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Nonlinear Processes in Geophysics
Discussions

Interactive comment on "Magnitude correlations in a self-similar aftershock rates model of seismicity" *by* Andres F. Zambrano Moreno and Jörn Davidsen

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ANONYMOUS REFEREE #1 COMMENTS

RC1: "The authors test the existence of magnitude correlations for a self-similar earthquake occurrence rate model. As a first observation I would like to remark that magnitude cor- relations are intrinsic to this kind of models simply because the occurrence probability cannot be factorized."

AC1: This is correct as we state in our paper. Yet, it is necessary to quantify the strength and type of the correlations. This is what our paper does.

RC2: "A second crucial observation is that this kind of model was firstly introduced by (; ; ; ; ;) and all these articles should be quoted."

AC2: We had already given the two main references to this previous work (Lippiello, E., Godano, C., and de Arcangelis, L.: Dynamical Scaling in Branching Models for Seismicity, Physical Review Letters, 98, 098 501, 2007; Lippiello, E., de Arcangelis, L., and Godano, C.: Influence of Time and Space Correlations on Earthquake Magnitude, Physical Review Letters, 100, 038 501, 2008.). In particular, we had already discussed the difference between the model proposed in these papers and the SSAR model just after Eq.(7). In brief, that model is a special case of SSAR corresponding to z=0 and it predicts a logarithmic divergence of the Omori-Utsu rate at short times (Lippiello, E., Bottiglieri, 5 M., Godano, C., and de Arcangelis, L.: Dynamical Scaling and Generalized Omori Law, Geophysical Research Letters, 34, 2007a.). However, both features are not consistent with high-resolution earthquake catalogs from Southern California (Davidsen, J. and Baiesi, M.: Self-Similar Aftershock Rates, Physical Review E, 94, https://doi.org/10.1103/PhysRevE.94.022314, 2016.). We have now added the Lippiello et al. (2007a) reference and expanded our discussion of their model throughout our paper.

RC3: "As stated in the previous section this approach is not new. The only difference is in the introduction of two scaling exponents instead of only one... The authors should discuss the advantage of introducing the two exponents in respect of using only one."

AC3: Having two relevant time scales and, hence, two scaling exponents is a crucial generalization as it matches with observational data from Southern California as already stated in our paper (page 2). See AC2 directly above for a more detailed

response and the revisions we made.

RC4: “The only novelty in the article is represented by the introduction of the sub-catalog randomizing. This aspect remain, however, obscure and should be better described and discussed, In particular, at my opinion, the differences between the sub-catalog randomizing and the full-catalog randomizing are not sufficiently enlightened."

AC4: We disagree with the referee regarding the novelty. Our paper quantifies for the first time the type and strength of the magnitude correlations arising in the SSAR model. The SSAR model is a non-trivial generalization of earlier attempts to provide a self-similar extension of the Omori-Utsu relation and it is consistent with high-resolution earthquake catalogs from Southern California as shown previously. To establish the type of correlations in the SSAR model, we use different null models or randomization procedures. To clarify these procedures, we have now added supplemental material providing a more detailed description and reference it in section 3.1.

RC5: “Moreover I suggest that the sub-catalog randomizing should be applied to real catalogs."

AR5: This has already been done in (Davidsen and Green, 2011). We have added a corresponding remark at the beginning of section 3. It is important to realize, though, that for real-world catalogs one does not have direct access to the triggering relations between events. In addition, one needs to consider, for example, the effects of short-term aftershock incompleteness as well. Thus, a direct comparison is outside the scope of the paper at hand but will be investigated in the future.