The carbon balance of European croplands: a Trans-European, cross-site, multi model simulation study

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Croplands cover approximately 45% of Europe and play a significant role in the overall carbon budget of the continent. However, the estimation of the regional carbon balance is still uncertain. Here, we present a multi-site model comparison for four cropland ecosystem models namely the DNDC, ORCHIDEE-STICS, CERES-EGC and SPA model. We compare the accuracy of the models in predicting net ecosystem exchange (NEE), gross primary production (GPP), ecosystem respiration (Reco) as well as actual evapo-transpiration (ETa) for winter wheat (Triticum aestivum L.), winter barley (Hordeum vulgare L.) and maize (Zea mays L.) derived from eddy covariance measurements on five sites of the CarboEurope IP network. The models are all able to simulate mean daily GPP. The simulation results for mean daily ETa and Reco are, however, less accurate. The resulting simulation of daily NEE is adequate beside some cases where models fail due to a lack in phase and amplitude alignment. ORCHIDEE-STICS and the SPA demonstrate the best performance, nevertheless, they are not able to simulate full crop rotations under consideration of multiple management. CERES-EGC and especially DNDC although exhibiting a lower level of model accuracy are able to simulate such conditions resulting in more accurate annual cumulative NEE.