Poster 710

Characteristics of Tropical Midlevel Precipitating and Non-Precipitating Clouds Using A-Train Measurements

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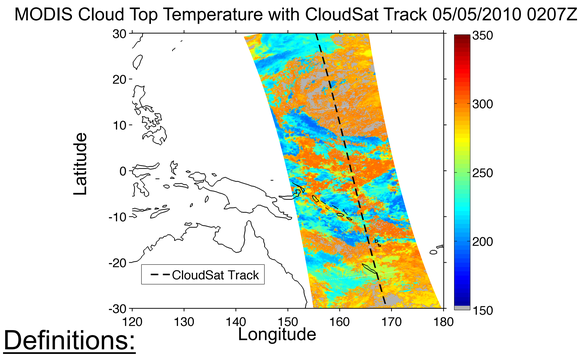
1. Introduction

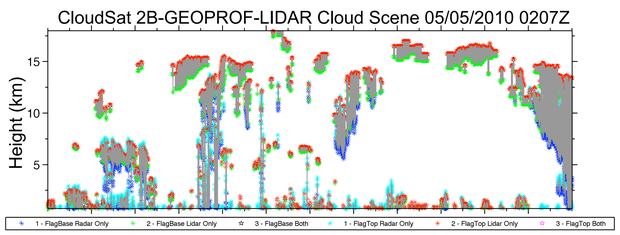
Midlevel cloud characteristics from NASA A-Train observations are analyzed to better understand these relatively unstudied clouds. Characteristics such as phase, geometric thickness, optical thickness, effective radius, and liquid/ice water path are used to study the differences between single layer precipitating and non-precipitating midlevel clouds.

2. Data

- Region: Tropical Western Pacific
- Time Period: January – December 2010
- Data: Daytime, oceanic midlevel clouds identified using co-located MODIS, CALIPSO, and CloudSat observations

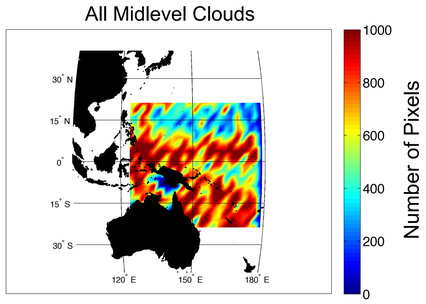


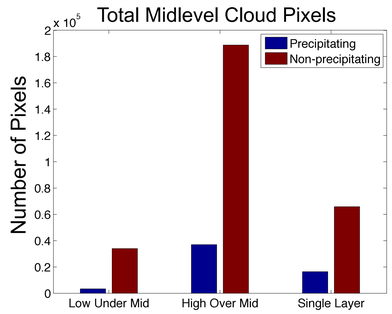
- Definitions:
  - Midlevel clouds have cloud top height between 4 and 8 km from CALIPSO
  - Precipitation detection from CloudSat 2C-RAIN-PROFILE
  - Cloud phase (ice/water) and properties from MODIS MAC06S0



- Because tropical clouds frequently occur in multilayer scenes, data is filtered for three categories:
  - multilayered clouds (high over midlevel)
  - multilayered clouds (low under midlevel)
  - **single layer midlevel clouds**

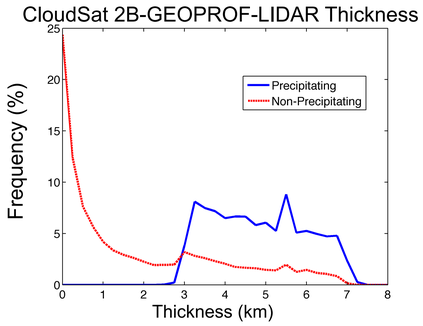
3. Cloud Frequency

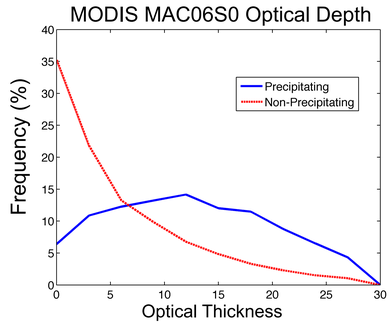




- Midlevel clouds are most frequent in the ITCZ and the SPCZ
- High clouds over midlevel clouds dominate, however, a greater fraction of single layer clouds precipitate.

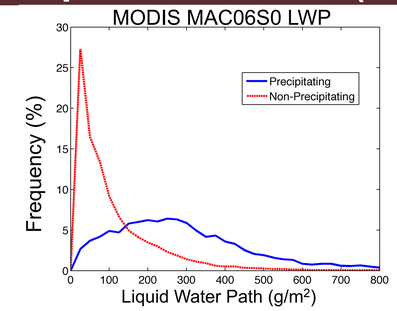
4. Cloud Geometric and Optical Thickness

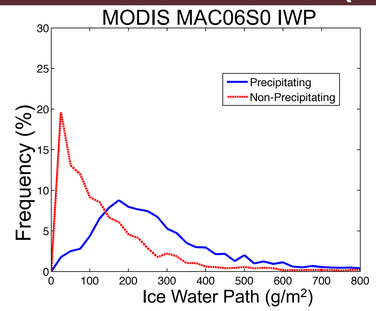




- Most non-precipitating single layer clouds have a thickness of less than 2 km and an optical depth of less than 5.
- Mean thickness of all single layer precipitating clouds is 5.19 km.

5. Liquid Water Path (LWP) and Ice Water Path (IWP)

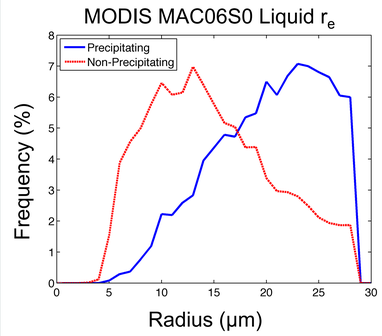




- Most non-precipitating single layer clouds LWPs and IWPs are less than 100 g/m^2.

Average	Non-Precipitating	Precipitating
LWP (g/m^2)	92	374
IWP (g/m^2)	167	383

6. Liquid and Ice Effective Radius (r_e)



- Averages for single layer midlevel clouds:

	Non-Precipitating	Precipitating
Liquid r_e (μm)	16	22
Ice r_e (μm)	18	24

- Ice particles are larger in both precipitating and non-precipitating scenes
- Larger precipitating r_e for both liquid and ice clouds

7. Future Work

- Expand observation period to 2006-2010
- Compare co-located environmental temperature and moisture profiles from AIRS/AMSU for precipitating and non-precipitating cloud scenes
- Include midlevel clouds from multi-layered cloud scenes in analyses
- Determine relationships between additional midlevel cloud properties in precipitating and non-precipitating scenes

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References

Riihimaki, L. D., S. A. McFarlane, J. M. Comstock, 2012: Climatology and Formation of Tropical Midlevel Clouds at the Darwin ARM Site. J. Climate, 25, 6835–6850.