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Patterns and behavior of GHG fluxes from a Mediterranean reed wetland, Southern Spain

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Wetlands are crucial ecosystems modulating climate change due to their great potential to capture carbon dioxide (CO_2), to emit methane (CH_4) and to regulate local climate through evapotranspiration (ET). In particular, the common reed is one of the most widespread and productive wetland plant species. Yet our understanding about carbon (CO_2, CH_4) fluxes and ET behavior in reed wetlands is limited to a few studies that have simultaneously measured net CO_2, CH_4 and ET exchanges. What is more, interannual variability has yet to be assessed. We measured ecosystem carbon and ET fluxes by eddy covariance for almost 6 years (for CH_4 fluxes 3 years) from a Mediterranean reed wetland characterized by seasonal flooding, providing relevant information at different timescales. At daily scales, the enhanced vegetation index (EVI) was strongly correlated with gross primary production (GPP) and soil temperature with ET, both following a growth/sigmoidal function (adjusted $R^2 > 0.80$), whereas soil temperature was correlated with ecosystem respiration (R_{eco}) following an exponential function (adjusted $R^2 > 0.85$), and CH_4 fluxes did not show any correlation. At seasonal scales, great variability in carbon and ET fluxes were linked to the growth dynamics of reeds. At the annual scale, averaged values of net ecosystem CO_2 exchange (NEE), ET and CH_4 fluxes were -260±160 g C (CO_2) m^{-2}, 840±90 mm and 10±2 g C (CH_4) m^{-2}, respectively. The great interannual NEE variability mainly depends on the behavior of the wetland during the transition to senescence period (from 1 August to 14 November) promoted by vegetation dynamics (EVI) controlling GPP and abiotic factors (temperature) controlling R_{eco}. Finally, given the low contribution of CH_4 fluxes, the Mediterranean reed wetland's forcing on global climate can act as annual net cooling or warming effect, depending on the behavior of CO_2 fluxes (from -660 (in 2014) to 360 (in 2016) g C-eq m^{-2} y^{-1}).