Geophysical Research Abstracts
Vol. 14, EGU2012-1057, 2012
EGU General Assembly 2012

Earthquakes' local site effects in Christchurch revealed by Cosmo-Skymed and Envisat radar images

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In September 4th, 2010, and February 22nd, 2011, a 7.1 and 6.3 earthquakes have strongly affected the city of Chirstchurch, New Zealand. The hypocenters were located 40 km westwards and 10 km southwards respectively. The shallow depths of the epicenter were estimated to 10 and 5 km.
The deformation field associated with the first event was mapped with Envisat data (C band). One month later, the Italian Space Agency started the surveillance of the city of Chirstchurch. Cosmo-Skymed images (X band) in spotlight mode (pixel of about one meter) were collected from November onwards with a minimum of four days between repeated acquisitions.
In that framework, it was possible to study with great accuracy and precision the ground deformations caused by the aftershock that took place on February 22nd, 2011. One image was acquired three days before and another scene one day after.
Moreover, two days after this event that killed 181 persons; an aerial survey was performed leading to an orthophoto of the city having a pixel size of 20 cm.
An interferometric processing was applied to the Cosmo-Skymed scenes. The interferogram revealed the fringes of the major displacement with a precision of 1.5 cm (half of the wavelenght). At closer look, the general dislocation pattern shown numerous irregularities that have been interpreted as local sites effects.
One of the most obvious evidence of local site effects can be seen in the kilometric abandoned landfill of Barwood. Field observations and interviews of local people support the observations regarding the limits of specific zones in the urban area.
This research is still in progress and comparisons are currently performed with other earthquakes in Chili and Turkey. This work suggests that an independent method could provide new original data in the frame of the mapping of earthquakes local sites effects.