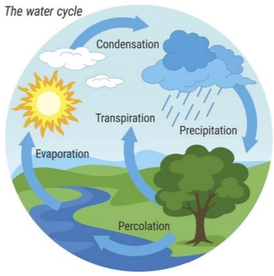
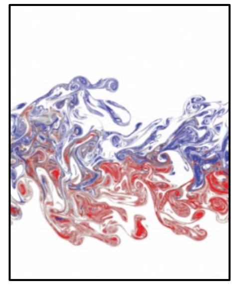
Boase Seminar Series in Hydrology and Water Resources Engineering

Department of Civil, Environmental and Architectural Engineering





A Bayesian Approach to Uncover the Asymptotic Nature of Water use in Groundwater Dependent Ecosystems

Mr. Matthew Lurtz

Ph.D. Candidate

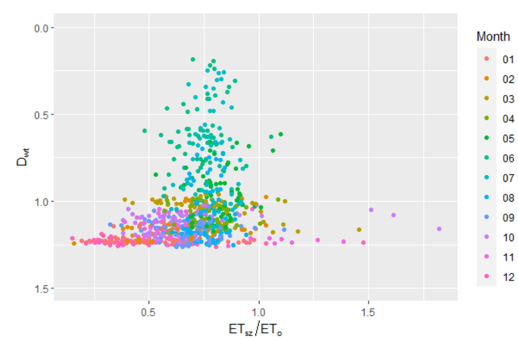
Department of Civil and Environmental Engineering

Colorado State University

Fort Collins, CO, USA

Wednesday, April 5, 2023 | 11:15 AM | ECCE 1B41 & Zoom: https://cuboulder.zoom.us/j/98861379124

Abstract:



Evapotranspiration (ET) is the most elusive flux of the hydrologic cycle and the relationship to groundwater dependent ecosystems (GDE) has important implications on the co-management of groundwater and surface water supply in Colorado. Germane to this topic is the point-scale deterministic fit between ET and groundwater depth; and changes in hydroclimatic conditions can modify the functional relationship between ET and groundwater depth, depending on plant functional group. Literature has shown that linear threshold functions (i.e., change point models) are adequate predictors of the relationship between ET and groundwater depth. Additionally, there is scale dependent observational support that the relationship between groundwater depth and plant health approach saturating conditions (i.e., asymptotic nature) in shallow groundwater. For the purposes of creating scale-enlightened models, it is imperative to test the predictive abilities of these function forms. Therefore, the objective of this work is to use data from a network of sensors to feed a Bayesian analysis that can test the functional fit between evapotranspiration and groundwater depth for plant functional groups commonly found in arid GDEs. To accomplish this objective we collected daily water table fluctuation data from 12 groundwater wells, in-situ and nearby weather station data, mass-based observations of ET from a weighing lysimeter, and over 200 multispectral nanosatellite images along a 5-kilometer segment of the Arkansas River with heterogeneous vegetation (e.g., native and non-native). We quantify the response variable as the relative energy demand in our GDE using a ratio between standardized ET and potential ET (unitless). We use hydraulic head (masl) as the explanatory variable. Results will be presented on the predictive abilities of each function using within sample, and out-of-sample, model validation at varying temporal resolutions. Output from this work will be used to enlighten current process-based models used in water management routines.

Speaker Bio: Matthew is a Ph.D. Candidate at Colorado State University (CSU) in the Civil and Environmental Engineering department. Drs. Ryan Morrison and Tim Gates are his advisor and co-advisor, respectively. His work examines groundwater dependent ecosystems and their river-aquifer connections with human-built systems, including multiscale impacts of agricultural practices on riparian water use. He currently works part-time as a water resource engineer at a global environmental consulting firm where he focuses on hydrologic and hydraulics of surface water. His graduation from CSU is set for the summer of 2023.