**Interactive comment on "Short-to-medium range
hydrologic forecast to manage water and
agricultural resources in India" by Reepal Shah
et al.**
Anonymous Referee #2
Received and published: 14 November 2016
The analysis contributes to a very important problem in Hydro climatology of Indian
subcontinent and provides very useful information towards creating an operational subseasonal
hydro-meteorological forecasts. The results show a distinct improvement by
the IITM forecasts over the NCEP version of CFS 2.0. I have few minor comments,
which the authors may address:

1. The authors may highlight, what are the reasons behind such improvements by the
IITM model over NCEP CFS v2.0. This should come with some bullet points clearly
highlighting the need for any model to be successfully applied for monsoon forecasts.

We appreciate your suggestion and added the following text in the revised manuscript (page #13, lines #13-18)

"The major factors that might have contributed in the improvements in the IITM forecast are:

  i.   *Ensemble members of IITM forecast are generated by perturbing initial atmospheric conditions to improve simulation of the northward propagation*

  ii. *Improvements in the boundary conditions with bias corrected SST result in an improved precipitation prediction*

  iii. *Higher spatial resolution of the IITM forecast can better resolve orographic rainfall"*

2. Please, provide some details on the lead-time dependant bias correction. Can this
be applied to the CFS2.0 forecasts of precipitation?

Thanks for your valuable suggestion. We have provided following (page #11 Lines #21-25)

"However, the bias in the forecast products may have temporal variability and may not be constant for the entire period of 45 days. Therefore, bias correction approaches based on the variable lead time (Stockdale, 1997) need to be evaluated in future when IITM forecast for long-term retrospective period is available. The bias correction approach that we presented can be applied to evaluate seasonal forecast skill."

3. I could not understand the sources of the observed soil moisture and runoff data.
The authors may mention the same or they may provide a table on the details of the
data used with their sources. This will help others to reproduce the results and validate
the same.
Thanks. The VIC model was calibrated and evaluated using observed streamflow and satellite soil
moisture and evapotranspiration (Shah and Mishra, 2016a,b). In this study, we used calibrated VIC model

forced with observed IMD data to simulate soil moisture and runoff, which was considered as a reference to evaluate the forecast of soil moisture and runoff.

We have provided following (page#11 in lines#27-32)

 "The VIC model was calibrated and evaluated using observed streamflow and satellite soil moisture and evapotranspiration (Shah and Mishra, 2016a and Shah and Mishra, 2016b).In this study, we used calibrated VIC model forced with observed IMD data to simulate soil moisture and runoff, which was considered as a reference to evaluate the forecast of soil moisture and runoff. Forecast of root-zone soil moisture and runoff was simulated using the VIC model forced with the forecast products (IITM-ensemble-bc, IITM-ensemble, and CFSv2), which were evaluated against the soil moisture/runoff obtained from the VIC model simulation using the observed forcing from IMD (Supplemental Fig. S17)."

4. During the low rainfall periods, the human intervention is quite high in terms of irrigation. To the best of my knowledge, VIC does not have the capability of doing the same in a way that is applicable to Indian condition. I do not really blame the authors for the same as there is as such no way out, given the status of latest version of VIC. But this should be explicitly mentioned as limitation.

We appreciate your valuable comment. The present study considers only the monsoon season for analysis, however, we acknowledge that the role of irrigation during the dry season.

We have mentioned this limitation and added the following text (page #6 Lines 3-7) in the revised manuscript:

 "The VIC model's version that was used in this study does not explicitly represent groundwater, rather it only accounts for baseflow. We acknowledge that India specific soil and vegetation parameters along with the representation of irrigation, reservoir, and groundwater can improve the water budget; however, these were not considered in the present study due to unavailability of either observations or the model version that has the representation of human interventions."

5. Similarly, the crop parameters, which are used in VIC are mostly based on Maize and Soyabean and this is different from Indian crop conditions. The authors may correct me if I am wrong. If I am correct, this should also be mentioned as a limitation. VIC also have limitation of not having a good ground water model. This should also come as a limitation.

Thanks. The point is valid.

We included the following text to address this (page #6 , Line 1-3):

"The vegetation parameters used in this study were developed using 1-km Advanced Very High Resolution Radiometer (AVHRR) global land cover information. We used vegetation library that was developed at University of Washington. The vegetation parameters were not specifically developed to incorporate crops that are grown in India. However, the existing parameters were successfully used in the model application over India (Shah and Mishra, 2015; Shah and Mishra, 2016)."

6. Is the model calibrated or does it consider the recommended values of parameters of VIC from global data set? The authors may also publish the sensitive parameter values for VIC as supplementary dataset so that the readers will be able to reproduce and apply the work.

We appreciate your suggestion. However, the model calibration and evaluation is a part of the previously published manuscript (Shah and Mishra (2015, 2016) and Shah and Mishra (2016)), therefore, we are unable to provide the calibrated values of parameters in this study. Authors will be happy to share the parameters and data, if someone is interested.

We have mentioned following text in the revised manuscript (page #6 lines 7-8):

 "*The VIC model setup used in this study is well calibrated and evaluated against observed streamflow and satellite based evapotranspiration and soil moisture in Shah and Mishra (2016a) and Shah and Mishra (2016b)*."