RC #1

In their manuscript the authors deal with the effects of glacial isostatic adjustment (GIA) on the stress and deformation patterns in the Western European Alps. In particular they investigate whether present-day observations of strain rates measured with GNSS and earthquake mechanisms correlate with the theoretical deformation pattern that would be associated with GIA. Further they investigate whether GIA would promote or inhibit movement along some of the major fault systems in the Western Alps.

They use the LGM ice load, a simplified deglaciation history and a thin-plate model with a ranges of values for the effective elastic thickness of the lithosphere (he) and upper mantle relaxation times (tau). They find that model derived strain rates are consistent with the GNSS observations in the inner Western Alps, both, in orientation and magnitude. In the foreland regions to the west and to the north only the orientation matches the GNSS observations, whereas in the south neither orientation nor magnitude are in line with the data.

Concerning the faults, they perform a Coulomb Failure Stress analysis that includes (1) only the stress perturbations caused by GIA and (2) the full stress field (GIA + background). They present results for different fault dip angles and friction coefficients and conclude that the present influence of GIA tends to inhibit fault slip and that the observed earthquake kinematics is at odds with the deformation predicted for GIA and measured with GNNS.

Their main conclusion is that the GNSS is dominated by transients caused by GIA, whereas the seismicity reflects long-term geological forcings.

The manuscript is well written and I have no objections with it being published except that it lacks a conclusion section and the figures should be improved.

A conclusion section has been added at the end of the article.

Minor comments/edits:

Line 103: flowing -> following

Corrected l.103.

Line 186: high altitude

Reformulated using “northern”, l. 188.

Line 191 – 200: Is there an effect on the strain rate induced just by the topographic gradient between the Alps and the foreland?

This effect hasn't been tested in the frame of this study. Although this hypothesis is of interest, studies on European mountains suggest a negligible effect of gravitational collapse on geodetic fields and present-day deformation in the Alps (Hivert et al., 2011; Vernant et al., 2013).

Line 222: in mind

Corrected l.224.

Line 234: IMNF should be defined at its first use

Corrected, definition added l.236.

Line 240: I suggest to use tau either for the relaxation time or the shear stress, not for both. Maybe add a subscript.

Corrected. Relaxation time has been changed to "τ_r" in the text and figures.

Line 254: delete "of"

Corrected l. 256.

Line 283: μ' has been defined already in Line 241

Corrected l. 286.

Line 327: oriented

Corrected l. 331.

Figures:

The figures could be improved by using only one font style and size and a more consistent panel labeling.

- *add scale bars to all the maps*

Scale bars has been added on figure 2, 3, 4, 5, 6 and 7.

- *Fig. 3. omit the dot in the velocity unit*

As the standard formulation "mm.yr^{-1}" is used throughout the text, we prefer to keep the dot in the velocity unit in figure as well.

- *Fig. 6 & 7: I struggled with the symbology of panels b) and c). The results for the different dip angles cannot be distinguished. Perhaps different marker symbols could be used (e.g. squares, triangles etc.). I suggest to replace the horizontal bars with markers.*

We agree that it would be interesting for the details of the parametrizations to appear in the figures. Unfortunately, adding this information makes the figure unreadable. Thus, details of the parameters corresponding to an increase in the Coulomb stress on an optimally oriented fault (fig. 6.c) have been added to the text (l. 319).

Furthermore, our study emphasizes the general impact of the GIA in the Western Alps. Thus, a more detailed parametric study on the projection of stress perturbations on specific faults should be realized thereafter.

- *Fig. 6: "(a) Horizontal full stress (background + GIA) and **faults** tested in the CFS analyses." But there is only a single fault shown in (a).*

Corrected l. 329.

Hivert, F., Vernant, P., chery, J., Cattin, R., and Rigo, A.: Can the gravitational collapse paradigm withstand the geodetic and seismologic observations in the Alps and the Pyrenees, birth of a new paradigm?, 2011, EP41D-0636, 2011.

Vernant, P., Hivert, F., Chéry, J., Steer, P., Cattin, R., and Rigo, A.: Erosion-induced isostatic rebound triggers extension in low convergent mountain ranges, Geology, 41, 467–470, https://doi.org/10.1130/G33942.1, 2013.