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Atmospheric Chemistry and Physics Discussions

Interactive comment on "A climatological perspective of deep convection penetrating the TTL during the Indian summer monsoon from the AVHRR and MODIS instruments" *by* A. Devasthale and S. Fueglistaler

Anonymous Referee #1

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General:
The manuscript presents remote sensing observations (AVHRR, AIRS, MODIS) of the cloud top brightness temperature during the Indian summer monsoon. The interpretation of these observations allows to infer the impact of deep convection on the composition of air within the tropical tropopause layer (TTL). In particular, the spatial and temporal pattern were derived showing that the strongest impact occurs over the bay of Bengal and over the central northeast India but not over the Tibetan Plateau (Figure 5). These findings are very crucial in understanding of transport and chemistry driven by

the Indian summer monsoon - in particular to quantify transport across the tropopause, especially over Asia.

The paper is well-written, however, some additional points (major points of this review, see below) have to be addressed before this paper can be recommended for publication:

- "horizontal versus vertical resolution of the used data"
  Here, the authors avoid some clear statements like "there is no vertical resolution in the nadir data of the AVHRR instrument" (The 4 km spatial resolution mentioned in the paper is the horizontal resolution of the instrument, I guess). Thus the brightness temperature used in this paper has no vertical information and, consequently, different instruments, like AIRS, with vertical profiles of temperature have to be used. Here, some more detailed information on the vertical resolution of AIRS (and on the quality of the AIRS retrieval) is necessary. Same for MODIS.

- "proxy how to estimate the altitude of convection from the observed brightness temperature".

  Here, the used procedure is not sufficiently well explained. I guess (and because I am not an expert, I am not sure) that the used procedure works in the following way: The brightness temperature measured by AVHRR has no vertical information, so the assumption is used that "if the observed brightness temperature is smaller than the mean clear sky temperature at a given pressure-level, then convection may reached this level". The mean temperature profiles are obtained from the AIRS observations. In this way, a proxy for the altitude of convection can be derived and, of course, there are some shortcoming of this procedure (which are partially described in section 2). I missed some clear sentences describing the method which should be included into the revised version.

Minor comments:

- Fig.1
  Maybe you should mark also the "North western India/southeastern Pakistan" region in the figure. In Fig. 5 (the most important figure of the paper) you describe this region as an important source region of convection.
- section 2.2, par 2
  Please explain "NOAA-N" and "afternoon polar orbiting platform"
- section 2.3, last par
  Even if the figure 2 (bottom panel) is very instructive, I have some doubts with the interpretation you give. If the (deep) convection reaches the LZRH level over India, i.e. $\theta \approx 360$ K, the high level anticyclone would transport these air masses, approximately isentropic, northwards, and "press" these air masses below the LZRH, i.e. back into the troposphere. Thus to transport these air masses into the stratosphere, either convection has to reach higher pot. temperature levels or other physical processes like radiation (within the clouds) or vertical mixing are necessary. Please discuss these points.
- section 3.3, 2nd par
  Please replace "mean temperature of" by "mean temperature at"
- Fig. 3
  What is the cloud fraction that corresponds to the red colors (0.3 or 10). Please add this mark at the color bar.
- Fig 6-9
  Maybe you cane remove one of these figures ?

- Fig 10
  Legend: Instead of temperature, the corresponding pressure level would be a more desired information.

Interactive comment on Atmos. Chem. Phys. Discuss., 10, 2809, 2010.