Department of Atmospheric Sciences
M.S. Defense Announcement

Department of Atmospheric Sciences, S.O.E.S.T., University of Hawai'i at Mānoa
2525 Correa Road, HIG 350; Honolulu, HI 96822 ☎956-8775

Hybrid Event: In-Person & Virtual

Comparing a Simple Stochastic Weather Generator with Two Common Statistical Techniques for Gap-filling Daily Rainfall in Hawai'i

Julie Henry
Masters Candidate
Department of Atmospheric Sciences
School of Ocean and Earth Science and Technology
University of Hawai'i at Mānoa

Date: **Tuesday, May 3, 2022**
Seminar Time: **10:30am HST**
Location: **IPRC Conference Room, POST 414**
Zoom Meeting: **https://hawaii.zoom.us/j/98551442421**
Meeting ID: 985 5144 2421
Passcode: 655858

Abstract:

Considerable gaps and breaks of varying lengths are present in many historical daily rainfall records for Hawai'i. Countless gap-filling methodologies exist, some more complicated than others, and all challenged by the spatial variability and complex terrain environment in Hawai'i. Stochastic weather generator (SWG) models attempt to address the randomness and temporal persistence of rainfall and can be used as a gap-filling measure. This study compares a simple two-state, first order Markov chain SWG rainfall occurrence and amounts process, utilizing the mixed exponential distribution, to two common gap-filling methods - quantile mapping (QM) and normal ratio (NR). QM and NR require at least one neighboring ("supporting") station to gap-fill the target ("primary") station. A simple single-site SWG model uses the history of daily rainfall of the station itself, thus eliminating spatial bias. Intentional gaps were created in the record to 65%, 75%, 85% data coverage utilizing gaps found elsewhere in the record consisting of random (1-5 days), regular (2-3 days every week), and month-long gaps.

Results show QM is the best performing method when using only one supporting station. The SWG model exhibited bias errors at least twice that of QM and NR, had a wider disparity between mean absolute error and median absolute error which is an indicator the model is influenced by extreme outliers, and regularly underpredicted monthly mean rainfall. However, the SWG model did perform slightly better in a few circumstances, usually at dry stations with regular gaps in the record. In the event a nearby supporting station is unavailable or missing substantial amounts of data, the single-site SWG model could be a viable method for gap-filling. Moderate and heavy daily average rainfall days which occur in the observational record are largely underpredicted when parameters for the mixed exponential distribution are estimated from only the intentionally gapped series. While the mixed exponential distribution is not intended to model extreme events (> 100 mm), it is a good fit for the majority of non-zero daily rainfall in Hawai'i. Using climatological calculation for transition probabilities and parameter estimations for the rainfall amount process might yield more competitive results for the moderate rainfall amounts. Incorporating the extreme value distribution into the SWG model may address the instances of heavy disturbance-driven rainfall as well.