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Using long-term lysimeter data to analyze hydrological trends

Thomas Puetz, Harrie-Jan Hendricks-Franssen, Anne-Kathrin Roesseler, and Harry Vereecken
Forschungszentrum Juelich GmbH, Institute of Bio- and Geoscience IBG-3: Agrosphere, Juelich, Germany (t.puetz@fz-juelich.de)

Evapotranspiration (ET) is a major component of the terrestrial water cycle. Recent studies based on analysis of experimental and observations-based data have shown that over the last decades the magnitude of evapotranspiration (both potential and actual) has been affected by global climate change although the sign and size of the change in ET differ strongly between regions around the globe, as well as between datasets (e.g. Teuling et al. 2009, Jung et al. 2010, Sheffield et al. 2012).
Basically, there are two approaches that are available to measure actual evapotranspiration in situ (e.g. Seneviratne et al. 2010): the measurement from micrometeorological approaches (in particular the Eddy Covariance method) and the determination of evapotranspiration by measuring the components of the soil water balance. Evett et al. (2012) showed that Eddy Covariance measurements of actual evapotranspiration obtained in irrigated cotton fields was 31 to 45% lower than estimates obtained from soil water balance measurements using lysimeters. Forcing the closure of the energy balance with more data than typically available at EC stations, the difference was still about 17%.
Despite the fact that lysimeter systems, especially the weighing based systems, are ideal tools to determine actual evapotranspiration no global assessment has been made of available data at present that might be valuable to assess the impact of climate change on actual evapotranspiration. A screening of literature showed that many data are either not reported or made available through research reports rather than peer reviewed literature. Typically lysimeter studies have been used for well-designed experimental studies for the assessment of flow and transport processes in cropped systems that were limited in time. Still at present, we have lysimeter systems operational that have long term time series available on soil hydrological fluxes. Recently, a few studies were reported that analyzed long term series of actual evapotranspiration derived from lysimeter measurements at specific locations.
Observed water storage changes, and evaporative and drainage fluxes in lysimeter systems combined with mathematical modeling of the soil water balance may help to separate climate forcing from management.

Evett, S.R., et al., 2012. Can weighing lysimeter et represent surrounding field et well enough to test flux station measurements of daily and sub-daily et? Adv. Water Resour. 50:79-90.
Jung, M., et al., 2010. Recent decline in the global land evapotranspiration trend due to limited moisture supply. Nature 467:951-954.
Seneviratne, S.I., et al., 2010: Investigating soil moisture-climate interactions in a changing climate: A review. Earth-Science Reviews, 99, 3-4, 125-161, doi:10.1016/j.earscirev.2010.02.004.
Sheffield, J., et al., 2012. Little change in global drought over the past 60 years. Nature, 491, 435-438.
Teuling, A.J., et al., 2009: A regional perspective on trends in continental evaporation. Geophys. Res. Lett., 36, L02404, doi:10.1029/2008GL036584.