Abstract Submitted
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CO2 Absorption Spectroscopy and Climate Change[1] DANIEL FELDMAN, Lawrence Berkeley Lab, ELI MLAWER, AER, Inc., MARTIN MLYNCZAK, NASA LaRC, JON GERO, University of Wisconsin, WILLIAM COLLINS, MARGARET TORN, Lawrence Berkeley Lab — Most of the absorption, and therefore radiative forcing, due to increased atmospheric CO2 occurs in line wings, so utilizing an accurate line shape is necessary for climate science. Recent advances in CO2 absorption spectroscopy have been incorporated into benchmark line-by-line radiative transfer models. These updates include the Energy Corrected Sudden Approximation to represent isolated line profiles, line mixing, and line clusters. The CO2 line profiles are sub-Lorentzian and are explicitly modeled up to 25 cm-1 from each line's center. Consistent continuum absorption is implemented over the remainder of the profile except for modest empirical adjustments based on observations. Thus, line-by-line models calculate the absorption effects of CO2 that agree with theory and measurements. This is validated with long-term spectroscopic measurements from the ARM program's AERI instrument. This spectroscopy trains computationally-efficient correlated-k methods for climate model radiative transfer, but they overpredict instantaneous radiative forcing from doubled CO2 by approximately 7% in part because they have larger errors handling the impact of increased CO2 in the stratosphere than the troposphere. The implications of this can be tested with supercomputers.

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