**Hydrology and
Earth System
Sciences
Discussions**

Interactive comment on "Seasonal and diurnal variations in moisture, heat and CO_2 fluxes over a typical steppe prairie in Inner Mongolia, China" *by* Z. Gao et al.

Anonymous Referee #1

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Seasonal and diurnal variations in moisture, heat and CO2 fluxes over a typical steppe prairie in Inner Mongolia, China by Z. Gao et al.

General comments

The authors present new eddy covariance data obtained on a prairie site in Inner Mongolia (China) and put the results in the perspective of other prairie and grassland sites in the world. The Asian steppes represent a large area of which little is known with respect to energy and carbon budgets. Therefore these data are more than welcome to develop process understanding and to serve as model verification. Radiation budgets, albedo, energy and carbon fluxes are presented and discussed in the form of seasonal

and diurnal cycles, which gives a good overview of orders of magnitude and variation. The authors argue that the data are important to understand the role of prairie in a changing climate. However, they make no effort to explain and understand the variability in sensible and latent heat fluxes and carbon dixiode fluxes as a function of weather or climate conditions and/or vegetation stature. This is the deficiency I have the most problems with. An explanation of how these fluxes behave as a function of environmental conditions would add considerable to the process understanding as well as to the comparability of the site with others. Without addressing this, the paper does not address a broad scientific community. The paper is well written and to the point. The figures are clear, to the point and appropriate in numbers.

Specific comments

p1942, line 16: please clarify what is meant with 'asymmetrically'

p1942, line 25 vv: In the paragraph above you discuss grasslands in general and in this paragraph you focus on your natural steppe prairie. Please explain how that prairie is the same or different in terms of climate, vegetation, geography, hydrology, from other grasslands, because that information is needed to later understand the differences in flux observations.

p1944, line 16: Linear interpolation is fine for short gaps (a few half hours maximum). Please provide gap statistics to allow judgement whether linear interpolation is acceptable.

p1944, line 26 to p1945, line 29: This part may be better placed in the results section, particularly because section 2.3 looks a bit mislocated in between.

p1945, line 29: what are the typical snowdepth and length of the period of snow cover in the climatic sense?

p1950, line 8: how are 'clear days' selected, and how often do they occur relatively?

p1951, first paragraph: This discussion is not entirely clear: It appears that the authors

state that Hao et al (2007) do not observe a clear diurnal cycle in Go. However, fig. 4 in Hao's paper shows a clear diurnal cycle in Go. Do the authors intend to say that Hao did not observe a clear seasonal variation in the amplitude of the diurnal cycle? Please clarify.

p1951, line 10: 'but in the reverse phase' should read 'but of opposite sign'.

p1951, line 13: -0.21 mg/m2/s is still 1/3 of the peak value. How do you explain that the grass is taking up carbon in the winter? Is it still growing then?

p1951, line 16: what do you mean with 'climate indicators'?

p1951, line 23: The study of Bi was performed in Southern China, in a probably very different climate region. Why do you compare your results only with that study, and not also with studies in similar climate zones?

p1951, line 14-24: This paragraph could better be moved to the discussion.

p1951, line 26-p1952, line 11: The observed seasonal variations in H/Rn, LE/Rn, Bowen ratio are extremely small, it would be better to state that they are constant and not focus on the monthly variations.

p1952, line 2: 'G0/Rn=9%': does that mean that G0 summed over a day/season/year does not approximate 0 W/m2? If not, G0/Rn is not a very useful metric.

p1952, line 2: Explaining 11% of residual energy as heat storage in the grass is not realistic, because the heat storage capacity of grass is not sufficient. It is more realistic to explain it as measurement error.

p1952, line 12-19: This part belongs to the discussion.

p1954, section 3.6: Writing down the values of the variables is unnecessary and inhibits good readability. Let the graphs speak for themselves.

p1954, section 3.6: why do you not show H,LE and fCO2 on summer days with high

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and low soil moisture, to highlight the impact of soil moisture?

p1955, section 4: The introduction of this paper puts the work in the context of CO2 and climatic change, as well as climate modelling. I do not see anything of that coming back in the results and conclusions. It would be particularly interesting to a broad scientific audience to know how H, LE and fCO2 depend on weather and climate conditions, soil moisture, vpd, global radiation, temperature. What is the net annual carbon balance and how is it composed of GPP and ecosystem respiration?

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