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CO_2 and CH4 fluxes of an Alpine peatland during extraordinary summer drought

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In peatland ecosystems, plant production exceeds decomposition due to their typical characteristic of waterlogged soils leading to peatland growth and an accumulation of thick organic soil layers. As a result, peatlands constitute a major global storage of carbon (C) by storing about 612 PgC in their peat, thus representing the most space-effective C stocks of all terrestrial ecosystems, similar in magnitude as the increasing atmospheric C pool ($\sim$ 850 PgC). However, little is known about the effects of climate change on peatlands and the contribution of Alpine peatlands as a source of greenhouse gases in the course of a changing climate. It is debatable how land-use changes and ongoing degradation of Alpine peatlands affect the peatland-atmosphere C exchange. On the one hand, more C may sequester due to increased plant growth in a warmer climate, on the other hand large amounts of respired C may release as a consequence of higher temperatures and lowered peatland water table depths due to increasing evaporation rates and extending drought periods.

To examine the potential effects of climate change on the peatland carbon exchange with the atmosphere, we calculated CO_2 and CH4 fluxes using the eddy covariance method. The investigated ombrotrophic peatland is located on the bottom of the Styrian Enns valley at an altitude of 632 m above sea level. It is a slightly degraded pine peat bog (62 ha) with a closed peat moss cover featuring the three plant associations Pino mugo-Sphagnetum magellanici, Sphagnetum magellanici, and Caricetum limosae, according to the prevailing hydrological site conditions. During summer drought in 2015, the water level decreased from an annual average water level of -10.44 cm to -28.50 cm below surface at the centre of the peat bog. Here, we present diurnal pattern of CO_2 and CH4 fluxes during an extraordinary dry summer and compare them to calculated fluxes during periods characterised by precipitation and higher peat water levels of the same year. We compute differences of diurnal C fluxes and evaluate the underlying factors affecting the peatland-atmosphere C exchanges.