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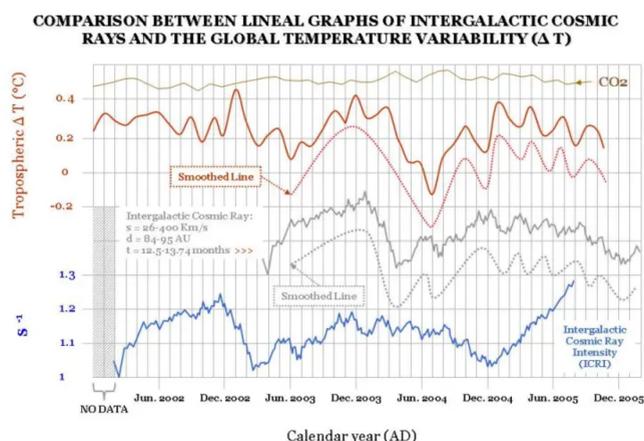
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Cosmic rays and global warming

The influence of GCR's (galactic cosmic rays) and global temperature is a hot subject: the theory developed by Friis-Christensen, Laassen and Svensmark, and now studied in the CLOUD experiment by Jack Kirby says essentially this: GCRs deliver condensation nuclei for lower clouds. If the GCR intensity is high, there will be more of these **cooling** clouds, and global temperatures will fall. The sun's magnetic activity (solar wind) modulates the GCRs: more active sun => higher solar wind => lower GCRs => less low altitude clouds => less cooling => higher temperatures.

The effect can be nicely seen in the following picture (from http://biocab.org/Cosmic_Rays_Graph.html):

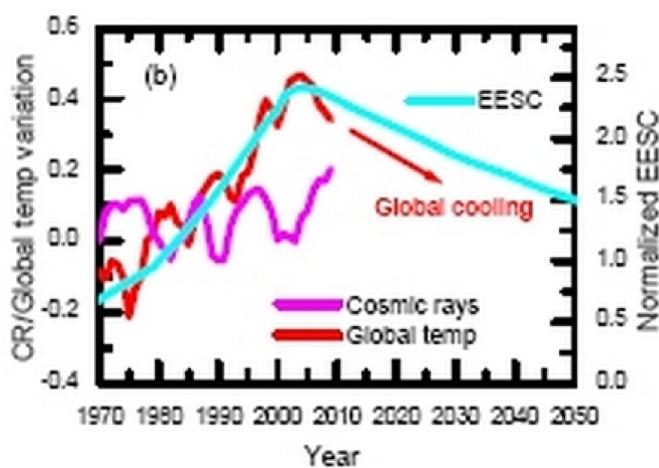
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Compare the 2 smoothed curves of temperature anomaly (red) and GCR's (grey): most temperature anomaly maxima coincide with GCR's minima (at least from 2004 on). As expected, this theory is bitterly attacked by other scientists, most in the AGW alarmist camp (e.g. see [here](#)). For the moment, this controversial issue is not solved; but the GCR/cloud theory gives a good example of a potential warming/cooling mechanism unrelated to variations of the CO2 concentration.

Prof. Qing-Bin Lu from the University of Waterloo in Canada has published a new paper (see abstract [here](#), full paper is paywalled by ScienceDirect), arguing that GCR's modulate the ozone layer, and that this modulation may explain the warming of the past 30 years and the ongoing cooling seen since about 2000. The paper is large (87 pages) and makes for some heavy reading. The GCR deliver the electrons that may activate chlorinated molecules attached to ice surfaces. These molecules (of freon-type for example) then do destroy a more or less greater part of the ozone layer, which will lead to a global warming: less ozone in the stratosphere means less IR absorption, hence cooler stratosphere. As this cooler stratosphere does emit less heat into space (and the incoming energy from the sun remaining the same), the troposphere and surface of the globe must absorb more and get warmer to satisfy the balance of energy. Lu introduces an index called EESC (equivalent effective stratospheric chlorine) to quantify the ozone loss.

He finds a very good correlation between that index and global temperature change:



If he is right, we should accept these 2 conclusions:

1. global temperatures are not driven by atmospheric CO2 concentrations (or at least CO2 is not the dominant factor)
2. we should expect a coming cooling period extending possibly up to 2050, caused essentially by a smaller and smaller ozone depletion.

This latter prediction has been made by many scientists (one of the first being the late Dr. Theodor [Landscheidt](#)), often based on a very different analysis. What we see in this research is that the solar influence on the global climate comes more from indirect solar effects than from variations of the TSI (total solar irradiance). Even the Earth magnetism, another parameter influenced by the solar wind, could play a major role, as told in this [article](#) and as investigated by a team of the [Institut de Physique du Globe de Paris](#).

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