Climate projections show a warmer future for the Pacific northwest

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In the midst of an unseasonably warm winter in the Pacific Northwest, a comparison of four publicly available climate projections has shown broad agreement that the region will become considerably warmer in the next century if greenhouse gas concentrations in the atmosphere rise to the highest levels projected in the the Intergovernmental Panel on Climate Change (IPCC) "business-as-usual" scenario.

In this scenario, carbon dioxide concentrations are projected to continue to rise and to exceed 900 parts per million, more than double today's level of just over 400 parts per million. Annual average global temperatures are projected to rise between 1.5 and 7 degrees Celsius (2.7 to 12.6 degrees Fahrenheit), and precipitation is expected to increase during the winter and decrease in the summer.

To examine projections of future climates in the Northwest, researchers in the College of Forestry at Oregon State University and the U.S. Forest Service obtained outouts from more than 30 climate models, known as general circulation models. These models simulate the Earth's climate at scales that are generally too large to be applied with confidence to local areas, such as the watersheds of small rivers and streams.

The scientists examined four different versions of the model outputs, each one translated for the region with data from weather stations in the Northwest through a process called "downscaling." While the resulting fine-resolution climate projections vary for parts of the Northwest, such as coastal watersheds and mountain crests, the general agreement among

them gives scientists increasing confidence in using fine-resolution climate projections for exploring future climate change impacts. The differences among them were no more than 0.3 degrees Celsius (about 0.5 degrees Fahrenheit) for the region.

The results were published this week in the journal *Scientific Data*.

"From a regional perspective, the differences in projected future changes are minor when you look at how much each projection says climate will change for the business-as-usual scenario," said Yueyang Jiang, lead author and a postdoctoral scientist at OSU. "The climate projections were created using different downscaling methods, but the projected changes in climate among them are similar at the regional scale."

The researchers chose to analyze projections for the recent past as well as for three 29-year periods from 2011 to 2100. Their goal was to characterize the differences to inform and guide scientists and land managers who are evaluating the projected impacts of climate change on local resources.

The fine-resolution climate projections vary in downscaling techniques and in the choice of historically observed weather datasets used to calibrate their calculations. Jiang and his team confirmed that the methods used to downscale each of the models had little to no effect on the data. They showed instead that differences arose from the choice of historical observation datasets used, which vary due to highly variable weather patterns or due to a lack of data in areas where weather stations are far apart.

"These differences become enhanced in areas with strong geographic features, such as the coastline and at the crest of mountain ranges," said John Kim, co-author on the paper and a scientist with the Pacific

Northwest Research Station of the U.S. Forest Service.

Nevertheless, Kim added, the analysis reveals "a fairly consistent high-resolution picture of climate change" under the highest greenhouse gas concentration scenario projected by the IPCC. "So, individuals and organizations that are interested in how much climate may change for most parts of the region can use any of the datasets we examined."

However, the researchers also caution against using only one projection to explore the effects of climate change at specific threshholds, such as how plants and animals might respond to a decrease in days with temperatures below freezing. Scientists interested in such climate effects should use several models, they added.

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