Hydrol. Earth Syst. Sci. Discuss.,
doi:10.5194/hess-2016-102-AC2, 2016

Hydrology and Earth System Sciences
Discussions

Interactive comment on "An experimental seasonal hydrological forecasting system over the Yellow River basin – Part II: The added valuefrom climate forecast models" *by* Xing Yuan

X. Yuan

yuanxing@tea.ac.cn

Received and published: 24 April 2016

The second of the two papers concerning the establishment of the seasonal ensemble hydrological prediction system in the Yellow River basin, this paper describes the investigation of the added value from implementing the ensemble of climate models into the considered framework. Two main forecast ensembles are compared: the ESP/VIC approach produces streamflow forecasts based on the ensemble of 28 meteorological conditions from the period of 1982-2010 and an ensemble of 8 North American Multimodel Ensemble models with a total of 99 members (referred to as NMME/VIC). The forecasts of soil moisture and naturalized streamflow are compared using two metrics – Anomaly Correlation and RMSE Skill score. The AC plots show that the NMME/VIC

approach may enhance the forecast skill for both streamflow and soil moisture at longer lead times. To produce a forecast that would be comparable to the observations, the output from both approaches is then post-processed by a linear regression. The regression coefficients are derived by fitting the naturalized multiannual streamflow time-series to the observed time-series. After the post-processing, the NMME/VIC shows a significant reduction in RMSE as compared to the naturalized streamflow.

Response: We would like to thank the reviewer for the compliment and recognizing the value of our work. The thoughtful comments have helped improve the manuscript. The reviewer's comments are italicized and our responses immediately follow.

Considering a hydrological system with high human interventions, would applying a linear regression for streamflow time-series be the best practice in fitting the simulated streamflow to the obeserved? Would water subtractions be a linear or a non-linear process? Is it possible to introduce a seasonally-dependent water subtraction submodel in the VIC model based on e.g. municipal subtraction statistics and would the whole framework benefit from that?

Response: Thanks for the important comment. We agree with reviewer that a linear regression is not sufficient to account for the nonlinearity and nonstationarity in the hydrological system with intensive human interventions. We will incorporate the reviewer's comment into the discussion section as follows: "(1) a linear time series post-processing model, although considering the seasonality in the water subtraction by calibrating the parameters against observed streamflow month by month, is not sufficient to simulate and forecast a hydrological system with intensive human interventions because of the nonlinearity and nonstationarity. Either connecting with a seasonally-dependent water subtraction sub-model based on the subtraction statistics or explicitly representing the human intervention processes in the forecasting system is not only necessary to further reduce the uncertainty in the hydrological models, but also to facilitate the understanding of the hydrological predictability with human dimension;"

The reviewer kindly asks the author to provide further insight in section 5 on the reasons for a significant decrease in forecast RMSE skill verified against the observed streamflow. As far as the reviewer have understood, the VIC model was calibrated against the naturalized streamflow and only fit to the observed streamflow by linear regression, so were the forecasts.

Response: Thanks for the suggestion. We will revise the manuscript as follows: “The decrease in the RMSE skill score is consistent with previous finding over the USA (Yuan et al., 2013), which is because of the increase in the uncertainty of hydrological models. Given that the VIC model used in this study has no parameterization in the human water consumption, a linear regression in the post-processing procedure may reduce the systematic bias with the consideration of seasonality, but do not necessarily correct the errors in the variability. Connecting the VIC model with water subtraction model with different complexities (e.g., from statistical to process-based models) will reduce the uncertainty in the hydrological model, and thus amplify the add value from climate forecast models.”

With the minor additions the paper is suitable for publication. Technical corrections: - page 3 line 19: correction “of the simulated streamflow”

Response: Revised as suggested.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., doi:10.5194/hess-2016-102, 2016.