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Carbon dioxide and water budget of grazed grassland in Grünschwaige (Munich, Bavaria) measured by EC-method with an open path gas analyzer

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Terrestrial ecosystems like grasslands can act as a sink or source for greenhouse gases (GHG) like carbon dioxide. This is important for scientific and political stakeholders as GHG cause the climate change. The eddy covariance method has become a major tool for quantifying such fluxes. It depends, however, on a number of corrections applied to the measured data. The influence of air density is often considered following the WPL-correction (Webb-Pearman-Leuning), which does not take the heating of the instrument surface into account in contrast to the recently published method by Burba et al. (2008). The aim of the study is the comparison of the influence of the two density correction on the CO2 fluxes.

The fluxes of water and carbon dioxide were measured with the eddy covariance method from 2002 to 2008 on a grazed grassland site located in Grünschwaige close to Munich (Bavaria) in the South of Germany. The climate in this area is temperate with an annual precipitation of 800 mm and an annual mean temperature of 9 °C. For eddy covariance measurements an open path CO2/H2O analyzer was used. Wind speed (3D) and temperature were measured by a sonic anemometer. The sensible/latent heat flux and the carbon dioxide flux were calculated and corrected using EdiRe. The application of the two density correction methods resulted in important differences of the carbon dioxide flux. The fluxes corrected according to Burba et al. (2008) indicated small CO2 sinks (= negative net carbon exchange) or even sources while the WPL-correction showed (larger) CO2 sinks. Additionally, with both correction methods the results showed a high sensitivity to weather conditions but the effects were stronger using the correction following Burba et al. (2008).

The most important drivers of flux variability were precipitation and temperature. The seasonal pattern of precipitation was important especially during the vegetation period. Drought and heat periods, which lasted at last one month like in 2003 and 2006, lowered evapotranspiration and resulted in lower CO2 sinks or even turned the grassland into a source. This study shows the sensitivity of the carbon dioxide and water vapour fluxes quantified by the eddy covariance method to density correction, which can cause substantial changes in the assessment of the influence of environmental factors on fluxes from grassland.

Burba, George G.; McDermitt, Dayle K.; Grelle, Achim; Anderson, Daniel J. and Xu, Liukang (2008): Addressing the influence of instrument surface heat exchange on the measurements of CO2 flux from open-path gas analyzers. Global Change Biology, 14, 1854 - 1876