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The amount of solar energy radiated from the Sun is simply massive  
NASA

## Solar Activity and Climate on Earth

### *The Sun partially to blame for Earth's global warming*

It is most certain that Earth's climate took a severe turn towards global warming ever since the Industrial Revolution began. Greenhouse gas concentrations have been rising steadily since, but one cannot stop wondering what the Sun's part is in all this. How does the Sun itself affect the climate of our planet? "For the last 20 to 30 years we believe greenhouse gases have been the dominant influence on recent climate change", says Robert Cahalan, NASA climatologist from Goddard Space Flight Center.

NASA has been investigating the dependence between the Sun and Earth for the last three decades. Solar Radiation and Climate Experiment for example, is studying the amount of solar energy absorbed by Earth and the effects determined by this energy as it passes through the atmosphere. The total solar irradiance is the amount of solar energy passing through the outer atmosphere of the planet and varies according to the solar activity.

A typical solar cycle takes place every 11 years or so, during which time the solar activity alternates between a maximum and a minimum of solar storms, or between a high number of sunspots and no sunspots. The solar activity of the Sun is driven by its powerful magnetic field.

"The fluctuations in the solar cycle impacts Earth's global temperature by about 0.1 degree Celsius, slightly hotter during solar maximum and cooler during solar minimum. The Sun is currently at its minimum and the next solar maximum is expected in 2012", said Thomas Woods, solar scientist at the University of Colorado.

Investigations carried out with the help of the SORCE probe showed that each square meter of the Earth's outer atmosphere receives an amount of energy equal to 1,361 watts and increases by 1.3 watts during high solar activity. "This TSI measurement is very important to climate models that are trying to assess Earth-based forces on climate change", says Cahalan.

Extending that study on a period of one hundred years reveals that the Earth temperature has risen during this time by 0.6 degrees Celsius, out of which only 25 percent can be accounted for by increases in solar energy outputs. One third of the energy received from the Sun is reflected back into space, leaving the rest to be absorbed by the earth, water bodies and the atmosphere.

"Greenhouse gases block about 40 percent of outgoing thermal radiation that emanates from the Earth", Woods says. This ultimately leads to an accumulation of energy that is dissipated through the melting of the polar ice caps, which further increases the unbalance by triggering a rise in water levels and changes in weather behavior.

Prior to the Industrial Revolution, the Earth climate was largely influenced by volcanic eruptions that often triggered warming and cooling cycles, such as the ice ages for example. "Right now, we are between major ice ages, in a period that has been called the Holocene. Over recent decades, however, we have moved into a human-dominated climate that some have termed the Anthropocene. The major change in Earth's climate is now really dominated by human activity, which has never happened before", explains Cahalan.

"We don't know what the Sun is going to do a hundred years from now. It could be considerably more active and therefore have more influence on Earth's climate", says Doug Rabin, solar physicist at Goddard. Towards the end of the 17th and the beginning of the 18th century the Sun seemed to present no sunspots, which resulted in longer, colder winters in Europe, although the temperature had only dropped by only 1 degree Celsius.

The solar activity has been increasing ever since, although greenhouse gases will dominate climate change over the Sun's influence if humans don't do something about it.