

Heatwaves to move toward coasts, study finds

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(Phys.org)—A new study by researchers at Scripps Institution of Oceanography, UC San Diego, suggests that the nature of California heatwaves is changing due to global warming.

[Climate researchers](#) Alexander Gershunov and Kristen Guirguis detected a trend toward more humid [heatwaves](#) that are expressed very strongly in elevated nighttime temperatures, a trend consistent with [climate change](#) projections. Moreover, relative to local warming, the mid-summer heatwaves are getting stronger in generally cooler coastal areas. This carries implications for the millions of Californians living near the ocean whose everyday lives are acclimated to moderate temperatures.

"Heatwaves are stressful rare extremes defined relative to [average temperatures](#)," said Gershunov. "We've known for a while that humid heatwaves that are particularly hot at night are on the rise in California as the [climate](#) warms. Here, we sharpen the geographic focus to consider sub-regions of the state."

Gershunov added that in this new sharper and "non-stationary" perspective, coastal heatwaves express much more intensely than those inland where the summertime mean warming is stronger. This translates to a variety of impacts on the typically cool, un-acclimated coast.

Classic California heatwaves have been characterized as interior desert and valley events that are hot during the day and marked by dryness and strong nighttime cooling. Gershunov and Guirguis said their analysis of observations and [computer model](#) data indicates that the emerging flavor of heatwaves marked by greater humidity, greater expression in nighttime temperatures, and greater expression in coastal areas relative to the generally cooler coast are intensifying and will keep intensifying in coming decades. Both coastal and desert heatwaves will continue to be more common as climate changes relative to the past, but the desert heatwaves are becoming less intense relative to strong average warming observed and projected for the interior of the state.

The study, "California heat waves in the present and future," will appear in the American Geophysical Union journal *Geophysical Research Letters*.

The "non-stationary" approach reflects an acknowledgment by scientists that what has been considered extreme heat is gradually becoming commonplace. The rate of climate warming necessitates a measure of extreme heat relative to the changing average climate rather than to historical climate norms. So, instead of defining heatwaves relative to fixed temperature thresholds, the researchers projected heatwave intensity against a backdrop of increasing average summertime temperature. This causes the definition of heatwaves – temperatures in the warmest 5 percent of summertime conditions – to evolve with the changing climate and reflect extreme conditions relevant to the climate of the time.

"The advantage of using this evolving 'non-stationary' definition is that heatwaves remain extreme events even under much warmer climate," said Gershunov. "If they change in this evolving framework, it's because the variance of temperature is changing, not just the average."

The authors point out that the trend could precipitate a variety of changes in California's coastal communities, where stronger heat will lead to the installation of air conditioners in homes traditionally not in need of cooling.

This lifestyle trend would in turn affect energy demand in [coastal areas](#), its magnitude and timing. In the absence of technological or physiological acclimatization, high humidity and the lingering of heat through the night is expected to have strong public health implications, placing added stress on many of the more than 21 million [Californians](#) who live in coastal counties. The same would be true for animals and plants living in the highly populated and diverse coastal zone.

"This trend has important human health implications for coastal California where most of the state's population lives," said Guirguis. "Coastal communities are acclimated to cooler mean temperatures and are not well prepared for extreme heat either physiologically or technologically through air conditioning use. Populations tend to adapt to changes in their average conditions but extreme events can catch people off guard. An increase in heat wave intensity relative to average conditions could mean much more heat-related illness during heat waves unless effective heat emergency plans are implemented."

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