High-Resolution LOCA Downscaled Climate Projections Aim to Better Represent Extreme Weather Events

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Greenhouse gases and atmospheric aerosols (tiny particles suspended in air) have already changed our climate, and will continue to do so at an accelerating pace in coming decades. Some of the best tools we have to anticipate these changes are global climate models, which are used to project possible future climates, given assumptions of future greenhouse gas releases.

Although global climate models are useful, their pixels can be a hundred miles across, which is too coarse to study many local impacts of climate change. This is typically addressed by adding in the systematic effects of topography on temperature and precipitation, a process called “downscaling”.

The newly developed LOCA downscaling method estimates finer-scale climate detail using the systematic historical effects of topography on local weather patterns. These historical relationships are taken from a new high-resolution observational dataset developed by researchers at the University of Colorado.

The LOCA downscaled climate projections provide temperature and precipitation on pixels that are six kilometers (3.7 miles) across. LOCA attempts to better preserve extreme hot days and heavy rain events than the previous generation of downscaling approaches. Extreme events such as heat waves or heavy precipitation have some of the biggest economic and societal impacts, even though they can last just a few days.

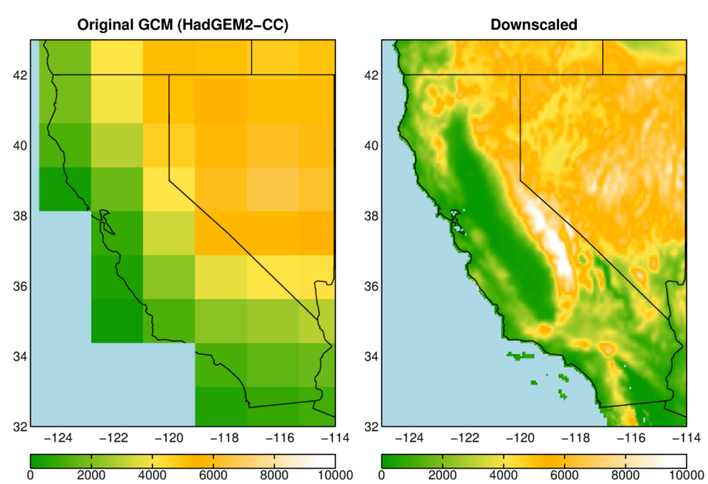
LOCA also does a better job maintaining both regional patterns of precipitation and the future climate changes predicted by the global climate models. These improvements are achieved by having less averaging of historical information in the final product. While previous downscaling techniques typically formed the downscaled model day using a weighted average of 30 similar historical days, LOCA looks locally around each point of interest to find the *one* best matching day.

The data are daily, covering the period 1950-2100 for 32 global climate models. Among the applications provided by the new dataset will be investigations of changes in intensity and frequency of occurrence of extreme weather conditions.

More spatially specific climate projections are increasingly sought after by natural resource managers, urban planners, and other officials for planning and decision making, which often hinges on having climate change information at local levels.

Because the new dataset spans from Mexico through southern Canada, it can be used to assess climate impacts across much of North America, including the entire conterminous U.S. A noteworthy example is its prominent role in California’s Fourth Climate Change Assessment, the latest in a series of California state climate vulnerability and adaptation studies undertaken since 2006. The assessment relies on regionally specific climate projections to understand climate change impacts across the state. The fourth assessment, to be completed in 2018, is being conducted by numerous teams of experts who will investigate implications of potential climate change on broad range of sectors including energy, health, wildfire, water, and other natural resources in California.

The work represents a collaboration across many groups, including SIO, the California Energy Commission, the U.S. Army Corps of Engineers, the U.S. Geological Survey, the Bureau of Reclamation, the NOAA Regional Integrated Sciences and Assessments (RISA) program, the Climate Analytics Group, the nonprofit group Climate Central, Lawrence Livermore National Laboratory, NASA Ames Research Center, Santa Clara University, the Cooperative Institute for Research in Environmental Sciences at the University of Colorado Boulder, and the Southwest Climate Science Center.



Left: Topography in a typical Global Climate Model (GCM). Major land features of California, such as the Sierra Nevada and Central Valley, are almost entirely absent in the global models. Right: Topography after downscaling to the 1/16th degree (6 km, or 3.7 mile) grid. At this scale not only the Central Valley and Sierra Nevada, but also details of the coastal ranges are captured.