Response to the comments of reviewer # 2 on the manuscript, entitled 'Estimations of climate sensitivity based on top-of-atmosphere radiation imbalance' by Lin et al. submitted to ACP

Response to reviewer #2

Comments:
This paper attempts to estimate the climate sensitivity for mainly medium-range timescale from climatological point of view, and will contribute to reduce the uncertainty in climate projections. I do not find any major problems in this paper, thus I recommend this to be published in the almost current form.
I have one request. Why did you assume O in eq. (2) as eq. (3), although O is proportional to TOA net radiation? Please elaborate this in the text.

Response: Thank the reviewer for these constructive comments.
The answer to the reviewer's specific question is:
From the equation 2 (i.e., our energy balance model), it can be seen that there are only three radiative terms: one forcing (F) and two feedback (f_sT and $\frac{fm}{tm}\int_{t-tm}^{t} Tdt'$) terms. A combination of all these radiative forcing and feedback terms would result in the net radiation of the climate system. Thus, with the assumed proportionality of O with net radiation, we obtained Eq. 3. To clarify this point, we have added an explanation of the net radiation for a climate system with memory feedbacks when we introduce Eq. 2. The text reads: 'Again, the net radiation is the combination of all radiative forcing and feedbacks (i.e., the summation of the first three terms in the right hand side of the equation 2 for current case).' By the way, for a climate system without memories as expressed by Eq. 1, we have also defined the net radiation as a part of the response for the reviewer #1 (see the response to the second specific comment of reviewer #1).