ABSTRACT

The 2015 Paris Agreement stipulates that the signatory nations take collective action to reduce carbon dioxide emissions so as to limit the increase in global mean surface temperature to 2°C. How much would CO₂ emissions have to be reduced to achieve this, or can this even be achieved at all? These questions are examined using a global energy balance model to carry out a “cold turkey” experiment in which emissions from fossil fuel combustion are abruptly set equal to zero; this is a limiting case for any practically feasible, gradual reduction in emissions. Such emission reductions would not only reduce CO₂ emissions but would also reduce emissions of atmospheric aerosols, microscopic particles suspended in air, and their precursor gases. By scattering solar radiation and by increasing cloud reflectivity these aerosols are thought to be offsetting a substantial but highly uncertain fraction of radiative forcing by anthropogenic carbon dioxide. In contrast to carbon dioxide, which would persist in the atmosphere, aerosols would be removed almost immediately after cessation of emissions. Consequently, and contrary to general expectation, the net forcing and global temperature would likely increase, not decrease. This study examines the amount of the resultant temperature rise within present uncertainty estimates of Earth’s climate sensitivity and current aerosol forcing. Within this uncertainty, future global CO₂ emissions consistent with achieving the 2 °C target range from as much as 100 years at current emission rates to essentially zero.

Can Global Temperature Rise be Limited to 2 Degrees? The Cold Turkey Experiment

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