

Solar Influences on Earth's Climate

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Recent paleoclimate studies have revealed a persistent correlation between indicators of Earth's climate throughout the Holocene (the warm period since the last ice age) and the variation of cosmogenic isotopes. The cosmogenic isotopes are spallation products generated by galactic cosmic rays hitting the atmosphere and the similarity of results for different isotopes shows that the causal factor is the shielding of the cosmic rays which is dominated by the effect of the magnetic field in the heliosphere (generated by the Sun) on the timescales in question. These results raise two possibilities: (1) Earth's climate is directly influenced by cosmic rays or (2) cosmic rays are a proxy indicator of another factor which influences climate. In the first category is the controversial suggestion that cosmic rays facilitate cloud condensation, although other possibilities include modulation of the global thunderstorm electric circuit. The most likely candidate for the second possibility is that the total or UV solar irradiance varies in concert with the cosmic ray flux on timescales of 100-1000 years. Such an effect has been observed over recent solar cycles, but for it to apply on longer timescales raises some very interesting questions about the relationship between the magnetic flux leaving the solar corona (which modulates cosmic rays) and that threading the photosphere (which modulates irradiance). The implications and the need for further data are discussed.