Solid Earth Discussions

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Comment on se-2021-6

Mathilde Radiguet (Referee)

Referee comment on "Very early identification of a bimodal frictional behavior during thepost-seismic phase of the 2015 Mw8.3 Illapel, Chile, earthquake" by Cedric Twardzik et al., Solid Earth Discuss., https://doi.org/10.5194/se-2021-6-RC2, 2021

Twardzik and co-author investigate the early postseismic signal of the Mw 8/3 Illapel earthquake in Chile. The author use subdaily GNSS processing to extract the postseismic signal of the first 12 hours after the earthquake. The GNSS displacements are inverted to provide an image of the slip distribution on the plate interface every hour. Two main slip patches are identified, the one located South of the rupture being mostly seismic (the cumulative moment is mostly due to aftershocks), whereas the Northern patch is mostly aseismic. They observe that the patches identified in the first 12 hours are consistent over longuer time period.The author then discuss the implications of their results in terms of frictionnel behavior and driving mechanism for aftershock occurence.
The paper is well written in general, and the figures are clear. I have a few suggestions, mostly minor, which are detailed below.

section 3:
The discussion on the relative location of the co-seismic and postseismic slip is difficult to follow since the co-seismic slip distribution is not shown. It would be useful to add on Figure 3 the coseismic slip distribution estimated from previous studies (for example the one inferred by Melgar et al. 2016, as the authors refer to it), or inverted by the authors. Of course uncertainties exist on this slip distribution based on the data, inversion scheme and fault geometry used by previous authors, but the authors could show several models if needed.
The authors could also perform their own inversion of the co-seismic slip (using only GNSS data). Even if this inversion would be constrained only by geodetic data, it would be interesting because fully consistent with the post-seismic study in terms of fault geometry, Green's function and data with the post-seismic study. it could be added to the supplementary material.

l. 104: "We search for the spatial distribution of slip amplitude and rake angle independently for each time step": the slip amplitudes obtained are shown but not the rake angles. Do they vary from one time step to another ? The optimal rake for each time step should be given in the supplementary materials.

Section 4:
The discussion on the relationship between early aftershocks and afterslip could be clarified by a better description of the areas involved when the seismic or geodetic

moments are calculated: l.181"a seismic moment of 9.5x 10^19 Nm." what is the region considered for the calculation ? Is it the same as the one shown in Fig. S6.2 ?
l. 189-190: same question, what is the area considered ?

The times series from figure S7 could be a nice illustration of the seismic/aseismic ratio on both regions, if the time series showed the seismic moment in both regions (instead of an arbitrary normalised unit). I understand the interest of the normalised unit when comparing the number of aftershock with the cumulative slip, but this is already shown in Fig 7 and S6 for both regions. In Fig. S7, the cumulative slip could be converted to seismic moment so that one can see where the values given in the text for the seismic/aseismic rations come from.
The time series from Fig.7 could also be included in the main text, as they are really relevant for the discussion of the paper.

On FigureS7.2: what is happening between 6h and 7h (strong increase in cumulative moment): is there a large aftershock at this time ?

Formal issues:

Figure 1 (legend):
- "yellow circles" should be "pink stars"

Several problems with figure/table numbers (they appear with "??"): Line 85, 136, 165...