CAN WE RELIABLY FORECAST THE FUTURE WITHOUT KNOWING THE PAST? UFA LEVEL PREDICTIONS IN NORTH FLORIDA

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Long-term groundwater management relies on forecasts of decadal or longer groundwater levels driven by nested scales of variability in climate for establishing predevelopment benchmark groundwater conditions and developing climate change adaptation strategies to reduce risks and increase resiliency. A Physically Constrained Wavelet-Aided Statistical Model is utilized to hindcast the predevelopment groundwater levels back to early 1900s at three sites in North Florida. Hindcasting yielding 110 years of monthly levels is used to assess the effect of climate change and pumping on the frequency of critical low levels. At all three sites, the frequencies of critical low levels increase significantly in the 1960-2015 period when compared to the 1904-1959 period. Long-term groundwater level trends are also forecasted and examined using a large ensemble of global climate model (GCM) projections under low and medium emission scenarios. The forecasts from 2020 to 2099 indicate groundwater levels may continue to decline, however, at an accelerated pace after 2040s reaching critical levels by the end of this century. Results show highly divergent groundwater response to projected hydroclimatic changes in that future long-term rainfall trend may lead to rising groundwater levels, which, however, may be overshadowed by heightened ET loss driven by global warming and increased groundwater pumping. This study also reveals poor performance of predictions driven by GCM projections in replicating the timing of high and low extremes, attributed to failure of GCM projections and downscaling methods to capture the timing of climatic cycles, controlling hydrologic memory. Additionally, a multidecadal harmonic trend analysis exposes presence of potential centennial cyclic trends in groundwater levels, critical for future predictions. Thus, GCM-based forecasts are recommended to be cautiously utilized for groundwater resource planning when significantly departing from historical long-term cyclic patterns.

PRESENTER BIO: Dr. Gordu is a chief water resource engineer at SJRWMD with more than 20 years of experience in groundwater and surface water modeling, MFL studies, aquifer recharge investigations, statistical analysis, water supply planning and climate change studies. He currently serves in the state rainfall projections and drought resiliency workgroups.