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Interactive comment on "Robust increase of Indian monsoon rainfall and its variability under future warming in CMIP-6 models" *by* Anja Katzenberger et al.

Anonymous Referee #1

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This manuscript discusses expected future changes in Indian Monsoon precipitation amounts and variability. To this end, the authors use 32 CMIP-6 model projections under different shared socioeconomic pathways: SSP1-2.6, SSP2-4.5, SSP3-7.0 and SSP5-8.5. The main conclusions are that the Indian Monsoon will experience an increase in precipitation and its interannual variability will become larger. The methods are standard in this type of analysis, the results are properly discussed and well supported by easy to follow figures. The final discussion does a good summary of the findings. While the results would stand on their own, they seem to contradict previous studies summarized in the introduction. This discrepancy needs to be resolved before the manuscript is accepted for publication. There are also several minor comments

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Discussion paper

that will need to be corrected.

1. The main conclusions in this study are that regardless of the shared socioeconomic pathway considered, most models show an increase in precipitation in the Indian Monsoon. Even more, the simulation ensemble indicates a linear dependence of rainfall on global mean temperature with high agreement between the models and independent of the SSP. These results contradict previous observational studies (see introduction) where it was shown that there was a decreasing trend of precipitation in the second half of the 20th century. Those same studies suggest possible physically-based reasons for the decreasing trend. If there was a decrease in the 20th century precipitation, it would contradict the assumption of a linear relation between rainfall and temperature. What changed to start having the positive trend discussed in this manuscript? Can you offer a justification that explains the perceived differences between the 20th and 21st centuries?

2. The figures show the projections for each model. The ensembles should be included as well.

3. A thorough review is necessary. Note, for example, the incomplete sentence in line 111, or the repeated text around lines 239-252 and 242-244.

4. All Figure Captions in the Appendices are incomplete: They all state: “According to Fig. (missing number)”

Minor comments: Line 22: what is a retractable effect? Line 101 onle –> nly Lines 106, 249 It is “moisture flux convergence”. Moisture (a scalar) does not converge. Moisture flux (a vector) does. There may be other instances with this mistake Line 108: Walker is uppercase Line 250: Moisture (flux) convergence is not a thermodynamic effect. It involves moisture, but it is a dynamic effect as well. It is mostly driven by the convergence of winds.

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