Many thanks to Carlos Jiménez for his thorough review and insightful comments on this paper. In the following, we give a item-by-item response to the comments. Reviewer's comments are written in italic; authors' responses are shown in upright font.

The paper presents evapotranspiration estimates based on the "triangle method" using top-of-the-atmosphere (TOA) radiance and TOA NDVI, instead of the more usual land surface temperature (LST) and NDVI (at the surface). The paper is well written, their contents are well presented, figures and table are clear, and the subject is of interest for HESSD readers.

My main points of concern are related to
(1) Surely atmospheric corrections introduce complexity and uncertainty into remotely sensed variables at the surface. But there are required to avoid the signal retrieved at the surface being modulated by the atmosphere. In my opinion a surface-variable-triangle-method and a TOA-variable-triangle-method working similarly is due to the fact that estimation errors associated to this specific methodology do not allow to distinguish between the use of one or another type of algorithm forcing. If TOA variables (instead of surface variables) were best suited to address a surface retrieval problem, that would indicate a very poor atmospheric correction (uncertainty from atmospheric correction larger than atmospheric signal modulation). That could be the case over a specific place or time of the year, but it is difficult to believe that this would always be the case. It should be noted that for some of the variables discussed other factors may be at least as important (in terms of adding uncertainty) as the atmospheric correction (e.g. land emissivity for the derivation of LST, see for instance Jimenez et al., 2011). For this estimation, using a TOA thermal emission instead of a LST neglects the modulation in the thermal signal by the emissivity, which may (or may not be) of importance here. So I understand that TOA variables are used for the sake of simplicity as it does not matter for the end result in this particular case (ET estimation), but I would not say that we are using less uncertain remote sensing observations as the authors seem to conclude.

Response：The TOA variables normally differ from the actual surface variables due to atmospheric attenuation effects. If remote sensed data are used to provide substitute or equivalence for those detected by field measurements, correcting TOA variables by atmospheric profiles for many important variables are necessary. In practice, the remote sensing community has made a great effort to incorporate various correction procedures that account for atmospheric attenuation effects. These procedures are often troublesome and increase the operational difficulty for practical applications. Under this background, we generate the idea of using TOA variables directly to estimate ET. It is found that the triangle method based on contextual information from remote sensing is less sensitive to atmospheric effects (Carlson, 2007;Venturini et al., 2004). Thus, the complicated corrections to remote sensed data may not be necessary. The data interdependency could be minimized to facilitate the overhead of operationally utilizing remote sensed data. For triangle method, the similarity between surface-variable-estimate and TOA-variable-estimate is decided by both surface and atmospheric variability. Peng et al (2012). explored the effects of key surface and atmospheric parameters on TOA-variable-triangle-method. The differences between surface-variable-estimate and TOA-variable-estimate are expected to be less than 10%, if the spatial variabilities of atmospheric parameters (water vapor and effective atmospheric temperature) and surface emissivity are below 10%, 4 K, and 0.05, respectively. In

the present study, we would like to conclude that the proposed method requires less apriori information on the atmospheric state while providing estimates at a similar level of accuracy than obtained using atmospherically corrected surface data products. It therefore provides a useful alternative for determining ET from satellite data. “using less uncertain remote sensing observations” is not our intention and conclusion. The relevant parts in the paper that are not suitable have been rephrased, which could be found in the following.

“Overall, the proposed algorithm requires fewer assumptions and can avoid complex atmospheric corrections associated with the satellite derived products.”

“It eliminated the complex processing chain of deriving these variables and provided a useful alternative for determining ET from satellite dada.”

(2) The validation of the proposed methodology is carefully done, but very limited in time and space. Statistics are computed just over 16 case days for just one location. Giving the phrasing used in the text, the paper seems to indicate cloud cover as the limiting factor for case selection. Even if this is a clear sky day technique, selecting 16 cases from a 9 months period over a sub-tropical area of ≈ 20,000 km2 casts serious doubts about the applicability of this technique. For the MODIS TOA and MODIS product comparison this is further reduced to 11 cases. Giving that the difference in the statistical figures are not large for many of the comparisons, conclusions about one methods and/or dataset being better than other should be very carefully drawn. The paper would clearly benefit for more solid statistics (in terms of number of cases, not methodology).

Response：We agree that the validation of the proposed methodology is very limited in time and space for the current study. But the location we chose to validate the method is the only place where we could get ground observations of both ET and net radiation. And this study area is in the Poyang Lake basin, which is well known by hydrology community. It is true that 16 case studies sound not enough. But the limited cases are caused by the study area's humid subtropical climate and MODIS data's instantaneous overpass. 11 case days rather than 16 days were selected for the comparison of MODIS TOA and MODIS products, because MODIS products have no values over the validation site for the other 5 days. These void values in the MODIS products may be caused by mis-classification of MODIS cloud mask product. We thank the reviewer for pointing out that conclusions about one method or dataset being better than other should be very carefully drawn. We have modified the text to avoid this strong conclusion (see below). In addition, we now are conducting more validations of the proposed method over various climate regions and under different surface conditions against flux tower measurements over the global.

“The results suggest that the proposed method could reach similar level of accuracy as the MODIS products-based triangle method.”

“The results suggested that the proposed method achieved similar accuracy as the MODIS products-based triangle method, which further confirmed the feasibility of the proposed method for ET estimation.”

(3) Looking at the statistics comparing TOA ET and surface-variable ET, the differences do not seem related to the triangle-method itself (both EF seems quite similar), but rather to the net radiation (poorer for the surface-variable formulation, compared with the TOA formulation). So the differences are more related to one of the ET algorithm forcings, rather than the algorithms themselves. Without being an expert, I assume that there are different schemes to estimate Rn from the set of MODIS variables, not just Bisht 2005, which may (or may not) give better results for this specific location. Granted that net radiation is an important part of an ET estimation, but it seems to me that we are discussing (for this specific location and the 11 days compared) net radiation algorithm issues (more than ET estimations).

Response：Yes, you are right. Concerning the triangle method, the inclusion of Rn could improve the accuracy of ET. But our aim is not trying to compare different Rn estimation schemes. The results only reveal that TOA Rn and Products Rn are comparable, although TOA results is slightly better than Products results. These together show that using TOA radiance to estimate ET is feasible, and could reach similar level of accuracy as products based ET. For triangle method, estimations of EF and Rn are independent from each other, thus making it impossible to trace ET errors back to EF and Rn separately. As you said, the accuracy of TOA based EF and products based EF are in the same order of magnitude. Then the differences between ET results are more related to Rn results. Actually, this further demonstrate that the comparison of estimated EF rather than Rn with measurements is essentially the true validation of the triangle method for ET estimates. Similar conclusion is also reported by Jiang et at. (2009).

(4) Giving that the paper mainly uses MODIS products, it could have been made more interesting by including the MODIS ET official product (MOD16, Mu et al., 2011). This is not a ground validation as the use of a weighting lysimeter, but it would allow to compare this triangle-method with other ET estimates from the same instrument, and to discuss this work at larger scales and in the context of one of the main methodologies (the Penman-Monteith based approaches) use at the moment for regional/continental ET estimation from space.

Response: Thank you very much for this suggestion. We have also thought about comparing our results with other ET products before. But we did not find suitable products for our goal. Concerning MOD16 ET product, it only provides 8-day, monthly and annual intervals. However, our results are daily scale. So the time differences restrict the comparisons between MOD16 product and our result. However, we are well aware of the importance of ground validation. Relevant validation work against global flux tower measurements is carrying out, and preliminary results have already been analyzed.

References:

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