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Interactive comment on "Investigation of negative cloud radiative forcing over the Indian subcontinent and adjacent oceans during the summer monsoon season" *by* B. V. Thampi and R. Roca

Anonymous Referee #2

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Review of the paper "investigation of negative cloud radiative forcing over the Indian subcontinent and adjacent oceans during the summer monsoon season"by Thampi and Roca.

This is an interesting study on cloud radiative forcing over the Indian sub-continent and adjoining oceans. Using data from different satellite platforms and a radiative transfer model, they discussed the large negative net cloud radiative forcing over the Indian region and examined the possible causes. They argue that high content of precipitable

water content over the north Bay of Bengal and adjoining areas cause decrease in LW forcing and thus creates an asymmetry in the cloud radiative forcing (between SW and LW forcing). They argue that macro and micro physical properties are not that important over the north Bay of Bengal for the observed negative net forcing.

As cloud radiative forcing is very important in terms of its climate sensitivity and climate change scenarios, the present study is very important and the results are worth for publication. I recommend the paper may be accepted for publication.

However, I have the following two important points on this paper.

1) Satellite data derived low cloud cover over the Indian region during the monsoon season has large negative bias. As the region is covered by large amount of high clouds due to monsoon convection, determination of low clouds from satellite data is a serious problem. An unpublished study showing the comparison of low cloud amount from ISCCP and ship observations suggest that ISCCP underestimates low cloud amount almost by 30%. This may be an issue in the radiative transfer calculations in which cloud amounts are prescribed. The authors apparently used less amount of low clouds in the radiative transfer model calculations. This may have an impact on the simulation results.

2) The sensitivity studies on cloud microphysics did not consider the variation of cloud optical depth (cloud liquid/ice water content) on cloud radiative forcing. In my opinion, the major difference between Bay of Bengal and west Pacific is the presence of large amount of deep convective clouds over the Bay of Bengal. If you see the spatial distribution of Deep convective clouds (clout top above 400 hpa and optical depth more than 10) then you will find maximum over the north Bay of Bengal. These deep convective clouds may be making the big difference of cloud radiative forcing between Bay of Bengal and west Pacific. There is a large difference in optical depth of high clouds between Bay of Bengal (which crosses 14) and West Pacific (where it hardly crosses 10). The analysis by Rajeevan and Srinivasan (2000) clearly showed that the

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asymmetry between SWCRF and LWCRF becomes significant at cloud optical depth exceeding 10. They should have done a sensitivity analysis of cloud optical depth on cloud radiative forcing using the radiative transfer model.

More insights to cloud raditive forcing can be obtained by making use of the CloudSat data, which gives vertical profile of cloud microphysics. CRF may be dependent more on vertical distribution of cloud microphysics.

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