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Interactive comment on "Role of surface hydrology in determining the seasonal cycle of Indian summer monsoon in a general circulation model" *by* Shubhi Agrawal and Arindam Chakraborty

Anonymous Referee #2

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Role of surface hydrology in determining the seasonal cycle of Indian summer monsoon in a general circulation model by Shubhi Agrawal and Arindam Chakraborty. It is a very interesting work, which highlights effects of soil moisture bias on the simulation Indian summer monsoon rainfall and particularly on the monsoon onset. The manuscript is well written, results are convincing and nicely organized.

This study shows how the excessive dry soil condition (bias) over western Central Asian region can lead to excessive monsoon rainfall during the month of June. On the other hand local soil moisture plays important role during rest of the monsoon

season. This study may have real implications on the understanding of the sources of predictability of the ISMR and hence improving the forecast skill. Overall it will be a good contribution towards our understanding of land-atmosphere interactions over the south Asian monsoon region. These are comments (minor), which needs to be addressed before it is accepted for publication.

1) The result of this modeling study is very much consistent with Rai et al. (2015), which is based on only observations. Pre-onset (April-May) rainfall and 2m air temperature, which can be also used as proxy for soil moisture/land-surface conditions, shows strong inverse link with the first phase (June-July) of monsoon rainfall (see Figure 1,2 in Rai et al 2015). Similarly there are previous study by Parthasarathy et al., 1992; Singh et al., 1995 . The point is here that this modeling study should be build on such note and finally this study shows that model is able to capture this observed teleconnection faithfully.

2) Many previous observational study have pointed out that pre-onset land surface conditions, particularly over the heat-low regions (Iran, Afghanistan, Arabian region) have significant impact on the performance of ISMR. This could be one of the non-ENSO sources of predictability in a forecast model. Unfortunately we do not have deeper layer soil moisture observation, which can be feed into land data assimilation system.

3) In the summary and conclusions part "It follows from our work that the surface soil moisture anomalies bear serious consequences .... " It is not anomaly but a systematic bias.

4) Soil moisture shown in Figure 5 is from top model layer ? In nudged experiment, only top soil layer is nudged ? What about the deeper layers, what kind of effects it can have on the results ?

5) In page 2, " The contribution of land-atmosphere interaction......." is a very big sentence, hard to read. Please split it into smaller sentences.

Parthasarathy, B., R. Kumar, and A. A. Munot (1992), Surface pressure and summer monsoon rainfall over India, Adv. Atmos. Sci., 9, 359–366.

Singh, D., C. V. V. Bhadram, and G. S. Mandal (1995), New regression model for Indian summer monsoon rainfall, Meteorol. Atmos. Phys., 55, 77–86.

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