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Short-term forecasting of daily reference evapotranspiration using the Penman-Monteith model and public weather forecasts

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Evapotranspiration (ET) plays an important role in real-time water resource management and irrigation decision making by quantifying the near-future spatial changes of hydrological and agricultural processes. The key parameter required for short-term real-time irrigation decision scheduling in near-future is toward the ET forecast, which can be calculated by the short-term daily reference evapotranspiration (ETo) forecast. In China, public weather forecast information are open for free, which means daily ETo forecast can be computed by public weather forecast. We evaluate forecast of daily ETo for lead time 1 to 7 days using the Penman–Monteith (PM) model and public weather forecasts. Public weather forecast data, including daily maximum temperature, minimum temperature, weather types and wind scales, for the period 2012-2014 at six stations located in a wide range of climate zones of China were collected. Meanwhile, daily meteorological data for the same period and locations were collected to calculate ETo, which served as reference standard for evaluating the forecast outcome. Weather type and wind scale forecasts from weather forecast information cannot be directly applied as inputs to the PM model, while they can be respectively transformed into sunshine duration and wind speed, which are available for the calculation of PM model. The forecast performance of four input weather variables were quantified firstly and results showed that the forecasting performance for the minimum temperature was the best, followed by maximum temperature, sunshine duration and wind speed. Also, it was found that using public weather forecasts and the PM model improved the forecast performance of daily ETo compared to those obtained when using the Hargreaves-Samani (HS) model with temperature forecasts as the only input data, and this improvement was because the weather type and wind scale forecasts also have positive influence on ETo forecasting. Further, the greatest impact on ETo forecasting error was found to be caused by the errors in sunshine duration and wind speed, followed by maximum and minimum temperature.