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Seismic rupture process of the 2010 Haiti Earthquake (Mw7.0) inferred from seismic and SAR data

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On January 12th 2010 at 21:53, the Port-au-Prince – Haiti region was struck by an Mw7 earthquake, the second most deadly of the history. The last seismic significant events in the region occurred in November 1751 and June 1770 [1].
Geodetic and geological studies, previous to the 2010 earthquake [2] have warned to the potential of the destructive seismic events in that region and this event has confirmed those warnings.
Some aspects of the source of this earthquake are nonconsensual. There is no agreement in the mechanism of rupture or correlation with the fault that should have it generated [3].
In order to better understand the complexity of this rupture, we combined several techniques and data of different nature.
We used teleseismic body-wave and Synthetic Aperture Radar data (SAR) based on the following methodology:
1) analysis of the rupture process directivity [4] to determine the velocity and direction of rupture;
2) teleseismic body-wave inversion to obtain the spatiotemporal fault slip distribution and a detailed rupture model;
3) near field surface deformation modeling using the calculated seismic rupture model and compared with the measured deformation field using SAR data of sensor Advanced Land Observing Satellite - Phased Array L-band SAR (ALOS-PALSAR).
The combined application of seismic and geodetic data reveals a complex rupture that spread during approximately 12s mainly from WNW to ESE with average velocity of 2,5km/s, on a north [U+2010] dipping fault plane. Two main asperities are obtained: the first (and largest) occurs within the first $\sim$ 5sec and extends for approximately 6km around the hypocenter; the second one, that happens in the remaining 6s, covers a near surface rectangular strip with about 12km long by 3km wide. The first asperity is compatible with a left lateral strike-slip motion with a small reverse component; the mechanism of second asperity is predominantly reverse. The obtained rupture process allows modeling a coseismic deformation which is in agreement with the deformation field measured by InSAR.
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