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New insights on the seismic hazard in the Balkans inferred from GPS

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The Balkans region sits at the transition between stable Eurasia and highly straining continental Eastern Mediterranean, resulting in a widespread seismicity and high seismic hazard. Because of intensive human and economic development over the last decades, the vulnerability has increased in the region faster than the progress in seismic hazard assessments. Opposite to the relatively good understanding of the seismicity in plate boundaries contexts, the seismic hazard is poorly known in the regions of distributed continental deformation like the Balkan region and is often underestimated (England and Jackson, 2011). Current seismic hazard assessments are based on the historical and instrumental catalogues. However, the completeness interval of the historical data bases may be below the average recurrence of individual seismogenic structures. In addition, relatively sparse seismological networks in the region and limited cross-border seismic data exchanges cast doubts in seismotectonic interpretation and challenge our understanding of seismic and geodynamic processes. This results in a inhomogeneous knowledge of the seismic hazard of the region to date. Geodetic measurements have the capability to contribute to seismic hazard by mapping the field of current active deformation and translating it into estimates of the seismogenic potential. With simple assumptions, measurements of crustal deformation can be translated in estimates of the average frequency and magnitude of the largest events and assessments of the aseismic deformation. GPS networks in the Balkans have been growing during the last few years mainly for civilian application (e.g. Cadastral plan, telecommunications), but opening new opportunities to quantify the present-day rates of crustal deformation.

Here we present the initial results of GEOSAB (Geodetic Estimate of Strain Accumulation over Balkans), an AXA-Research-Fund supported project devoted to the estimation of crustal deformation and the associated seismic hazard of the Balkan region. We processed all the currently available data acquired on these new networks using the precise point positioning strategy of the Gipsy-Oasis software (Bertiger et al. 2010) and the daily ITF2008 transformation parameters (x-files) from JPL. Daily coordinates are obtained in a Eurasia-fix reference frame obtained using the strategy developed by Blewitt et al. (2012). Here we present this new velocity field combined with previously published data sets covering the Balkan Peninsula. This unusually dense picture of the current deformation, in particular in Slovenia and Serbia, enables us to derive a continuous map of the strain rate over the region using the approach of Haines and Holt (1993). We then derive the seismogenic potential of the region combining the geodetic strain rate and the available regional CMT moment tensor solutions. These maps bring new insights on areas of significant strain accumulation over the Balkan Peninsula and are a first step to better assess seismic hazard there.