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Impact of rapeseed cropping on the soil carbon balance

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Winter oilseed rape is the dominant biofuel crop in the young moraine landscape in Northern Germany. Since the cultivation of biofuel crops requires sustainability compared to fossil fuels by law, detailed knowledge about their green house gas (GHG) balance is necessary. The soil carbon balance is one of the key contributors to the total GHG balance and also very important for the assessment of soil fertility. However, the knowledge about the impact of different management practices on the soil carbon balance is very limited up to now. Therefore, we investigated the carbon fluxes of winter oilseed rape at field plots near Dedelow/Uckermark in NE Germany with different treatments of fertilization (mineral versus organic) and tillage (no-till and mulch-till versus ploughing).
The dynamics of the carbon fluxes are mainly driven by the current climatic conditions but the overall response depends strongly on the ecosystem state (with its physiological and microbiological properties) which is affected by management. To get the full carbon flux dynamics but also the impact of the different management practices, two different approaches were used: The eddy covariance technique to get continuous fluxes throughout the year and the manual chamber technique to detect flux differences between specific management practices. The manual chamber measurements were conducted four-weekly as all-day campaigns using a *flow-through non-steady-state* closed chamber system. The fluxes in-between campaigns were gap-filled based on functional relationships with soil and air temperature (for the ecosystem respiration) and photosynthetic active radiation (for the gross primary production).
All results presented refer to the cropping season 2012–2013. The combination of the two measurement techniques allows the evaluation of chamber fluxes including an independent estimate of the error on the overall balances. Despite the considerable errors, there are significant differences in the soil carbon balance between the tillage and fertilization treatments - ranging from net losses to net gains in the soil carbon stock.