

entire region," Villaraigosa said. "With good data driving good policies, we can craft innovative solutions that will preserve our environment and enhance the quality of life for the next generation of Angelenos."

Facts and figures from the study

The study looked at the years 2041–60 to predict the average temperature change by mid-century. The data covers all of Los Angeles County and 30 to 60 miles beyond, including all of Orange County and parts of Ventura, San Bernardino, and Riverside counties, and reaching as far as Palm Springs, Bakersfield, and Santa Barbara. The study overlaid this entire area with a grid of squares 1.2 miles across and provided unique temperature predictions for each square. This is in contrast to global climate models, which normally use grids 60 to 120 miles across—big enough to include areas as different as Long Beach and Lancaster.

According to the study, coastal areas like Santa Monica and Long Beach are likely to warm an average of 3 to 4 degrees. Dense urban areas like downtown Los Angeles and the San Fernando and San Gabriel valleys will warm an average of 4 degrees, and mountain and desert regions like Palm Springs and Lancaster will warm 4 to 5 degrees.

Some of the smallest changes predicted, yet still nearing a 4-degree increase, are in Oxnard (3.68 degrees), Venice (3.70), Santa Barbara (3.73), Santa Monica (3.74), San Pedro (3.78), Torrance (3.80), Long Beach (3.82), and Santa Ana (3.85). Among the highest predicted increases are Wrightwood (5.37), Big Bear Lake (5.23), Palm Springs (5.15), Palmdale (4.92), Lancaster (4.87), Bakersfield (4.48), and Santa Clarita (4.44). Table 2 in the study calls out 27 distinct locations, such as downtown Los Angeles (3.92), San Fernando (4.19), Woodland Hills (4.26), Eagle Rock (3.98), Pasadena (4.05), Pomona (4.09), Glendale (3.99), and Riverside (4.23).

These figures are only annual averages, and the day-to-day increase in temperatures will vary, said Hall, who is a member of UCLA's Institute of the Environment and Sustainability (IoES) and director of the institute's Center for Climate Change Solutions. Southern Californians should expect slightly warmer winters and springs but much warmer summers and falls, with more frequent heat waves. Temperatures now seen only on the seven hottest days of the year in each region will occur two to six times as often. The number of days when the temperature will climb above 95 degrees will increase two to four times, depending on the location. Those days will roughly double on the coast, triple in downtown Los Angeles and Pasadena, and quadruple in Woodland Hills. In Palm Springs, the number of extremely hot days will increase from an annual average of 75 to roughly 120.

"Places like Lancaster and Palm Springs are already pretty hot areas, and when you tack on warming of 5 to 6 degrees, that's a pretty noticeable difference," Hall said. "If humans are noticing it, so are plants, animals and ecosystems. These places will be qualitatively different than they are now."

The most sophisticated regional climate study ever developed

The type of climate modeling used in the study is done almost exclusively at the

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national or international level, said Paul Bunje, the managing director of the LARC, which is based at UCLA's Institute of the Environment and Sustainability. Other cities and states have localized global climate models—but usually by localizing only one model. Hall's team needed months of computer time to downscale 22 global climate models, each with slightly different assumptions about how to predict climate change or factors like future greenhouse gas emissions.

Hall's team included UCLA postdoctoral students Fengpeng Sun and Daniel Walton and graduate student Mark Nakamura. Once they recalculated the almost two dozen global models at the local level, the team analyzed the results and integrated them into an ensemble projection to create the forecast for the entire region.

"This is the best, most sophisticated climate science ever done for a city," said Bunje, who is also the executive director of UCLA's IoES Center for Climate Change Solutions.

"L.A. is one of the first cities to get its act together, from the scientists all the way up to the mayor," Bunje said. "Nobody knew precisely how to adapt to climate change because no one had the data—until now. These are shocking numbers, and we will have to adapt."

Cutting emissions will reduce but not eliminate warming

Cutting greenhouse gas emissions could reduce the impact on Los Angeles, Hall said. However, even if the world has unanticipated—and perhaps unrealistic—success in drastically reducing greenhouse gas emissions, the greater Los Angeles area will still warm to about 70% of the currently predicted levels, the study found.

"We looked not only at a business-as-usual scenario where greenhouse gas emissions continue but also at a scenario where emissions are curtailed," Hall said. "Even if we drastically cut pollution worldwide, there will still be quite a bit of warming in Los Angeles. I was a little taken aback by how much warming remains, no matter how aggressively we cut back. It was sobering."

"Mid-Century Warming in the Los Angeles Region" is the first of five planned studies Hall will conduct for the city and the LARC about how climate change will affect the Southland. Hall's team plans to develop similarly comprehensive models for local rainfall, Santa Ana wind patterns, coastal fog (including June gloom), and soil moisture, run-off and evaporation. Preliminary results already show that Santa Ana winds and June gloom will react to climate change, Hall said.

Global warming is local warming

"I think for many people, climate change still feels like a nebulous, abstract, potential future change, and this makes it more real," Hall said. "It's eye-opening to see how much it will warm where you live. This data lays a foundation for really confronting this issue, and I'm very optimistic that we can confront and adapt to a changing climate."

The complete study, "Mid-Century Warming in the Los Angeles Region," along with

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interactive maps and ways to get involved, can be accessed online at c-change.la [1].

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