



Heavy precipitation events where there's no rain: Saharan rainfall climatology

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The scarcity of rainfall in the Sahara, the largest desert in the world, turns almost every rainstorm into an "extreme" event. The desert is situated to the south of the Mediterranean's storm track and north of the equatorial-monsoonal rain belt, at the subsiding branch of both the Hadley and Walker circulation cells. The meager rainfall is observed by just a few rain gauges, recording few rainy days almost every year, occasionally triggering flash floods. Given the low amount of rainfall and the low number of observations, the characteristics of rainfall during such events were seldomly analyzed, especially at the scale of the whole Sahara. In this study, we (a) use high-resolution satellite remote sensing rainfall data (IMERG), to identify thousands of heavy precipitation events over the past 20 years, (b) characterize rainfall properties during these events, and (c) identify the governing atmospheric conditions on days of heavy precipitation using meteorological reanalysis (ERA5) data.

Heavy precipitation events occur throughout the Sahara, except for a small portion of its core. Southern Sahara events are the most frequent and happen mainly in summer. During winter, events occur primarily in the north and west parts of the desert. Preliminary analyses indicate that the events with the largest volume of rainfall (with volumes \geq roughly the volume of Lake Chad) are characterized by much higher than normal upper-tropospheric temperatures over the eastern Mediterranean and lower temperatures over the southern Sahara.

The small number of events at each location is compensated in our analysis by the huge area of the desert with events occurring on average every second day. The high-resolution datasets we use enable us to characterize small-size events, with substantial implications at the local scale, which can help to cope with natural hazards.