Climate models accurately simulate Pacific Northwest weather patterns, study finds

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Climate models are powerful tools that scientists use to study how the climate system works now and how it will change in the future under different scenarios of global warming. When models are updated with

new scientific information, they must be evaluated to see how well they represent different climate features, including weather patterns found in particular geographical regions.

A new study led by Graham Taylor, a Ph.D. student in Portland State's Earth, Environment, and Society program and Paul Loikith, associate professor of geography at PSU, tested how well climate models represent large-scale weather patterns over the Pacific Northwest. Researchers from Oregon State University and the Jet Propulsion Laboratory also contributed to the study, which was published in the journal *Climate Dynamics*.

"These complex computer models that simulate the Earth system can be thought of as virtual laboratories for climate science experimentation," says Loikith. "If the models can't reproduce important features of the observed climate, they will not be very useful for studying the future climate."

Since all computer models have different strengths and weaknesses based on differences in physics, scientists often use the output from many different climate models to assess projections of future climate change. For this study, the researchers used data from the state-of-the-art sixth phase of the Coupled Model Intercomparison Project (CMIP6) to test how well 26 different climate models could simulate the range of large-scale patterns of atmospheric circulation (like wind and pressure) found over the Pacific Northwest. These patterns range from those associated with warm and dry weather, to cold and stormy and everything in between.

To test the models, the team used a machine learning technique called self-organizing maps to group daily weather patterns simulated by the climate models into a set of 12 categories. They did the same for historical observed weather data. They then compared the two sets of

data to see how well they lined up.

The researchers found that the climate models generally simulated the observed wind and pressure patterns very well and that the temperature and precipitation patterns created by the models closely matched the correct patterns found in the historical data.

These results are important because they suggest that current climate models represent large-scale weather patterns reasonably well in the Pacific Northwest and can be used to better understand future climate change under continued global warming.

"These findings boost our confidence in the ability of these models to help us better understand how the climate will change over the region and why those changes occur," says Loikith.

More information: Graham P. Taylor et al, CMIP6 model fidelity at simulating large-scale atmospheric circulation patterns and associated temperature and precipitation over the Pacific Northwest, *Climate Dynamics* (2022). DOI: 10.1007/s00382-022-06410-1

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