Lithosphere deformation and seismicity distribution in intraplate domains, the Western Europe example

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Abstract

With the lengthening of geodetic time series and their refinement, we are now able to detect and record extremely slow crustal deformation in intraplate domains. Identifying and understanding the sources of low strain rate and its associated sparse seismic activity remain yet a challenging question in these continental regions. In low tectonic activity areas, slow crustal deformation involves both the presence of volume forces, such as crustal-mantle interactions, and surface processes with erosion and post-glacial rebound as examples. As crustal-mantle interaction, structural heritage and its involvement on the reactivation of ancient structures (i.e. ductile shear zones, rifts, lithospheric faults) can leads to both strain and seismicity localization. In the same way, erosion, sedimentation and post-glacial rebound involve uplift and small horizontal movements in mountain ranges that can lead to the reactivation of inactive or very slow faults. Through a 3D numerical modeling of lithosphere mechanics and deformation, we will focus on present-day deformation and seismicity distribution in the Western Europe. Based on recent geodetic and geomorphologic surveys, we will analyze surface processes forcing (erosion, sedimentation and post-glacial rebound) that can trigger deformation in the Alps and the Pyrenees. We will also implement and quantify the structural heritage from large tectonic systems, such as the South Armorican shear zone, with various rheologies that can account for strain localization. Besides improving our understanding of slow and intracontinental deformation, this integrating study will have a direct application on the assessment of seismic hazard in Western Europe.

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