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How Dust Could Solve California's Drought

Dusty air can change the amount of precipitation produced by clouds

ClimateWire

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With 80 percent of California in a state of extreme drought, you wouldn't think dust would be the answer to the state's water woes. New research presented in San Francisco yesterday suggests, however, that dusty air blown across the Pacific Ocean from Asia and Africa could be influencing precipitation in the region.

Monterey, California.
Credit: mLu.fotos via Flickr

In a presentation at a national meeting of the American Chemical Society yesterday, Kim Prather from the University of California, San Diego, described research she is leading into the dust swept westward by the jet stream. The dust—and the tiny bacteria and molecules it carries with it across the Pacific Ocean—is then mixing with other airborne particles like sea spray and smoke to have distinct and variable impacts on clouds and precipitation, Prather said.

Prather's new research could be the first step in a longer process toward better predicting—and maybe even artificially manufacturing—rainfall events.

"Precipitation depends on ice; it's very sensitive to ice in a cloud, so figuring out what forms ice [in clouds] is sort of the holy grail of the measurements we've been trying to do, and it's a very chemically selective process," Prather said at the ACS meeting yesterday afternoon.

'It's like a switch'

An important process in clouds creating precipitation is their ability to form ice crystals around the microscopic particles that infiltrate and "seed" them, according to Prather. Without ice crystals, it can be much harder for clouds to produce precipitation.

Prather said her team's research is going to investigate the earliest stages of this ice-forming process, trying to distinguish the different effects that different microbes and bacteria can have when they infiltrate a cloud.

Experiments Prather and her team conducted in California's Sierra Nevada produced the first conclusive evidence that dust aerosols can change the amount of precipitation produced by clouds.

"Nobody kind of believed that they could change the amount of water or snow you get," Prather said. "This was the first evidence that they could, in fact, change the amount of precipitation."

"It's like a switch. If these particles aren't there, clouds just sit there and maybe rain a little bit," Prather added.

Not all dust aerosols help generate precipitation, Prather said. In particular, human-induced aerosols like soot and combustion particulates actually work the opposite, reducing the amount of precipitation clouds can form.

But through future research, Prather said, scientists could gain a better understanding of how different aerosols react with clouds. This research could in turn help lead to more accurate weather and rainfall forecasting by tracking the kind of dust that gets blown toward the West Coast.

"You can see this dust marching across the Pacific," Prather said.

"If we know these conditions," she added, "we can think about water resources and can we let water out of our dams."

A difficult path toward manufacturing rain

But a lack of dust isn't California's problem right now, Prather said. The West Coast can rely on a steady stream of dust particles from Africa and Asia—it takes between seven and 10 days for the dust to cross the Pacific Ocean, Prather added, and dust can circumnavigate the globe in a matter of weeks—but what the western United States has been missing during this drought is the other main part of the equation: clouds that the dust can seed.

Without clouds, there is nothing for the dust particles to seed and generate rain or snowfall. But if scientists are able to gain a deeper understanding of which dust particles best form ice and which don't, they may be able to maximize precipitation when clouds do form and stave off future droughts like the one that has beset California recently (*ClimateWire*, Aug. 4).

More than 80 percent of California is in a state of extreme drought, according to the National Drought Mitigation Center. Almost 60 percent of the state is in a state of "exceptional drought"—the most severe category.

"Right now, the tricky part is it doesn't really matter what dust is doing if we don't have clouds," Prather said.

A deeper understanding of dust aerosols and their effects on precipitation could also be used to boost precipitation artificially, Prather said. There are inherent dangers when it comes to tampering with natural processes, however, and Prather said that what could be seeded into a cloud one day to increase precipitation could fall down to the ground later as a pollutant.

"A lot of people are thinking about what we can put up there," she said, "but in trying to fix one environmental problem, you can create another one."

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