Geophysical Research Abstracts, Vol. 8, 05564, 2006
SRef-ID: 1607-7962/gra/EGU06-A-05564

Respiration losses of the Swiss CarboEurope cropland site: Are winter conditions determining the annual balance?

W. Eugster (1), C. Flechard (2), C. Ammann (2), A. Neftel (2), J. Fuhrer (2) and N. Buchmann (1)

(1) Institut of Plant Sciences, ETH Zurich, CH–8092 Zurich, Switzerland (werner.eugster@ipw.agrl.ethz.ch, fax +41 44 632 1153)
(2) Agroscope FAL Reckenholz, CH–8046 Zurich, Switzerland

Winter barley was grown at the Swiss CarboEurope cropland site in Oensingen in the season of 2005, followed by a fallow crop after the harvest. To increase our understanding of the respiration losses of such a cropland agroecosystem, we carried out periodic chamber measurements to determine soil respiration in parallel to the continuous eddy covariance flux measurements. These soil chamber measurements were carried out at monthly intervals nominally, with local adaptations to weather conditions and crop status.

For the days with soil chamber flux measurementes we estimated ecosystem-scale respiration from eddy covariance flux data in two ways: (1) using the daytime light response curve of the same day, and (2) using nocturnal flux data of a 7-day period centered at the day with soil chamber flux measurements.

Despite the high scatter in all data sets, the order of magnitude of ecosystem respiration was the same for all three approaches. However, in detail we found that the daytime light response curve tended to yield lower estimates of ecosystem respiration than measured during the night, which is against conceptual expectations and might indicate that the former method is not easily applicable to our cropland ecosystem. In general, during the peak growing season the curvature of the light response curves often was very low and the intercorrelation between the three model parameters of the rectangular hyperbolic light response model was very high.

Between chamber fluxes and nocturnal eddy covariance data a good agreement was found during the growing season (adj. $r^2 > 0.26$, increasing to > 0.80 if forced through the origin; $P < 0.1$). However, in winter the differences of the temperature responses determined by the two methods were large, which translate to a high uncertainty in the quantification of winter flux measurements. The cumulative ecosystem respiration modeled with the Lloyd and Taylor (1994) model from the beginning of year 2005 until the harvest date differed by 170 gC m^{-2}, primarily due to discrepancies between the low chamber flux values and the high eddy covariance fluxes during winter. Since both methods have their specific limitations when applied in winter (snow cover, frozen ground, etc.), the question will be discussed of whether our flux measurements during winter are even more essential than during summer to understand the carbon sequestration potential of croplands.