

Climate engineering off US coast could increase heatwaves in Europe, study finds

Scientists call for regulation to stop regional use of marine cloud brightening having negative impact elsewhere

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A geoengineering technique designed to reduce high temperatures in California could inadvertently intensify heatwaves in [Europe](#), according to a study that models the unintended consequences of regional tinkering with a changing climate.

The paper shows that targeted interventions to lower temperature in one area for one season might bring temporary benefits to some populations, but this has to be set against potentially negative side-effects in other parts of

the world and shifting degrees of effectiveness over time.

The authors of [the study](#) said the findings were “scary” because the world has few or no regulations in place to prevent regional applications of the technique, marine cloud brightening, which involves spraying reflective aerosols (usually in the form of sea salt or sea spray) into stratocumulus clouds over the ocean to reflect more solar radiation back into space.

Experts have said the paucity of controls means there is little to prevent individual countries, cities, companies or even wealthy individuals from trying to modify their local climates, even if it is to the detriment of people living elsewhere, potentially leading to competition and conflict over interventions.

The recent sharp rise in global temperatures has prompted some research institutions and private organisations to engage in geoengineering research that used to be virtually taboo.

In Australia, scientists have been [trailing marine cloud brightening](#) strategies for at least four years to try to cool the Great Barrier Reef and slow its bleaching.

Earlier this year, scientists at the University of Washington [sprayed sea-salt particles across the flight deck of a decommissioned aircraft carrier](#), the USS Hornet, docked in Alameda in San Francisco Bay. This experiment was halted by the local government to allow it to evaluate whether the spray contains chemicals that might pose a health risk to people or animals in the Bay area.

The new paper suggests the consequences could be much further reaching and harder to predict. Published on Friday in Nature Climate Change, the authors claim to be the first to demonstrate that cloud brightening effects can diminish or reverse as climate conditions change due to the already dramatic human impacts of burning fossil fuels and forests.

Using Earth system computer models of the climate in 2010 and 2050, they simulated the impacts of two cloud brightening operations carried out over

different regions of the north-eastern Pacific Ocean, one in the subtropics near California and one in the mid-latitudes near Alaska. Both were designed to reduce the risk of extreme heat on the target region, the US west coast.

Counterintuitively, the more distant operation had the greater impact because it tapped into “teleconnections”, links in the climate system between geographically remote parts of the world.

The 2010 simulation suggested the operation near Alaska would lower the risk of dangerous heat exposure in the target region by 55% – equivalent to 22 million people-days per summer – while the closer subtropical test would cause smaller but still significant gains of 16%.

In simulations of the more disrupted climate of 2050, however, the same two operations produced very different results because there were fewer clouds, higher base temperatures and a slowing of the Atlantic meridional overturning circulation (AMOC). Under these mid-century conditions, the operation near Alaska would have a drastically reduced effect on relieving heat stress in the

western US, while the subtropical operation would push temperatures higher – the opposite of the desired result.

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The consequences outside the target regions were also markedly different between 2010 and 2050. At the earlier date, the simulations suggested Europe would also be cooled by the marine cloud brightening in the north Pacific. However, by 2050, the local cooling operation would increase heat stress around the world, particularly over Europe, as a result of the slowing of Amoc.

“Our study is very specific,” said Jessica Wan, who is part of the research team led by UC San Diego’s Scripps Institution of Oceanography. “It shows that marine cloud brightening can be very effective for the US west coast if done now, but it may be ineffective there in the future and could cause heatwaves in Europe.”

She said the results should concern policymakers, and prompt them to

establish governance structures and transparency guidelines, not just on a global level but regionally.

“There is really no solar geoengineering governance right now. That is scary. Science and policy need to be developed together,” she said. “We don’t want to be in a situation where one region is forced to do geoengineering to combat what another part of the world has done to respond to droughts and heatwaves.”