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The performance of current atmospheric radiation codes in Phase I of CIRC

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The Continual Intercomparison of Radiation Codes (CIRC) is intended as an evolving and regularly updated reference source for evaluation of radiative transfer (RT) codes used in Global Climate Models and other atmospheric applications. In our presentation we will discuss our evaluation of the performance of 13 shortwave and 11 longwave RT codes that participated in Phase I of CIRC. CIRC differs from previous intercomparisons in that it relies on an observationally validated catalogue of cases. The seven CIRC Phase I baseline cases, five cloud-free, and two with overcast liquid clouds, are built around observations by the Atmospheric Radiation Measurements (ARM) program that satisfy the goals of Phase I, namely to examine RT model performance in realistic, yet not overly complex, atmospheric conditions. Besides the seven baseline cases, additional idealized "subcases" are also examined to facilitate interpretation of model errors. We will quantify individual model performance with respect to reference line-by-line calculations, and will also highlight RT code behavior for conditions of doubled CO_2, aspects of utilizing a spectral specification of surface albedo, and the impact of the inclusion of scattering in the thermal infrared. Our analysis suggests that RT codes should work towards improving their calculation of diffuse shortwave flux, shortwave absorption, treatment of spectral surface albedo, and shortwave CO_2 forcing. Despite practical difficulties in comparing our results to previous results by the Intercomparison of Radiation Codes in Climate Models (ICRCCM) conducted about 20 years ago, it appears that the current generation of RT codes do indeed perform better than the codes of the ICRCCM era. By enhancing the range of conditions under which participating codes are tested, future CIRC phases will hopefully allow even more rigorous examination of RT code performance.