



Coming to grips with carbon exchange variability of European croplands

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Annual Net Ecosystem Exchange (NEE) of CO₂ from eddy covariance observations at 14 European cropland sites, over 28 cropping periods has been analyzed. Taking into account the lateral export of biomass due to harvest an average annual carbon loss of 120 gC m⁻² was found. This number does not include lateral input such as from the carbon content of applied manure, nor the carbon exchange outside the cropping period. Both are expected to have a major impact on high-energy summer crops like maize. Disregarding species and regions, over the whole of Europe crop net primary production based on inventories of biomass at these sites scaled well with NEE and gross primary production. To a lesser extent this was also the case for the measured yield (consumable part only) at these sites and the Nuts2 level yield data set of EUROSTAT. Simulated water-limited yield using a crop growth model compared reasonably well with the yield measured at the flux sites, except for some of the maize sites. These sites compared better with simulated non-water limited yield. Our results imply that heterotrophic respiration scales well with plant productivity. They also suggest that European-wide assessments of CO₂ emissions from croplands could be based on productivity statistics. Variability of carbon exchange from crops was further analyzed using results from the crop growth model as additional data. We investigated the variation in carbon exchange of different crops at the same location, of the same crop at different locations and the inter-annual variation due to weather conditions. It was found that the variations are firstly determined by the choice of crop, secondly by the location and to a lesser extent by the yearly differences in climate.