A Simple Algorithm to Find Cloud Optical Depth Applied to Thin Ice Clouds

Contributors

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Research Highlight

We have developed a simple, semi-empirical algorithm for finding cloud optical depth from surface-based broadband solar irradiance measurements. The algorithm consists of a one-line equation and is therefore very easy to apply. In a previous paper (Barnard and Long, 2004), the method was applied to warm, liquid water clouds. Here we describe the performance of the algorithm when applied to ice clouds.

Ice cloud properties have been investigated extensively using data from the 2000 ARM Climate Research Facility (ACRF) cloud intensive operating period (IOP) and the ACRF Tropical Warm Pool-International Cloud Experiment (TWP-ICE). In particular, data from these experiments have provided a means to evaluate ground-based inferences of cloud optical depth. We applied our simple algorithm to these two cases and found that it worked as well as other algorithms (except for cases of very low optical thickness). The algorithm's performance is illustrated in Figure 1, in which it is seen that cloud optical depth derived from the algorithm tracks optical depths, obtained from other methods, quite well.

The simple method described here seems to work as well as other methods, except for the thinest of clouds (optical depth less than about 0.1). The method can be used to estimate cloud optical depth distributions at the diverse, worldwide locations where broadband irradiances are measured.

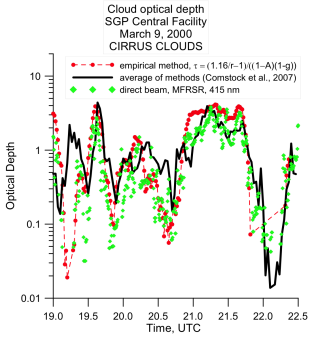

Figure 1: Cloud optical depth from: (1) an average of many methods, as described in Comstock et al. (2007), (2) direct beam measurements of the multi-filter rotating shadowband radiometer (MFRSR; Min et al., 2004), and (3) simple algorithm developed by Barnard et al. (2008)

Reference(s)

Barnard, JC, CN Long, EI Kassianov, SA McFarlane, JM Comstock, M Freer, and GM McFarquhar. 2008. "Development and evaluation of a simple algorithm to find cloud optical depth with emphasis on thin ice clouds ." The Open Atmospheric Science Journal 2, doi: 10.2174/1874282300802010046: 46-55.

Working Group(s)

Cloud Properties