

Pacific Islands Climate Change Cooperative



Projections of climate change for Hawai'i and other Pacific islands: both wetter and drier?

Scientists in Hawai'i have developed a new climate model specifically tailored to the Hawaiian Islands, dubbed the Hawaiian Regional Climate Model or HRCM. The model clearly shows that climate change will have the paradoxical effect of both increasing and decreasing rainfall in Hawai'i as average temperatures overall continue to warm.

Islands require fine-scale climate data and modeling due to their relatively small size. The HRCM is based upon global climate models but adds information specific to the islands, and simulates atmospheric processes at very fine scales.

Developing the HRCM

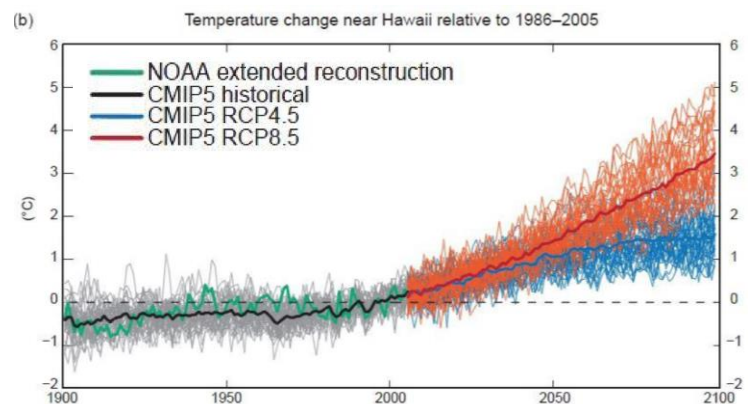
Global climate models simulate large-scale climate, and are influenced by the concentration of greenhouse gases, such as carbon dioxide, in the atmosphere. The HRCM model provides climate projections for Hawai'i that are derived from a "middle of the road" greenhouse gas emissions scenario worldwide. To develop the HRCM, researchers used these global climate models as the basis for finer scale regional simulations for Hawai'i.

They introduced detailed information on surface properties of the islands (reflectivity, land cover type, soil type, and the amount of green vegetation) and especially the rugged mountain topography, which creates the wide variety of microclimates of the islands. These sophisticated analyses were able to realistically simulate trade wind patterns and

rainfall along with fairly subtle aspects of the water cycle, including cloud formation and behavior. The scientists used the HRCM to simulate present-day conditions as well as conditions at the end of the 21st century.

Wet areas get wetter and dry areas get drier

In general, the model predicts that as warming proceeds, Hawai'i will have fewer days when thunderstorms can form. Normally, dry areas in Hawai'i depend on rising air masses (convection) to create rainfall, but the conditions that favor this will be suppressed in a warmer climate. Thus the climate projections show more drying of the already arid rain shadow areas (leeward side) of the islands. In contrast, since warmer trade winds will be able to carry more moisture, the model predicts increased rainfall on the wetter windward sides of the islands.



Projected temperature change near Hawai'i relative to 1986-2005, from 1900 to 2100 (°C)

In addition, HRCM projections show that over the oceans, rising air temperatures closely reflect the increases in sea surface temperatures derived from the global climate models. Over land, however, a clear pattern of increasing warming with height is evident. They found the greatest amount of warming expected near the summits of volcanic mountains Haleakalā, Mauna Kea, and Mauna Loa, exceeding 3.5 C. This intensified warming at higher elevations has already been observed at Hawai'i climate monitoring stations over the last few decades.

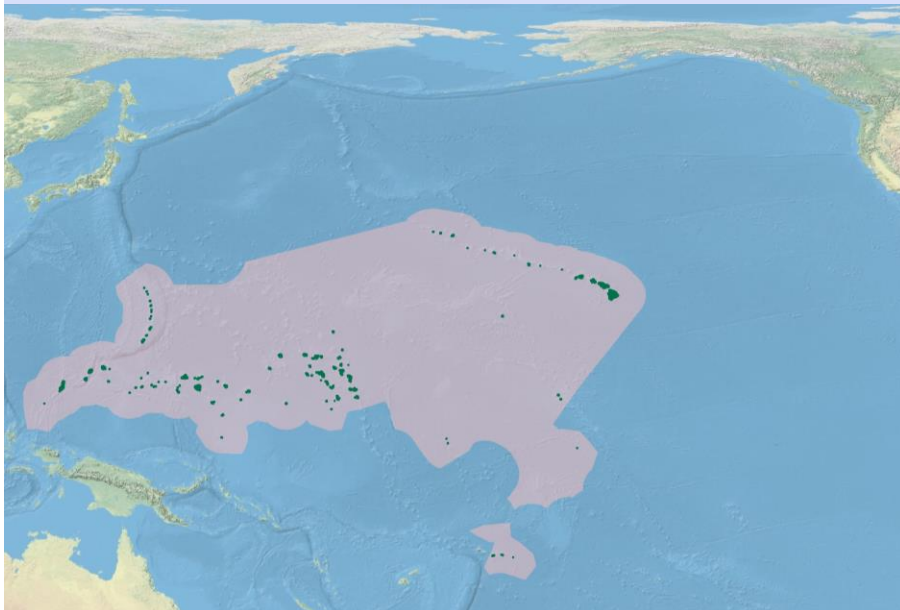
Future simulations and datasets

The HRCM simulations of future conditions have been saved in highly detailed data sets, which are already being used by other researchers to investigate the impacts of this potential future climate on water yield, agriculture, the spread of avian malaria, and various features of island ecosystems.

Several refereed journal articles based on research in this project have been prepared and published, with others to come. Detailed results of the final climate simulations will be made available through the International Pacific Research Center's interactive web portal. Further applications of the HRCM, funded by both the [Pacific Islands Climate Science Center](#) and the [Pacific Islands Climate Change Cooperative](#), are extending this approach to the Mariana Islands and American Sāmoa, and generating finer detail in Hawai'i.

For more details about this project, visit the PICCC projects page: piccc.net/our-projects.

The map below depicts the PICCC geography, which includes Hawai'i, American Sāmoa, Guam, the Northern Mariana Islands, the Marshall Islands, the Federated States of Micronesia, Palau and 4 Marine National Monuments.



Principal Investigator

Kevin Hamilton
[Univ. of Hawai'i](#) - Honolulu

Partners

[International Pacific Research Center](#),
[Univ. of Hawai'i - Mānoa](#)
[NOAA's Pacific RISA](#) (Regional
Integrated Sciences and Assessments)

[The Pacific Islands Climate Change Cooperative \(PICCC\)](#) was established in 2009 to assist those who manage native species, island ecosystems, and key cultural resources in adapting their management to climate change for the continuing benefit of the people of the Pacific Islands. The PICCC provides a range of services and tools to help managers in Hawai'i, the Mariana Islands, American Sāmoa, and other Pacific Island groups make informed decisions for conservation of natural and cultural resources including climate models at the scale of islands and archipelagos, ecological response models, and implementation and monitoring strategies for island species, resources, and communities. Our goal is to help managers reach explicit biological and cultural conservation objectives in the face of climate change and ongoing threats such as fire, land conversion, and invasive species.

Contact:

Jeff Burgett
PICCC Science Coordinator
jeff.burgett@piccc.net
677 Ala Moana Blvd., Suite 320
Honolulu, HI 96813
Phone: 808-687-6175
Fax: 808-664-8510

Banner photo of taro by Starr Environmental;
Projected temperature change in Hawai'i based
on 4 different climate models by Hamilton