

Global Precipitation and Thunderstorm Frequencies.

Part II: Diurnal Variations

Aiguo Dai, NCAR. Submitted to *J. Climate*, January, 2000

Abstract

Three-hourly present weather reports from $\sim 15,000$ stations around the globe and from the Comprehensive Ocean-Atmosphere Data Set (COADS) from 1975 to 1997 were analyzed for diurnal variations in the frequency of occurrence for various types of precipitation (drizzle, non-drizzle, showery, non-showery, and snow) and thunderstorms. Significant diurnal variations with amplitudes exceeding 20% of the daily mean are found over much of the globe, especially over land areas and during summer. Drizzle and non-showery precipitation occur most frequently in the morning around 0600 local solar time (LST) over most land areas and from midnight to 0400 LST over many oceanic areas. Showery precipitation and thunderstorms occur much more frequently in the late afternoon than other times over most land areas in all seasons, with a diurnal amplitude exceeding 50% of the daily mean frequencies. Over the North Pacific, the North Atlantic, and many other oceanic areas adjacent to continents, showery precipitation is most frequent in the morning around 0600 LST, which is out phase with land areas. Over the tropical and southern oceans, showery precipitation tends to peak from midnight to 0400 LST. Maritime thunderstorms occur most frequently around midnight. Solar heating on the land surface produces a late-afternoon maximum of convective available potential energy (CAPE) in the atmosphere that favors late-afternoon moist convection and showery precipitation over land areas during summer. This strong continental diurnal cycle induces a diurnal cycle of opposite phase in low-level convergence over large nearby oceanic areas that favors a morning maximum of maritime showery precipitation. Larger low-level convergence induced by pressure tides and higher relative humidity at night than at other times may contribute to the nighttime maximum of maritime showery and non-showery precipitation over remote oceans far away from continents.