

A warming world increases air pollution

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Climate change is warming the ocean, but it's warming land faster and that's really bad news for air quality all over the world, says a new University of California, Riverside study.

The study, published February 4 in *Nature Climate Change*, shows that

the contrast in [warming](#) between the continents and sea, called the land-sea warming contrast, drives an increased concentration of aerosols in the atmosphere that cause air pollution.

Aerosols are tiny solid particles or liquid droplets suspended in the atmosphere. They can come from natural sources, like dust or wildfires, or human-made sources such as vehicle and industrial emissions.

Aerosols affect the climate system, including disturbances to the water cycle, as well as human health. They also cause smog and other kinds of air pollution that can lead to health problems for people, animals, and plants.

"A robust response to an increase in [greenhouse gases](#) is that the land is going to warm faster than the ocean. This enhanced land warming is also associated with increased continental aridity," explained first author Robert Allen, an associate professor of earth sciences at UC Riverside.

The increase in aridity leads to decreased low cloud cover and less rain, which is the main way that aerosols are removed from the atmosphere.

To determine this, the researchers ran simulations of [climate change](#) under two scenarios. The first assumed a business-as-usual warming model, in which warming proceeds at a constant, upward rate. The second model probed a scenario in which the land warmed less than expected.

In the business-as-usual scenario, enhanced land warming increased continental aridity and, subsequently, the concentration of aerosols that leads to more air pollution. However, the second model—which is identical to the business-as-usual model except the land warming is weakened—leads to a muted increase in continental aridity and air pollution. Thus, the increase in air pollution is a direct consequence of enhanced land warming and continental drying.

The results show that the hotter Earth gets, the harder it's going to be to keep air pollution down to a certain level without strict control over the sources of aerosols.

Because the researchers wanted to understand how greenhouse gas warming affects air pollution, they assumed no change to human-made, or anthropogenic, aerosol emissions.

"That's probably not going to be true because there's a strong desire to reduce air pollution, which involves reducing anthropogenic aerosol emissions," cautioned Allen. "So this result represents an upper bound."

But it also suggests that if the planet keeps warming, larger reductions in anthropogenic aerosol emissions will be required to improve air quality.

"The question is what level of air quality are we going to accept," said Allen. "Even though California has some of the strictest environmental laws in the country we still have relatively poor [air quality](#), and it's much worse in many countries."

Unless anthropogenic emission reductions occur, a warmer world will be associated with more aerosol pollution.

The paper, "Enhanced land–sea warming contrast elevates [aerosol pollution](#) in a warmer world," was co-authored by Allen and Taufiq Hassan, a [doctoral student](#) at UC Riverside, Cynthia A. Randles, a researcher with Exxon Mobil, and Hui Su, a researcher at NASA's Jet Propulsion Laboratory.

More information: Robert J. Allen et al, Enhanced land–sea warming contrast elevates aerosol pollution in a warmer world, *Nature Climate Change* (2019). [DOI: 10.1038/s41558-019-0401-4](https://doi.org/10.1038/s41558-019-0401-4)

Provided by University of California - Riverside

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