The Effect of Solar Variations on Overall Climate Change

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The subject of climate change has undoubtedly been an important topic of international interest in recent decades. Although mankind has undoubtedly impacted the climate to some degree, the exact magnitude of mankind's contribution to this climate change has not been firmly established. This brief letter is not intended to deny that humans are having an influence on the climate, but, rather through a simple calculation show that variations in the solar output cannot be excluded in any viable climate models. The U.S. Army Chief Scientist Dr. Bruce West previously faulted the United Nations IPCC for having concluded that the contribution of solar variability to global warming as negligible in 2008. He argued that many global warming researchers have not adequately modelled the Sun's impact on the environment before concluding mankind was primarily responsible for these changes.(1) The brief calculation below simply illustrates the true significance in the sun's variance to the overall climate indicating that such solar variations must be considered for any climate model to be viable.

The mean solar electromagnetic energy output per unit area as observed at the distance of the earth from the sun, i.e. one Astronomical Unit (A.U.), is known as the solar constant. The **solar constant** has been accurately measured to be **1361W/m^2** .(2) Furthermore, this solar output has also varied up to 0.2% over the past 400 years.(3) Therefore, the **solar variation** per unit area is 0.2% of the solar constant or more explicitly **2.722 W/m^2**. This variation over the total area of the earth exposed to the sun can be easily calculated. The mean radius (r) of the earth is 6371.0 km.(4) Therefore, the area of the plane of the earth perpendicular to the solar-earth line is area = $\pi r^2 = 1.28 \times 10^{14}$ m^2. This multiplied by the solar variation 2.722 W/m^2 then gives the **total solar energy variation reaching the earth** or **3.5×10^{14} W.**

To understand the significance of this value, this total solar energy variation can be compared to the total energy generated by humans. In 2013, the IEA estimated that humans used on average 12.3 Terawatts (1.23×10^{13} W) of power.(5) This divided into the total solar energy variation reaching the earth is calculated:

Solar Energy Variation / World Energy Generation = 3.5×10^{14} W / 1.23×10^{13} W = 28.5

In conclusion, the solar electromagnetic energy reaching the earth over the past 400 years has varied by a factor of 28.5 times more than the total energy generated by humans in the year 2013! Therefore, in addition to any effects of greenhouse gases (6) on the climate, the solar variation must be considered in any climate change model for that model to be acceptable.

REFERENCES:

1) https://www.wired.com/2008/06/army-vs-global

2) https://en.wikipedia.org/wiki/Solar_constant

3) http://lasp.colorado.edu/home/sorce/data/tsi-data/

4) https://en.wikipedia.org/wiki/Earth_radius

5) https://en.wikipedia.org/wiki/World_energy_consumption

6) https://en.wikipedia.org/wiki/Greenhouse_gas ($H_2O > CO_2 > CH_4 > O_3$)