# Scientists develop a more efficient way to crunch climate numbers

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Scientists used a technique to shave time off computationally expensive global climate simulations, taking advantage of the most powerful super computers.

Mirroring the climate using ones and zeros takes a lot of computing power. Scientists at Pacific Northwest National Laboratory found a way to reduce that power hungry need dramatically with a novel computational approach. Replacing a single long computer drive with multiple short runs, they found a way to get more mileage out of the largest and fastest supercomputer systems and get the climate answers hundreds of times faster. The new strategy provides equally reliable results but at a fraction of the computational cost.

Like a sleek, modern sports car, a climate model has a complex computer engine running in the background. Making that engine run efficiently as possible is the goal in the race to simulate the climate. The computational cost of climate simulations continues to increase at a fast rate due to the craving for higher levels of detail. Current high-resolution simulations usually take multiple days, to months to finish even on the fastest computer systems. The longer the time-span, the more robust statistics can be derived to produce a reliable signal separate from the noise that is inherent for the highly complex climate system. In this paper, PNNL scientists showed that such a dramatic improvement in efficiency will help extend the scope and depth of detail in research investigations within a typical project lifetime.

Climate, by definition, is a statistical description of the state of the Earth's atmosphere, land and ocean over a period of time longer than a few months. The PNNL researchers calculated the statistics from a number of short simulations rather than from a single, multi-year simulation. Using the Community Atmosphere Model (CAM), they initialized the short simulations with different weather conditions, so that they were independent runs, and could be carried out simultaneously. By replacing a single long task with multiple short tasks, researchers better exploited the most powerful supercomputer systems, and answered their scientific questions much more quickly using state-of-the-art high-resolution climate models.

Currently, the research team is using the new experimentation method in a project to improve how climate process interactions are represented in the CAM5 model. They anticipate that the new strategy will help in a wide range of additional model development activities.

**More information:** Wan H, PJ Rasch, K Zhang, Y Qian, H Yan and C Zhao. 2014. "Short ensembles: An efficient method for discerning climate-relevant sensitivities in atmospheric general circulation models." *Geoscientific Model Development* 7: 1961-1977. DOI: 10.5194/gmd-7-1961-2014.

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