Author's response to the comments by A. Behrangi:

1) ... temperature less than 225K or 235K is attributed to deep convective clouds....

Your point is well taken.
I stated right up front (P16476 line 2) "loosely referred to as Deep Convective Clouds".

On P16479 line 26

We refer to these objects loosely as Deep Convective Clouds (DCC), recognizing that a single IR brightness temperature threshold is not enough to separate cold cloud tops associated with true deep convection from thick cirrus or anvil clouds.

On P16483 line 24 we propose to reword as follows:

The label "Deep Convection" has been loosely associated with a wide range of objects identified by various single IR brightness temperature thresholds, from cloud tops colder than 235 K (Mapes and Houze 1993) imbedded in cold clusters to 1x1 degree areas where the rain rate exceeds 1.6 mm/hr (Zelinka and Hartman, 2009). However, a single IR brightness temperature threshold is not enough to separate cold cloud tops associated with true deep convection from thick cirrus or anvil clouds. Clouds in the 12 km AIRS FOV identified with the DT<-2 K threshold have a very high rain rate, and therefore are DCC using the definition of Zelinka and Hartman (2009). The DT<-2 test accomplishes the separation between high clouds associated with strong convection and anvil clouds. DCC which satisfy the DT<-2K condition, referred to in the following as DCCi, reach very close to the tropopause.....

2) Page 16486 line 18 to the end of the paragraph. This paragraph is based on misconception of the role of the 235K threshold in the GOES precipitation index (GPI) algorithm.

You are right, there is no inconsistency between the bt1231<210K and the 235K threshold used in the GPI. However, the observation that with AIRS data bt1231<210K is statistically equivalent to bt1231-bt712<-2K is fortuitous because of the large difference in 12 km AIRS vs. the 5 km GOES FOV. As result, objects identified with AIRS bt1231<210 K would be seen with GOES has having may even colder clouds (to make the 12 km average 210K).

Delete the paragraph starting at page 16486 line 18 and replace with:

Fig 4 shows the rapid increase in the rain rate with DT<-2K, roughly equivalent to bt1231<210K with the AIRS 12 km footprint, but even there the average 4 mm/hr rain rate is not particularly high. The association between cold cloud tops and rain rate in the form of the GOES Precipitation Index (GPI, e.g. Arkin, 1979) uses a 235K threshold with the 5 km GOES footprint. There is no inconsistency, since the 210K threshold for the AIRS data corresponds to an extreme event in a single AIRS 12 km footprint, while the GPI assigns a fixed rain rate to every pixel with brightness temperature less than 235K in a several degrees lat/lon box.

3) Please spell out NCEP, AFGL, TIGR, EOS and AMSU where they appear for the first time.

Response:
NCEP National Centers for Environmental Prediction
AFGL Air Force (Cambridge) Geophysical Laboratory
TIGR3 (1999) is a reference. No spelling required
EOS Earth Observing System
AMSU is already spelled out page 16478 line 18

4) Please include the coordinates fro the region of study

P16476 line 4 ... Clouds (DCC) in the tropical oceans

P. 16479 line 21 ....conditions, in all cases from the tropical oceans, latitudes 30S-30N.

P. 16479 delete between latitude 40S and 40N.

While the cold clouds were collected for land and ocean between 40S and 40N, for this study we used the 30S-30N ocean subset.

5) Additional references:

See the response to anonymous reviewer#2 and added references.

6) Make dates consistent.

All specific dates are for 6 September 2002.

7) Fix Figure 1 and 2

Color labels for g (clouds more than 20 hPa below the trop), b (clouds more than 10 hPa above the trop) will be removed and the explanation will be expanded.

8) Make Figure 3 consistent with the text.

30 hpa refers to the peak of the contribution function, 40 hPa is the pressure altitude where the optical depth due to co2 absorption reaches unity.

Add reference

Mapes, B. and Houze, R.A. (1993) "Cloud Clusters and Superclusters over the Oceanic Warm Pool", Monthly Weather Review, 121,pp1398-1415.

Thank you for your careful reading of the manuscript.

H. H. Aumann