

## ***Interactive comment on* “Consistent increase in Indian monsoon rainfall and its variability across CMIP-5 models” by A. Menon et al.**

### **Anonymous Referee #1**

Received and published: 22 February 2013

The manuscript analyzes the performance of 20 CMIP GCMs in simulating the seasonal mean monsoon rainfall over India and its interannual standard deviation in the historical period as well as their variations in the 21st century. The authors find that all models simulate enhanced monsoon rainfall as well as interannual variability in the 21st century compared to the historical period. The topic is of great interest, as the Indian monsoon is very important for the livelihood of a substantial percentage of the world population. Additionally, models have in general a number of deficiencies in simulating the monsoon and therefore it is important to intercompare and evaluate them. The manuscript is thus addressing a very relevant issue. It is also well written. There are however some major issues that would need to be addressed before publication. I recommend acceptance of the manuscript subjected to a major revision.

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Major points:

\* The major weak point is that I find the analysis too simplistic: the manuscript does not investigate the mechanism responsible for the increased trends, especially the links with the changing circulation. This would add depth to the findings.

\* The analysis is carried out only in terms of area-average quantities, I wonder also how are the spatial patterns of the changes.

\* I suggest the authors to consider some recently published works, such as Lee and Wang (2012, Climate Dynamics), Hsu et al. (2012, JGR), Cherchi et al. (2011, CD). How are the findings of this work different from these others?

Minor points:

\* Did you use multiple ensemble members or one realization for each model? \* Page 3: mention also multi-decadal fluctuations, not only linear trends. See for example, Krishna Kumar et al. (2010, Climate Dynamics). Furthermore, why aerosols are not mentioned in the discussion? A number of recent studies have suggested they have played a very important role in the last decades, most likely dominating GHGs. \* Page 5, line 16: they also include the natural forcings, such as volcanoes and solar variations. \* Page 6, line 27: what do you mean by active regime? The monsoon has been found to have been declining in the last few decades. The paragraph is not clear. \* Fig 2: is view of the discussion (e.g., pag. 6, lines 15-20 ) you should show observations. The comparison is also qualitative. Use some measure to quantify the overall discrepancy in the patterns. \* Fig. 5: merge is some way the 2 figures, highlighting only critical values of the significance (e.g., 90%, 95%).

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Interactive comment on Earth Syst. Dynam. Discuss., 4, 1, 2013.

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