

Extreme Convection vs. Extreme Rainfall: A Global View

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ABSTRACT

Without doubt, there is more than one type of extreme weather event. Without doubt, some extremely intense convective storms also produce extreme rainfall rates. Also without doubt, some extreme rainfall rates come from storms without hail or without any symptoms of extreme convective intensity even without lightning. This paper examines the population of the full spectrum of extreme events over land and ocean, from tropics to high latitudes, with the goal of clarifying the environmental conditions conducive to these widely different events.

One archetype is common in the Great Plains of the U.S. with excessive rainfall *and* intense convection. Another is more characteristic of global oceans and monsoonal regions, with extreme short-term rainfall rates from cloud systems without strong convection. We also distinguish between extreme short-term rainfall rates and hourly or even daily extreme rainfall rates that are more likely responsible for catastrophic floods; these come almost exclusively from mesoscale convective systems (MCSs), organized on scales up to hundreds of km with lifetimes of many hours or more, vs. single-cell convective storms.

Not surprisingly, each type of extreme event tends to have a preferred diurnal and seasonal cycle, consistent with the different environments that favor each distinctive type. Last but not least, attempts to project how and where the frequency of these extreme events will change with climate change will require examination of how their distinctive environments will change in different regions of the globe. (This is an important task that is well beyond the scope of this review.)