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Greenhouse Gasses' Effect on Atmospheric Temperature Increase and the Observable Effects on Ecosystems

Authors : Alexander J. Severinsky

Abstract : Radiative forces of greenhouse gases (GHG) increase the temperature of the Earth's surface, more on land, and less in oceans, due to their thermal capacities. Given this inertia, the temperature increase is delayed over time. Air temperature, however, is not delayed as air thermal capacity is much lower. In this study, through analysis and synthesis of multidisciplinary science and data, an estimate of atmospheric temperature increase is made. Then, this estimate is used to shed light on current observations of ice and snow loss, desertification and forest fires, and increased extreme air disturbances. The reason for this inquiry is due to the author’s skepticism that current changes cannot be explained by a "~1 ^oC" global average surface temperature rise within the last 50-60 years. The only other plausible cause to explore for understanding is that of atmospheric temperature rise. The study utilizes an analysis of air temperature rise from three different scientific disciplines: thermodynamics, climate science experiments, and climactic historical studies. The results coming from these diverse disciplines are nearly the same, within ± 1.6%. The direct radiative force of GHGs with a high level of scientific understanding is near 4.7 W/m² on average over the Earth’s entire surface in 2018, as compared to one in pre-Industrial time in the mid-1700s. The additional radiative force of fast feedbacks coming from various forms of water gives approximately an additional ~15 W/m². In 2018, these radiative forces heated the atmosphere by approximately 5.1 ^oC, which will create a thermal equilibrium average ground surface temperature increase of 4.6 ^oC to 4.8 ^oC by the end of this century. After 2018, the temperature will continue to rise without any additional increases in the concentration of the GHGs, primarily of carbon dioxide and methane. These findings of the radiative force of GHGs in 2018 were applied to estimates of effects on major Earth ecosystems. This additional force of nearly 20 W/m² causes an increase in ice melting by an additional rate of over 90 cm/year, green leaves temperature increase by nearly 5 ^oC, and a work energy increase of air by approximately 40 Joules/mole. This explains the observed high rates of ice melting at all altitudes and latitudes, the spread of deserts and increases in forest fires, as well as increased energy of tornadoes, typhoons, hurricanes, and extreme weather, much more plausibly than the 1.5 ^oC increase in average global surface temperature in the same time interval. Planned mitigation and adaptation measures might prove to be much more effective when directed toward the reduction of existing GHGs in the atmosphere.

Keywords : greenhouse radiative force, greenhouse air temperature, greenhouse thermodynamics, greenhouse historical, greenhouse radiative force on ice, greenhouse radiative force on plants, greenhouse radiative force in air
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