H21F-07 - Observations and Modeling of Soil Moisture and Evapotranspiration in Irrigated Urban Parks of a Desert City

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Abstract

Outdoor water use in urban parks consists of a considerable fraction of the water demands in Phoenix, Arizona. Hence, ecohydrological processes need to be carefully considered to improve outdoor irrigation management in arid and semiarid cities. Most urban parks consist of a mosaic of turfgrass and trees which receive scheduled maintenance, fertilization and water application through either sprinkler or flood irrigation. Recent sustainability efforts by the City of Phoenix have focused on replacing traditional fertilization practices with the use of compost derived from residential green waste. In this study, we evaluate the effects that the compost treatment has had on soil moisture profile observations in three urban parks with different irrigation systems, compost applications and soil conditions. Each of the study parks has a soil moisture measurement station in a control plot with no compost application and in two treatment sites with either a once per year or a twice per year application in the fall and spring seasons. An eddy covariance system was also installed at one of the study parks to help quantify water losses, in addition to the water, energy and carbon fluxes between the turfgrass and the atmosphere. Additional meteorological observations are provided through a local network of rainfall gauges and weather stations. Our observational assessment covers approximately a one-year study period, including the active period of turfgrass growth and irrigation in the summer, as well as a period of turfgrass dormancy in the winter months, as quantified using daily, high-resolution, remotely-sensed imagery from the Planet CubeSat network. We then utilize the observations to setup and test a plot-scale soil water balance model to simulate changes in relative soil moisture in response to irrigation, precipitation and evapotranspiration demand for each of the parks at a daily scale. By combining modeling and observations of climate-soil-vegetation processes, we provide guidance on the optimal irrigation scheduling and compost treatment that could potentially minimize water losses while supporting a healthy turfgrass in desert urban parks.

Authors

Mercedes Kindler
Arizona State University

Enrique R Vivoni
Arizona State University

Arizona State University

Eli R R Perez-Ruiz
Arizona State University

Zhaocheng Wang
Arizona State University

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