



Carbon exchange in a Belgian grassland with cattle

Elisabeth Jérôme (1), Yves Beckers (2), Bernard Bodson (3), Christine Moureaux (3), and Marc Aubinet (4)

(1) University of Liege, Gembloux Agro-Bio Tech, Unit of Biosystem Physics, 8 Avenue de la Faculté, B-5030 Gembloux, Belgium (Elisabeth.Jerome@ulg.ac.be), (2) University of Liege, Gembloux Agro-Bio Tech, Animal Science Unit, 2 Passage des Déportés, B-5030 Gembloux, Belgium, (3) University of Liege, Gembloux Agro-Bio Tech, Unit of Phytotechnie, 2 Passage des Déportés, B-5030 Gembloux, Belgium, (4) University of Liege, Gembloux Agro-Bio Tech, Unit of Biosystem Physics, 8 Avenue de la Faculté, B-5030 Gembloux, Belgium

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Abstract

This work seeks to analyze a first year of carbon flux measurements exchanged by a grassland grazed by the “Blanc Bleu Belge” breed of cattle.

The study site is located at Dorinne, in the Walloon region in Belgium (50°18'44"N, 4°58'07"E, 248m asl.). It is a managed permanent grassland that is used for both grazing and cutting. Its total surface area is 10 ha with a moderate slope of 1 to 2 %. Homogeneity and topography criteria are met to ensure high quality turbulent flux measurements. At the start of the experiment, the area was divided into three large paddocks in order to allow rotational grazing. The stocking rate is monitored and the cattle rotation is optimized to avoid excessive growth or cuts (except at the beginning of spring).

The experimental field was equipped with an eddy covariance system that consisted of a fast response 3D sonic anemometer (CSAT3, Campbell Scientific, Logan, Utah) coupled with fast CO₂-H₂O analyzers measuring fluxes of CO₂, latent heat, sensible heat and momentum at a 30 min time step (LICOR, 7000, LICOR, Lincoln, NE, USA). Flux correction, quality control and data gap filling were performed following standardised procedures. This device was completed by a micrometeorological station that measured temperature and humidity respectively in the air and within the soil, radiation, atmospheric pressure and precipitations. In addition, the vegetation development was followed by weekly canopy height measurements and regular biomass samples were made to estimate dry matter, carbon content and cattle feeding. The carbon export due to harvest and the import due to fertilization were measured, allowing the establishment of a full carbon budget.

Responses of CO₂ fluxes to environmental conditions were analyzed. Results suggest that, if at hourly to daily scale, radiation was the main driving variable of the CO₂ flux, at a longer scale it was mainly controlled by soil water content and grassland management.