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Impact of water table drawdown on carbon fluxes at the Zoige alpine peatland in China

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Located in the eastern edge of the Qinghai–Tibetan Plateau, Zoige alpine peatlands is one of the highest and largest alpine peatlands in the world, and plays an important role in the global carbon cycle. Drainage, which is the main disturbance of Zoige, caused water table draw down and changes in ecosystem carbon fluxes. In order to reveal the impacts of drainage on carbon fluxes and detect the mathematic relationship between water table level (WTL) and carbon fluxes, we simulated six gradients (-30cm, -20cm, -10cm, 0cm, 10cm, 20cm) of WTL in a mesocosm water-table manipulation experiment at Zoige peatlands on the Qinghai-Tibetan Plateau. Carbon fluxes including ecosystem respiration (Re), net ecosystem exchange (NEE), gross primary production (GPP) and CH_4 flux (F_{CH4}) were observed during the growing season in 2017 by using a transparent chamber and a laser-based fast greenhouse gas analyzer. The results showed that the dynamic curves of GPP, Re and NEE at six WTL gradients during the growing season all acted as a single peak value wave. The GPP and absolute value of NEE reached their highest at mid-August, with the value of 3204 mg m^{-2} h^{-1} and -2350 mg m^{-2} h^{-1}, respectively. Therefore, the highest value of Re (1148 mg m^{-2} h^{-1}) occurred at late July. The GPP and Re were decreased with the increasing of WTL, and the NEE increased with the increasing of WTL. The GPP, Re and NEE were all showed quadratic relationships with WTL. The peatlands had highest GPP and Re, and lowest NEE at -10cm, which means the peatland could sequestrate more carbon at this water table level. The CH_4 emissions of peatland were very small when the water table level below 0 cm and increased with the increasing of water table level. The F_{CH4} showed significantly quadratic relationship (R^2=0.96, $P < 0.05$) with the WTL. We concluded that the relationships between carbon fluxes and WTL were quadratic and the peatland sequestrated more carbon when the WTL was -10cm. This study revealed the responses of carbon fluxes to various water table levels, provided more data support for accurately evaluating alpine peatlands carbon budget and have implication for the conservation restoration of alpine peatlands.