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Development of new drainage factor in ECOSSE model to improve water dynamics and prediction of CO_2 fluxes from drained peatlands

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ABSTRACT

Drained peatlands often act as carbon source and their drainage characteristics can be challenging to accommodate in biogeochemical models. This study uses the ECOSSE process-based biogeochemical model [to simulate water-table level and CO_2 fluxes (heterotrophic respiration) [1]], and empirical data from two Irish drained peatlands: Blackwater and Moyarwood, which were partly rewetted (both sites are extensively described in earlier studies [2]). Here we explain details on the development of a new drainage factor with seasonal variability Dfa(i) for drained peatlands, based on our recently published work [3] that we hope can contribute towards the potential future development of IPCC Tier 3 emissions reporting. The Dfa(i) was developed using empirical data from Blackwater drained bare-peat site (BWdr) and its application was further tested at the Moyarwood site under drained (MOdr) and rewetted conditions (MOrw) [3]. The development of the Dfa(i) was carried out in three main steps [3]: 1 - identification of the 'wt-discrepancy event'; 2 - development of Dfa without seasonal variability, and 3 - accounting for seasonal variability and development of Dfa(i). Dfa(i) was then applied to the rainfall inputs for the periods of active drainage in conjunction with the measured water-table inputs [3]. As explained in our published work [3], the results indicate that the application of Dfa(i) could improve the model performance to predict water-table level (BWdr: r^2 = 0.89 MOdr: r^2 = 0.94); and CO_2 fluxes [BWdr: r^2 = 0.66 and MOdr: r^2 = 0.78) under drained conditions, along with ability of the model to capture seasonal trends [2]. The model simulation of CO_2 fluxes at MOrw site was also satisfactory (r^2=0.75); however, the MOrw water-table simulation results suggest that additional work on the water model component under rewetted conditions is still needed [3]. We further discuss our insights into potential opportunities for future additional improvements and upgrading of the ECOSSE model water module.

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Literature

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