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TITLE: Radiative forcing of carbon dioxide, methane, and nitrous oxide: A significant revision of the methane radiative forcing

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ABSTRACT:

Abstract New calculations of the radiative forcing (RF) are presented for the three main well-mixed greenhouse gases, methane, nitrous oxide, and carbon dioxide. Methane's RF is particularly impacted because of the inclusion of the shortwave forcing; the 1750-2011 RF is about 25% higher (increasing from 0.48 W m<sup>-2</sup> to 0.61 W m<sup>-2</sup>) compared to the value in the Intergovernmental Panel on Climate Change (IPCC) 2013 assessment; the 100 year global warming potential is 14% higher than the IPCC value. We present new simplified expressions to calculate RF. Unlike previous expressions used by IPCC, the new ones include the overlap between CO<sub>2</sub> and N<sub>2</sub>O; for N<sub>2</sub>O forcing, the CO<sub>2</sub> overlap can be as important as the CH<sub>4</sub> overlap. The 1750-2011 CO<sub>2</sub> RF is within 1% of IPCC's value but is about 10% higher when CO<sub>2</sub> amounts reach 2000 ppm, a value projected to be possible under the extended RCP8.5 scenario.

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