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An enhancement of monthly weather forecast based on ANFIS and time-lagged ensemble members

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Monthly and seasonal weather forecast information is useful for preventing the damage from natural drought disasters. The ensemble weather forecast information has been used for drought outlook by many organizations, but the accuracy of the ensemble forecasts is still big challenge for the reliability of the drought outlook system. In this study a hybrid method combined the physically-based weather forecasts with data mining scheme is proposed and evaluated for the enhancement of accuracy of monthly and seasonal weather forecasts. For the weather forecasting components, Global Seasonal forecast system version 5 (GloSea5) data with 60 time-lagged ensemble forecasts for a month from Korea Meteorological Administration (KMA) are used. For the data mining scheme, Adaptive-Network-based Fuzzy Inference System (ANFIS) that has been applied successfully and provided high accuracy and reliability for simulating complex nonlinear nature phenomena by combining Fuzzy Inference System (FIS) and Artificial Neural Network (ANN) is adopted in this study. The selected study area is the Chungju multi-purpose dam watershed with area of 6648 km2 in South Korea. The hindcast data of GloSea5 during 1996-2009 are used for training and validation to tune the parameters (membership function, epoch etc.) of ANFIS and the forecast data for 2015 and 2016 are used for testing the performance of the proposed method. Root Mean Square Error (RMSE) and Correlation Coefficient (CC) are applied as indicators of evaluation criteria. The results indicate that RMSE and CC for 1-month forecast are 60.34, 0.70 in the case of the use of simple average of 60 time-lagged ensemble members as input of ANFIS, while those of RMSE and CC are enhanced up to 54.03, 0.89 when all 60 ensemble members are trained and validated for the ANFIS model. It is concluded that ANFIS-based hybrid model can enhance the accuracy of monthly weather forecast and is useful for the monthly and seasonal meteorological drought outlook system.

Keywords: ANFIS, GloSea5, ensemble forecast

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