

Figure S1. Similar to Fig. 3, but for ice-cloud-only sounder FOVs, which are determined as more than 80% of collocated MYD06 cloudy pixels reported as ice phase clouds in the optical property cloud phase retrieval. Comparisons of ECF (top row) and effective CTP (bottom row) derived from different sounder retrieval algorithms. Linear correlation coefficients are calculated for cloud properties obtained from retrieval products indicated on the axes and are given on top of the each plot. From left to right, results comparing AIRS Version 7 with CLIMCAPS-Aqua (C-A), CLIMCAPS-SNPP FSR (C-S-F), and CLIMCAPS-SNPP NSR (C-S-N) are shown using joint distributions of frequency of occurrence (%). The data points located in regions poleward of 60° are excluded. Cases are included only when both retrievals in comparison (x- and y-axes of the plot) report valid retrievals.

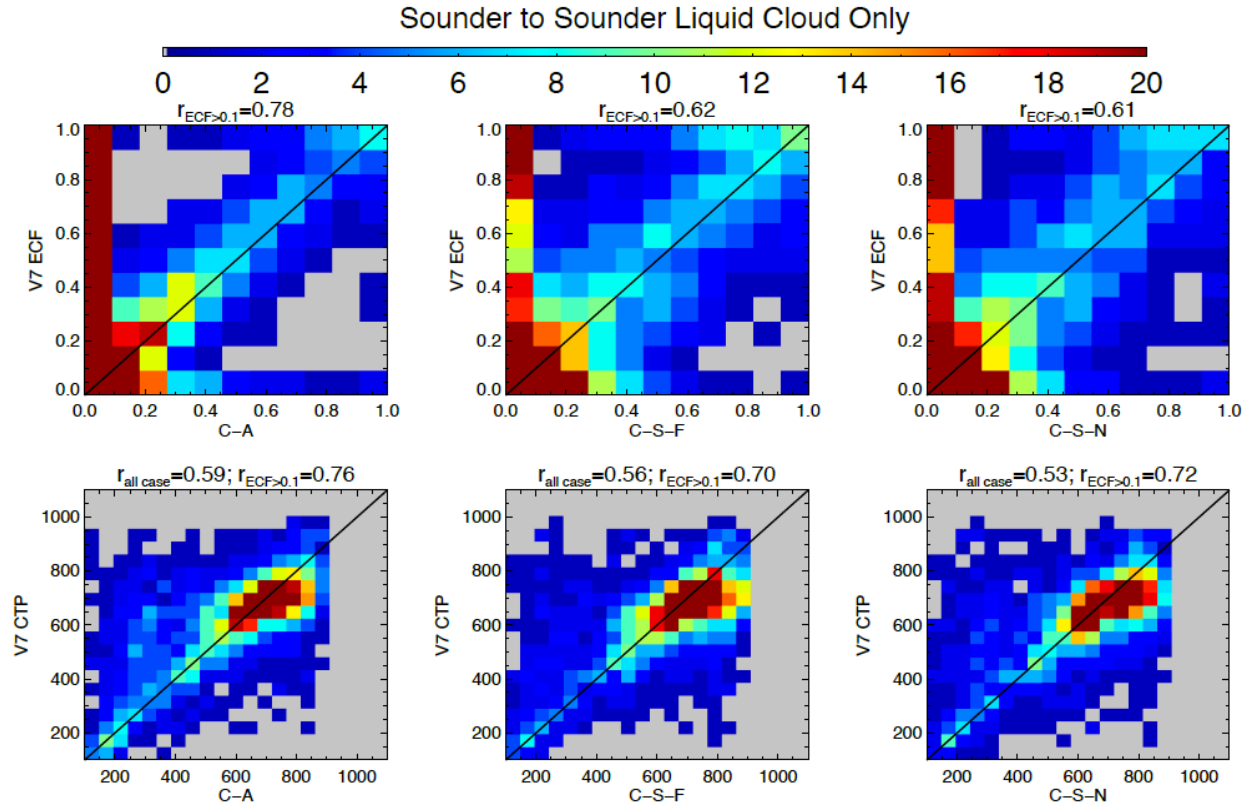


Figure S2. Similar to Fig. S1, but for liquid-cloud-only sounder FOVs, which are determined as more than 80% of collocated MYD06 cloudy pixels reported as liquid phase clouds in the optical property cloud phase retrieval.

Frequency of Occurrence (%): Sounder to MYD06 Imager Products
Ice Cloud Only

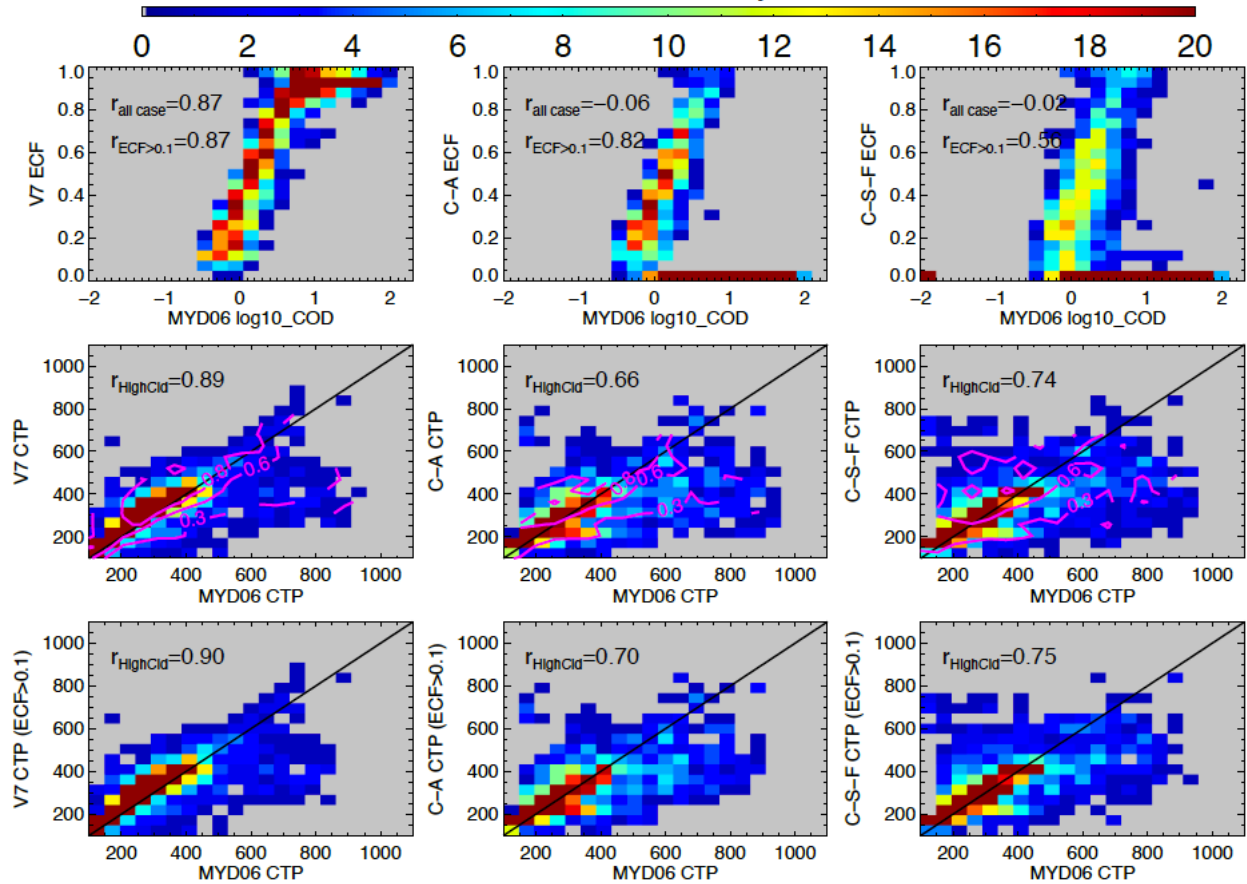


Figure S3. Similar to Fig. 5, but for ice-cloud-only sounder FOVs, which are determined as more than 80% of collocated MYD06 cloudy pixels reported as ice phase clouds in the optical property cloud phase retrieval. Comparisons of sounder and imager derived cloud properties shown by joint distribution of case frequency of occurrence. Top row shows evaluation of sounder-derived ECF by cloud optical depth (COD, in log10 scale) from the MYD06 products. The middle row compares the sounder effective CTP with CTP from MYD06 overlaid by the magenta contours showing the mean ECF from the corresponding sounder retrievals. The bottom row is similar to the middle row except that the cases with sounder ECF < 0.1 are removed from the comparison. Different sounder retrieval algorithms are included. From left to right, data from AIRS Version 7, CLIMCAPS-Aqua (C-A), and CLIMCAPS-SNPP FSR (C-S-F) are used. The data points located in regions poleward of 60° are excluded. Cases are included only when both retrievals in comparison (x- and y-axes of the plot) report valid retrievals. The cloud properties from MODIS pixels collocated within the same sounder FOV are averaged before comparing with the IR sounder data. Linear correlation coefficients between the variables on x- and y-axes for different conditions are given in each plot.

Frequency of Occurrence (%): Sounder to Imager Continuity Products
Ice Cloud Only

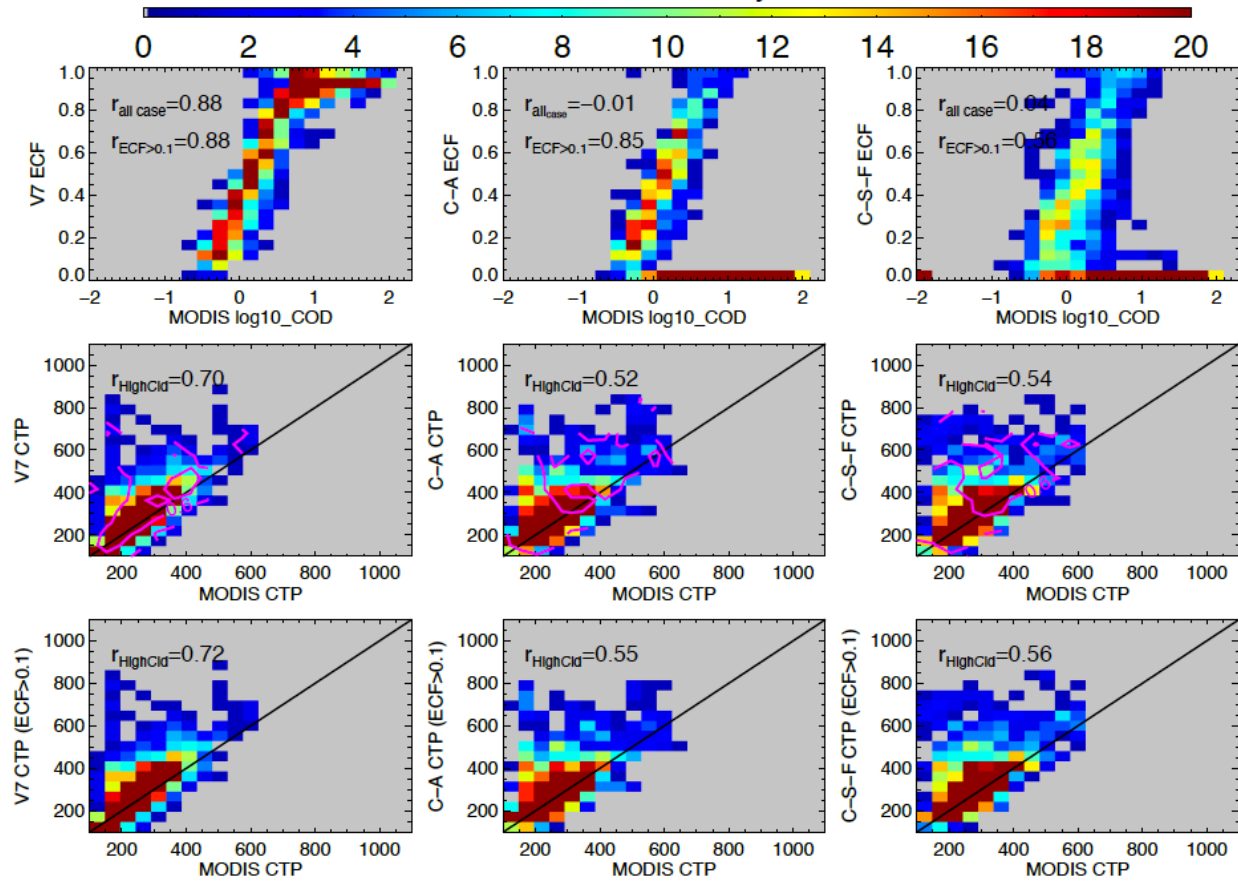


Figure S4. Similar to Fig. S3, except using the MODIS continuity cloud product (CLDPROP_MODIS).

Frequency of Occurrence (%): Sounder to MYD06 Imager Products
Liquid Cloud Only

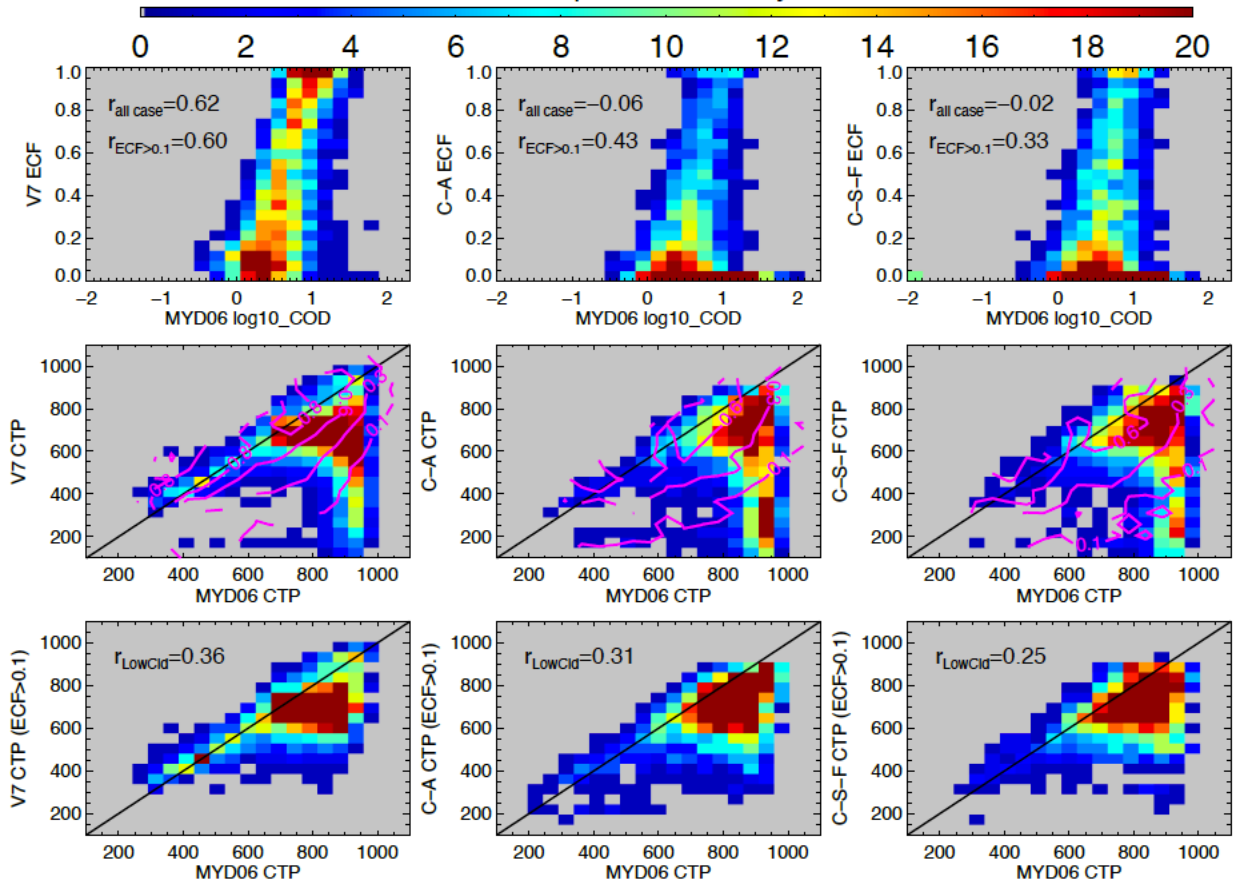


Figure S5. Similar to Fig. S3, but for liquid-cloud-only sounder FOVs, which are determined as more than 80% of collocated MYD06 cloudy pixels reported as liquid phase clouds in the optical property cloud phase retrieval.

Frequency of Occurrence (%): Sounder to Imager Continuity Products
Liquid Cloud Only

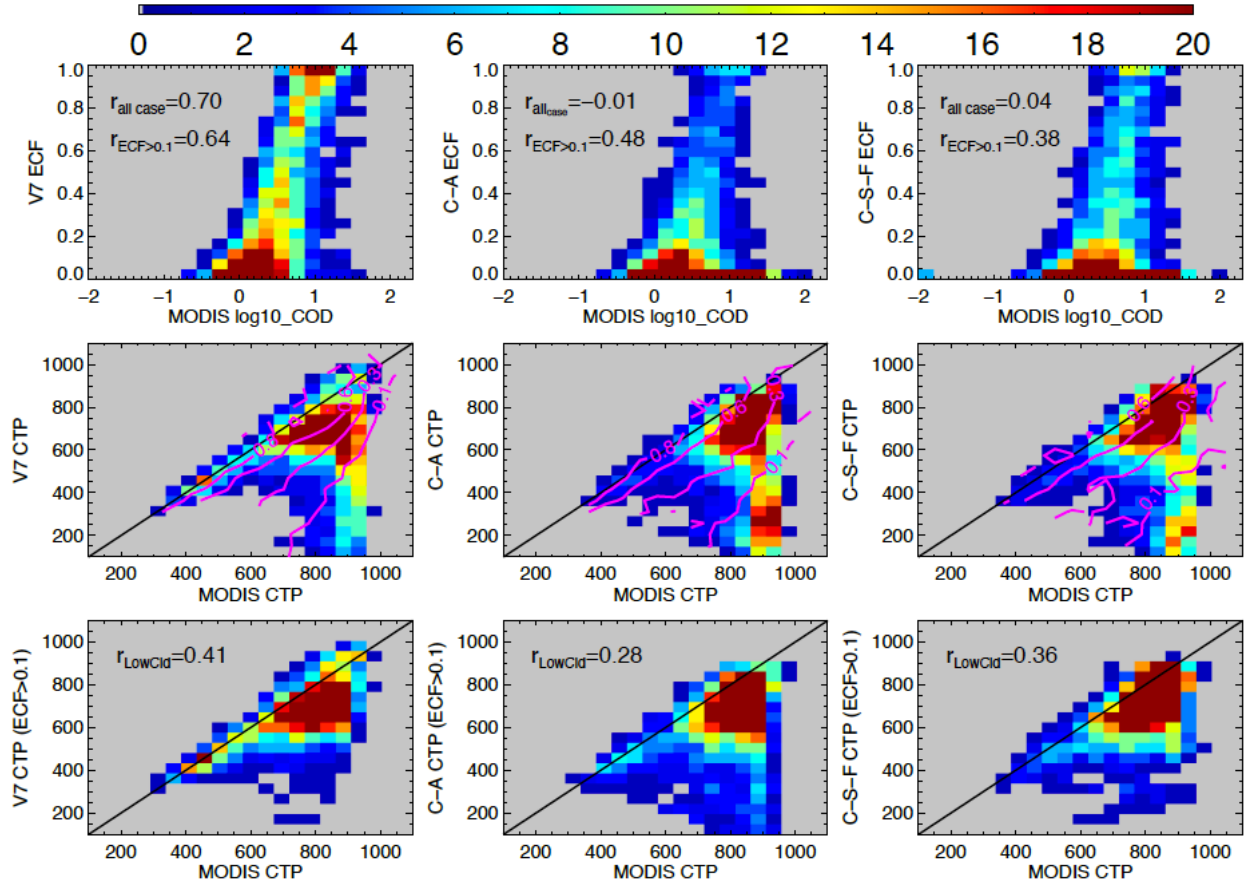


Figure S6. Similar to Fig. S5, except using the MODIS continuity cloud product (CLDPROP_MODIS).

Frequency of Occurrence(%) by Mean Cloud Properties over Sounder FOV:
Imager to Imager; Ice Cloud Only

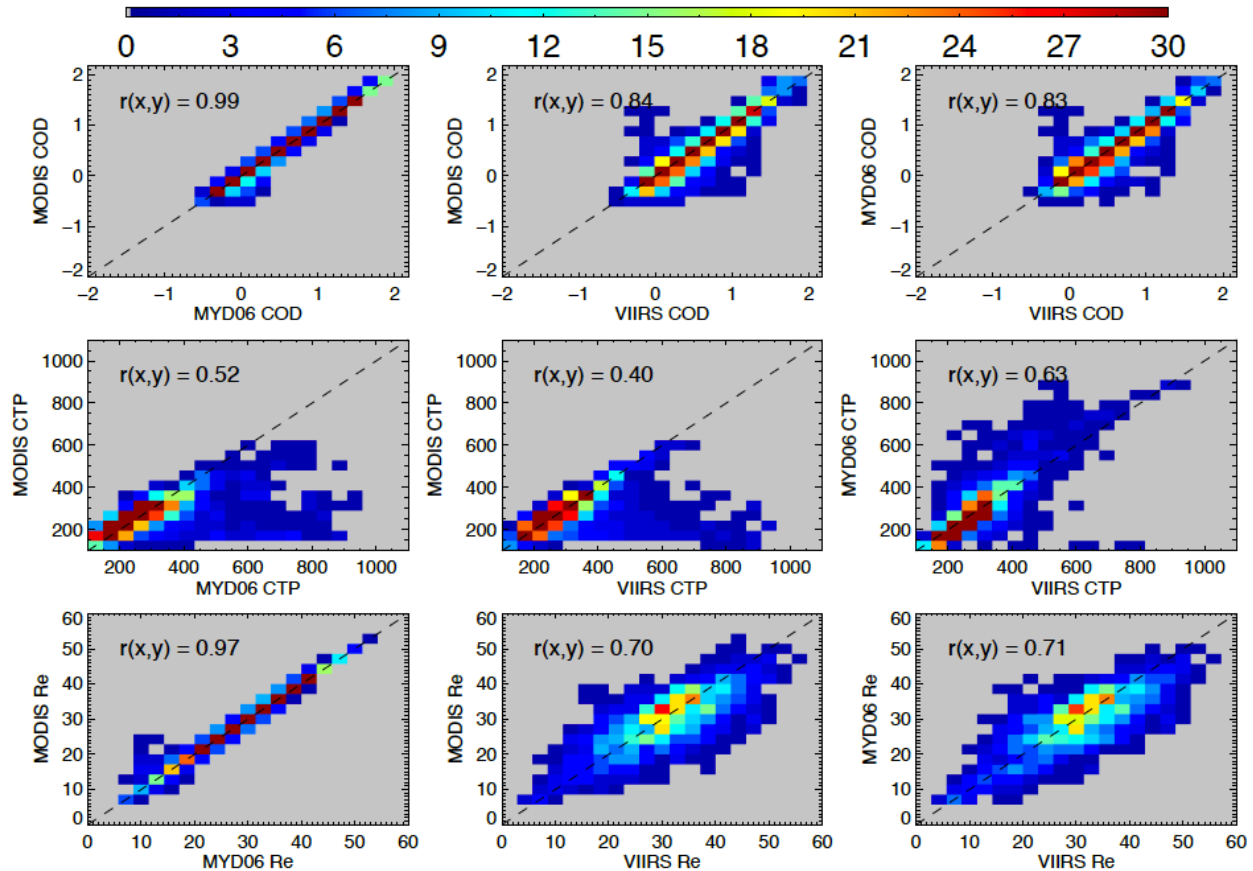


Figure S7. Similar to Fig. 7, but for ice-cloud-only sounder FOVs, which are determined as more than 80% of collocated MYD06 cloudy pixels reported as ice phase clouds in the optical property cloud phase retrieval. Comparison of cloud optical depth (COD, in log10 scale), cloud top pressure (CTP, hPa), and effective particle size (Re, μm) retrieved by MODIS and VIIRS cloud algorithms. The mean imager cloud properties over corresponding sounder FOVs are compared over the SNOs. From left to right show the results of following comparisons: *Aqua* MODIS continuity cloud products (CLDPROP_MODIS) with MYD06, CLDPROP_MODIS with *SNPP*-VIIRS continuity cloud products (CLDPROP_VIIRS), and MYD06 with CLDPROP_VIIRS, respectively. Linear correlation coefficients between the variables on x- and y-axes are given in each plot.

Frequency of Occurrence(%) by Mean Cloud Properties over Sounder FOV:
Imager to Imager; Liquid Cloud Only

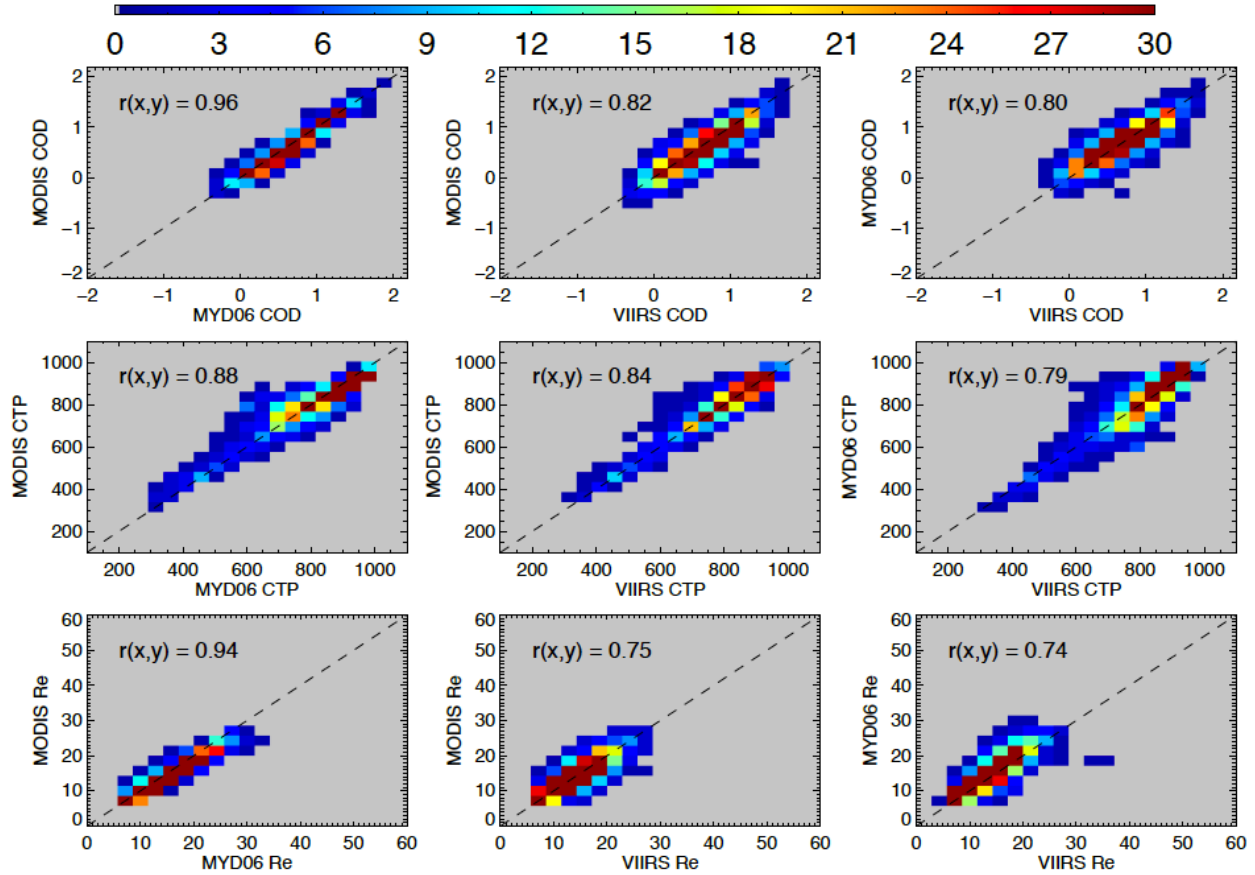


Figure S8. Similar to Fig. S7, but for liquid-cloud-only sounder FOVs, which are determined as more than 80% of collocated MYD06 cloudy pixels reported as liquid phase clouds in the optical property cloud phase retrieval.

Frequency of Occurrence (%) by Cloud Property Standard Deviation over Sounder FOV:
Imager to Imager; Ice Cloud Only

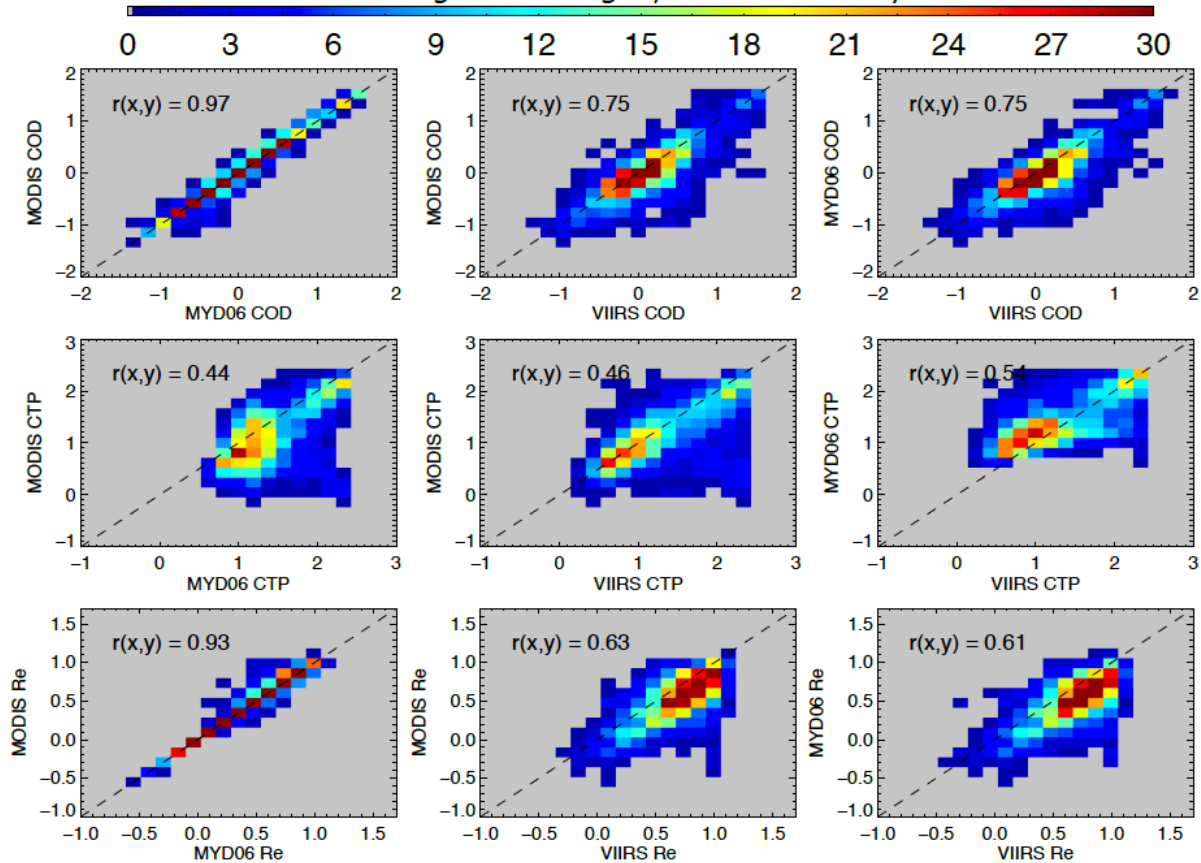


Figure S9. Similar to Fig. S7, except showing comparisons of standard deviation of cloud properties over the ice-cloud-only sounder FOV, which are calculated using the finer resolution imager observations collocated with the same sounder FOV. All the results are presented on log₁₀ scale. Linear correlation coefficients between the variables on x- and y- axes are given in each plot.

Frequency of Occurrence (%) by Cloud Property Standard Deviation over Sounder FOV:
Imager to Imager; Liquid Cloud Only

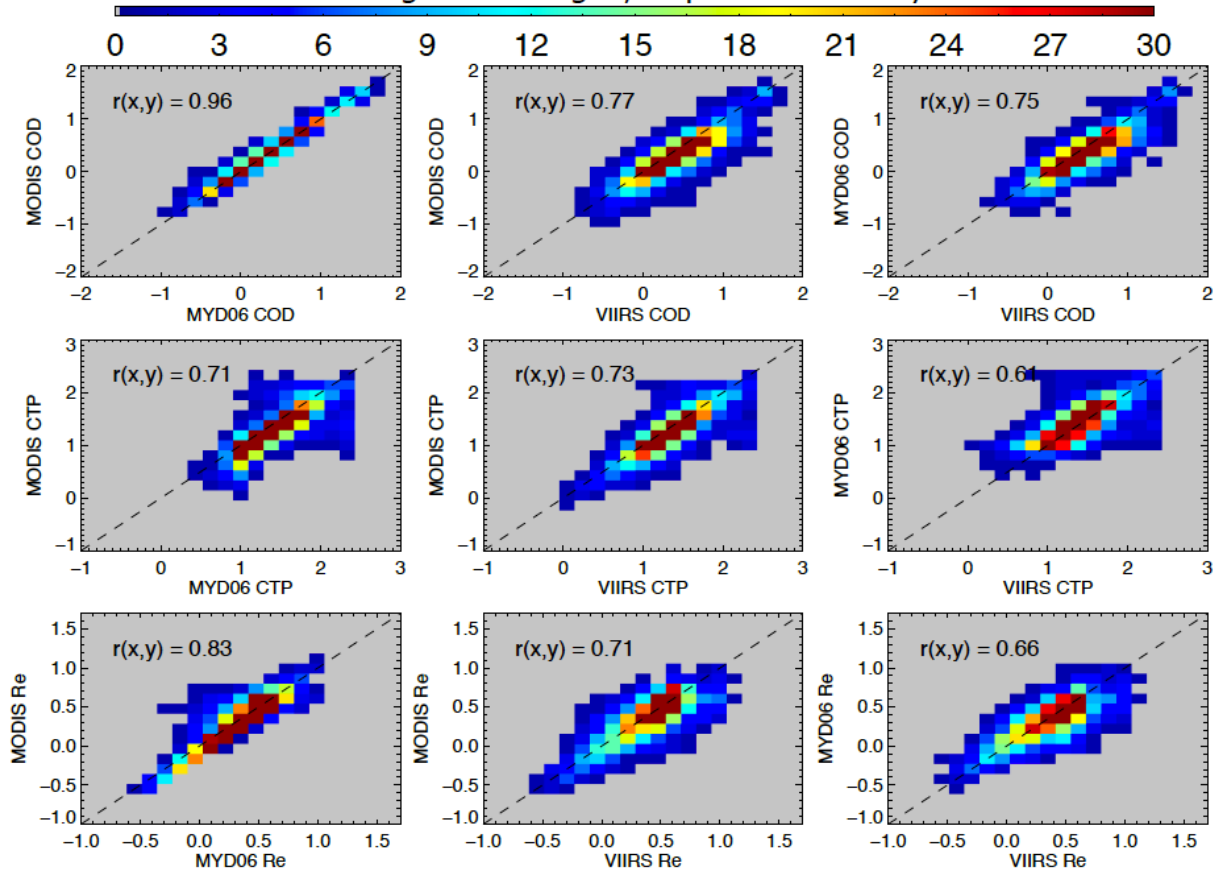


Figure S10. Similar to Fig. S9, but for liquid-cloud-only sounder FOVs, which are determined as more than 80% of collocated MYD06 cloudy pixels reported as liquid phase clouds in the optical property cloud phase retrieval.