When it rains these days, does it pour? Has the weather become stormier as the climate warms?

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There's little doubt—among scientists at any rate—that the climate has warmed since people began to release massive amounts greenhouse gases to the atmosphere during the Industrial Revolution.

But ask a scientist if the weather is getting stormier as the climate warms and you're likely to get a careful response that won't make for a good quote.

There's a reason for that.

"Although many people have speculated that the weather will get stormier as the climate warms, nobody has done the quantitative analysis needed to show this is indeed happening," says Jonathan Katz, PhD, professor of physics at Washington University in St. Louis.

In the March 17 online version of *Nature Climate Change*, Katz and Thomas Muschinksi, a senior in physics who came to Katz looking for an undergraduate thesis project, describe the results of their analysis of more than 70 years of hourly precipitation data from 13 U.S. sites looking for quantitative evidence of increased storminess.

They found a significant, steady increase in storminess on the Olympic Peninsula in Washington State, which famously suffers from more or less continuous drizzle, a calm climate that lets storm peaks emerge

clearly.

"Other sites have always been stormy," Katz says, "so an increase such as we saw in the Olympic Peninsula data would not have been detectable in their data."

They may also be getting stormier, he says, but so far they're doing it under cover.

The difference between wetter and stormier

"We didn't want to know whether the rainfall had increased or decreased," Katz says, "but rather whether it was concentrated in violent storm events."

Studies that look at the largest one-day or few-day precipitation totals recorded in a year, or the number of days in which in which total precipitation is above a threshold, measure whether locations are getting wetter, not whether they're getting stormier, says Katz.

To get the statistical power to pick up brief downpours rather than total preciptation, Muschinski and Katz needed to find a large, fine-grained dataset.

"So we poked around," Katz says, "and we found what we were looking for in the National Oceanic and Atmospheric Administration databases."

NOAA has hourly precipitation data going back to 1940 or even further for many locations in the United States. Muschniski and Katz chose 13 sites that had long runs of data and represented a broad range of climates, from desert to rain forest.

They then tested the hypothesis that storms are becoming more frequent

and intense by taking different measurements of the "shape" formed by the data points for each site.

Measuring these "moments" as they're called, is a statistical test commonly used in science, says Katz, but one that hasn't been applied to this problem before.

"We found a significant steady increase in stormy activity on the Olympic Peninsula," Katz says. "We know that is real."

"We found no evidence for an increase in storminess at the other 12 sites," he said, "but because their weather is intrinsically stormier, it would be more difficult to detect a trend like that at the Olympic Peninsula even if it were occurring."

The next step, Katz says, is to look at a much large number of sites that might be regionally averaged to reveal trends too slow to be significant for one site.

"There are larger databases," he says, "but they're also harder to sift through. Any one site might have half a million hourly measurements over the period we're looking at, and to get good results. we have to devise an algorithm tuned to the database to filter out spurious or corrupted data."

You could call that a rainy-day project.

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