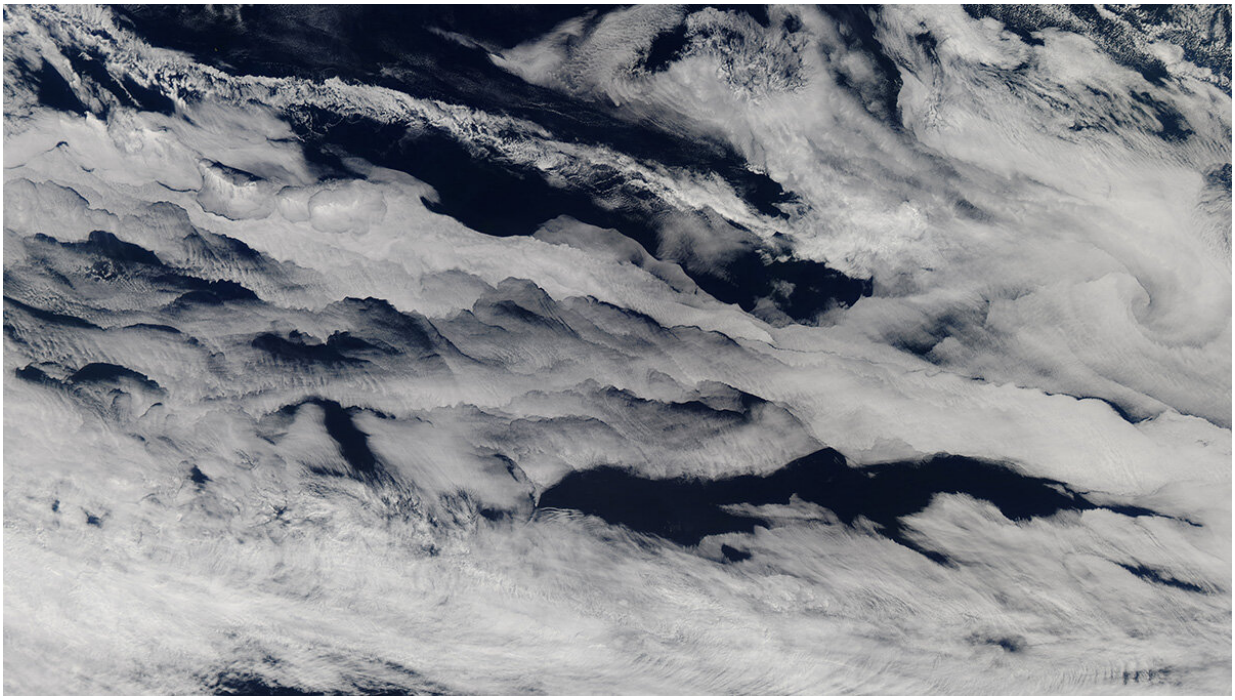
Family trees clarify relationships among climate models

July 18 2023, by Sarah Stanley



NASA’s Aqua satellite captured this image of stratocumulus clouds, which are difficult to simulate in climate models, over the Indian Ocean in March 2013. Credit: NASA

Climate models are sophisticated numerical tools used to estimate and explore what Earth's climate was like in the past, how it behaves now, and how it will change in the future.

Many studies combine results from multiple climate models to calculate average estimates and quantify the spread in model predictions of temperature, precipitation, and other Earth system characteristics. However, many climate models share parts of their underlying computer codes and other properties, so giving equal weight to all models included in a multimodel study may result in some codes being overrepresented or underrepresented, which can bias study results.

To help researchers more adequately account for relatedness between climate models, Peter Kuma and colleagues developed a computer code–based genealogy of 167 models, 114 of which are part of the Coupled Model Intercomparison Project (CMIP) Phases 3, 5, and 6. These models all simulate multiple components of Earth's climate system, such as atmospheric, oceanic, and biological processes. Because atmospheric physics, especially the description of cloud processes, is thought to contribute most to uncertainties related to climate sensitivity, the researchers focused their analysis on the atmospheric physics components of the 167 models.

The analysis identified 12 main groups, or families, of climate models. Within each family, model codes share a similar heritage and tend to generate similar estimates of important climate properties.

On the basis of these climate model "family trees," the researchers propose statistical methods that could be applied in future multimodel studies to better account for the code relationships among different models and reduce biases in study results. They also suggest that as more models are developed, these models can be added to further extend the new genealogy.

More information: Peter Kuma et al, Climate Model Code Genealogy and Its Relation to Climate Feedbacks and Sensitivity, *Journal of Advances in Modeling Earth Systems* (2023). DOI:

10.1029/2022MS003588

This story is republished courtesy of Eos, hosted by the American Geophysical Union. Read the original story here.

Provided by American Geophysical Union