Postprint on Cloud Macroscopic Characteristics over the Qilian Mountains and Central Gansu Region Based on Satellite Remote Sensing

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Abstract

An analysis of the macroscopic characteristics of different cloud types in the Qilian Mountains, central Gansu, and Shiyang River basin was conducted using CloudSat and CALIPSO satellite remote sensing data from 2007–2010 and ground precipitation data (1996–2016) provided by the China Meteorological Data Center (CMDC). The results indicate that the seasonal variation of total cloud fraction is relatively consistent across all study regions, with higher values occurring in spring and summer, both exceeding 70%. High-value zones of total cloud fraction are primarily concentrated on the southern slope of the Qilian Mountains, coinciding with the distribution of high precipitation areas. The maximum cumuliform cloud fraction occurs in summer, and the precipitation frequency of cumuliform clouds exceeds that of stratiform clouds. Cloud layers are dominated by single-layer clouds with thicknesses exceeding 2.0 km, with the maximum thickness of single-layer clouds in central Gansu reaching 3.0 km in spring; the interlayer thickness of double-layer clouds is greater than that of triple-layer clouds. Among precipitation-producing clouds, cumuliform clouds and single-layer clouds exhibit relatively high occurrence frequencies. The vertical distribution trends of cloud frequency are broadly similar across all regions, with stratiform clouds appearing at heights ranging from 0.5 km to 12.0 km above the surface and cloud frequency peaks occurring at approximately 6.0 km; the vertical distribution of cumuliform cloud frequency is significantly lower than that of stratiform clouds, with peaks appearing at approximately 1.5 km.

Full Text

Preamble

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Cloud Macro-Features over the Qilian Mountains and Central Gansu Based on Satellite Remote Sensing

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Abstract: This study utilizes CloudSat and CALIPSO satellite remote sensing data from 2007 to 2010, along with precipitation data from the China National Meteorological Information Center (CMDC) spanning 1996 to 2016, to analyze the macroscopic characteristics of different cloud types over the Qilian Mountains, central Gansu Province, and the Shiyang River Basin. The results reveal consistent seasonal variation in total cloud fraction across all study areas, with elevated values occurring primarily in spring and summer. High cloud fraction areas were predominantly located on the southern slopes of the Qilian Mountains, coinciding with regions of high precipitation. Cumulus cloud fraction peaked in summer, and cumulus clouds exhibited higher precipitation frequency than stratiform clouds. Single-layer clouds dominated, with thicknesses exceeding 2.0 km; the maximum thickness of single-layer clouds over central Gansu reached 3.0 km in spring. Two-layer cloud systems were thicker than three-layer systems. Cumulus clouds and single-layer precipitation-producing clouds occurred most frequently. The vertical distribution pattern of cloud frequency was similar across all study areas: stratiform clouds ranged from 0.5 km to 12.0 km in altitude, with peak frequency around 6.0 km, while cumulus cloud frequency peaked at a notably lower altitude of approximately 1.5 km.

Keywords: cloud; precipitation; CloudSat; CALIPSO; Qilian Mountains; Gansu

Note: Figure translations are in progress. See original paper for figures.