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Global Precipitation and Thunderstorm Frequencies. Part I: Seasonal and Interannual Variations

Aiguo Dai
National Center for Atmospheric Research[1], Boulder, Colorado

Abstract

Present and past weather reports from ∼15,000 stations around the globe and from the Comprehensive Ocean-Atmosphere Data Set (COADS) from 1975 to 1997 were analyzed for the frequency of occurrence for and the percentage of the days with various types of precipitation (drizzle, non-drizzle, showery, non-showery, and snow) and thunderstorms. In this paper, we document the mean geographical, seasonal and interannual variations in the frequencies. Drizzles occur most frequently (∼5−15% of the time) over mid- and high-latitude oceans. Non-showery precipitation is the preferred form of precipitation over the storm-track regions at northern middle and high latitudes in boreal winter and over the Antarctic Circumpolar Current in all seasons. Showery precipitation occurs ∼5−20% of the time over the oceans, compared with <10% over land areas except in boreal summer over Northern Hemisphere land areas where showery precipitation and thunderstorms occur in over 20% of the days. Inferred mean precipitation intensity is generally <1.0 mm/hr at middle and high latitudes, and ∼1.5−3.0 mm/hr in the tropics. The Inter-Tropical Convergence Zone (ITCZ) and the South Pacific Convergence Zone (SPCZ) are clearly defined in the frequency maps but not in the intensity maps. Non-showery precipitation at low latitudes is associated with showery precipitation, consistent with observations of stratiform precipitation accompanying mesoscale convective systems in the tropics. The seasonal cycles of the showery precipitation and thunderstorm frequencies exhibit a coherent land-ocean pattern that land areas peak in summer and the oceans peak in winter. The leading EOFs in the non-drizzle and non-showery precipitation frequencies are an ENSO-related mode that confirms the ENSO-induced precipitation anomalies over the open oceans previously derived from satellite estimates.

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