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# Evapotranspiration partitioning through in-situ oxygen isotope measurements in an oasis cropland

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The oxygen isotope compositions of ecosystem water pools and fluxes are useful tracers in the water cycle. As part of the Heihe Watershed Allied Telemetry Experimental Research (HiWATER) program, high-frequency and near-continuous in situ measurements of $^{18}$O composition of atmospheric vapor ($\delta_v$) and of evapotranspiration ($\delta_{ET}$) were made with the flux-gradient method using a cavity ring-down spectroscopy water vapor isotope analyzer. At the sub-daily scale, we found, in conjunction with intensive isotopic measurements of other ecosystem water pools, that the differences between $^{18}$O composition of transpiration ($\delta_T$) and of xylem water ($\delta_x$) were negligible in early afternoon (13:00-15:00 Beijing time) when ET approached the daytime maximum, indicating isotopic steady state. At the daily scale, for the purpose of flux partitioning, $\delta_T$ was approximated by $\delta_x$ at early afternoon hours, and the $^{18}$O composition of soil evaporation ($\delta_E$) was obtained from the Craig-Gordon model with a moisture-dependent soil resistance. The relative contribution of transpiration to evapotranspiration ranged from 0.71 to 0.96 with a mean of 0.87 $\pm$ 0.052 for the growing season according to the isotopic labeling, which was good agreement with soil lysimeter measurements showing a mean transpiration fraction of 0.86 $\pm$ 0.058. At the growing season scale, the predicted$^{18}$O composition of runoff water was within the range of precipitation and irrigation water according to the isotopic mass conservation. The $^{18}$O mass conservation requires that the decreased $\delta^{18}$O of ET should be balanced by enhanced $\delta^{18}$O of runoff water. (Wen, XF*, Yang, B, Sun, XM, Lee, X. 2015. Evapotranspiration partitioning through in-situ oxygen isotope measurements in an oasis cropland. Agricultural and Forest Meteorology , doi:10.1016/j.agrformet.2015.12.003).