Reply to short comment hess-2017-340-SC1 by Samuel G. Dixon

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Short comment:

Figure 1: Some gauges are located downstream of impoundments (e.g. catchment 12, Amu Darya). Are the data used corrected for management of upstream reservoirs or does management impact the flow record? A figure showing the annual regime could help to depict whether flows are natural or managed.

We used the discharge data provided by the hydromet services, which are not corrected for reservoir management. However, except the large Amudarya catchment all the gauges are located upstream of reservoirs, thus the discharge is not regulated. Within the Amudarya catchment the Nurek dam exists in the Vakhsh river, which is the right headwater tributary forming the Amudarya at the conjunction with the Panj river. The catchment area of the Vakhsh river is 31,415 km² at the outlet. This is about 11% of the whole Amudarya catchment at gauge Kerky. Because the Nurek dam is located upstream of the conjunction, the Amudarya catchment area affected by the dam is less than 10%. Assuming further that the reservoir can manage only a fraction of the total discharge of the Vakhsh river, and that the dynamics of the water retention are further buffered by the seasonal mean discharge spanning six months, it can be assumed that the regulating effect of the Nurek dam on the overall seasonal discharge is rather low. Additionally, the dam is operational since 1980, therefore a discontinuity in the time series 2000-2015 can be ruled out. We thus argue that the anthropogenic influence of the seasonal discharge time series of the Amudarya is negligible for the presented study. We will point this out in the revised manuscript.

Table 2: Adjusted R2 values may be more suitable to report due to small sample sizes

As mentioned in the reply to the comments of reviewer 1, we report adjusted R^2 values throughout the revised manuscript. The adjusted R^2 values decrease (compared to the R^2 values) for the early forecasts, while they remain high for the late forecasts.

Table 2: Model performance could be benchmarked against the long term average or persistence forecast to quantify additional skill provided by MLR models.

This is implicitly done in the R^2 values. The coefficient of determination R^2 (which is synonymous to explained variance and Nash-Sutcliffe efficiency) benchmark the squared residuals, i.e. the observations minus simulated or forecasted discharges, against the squared differences between observations and the mean observed discharge. In other words, R^2 values benchmark the model against the most simple model, which is the mean of the observed time series. Any R^2 value above 0 thus indicates an improvement compared to using the mean as predictor. Schaefli and Gupta (2007) nicely illustrate this in their paper about the value of Nash-Sutcliffe efficiency. Therefor we don't see any gain in reporting the mean discharge as reference.

General: Winter hydropower production is also a key use of water in the region as well as irrigation provision. Comment might be made as to whether these models could be useful for hydropower planning as well as summer irrigation demands.

The models are valuable for any planning concerning the use of water resources. This also includes the hydropower generation. Reliable forecasts support the reservoir management by planning the release, resp. the storage of water in the reservoirs for the winter season. However, for reservoir management also international treaties between the riparian states need to be considered. The demands of the upstream and downstream countries are often quite opposite, which is the core problem of water management in Central Asia.

General: The inclusion of local stakeholders in the authorship adds significant insight into the paper. This could be enhanced via the authors commenting on how the forecasts presented here facilitate improved water management in the region, possibly providing examples of better decisions made possible by the forecasts. Furthermore, insight could be provided regarding if the forecasts produced here fulfil the requirements of hydromet agencies, or if there are any specific areas in which the models do not perform satisfactorily requiring further research.

This is an interesting suggestion. The matter is, however, very complex. A detailed analysis would certainly by beyond the scope of this manuscript. Additionally there is the time problem. An encompassing assessment of the model performance, advantages and deficits can only be done after the forecasted vegetation season. i.e. after September. Considering the time required for collecting data, evaluating the forecasts, and the experiences and acceptance in the different hydromet services would likely take several months, certainly exceeding the time schedule for this manuscript. However, this suggestion is very welcome and we will consider to collect and summarize the experience with the models in operational forecasting and publish them additionally, maybe as a short comment.

Minor corrections

P6, L11: Typo - capitalised while

P7, L3: States “continuous time series for all data and stations were available” when later it is stated that there is some missing data (e.g. Figure 2)

P11, L27: “Figures presented in 4.3” – should this be 4.2?

P19, L19 and P21, L12: Catchment 9 is referred to as Andijan rather than Karadarya.

Figure 7: Possibly label x-axis as Jan, Feb, etc. rather than 1-6 to ease interpretation

General: Inconsistent spelling of Murgab/Murgap, e.g. Table 1 and Figure 1

Thanks for spotting these errors. We will correct them in the revised manuscript. However, we would keep the x-axis labels as 1-6, in order to avoid overloading the figures. Printed on A4 paper they are already very dense.

References:

Schaefli, B., and Gupta, H. V.: Do Nash values have value?, Hydrological Processes, 21, 2075-2080, 2007.