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Interannual rainfall variability effects on carbon sequestration capacity of a Mediterranean grassland ecosystem

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Eddy-covariance measurements of net ecosystem carbon exchange (NEE) were carried out above a grazed Mediterranean C3/C4 grassland in southern Portugal, during three hydrological years (2004-2005, 2005-2006 and 2006-2007) with different rainfall patterns in each of these years. Results will be presented of the seasonal and interannual variation in NEE and its major components, gross primary production (GPP) and ecosystem respiration (R_{eco}).

Long-term mean annual precipitation at the study site is 669 mm, with more than 80% of the precipitation being confined to the period between October and April. The first hydrological year (2004-2005) was dry, with a total precipitation of 364 mm, 45% below the long-term mean.

During 2005-2006, total precipitation amounted to 751 mm, 12% above the annual mean. The following hydrological year (2006-2007) total precipitation amounted to 872 mm, 30% above the annual mean.

The grassland was a net carbon source to the atmosphere in the dry hydrological year 2004-2005, with the NEE being 49 g C m^{-2} y^{-1}. However, the two following years the ecosystem was a considerable net carbon sink with values for NEE of -190 g C m^{-2} y^{-1} in 2005-2006 and -140 g C m^{-2} y^{-1} in 2006-2007. Annual values of GPP for these three years are 524 g C m^{-2}in 2004-2005, 1261 g C m^{-2}in 2005-2006 and 1130 g C m^{-2}in 2006-2007.

GPP and NEE were strongly related to incident photosynthetic photon flux density on short-term time scales, and changes in leaf area index on long-term time scales. The variations in R_{eco} were mainly controlled by the canopy photosynthesis.

For the three consecutive years, the total amount of precipitation was the main factor in determining the seasonal and interannual variation in NEE, GPP and R_{eco}. For the whole study period, the ecosystem was a considerable sink for carbon (281 g C m^{-2}) suggesting that this grassland has potential to sequester carbon. Results will be presented on the influence of the timing of rain events on the NEE.