The World's Largest Experiment Manipulating Solar Energy Input To Earth Resumed In 2003

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Small amounts of solar-ultraviolet-energy absorbing gases such as ozone, SO_2, and NO_2 play an unusually large role warming the atmosphere. A mere 3 to 8 ppmv ozone at elevations of 15 to 50 km and associated exothermic chemical reactions warm the atmosphere >50^{o}C, forming the stratosphere. All three molecules have an asymmetric top shape that, unlike linear molecules of CO_2, forms a permanent electromagnetic dipole enhancing interaction with electromagnetic radiation. Planck's postulate (Energy = a constant times frequency) implies that solar ultraviolet energy strongly absorbed by SO_2 is 43 times greater than infrared energy radiated by earth and strongly absorbed by CO_2. Solar energy in the blue visible spectrum and ultraviolet causes electronic transitions and an absorption spectrum that is a continuum, absorbing far more energy per unit gas than spectral line absorption of infrared energy caused by rotational and vibrational transitions. Absorption of electromagnetic energy by atmospheric gases increases rapidly with increasing frequency, an observation not accounted for by the use of specific heat in atmospheric models to link energy flux with temperature. While SO_2 in the stratosphere is oxidized to a sulfuric acid aerosol that reflects sunlight, cooling the earth, SO_2 in the troposphere is oxidized much more slowly than commonly assumed.

Well-documented concentrations of tens of ppbv SO_2 emitted by humans burning fossil fuels, especially coal, in northern mid-latitudes are contemporaneous, with suitable time delays for warming the ocean, with increased global warming during the 20th century, greatest by nearly a factor of two in the northern hemisphere. A decrease by 18% of anthropogenic SO_2 emissions between 1979 and 2000 aimed at reducing acid rain had the unintended effect of reducing the global mean rate of temperature increase to zero by 1998. By 2003, global SO_2 emissions began to rise sharply due to the rapid increase in number of new coal-burning power plants in Asia. The 20th century rate of increase in tropospheric methane also approached zero by 1998 but began to increase in 2007 as explained by SO_2 reducing the oxidizing capacity and thus the troposphere's ability to remove methane. SO_2 does not last long in the atmosphere, but a continual and increasing flux causes increased concentrations. SO_2 from China is traceable across the Pacific Ocean even to eastern America, perhaps playing a major role in the unusually high air temperatures in 2010. Atmospheric circulation in the northern hemisphere moves SO_2 towards the pole where it is the primary cause of Arctic Haze. In polar regions, solar radiation travels longer path lengths through the atmosphere during longer summer days than in equatorial regions, contributing to the well-documented excessive global warming in the Arctic.

The resumed increase in SO_2 emissions since 2003 provides the world's largest geoengineering experiment and an excellent chance to measure, especially in China and India, the effects of SO_2 and NO_2 on global warming. Technology exists to reduce SO_2 emissions economically. The time has come to control this large geoengineering experiment in the hopes that we can minimize continued global warming.