Quantification of seismic strain rates in the tectonic transfer area from the Alps to the French Rhone valley

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The center and borders of the Western Alps show significant recent deformations: radial extension combined with an important phenomenon of uplift in the center and transgressive deformations in borders. The region of the Rhone Valley and the alpine foreland that surround this area, have high societal challenges (demography, nuclear and chemical industry). In our study, we want to see how the transfer of active tectonics is translated from the Western Alps to the Rhone Valley and the alpine foreland in terms of stresses and seismic deformations.

The Rhone Valley region, however, remains poorly resolved in seismic data (e.g. only few focal mechanisms). It is for this reason that we use a new method of strain rate calculation adapted to our area: to combine the total energy obtained with a statistical integration of a Gutenberg-Richter distribution with an average mechanism calculated from a stress inversion. This method allows us to compute seismic strain rate tensors. We finally compare our results with those obtained by geodesy.

We thus obtain slow deformation rates in the Rhone Valley. Seismic strain rates range between a few nanostrains/yr and 10E-2 nanostrains/yr according to the different zones discretized by our seismotectonic zoning. In terms of amplitude, geodesy delivers ten times higher deformation rates than seismicity in the region. On the other hand, our seismic strain tensors are consistent with geodesy in the Belledonne region only, where seismic and geodetic networks are well constrained. In the other seismotectonic zones, our results provide discrepancies with geodesy. We discuss here the differences observed in each subarea.

Mots-Clés : Seismotectonic – Active tectonic – French Alps

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