

Can active and passive instruments remotely sense the same clouds?

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It is a great challenge to derive true cloud fractions (CFs) from both active and passive remote sensing observations, and it is even more difficult to infer their vertical distributions globally and regionally. With the NASA Clouds and the Earth's Radiant Energy System (CERES) Edition 4 cloud property products in conjunction with the availability of long-term DOE ARM ground-based and NASA CloudSat–CALIPSO spaceborne radar–lidar observations, we will tentatively answer the following two scientific questions:

- 1) Can space- and ground-based radar–lidar combinations observe the same types and amounts of clouds over different climatic regions, such as those represented by the ARM SGP, NSA, ENA, and TWP sites?
- 2) Are clouds detected and analyzed using passive satellite remote sensing, such as in the CERES MODIS and GEO products, comparable to these actively sensed clouds over these four regions?

Our preliminary results show that the passively sensed CFs from CERES MODIS and GOES are approximately 10% lower than the CloudSat–CALIPSO radar–lidar detected counterparts. This 10% difference is primarily due to the optically thin clouds detected by CALIPSO but not by passive remote sensors (MODIS and GOES). Comparing to ARM CFs, CERES-retrieved clouds have the same seasonal variations but CERES CFs are 5% and 7% lower than the ARM observations at the ARM NSA and SGP sites, respectively. The CFs detected by the CloudSat–CALIPSO active sensors are 6.3% lower than ARM NSA observations because they missed some low-level clouds (below 1 km) over the Arctic. However, they are 2.3% higher than ARM SGP observations because CALIPSO can detect more optically thin high-level clouds. Therefore, knowing the limitation of platforms and retrieval methods, we have been endeavoring to uncover the physical mechanisms underlying each measurement and retrieval method with the aid of multiple instruments on various platforms. In-depth analyses for ARM ENA and TWP sites are currently ongoing and will be presented at the ELX-XVIII.

Mode of presentation: Invited