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Seasonal variations in energy and carbon dioxide fluxes over a marsh wetland in southwest China

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Wetlands are very sensitive to climate change intensifies. More than 64% of wetlands have been lost through drainage and conversion since 1900 (https://www.wetlands.org). Based on the eddy covariance measurements over a plateau marsh wetland in a subtropical zone of southwest China from July 2015 to December 2016, we analyzed the seasonal variations of the sensible heat, latent heat and CO_2 fluxes and their controlling factors. Due to the abundant water conditions, the latent heat flux (LE) was significantly larger than the sensible heat flux (H) in all seasons. The mean daily H and LE for 2016 were 10.6 $\pm$ 4.9 W m^{-2} and 49.1 $\pm$ 21.4 W m^{-2} (mean $\pm$ S.D.), respectively. Net radiation (R_n) was the main controller of H at all time scales. At a half-hourly scale, LE was affected by R_n, air temperature (T_a) and vapor pressure deficit (VPD). On daily and monthly scales, R_n was much more important than T_a and VPD. R_n can explain 70% and 98% of the variation in the daily and monthly LE, respectively. The annual total ET for 2016 was 689.8 mm yr^{-1} with the annual total precipitation 1211.6 mm yr^{-1}. On a half-hourly scale, net ecosystem exchange (NEE) decreased with photosynthetic active radiation (PAR) in daytime. The PAR demand of NEE was not saturated for this wetland, and the maximum CO_2 uptake occurred at noon. By affecting canopy growth conditions, T_a regulated the saturated NEE (NEE_{sat}), which is an indicator of photosynthesis capacity. T_a primarily determined the daily and monthly total NEE (R^2=0.60 and 0.85). The wetland absorbed CO_2 in most months except December and January. The monthly NEE varied between -46.8 and 3.2 g C m^{-2} month^{-1}. On an annual scale, the wetland ecosystem was a significant carbon sink and the annual total NEE for 2016 was -202.2 g C m^{-2} yr^{-1}.