



Diurnal cycle of monsoon rainstorms in complex terrain from spaceborne and surface-based radar

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We make use of 10 years of data from the TRMM precipitation feature database to extract the diurnal cycle of rainfall over the complex terrain of the southwestern United States during the summer monsoon rainy season of July and August. This limited region in Arizona and New Mexico is chosen partly because there are data available from the 10-cm operational WSR-88D radars operated by the National Weather Service, but there are strong similarities between this region and the Sierra Madre Occidental of Mexico studied intensively during the NAME field program in 2004. Both regions are subject to occasional destructive flash flooding, and we are interested in the differences between "ordinary" and extreme events. The surface-based and satellite-based rainfall estimates are complementary, the former used to study the life cycle of specific events (but with data gaps from beam blockage by terrain), the latter not restricted geographically but temporally. We demonstrate that the diurnal cycle on most days is dominated by frequent small storms, which start before noon on the highest terrain and propagate to lower elevations during the afternoon, occasionally (but importantly) continuing to the low deserts. Events that are both large and intense occur most frequently in late afternoon. The small storms that develop early produce relatively little of the region's precipitation when compared to rainfall events that cover a large area (but lack intense convection). These rainy features have a markedly different diurnal cycle, with a maximum frequency of occurrence in the evening.