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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 #2

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General Comments

The Authors report the results of a 13 months campaign of micrometeorological measurements of CO2, sensible heat and latent heat fluxes and of long and shortwave radiation between a natural steppe ecosystem and the atmosphere. The objective of the paper is to quantify the seasonal and diurnal variations in the recorded CO2 and energy fluxes.

In a global perspective, the number of similar studies carried out in steppe ecosystems of Eurasia is still poor represented compared to grasslands in other climatic zones (temperate grasslands, savannas, etc.) and therefore the data presented are a valuable

contribution to enhance the knowledge of Asian steppe environments in respect with their dynamics of carbon and energy fluxes from daily to seasonal scale. Information provided by the manuscript can be of interest also to the flux modeling community to constrain and verify models. The manuscript however, does not attempt to analyze the functional relations between the measured fluxes and the meteorological drivers, missing an opportunity to attract the interest of a larger number of readers interested in climate and global change sciences.

Results are clearly illustrated, even if in several sections the manuscript might benefit from a more fluent style avoiding to report a large number of numerical values but to guide the reader at visually retrieving results from the graphs.

As a main shortcoming, the Authors do not explain relevant methodological issues on the instrumental set up and processing of eddy covariance data, that has to be necessarily taken into account to evaluate the results obtained.

Specific comments:

P 1941, line 3: Please specify which IPCC report you are referring to

P 1943, line 3: What was previous land use of the investigated prairie?

P 1943, line 13: The humus layer is described qualitatively as "thin" What is the depth of the soil organic layer? what is the depth reached by the root system? Please provide a reference for the soil classification system (FAO, USGS, ..).

P1944, line2: instruments measure high frequency signals of water vapor density and CO2. Means and standard deviations are computed thereafter.

P1944, lines 2-4: Please provide more complete information about the calibration of the gas analyzer. In particular: (i) apart from the mentioned gases at known CO2 concentrations used to set the "span" value, how was the zero CO2 point of the calibration curve regulated? (ii) Calibration for water vapor is not reported, was it omitted? (iii) Calibration was performed only once before the experiment, or periodic calibrations

were performed during the following 13 months of monitoring in the field? If so, how frequent?

P1944, line 6: Please specify which corrections were made for non-zero mean vertical velocity

P1944, line 1: Linear interpolation can be a suitable gap-filling method for relatively small gaps (Moffat, A et al. (2007)Agricultural and Forest Meteorology, 147: 209-232). Please provide statistics on the gaps size and distribution.

P 1944 lines 6-16: the description of the methods used to elaborate eddy covariance data does not address the night-time underestimation of CO2 fluxes in conditions of atmospheric stability (see.Aubinet (2008) Ecological Applications, 18(6) 1368-1378). In such an ideal site for the application of eddy covariance technique it would be interesting to examine the dependence of nocturnal Fc on friction velocity (u*). In any case this analysis should be used to justify the choice of not rejecting Fc associated to low u* values.

Fig.2 –caption: Please complete the caption by explaining the variables in the graph

P1944, line 28 to P1945, line 29: this part is appropriate in the results section.

P1946, par 2.3 (theoretical considerations): This paragraph should be better merged with par. 2.2, presenting the methods used for fast and slow response measurements respectively with more continuity.

Fig 3- caption: correct number of equation 5 and not 6

P1951, line 12: how to justify a CO2 uptake during winter months if grass was senescent, soil periodically snow covered, and air temperature on average below 260K from December to mid February (fig.2b)?

P1951, line 20: results reported by Bi et al (2007) refer to tropical monsoon climate that is different from that of the area investigated by the present study. Please discuss

results referring to studies accomplished in similar climate regions.

P1952, line 3: it is highly unlikely that the missed closure of the energy balance can be attributed to heat storage in the grass, because of its limited biomass. The residual term of the energy balance would be dependant more likely on the uncertainty in the individual energy components, as besides it is stated later on in section 3.4 (P1953, line 2)

P1953, line 12: The measurements of upward long wave radiation (ULR) include radiation emitted from the soil and the grass covering it. Thus the ULR is not only a direct function of soil temperature.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 6, 1939, 2009.