Hydrol. Earth Syst. Sci. Discuss., 7, C4709–C4715, 2011
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Hydrology and Earth System Sciences Discussions

Interactive comment on "Measurements of energy and water vapor fluxes over different surfaces in the Heihe River Basin, China" *by* S. Liu et al.

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Received and published: 15 January 2011

Dear Anonymous Referee#3: We are very grateful for you review our paper and give us very useful suggestions. We will try to take advantage of your advice to improve the manuscript. For an easier comprehension, your comments are also reported. We respond below to your comments item by item.

Referee#3: The title chosen for the paper makes it appear to be not very interesting, because there are many papers of this type available which do not make a significant contribution to recent scientific problems. Nevertheless the paper does have an interesting topic: the comparison of eddy-covariance measurements and Large Aperture Scintillometer measurements in respect to the energy balance closure problem.

Perhaps a change of title would highlight the paper to a larger group of scientists.

Thanks for the Referee#3's suggestion. The main concerned issues of this paper contain data processing and quality control, source areas of flux measurements, seasonal variation of energy and water vapor fluxes, and comparison of large aperture scintillometer (LAS) and eddy covariance (EC) measurements based on the above analysis. Although there are many published papers have a similar title, this manuscript focuses on describing the characteristic of energy and water vapor variations over the Heihe River Basin in China. We will write a special paper on the topic of comparison between LAS and EC measurements under different underlying surfaces (e.g. grassland, forest, cropland, etc) in the near future. So in this paper, we still use the title. We thank for the referee's good idea.

Because the data calculation and the analysis are at a high level the paper can be accepted with minor revisions and the following additional investigation: Because the ratio of HEC and HLAS changes with the energy balance closure it may be interesting to determine which conditions are responsible for a lower or higher energy balance closure. Perhaps this can be investigated depending on wind velocity, stability and land use characteristics in the footprint of both instruments. The following papers are probably also interesting for this problem: Meijninger et al. (2006), Foken et al. (2010)

Thanks for the Referee#3's suggestion. We will refer to the papers.

p. 8745: Because of climate change uniform time periods for climate date may be better – such as 1961-1990 – for all stations.

Thanks for the Referee#3's suggestion. We will reprocess our data, and use the uniform time period for the three sites in the revised manuscript.

p. 8746: It would be good to have the reference to Table 1 already on this page.

Thanks. We will add the reference to Table 1 in p.8746.

p. 8748-9: Eq. 3 is based not on the Monin-Obukhov similarity theory (Monin and

Obukhov, 1954) but on the paper by Obukhov (1960).

In Eq.3 fT is the universal MOST function given by many researchers (e.g. Andreas, 1988; Wyngaard et al., 1971; De Bruin et al., 1993; Thiermann and Grassl, 1992).In many papers (Meijninger et al.2002; Hoedjes et al.2002; Hartogensis et al.2003), it was considered as an application of Monin-Obukhov similarity theory for the structure parameter.

p. 8749: L is nowadays only called Obukhov length (Businger and Yaglom, 1971; Foken, 2006).

Thanks. We will revise it.

p. 8749: In Eq. 5, only the integral of the universal function Ψ is given. A function fT, probably the universal function for temperature, is missing in Eqs. 1-5. This part must be more clearly written.

In Eq.3, the stability function fT is given in p.8749 L.8-9, namely following Andreas (1988) defined as follows:

For unstable conditions, Eq.1(see the appendix equations) (LOb<0);

For stable conditions, Eq.2(see the appendix equations) (LOb>0).

In Eq.5, due to the limitation length of the paper, the stability correction function for the momentum transfer Ψ is given the reference (Paulson, 1970; Webb, 1970; Businger et al., 1971) in p.8749 L.14, and the equation expression is as following:

Eq.3(see the appendix equations) (LOb<0) with Eq.4 (see the appendix equations)

Eq.5(see the appendix equations) (LOb>0)

p. 8749: Explain in a few words what is special about the method by Yang et al. (2003) for determining the roughness length in comparison to the textbook knowledge.

We will add some descriptions in the revised manuscript.

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p. 8752: Why have you deleted night time data – because of stable stratification and the larger footprint?

Data in the night time period were deleted not only because of the relative poor quality, but also the large footprint and small relative weight as the Referee#3 mentioned. Thus, we don't consider the night time data.

p. 8782: The conclusion is more a summary. The authors can probably give some hints to other investigators as to which are relevant problems for such investigations and how to solve them.

Thanks for the Referee#3's suggestion. We will modify this part in the revised manuscript.

p. 8773: Include LAS in the middle row of the figures to provide a better visual separation of the EC and LAS footprint. Generally (also other figures), the legend is very short and the reader has problems in understanding the figures without knowing the whole text.

Thanks for the Referee#3's suggestion. We will adjust the figures to make them more clearly.

p. 8767: citation Yang et al. (2003) is wrong, it is volume 106

I am sorry for the mistake. In Yang's (2003) paper, it writes the volume 116. We find it in the journal of Boundary-Layer Meteorology, it is volume 106.

References:

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Hoedjes J C B, Zuurbier R M, Watt C J.: Large aperture scintillometer used over a homogeneous irrigated area, partly affected by regional advection. Boundary-Layer Meteorology, 105: 99-117, 2002.

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Webb, E. K.: Profile relationships: The log-linear range and extension to strong stability, Q. J. Roy. Meteor. Soc., 96, 67–90, 1970.

Please also note the supplement to this comment:
http://www.hydrol-earth-syst-sci-discuss.net/7/C4709/2011/hessd-7-C4709-2011-supplement.pdf

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Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 7, 8741, 2010.

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Eq.1 For unstable conditions, $f_T = 4.9\left[1 - 6.1\left(\frac{Z_{LAS} - d}{L_{Ob}}\right)\right]^{-2/3}$ (L_{Ob}<0)

Eq.2 For stable conditions, $f_T = 4.9\left[1 + 2.2\left(\frac{Z_{LAS} - d}{L_{Ob}}\right)^{2/3}\right]$ (L_{Ob}>0)

Eq.3 $\psi_m = 2\ln\left[\frac{1+x}{2}\right] + \ln\left[\frac{1+x^2}{2}\right] - 2\arctan(x) + \frac{\pi}{2}$ (L_{Ob}<0)

Eq.4 with $x = \left(1 - 16\frac{z-d}{L_{Ob}}\right)^{1/4}$

Eq.5 $\psi_m = -5\frac{z-d}{L_{Ob}}$ (L_{Ob}>0)

Fig. 1. Equations

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