

EGU21-1871

<https://doi.org/10.5194/egusphere-egu21-1871>

EGU General Assembly 2021

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## Development of new drainage factor in ECOSSE model to improve water dynamics and prediction of CO<sub>2</sub> 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<sub>2</sub> fluxes (heterotrophic respiration) <sup>[1]</sup>], and empirical data from two Irish drained peatlands: Blackwater and Moyarwood, which were partly rewetted (both sites are extensively described in earlier studies <sup>[2]</sup>). 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 <sup>[3]</sup> 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) <sup>[3]</sup>. The development of the Dfa(i) was carried out in three main steps <sup>[3]</sup>: 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 <sup>[3]</sup>. As explained in our published work <sup>[3]</sup>, 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<sub>2</sub> 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 <sup>[2]</sup>. The model simulation of CO<sub>2</sub> 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 <sup>[3]</sup>. We further discuss our insights into potential opportunities for future additional improvements and upgrading of the ECOSSE model water module.

## **Acknowledgements**

The authors are grateful to the Irish Environmental Protection Agency (EPA) for funding the AUGER: Project (2015-CCRP-MS.30) under EPA Research Programme 2014–2020. Full acknowledgements are provided in Premrov et. al (2020) [3].

## **Literature**

[1] Smith, J., et al. 2010. ECOSSE. User Manual.

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