Estimating Maize and Soybean Stomatal Conductance Based on Time Series Soil Moisture, Canopy Temperature and Weather Conditions

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Keywords: Stomatal Conductance, Recurrent neural network, Long Short-Term Memory, Autoregressive integrated moving average, Time series forecasting, Soil moisture, Canopy temperature

Stomatal conductance (SC) was utilized to indicate the rate of gas and water exchange through stomata on the leaf surface. When crops are experiencing water stress during the daytime, their stomata will close to prevent water loss. However, the crop will also receive less CO2 for photosynthesis under this condition. Consequently, accurate and efficient SC prediction can improve irrigation efficiency, particularly in the present day when water is scarce. The common way to estimate SC nowadays is to make predictions using other variables that can be measured quickly, such as conventional regression analysis. The limitation of conventional regression analysis is that it does not account for changes in SC when crops are subjected to both prolonged drought and high temperature stress. We intend to use time series prediction techniques, such as Long Short-Term Memory (LSTM), to determine the correlation between variables at different time scales. The objective of this study is to (1) Investigating the relationship between SC and persistent weather patterns. (2) Predict SC based on continuously collected soil moisture, plant canopy temperature and weather information. In this study, we measured the SC of soybean and maize by using a handheld leaf porometer. This was then compared to short-term historical crop SC predictions based on canopy temperature, soil moisture, and weather conditions. Autoregressive Integrated Moving Average (ARIMA) and LSTM based on Recurrent neural network (RNN) are used to predict SC, and the results are compared with the conventional modeling method. More details will be presented at the NAPPN conference.