

Interactive comment on “An MCMC Bayesian full moment tensor inversion constrained by first-motion polarities and double couple percent” by Mehrdad Pakzad et al.

Frantisek Gallovic (Referee)

gallovic@karel.troja.mff.cuni.cz

Received and published: 18 February 2020

Review of paper “An MCMC Bayesian full moment tensor inversion constrained by first-motion polarities and double couple percent” by Pakzad, Khalili and Vahidravesh.

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The paper presents a Bayesian approach to centroid moment tensor inversion with constraints on polarities and DC percentage. The method is illustrated on synthetic tests and then applied to two real events. The combination of waveforms and polarities is suitable for small events with typically imperfect data coverage. Below and in the

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annotated manuscript, I present many issues that need to be resolved before the paper can be accepted for publication.

The inversion method itself seems improperly chosen. Much computationally simpler approach providing mathematically the same result can be formulated considering that the Bayesian approach is “additive” in terms of applying constraints. In particular, the authors could use the ISOLA-ObsPy code (which they use anyway) and omit all results dissatisfying the polarities and DC percentage limit. This way, they could avoid the nested MCMC approach to sample the posterior. My proposed approach assumes that the centroid location is sought on a predefined grid of points for which the GFs are precalculated.

The structure of the paper should be simplified. All methodological details should be given in a single (Method) section. In the present version, the coarsening method (also called tempering) is introduced in the middle of the discussion of the results, which is confusing. Moreover, many things regarding the calculations are missing. For example: what is the sampling step of the centroid location, are the Green’s functions precalculated or calculated on the fly?, how are the frequency ranges determined?, what Cd is used when synthetic tests with no noise are considered?, is the coarsening used only for determining the centroid location?, how long is the burn-in period? Other points can be found in the annotated manuscript.

The results and conclusions of the synthetic tests are not laid out clearly. How do the polarities help to the inversion? Are there any critical lessons learned that are then considered in the real data applications? At line 236 (just before the Conclusions section), something about “one polarity” is mentioned, which is not discussed in the synthetic tests at all. Generally speaking, the synthetic tests and the real data applications must be made more coherent.

Regards, Frantisek Gallovic

Please also note the supplement to this comment:

<https://www.solid-earth-discuss.net/se-2019-191/se-2019-191-RC1-supplement.pdf>

Interactive comment on Solid Earth Discuss., <https://doi.org/10.5194/se-2019-191>, 2020.

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