

Signal Filtering Methods of InSAR

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SAR interferometry (InSAR)

Wavelength - 23.6 cm

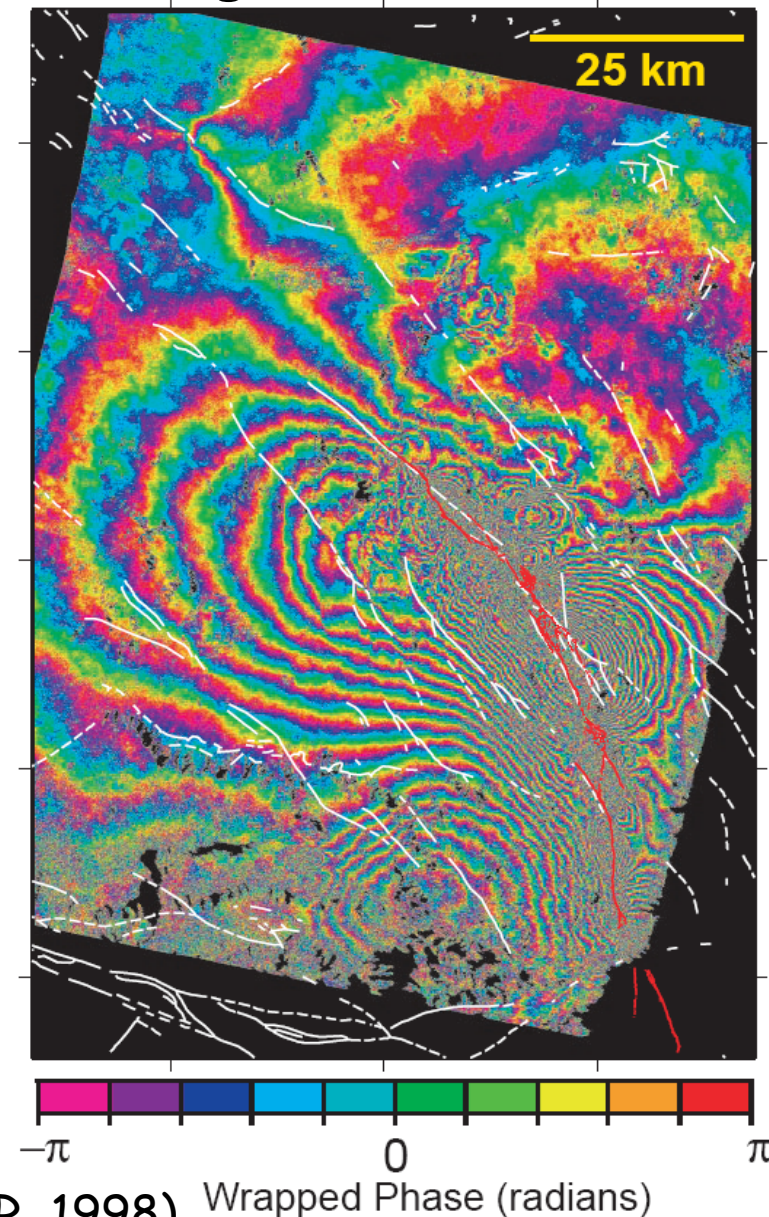
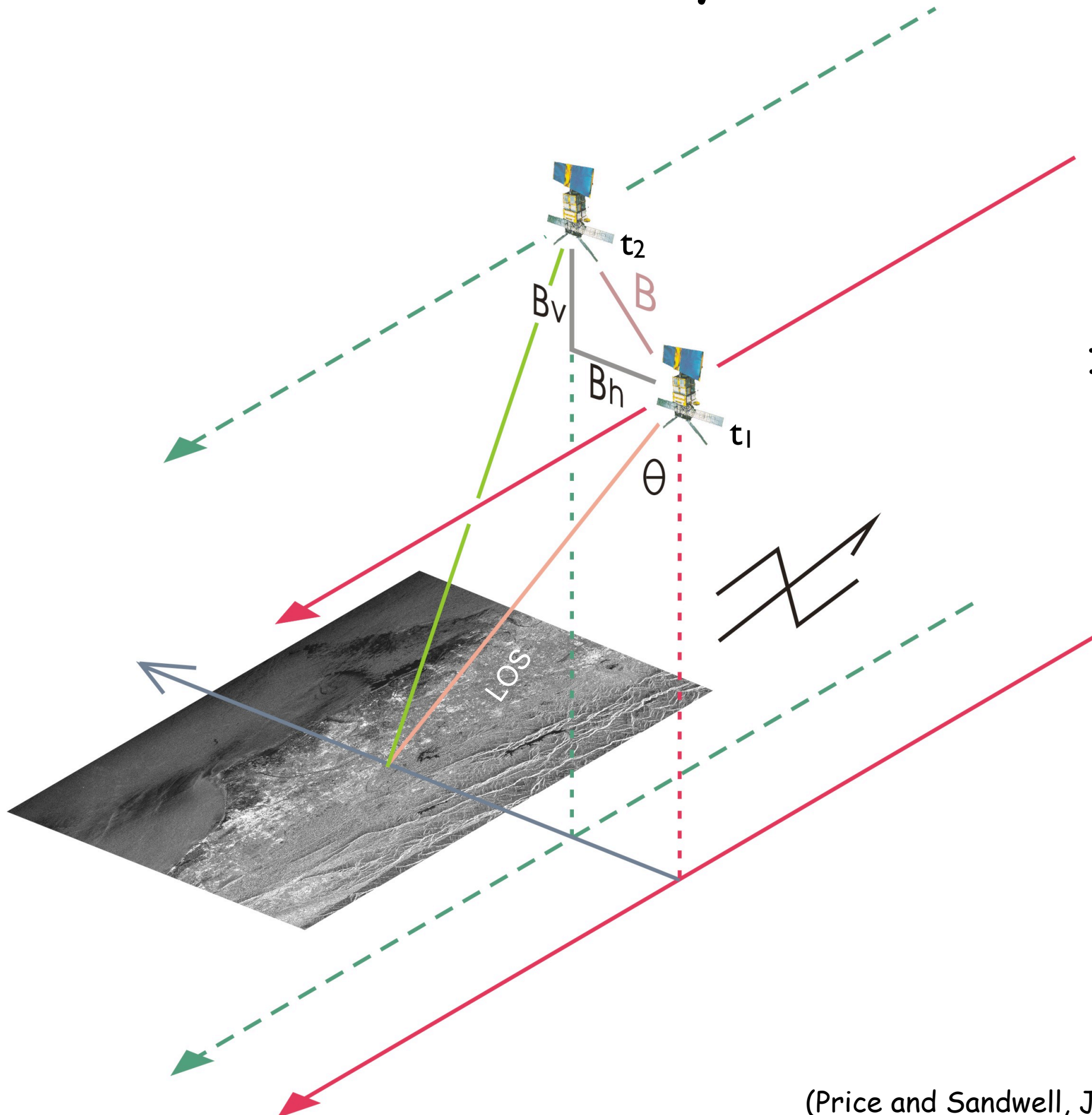
Height - 800 km

Velocity ~ 7 km/s

B - baseline

Θ - looking angle

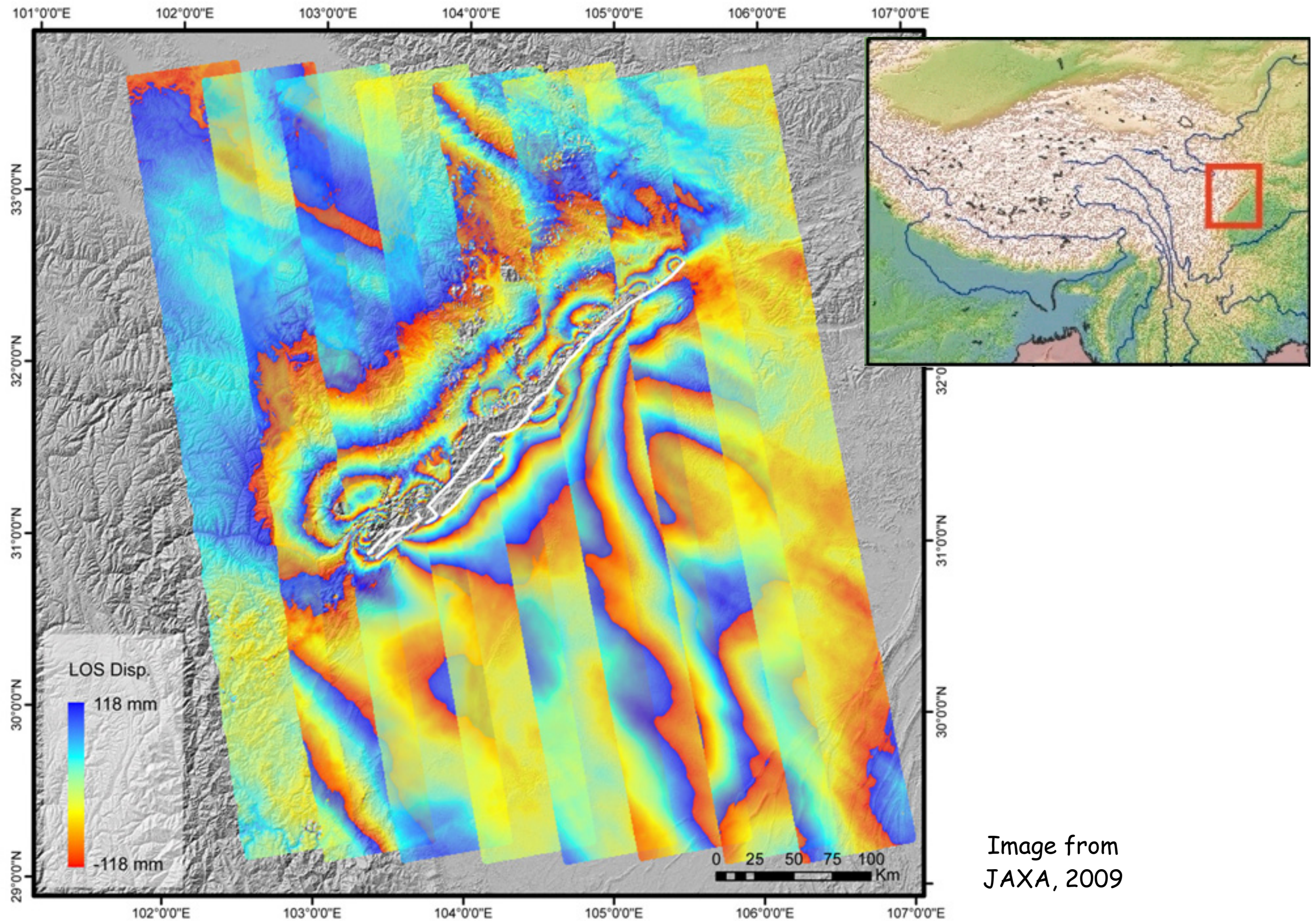
Interferogram



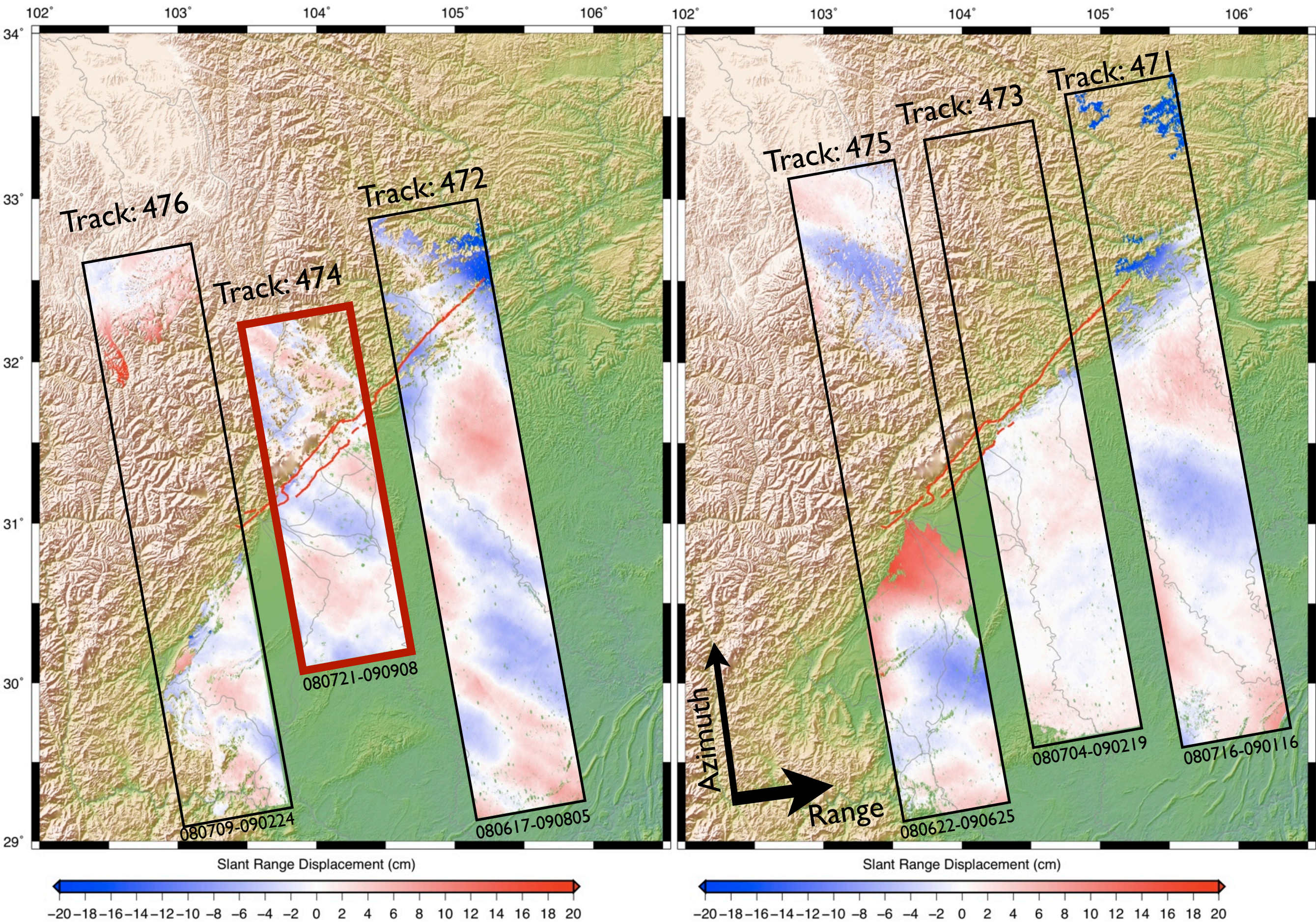
(Price and Sandwell, JGR, 1998)

Wrapped Phase (radians)

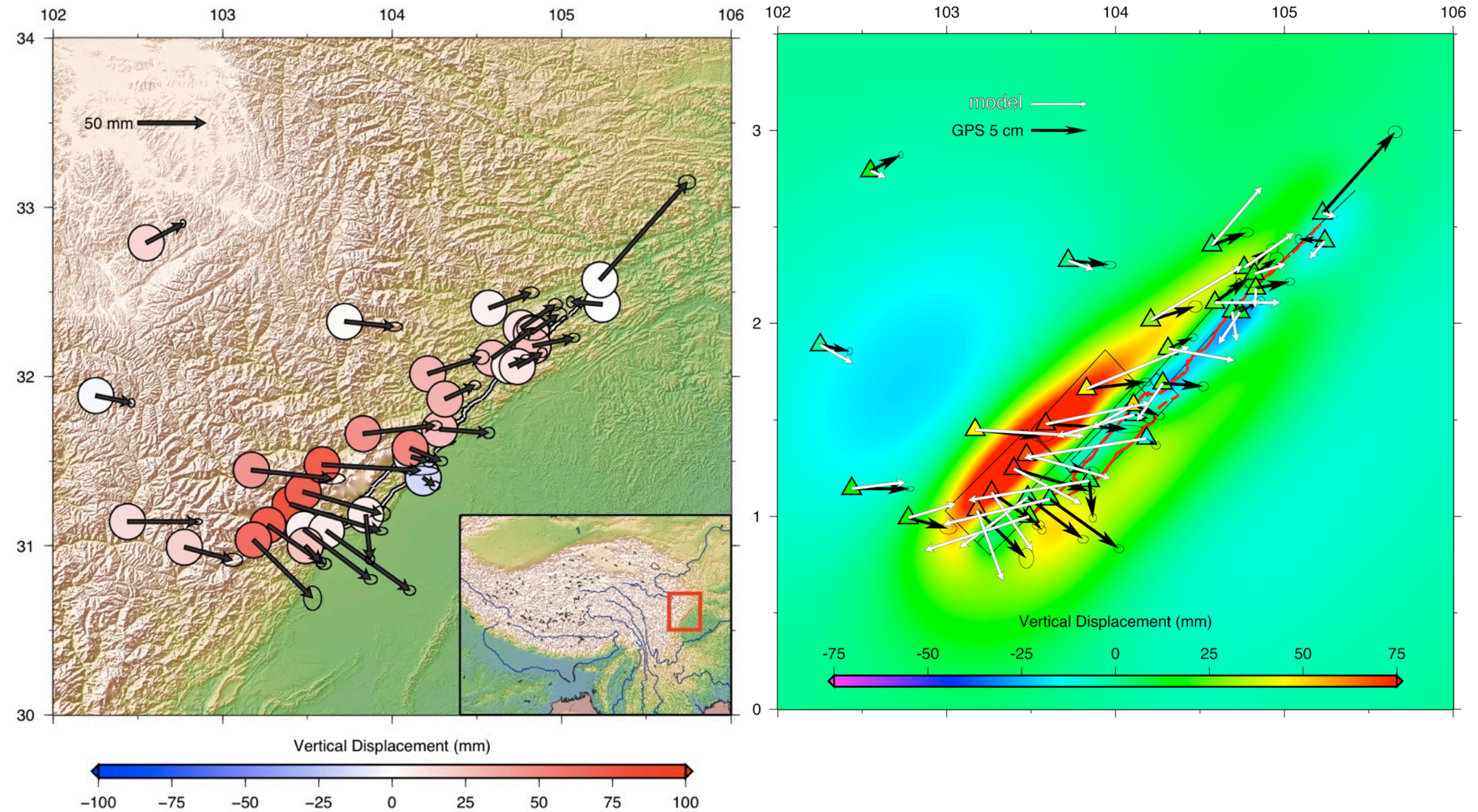
Wenchuan Coseismic Deformation (ALOS PALSAR InSAR)



Wenchuan Postseismic Deformation (ALOS PALSAR InSAR)

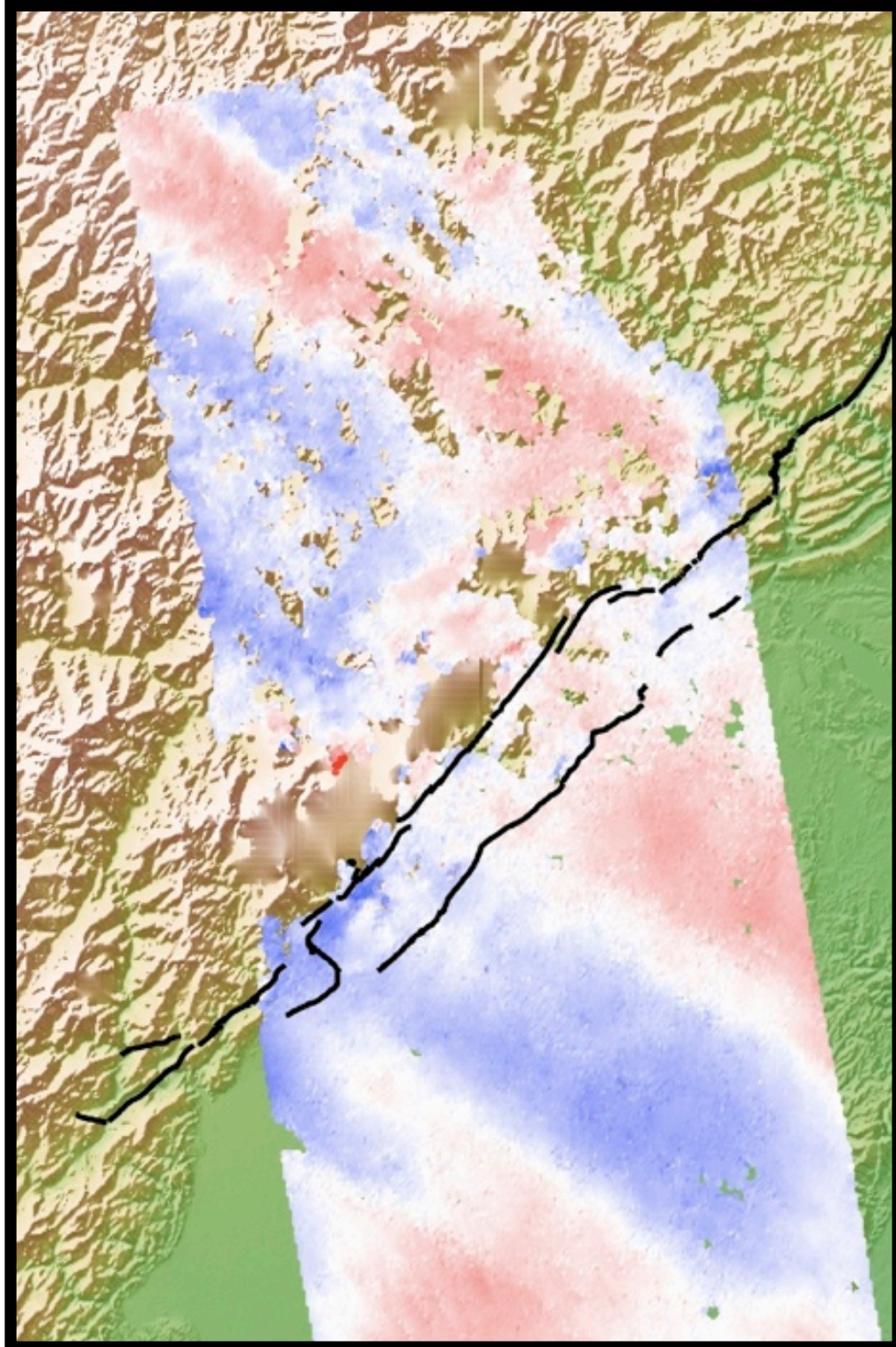


Wenchuan Postseismic Deformation (GPS & model)

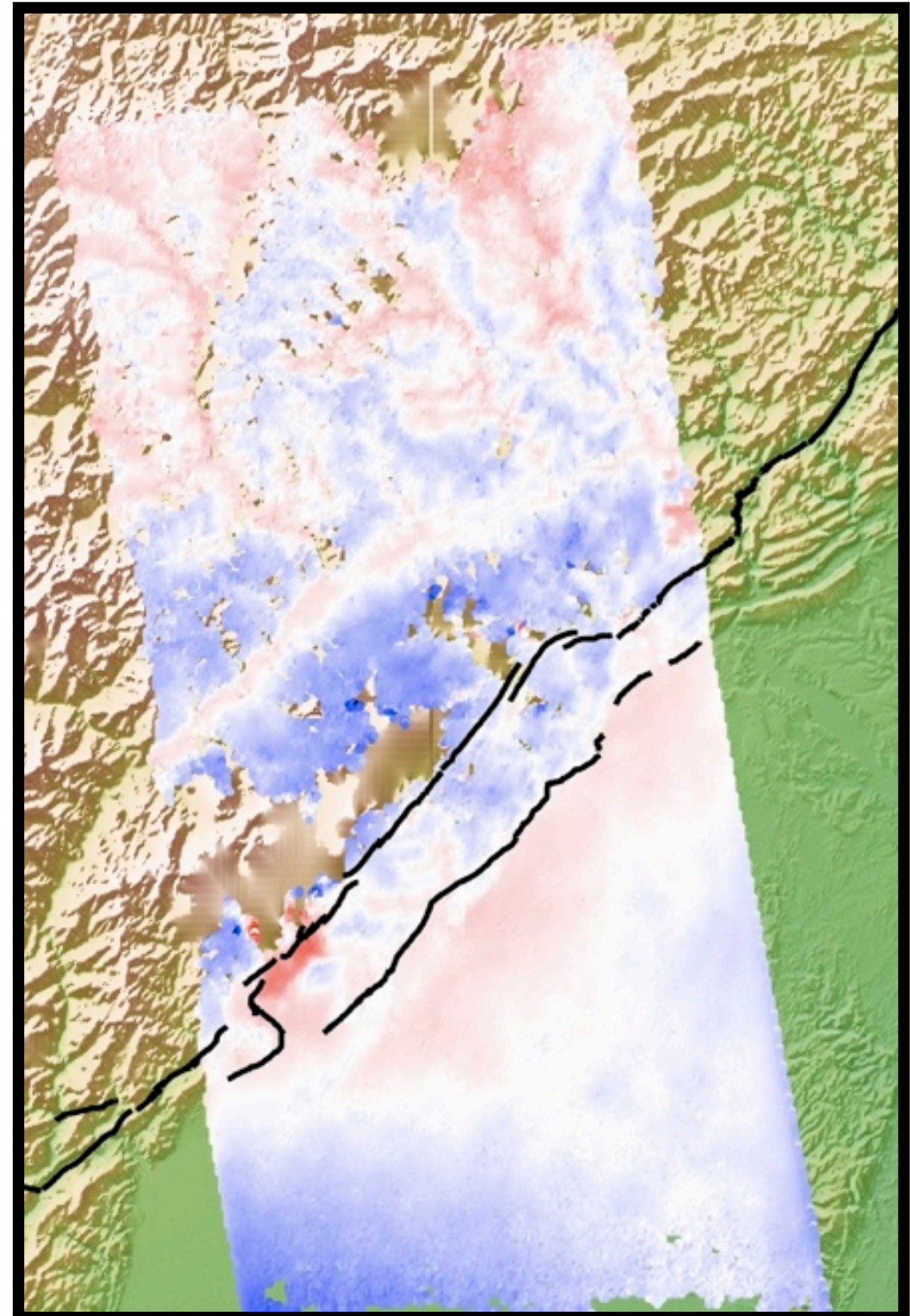


Noise: topographic related & ionospheric related

080721-090908



090908-091024



Method

Y_1 : signal 1 (InSAR); Y_2 : signal 2 (dem)

Fourier transform

$$X_k = \sum_{n=0}^{N-1} x_n e^{-\frac{2\pi i}{N} kn}$$

$$Z_1 = \text{fft}(Y_1)$$

$$Z_2 = \text{fft}(Y_2)$$

Complex cross-correlation

$$\gamma = \frac{\text{E}[z_1 z_2^*]}{\sqrt{\text{E}[|z_1|^2] \text{E}[|z_2|^2]}} = D \exp(j\beta)$$

$$D = |\gamma|$$

(Degree of coherence)

Decorrelation

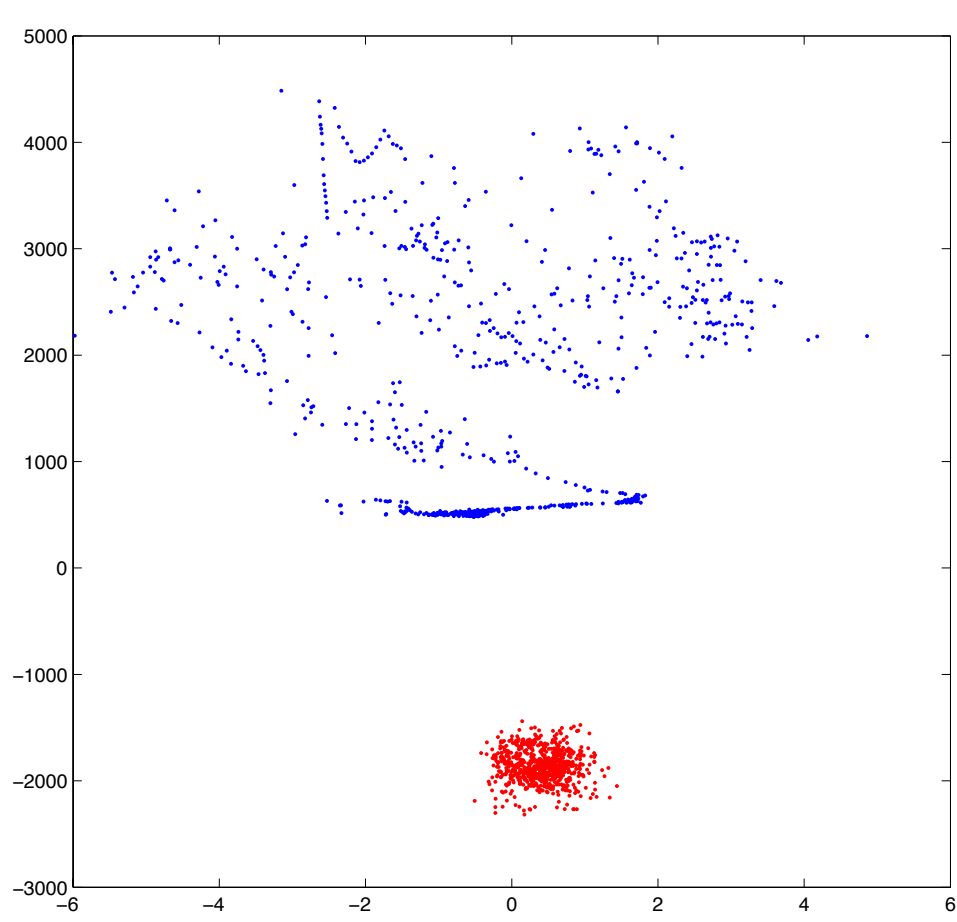
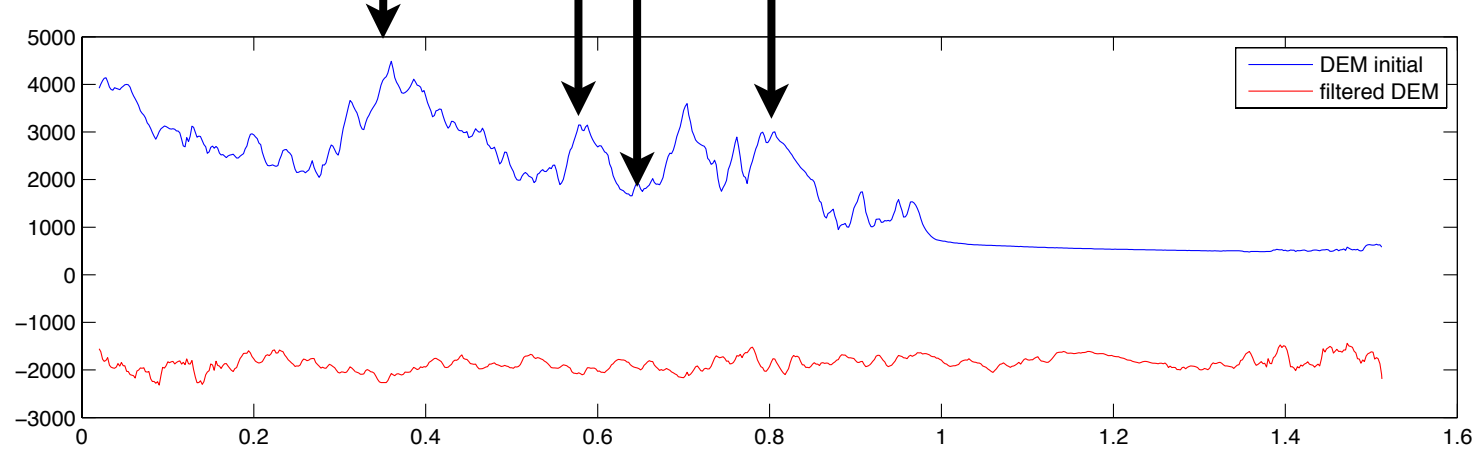
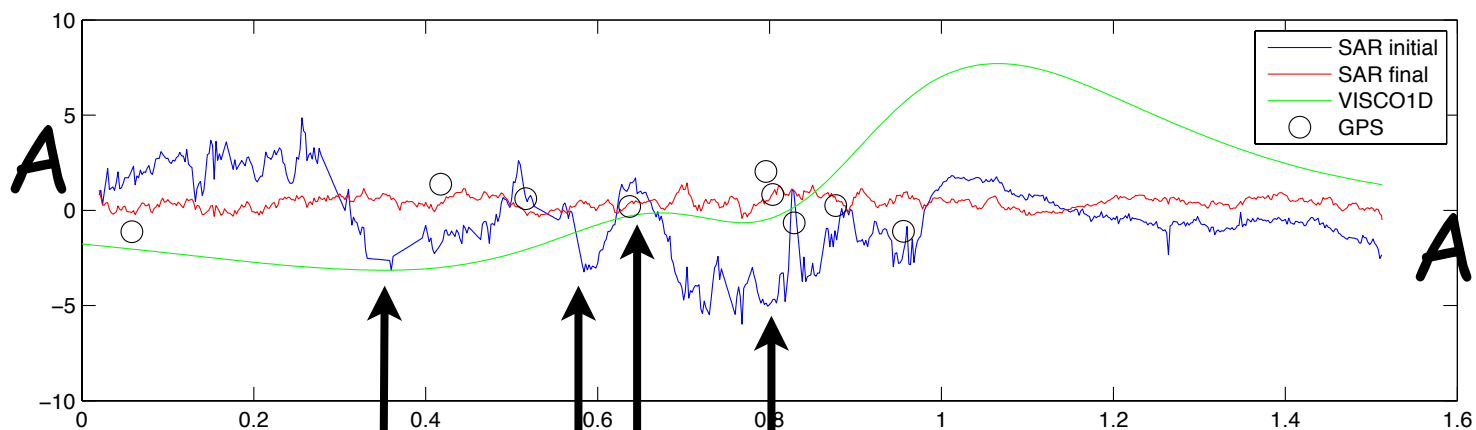
$$\delta = 1 - \text{smooth}(D)$$

Inverse Fourier transform

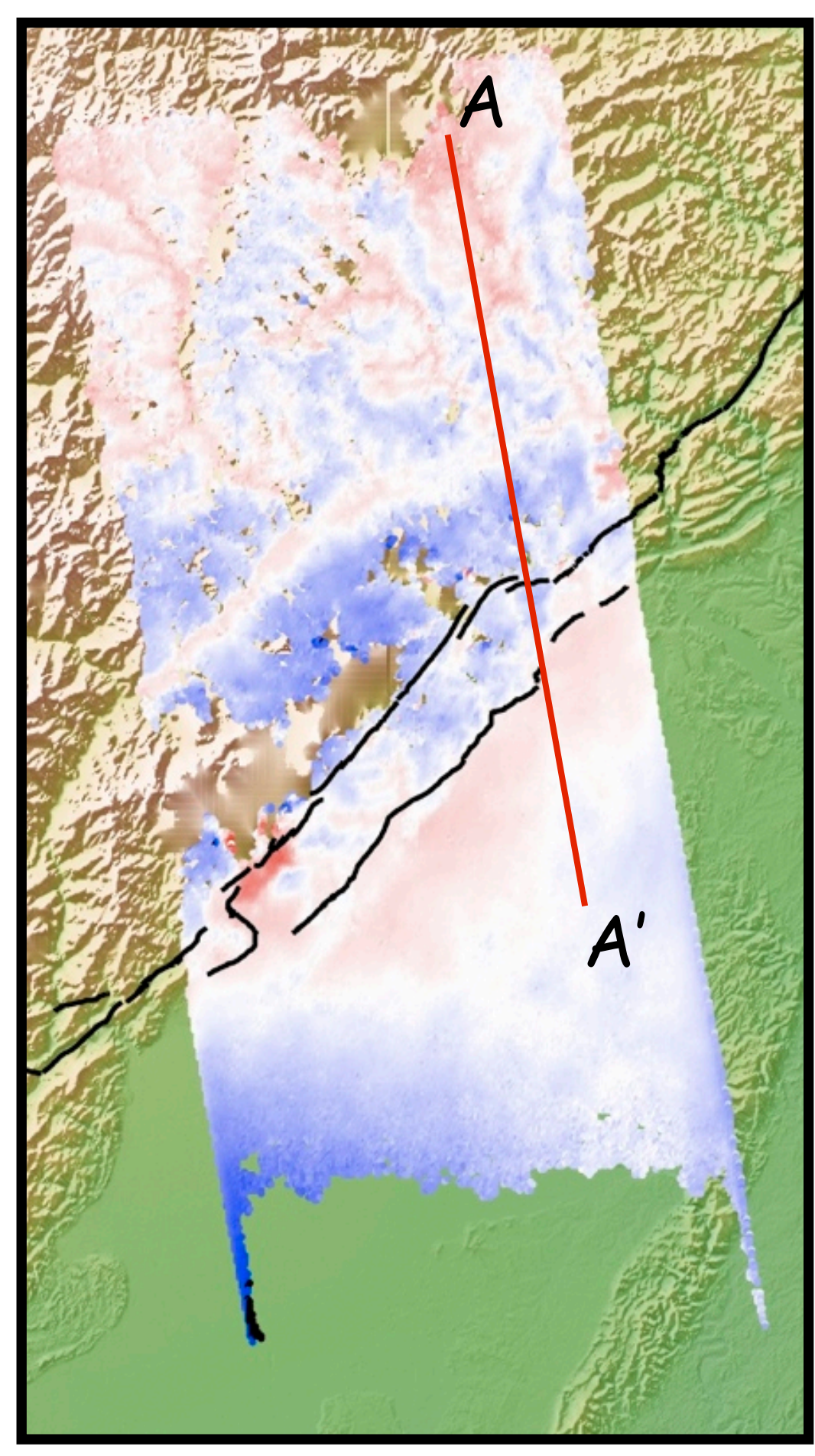
$$x_n = \frac{1}{N} \sum_{k=0}^{N-1} X_k e^{\frac{2\pi i}{N} kn}$$

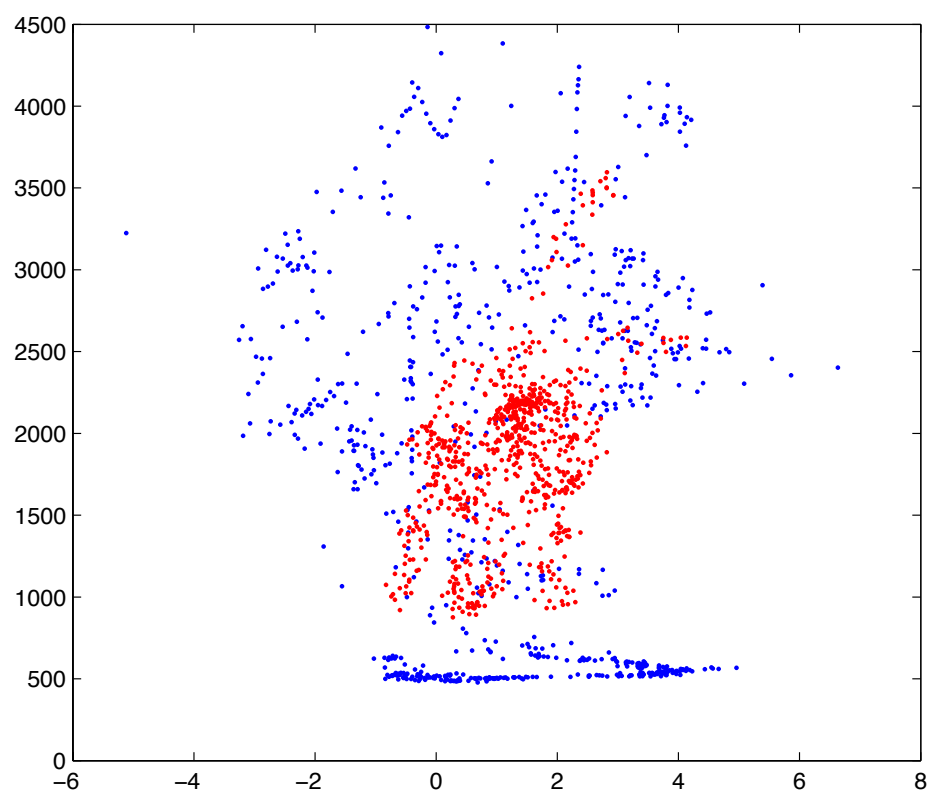
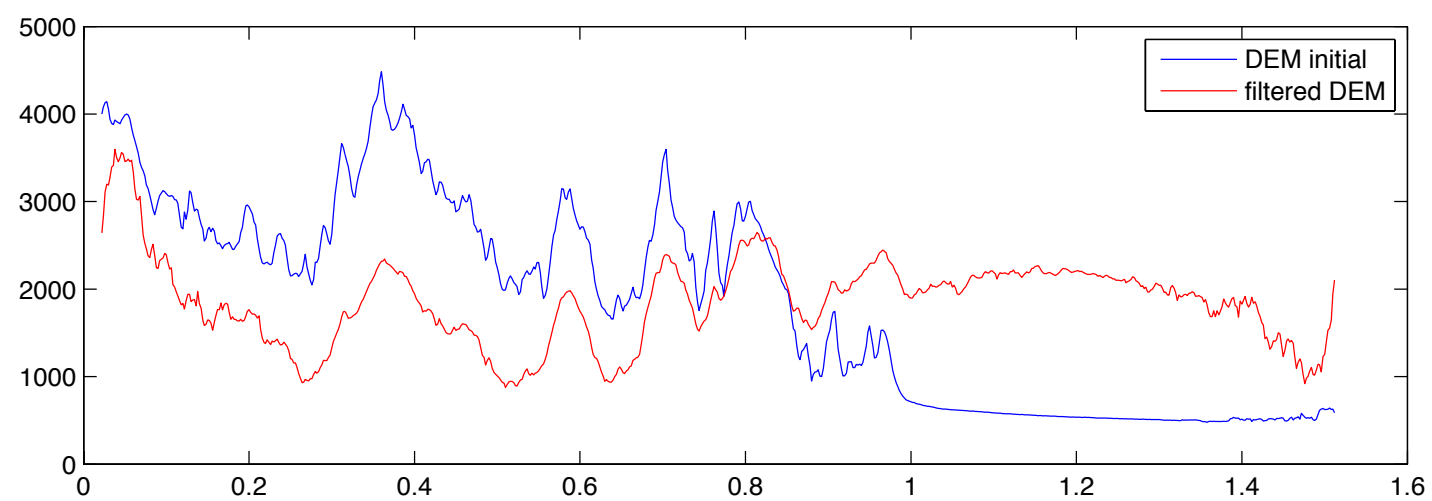
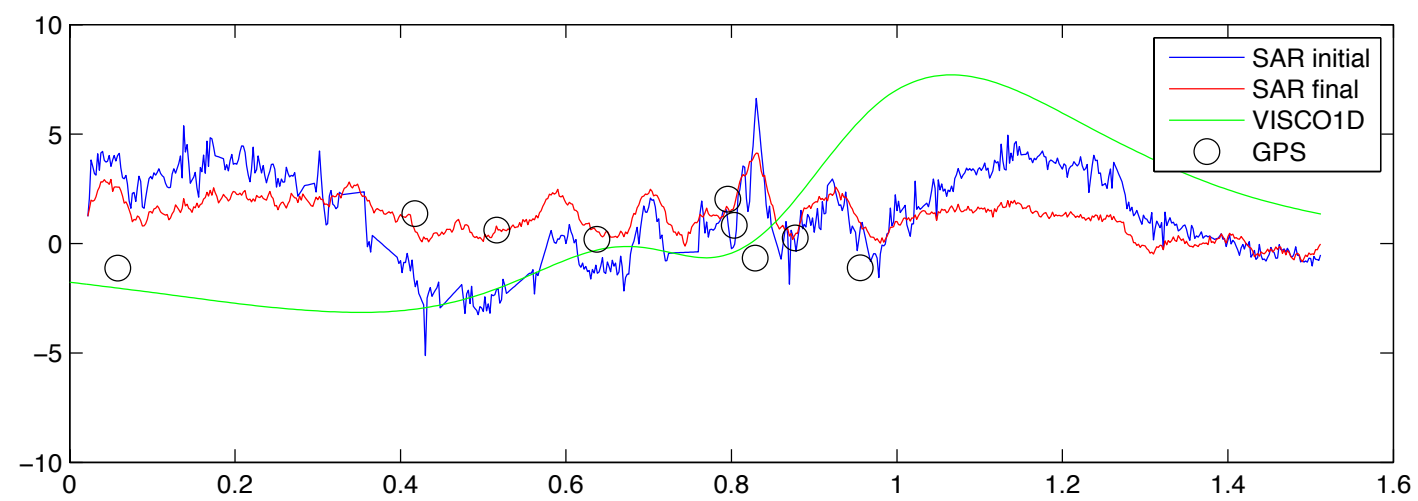
$$Y_1 = \text{ifft}(\delta Z_1)$$

$$Y_2 = \text{ifft}(\delta Z_2)$$



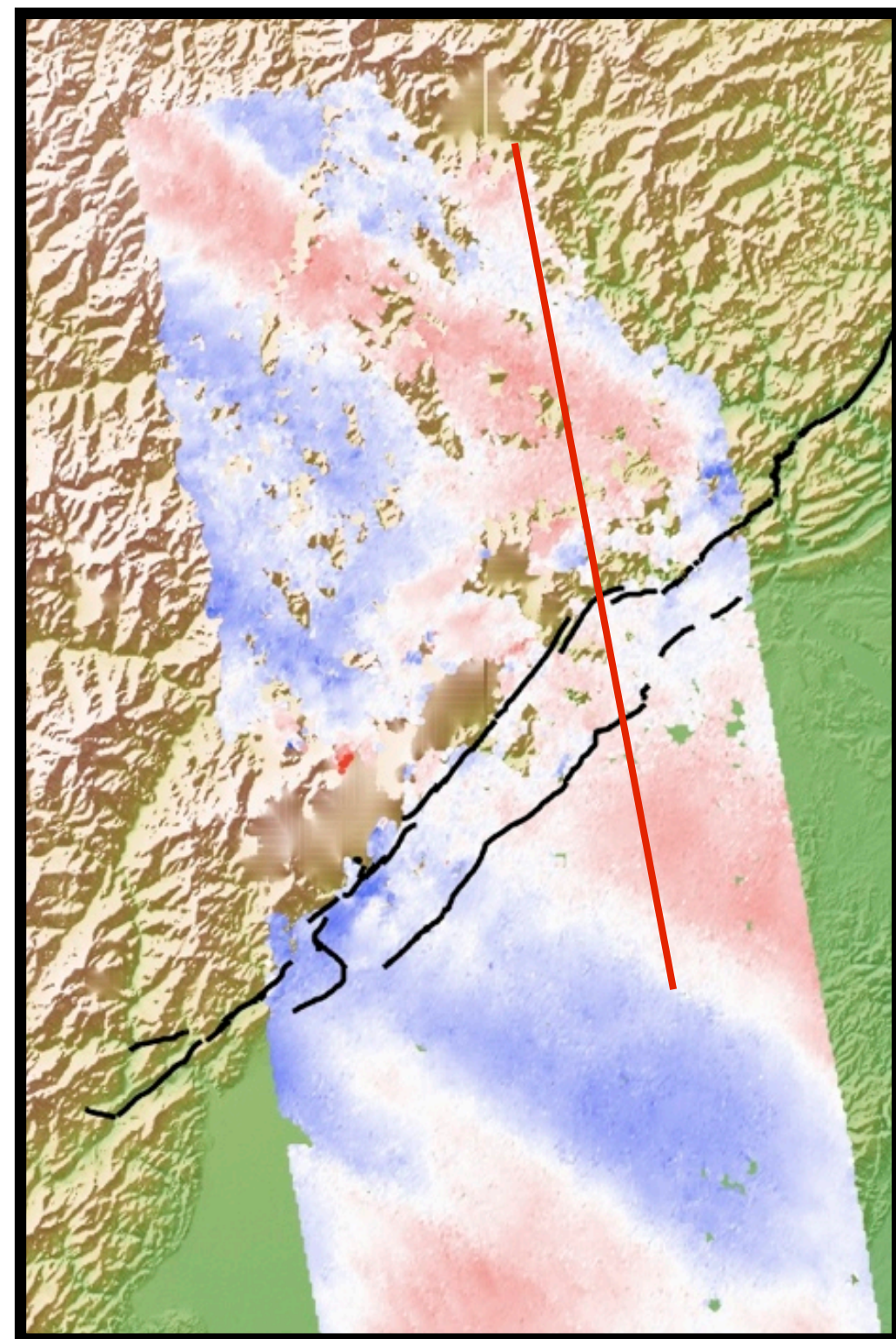
● before
● after





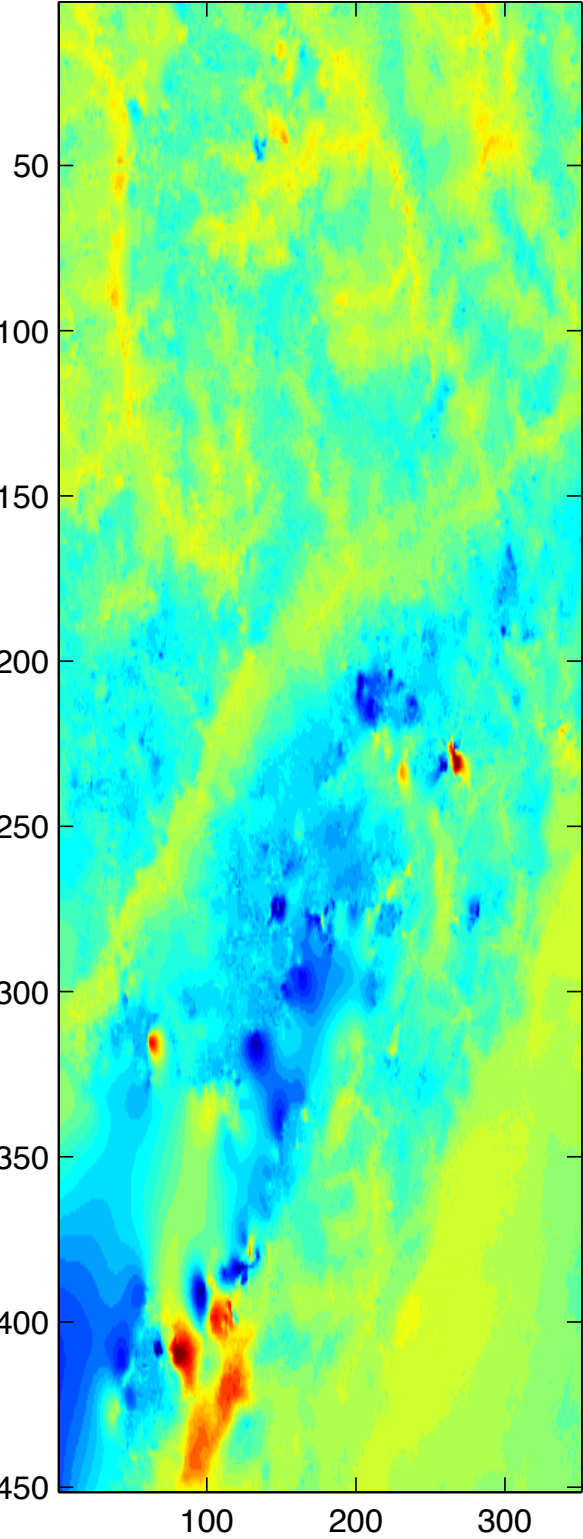
● before

● after

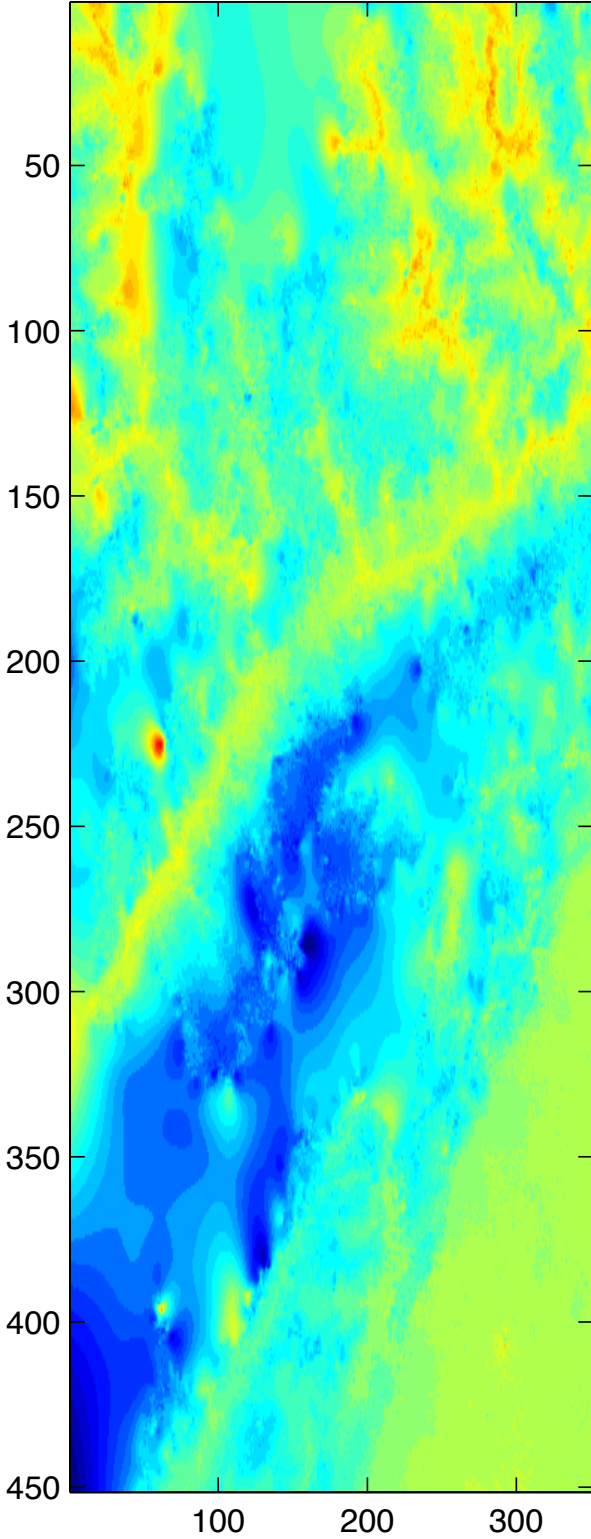


whole SAR images

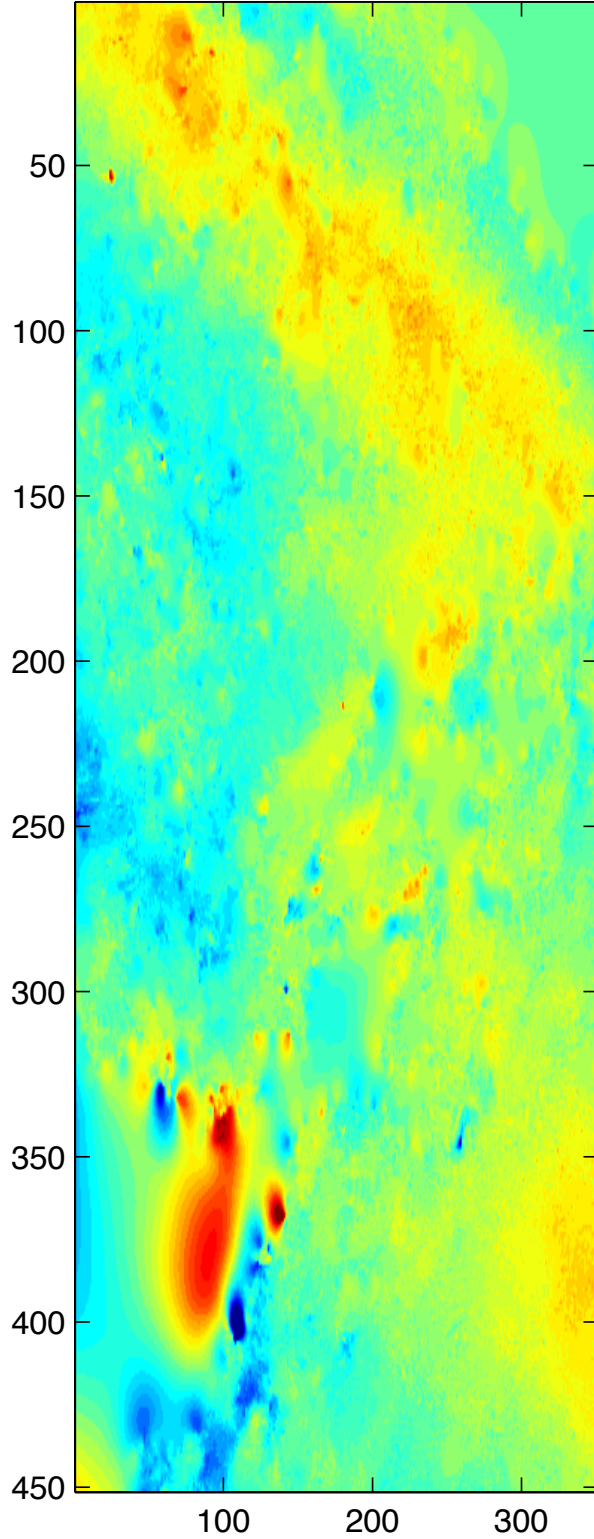
090908-091024



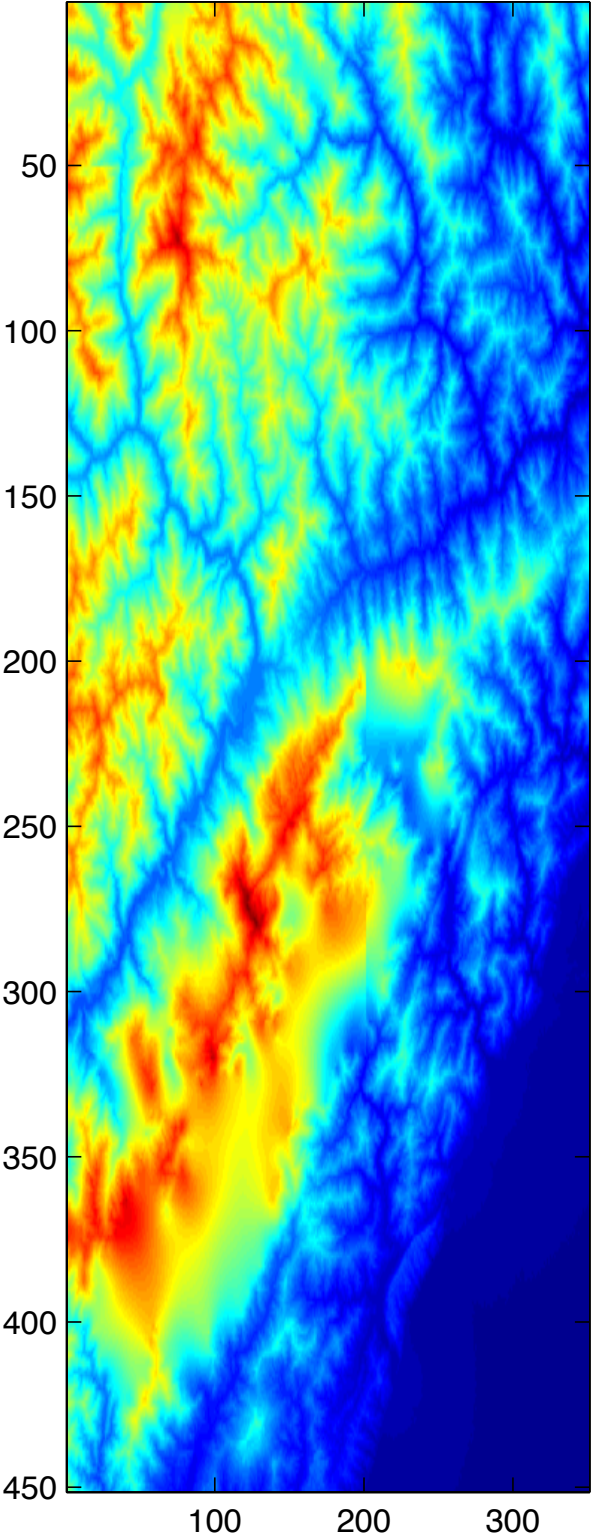
100727-101027



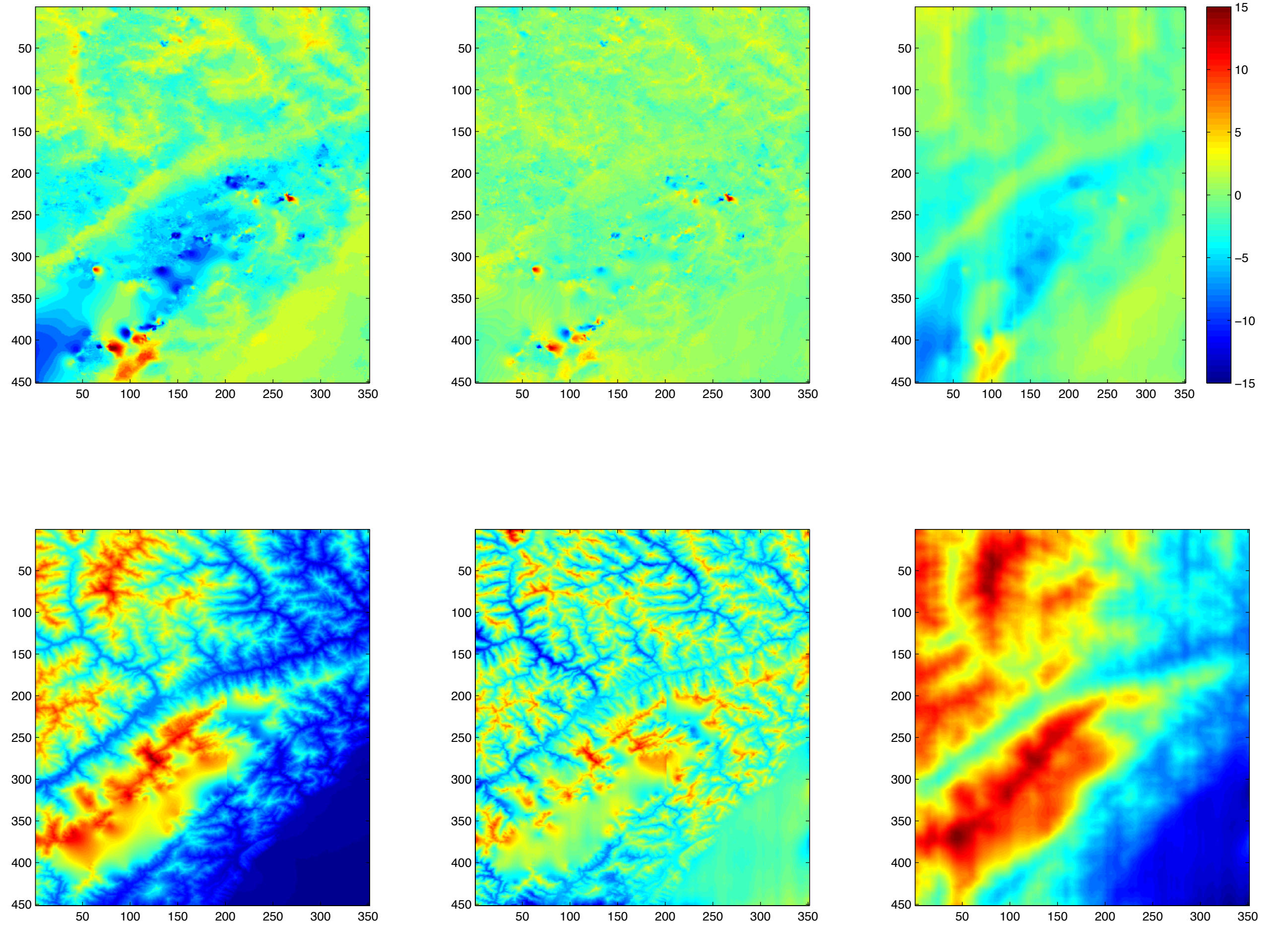
080721-090908



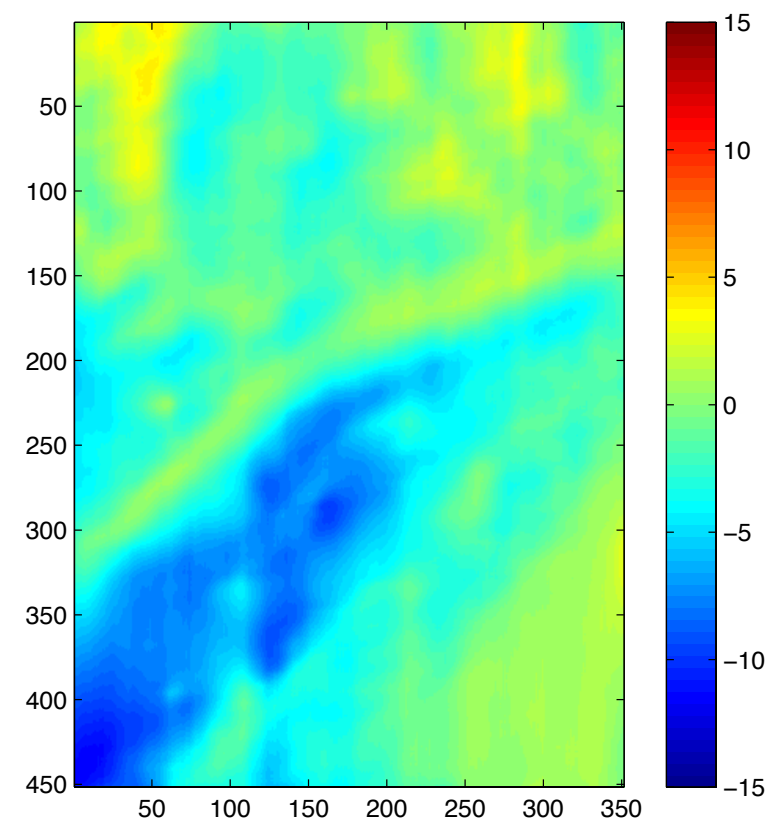
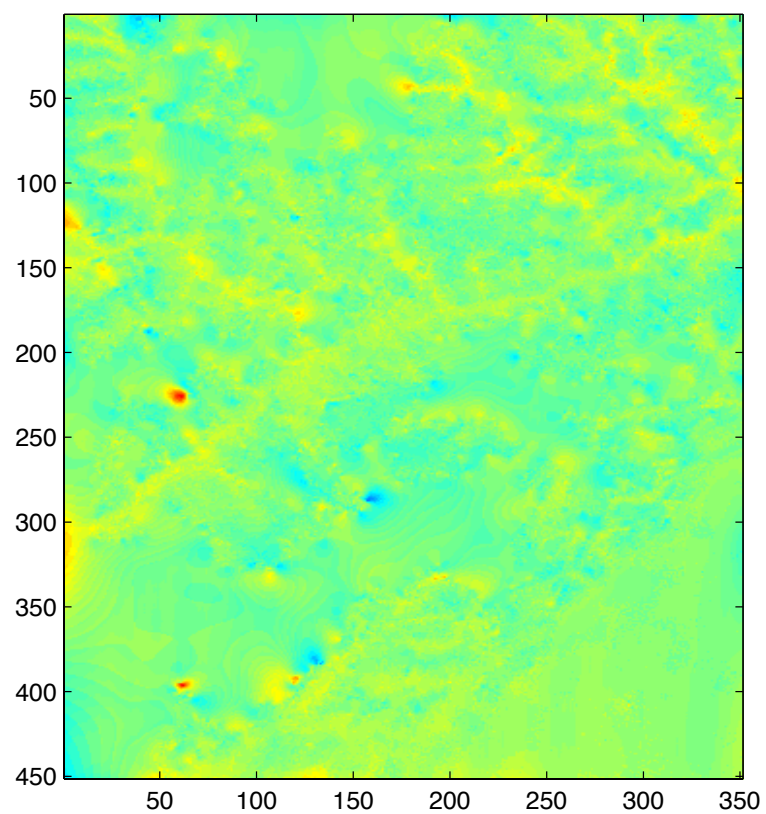
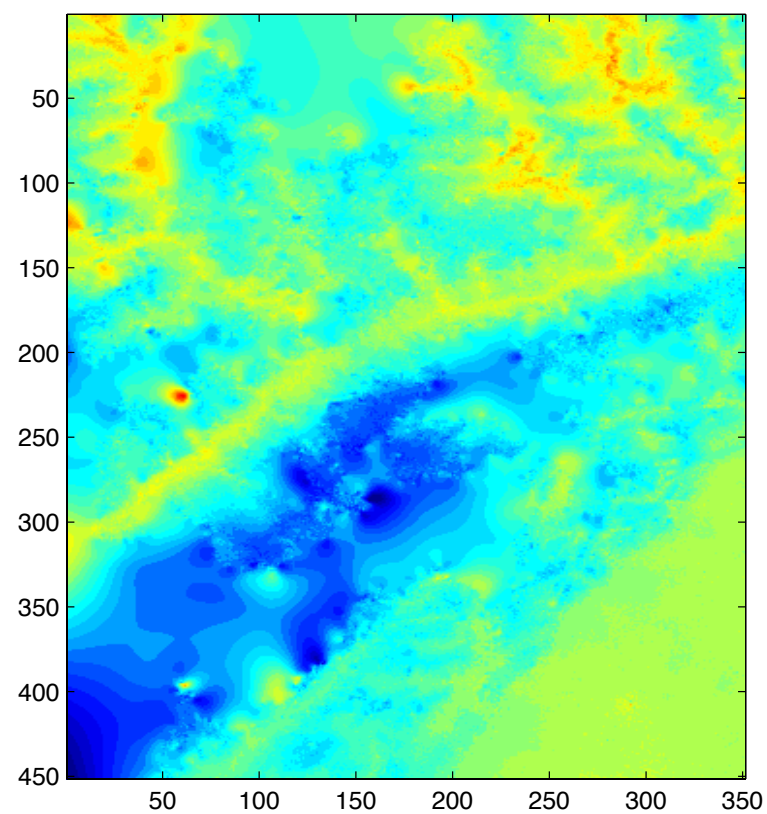
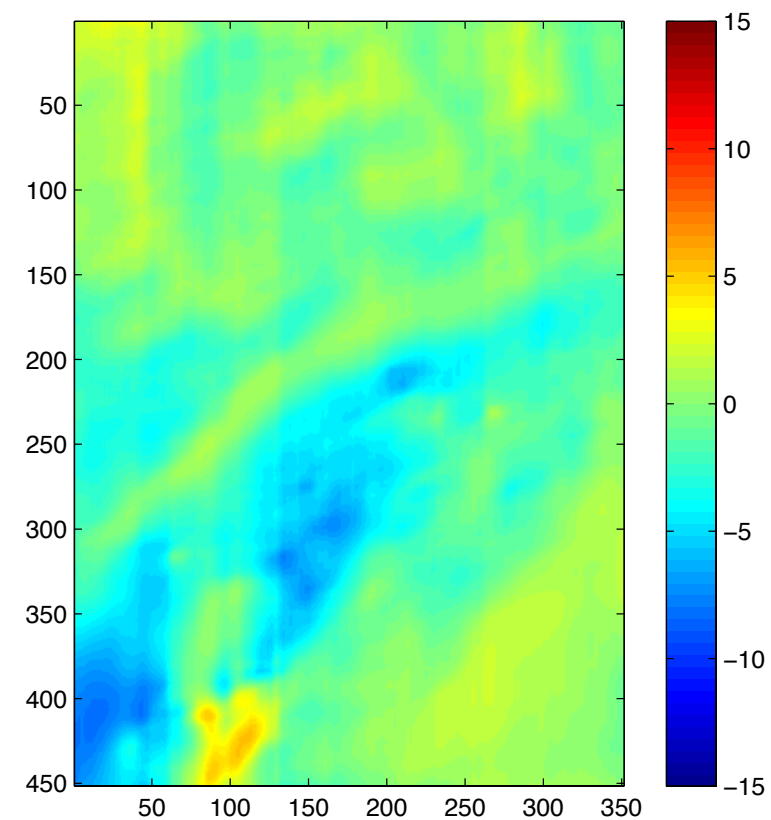
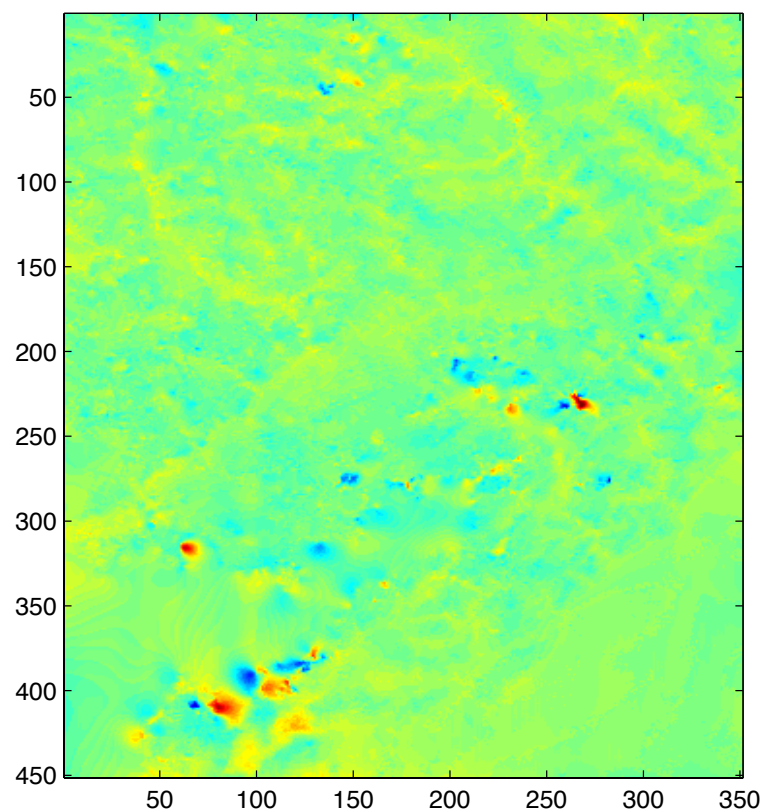
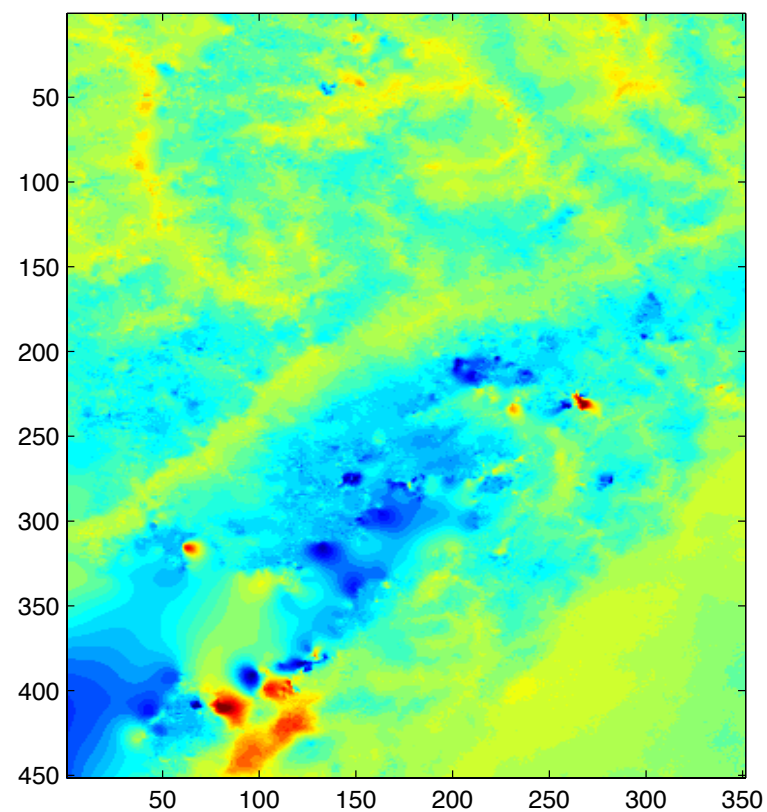
DEM



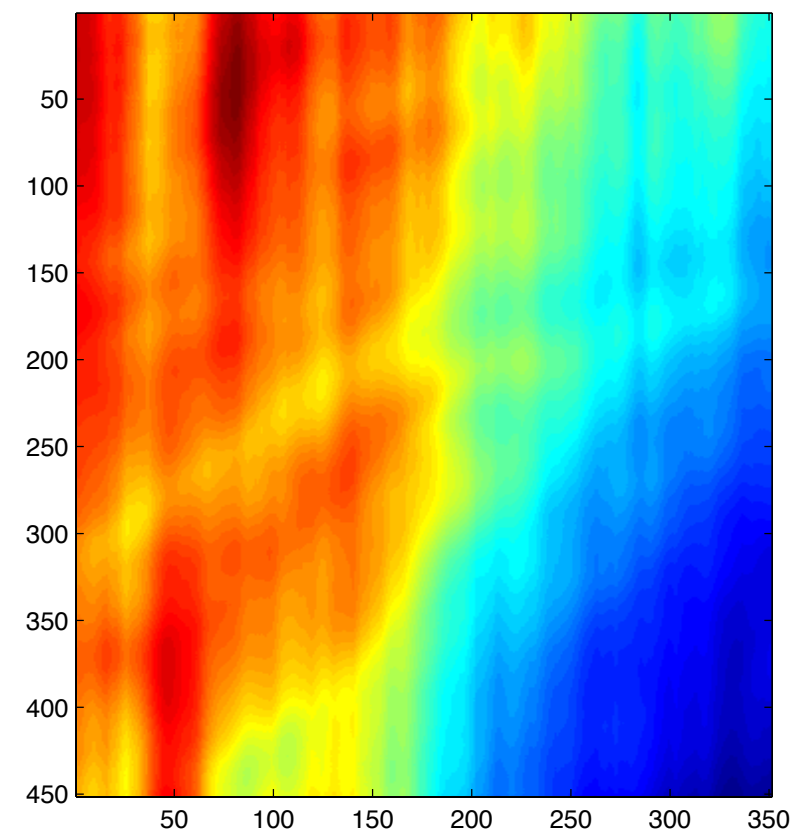
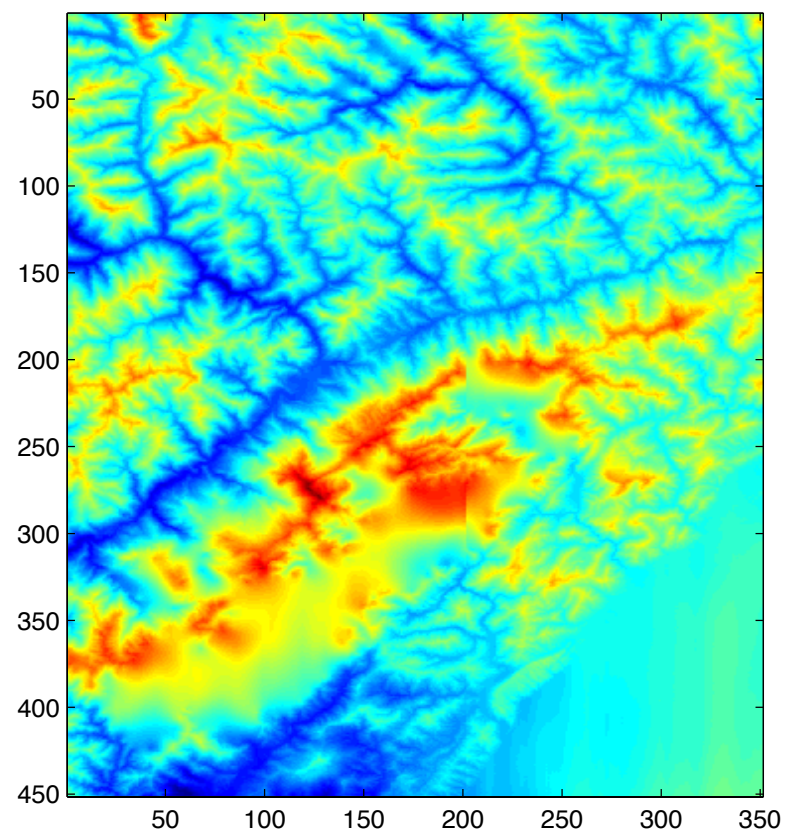
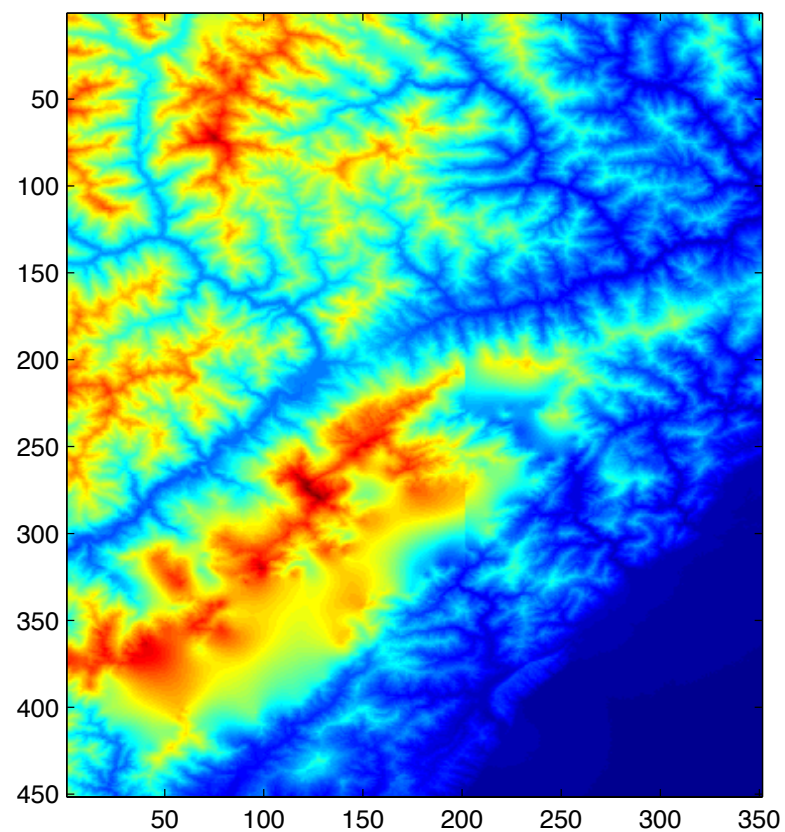
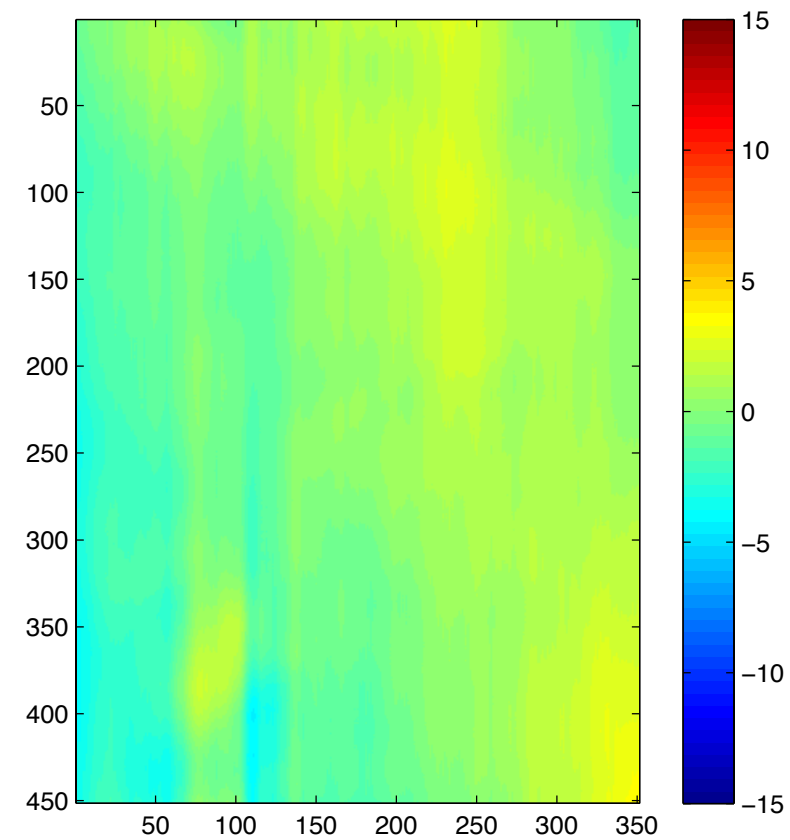
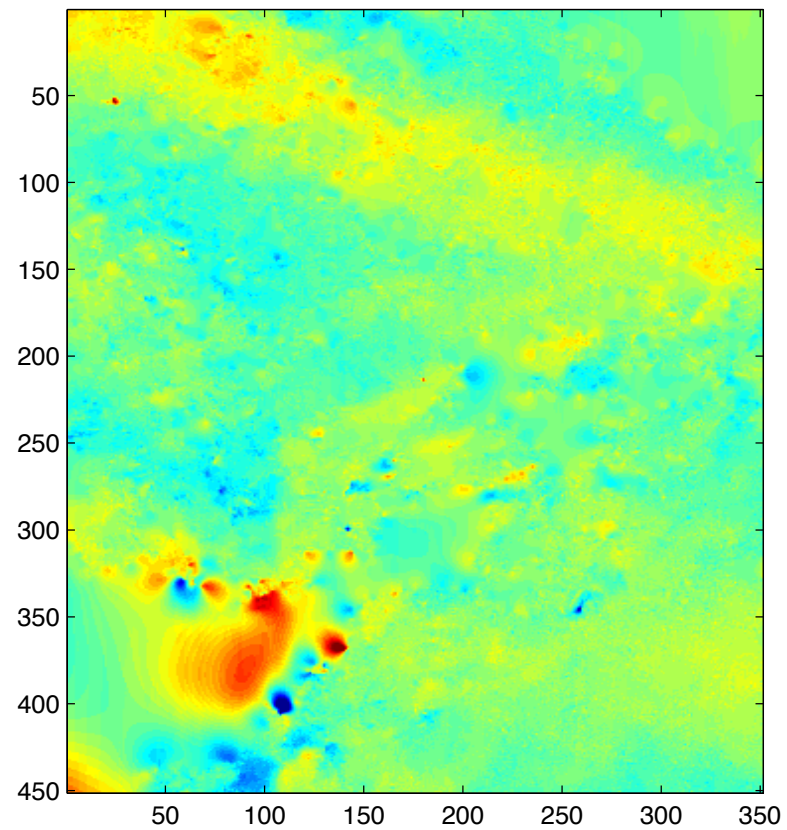
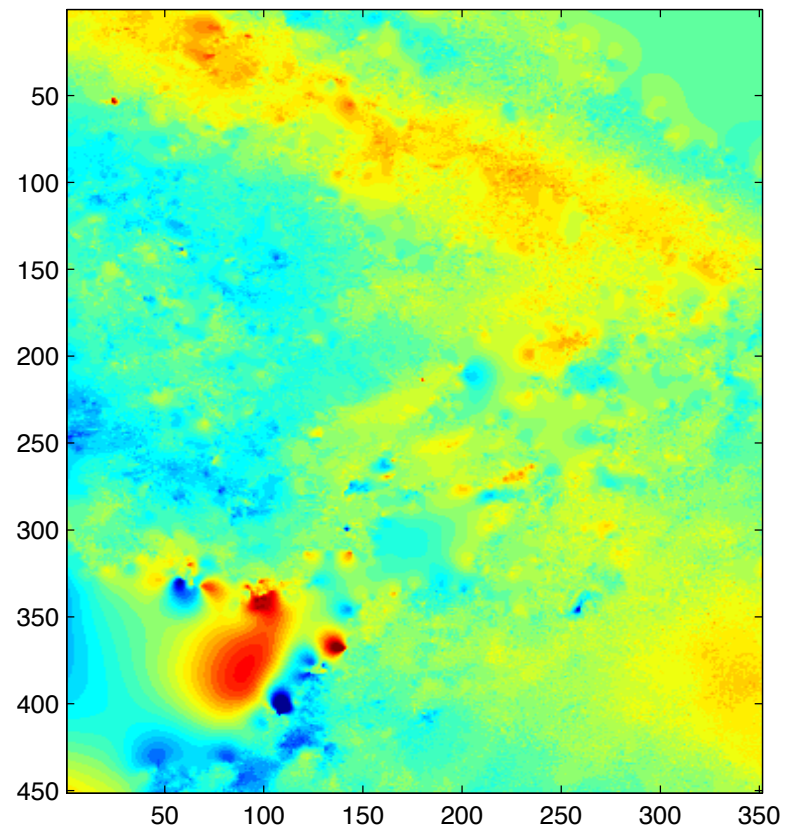
090908-091024 & DEM



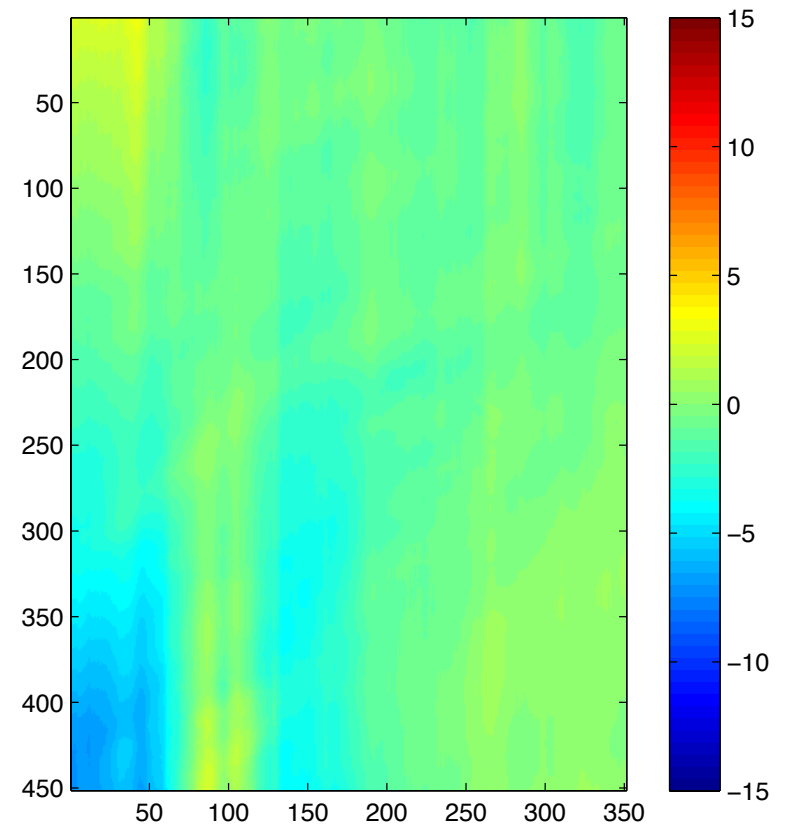
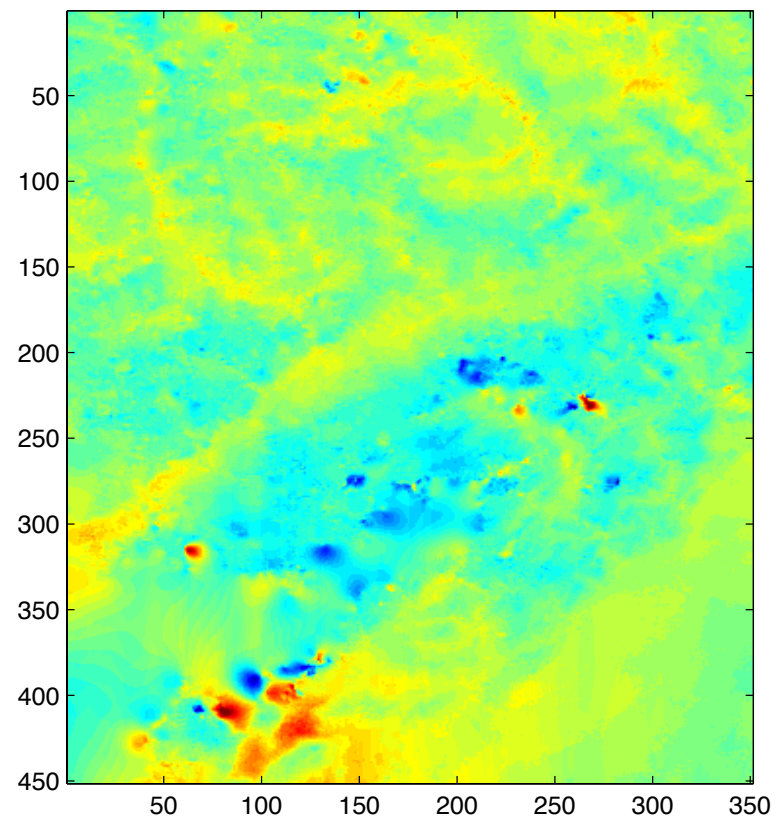
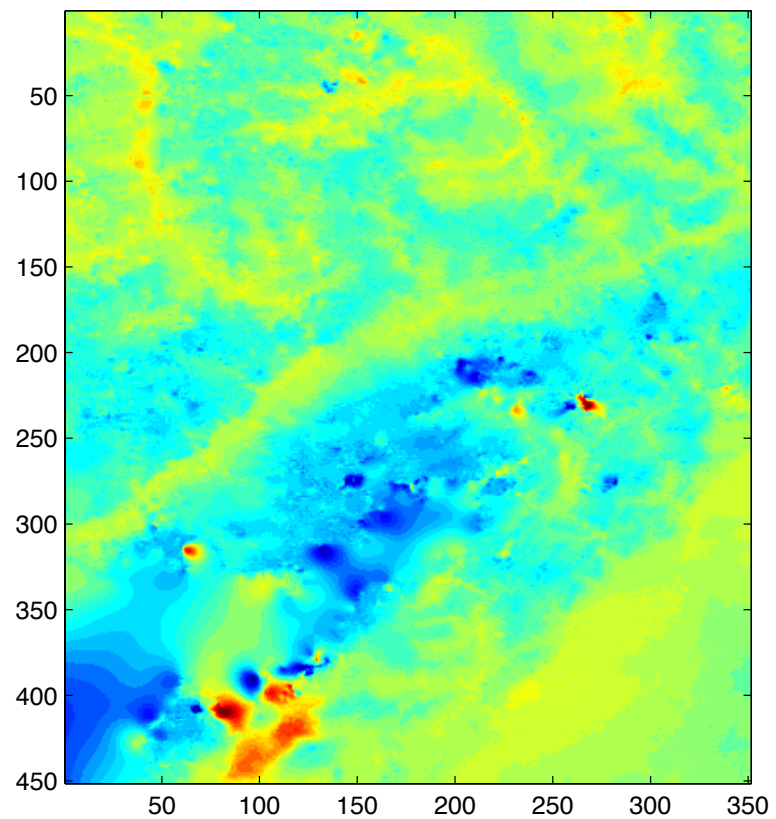
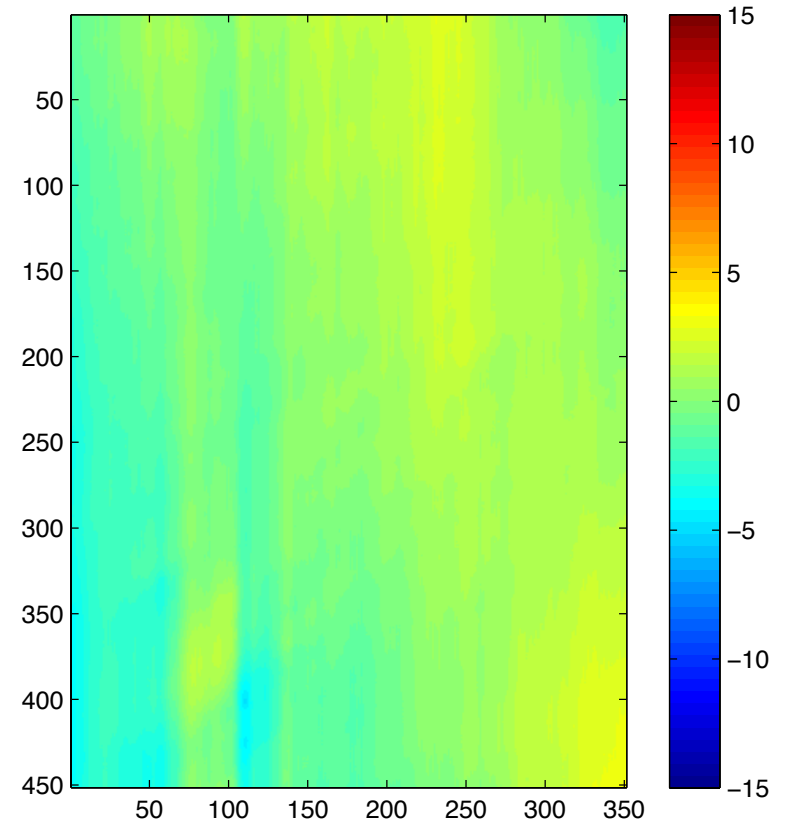
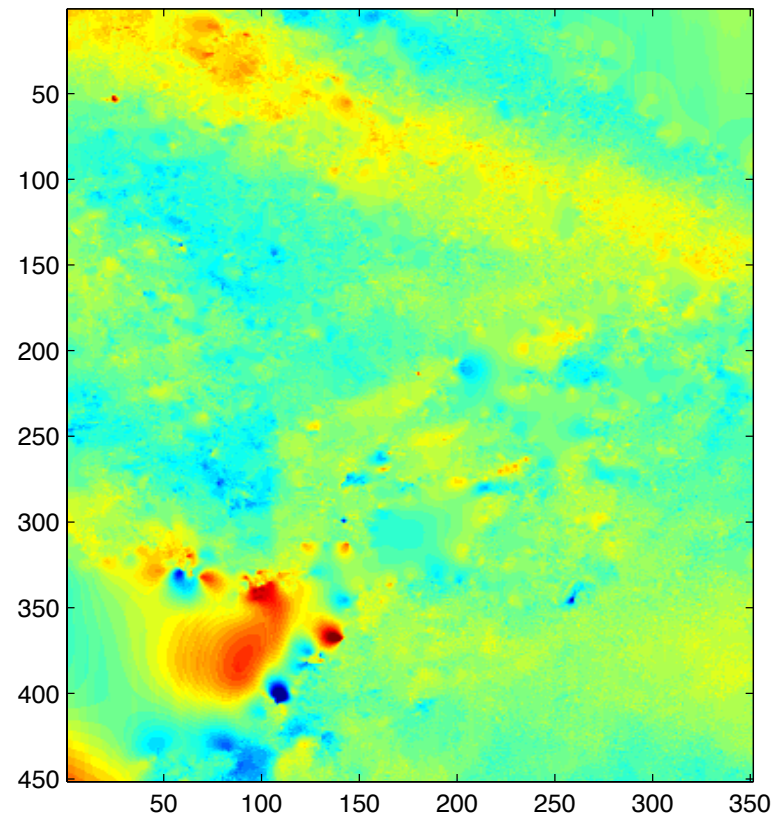
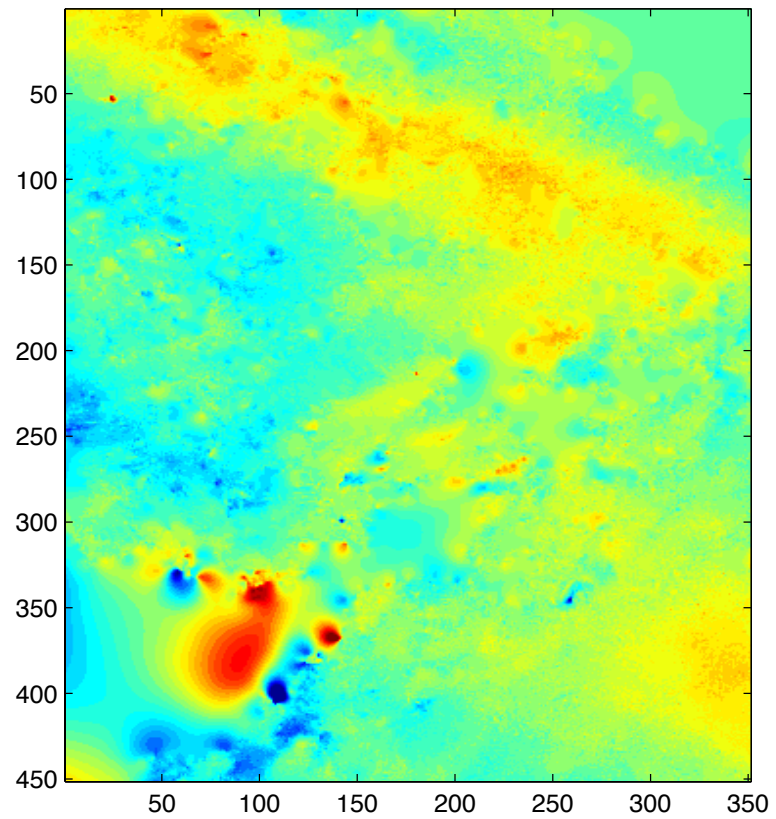
090908-091024 & 100727-101027



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Another Approach

- average SRD
- modeled SRD
- GPS in LOS

