

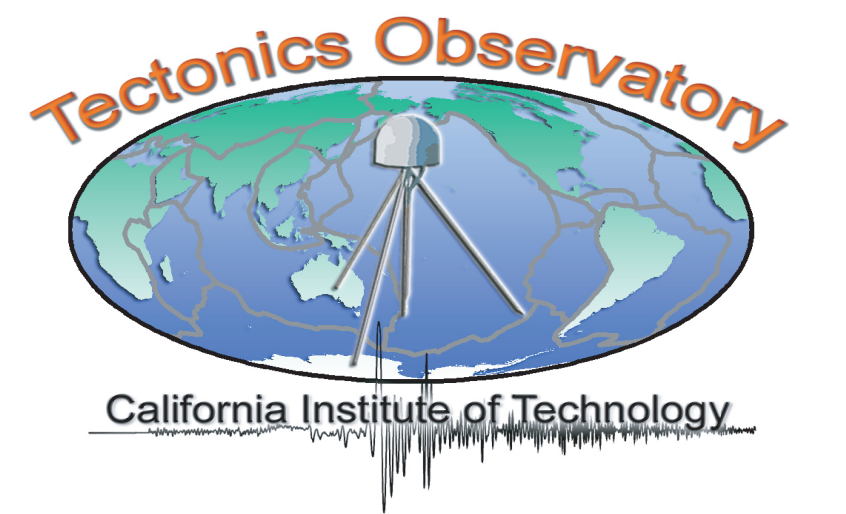


Measuring Horizontal Co-seismic Deformations from Optical Images

Application to the 1999 Chichi Earthquake (Mw 7.6)

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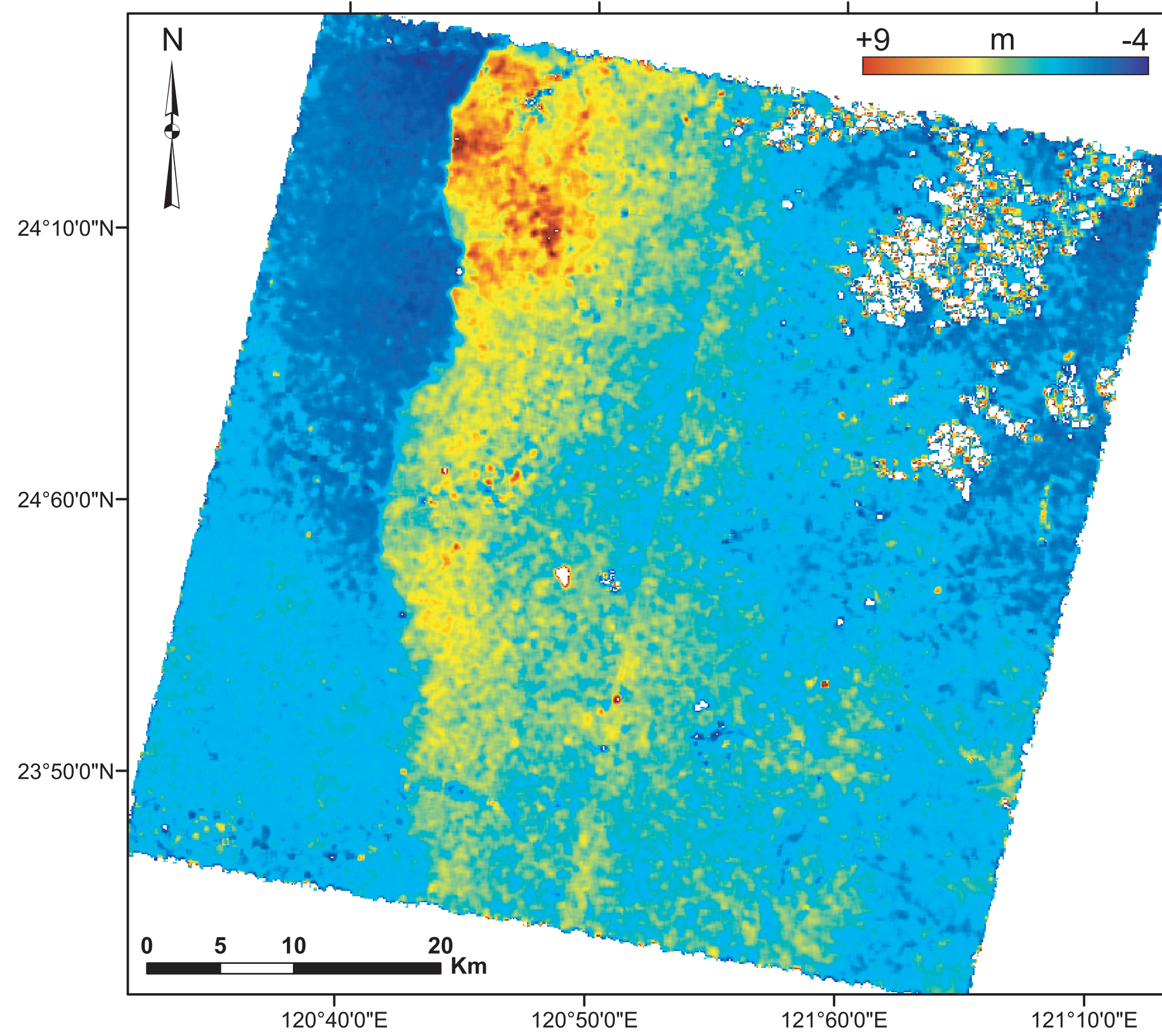
In complement to seismological records, the knowledge of the ruptured fault geometry and co-seismic ground displacements are key data to investigate the mechanics of seismic rupture. This information can be retrieved from sub-pixel correlation of optical images. We are investigating the use of SPOT satellites images and aerial images. When used together, precise measurements close and further away from the fault zone area can be delivered. The techniques developed here are attractive due to the operational status of a number of optical imaging programs and the availability of archived data. However, uncertainties on the imaging system itself and on its attitude dramatically limit the technique. We overcome these limitations by applying an iterative corrective process allowing for precise image registration that takes advantage of the availability of accurate Digital Elevation Models with global coverage (SRTM). This poster presents an application of this technique by showing accurate and dense horizontal co-seismic displacement field induced by the 1999 Chichi earthquake in Taiwan (Mw 7.6).

The 1999 Chichi earthquake seen from SPOT images

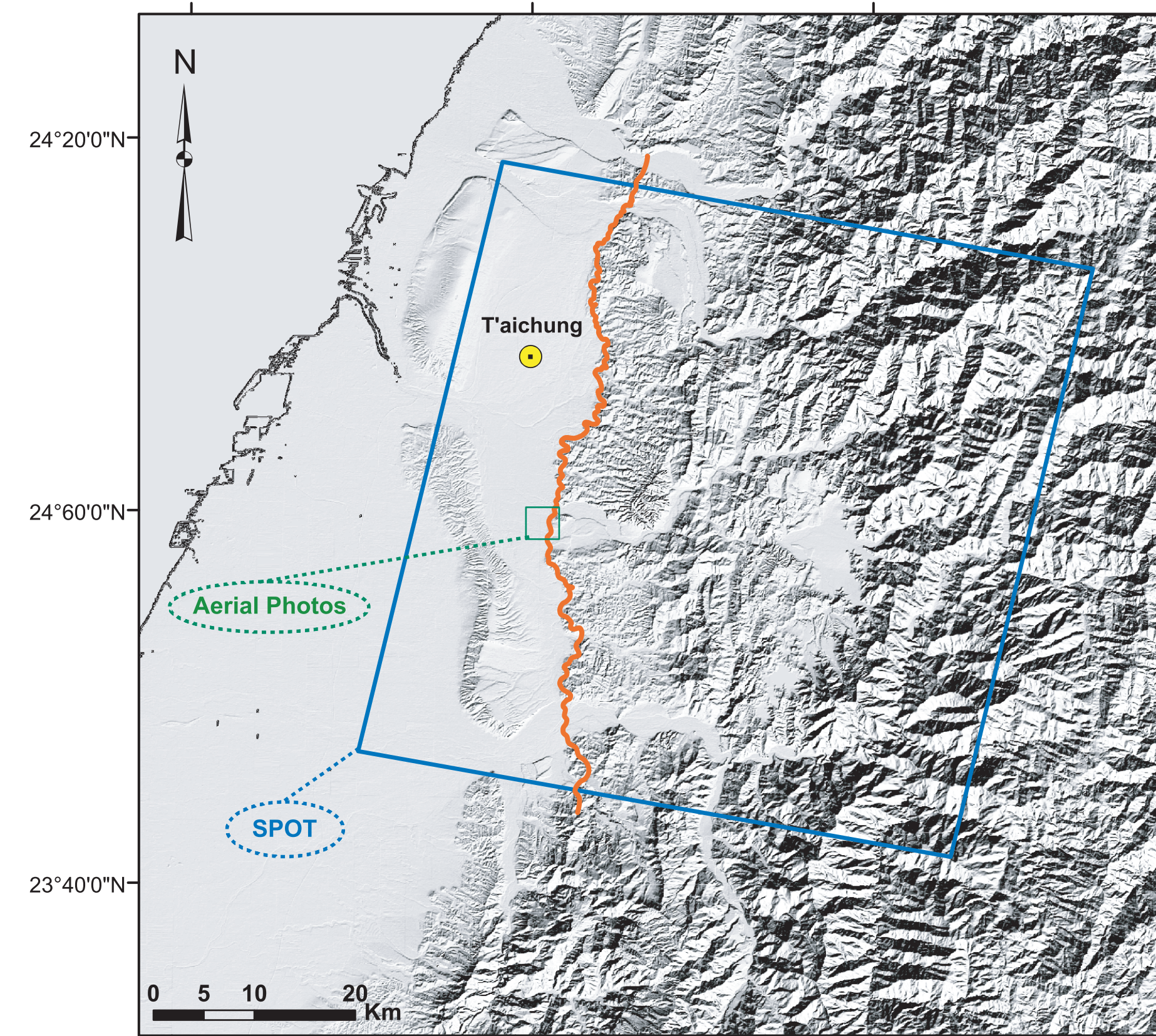
Pre-earthquake image:
 SPOT 2, acquisition date: 01-29-1999
 Ground resolution: 10m

Post-earthquake image:
 SPOT 1, acquisition date: 11-23-1999
 Ground resolution: 10m

Offsets meared from correlation:
 Correspond to sub-pixel offsets in the raw images (less than 10m).
 Correlation windows: 32x32 pixels
 96m between two measurements



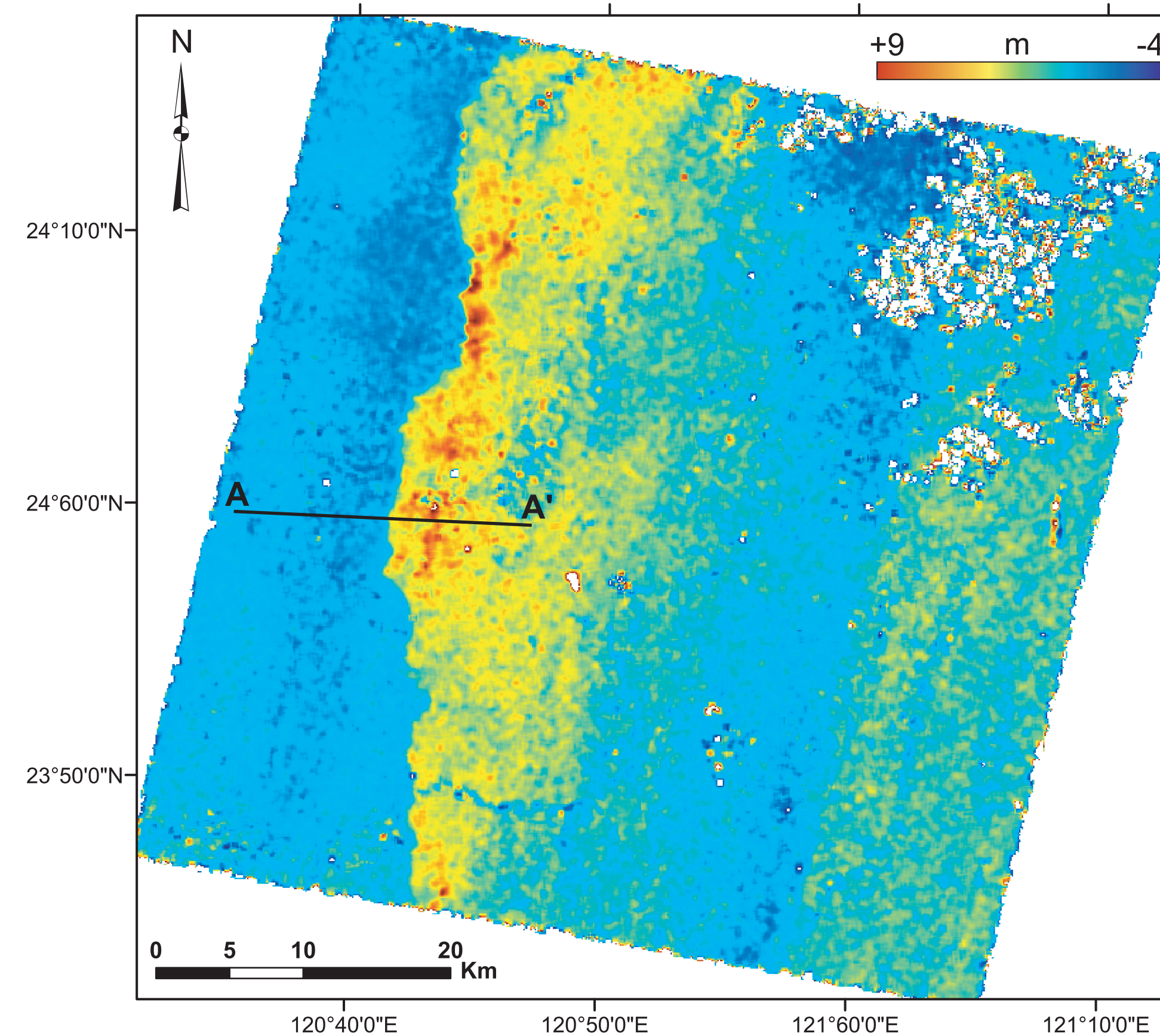
Filtered N/S Offsets



Location of the Taiwan-Chichi rupture

Filtered N/S and E/W horizontal SPOT offsets filtered using a 5x5 pixels sliding window (1 pixel is 96m)

Filtered E/W Offsets



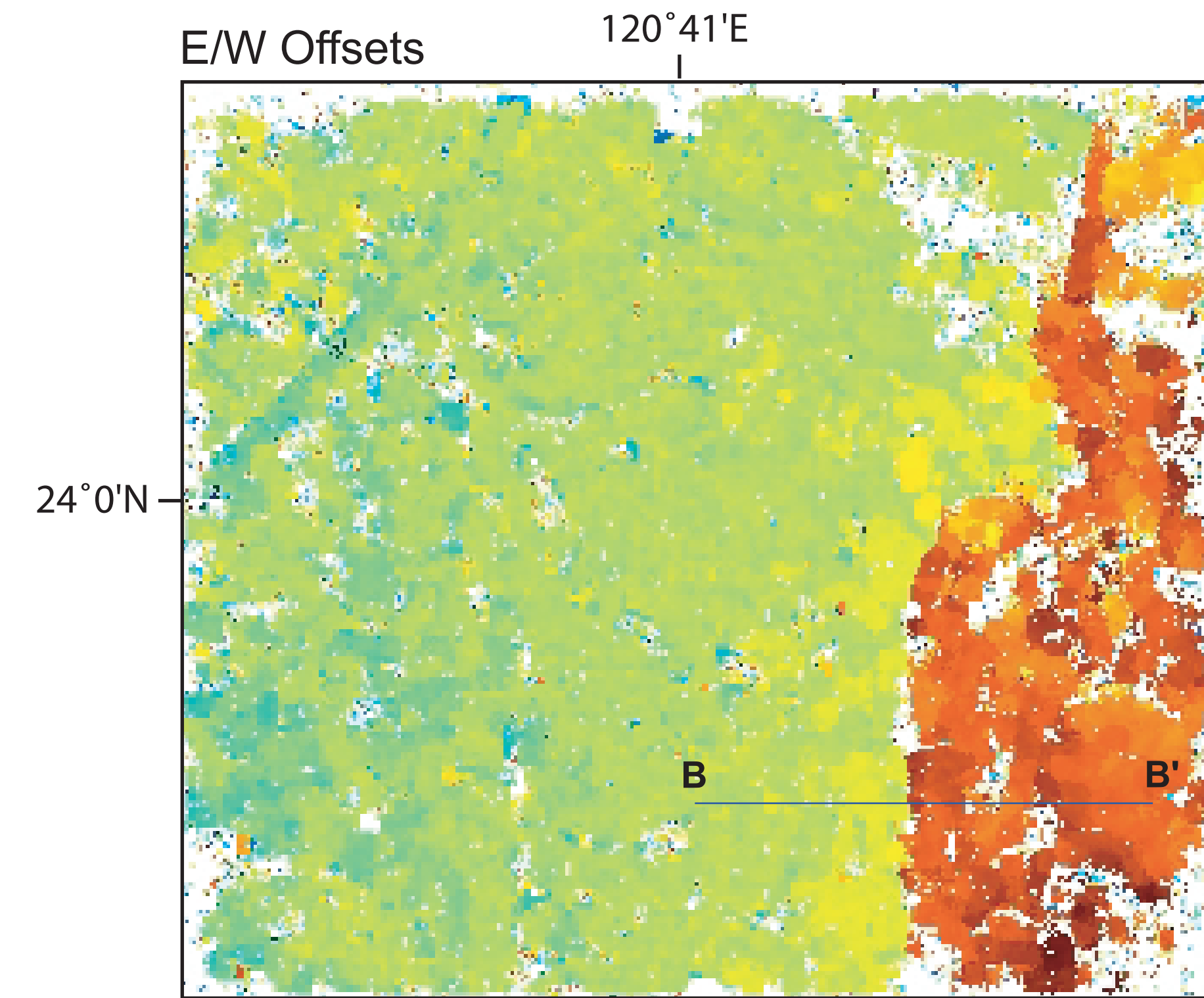
Vector field displacement obtained from the SPOT measurements

The 1999 Chichi earthquake seen from Aerial images

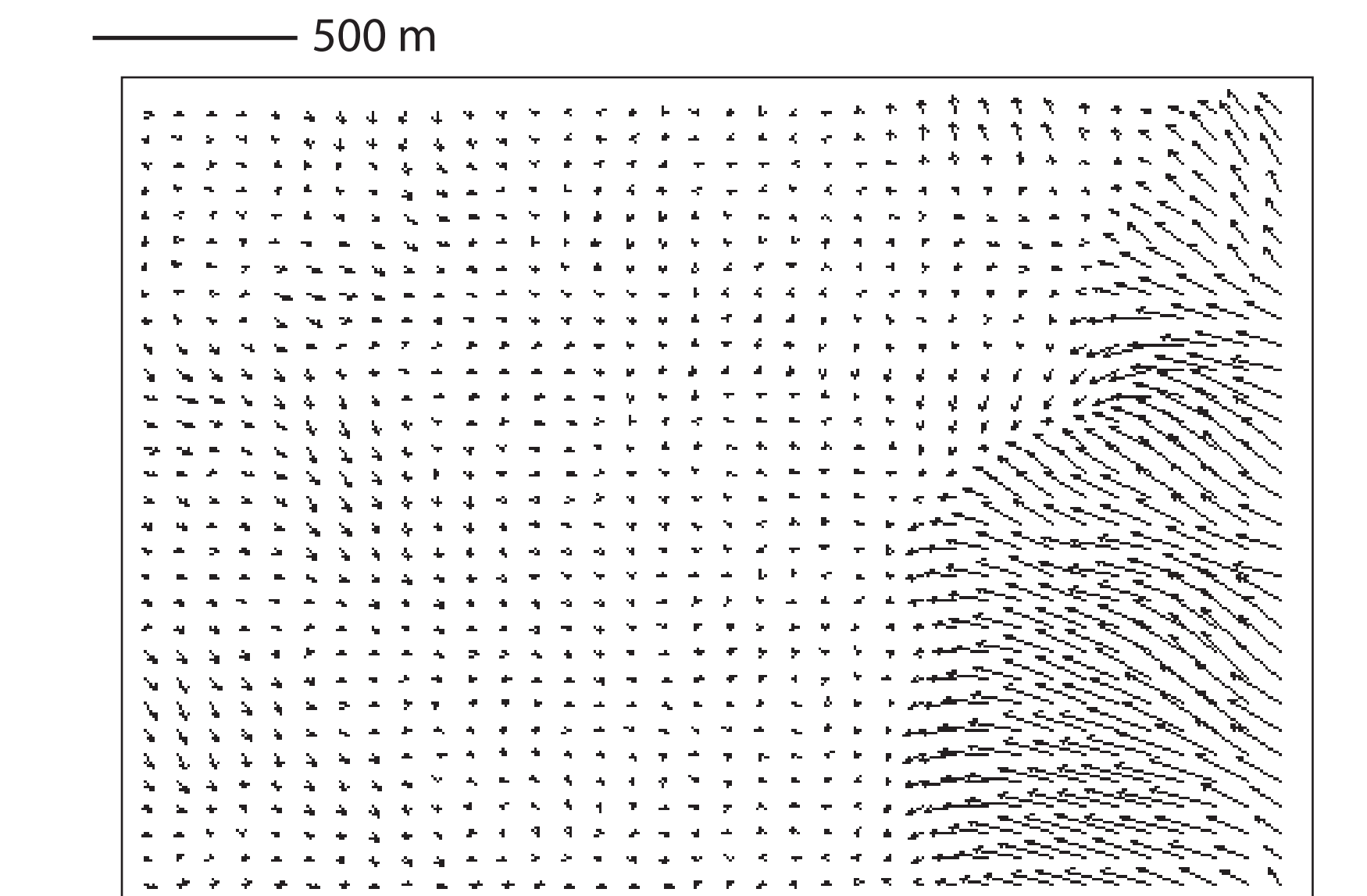
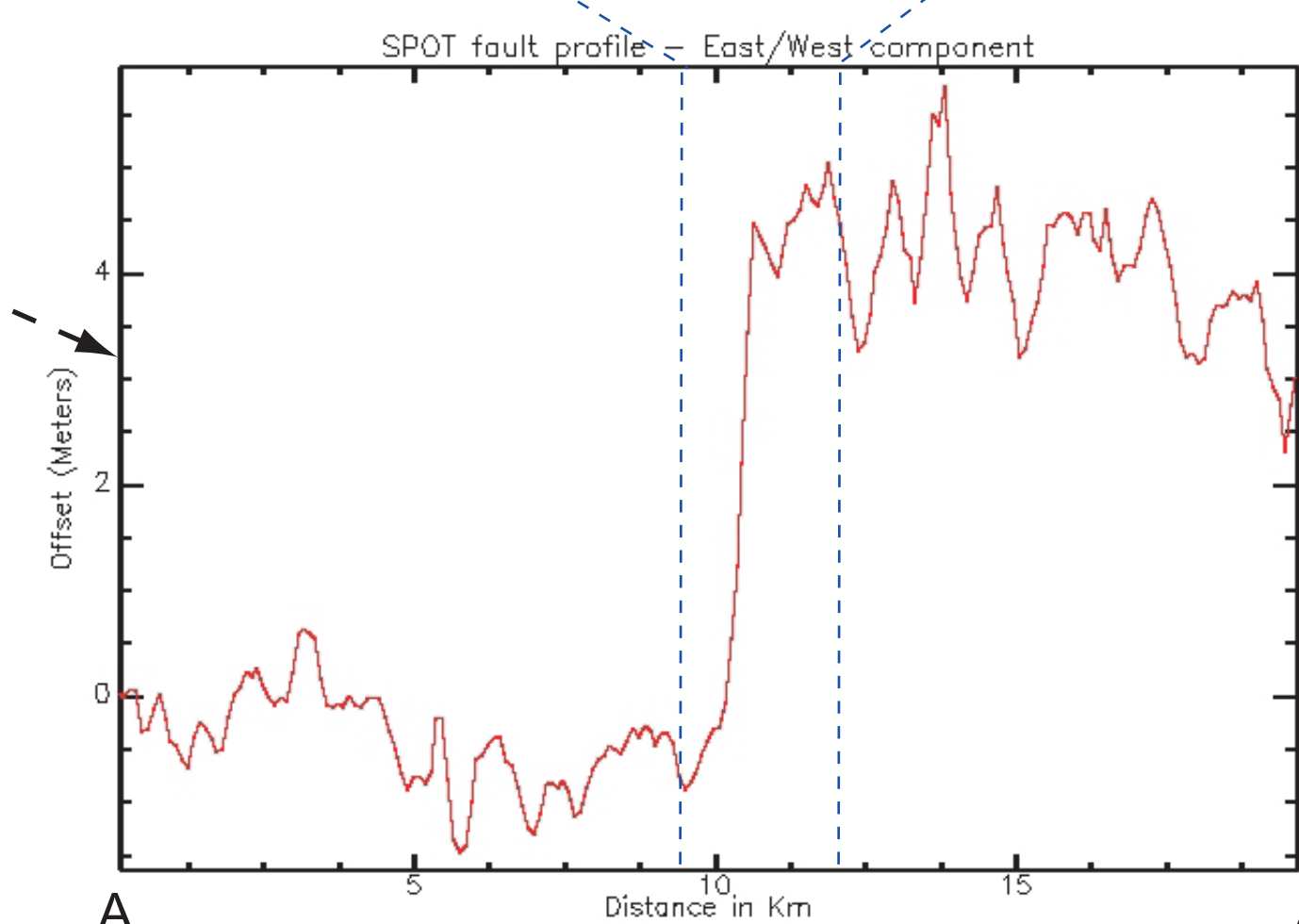
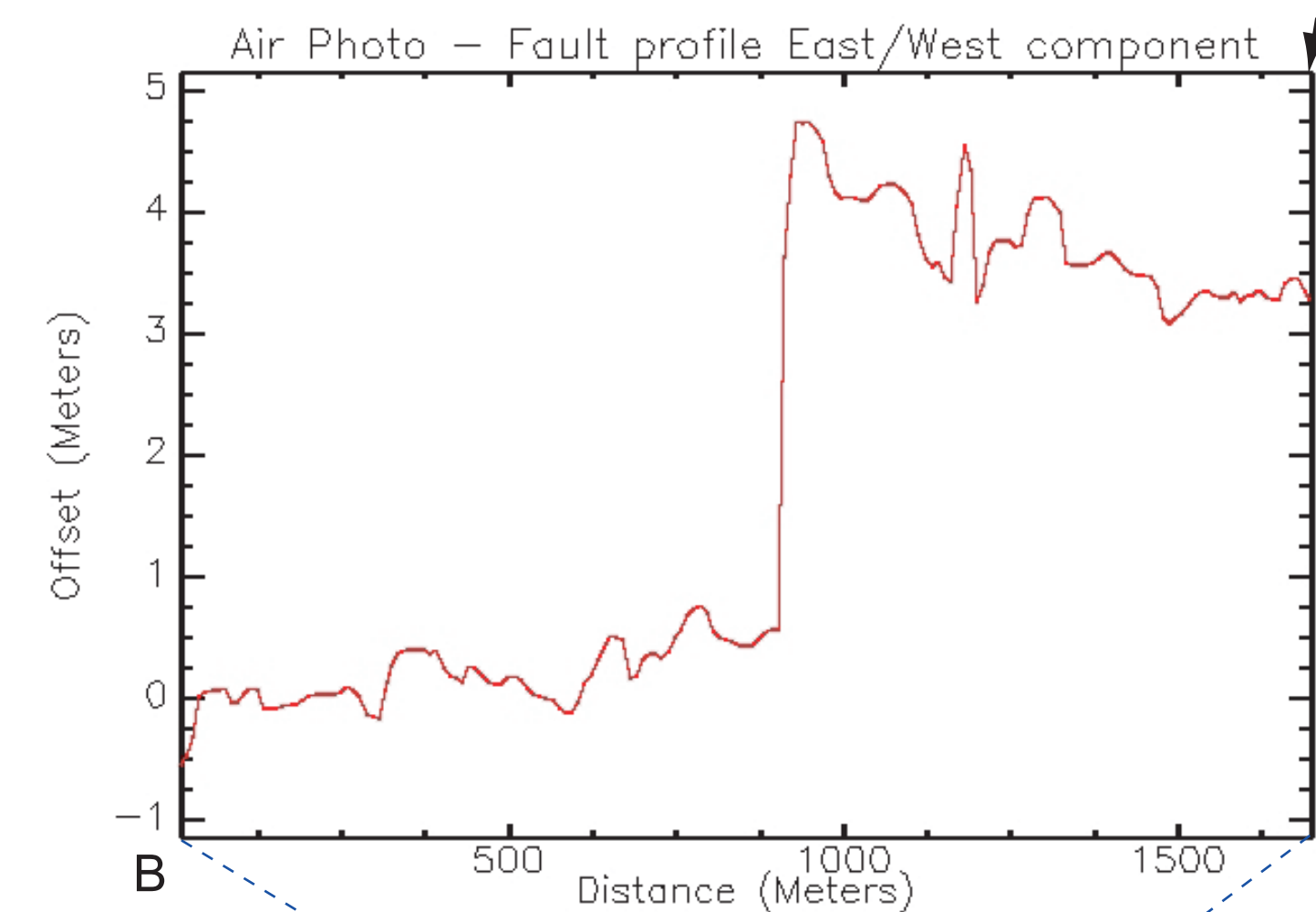
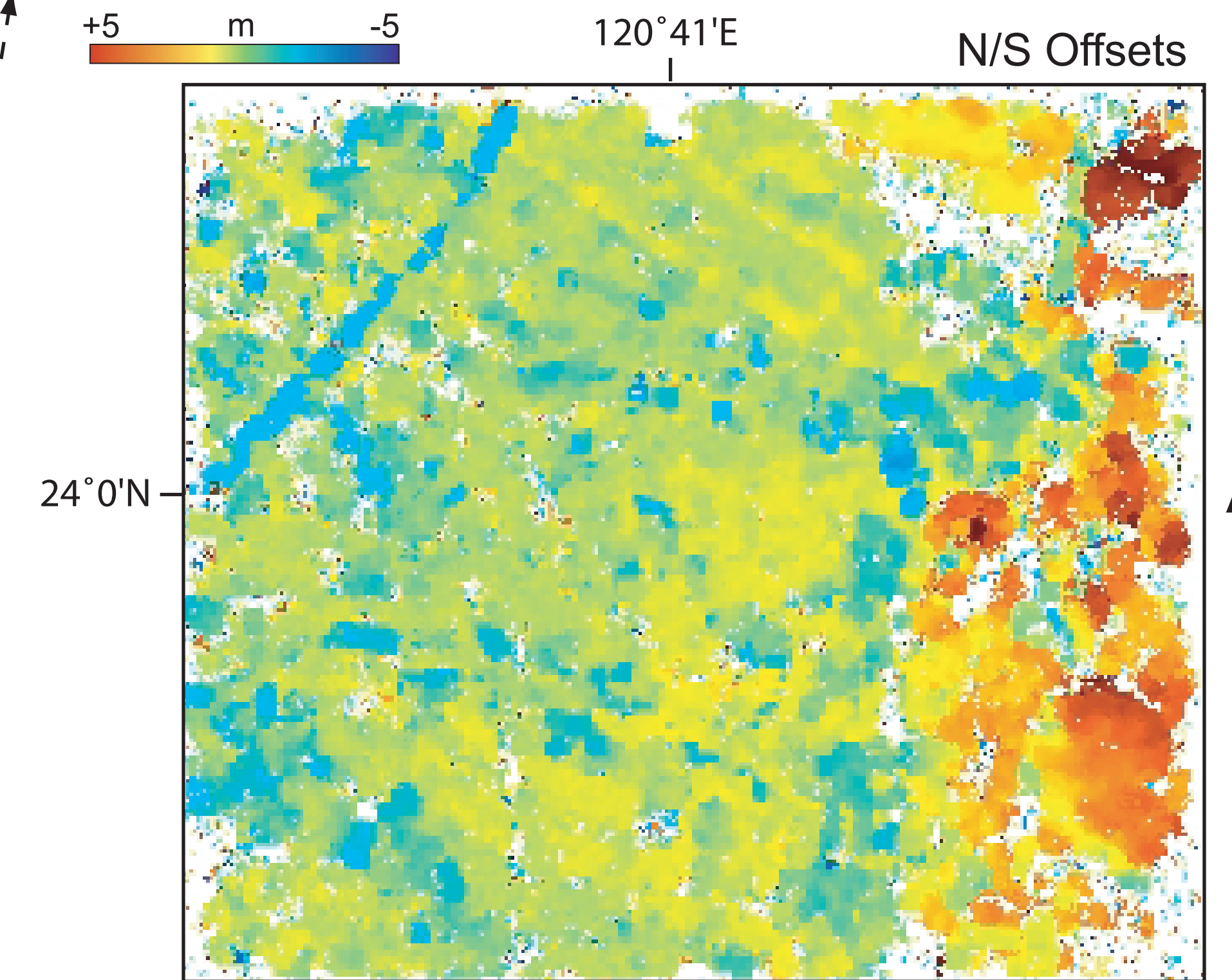
Pre-earthquake image:
 acquisition date : 09/08/98
 resolution : 60cm

Post-earthquake image:
 acquisition date : 09/22/99
 resolution : 60cm

Correlation image:
 - 75m x 75m correlation windows
 - 10m step between windows
 ---> 10m displacement resolution



E/W and N/S horizontal offsets measured from correlation of Aerial images



Vector field displacement obtained from the Aerial measurements