EGU21-1871
https://doi.org/10.5194/egusphere-egu21-1871
EGU General Assembly 2021


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

**Alina Premrov**[1,2], David Wilson[3], Matthew Saunders[2], Jagadeesh Yeluripati[4], and Florence Renou-Wilson[1]

[1]School of Biology & Environmental Sciences, University College Dublin (premrova@ucd.ie)
[2]Botany Department, School of Natural Sciences, Trinity College Dublin, Ireland
[3]Earthy Matters Environmental Consultants, Donegal, Ireland
[4]Information and Computational Sciences, The James Hutton Institute, Aberdeen, Scotland, UK

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.

**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.

[2] Renou-Wilson, F., et. al. 2019. Rewetting degraded peatlands for climate and biodiversity benefits: Results from two raised bogs. Ecol. Eng. 127:547-560.

[3] Premrov, A., D. Wilson, M. Saunders, J. Yeluripati and F. Renou-Wilson (2020). $CO_2$ fluxes from drained and rewetted peatlands using a new ECOSSE model water table simulation approach. Sci. Total Environ. (https://doi.org/10.1016/j.scitotenv.2020.142433; on-line 2020; in print Vol. 754, 2021; under CC BY 4.0).