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Full title: What CoudSat can't see: Liquid water content profiles inferred from MODIS and CALIOP observations

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CloudSat radar echoes from nonprecipitating liquid clouds can be either too weak or significantly contaminated by surface clutter effects. This paper found that the CloudSat 2B-CWC-RVOD products can miss these clouds by 73% and 84% compared to the overcast and partially cloudy pixels for liquid clouds detected by MODIS. In addition, this paper developed and validated a method to obtain the vertical profiles of cloud properties under such conditions using MODIS and CALIOP products collocated with CloudSat. The method aims at filling the data gap in nonprecipitating liquid clouds that the CloudSat 2B-CWC-RVOD product misses. The method uses the sub-adiabatic assumption to interpret the MODIS-derived cloud properties into the vertical profiles of these properties. The developed method can successfully reproduce the probability density distribution of the cloud water path for clouds detected by radar, confirming the consistency with that from the CloudSat 2B-CWC-RVOD product.

Furthermore, case studies demonstrated that the cloud profiles based on the new method could supplement the CloudSat profiles. Thus, this method is considered a plausible approach to obtaining the vertical profile of nonprecipitating liquid clouds when the CloudSat radar profile is unavailable. This paper is well-written and well-organized. The topic is suitable for a formal publication in Atmospheric Measurement Techniques. This manuscript can be accepted after minor revisions. I have only several comments that the author can consider for improving the manuscript.

Minor comments

1. Eq. (11) on page 7: The cloud depth H (i.e., geometric thickness) is derived from cloud optical thickness and effective radius from the MODIS cloud product. I wonder if this formulation guarantees that the cloud bottom does not reach the

ground level or does not provide such situations in practice.

2. Lines 191-192 on page 8: As the MODIS product assumes the single-layer homogeneous cloud in the retrieval process, applying this assumption to vertically inhomogeneous clouds leads to a systematic bias in the retrieval products (i.e., τ and r_e) due to vertically inhomogeneous microphysical properties (Platnick, 2000). Although these biases are small for adiabatic clouds (Saito et al., 2019), it would be good to mention this here.

3. Line 239 on page 8: “estimates of estimates of” should be “estimates of.”

4. Line 281 on page 10: Figure 9a shows SW reflectance (true color), but the corresponding description indicates IR brightness temperature. Please clarify this.

5. Line 290-291 on page 10: “are some are some” should be “are some.”

Platnick, S. (2000). Vertical photon transport in cloud remote sensing problems. Journal of Geophysical Research, 105(D18), 22,919–22,935. https://doi.org/10.1029/2000JD900333

Saito, M., Yang, P., Hu, Y., Liu, X., Loeb, N., Smith Jr, W. L., & Minnis, P. (2019). An efficient method for microphysical property retrievals in vertically inhomogeneous marine water clouds using MODIS-CloudSat measurements. Journal of Geophysical Research: Atmospheres, 124. https://doi. org/10.1029/2018JD029659