Geophysical Research Abstracts
Vol. 12, EGU2010-3360, 2010
EGU General Assembly 2010

Eddy covariance based carbon fluxes from differently grazed grassland in Inner Mongolia, China

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Grasslands are one of the dominating vegetation types in the world. In China grasslands capture 400 Mha. This huge area has great influence on water and carbon stocks and fluxes. Water and carbon exchange influence the local concentration of greenhouse gases. In the steppe of Inner Mongolia (China) problems exist of overgrazing, erosion and ongoing desertification. Through these processes the seasonal patterns of the carbon cycles are changed. Within the project MAGIM (Matter fluxes in grasslands of Inner Mongolia as influenced by stocking rate), which is a multidisciplinary project bringing together German and Chinese expertise, fluxes of CO2 and H2O were measured by the eddy covariance (EC) method. The study site is in the Xilin River catchment in the Northeast of Inner Mongolia Autonomous Region, China. The region is a continental temperate semiarid zone with cold dry winters and warm humid summers. The annual mean temperature is about 2 °C and the annual precipitation is 350 mm. The EC measurements at Leymus chinensis steppe include various grazing intensities (heavily grazed, continuously grazed, winter grazed, ungrazed since 1979) by one permanent and one roving tower. From 2004 to 2006, there were continuous measurements at the ungrazed site (Leymus chinensis). The roving tower was used in the vegetation period at the grazed sites.

In general, carbon fluxes are small in Inner Mongolia: At the ungrazed site an average negative net ecosystem exchange NEE was observed of -0.13 g C m-2 d-1 (C sink) over all observations from 2004 to 2006. During roving periods only, ungrazed was C neutral, but the heavily grazed site showed a positive NEE of 0.48 g C m-2 s-1 (C source). The intermediately grazed sites switched from CO2 sink to source. Lack of precipitation reduced the CO2 sink or increased the CO2 source. So, precipitation and its seasonal pattern are the major drivers controlling the atmospheric fluxes. Temperature and soil moisture, as drivers of respiration, had additional influence. We assume that the steppe in Inner Mongolia will be a CO2 source in a changed climate characterized by increased temperatures and higher precipitation.