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Mega-earthquake vs. small size seismic events: tradeoff and limits of Remote Sensing in the application of source parameters

Salvatore Stramondo (1), Christian Bignami (1), Valentina Cannelli (1), Daniele Melini (1), Marco Moro (1), Marco Polcari (1), Sergey Samsonov (2), Michele Saroli (3), and Paola Vannoli (1)

(1) Istituto Nazionale di Geofisica e Vulcanologia, Rome, Italy (salvatore.stramondo@ingv.it), (2) Canada Centre for Remote Sensing, Ottawa, Canada (Sergey.Samsonov@nrcan-rncan.gc.ca), (3) of Cassino and Southern Lazio, Dept. of Civil and Mechanical Engineering, Cassino, Italy (michele.saroli@unicas.it)

The aim of this work is to provide an overview of the capabilities and limitations of Differential Interferometric SAR (DInSAR) technique to supply reliable information about earthquakes over a very wide range of magnitudes, from mega-earthquakes (of magnitude 8+) up to those reaching the lower limits of detection. The capability of DInSAR to detect surface movements over large areas has been successfully used in seismology, where traditionally the main topic of scientists is to determine the seismic source parameters, such as geometry and slip distribution. In recent years some scientific reviews have been focused on defining the thresholds of detection of a coseismic signal (i.e., surface deformation) and to investigate the tradeoff magnitude-depth. An additional variable to provide reliable constraints concerning the role of "remote sensing" is the available satellite system. Today we may exploit the capabilities of VHR (very high resolution) SAR systems that are addressed to investigate moderate size earthquakes at high sampling density. Additionally, we may say to be in the middle between the past generation of SAR systems (from ERS to Envisat) and the forthcoming Sentinel-1 missions that are specifically addressed to the investigation of surface effects of major and medium size natural disasters. This work will describe which role remote sensing and, in particular, DInSAR had in the case of the March 11, 2011, Tohoku-Oki (Japan) earthquake (M_w 9.0), with particular emphasis on the retrieval of source parameters. On the other side, we will focus on the June 21, 2013, Lunigiana (Northern Italy) earthquake (M_w 5.3), which is only the last example of low magnitude events where, however, DInSAR results are able to provide information relevant to seismological analyses.