Review of the manuscript:

"Bayesian earthquake dating and seismic hazard assessment using chlorine-36 measurements (BED v1)" by Beck J. et alii

The Authors present a MATLAB code, called BED v1, that using a Bayesan Markow-chain Monte Carlo approach account the relevant uncertainties involved in dating seismic events occurrences on fault planes by measuring the 36Cl abundance.

The subject of the article is of broad interest to the scientific community involved in this topic and can represent an original and significant contribution to fault-based seismic hazard studies.

The manuscript is properly organized and written clearly, the objectives are clear and the interpretations of the results are supported by the well presented data. Moreover, the code BED v1 runs without problem with the Matlab vers. 2016b and it is quite user-friendly.

Considering my skills I mainly focused my review on the application to regional probabilistic seismic hazard assessment and I suggest some minor revisions on this part to improve the paper and the interest of the seismic hazard modelers community. First of all the authors have to better explain, at the beginning of the paragraph, that only fault-based and time-dependent seismic hazard models, and not all the current probabilistic seismic hazard calculations, are mainly based on Brownian passage-time (BPT) distribution. Moreover, the choice of a BPT distribution try to take into account physically motivated models, where the probability of occurrence of the next earthquake on a single source cannot grow indefinitely but considers the possibility that, after an elapsed time close to the mean recurrence time of the characteristic earthquake, the probability follows a Poisson-like behaviour. The reason for this behavior can be linked to the fault system interaction effect. Furthermore, the coefficient of variation (CV) parameter takes into account the effects of the tectonic loading stress, the fault system geometry and the slip-rate variability (see for some details Visini and Pace, 2014, SRL). For these reasons, the assertion that such fault-based seismic hazard models do not consider the slip rate variability is not totally correct. In any case, in my opinion, the authors' proposed approach is very interesting and challenging. What is missing, from my point of view, is a comparison of the results with the "classical" BPT distribution, both in terms of next earthquake probability and, if possible, of probabilistic expected ground shaking (using a simple model). The probabilities shown in Fig. 16 seems to me very "high" but without a comparison with other approaches (e.g. FiSH approach, Pace et al., 2016, SRL) and without an application in terms of probabilistic seismic hazard maps (or curves) is not easy to understand the impact of the proposed methodology. The knowledge in terms of earthquake occurrences on *individual faults and of slip rate variability is growing fast and this manuscript and the related code can give another important incentive, and so some sensitivity tests to show the impact of different approaches I think are essential.*

In conclusion, I suggest to the authors to improve the paragraph 5.3, in order to make the paper even more challenging, but overall I consider the manuscript and the related code an important step towards a next generation of fault-based seismic hazard models that includes fault interactions and slip rate variability.

Chieti 27/07/2018

Best regards,

Bruno Pace