Investigating the Benefit of Improved Rainfall Forecasts on Regional Groundwater Level Predictions

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The goal of this project is to assess the benefits of incorporating seasonal rainfall forecasts into Tampa Bay Water's operations planning process. Tampa Bay Water's planning process is based on a decision support system that uses forecast demand, surface water flows, groundwater level conditions and rainfall data to determine how to rotate production among available supplies to meet demands in an environmentally sound manner. Initial project efforts have focused on the Tampa Bay Water Ground Water Artificial Neural Network (GWANN) model which currently generates 1-week to 4-week forecasts of groundwater levels at 57 monitoring wells using recent observed rainfall, pumping and groundwater levels, and a rainfall forecast that assumes that the same rainfall observed in the week prior to the forecast will occur over the next 4 weeks.

This poster compares model-predicted groundwater level errors generated using weekly rainfall forecasts from the historic period of record in an ensemble approach and model-predicted groundwater level errors generated using "perfect" rainfall forecasts, to the groundwater level errors generated from the current GWANN model. The intent is to determine to what extent improved rainfall forecasts may improve weekly and monthly model predictions of groundwater levels. Preliminary results indicate that using the median weekly rainfall from the long-term data record as the rainfall forecast improves the average root mean square error of groundwater level prediction by 0.03ft (for the 1 week forecast) to 0.20ft (for the 4 week forecast) over the current method. Using the actual observed rainfall as a "perfect" rainfall forecast improves the average root mean square error of groundwater level prediction by 0.08ft (for the 1 week forecast) to 0.30 ft (for the 4 week forecast) over the current method. Future work will evaluate the improvement in groundwater level predictions achieved by partitioning the historic rainfall record based on ENSO phase and using this partitioned record in an ensemble approach, and the feasibility of retraining the GWANN model using forecasts of rainfall and/or other climate indices to improve the model's forecasting accuracy.

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