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Evapotranspiration partitioning in a semi-arid African savanna using stable isotopes of water vapor

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Evapotranspiration (ET) represents a major flux of water out of semi-arid ecosystems. Thus, understanding ET dynamics is central to the study of African savanna health and productivity. At our study site in central Kenya (Mpala Research Centre), we have been using stable isotopes of water vapor to partition ET into its constituent parts of plant transpiration (T) and soil evaporation (E). This effort includes continuous measurement (1 Hz) of δ^2H and δ^{18}O in water vapor using a portable water vapor isotope analyzer mounted on a 22.5 m eddy covariance flux tower. The flux tower has been collecting data since early 2010. The isotopic end-member of δ_{ET} is calculated using a Keeling Plot approach, whereas δ_T and δ_E are measured directly via a leaf chamber and tubing buried in the soil, respectively. Here we report on a two recent sets of measurements for partitioning ET in the Kenya Long-term Exclosure Experiment (KLEE) and a nearby grassland. We combine leaf level measurements of photosynthesis and water use with canopy-scale isotope measurements for ET partitioning. In the KLEE experiment we compare ET partitioning in a 4 ha plot that has only seen cattle grazing for the past 15 years with an adjacent plot that has undergone grazing by both cattle and wild herbivores (antelope, elephants, giraffe). These results are compared with a detailed study of ET in an artificially watered grassland.