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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Joint spatial variability of aerosol, clouds and rainfall in the Himalayas from satellite data" *by* P. Shrestha and A. P. Barros

Anonymous Referee #2

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This paper discusses the linkages among topography and the variability of aerosol, cloud, and precipitation with satellite-based observations. The region of the study is carefully chosen, EOF analysis is solid, and the results are interesting. However, I suggest the following minor revisions.

1. Section 3. Satellite Data

It is well known that the MODIS aerosol retrievals over land use the dark-target approach, and no retrievals are performed when the surface reflectance is low. Your statement 'The MODIS aerosol retrieval is more accurate ∼' can be restated like 'The MODIS aerosol retrieval is less accurate where albedo is low compared to the region of high albedo (e.g., ocean and dark vegetation)'. The authors can mention what percentages are missing in the region of interest.

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2. Section 4.1 Aerosol Variability Before discussing aerosol variability, it would be helpful to remind the readers about the detailed description of the mean aerosol field. If it is already published in other work, pointing out a few characteristics would help. In general, authors did not discuss the inter-annual variability of the modes. EC1 time series computed from MODIS aerosol optical depth (AOD) shows large year to year variability. The interannual variability is obvious within the 8 years of TOMS aerosol index (AI) observations (Figure 4). Is it a natural variability or is there any other local influence? Is there any possibility of instrumental drift? If it is related with monsoon, the EC1 and/or EC2 must be connected with the monsoon variability. Is there any correlation between EC1 and EC2 with other climate or ocean variability indices, e.g., arctic oscillation (AO) and ENSO? This paper focuses on the intra-annual variability, but showing the inter-annual variability of aerosol, cloud, and rainfall by removing seasonal cycle from the ECs would be useful for interpreting the connection mechanism of the aerosol to the cloud and precipitation.

3. Section 4.2 Rainfall and cloud variability

The discussion of the correlation among the first modes of MODIS AOD, COD and TRMM is confusing. Is the highest correlation ($r \sim 0.7$) found to be the one between AOD and COD or between AOD and TRMM? Please add the explanation about the correlation length of six months. Most importantly, why this high correlation expresses the fact that the same large scale dynamics are governing aerosol and moisture transport in the region? The authors need to add reasoning for this.

4. Section 5 Joint variability

In section 4, the highest correlation between ECs of AOD and ECs of precipitation was found with a lag of three months. However, EC1's show a strong correlation at zero lag over the monsoon season in the joint variability between TRMM precipitation and AOD. Comments about this would be helpful for the readers.

5. Scection 5. 2 AOD and COD

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The authors can discuss where the indirect radiative effect of aerosols on cloud properties is pronounced and explain why they think an aerosol-cloud indirect effect is significant in this region.

6. Figure2

Enlarging the Figure 2 would help to identify the wind fields.

Interactive comment on Atmos. Chem. Phys. Discuss., 10, 4373, 2010.

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