California Building Resilience Against Climate Effects (CalBRACE) Project

Short Title: Extreme heat days
Full Title: Projected number of extreme heat days (per year)

Why is this important to health?

Periods of warmer temperatures and heat waves are expected to increase in frequency, intensity, and duration throughout the 21st century. Specifically, there will be increases in annual average temperature of up to 5^0 F by 2030 and up to 10^0 F in California by the end of the century or sooner. Increased temperatures also add to the heat load of buildings in urban areas and exacerbate existing urban heat islands adding to the risk of high ambient temperatures. Sustained high heat waves directly affect human health through heat-related illnesses, such as heat stroke, heat exhaustion, and dehydration, as well as other illnesses and premature deaths from cardiovascular or respiratory diseases. Heat waves are associated with increased hospital admissions for cardiovascular, kidney (including kidney stones), mental health, diabetes, and respiratory disorders. Although warmer temperatures are likely to impact a range of individuals and populations, the vulnerable subgroups with the greatest risk of health impacts from extreme heat, or with greater difficulty preparing for extreme heat events and reduced access to care, may include the following populations: the elderly, children, those who work outdoors, those with lower socioeconomic status, those who are socially or geographically isolated, and those who lack adaptive capacity (e.g., air conditioning).

Summary of Evidence for Climate and Health

A systematic review of epidemiological studies examining the association between high ambient heat and mortality identified increased risk among those dying from cardiovascular, respiratory, cerebrovascular, and some specific cardiovascular diseases. The association between temperature and mortality is independent of air pollution, as supported by a time-stratified cross-over study of nine California counties. Evidence also shows that significant differences in risk exist among persons with varying physical and social vulnerabilities; thus, region specific characteristics substantially influence the effect of heat on vulnerable subgroups. A study of hospitalizations and emergency department visits during the 2006 California heatwave showed significant increases in morbidity statewide, notably among children (0-4 years old), the elderly (≥65 years old), and in regions with relatively lower temperatures compared to others, suggesting acclimatization to local climate influences heat effects.

Key References

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What is the indicator?

Detailed Definition

- Indicator = Projected annual number of extreme heat days above the 98th percentile of computed maximum temperature for each location using 1961-1990 baseline data
- Stratification: Time periods 2040-2060 and 2080-2099
- Interpretation: Vulnerable communities will have higher extreme heat days

Data Description and Source

- Historical and projected LOCA model data obtained from Cal-Adapt (cal-adapt.org)
    - Years available: 2040-2060, 2080-2099
    - Geographies available: County, Census Tract

The data are derived from daily climate projections which have been downscaled from global climate models from the CMIP5 archive, using the Localized Constructed Analogs (LOCA) statistical technique developed by Scripps Institution of Oceanography. LOCA is a statistical downscaling technique that uses past history to add improved fine-scale detail to global climate models. An extreme heat day is defined as a day in a year when the maximum temperature exceeds the 98th historical percentile of the maximum temperatures based on observed historical data from 1961-1990 between April and October. By definition the baseline annual number of extreme heat days is 4.27 for all counties and geographic units. Projected data were provided from the four models that were selected by California's Climate Action Team Research Working Group as priority models for research contributing to California's Fourth Climate Change Assessment:

1) A warm/dry simulation – HadGEM2-ES
2) A cooler/wetter simulation – CNRM-CM5
3) An average simulation (CanESM2)
4) The model simulation that is most unlike the first three for the best coverage of different possibilities – MIROC5

Data were provided for each of these four models, for the RCP 8.5 scenario, for the County and Census Tract levels. The RCP 8.5 is a scenario where emissions continue to rise strongly through 2050 and plateau around 2100.

Limitations

Climate projections tell us how weather conditions are likely to change on average, but they cannot predict the weather at a particular day and time. Climate model projections illustrate how the climate system is expected to behave under specific scenarios of greenhouse gas emissions. Since our emissions of greenhouse gases depend on a variety of different social, political, and economic factors, we cannot be certain how they will change. Therefore, projected climate data may not prove to be accurate if the actual emissions pathway we follow differs from the scenarios used to make the projections. In addition, some aspects of the climate system are less well understood than others.