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Application of data-preprocessing and -driven methods for irrigation water prediction

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Anomalies in regional hydroclimates can intensify wet and dry spells, undermining the existing water resources allocation and regulations. According to the water consumption report from Taiwan's Water Resources Agency, agricultural water use takes the greatest share, accounting for more than 70%. Thus, the accurate prediction of irrigation water along with rainfall, contingent upon the given condition of water resources (e.g., river and reservoir stage at the current/previous state), can significantly enhance water resources management. In this study, we derive irrigation water data for five irrigation areas in Taiwan, and apply a variety of data-preprocessing and -driven methods to establishing a forecasting framework. Singular spectrum analysis (SSA) is a data-preprocessing method for decomposing the original or seasonal time series into a number of components, including trends, periodicities, and noises, whereas the autoregressive model, quantile regression, and support vector machine are adopted as the data-driven methods for identifying the predictor-predictand relationship. Target predictands include the irrigation water and crop water requirements in the five irrigation areas. We first apply SSA to the predictands as well as other predictor variables (e.g., climate indices, sea surface temperature, and sea level pressure) to reconstruct less noisy series, and then conduct hindcasting experiments using the selected data-driven models and perform an inter-model comparison. We plan to integrate the findings from the hindcasting experiments to a regional water resources simulation system to further optimize the pertinent water resources regulations.

Keywords: climate variability, seasonal forecasting, teleconnection, water resources planning and management