Problem: Radiative effects of clouds may result in either a warming or a cooling of the atmospheric layer, generating strong changes in the general circulation. The vertical structure of these radiative effects is still largely unconstrained in climate models.

Here we use CloudSat/CALIPSO measurements to assess the vertical structure of radiative heating in climate models.

Finding: The models used in this study fail to reproduce the observed vertical structure of the radiative heating rates due to clouds (see figure). The clouds tend to produce too little warming in the models particularly in the lowest levels and in the tropics. The radiative heating rate biases highlighted in this study are likely to cause an amplification of the modeled cloud biases.

Significance: A reduction of cloud biases in climate models is of first order importance to ameliorate the representation of cloud-radiation interactions and cloud-climate feedback and thus reduce uncertainties in regards to future climate projections.


This work was supported by the NASA ROSES Modeling, Analysis and Prediction Program (Program manager: D. Considine)