Introduction to special section on Toward Reducing Cloud-Climate Uncertainties in Atmospheric General Circulation Models

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1Uncertainties of global warming projections have not changed much in general circulation models (GCMs) in the last 20 years. For example, in the first, second, and third reports of the Intergovernmental Panel on Climate Change (IPCC), the ranges of global warming simulated in GCMs are 1.9° to 5.2°C [Mitchell et al., 1990], 2.1° to 4.6°C [Kattenberg et al., 1996], and 2.0° to 5.1°C [Cubasch et al., 2001] respectively. These discrepancies in model’s climate sensitivities can be largely attributed to differences in their cloud-climate feedback processes [e.g., Cess et al., 1990; Soden et al., 2004].

2Many research efforts have therefore been directed to understand how cloud feedbacks operate in a climate change, with the hope to design models that can correctly describe them in a climate change scenario. It is however well known that cloud feedbacks are sensitive to perturbations of physical parameterizations and subgrid-scale processes in the models that are well justifiable at the present time.

3Thus the search to magically find a “correct” model may well be analogous to the search for “The Gold in the Orchard,” the story of the three sons trying to find the hidden gold in an orchard. In this Italian folk tale, an elderly farmer called his three sons to his deathbed to tell them that there was a pot of gold buried in the family orchard. After his death, the three sons dug up the whole orchard but found no gold. In the next season, however, the olive trees bore a lot more fruits than usual. When they were sold, they gave the sons a whole pot of gold. In the third story, after a long period of digging, they finally found the gold in the orchard. Their work led to a great find. These papers may have raised more questions than solutions. They, however, collectively expose many issues that have to be dealt with in order to design GCMs that can correctly describe cloud-climate feedback processes: the gold in the orchard.

References


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