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**Biogeosciences Discussions**

# *Interactive comment on* "Numerical study of surface energy partitioning on the Tibetan Plateau: comparative analysis of two biosphere models" *by* J. Hong and J. Kim

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Thank all reviewers and editor and we appreciate constructive comments on our manuscript. We, authors believe that sharing your constructive comments improve this manuscript a lot. As you have suggested, we have revised the manuscript by incorporating all of the comments provided by the referee #2. Below is the authors' response to the reviewers (blue colored sentences).

**Reviewer #2 comments :**



This study identifies the model performance of two land surface models (LSM) in terms of the energy and water fluxes in the Tibetan Plateau, which plays an important role in the Asian monsoon. Authors compared between observed and simulated surface fluxes, and showed the possible model uncertainties. The manuscript is generally structured and well written, and I believe the manuscript will be published after some minor modification as follows:

Page 10851 Line 15: Further explanation might be required for "radiative coupling". It might be ambiguous.
REPLY: We incorporated the reviewer's comment and cited our previous paper on the radiative coupling (Hong and Kim, 2008, Simulation of surface radiation balance on the Tibetan Plateau, Geophysical Research Letters, 35, L08814, doi:10.1029/2008GL033613).

Page 10851 Line 25: Authors mention one of the objectives as "to elucidate the characteristics of surface energy balance on the Plateau". But, in the manuscript, authors only mostly concentrated to show the performance of two LSMs and its uncertainties. It will be required to describe the characteristic of SEB of the Tibetan Plateau by adding a sub-section in section 4.
REPLY: We already published one paper on the observed surface energy balance on the Plateau (Choi et al., 2004, Turbulent exchange of heat, water vapor, and momentum over a Tibetan prairie by eddy covariance and flux variance measurements, Journal of Geophysical Research, 109, D21106, doi:10.1029/ 2004JD004767.) By incorporating the reviewer's comment, we more discussed the simulated surface energy partitioning on the Plateau in section 4.3 in which we discuss the overall model performance to simulate the surface energy partitioning.

Page 10852 Line 16: As generally known, the eddy covariance measurements has a

problem to measure the surface energy balance, so called energy imbalance problem. Author should mention the energy balance closure of this site at half-hourly and longer time scales. In addition, if the energy was not balanced in this site, possible uncertainties of the measurement should be mentioned in the discussion section.
REPLY: As the reviewer correctly pointed out, the observed energy imbalance hinders us from correctly assessing the model performance. As far as we know, we do not have any pillar we can stand on for this energy imbalance issue and its impacts on the model simulation. That is why in our manuscript, we tried to focus on ratio of soil evaporation to total precipitation rather than absolute flux values. That is why we used other independent observation data like stable isotope and soil temperature. Also, that is why we compared two independent models with the observation data to quantify the environmental uniqueness of the Plateau, not used a single model. In our manuscript, we scrutinized many different aspects of land surface processes including not only surface fluxes from eddy-covariance data but also soil evaporation, soil temperature and soil moisture. In particular, by using multiple constraints, we examined many aspects of land surface processes on the Plateau and the simulated Bowen ratio showed better agreement to the observation after adjusting a few key parameters described in the manuscript. As the reviewer suggested, we revised the text for clear information on this issue.

Page 10855 Line 5: I could not confirm that LE slightly increased in Fig. 2. Some modification of the figure will be helpful for readers.
REPLY: We revised the figure for better readability.

Page 10858 Line 17: k in the equation is missing in the Appendix A.
REPLY: It is corrected now. Thank you.

Page 10859 Line 7: I could not confirm that Rn, H, and LE increased, and Ts



decreased in Fig. 5. Authors should modify the figure for clear presentation, or change the expression.
REPLY: We revised the figure and text for better readability.

Page 10862 Line 5: Since there are two styles for “the force-restore method”: “the force-restore method”(e.g., Page 10862 Line 8), and “the Force-Restore method”(e.g., Page 10862 Line 8). It is to be written in a same manner.
REPLY: It is corrected now.

Fig.7: It is helpful to show the observed results in Fig. 7.
REPLY: Indirectly, We can estimate the observed canopy evapotranspiration (LEc) by subtracting total LE form the eddy-covariance method by LEg from stable isotope observation. However, this is not independent and direct measurement of LEg and LEc. In addition, as we replied above, the observed energy imbalance makes us focus on the partitioning or ratio such as Bowen ratio and ratio to total precipitation when we dealt with the observed surface fluxes. The relevant information also can be found in Figure 8. By incorporating the reviewer’s comment, we revised the manuscript for clear readability.

Authors show the details of the LSMs by using some equations. I think that some of equation is difficult to fully understand the LSMs for the readers who are not specialist of boundary-layer meteorology. It might be helpful to show the diagrams of the model structure related in this study (e.g., Fig.1 in Engstrom et al., 2006; Goetz et al., 1999). References: Engstrom et al., (2006): JGR 111, doi:10.1029/2005JG000102. Goetz et al., (1999); Ecological Modeling 122, 239-255.

REPLY: All land surface models have the nearly same structure but use different pa-

rameterizations. In particular, we want to mention that the two models used in this study are one of the well known models and we are providing several key papers where readers can find more detailed information on the models. Also, we already provided a table to see main differences between two model. By incorporating the reviewer's comment, we revised the text for better readability. Thank you.

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Interactive comment on Biogeosciences Discuss., 6, 10849, 2009.