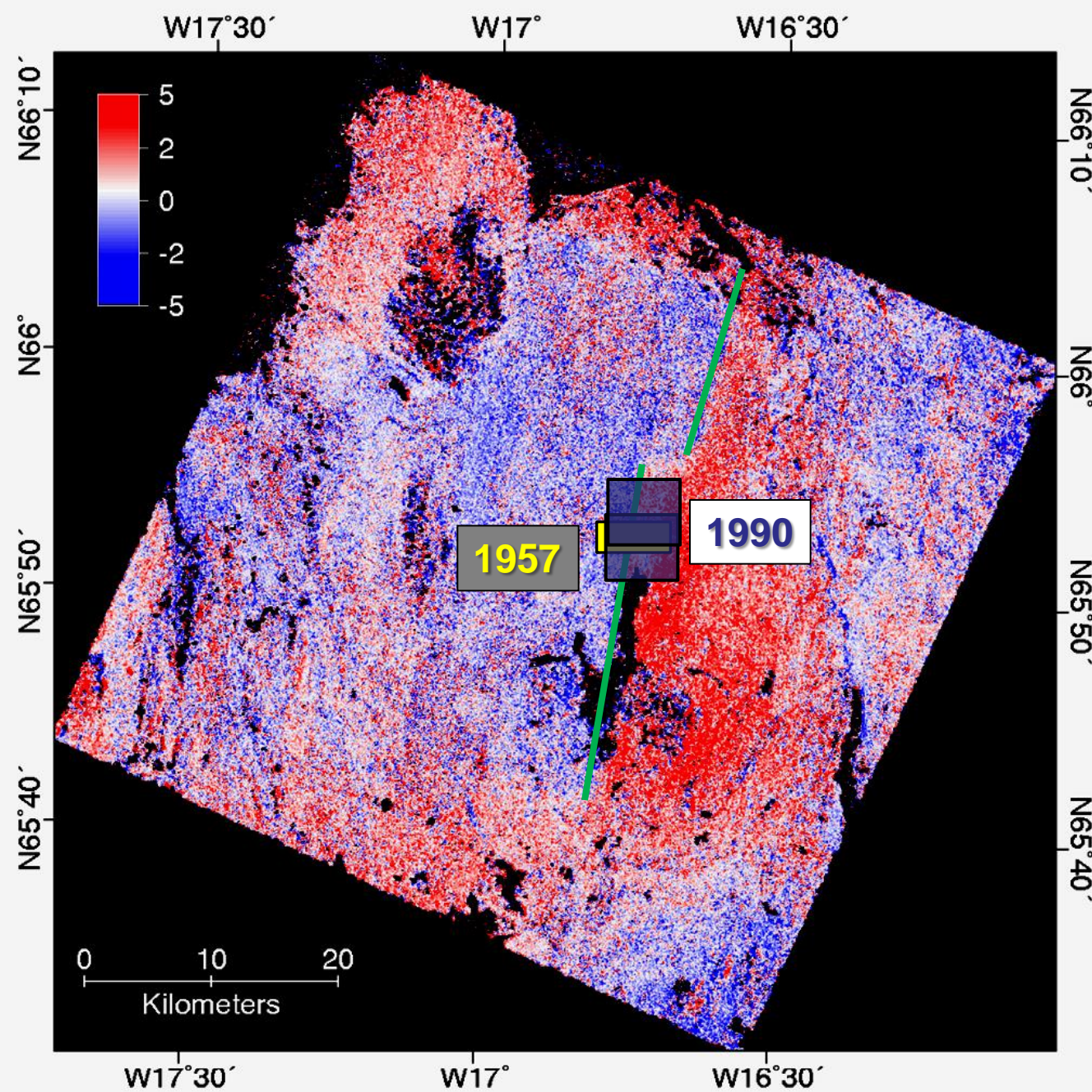
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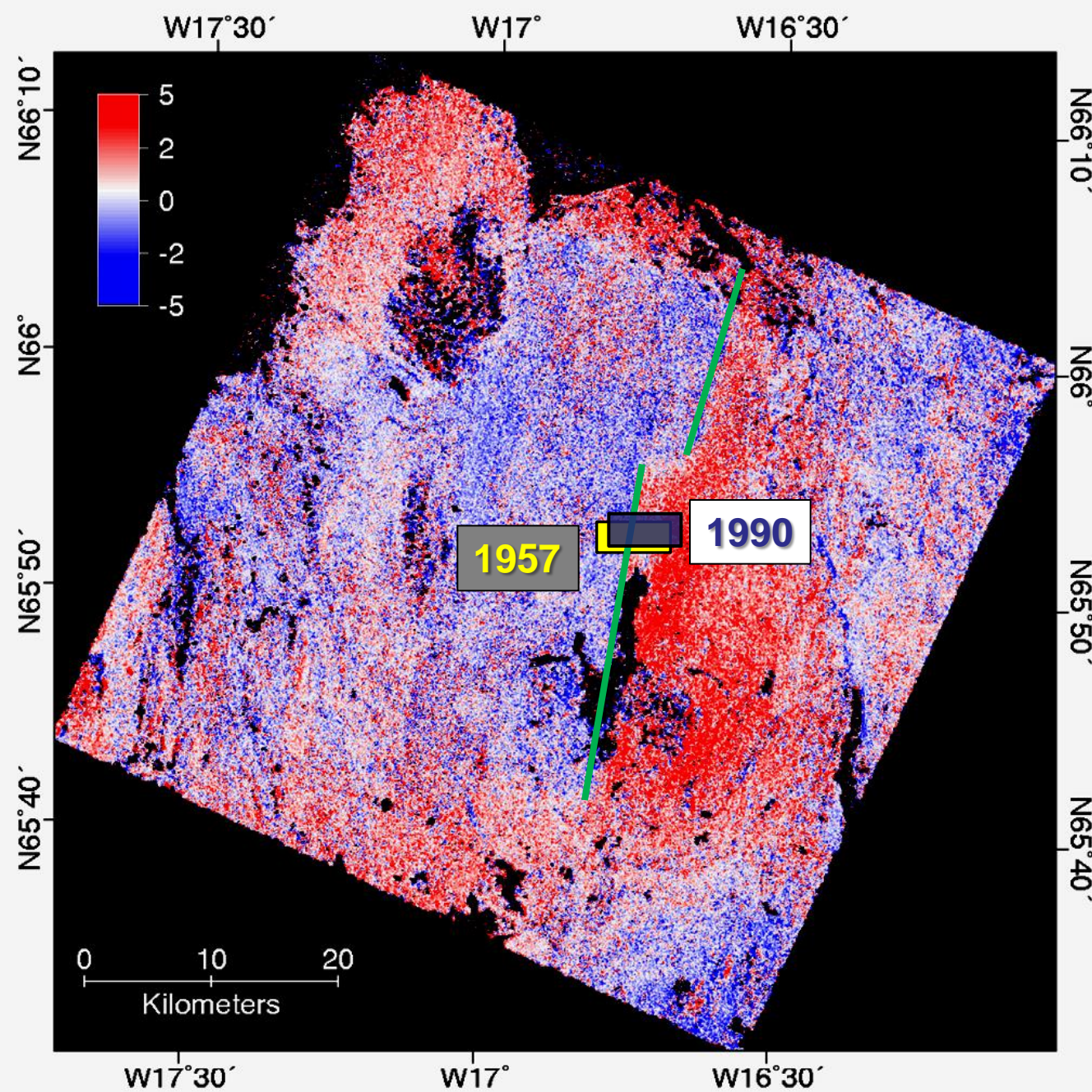
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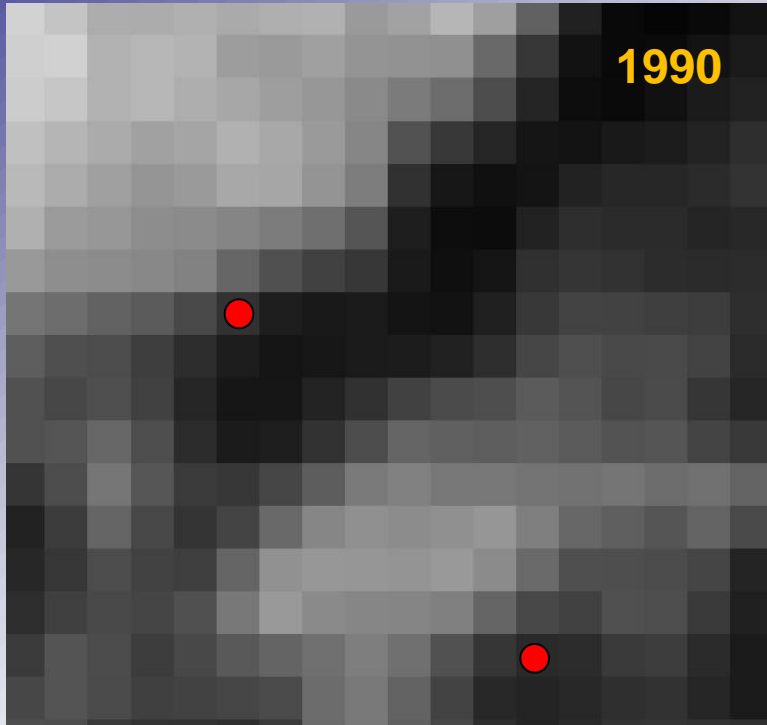
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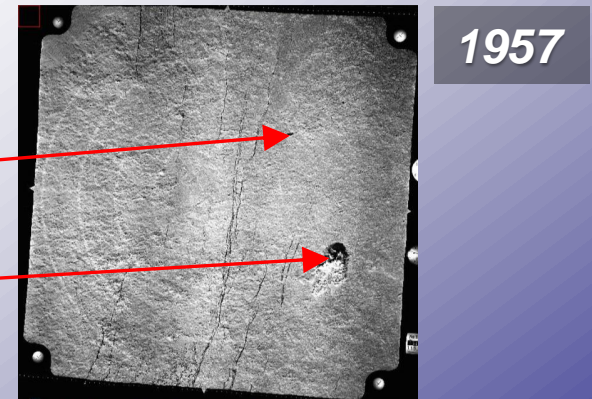
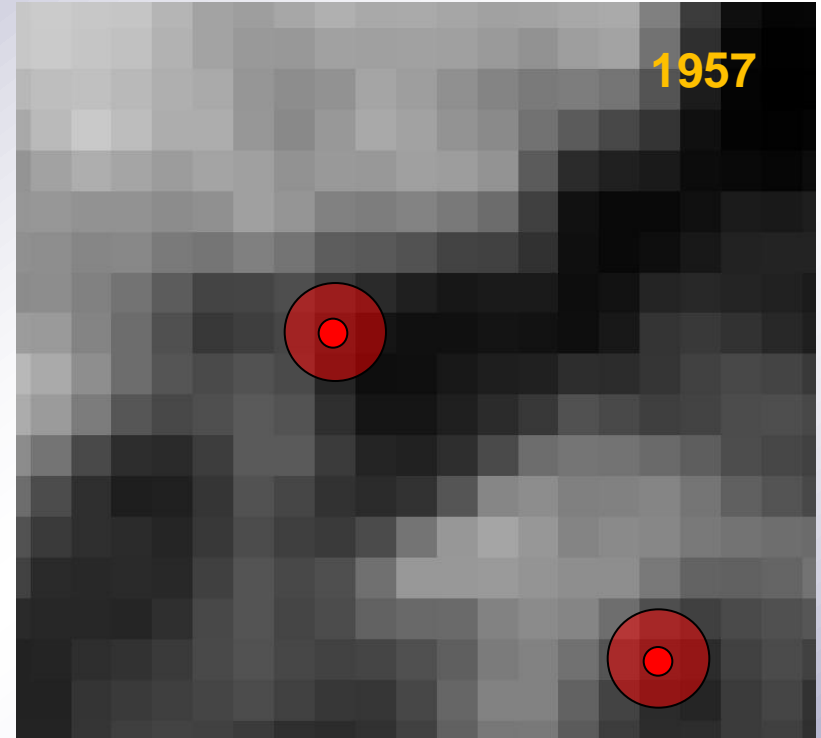
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*Reference image*

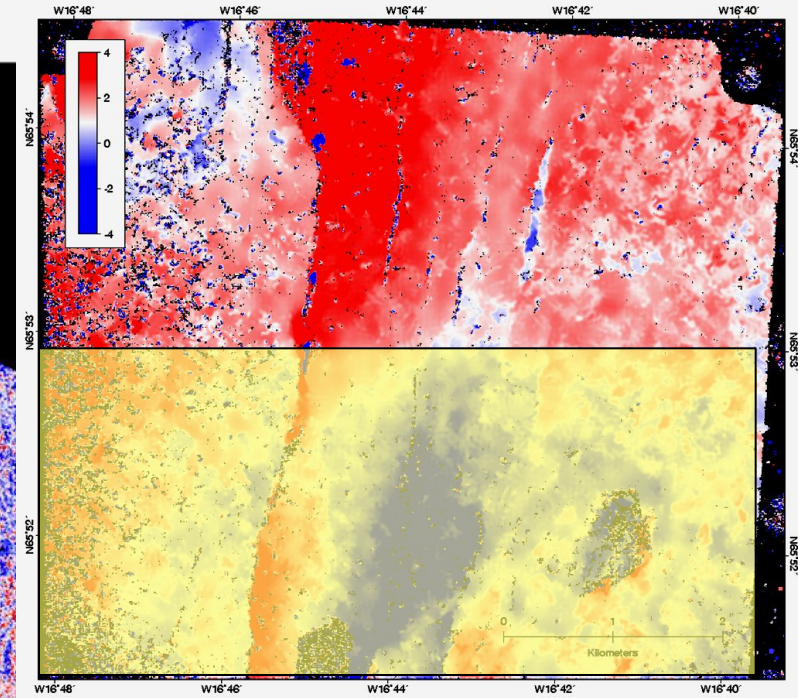
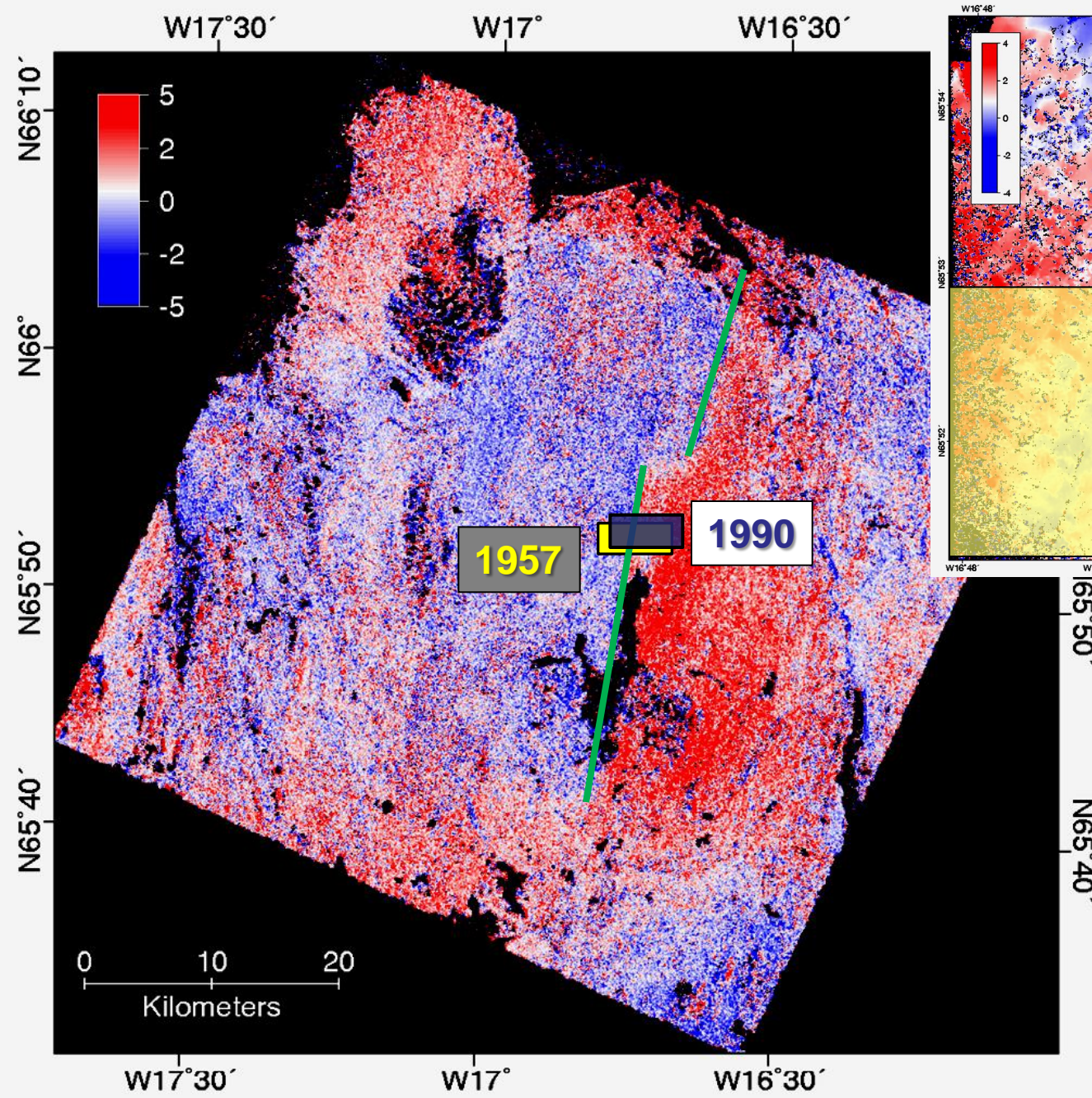


*Raw image*

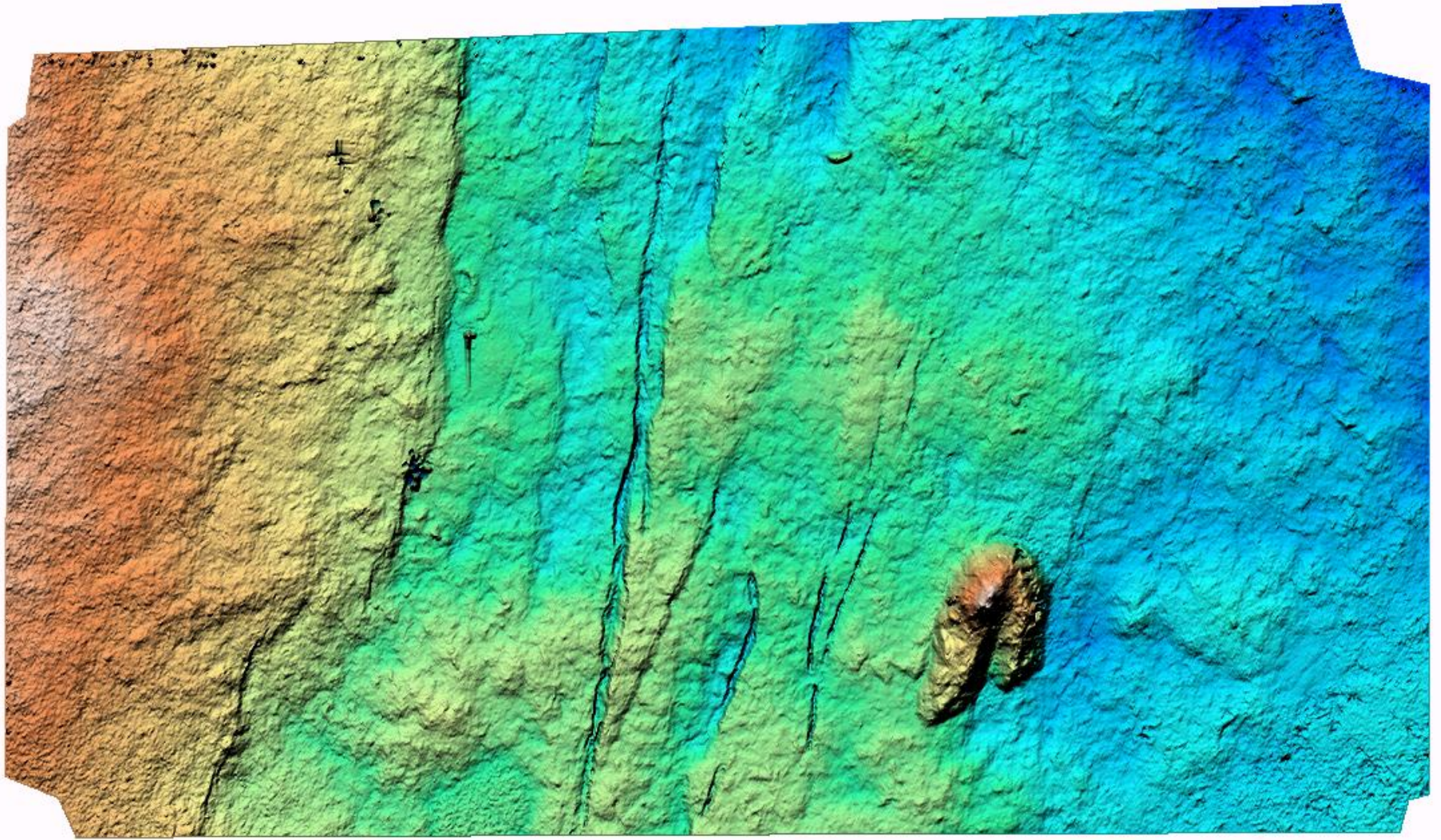








1957-1990



*1990 DEM*

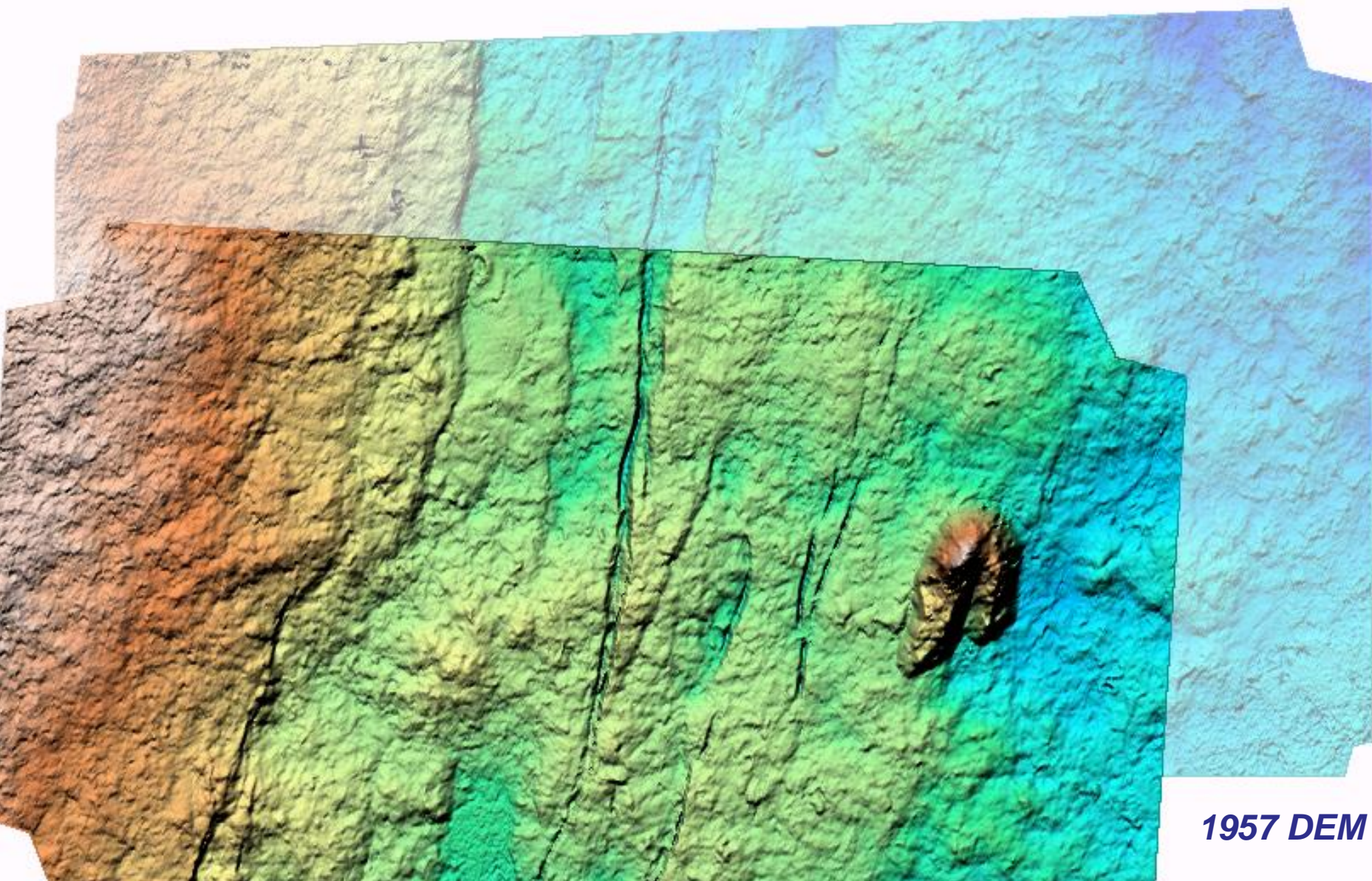
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**1957 DEM**

**1. Introduction**

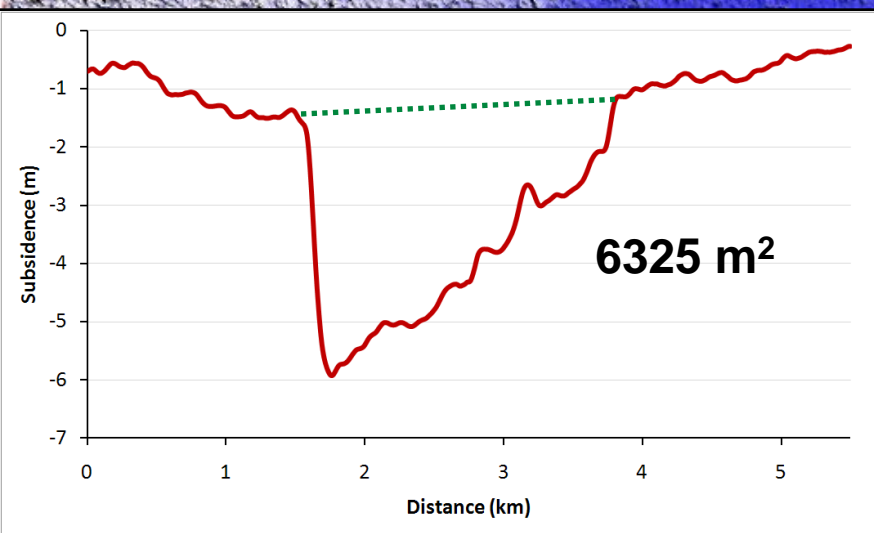
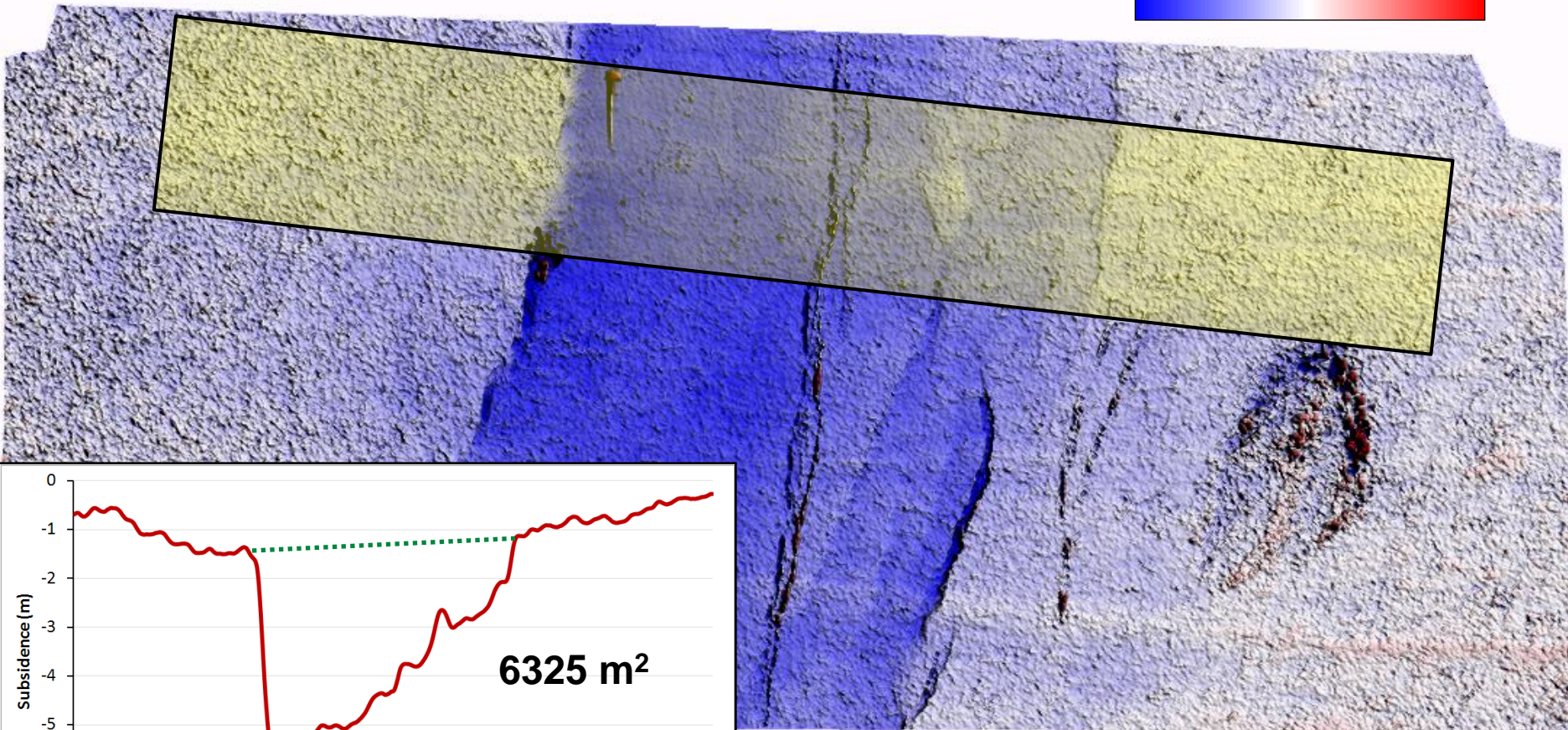
**2. Iceland tectonics**

**3. Krafla - KH9/SPOT**

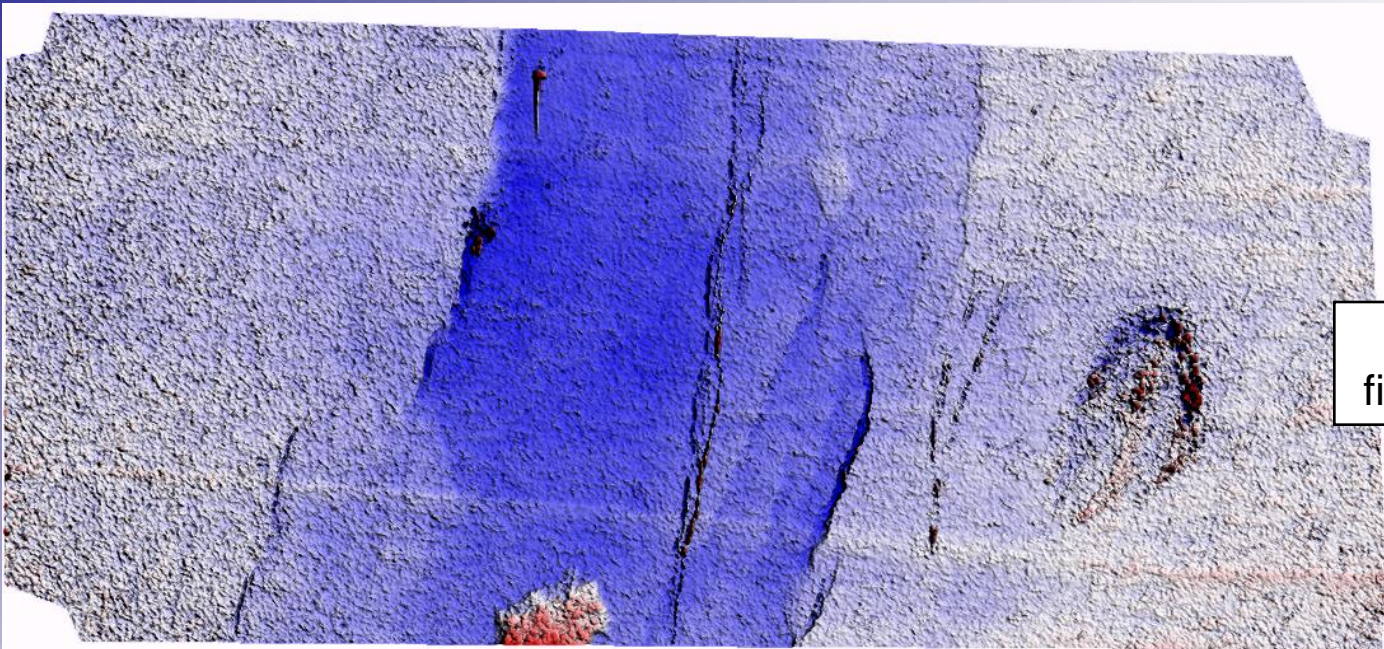
**4. Krafla - airphotos**

**5. Conclusions**

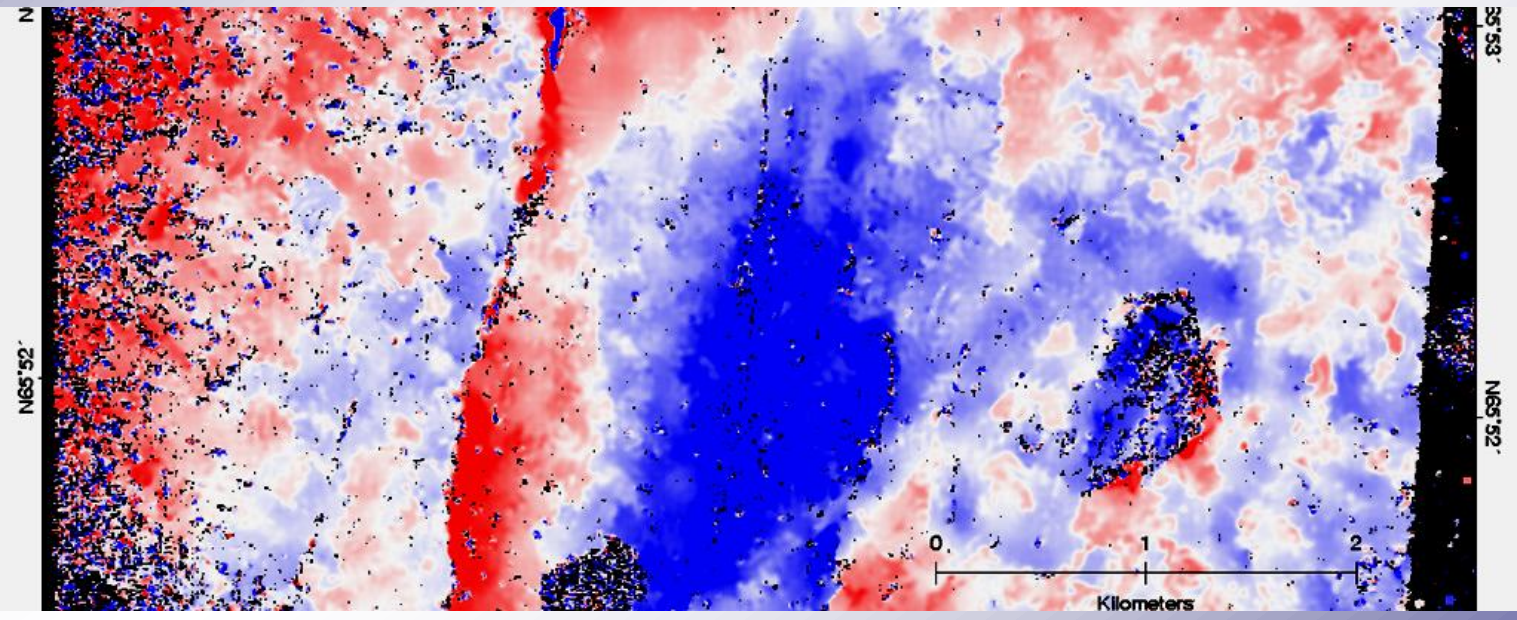
# Map of subsidence during the Krafla rift crisis (1975-1984):



**1990-57 DEM difference**



Full 3D deformation field from aerial photos



*epipolar  
perpendicular  
plane (119/299°)*



**General:**

- Monitor any 20<sup>th</sup> century ground displacements (horizontal or vertical) of 1+ m (spy image) or 10+ cm (aerial photos), where we have data coverage!

**Iceland specific:**

- 7-8 m extension in each dike injection
- Begin to reconcile how episodic dike injections add up to the long term plate spreading rate.

**STILL NEEDED!**

- complete global archive of aerial and satellite imagery for the 20<sup>th</sup> Century.
- declassification of spy image camera calibration information.
- improved resampling to account for film distortions in spy images (using reseau grid).
- support for panoramic camera systems (e.g. Corona images).
- access to declassified Russian spy imagery.
- bundle block gcp optimization to mosaic aerial photos
- epipolar geometry for SPOT