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Insights into CO2 simulations from the Irish Blackwater peatland using ECOSSE model

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Abstract

Non-degraded peatlands are known to be important carbon sink; however, if they are exposed to anthropogenic changes they can act as carbon source. This study forms a part of the larger AUGER project (http://www.ucd.ie/auger). It uses the ECOSSE process-based model to predict CO_2 emissions [heterotrophic respiration (Rh)] associated with different peatland management (Smith et al., 2010). The work aims to provide preliminary insights into CO_2 modelling procedures for drained and rewetted sites from Blackwater, the former Irish raised bog. After drainage in 1950's (due to peat-extraction) and cessation of draining in 1999, the landscape developed drained 'Bare Peat' (BP), and rewetted 'Reeds' (R) and 'Sedges' (S) sites (Renou-Wilson et al., 2019). Modelling of CO_2 from these sites was done using ECOSSE-v.6.2b model ('site-specific' mode) with water-table (WT) module (Smith et al., 2010), and default peatland vegetation parameters. The other model-input parameters (including soil respiration, WT and other soil parameters) were obtained from measurements reported in Renou-Wilson et al. (2019). Simulations on drained BP site were run starting from 1950 and on rewetted R and S sites starting from 1999 (which is the year of cessation of drainage). The climate data inputs (2010-2017) were obtained from ICHEC (EPA_Climate-WRF, 2019). The long-term average climate data for model spin-up were obtained from Met Éireann (2012) with potential evapotranspiration estimated by Thornthwaite (1948) method. Daily ecosystem respiration (Reco) data for May/June 2011 to Aug 2011 obtained from raw CO_2 flux measurements (Renou-Wilson et al., 2019) were used. For vegetated sites Rh was estimated from Reco using method explained in Abdalla et al. (2014). Daily CO_2 simulations were compared to Reco for BP site (r^2 =0.20) and to Rh for R site (r^2 = 0.35) and S site (r^2 = 0.55). The preliminary results showed some underestimation of simulated CO_2 indicating the need for further modelling refinements for satisfactory results. The results from BP site further indicated on the importance of including long-term drainage period (i.e. from 1950 on) because avoiding this step resulted in a large overestimation of predicted CO_2.

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