

## ***Interactive comment on “Determination of land surface heat fluxes over heterogeneous landscape of the Tibetan Plateau by using the MODIS and in-situ data” by Y. Ma et al.***

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Received and published: 29 August 2011

General comments:

The determinations of heat fluxes over the heterogeneous surfaces are essential to the land surface process research. This manuscript demonstrates a technique to estimate the land surface heat fluxes using MODIS and precious in-situ data over the Tibet region. This is a very valuable research on the regional heat flux estimates. It is also one of the most important research issues in the water and energy balance studies for climatic and hydrological researches. The technique presented in this manuscript is also very interesting. The manuscript is well organized, and the results are quite

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accurate compared with observations. The manuscript is investigating the possibility to upscale patch-scale observations to regional scale by introducing satellite data, which is an important topic in data assimilation and surface processes studies. The science and technology described in this paper are good to make an acceptable publication in ACP. I suggest that this manuscript should be accepted for publication in ACP. However, the following questions are needed to be considered.

ANSWER: Thank you very much for your comments and encouragement.

Major comments

1. What is the different between your Article in 2006 (Ma, Y., Zhong, L., Su, Z. et al., 2006, Determination of regional distributions and seasonal variations of land surface heat fluxes from Landsat-7 Enhanced Thematic Mapper data over the central Tibetan Plateau area, *J. Geophys. Res.-Atmos.*, 111, D10305, doi:10.1029/2005JD006742) and this paper?

ANSWER: Thank you very much for your comments. The differences between our Article in 2006 (Ma, Y., Zhong, L., Su, Z. et al., 2006, Determination of regional distributions and seasonal variations of land surface heat fluxes from Landsat-7 Enhanced Thematic Mapper data over the central Tibetan Plateau area, *J. Geophys. Res.-Atmos.*, 111, D10305, doi:10.1029/2005JD006742) and this paper are: 1) the surface reflectance, surface temperature, vegetation coverage, emissivity etc. are derived from MODIS data in this paper and ETM was used in the previous one; 2) The study area and the determination procedure of sensible heat flux are different. The study area in this study is entire Tibetan Plateau, and the land surface becomes more heterogeneous than previous ones. The previous study in 2006 was only carried out in meso-scale area. The “blending height approach” has been used for the determination of sensible heat flux in the previous study in 2006 and the “tile approach” has already been used for the determination of sensible heat flux in this paper.

2. Why only four scenes MODIS data were used in your study?

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ANSWER: Thank you very much for your comments. You are right, the main goal of this research is to analyze the inter-annual variation of surface heat fluxes, and we should use as many MODIS images as possible for the study. Unfortunately, only four clear days (cloud-free days) over the entire Tibetan Plateau were found due to the strong convection over there. Therefore four cases were used here for the study of inter-annual variation of surface heat fluxes.

3.How can you determine each “tile” in your “tile approach”?

ANSWER: Thank you very much for your comments. We determined each “tile” according the surface reflectance  $r_0$ . For example,  $r_0 \sim 0.17$ , we determined the land surface is grassy marshland;  $r_0 \sim 0.25$ , we determined the land surface is Gobi-sparse grass; and  $r_0 \sim 0.05$ , we determined the land surface is lake (water surface) etc.

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Interactive comment on Atmos. Chem. Phys. Discuss., 11, 19617, 2011.