Review Comments for "Methodology for Earthquake Rupture Rate estimates of fault networks: example for the Western Corinth Rift, Greece" by Chartier et al. 2017.

The manuscript proposes a new methodology to calculate the magnitude probability density function (PDF) for fault systems considering the fault-to-fault ruptures and seismic moment accumulation. Proposed methodology might be a good and repeatable alternative for the "grand inversion" technique used in UCERF3; therefore, I found the technical content of the manuscript important and worth to be published after the following issues are clarified:

1) The method proposed here is built on the assumption that the G-R distribution is valid for the faults and fault systems. Earthquakes in seismically active regions are observed to follow an exponential distribution of magnitudes (G-R distribution); however, the size distribution of earthquakes on faults has been the subject of debate. According to Hecker et al. (2013), the common practice in probabilistic seismic-hazard analysis (PSHA) is to favor a characteristic-earthquake distribution for faults, but to incorporate an exponential distribution in some aspect of the modeling. In Figure 1 of Hecker et al. (2013) a very clear example of the overestimation of the rates of small-to-moderate earthquakes when the G-R distribution applied to Hayward Fault is provided. Therefore, the authors should discuss the reasoning behind the selection of the target MFD as a G-R distribution. Would the Youngs and Coppersmith (1985) composite model be a better target MFD for fault-to-fault ruptures?

2) The computational steps for proposed methodology should be clearly demonstrated. Annex 1-Figure 1 is quite adequate for this purpose, but it is not properly explained in Section 2. Here is how I interpret the method from the text and Figure 1:
    a) Maximum magnitude and the magnitude bins for each fault are defined. For the example in Figure 1, M_{max}=6.2, 6.3, and 6.6 for F1, F2 and F1+F2, respectively.
    b) According to the figure, the computations start from the maximum magnitudes (Figure , panel 2). Since there is no other combination that can end-up in M=6.6, Mo for M=6.6 is calculated and reduced from F1+F2. Is my interpretation correct?
    c) The computations continue with decreasing magnitude. For the smaller M (for example M=6.2), all faults can be responsible. According to the text, the seismotectonic source that can be responsible for that is selected randomly. It can be F1, F2 or F1+F2. This point forward needs more explanation. What happens than? If F1 is randomly selected, the budgets for F1 and F1+F2 are both reduced? What happens to F2 e.g. can F2 also result in a magnitude 6.2 in this procedure?
    d) The incremental MFD on Figure 1 is equal to dr_e/dM_o. Is this correct? dr_e/dM_o is basically equal to the seismic moment for that bin, coming from all fault combinations?
    e) Page 4, Line 6: "As the magnitude bins are picked according to a distribution based on the moment rate…" Can you please clarify that? Are the magnitude bins selected in a decreasing order (because the figure implies that)?
    f) Since the slip rates are spend in the decreasing order of magnitudes, this model somehow supports the characteristic assumption; the faults may not create small magnitude events if the budget is spent. This is consistent with Figure 3 third panel where the distribution looks like a skewed normal distribution. However, the rate of

the largest magnitude event (dr_e/dM_o) would be larger if dr_e/dM_o=Mo(M=6.6). That's not consistent with Figure 1.

g) Page 4, Lines 9-11: "The target MFD for the whole fault-system is then calculated based on the imposed regional b value and the average rate of the three highest magnitude bins (0.3 being the range of uncertainties in the scaling laws used to assess the maximum magnitude)". To my understanding based on this statement and Figure 1, the activity rate (or the intercept of target MFD) is determined based on the known slope fitted to large magnitude rates. Can you please discuss the assumption that the slope is constant under the assumption that proposed model has a "close to characteristic" shape?

h) At the end, the shape achieved is "kind of" similar to the composite model of Young and Coppersmith (1985). Please discuss this similarity (or lack thereof) by plotting the proposed model and composite model in moment rate space.

Based on the questions raised above, the text explaining the procedure should be rewritten in more details for the sake of the reader, since it's the heart of the paper. Adding the spreadsheet for the example given in Figure 1 would also be very useful.

3) Proposed methodology does not have a check point. In the study referenced by the authors (Gülerce and Ocak, 2013), or in Hecker et al. (2013), assumed magnitude recurrence model is tested by the rate of earthquakes associated with that particular fault system for consistency. It seems like the authors foresee such a check point according to Figure 2 and 4. I recommend that the check is also added as the last step of the procedure.

4) Second part of the manuscript presents the application of the proposed methodology on western Corinth rift fault system. A few questions regarding the application side:
   a) The b-value is assumed as 1.15. Please provide the reason why it is not calculated from the catalogue but assumed.
   b) Page 5, Line 32: "We propagate the uncertainties on the earthquake magnitudes and on the time of completeness of the catalog in the seismic moment rate and earthquake rate calculations". Please explain this statement since the application procedure does not elaborate these matters.
   c) I'm assuming that the catalogue completeness levels are considered in comparing the earthquake rates from the catalogue to the proposed MFD, specifically in Figure 4. Please clarify that issue.
   d) One of the significant problems in utilizing the moment-balanced PSHA in the extensional regimes is the slip rate participation on parallel dipping faults (as in N. Erratini and S. Erratini Faults in Figure 2). Please explain how the extensional slip rate is calculated for these systems and how the uncertainty affects the proposed methodology.
   e) Finally, the maximum magnitudes of the faults used in the example are not that big (none of them are above 6.5). Please comment on the applicability of this method for larger faults that can produce M>7 events.