

Interactive comment on “Estimating surface fluxes over the north Tibetan Plateau area with ASTER imagery” by W. Ma et al.

W. Ma et al.

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First of all, we would like to thank Prof. R. Ludwig for his careful work and his very useful suggestions. We will try to take advantage of his advice for improving the revised manuscript. For an easier comprehension, the comments of Prof. R. Ludwig are also reported. At the same time, the reply part uses the red typeface.

Prof. R. Ludwig: The paper is, in principle, comprehensively structured and written. However, it is recommended to thoroughly revise the manuscript for grammar and syntax. Mathematical understanding and equations are correct and generally presented well.

Answer: According to Prof. R. Ludwig 's request, we have made the revision com-

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pletely. In the paper we marked using red typeface all the improvements (see the revised manuscript).

Prof. R. Ludwig: Figures and tables are suitable, but need some refinement for legibility. Please consider that figures 3 and 5 should be interpretable in black-white as well. Axis descriptions, especially in Fig. 6, must be increased.

Answer: The black-white image is very difficult to describe the change of land surface fluxes. We think that the colored picture maybe good to describe the land surface fluxes, especially for the open access HESS, digital version is the preferred format. Therefore we suggest to retain the color pictures. The abscissa has been already marked the meaning in figure 6, such as net radiation flux, soil heat flux, sensible heat flux and latent heat flux. Concrete content has been detailed showing in the article (see the revised manuscript).

Prof. R. Ludwig: The extensive list of references is of high quality. Quotations are well-placed in the text.

Answer: Thanks Prof. R. Ludwig 's kind praise. We will try our best to modify this paper.

Prof. R. Ludwig: Abstract: ASTER basics should not have to be explained here.

Answer: You are right, we follow your suggestion (see the revised manuscript).

Prof. R. Ludwig: Abstract and conclusions: it is argued that a parameterization method has been proposed and tested for NDVI, MSAVI etc. Where do these vegetation parameters reappear in the manuscript? It is simply missing except for a small indication in chap.2.2.2. Please include substantial results and explain the procedures behind the derivation of vegetation coverage and LAI or skip this part.

Answer: At the beginning, we think that the vegetation parameters are simple part, so only references have been given in the paper. Moreover, the goal of this paper is to calculate the land surface fluxes, but pays attention to the surface parameters.

Therefore the vegetation parameters have not been reported extensively. According to Prof. R. Ludwig's suggestion, we skip this part.

Prof. R. Ludwig: the retrieval technique for land surface temperature should be presented in more detail, as it is a crucial parameter for both, following parameterizations and final results of this study.

Answer: Yes, we have made the corresponding revision, especially land surface temperature explanation. We marked using red typeface in the revised manuscript.

Prof. R. Ludwig: In some parts, it is not clear to me, how you are accounting for the spatial heterogeneity of some crucial parameters (soil texture, friction, roughness length etc.). Please provide a little more detail on this important issue.

Answer: When accounting for the spatial heterogeneity of some crucial parameters, we use references or actual observations. Such as soil texture. In BJ station, the soil texture is sandy clay loam (United State Department of Agriculture, 1951). Although all kinds of soil types except sand and peat were tested, difference of each soil heat flux result was quite small. For the important parameter in the calculation of sensible heat flux, the excess resistance for heat transportation, k_B^{-1} , observational data was used in this paper. It is: $k_B^{-1} = 0.062u(T_{sfc} - T_a) + 0.599$. We have used the AWS (automatic weather station) observation data (wind velocity and temperature).

Prof. R. Ludwig: How many AWS were actually available for this study? Were you able to differentiate AWS used for parameterization schemes and product validation? If yes, please explain in more detail. If no, please give us your critical opinion about the validity and independence of your results.

Answer: Yes. In this study, only BJ station is used for the study. We know that the ASTER coverage is $60 \text{ km} * 60 \text{ km}$. As a result of Tibet weather and climate reason, it is very difficult to find the cloudless day for ASTER data. It is a pity that only BJ station is inside the ASTER scene, other stations were not covered. But we are very

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happy to see, the remote sensing results and the land surface observation data have the very good consistence. At least the explanation of our parametrization plan is feasible in Tibet Plateau. We have the turbulent heat flux measurement and AWS in BJ station. Using the land surface flux which the AWS (automatic weather station) profile (gradient) data obtains to consider that is credible, and has carried on the contrast with the turbulent data. The result revealed that the computation of surface flux using the profile data is credible. That is, we may use the profile data as the "ground truths", using the ground truth to validate the remote sensing results is feasible. By the way, the profile observed data are obtained in the large-scale international cooperation experiment, the observed data are more credible, laying the foundation for the remote sensing validation.

Prof. R. Ludwig: It would be very helpful, if you would include a more thorough discussion about the issue of scale. What scale are you aiming at with your procedure? Is it really necessary to work on the ASTER scale, when you are looking at regional land surface-atmosphere interactions? Please discuss the benefits you are expecting from your high resolution approach in a little more detail. Especially, since you (surprisingly) include low resolution sensors in your concluding remarks Your conclusions are generally a little too generic and un-specific. Please try to place your approach in a wider context, highlight its potentials (especially with regard to hydrological sciences) and discuss its limitations in more detail.

Answer: Thanks for Prof. R. Ludwig's suggestion. Just R2's question, we want to say our intention in following: The land surface fluxes are computed correctly, this may build the foundation for the land surface-atmosphere interactions. At first land surface fluxes have been calculated using the AVHRR data from our group in the Tibet Plateau area, then the TM data were also used to calculate the land surface fluxes. We found that the results of the AVHRR data and the TM data have resolution's problem due to, they cannot reflect the land surface real condition. In order to make up this kind of insufficiency, we use the high resolution data (ASTER data) to have a look at the

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land surface flux of the slight change in Tibet Plateau area. We discovered that the results of the land surface fluxes value derived from the ASTER data were very good and could better explain the land surface heterogeneity in Tibetan Plateau. We thought that reviewer's opinion is very good.

Prof. R. Ludwig: For technical corrections, I refer to the precise comments of Anonymous Referee #2. I kindly ask you to perform a major revision of your manuscript with regard to the recommendations given in this discussion.

Answer: We have finished technical corrections using red typeface.

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