Coseismic displacement of the Oct 8, 2005, M@affarabad, Pakistan

earthquake as observed by satellife radar imagery

On Oct 8, 2005, at 8:50 a.m., a magnitude Mw = 7.6 earthquake struck the Himalayan region of northern Pakistan and Kashmir. The earthquake epicenter was located approximately 19 km northeast of the city of Muzaffarabad. The hypocenter was located at a depth of 26 km below the surface.

The earthquake wiped entire villages off the face of the earth. Some 400.000 houses were destroyed and over 73.000 people perished. Over 135.000 people were injured, with thousands becoming disabled.



The earthquake caused permanent deformation of the earth's surface. Using satellite imaging radar technology, this deformation can be estimated. Standard interferometric techniques were unsuccessful due to temporal decorrelation. We applied speckle-tracking in the radar intensity images to estimate the deformation. Hereby we reach accuracy levels in the order of 1 m.





Data. Coseismic interferometric pairs of Envisat in Ascending and Descending mode were made available by the European Space Agency.

Descending track 463 IS2 (23° incidence angle)

Ascending track 499 IS6 (~41° incidence angle)



Kashmir lies in the area where the Eurasian and Indian tectonic plates are colliding. Out of this collision, the Himalayas began uplifting 50 million years ago, and continue to rise by about 5 mm/year. This geological activity is the cause of the earthquakes in the area.

Muzafferabad **Balakot** Viewed from West

Kabul

1819

2005-09-17 / 2005-10-22 baseline 290 m; 35 days

2005-09-19 / 2005-10-24 baseline 270 m; 35 days

Islamabad Tibet Delhi 1833 Calcutta

Interpretation of results. Reverse (thrust) fault, causing significant bulging. Hanging wall shows vertical uplift of up to 3 m; horizontal motion of 2-

2.5 m southward and 1-3 m westward. Foot wall shows up to 1 m of subsidence, up to 1.5 m northward and marginal eastward motion.

Okada inversion Strike: 325 Dip: 35° 110° Rake: 5.6 m Slip: length of scarp: 55 km fault plane width: 18 km Moment magnitude Mw: 7.51

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