3D GNSS Velocity Field in Europe: Conciliating the observed seismicity with the tectonic and Isostatic deformation.

Auteurs : Jesús Piña-Valdés [1], Anne Socquet [*1], Céline Beauval [1], Pierre Yves Bard [1], Marie Pierre Doin [1], Nicola D'Agostino[2] Zhengkang Shen[3]

Affiliation : [1] Institute de Science de la Terre (ISTerre) – France
[2] Istituto Nazionale di Geofisica e Vulcanologia (INGV) – Italy
[2] Department of Earth, Planetary, and Space Sciences University of California, Los Angeles (UCLA) – USA

Texte :

Probabilistic Seismic Hazard Assessment requires reliable earthquake recurrence models, usually based on time and spatial distribution of the past seismicity of catalogs. This usually generate models rather well constrained on seismically active regions, but on low to moderate seismicity regions establishing earthquake recurrence from past events is a major challenge. On those regions, geodetic measurements can provide useful information for deriving alternative recurrence models based on strain rate.

The impact of the crust deformation on the processes that control the seismic activity is still controversial. The seismic activity is usually thought to be associated to the active tectonic deformation as estimated from the horizontal displacements field. But in regions with low horizontal deformation, getting the horizontal strain rates is difficult since the displacements field can be dominated by the noise of the geodetic data. Additionally, non-tectonic processes such as the Glacial Isostatic Adjustment (GIA) can exist, and may impact the seismicity rate of those regions. Then seismicity rates derived from the horizontal velocity fields might not adjust the observed seismicity rates on such regions.

We present a method to build a combined GNSS velocity field dataset for Europe, that could be used to generate earthquake recurrence models. Using the velocity solutions of common stations, the different datasets are converted to a common reference frame. Then their uncertainties are homogenized. An automatic identification and outliers removal is applied, as well an adaptive smoothing scheme that depends on the station density, the noise and the local tectonic deformation rate. Using this method, 10 different GNSS velocity field solutions were combined, resulting in a velocity field with more than 3800 GNSS stations in Europe, from which a strain rate map is derived.

Assuming the Hooke law for the earth crust, we decompose the vertical velocity field into a component due to tectonic deformation and a component due to isostatic rebound. To better understand the effects of horizontal tectonic deformation versus the flexure generated by GIA on the seismicity, the spatial distribution of the seismicity is compared to the strain rate map and to the vertical velocity fields. Different scenarios for earthquake recurrence models are then proposed.

Mots-Clés : Strain Rate, Crustal Flexure, Seismic Hazard, Earthquake Recurrence models.

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