37. CLIMATE (COSMIC RAYS) AND THE CONSTITUTION #8

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Former Senator Schmitt Summarizes the Effects of Cosmic Rays on Climate Change

Climate change driven by the sun, constitutes a strongly competitive hypothesis to the climate modeling-political hypothesis of human-caused global warming. As many scientists have documented, the position and orientation of the Earth in its orbit around the sun and the sun's variable activity determine weather and climate **[1]**. As part of this process, oceans store enormous amounts of solar energy, dwarfing by a factor of 10 the energy stored in the atmosphere. Ocean currents create climate variations over vast regions by transferring their energy around the globe over decades and centuries through a system of interconnected currents and current oscillations **[2]**.

Increasing evidence suggests that a mechanism exists for strong amplification of relatively small solar variations of only ±0.1%. That mechanism lies within the interaction of changes in the ionosphere, heating of the stratosphere, ozone production, ionization in the troposphere, concentrations of atmospheric water and other greenhouse gases, nucleation of reflective clouds, and variations in ionization effects and resistive heating within the global electric circuit **[3]**. Obviously, this constitutes a very complex mix of interrelationships, not likely to be soon subject to predictive computer modeling.

The direct relationship of the strength of solar magnetic fields with the sunspot activity on the sun **[4]** may provide a large part of the amplification answer. Research by Henrik Svensmark of Denmark's Center for Sun-Climate Research and others indicates that the strength of solar magnetic fields influences the depth of penetration of cosmic rays entering the Earth's atmosphere **[5]**. These cosmic rays consist largely of extremely high-energy, electrically charged hydrogen and helium nuclei that to some degree can be diverted from entering the solar system by sufficiently strong solar magnetic fields. Cosmic ray collisions with gases in the atmosphere also produce isotopes of Beryllium (10Be) and Carbon (14C) that in turn provide a measurable history of variations in cosmic ray intensity when taken up in tree rings and other annually layered materials **[6]**.

The physical mechanism for a cosmic ray stimulation of low cloud formation appears to be increased ionization of aerosols and the resulting enhancement of water nucleation sites **[7]**. Indeed, the increase in satellite measured global brightening since about 1992 probably relates to a steady increase in total global cloud cover **[8]**. Periods of weak solar magnetic fields, known to correlate with low sunspot activity, allow

cosmic rays to penetrate more deeply into the lower atmosphere [9] where they ionize more gas molecules than average, thus seeding more cloud cover and increasing the reflection of solar energy back into space. The reverse occurs with periods of strong solar magnetic fields.

As cloud cover expands, more solar radiation reflects back into space, resulting in a net cooling of the atmosphere and increased snow accumulation, particularly in temperate and arctic regions. A current illustration of the cooling effect of decreased solar activity appears to be in the currently very quiet sun and the recent reversal of the slightly elevated warming trend of the 1970s through 1990s. How long this cooling trend will persist remains to be seen; however, Greenland glaciers have been advancing since 2006 [10] and snowy, cold winters have dominated weather news coverage from northern North America and Europe. In addition, 2009 Fall Arctic sea ice has returned to most of its 1979 levels of coverage [11].

Satellite observations of cloud cover, isotopic analysis of tree rings, ice cores and stalagmites, and historical analyses of solar activity support the hypothesis that cosmic rays can amplify solar variations. As to the fundamental nature of sunspot generation and corresponding strengthening of the interplanetary magnetic field, a strong positive correlation exists between small changes in solar radius and sunspot number [12] as well as with variations in magnetic fields at the surface of the Sun [13]; but a full understanding of these phenomena remains elusive.

Additional evidence of long-term variations in cosmic ray damage in meteorites, correlated with major ice ages on a 150 million year cycle of global cooling, strongly suggest that such ice ages may result from (or be intensified by) the solar system's passage through the regions of high intensity cosmic ray sources in the spiral arms of the Milky Way Galaxy [14]. This potential galactic influence on cloud formation and colder climate matches the observation that long periods of very low sunspot activity, and an accompanying weakened solar magnetic field, correlate with the coldest periods within the of the Little Ice Age of 1400-1900 [15].

A significant test of the existence of significant solar amplification may occur over the next sunspot cycle (Cycle 24); the beginning of which was delayed at least two years and its slow onset continues to confound predictions [16]. This slow onset has been accompanied by a particularly large decline in ultraviolet radiation, a commensurate decline in stratospheric ozone, and solar activity apparently out of phase with radiative forcing of global temperature [17]. Given the recent research findings discussed above, the current prolongation of less solar irradiance, reduced solar magnetic field strength, and greater convective energy between the surface and stratosphere may combine to create increased cosmic ray induced cloud formation and cooling in middle latitudes and greater total energy of tropical hurricanes and cyclones originating in the tropics [18].

The north-south flow of material at the Sun's surface has been faster and more variable than normal during the approach to sunspot Cycle 24 and the current prolonged sunspot minimum— the quietest in 100 years [19]. This coincides as well with an anomalously low output of solar soft x-rays [20]. The strength of the resulting solar polar magnetic fields during the drop off from the sunspot maximum in 2000-2001 has been about half of normal and also may have re-

sulted in increased cosmic ray induced cloud formation since that maximum. That would coincide with evidence of relatively constant or decreasing global temperature since about 2000.

In addition to strong evidence that solar mediated cosmic ray flux can amplify variations in solar energy input, the theoretical potential also exists for a weakly varying solar heating or cooling signal to be amplified through "stochastic resonance," that is, amplification by the addition of nature's random weather-related background noise to an otherwise weak solar signal **[21]**. Such an addition could raise a solar heating signal over and above the background and could be further amplified by a non-linear system like ocean currents.

A further complication for those trying to model the future of climate change lies in the aforementioned global electric circuit. This circuit carries a net electric current of about one kilo-amp that flows from thunderstorms in the lower atmosphere (troposphere) into the ionosphere and magnetosphere and then closes with the Earth's surface through atmospheric contact and lightning **[22]**. Convection in thunderstorms, solar wind interaction with the Earth's magnetosphere, and tides in the atmosphere's thermosphere (high temperature, ionized, very thin atmosphere above about 80 km) power the global electric circuit. Thunderstorms, particularly those in the equatorial Intertropical Convergence Zone, appear to be the most important component this process. No indication exists that current global climate models adequately address any of these global natural phenomena.

What are the policy implications of this complicated natural science summarized in the Climate essays of this series? The unconstitutional regulatory responses in the name of controlling climate proposed by the Environmental Protection Agency, the Congressional Leadership, the President, and some State leaders must be resisted with the certainty that strong scientific research supports the hypothesis that climate is controlled by nature, not by human use of fossil fuels.

Using naturally warming climate as a false crisis, Government desires to regulate and tax the American economy without constitutional authority. In doing so, Government's inherently arbitrary and capricious regulatory actions will reduce individual and collective liberty by raising the cost of living of all citizens and in clear violation of the natural, intensive rights guaranteed by the 9th Amendment.

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