First-of-Its-Kind Intercomparison Study Highlights Needed Improvements in Atmospheric Models

Research Highlight

When it comes to determining the most accurate model to simulate real-world conditions, even scientists will shop and compare. How well atmospheric models in particular perform has been hotly contested across scientific disciplines. Now, in one of the largest regional-scale intercomparison projects conducted to date, an international team of researchers analyzed more than thirty models and identified changes that would improve the prediction of cloud properties, which are intimately connected with weather patterns and climate change.

The study, funded in large part by DOE's Atmospheric System Research program and recently discussed in the **Quarterly Journal of the Royal Meteorological Society**, describes the spread and variation among the models, which fell into four main types:

- single-column models, which focus on a narrow slice or column of the area being evaluated;
- cloud-resolving models that study small-scale processes and physical feedback;
- limited-area models used in regional weather prediction; and
- global atmosphere models for predicting climate change.

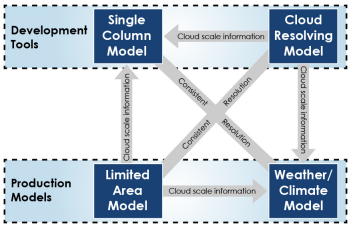
Their analysis showed that cloud-resolving models were more likely to match real-world observations than the other types of models. Single-column models tended to perform the worst. Scientists also concluded that explicitly modeling convection based on real-world data rather than allowing the model to estimate it based on other parameters yielded the most accurate results.

The work built on four previous journal articles (two highlighted by Fridlind and Lin) that explained the results of applying each of the four types to the same data set, using information gathered from the Tropical Warm Pool-International Cloud Experiment (TWP-ICE), conducted in early 2006.

TWP-ICE was an intense international airborne measurement campaign conducted in and around Darwin, Northern Australia, where the U.S. Department of Energy's Atmospheric Radiation Measurement (ARM) Climate Research Facility maintains a heavily instrumented atmospheric observatory. During the campaign, atmospheric sounding balloons were released continuously every three hours at land and ship-based locations around Darwin's coastal location, with multiple surface stations also deployed to measure conditions. TWP-ICE aimed to describe the properties of tropical cirrus clouds and the convection that leads to their formation.

#A field campaign of this kind provides an ideal test bed for evaluating models,# said Jon Petch, head of the UK Met Office's Science Partnerships, who led the team of researchers comparing the models on behalf of the Global Atmospheric System Studies' World Climate Research Programme project. #Because the same high-quality data had been used by all models, differences and similarities in model performance were all the more evident.#

Based on the intercomparisons of the models, institutions developing weather and climate models around the world will be able to pinpoint issues and improve how models represent tropical clouds, resulting in more accurate predictions of weather and climate change.



Using data gathered by ARM, scientists compared more than thirty models that simulate weather patterns and predict climate change to identify needed improvements.

Reference(s)

Petch J, A Hill, L Davies, A Fridlind, C Jakob, Y Lin, S Xie, and P Zhu. 2013. "Evaluation of intercomparisons of four different types of model simulating TWP-ICE." Quarterly Journal Royal Meteorological Society, , . ACCEPTED.

Contributors

For original submission and image(s), see ARM Research Highlights
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Ann M. Fridlind, *NASA - Goddard Institute for Space Studies*

Working Group(s)
Cloud Life Cycle, Cloud-Aerosol-Precipitation Interactions