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Seasonal and diurnal methane emissions from a wetland meadow on the Eastern Qinghai-Tibetan Plateau: effects of soil temperature, water table level and gross primary productivity (GPP)

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Peatlands covered about 4.6×10^9 m^2 land surface of the eastern Qinghai-Tibet Plateau, and accumulated about 7.14×10^8 t C since the beginning of Holocene. Over the last decades, more than 30% of these peatlands have degradated due to climate change, land management and disturbance. For assessing the magnitude of diurnal and seasonal variations in CH_4 fluxes, and identifying the depence of CH_4 fluxes on environmental factors, we measured CH_4 fluxes in a typical alpine peatland in this region using eddy covariance technique, and tested the depence of CH_4 fluxes on soil temperature, water table level and gross primary productivity (GPP). The annual CH_4 emission of Hongyuan peatland is 47.04 g CH_4/m^2, while growing season emissions account for 75 of the annual sum. During growing season, there was a clear diurnal pattern in CH_4 fluxes with peaks and valleys appeared at16:30 and 1:00, respectively. While during non-growing season, CH_4 fluxes varied at a relatively low level and showed no clear diurnal patterns. The CH_4 fluxes were significantly correlated with the variations of soil temperature, and soil temperature at 25 cm depth can explain 83% of the variations in CH_4 fluxes. The CH_4 emissions during the growing season were barely correlated with the water table level (R^2=-0.0001), and the water table mostly varied from 0 cm to -20 cm, which indicate that the anaerobic environment below -20 cm was relatively stable for methanogenesis and CH_4 transportation. In addition, considering the fact that CH_4 fluxes were more significantly correlated with soil temperature at 25 cm depth, it might be concluded that the CH_4 were mostly produced in the peat deposits below -20 cm. The daily mean CH_4 emissions were significantly correlated with GPP (R^2=0.82), which suggest that CH_4 emissions were also regulated by plant growth activities, and the CH_4 fluxes might be decreased due to peatland degradation.