SAR干渉解析による能登半島地震に伴う地すべり変動の抽出

Detection of landslides triggered by the 2007 Noto Hanto Earthquake using SAR interferometry

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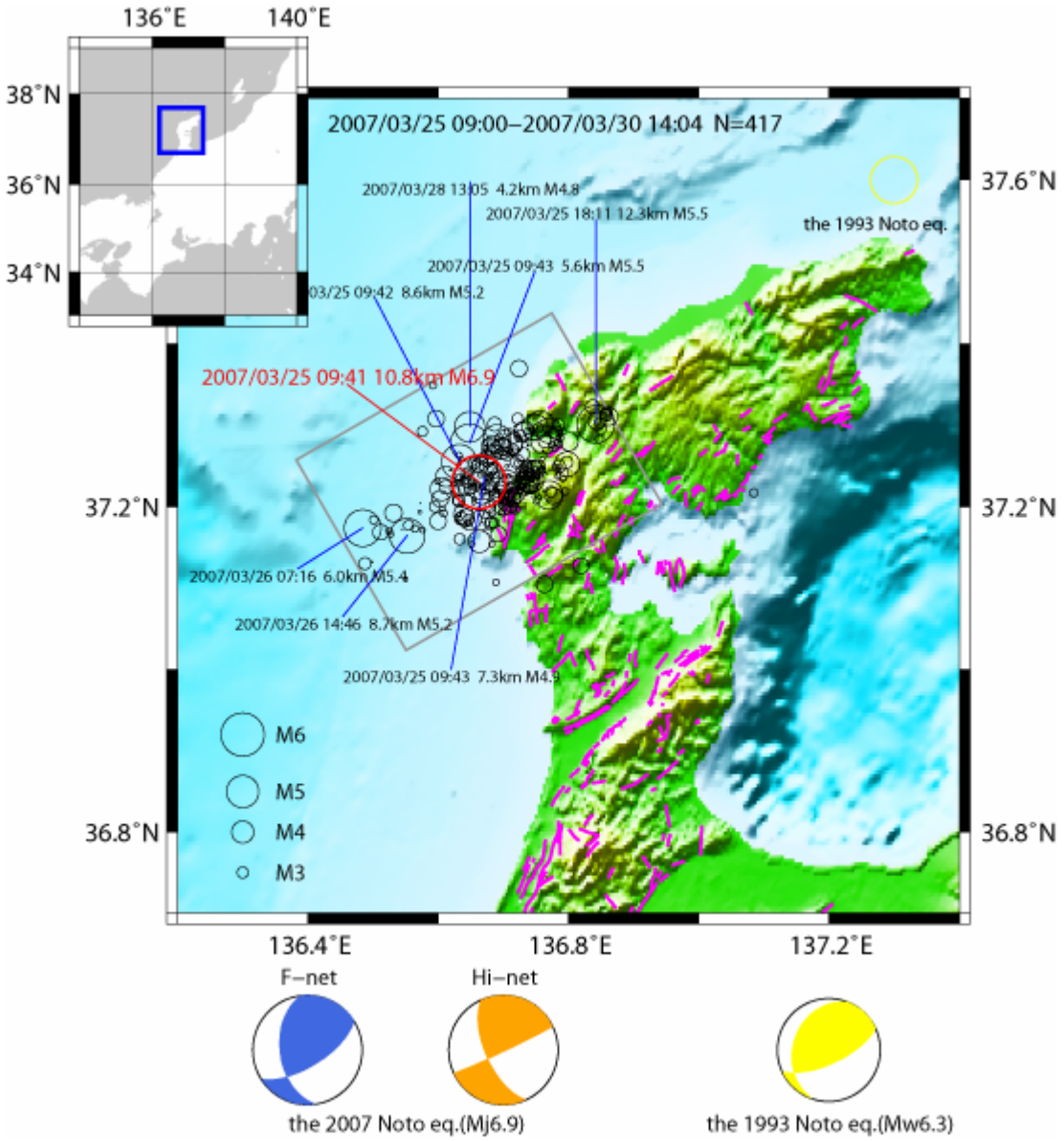
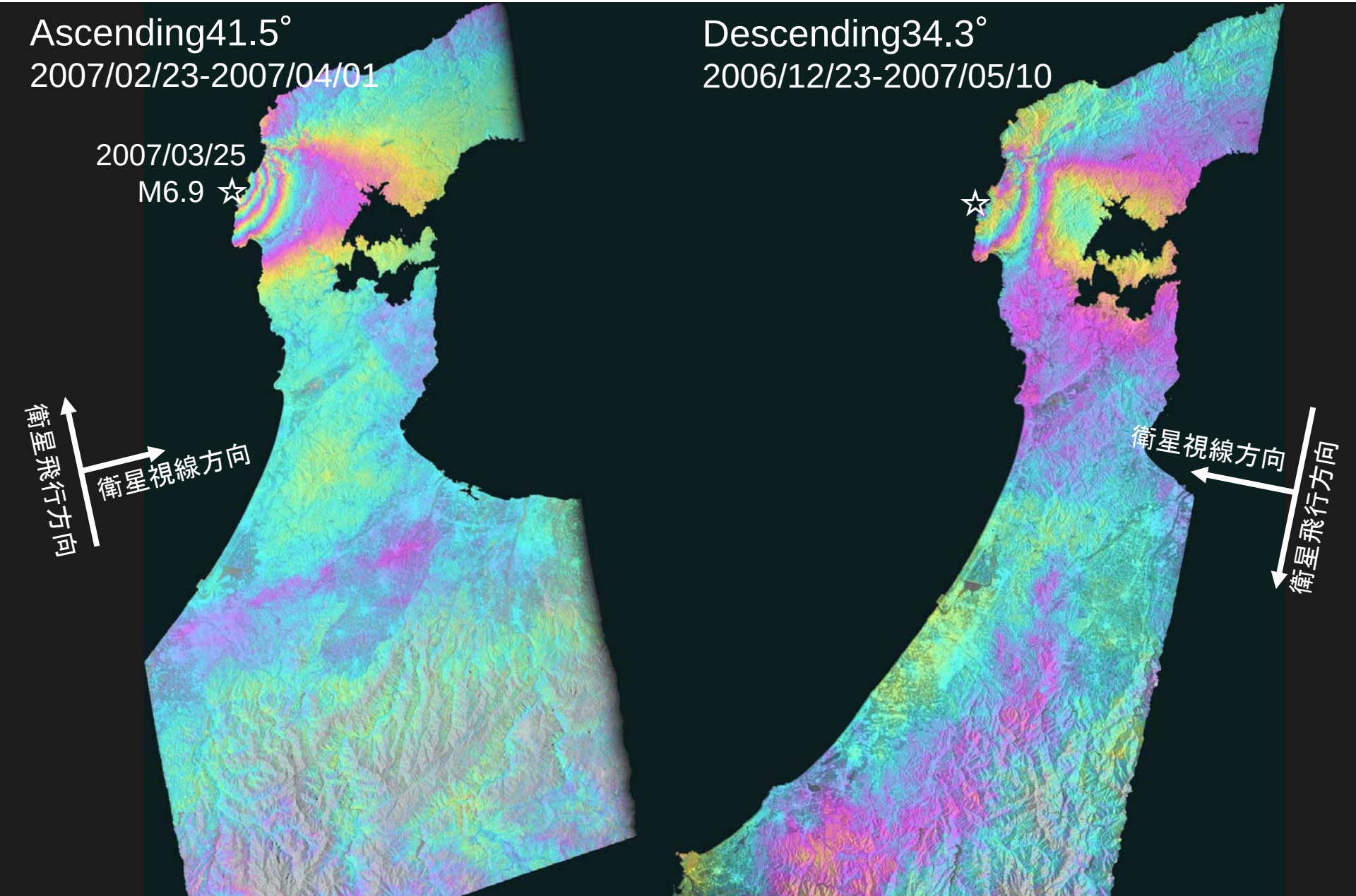
The 2007 Noto Hanto Earthquake



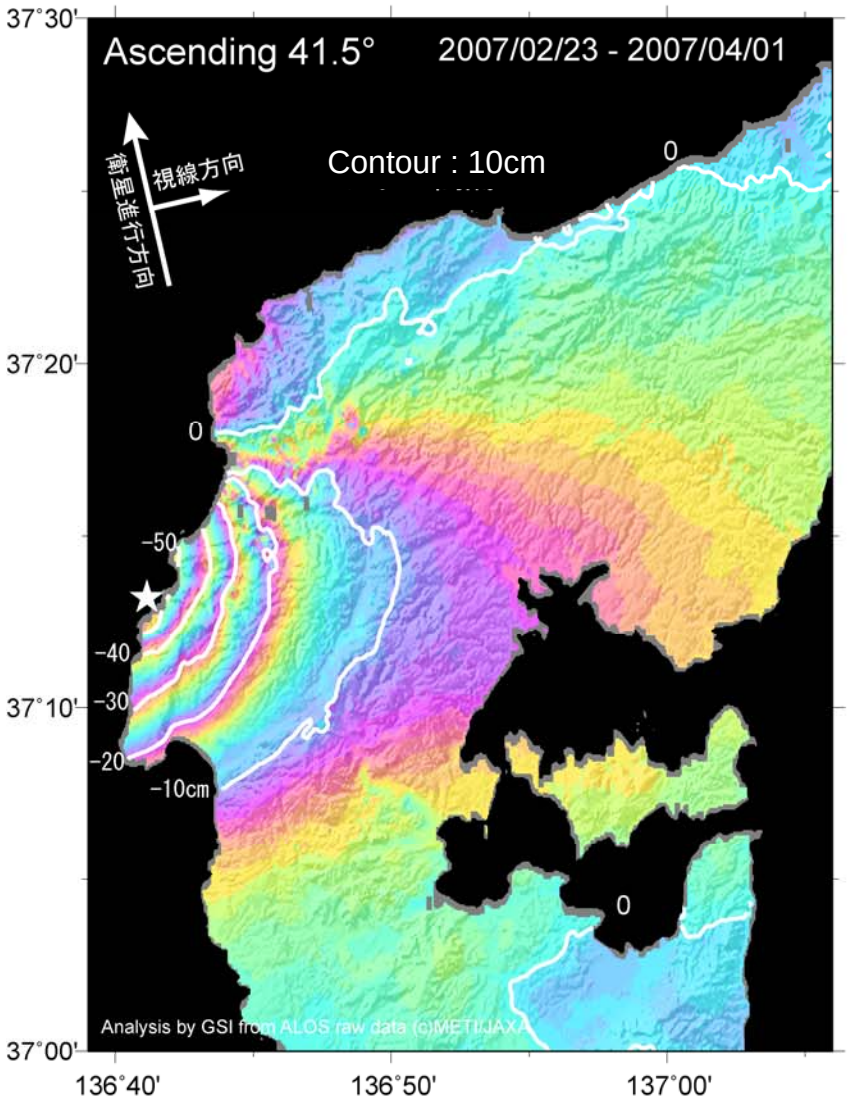
- March 25, 2007
- Mjma 6.9
- JMA seismic scale 6+
- Crustal deformation detected by GPS, Insar and leveling

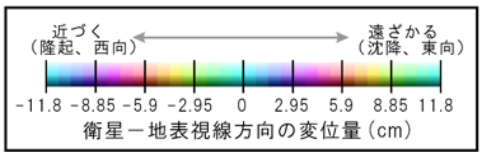
(from DPRI website)

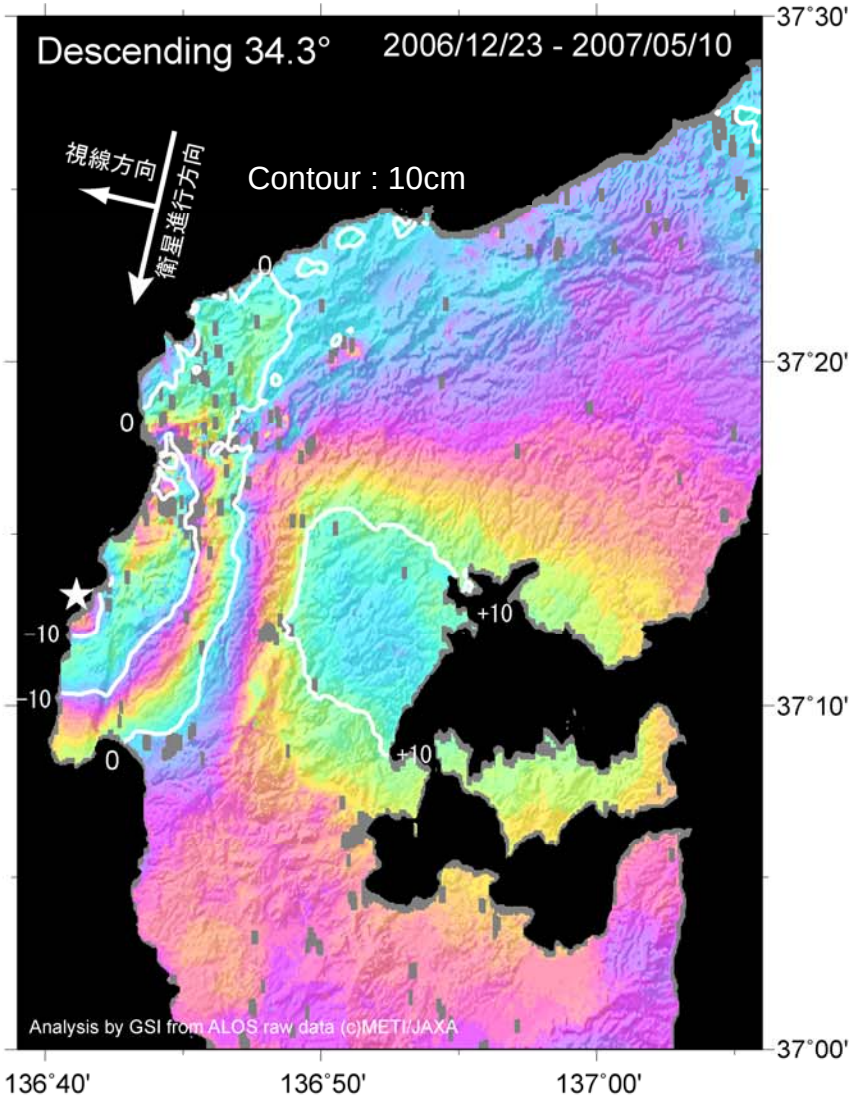
ALOS/PALSAR interferograms

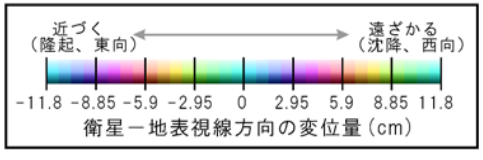


LOS displacement

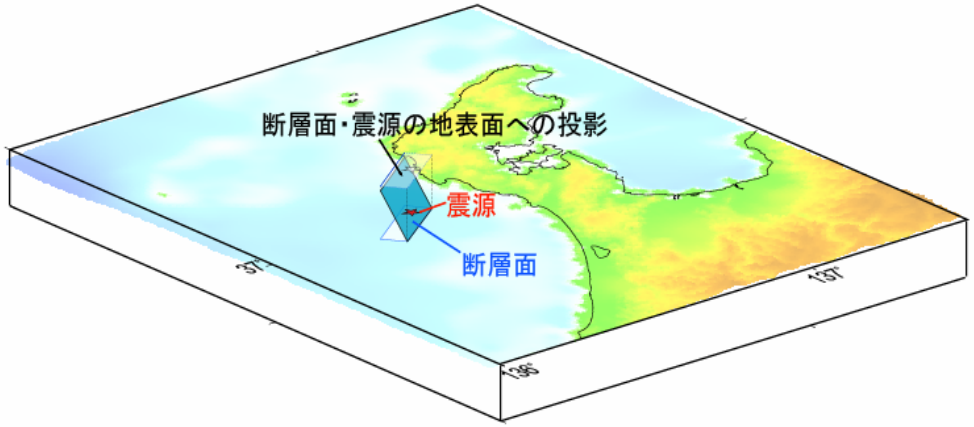


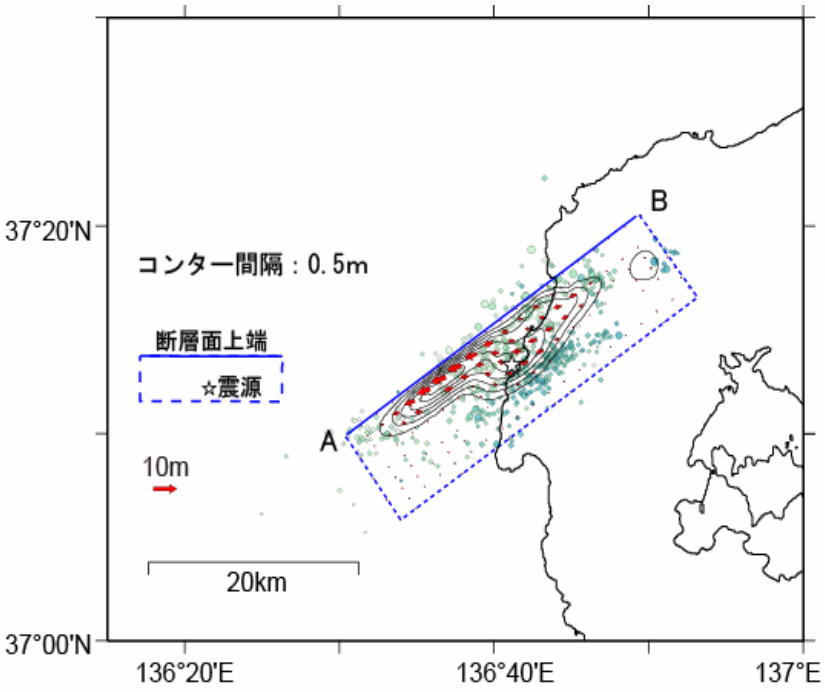


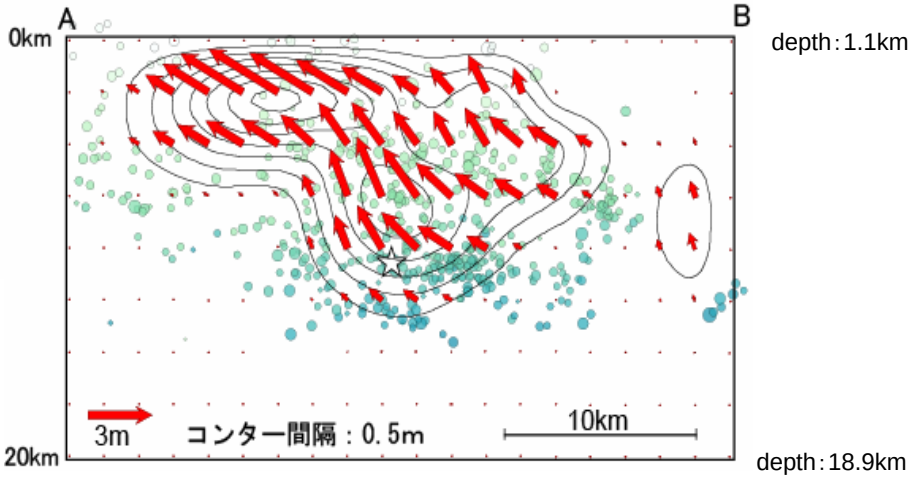




A fault model inverted from GPS and InSAR





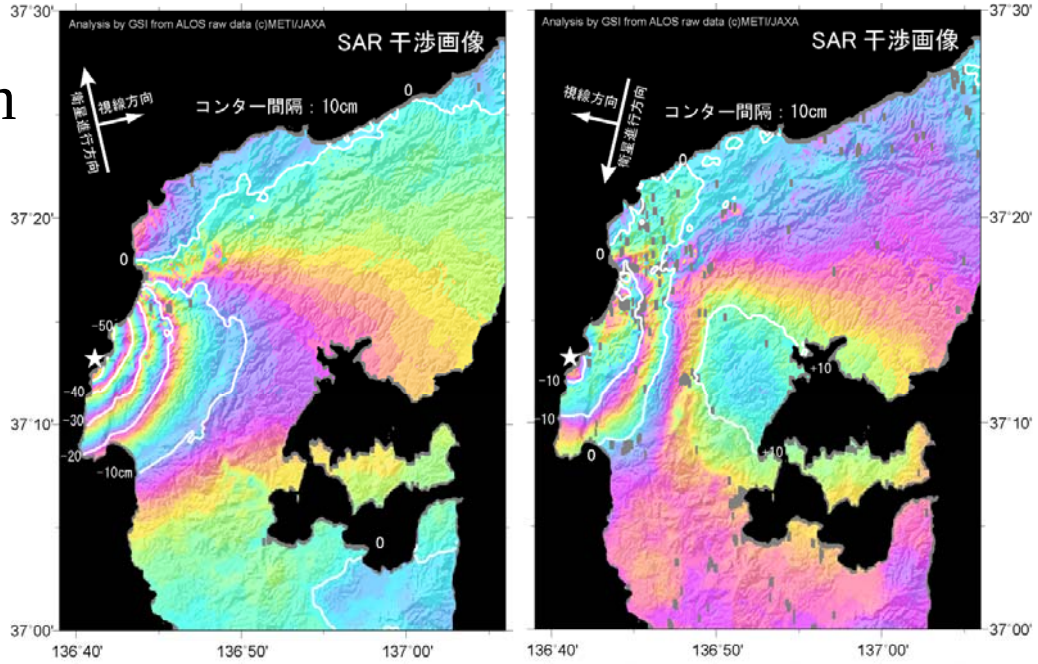


Ozawa et al. (2007)

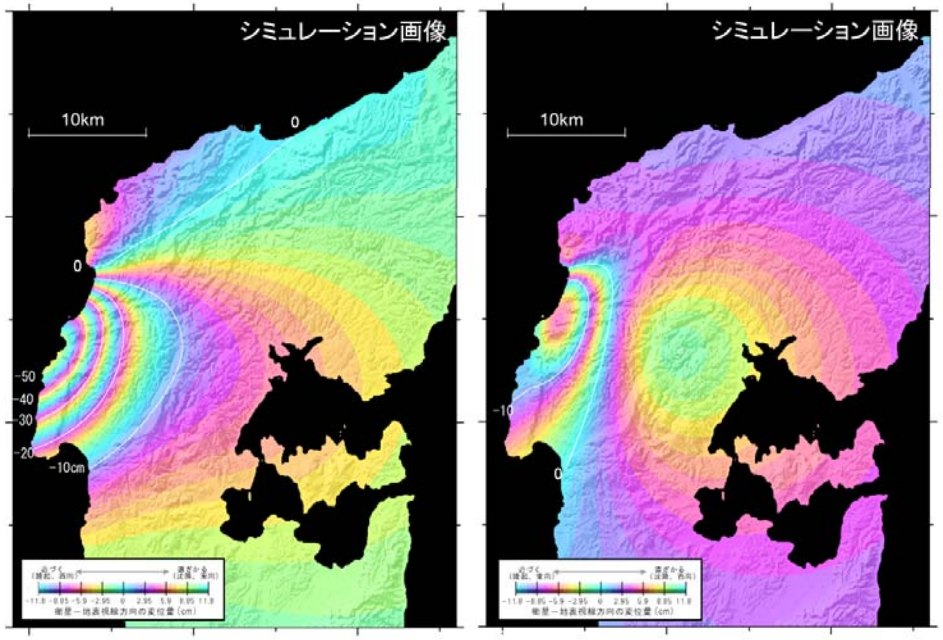
Ascending 41.5°

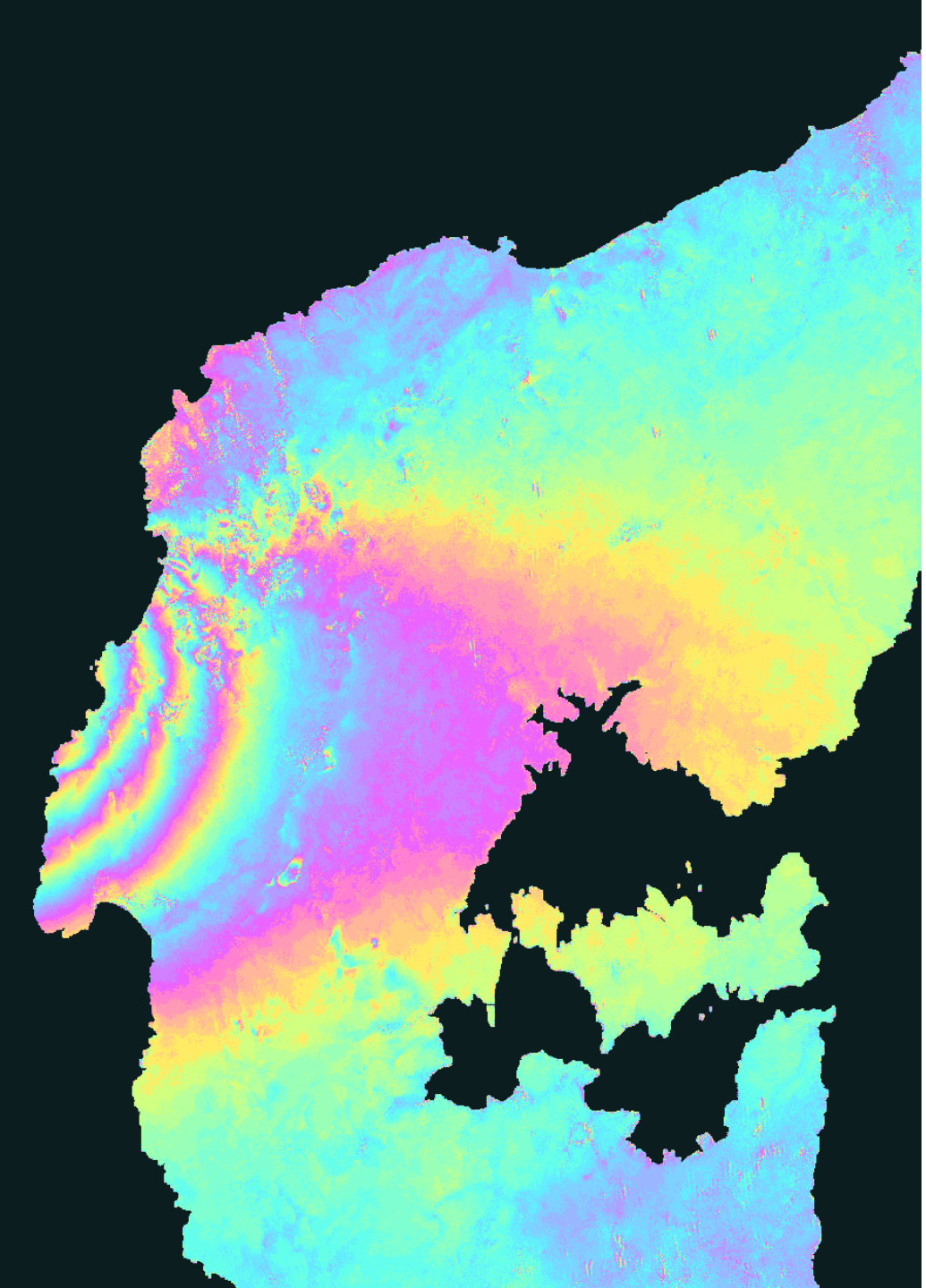
Descending 34.3°

Interferogram



Simulated image





Interferogram shows …

Coseismic deformation due to fault dislocation

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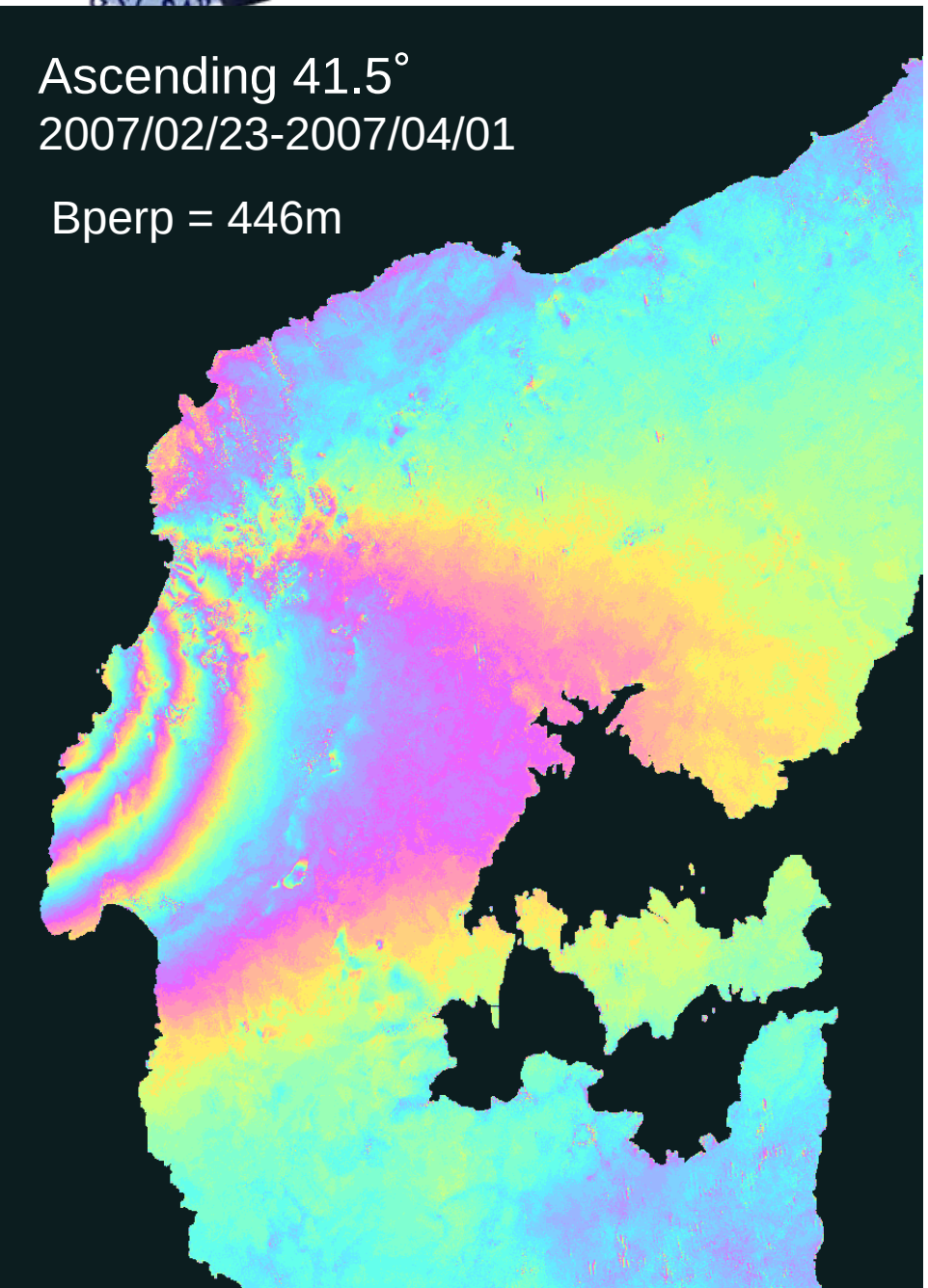
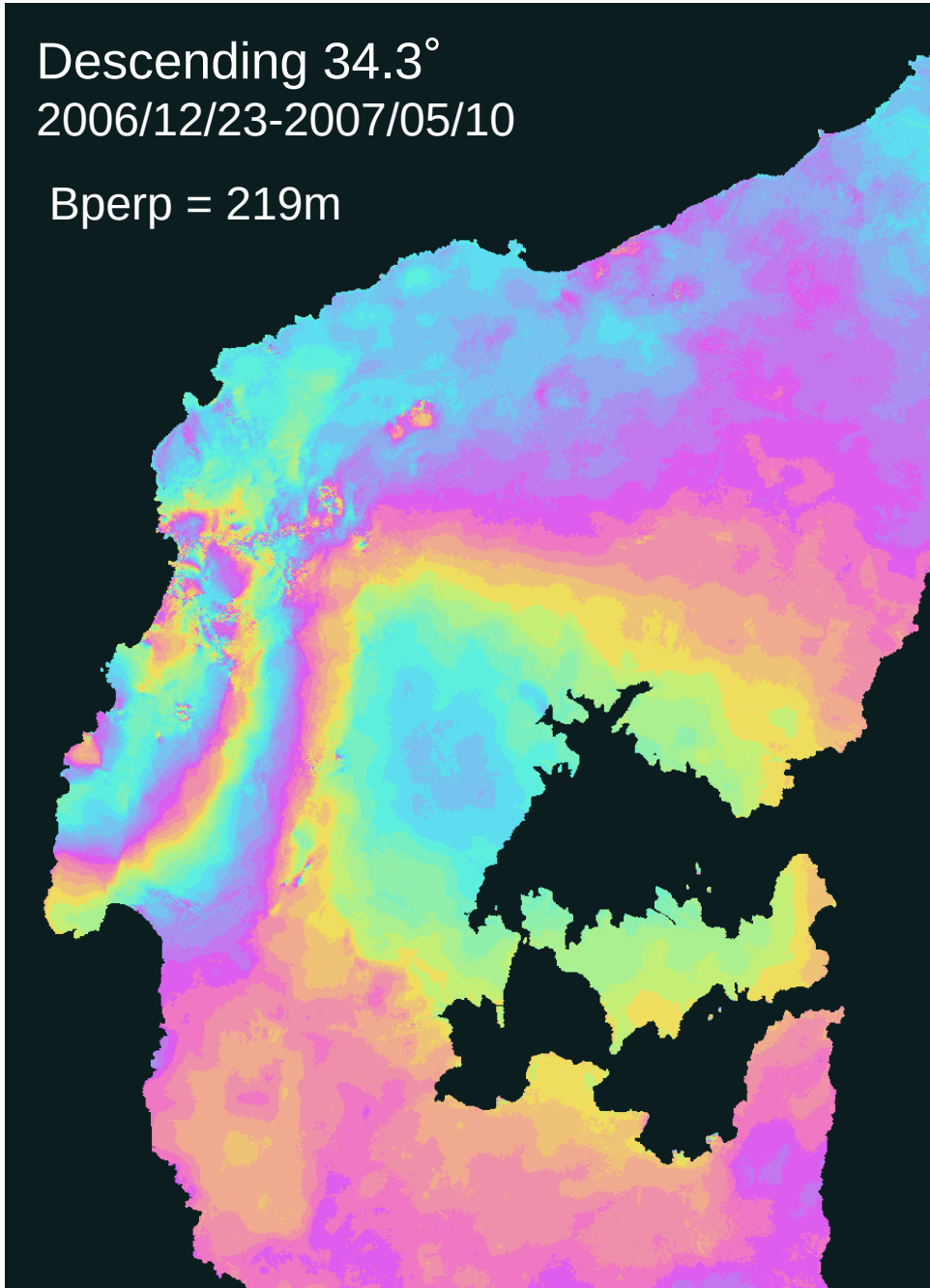
Several local phase change area (100m – a few km)

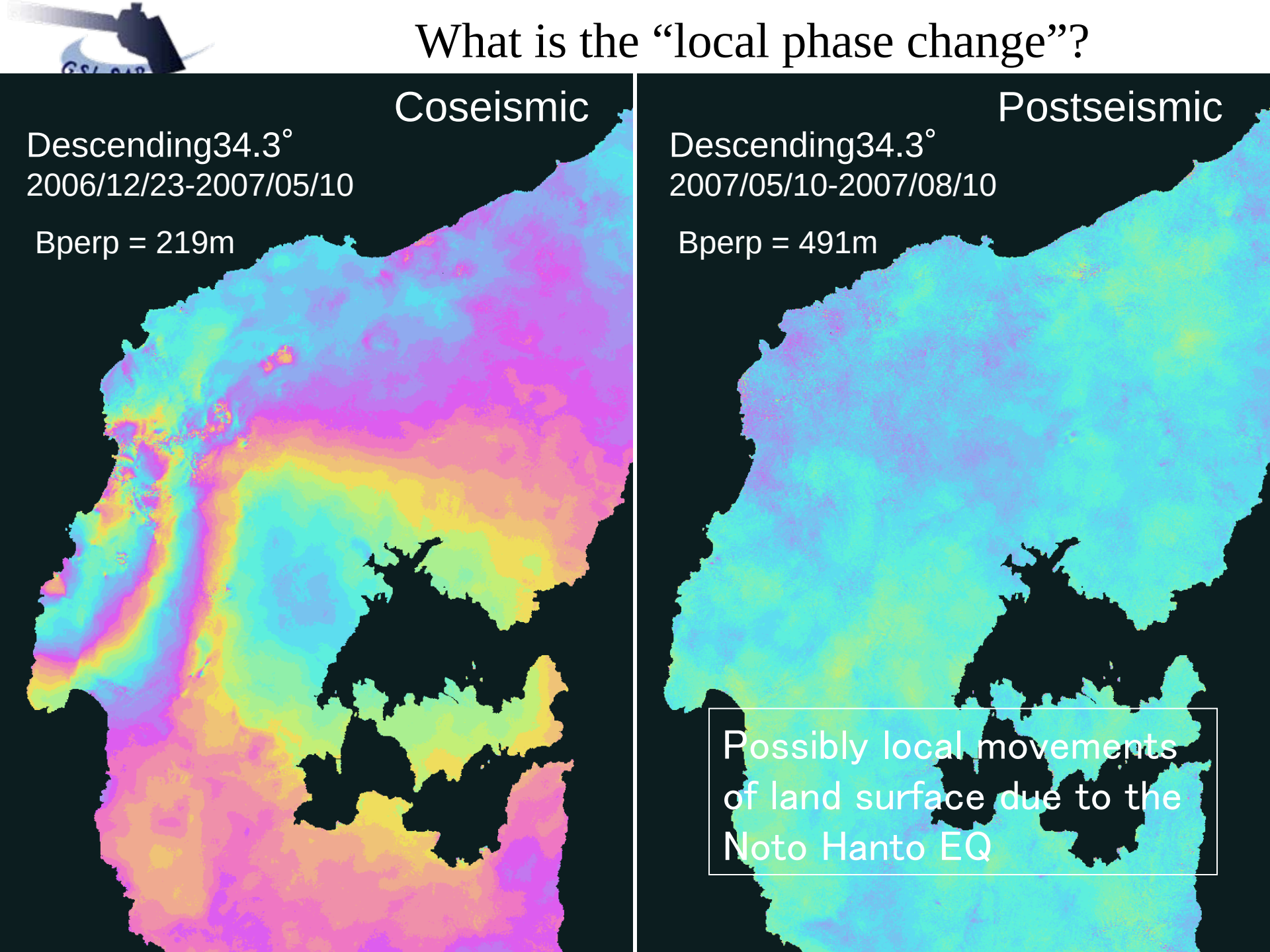
- DEM error ?
- Real displacement ?

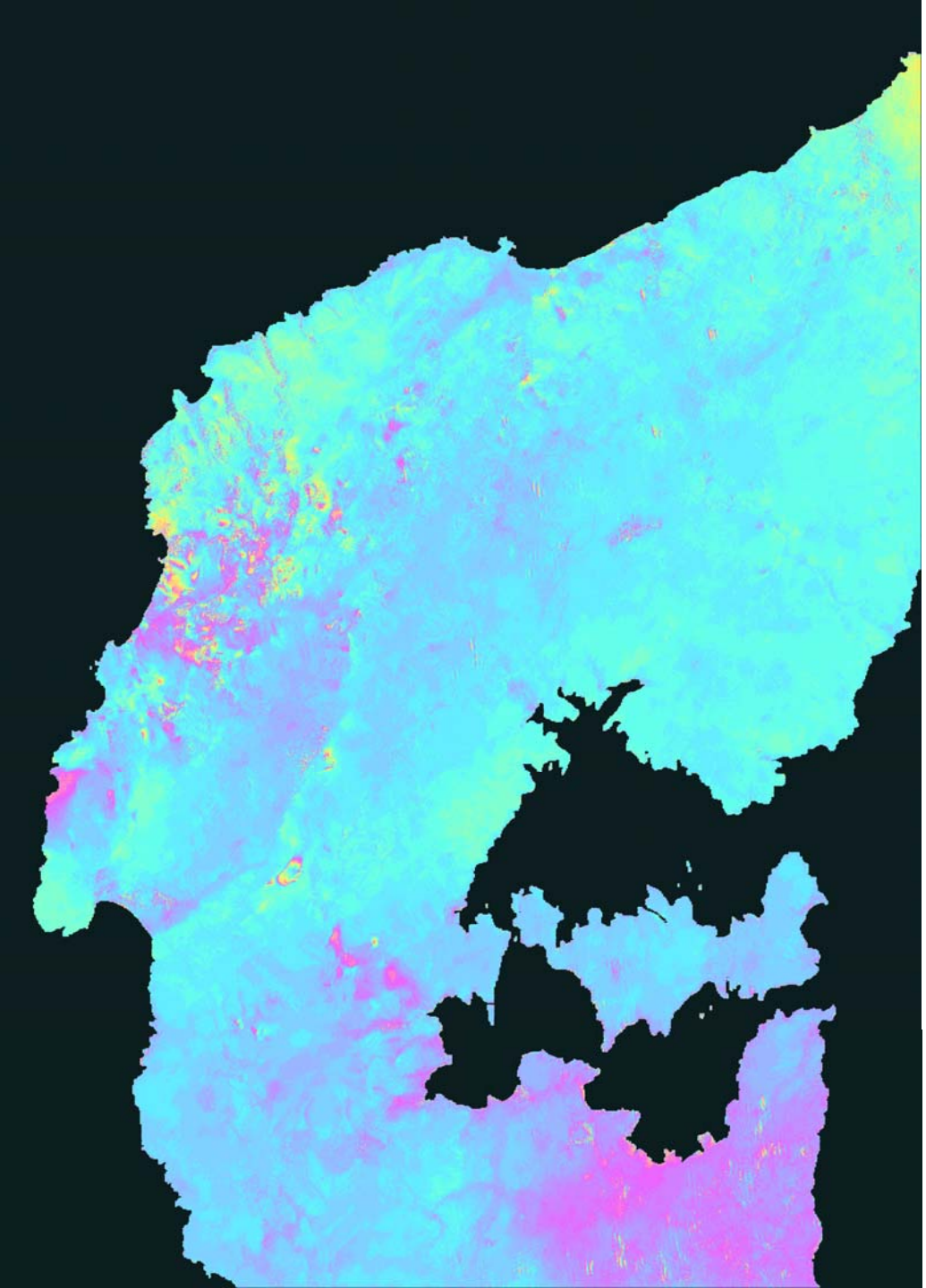
What is the “local phase change”?





What is the “local phase change”?





Residual image

Interferogram

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Crustal deformation due to the EQ

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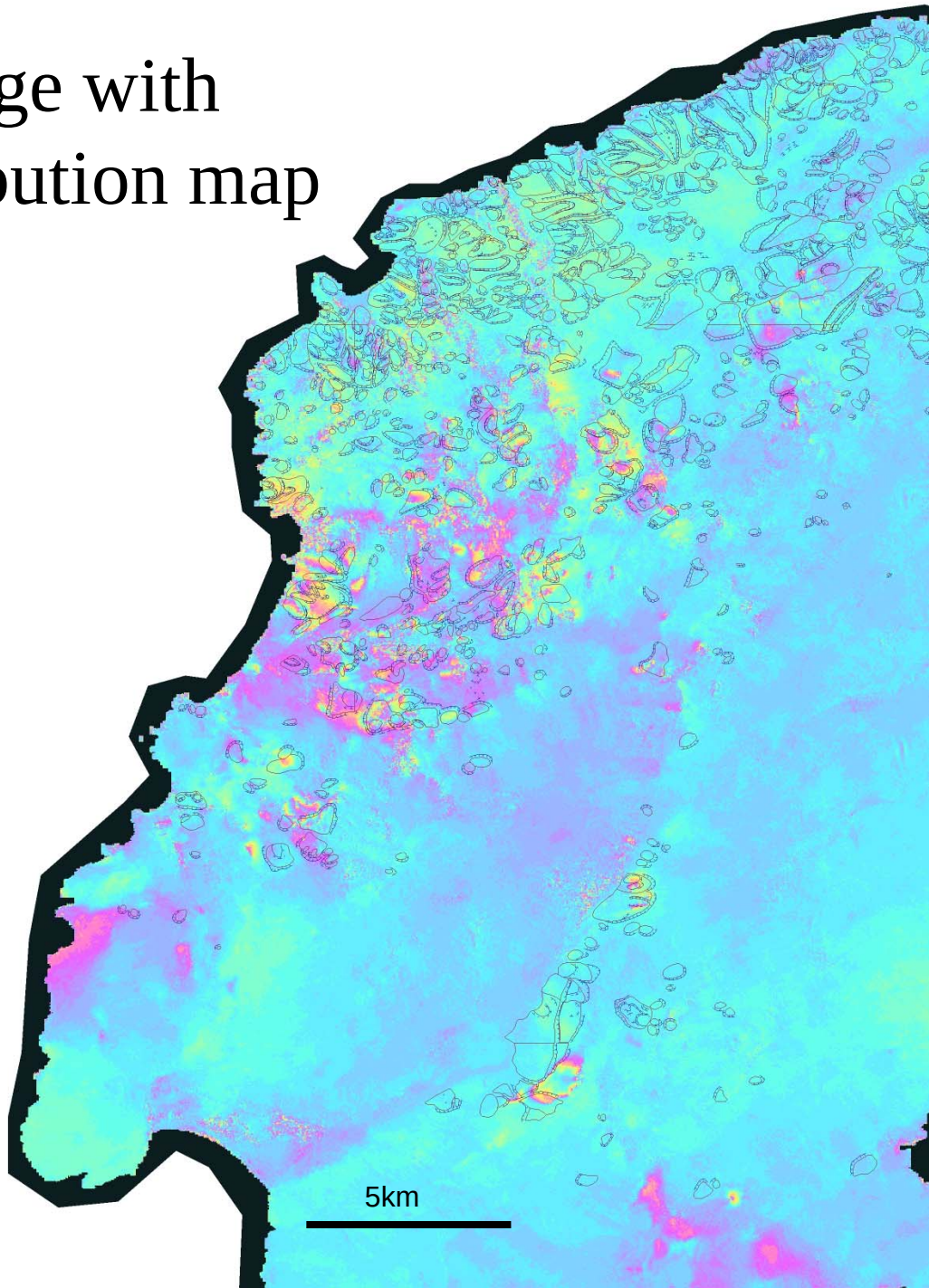
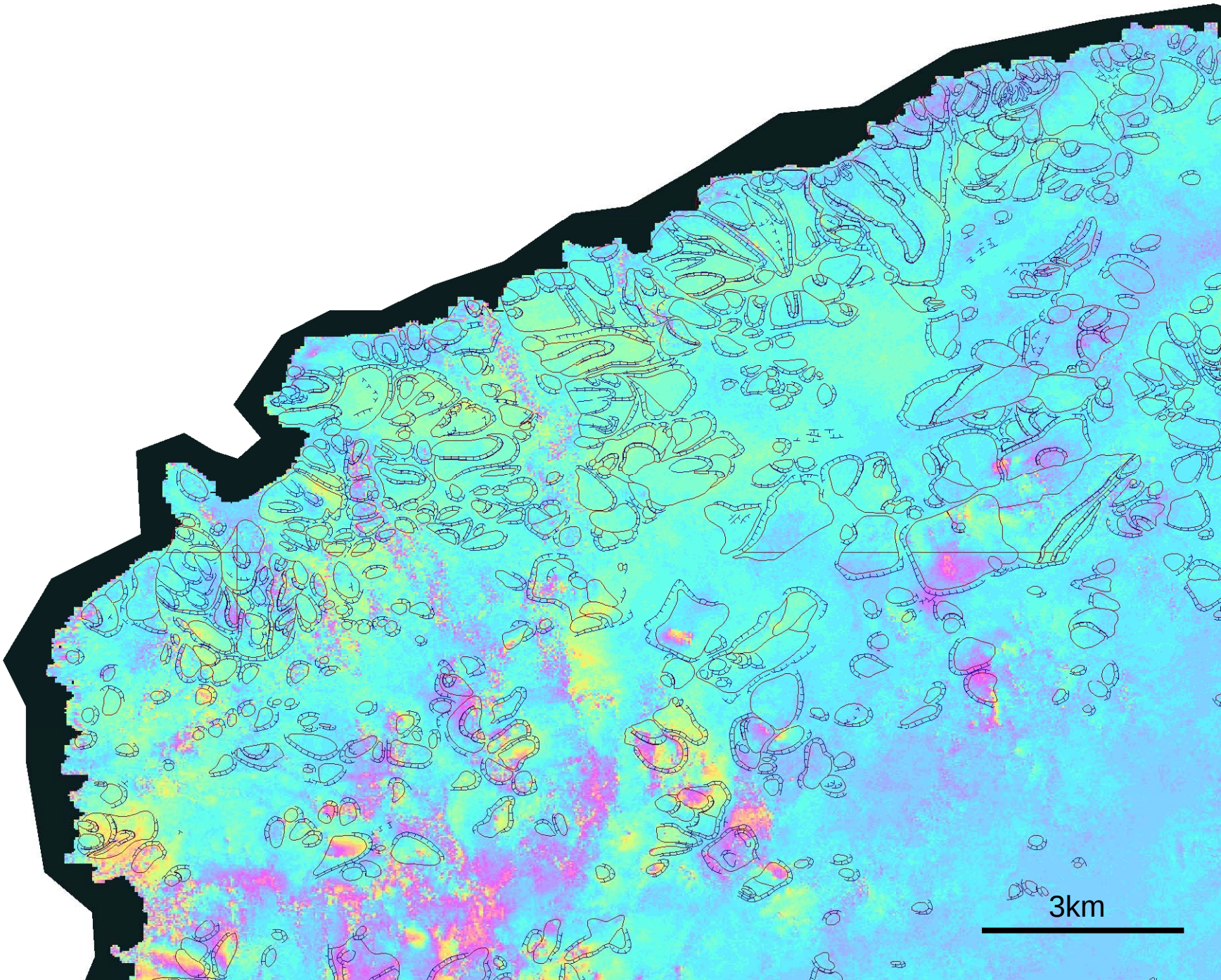
Local movements of land surface (such as landslide)

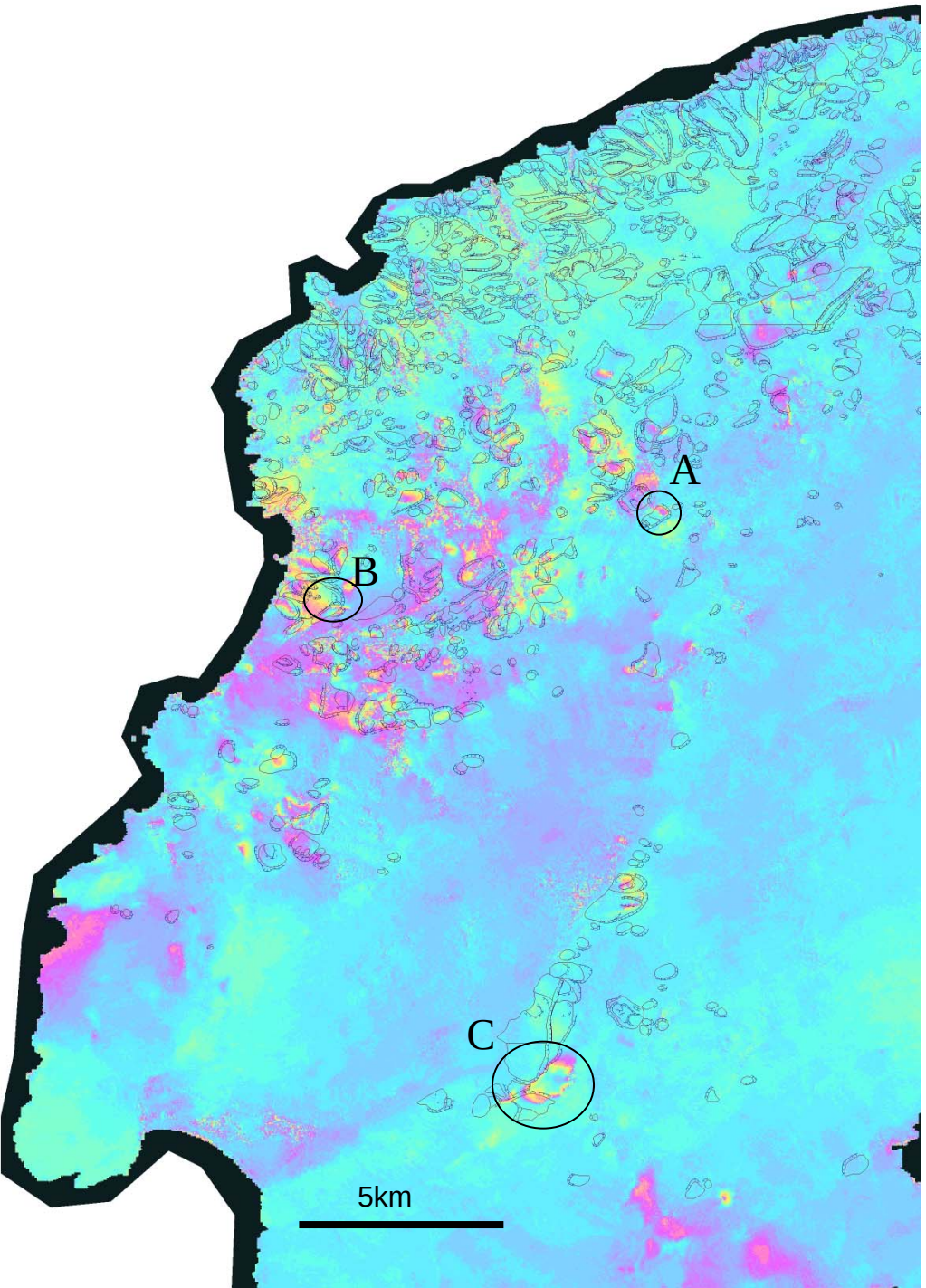
Residual image with landslides distribution map

- 震源域近傍で多数発生
- 長さ･幅数100m程度の楕円形や馬蹄形
- 多くが地すべり地形の全体あるいはその一部で発生
- 変位量は数cm～20cm程度
- 推定される変動の向きは概ね地形と整合的

（内部の沈下もしくは最大傾斜方向への水平移動）




3km

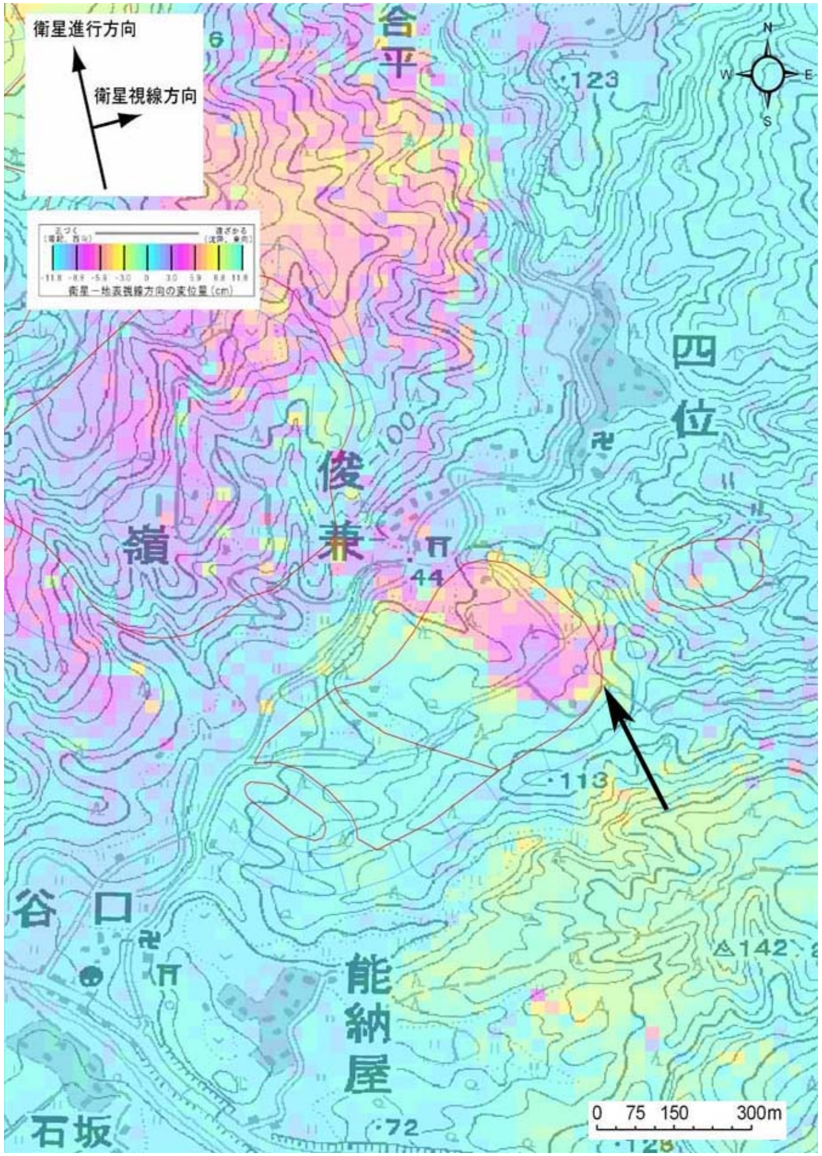


Field survey

A, B: Phase change area is consistent with landslide block.

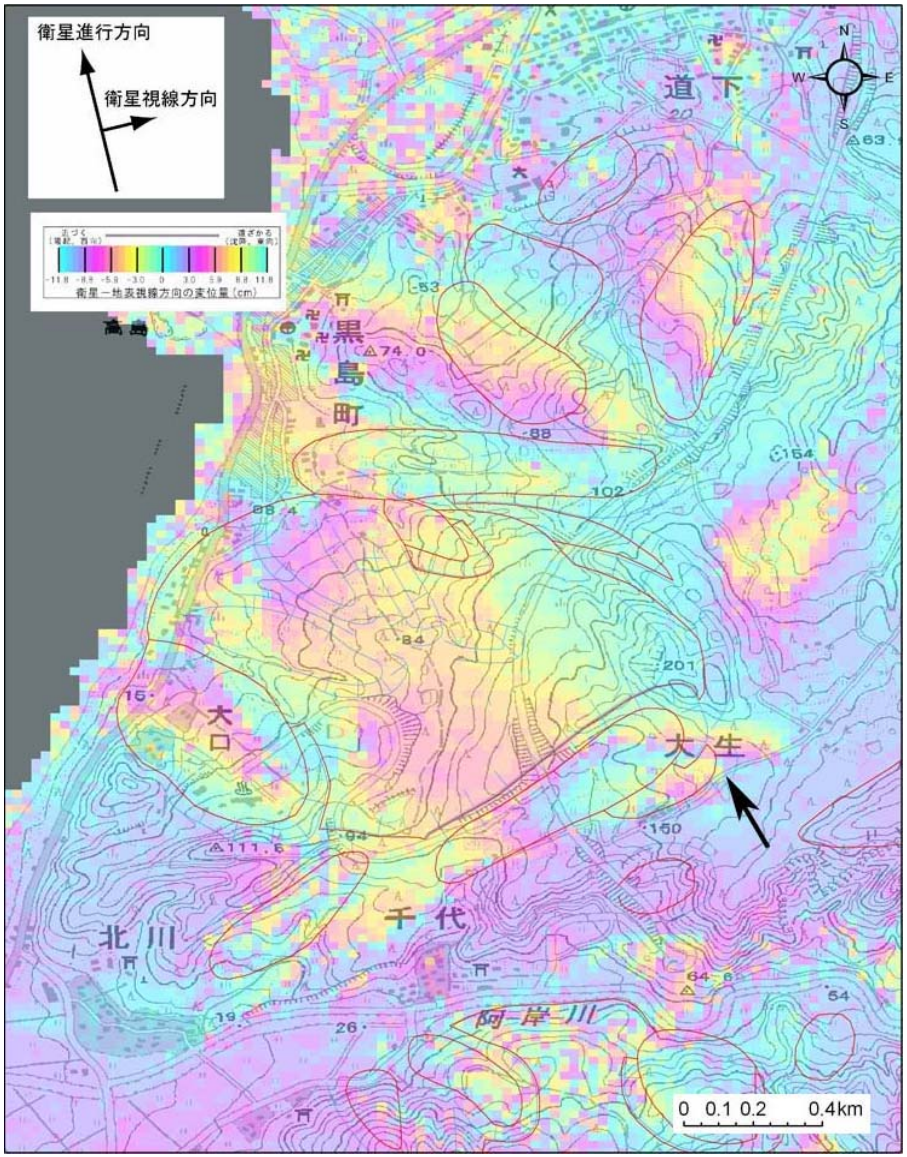
C: Phase change area is not consistent with landslide block.

A.（門前町俊兼）

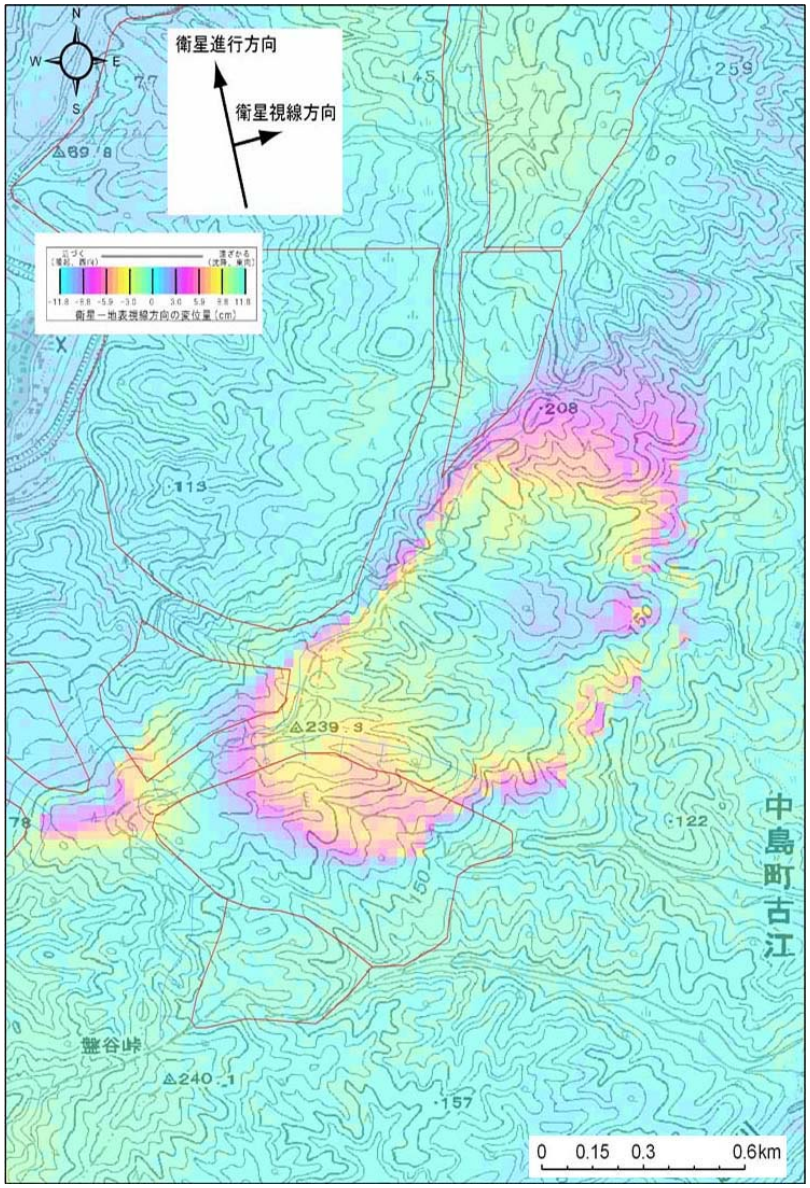


衛星進行方向
衛星視線方向
衛星ー地表視線方向の変位量 (cm)
N
S
W
E
合
平
四
位
俊
兼
嶺
谷
口
能
納
屋
石坂
100
123
44
113
142
72
0 75 150 300m

B.（門前町大生）

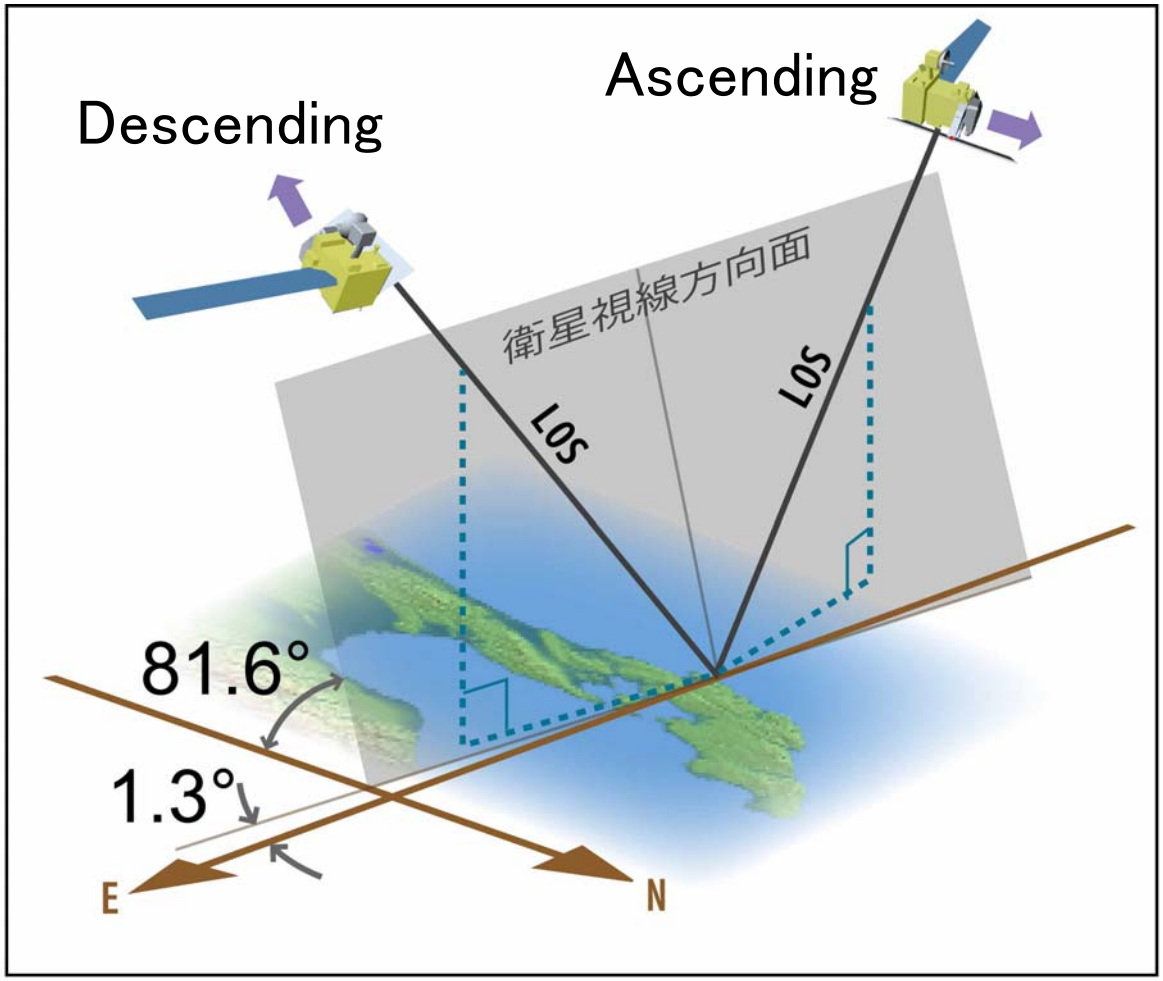

衛星進行方向
衛星視線方向
衛星－地表視線方向の変位量（cm）
道下
黒島町
大口
大生
千代
北川
岡岸川
0 0.1 0.2 0.4km

C.（中島町古江）



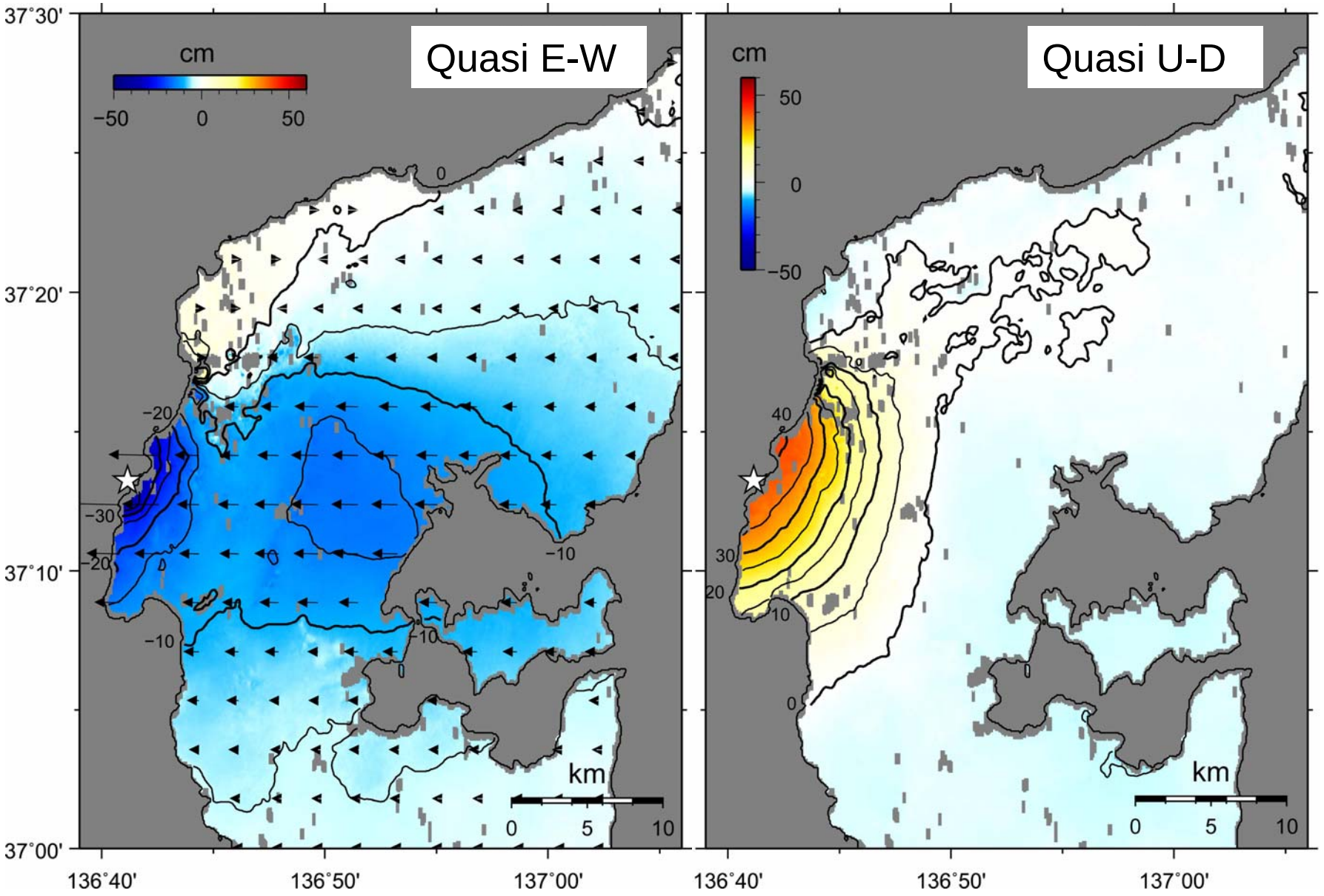
- Deformation area is not consistent with landslide area
- No evidence of landslide recognized at this area.

2-D displacement calculation

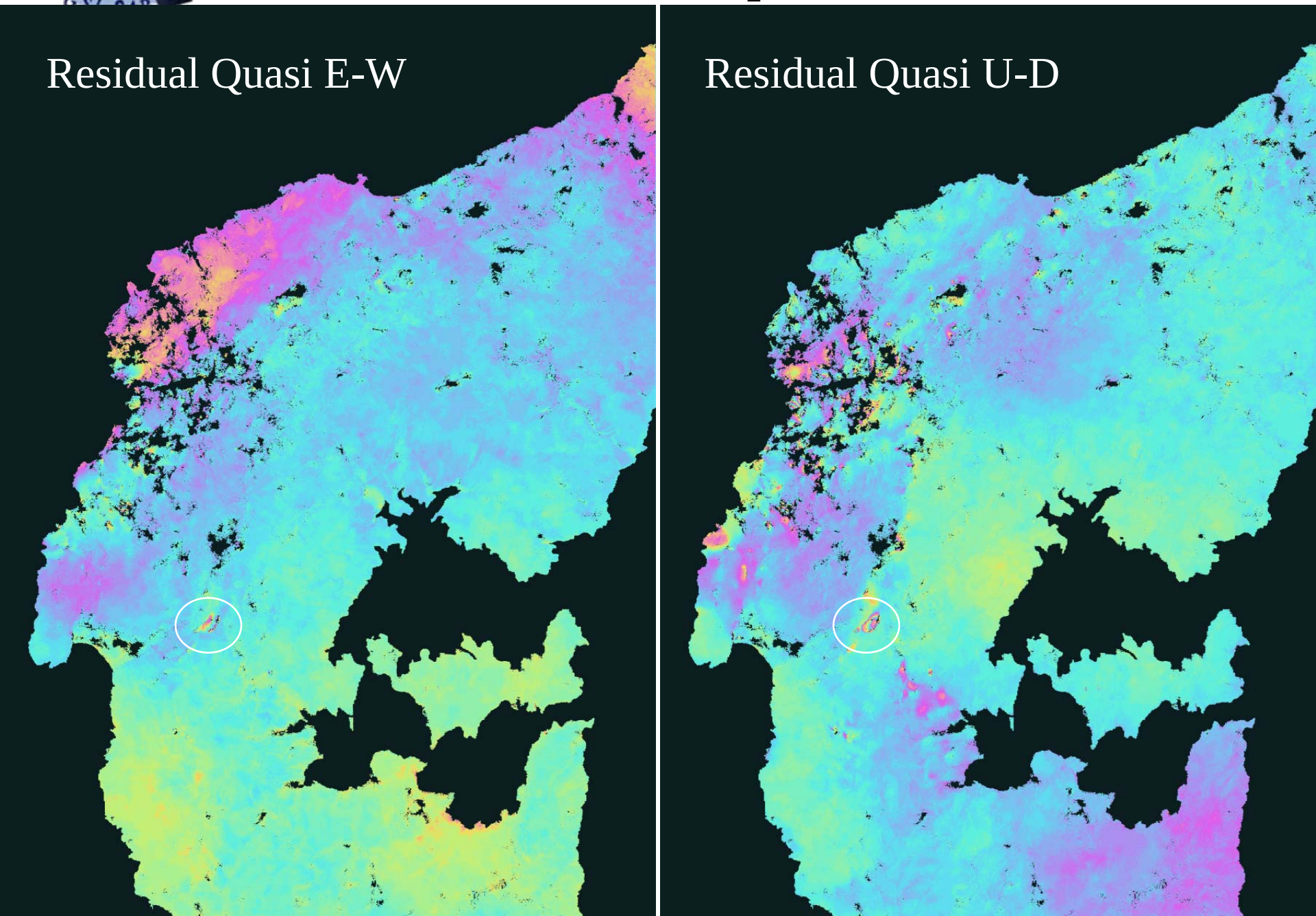


2つの方向からの観測を合成することで
変動を2次元で検出できる

2-D displacement

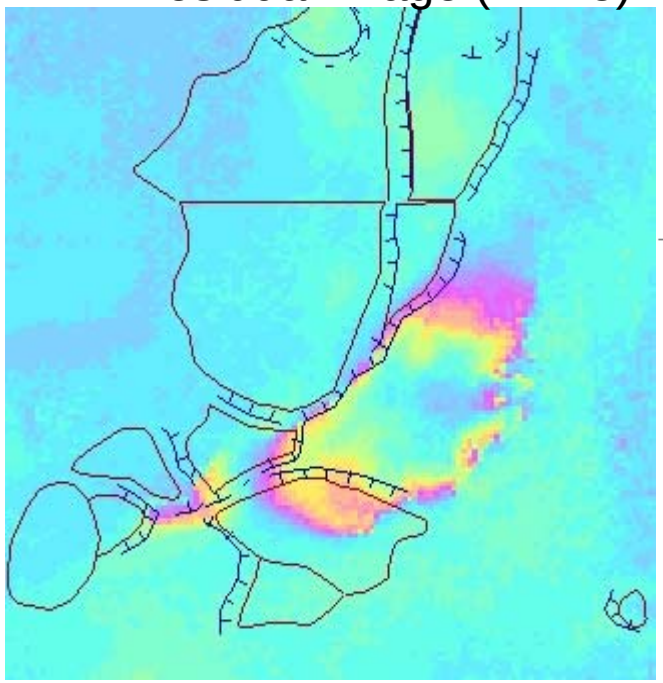


2-D residual displacement

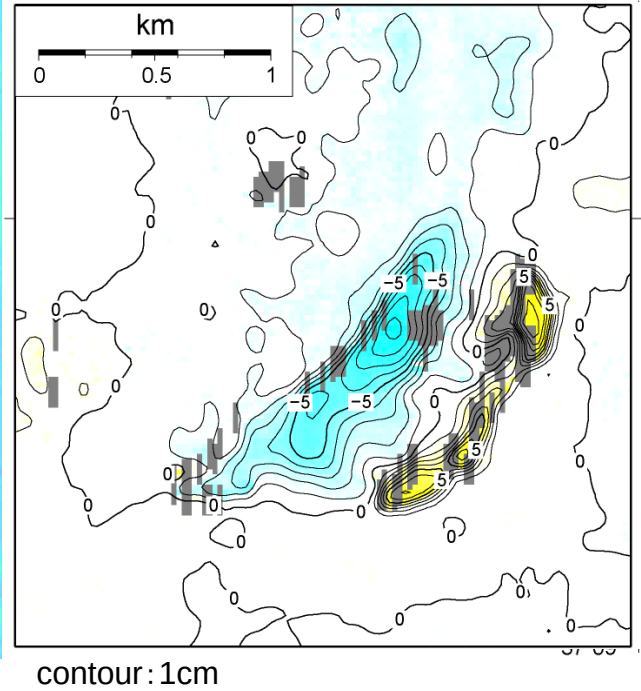


2-D residual displacement

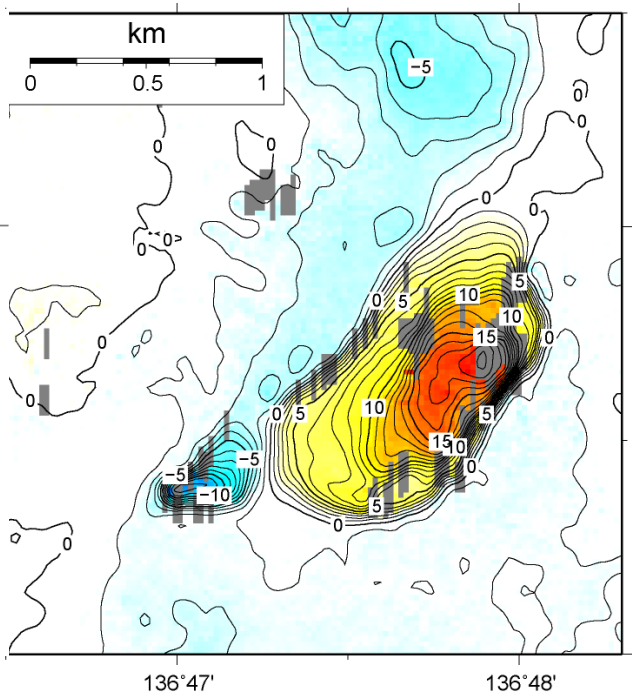
Residual image (A41.5)



Residual Quasi U-D



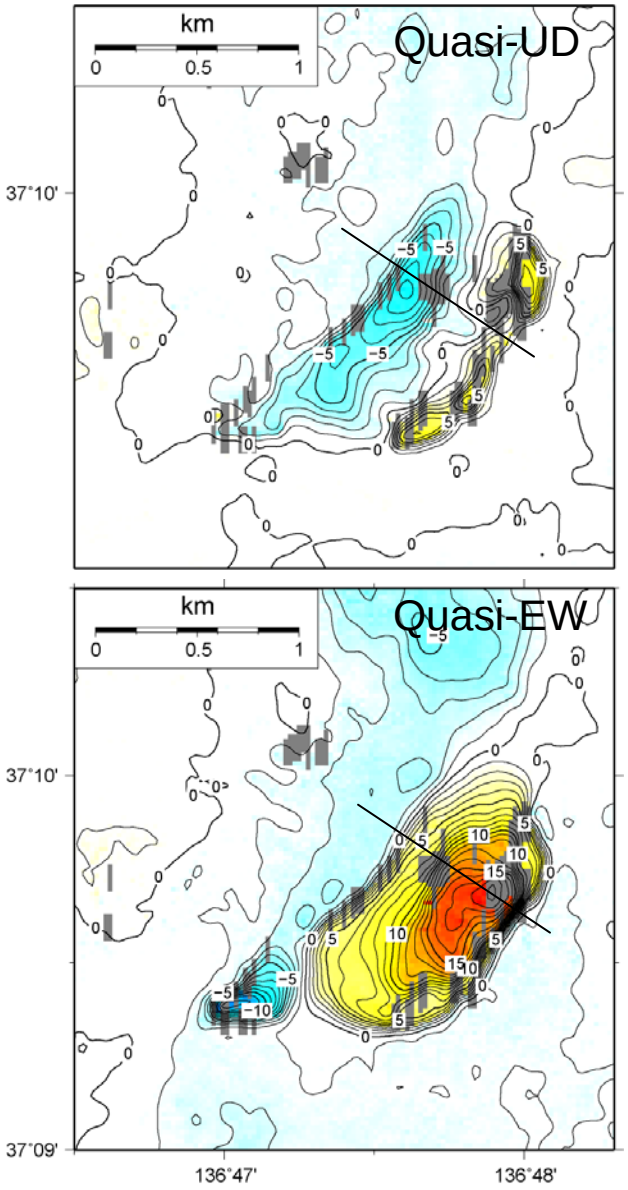
Residual Quasi E-W

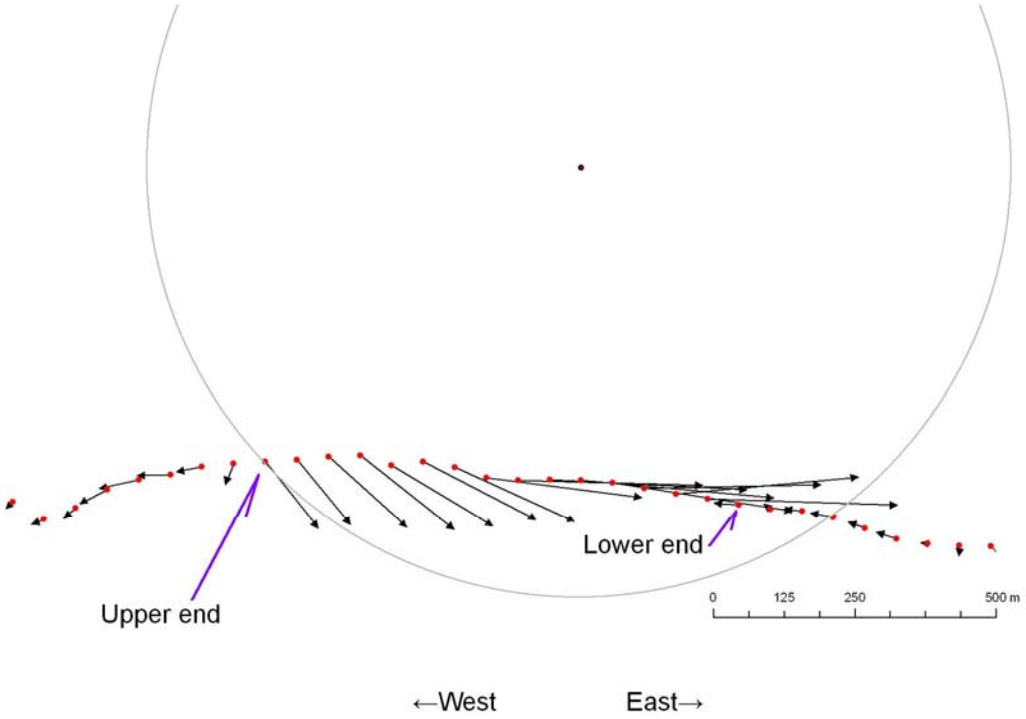


Deformation area is not consistent with landslide block.

But, typical landslide deformation.

Rotational slip estimation





Estimated slip surface depth : 200m

Such movement can be considered as the sign of the initial process of the development of large landslides.

Conclusion

- ALOS/PALSAR interferogram of the 2007 Noto Hanto earthquake includes not only crustal deformation derived from EQ but also local surface deformation, such as landslide.
- We can detect the local deformation such as landslide derived from earthquake by subtracting from interferogram to deformation due to earthquake.
- InSAR is a powerful tool for not only geophysics but also geography, disaster prevention.

謝辞

- 本研究で用いたALOS/PALSARデータは、国土地理院とJAXAとの間の共同研究協定に基づいて提供された。また、ALOS/PALSARデータの所有権は、JAXA及びMETIが所持する。