



Inter-annual variability of carbon and water exchange of managed temperate grassland

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Managed grassland ecosystems form a significant part of the European land cover. However, long-term flux monitoring on grassland sites are still rare in comparison to forest sites. Beside climatic factors, also the management regime (and history) have an influence on the carbon and energy exchange of agricultural ecosystems. We have monitored the carbon and water cycle of a sown grassland site on the Swiss Central Plateau since 2002 within the European flux network projects GreenGrass, CarboEurope-IP and NitroEurope-IP. The experimental field has been divided in two plots, one undergoing intensive management (high nitrogen input), the other extensive management (no fertilization). Continuous eddy covariance measurements of the CO₂ exchange and the quantification of carbon export and import by harvest and manure application allow for the assessment of the complete carbon budget of both plots. Over the entire 7-year period, the intensive management led to a significant carbon sequestration, while the extensive management caused a net carbon loss. Although the different management led to a systematic difference between the two fields, it had only little influence on the inter-annual variation of the carbon budget. The latter shows a positive correlation with the net ecosystem productivity (NEP) and with the harvest yield. They mainly depend on the spring temperature and the length of the growing season as well as on the soil moisture content during summer. Thus carbon sequestration in the grassland soil was most favoured in wet years with an early spring: 2002, 2004, and 2007. The variation in the annual water use efficiency was mainly driven by the plant assimilation while the evapotranspiration showed only a minor reaction to the varying precipitation and soil moisture. It was found, that even during the very dry period of the summer 2003 the grass roots were mostly able to take up water from deeper soil layers although plant growth was strongly limited.