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Hydrology and Earth System Sciences Discussions

Interactive comment on "Estimation of surface energy fluxes under complex terrain of Mt. Qomolangma over the Tibetan Plateau" *by* X. Chen et al.

Anonymous Referee #1

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This research presents estimations of the the radiative budget and surface energy balance calculated by combining remote sensing data (LANDSAT) with algorithms based on radiative and atmospheric surface layer theory. I think the results are potential very interesting due to the importance of the Tibetan plateau in hydrometeorological phenomena, and in addition due to the difficulty of these measurements due to the remote location and the extension of the plateau. However the lack of a systematic error analysis on the retrievals and the uncertainties associated to the applications of the algorithms make the results lacking the necessary robustness for that sort of studies. Closely related to this point, it is the use of only 8 LANDATA scenes which in my

opinion it is not enough to obtain reliable statistics (figs 3 and 4). I recommend therefore that they elaborate and add this error analysis study and they add more scenes to do a more reliable intercomparison between in-situ and TESEBS. Below, I include some points that need to be addressed in agreement with my major concerns abovementioned:

1.- Soil heat flux (section 2.2) is very difficult to be measured. Could the authors provide some information on the error associated to the in-situ measurements and their estimations? (figure 4c)

2.- The retrieval (section 2.3) of the heat flux depends on turbulent variables like the friction velocity that strongly depends on the location (in case of the in-situ measurements) or the model parameters (roughness lengths) and formulation. How do they account for these issues?

3.- At section 3.3, they stated that the model TESEBS is capable to represent the temporal development of the surface energy balance (SEB). This discussion requires much more elaboration since the reader is left alone with quite a lot of questions:

- Is the SEB close? (in all the 8 cases) - What is the uncertainty error associated to the four components SEB? - What is the component with larger uncertainty?

4.- In section 3.4 they addressed how to include land surface heterogeneity. The influence of the non-uniformity of the surface conditions (albedo, soil moisture, roughness length,...) depends strongly on the spatial scale of the heterogeneities. Which spatial scales of heterogeneity are they including? Are the relevant ones for their retrieval?

5.- At section 3.5, they assumed a constant temperature lapse rate and boundary layer height. These assumptions are not well justified. A “back-of-the-envelope” calculations using the sensible heat flux estimated at Figure 1 shows that for values larger than 100 W/m2, one obtains boundary layer heights larger than 1200 m. They therefore need to further justify their assumptions and perform a sensitivity analysis of the radiative

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budget and SEB in case they apply different values.

6.- As mentioned before, Figures 6 and 7 require a complete and thorough analysis of the errors associated to their estimation. By not including this information, the results are of difficult application.

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