Investigation of Cirrus Clouds Using the CALIPSO LIDAR data

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Cirrus clouds normally exist in the upper troposphere and sometimes extend into the stratosphere. Unlike many low altitude clouds that have a cooling effect on solar radiation through scattering, high thin cirrus clouds scatter only a small amount of solar radiation and prevent a large quantity of long-wave radiation from leaving the earth–atmosphere system. Cirrus clouds are globally distributed and are composed almost exclusively of non-spherical ice crystals. Maxima in thin, near-tropopause cirrus tend to occur over regions of intense convective activity like equatorial Africa and South America, both of which are sites for vigorous continental convection, and the western Pacific, which is a site of significant oceanic convection. The increase of high clouds is partially correlated to the formation of contrails produced by jet airplanes. Few instruments can deduce the global presence of cirrus clouds, especially subvisual clouds and those of low optical thickness. However, a global characterization of cirrus cloud properties is critical to understanding feedback processes that regulate or modulate the climate response to forcing. The Cloud-Aerosol Lidar and Infrared Pathfinder Satellite Observations (CALIPSO) satellite mission provides comprehensive observations of cloud vertical structure on a near-global scale. The CALIPSO payload consists of three nadir-viewing instruments: the Cloud-Aerosol Lidar with Orthogonal Polarization (CALIOP), the French-built Imaging Infrared Radiometer (IIR) and the Wide Field Camera (WFC). The CALIOP data products are archived with a vertical resolution of 30 m from 0 to 8 km, and 60 m from 8 to 20 km. We use the CALIOP data to characterize cirrus clouds. The vertical distribution of cirrus clouds occurrence frequencies are presented at different latitude bands. We also study the zonal mean distribution of the cirrus cloud thickness measured by CALIOP as a function of latitude.

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