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The Web's Longest-Running Climate Change Blog

May 8, 2007

[Neptune News](#)

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Neptune is the planet farthest from the Sun (Pluto is now considered only a dwarf planet), Neptune is the planet farthest from the Earth, and to our knowledge, there has been absolutely no industrialization out at Neptune in recent centuries. There has been no recent build-up of greenhouse gases there, no deforestation, no rapid urbanization, no increase in contrails from jet airplanes, and no increase in ozone in the low atmosphere; recent changes at Neptune could never be blamed on any human influence. Incredibly, an article has appeared in a recent issue of *Geophysical Research Letters* showing a stunning relationship between the solar output, Neptune's brightness, and heaven forbid, the temperature of the Earth. With its obvious implications to the greenhouse debate, we are certain you have never heard of the work and never will outside *World Climate Report*.

In case you have forgotten your basic science lessons on the planets, Neptune orbits the Sun at a distance 30 times the distance from the Earth to the Sun and Neptune revolves around the Sun once every 164.8 Earth years. Neptune has 17 times the mass of the Earth, its atmosphere is primarily composed of hydrogen and helium, with traces of methane that account for the planet's distinctive blue appearance. It was the only planet discovered mathematically – scientists noted variations in the orbit of Uranus, they calculated the orbit and position of a yet undiscovered planet that could cause the variations noted for Uranus, they determined where the planet should be, and on the first night they searched for it (September 23, 1846), they discovered the large planet sitting within 1 degree of their predictions. The new planet was named for Neptune, Roman god of the sea, given its distinctive blue color. Observations from Earth and a 1989 Voyager 2 flyby have revealed that Neptune's cloud tops are extremely cold (-346°F) being so far from the Sun while the center of the planet has a temperature of $13,000^{\circ}\text{F}$ due to high pressure generating extremely hot gases.

In the recent article, Hammel and Lockwood, from the Space Science Institute in Colorado and the Lowell Observatory, note that measurements of visible light from Neptune have been taken at the Lowell Observatory in Flagstaff, Arizona since 1950. Obviously, light from Neptune can be related to seasons on the planet, small variations in Neptune's orbit, the apparent tilt of the axis as viewed from the Earth, the varying distance from Neptune to Earth, and of course, changes in the atmosphere near the Lowell Observatory. Astronomers are clever, they are fully aware of these complications, and they adjust the measurements accordingly.

As seen in Figure 1, Neptune has been getting brighter since around 1980; furthermore, infrared measurements of the planet since 1980 show that the planet has been warming steadily from 1980 to 2004. As they say on Neptune, global warming has become an inconvenient truth. But with no one to blame, Hammel and Lockwood explored how variations in the output of the Sun might control variations in the brightness of Neptune.

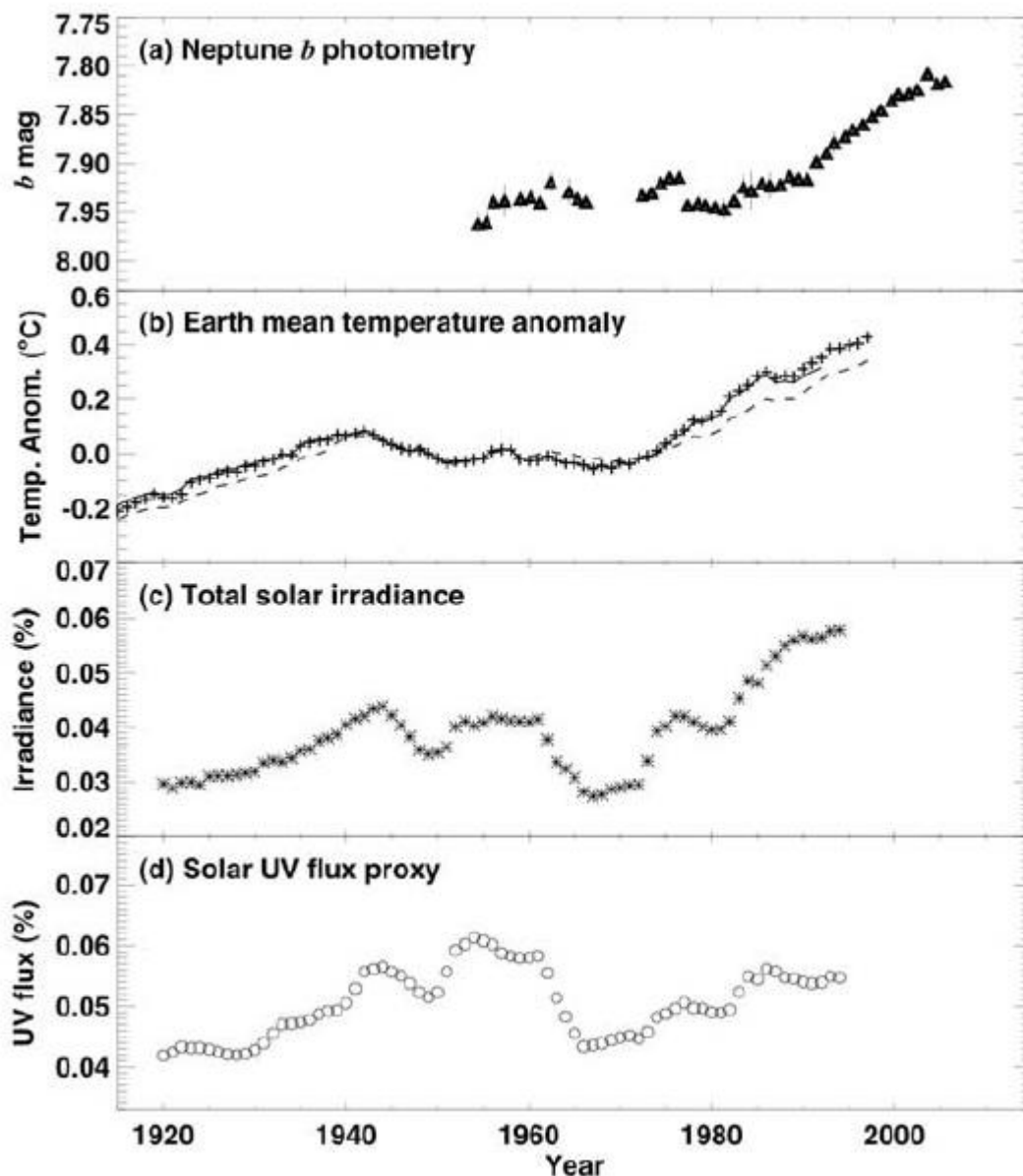


Figure 1 (a) represents the corrected visible light from Neptune from 1950 to 2006; (b) shows the temperature anomalies of the Earth; (c) shows the total solar irradiance as a percent variation by year; (d) shows the ultraviolet emission from the Sun (Source: Hammel and Lockwood (2007)).

What would seem so simple statistically is complicated by the degrees of freedom in the various time series which is related to the serial correlation in the data (e.g., next year's value is highly dependent on this year's value). Nonetheless, they find that the correlation

coefficient between solar irradiance and Neptune's brightness is near 0.90 (1.00 is perfect). The same relationship is found between the Earth's temperature anomalies and the solar output. Hammel and Lockwood note "In other words, the Earth temperature values are as well correlated with solar irradiance ($r = 0.89$) as they are with Neptune's blue brightness ($|r| > 0.90$), assuming a 10-year lag of the Neptune values." The temporal lag is needed to account for the large mass of Neptune that would require years to adjust to any changes in solar output.

Hammel and Lockwood conclude that "In summary, if Neptune's atmosphere is indeed responding to some variation in solar activity in a manner similar to that of the Earth albeit with a temporal lag" then "Neptune may provide an independent (and extraterrestrial) locale for studies of solar effects on planetary atmospheres."

World Climate Report has covered many [articles](#) in the scientific literature showing that variations in solar output, including variations within specific wavelengths (e.g., cosmic, ultraviolet, visible, infrared) are highly correlated with temperature variations near the Earth's surface. Believe it or not, when the Sun is more energetic and putting out more energy, the Earth tends to warm up, and when the Sun cools down, so does the Earth. The Hammel and Lockwood article reveals that the same is true out at Neptune; when the Sun's energy increases, Neptune seems to warm up and get brighter given a decade lag.

If for some reason you do not believe that the Sun is a significant player in determining the temperature of the Earth (after all, we are told repeatedly that humans are causing most of the observed warming on the Earth), then asked yourself if you believe that Neptune's temperature is controlled by the Sun. How is it possible that the Earth's temperature is so highly correlated with brightness variations from Neptune? The news from Neptune comes to us just weeks after an article was published showing that Mars [has warmed](#) recently as well.

If nothing else, we have certainly learned recently that planets undergo changes in their mean temperature, and while we can easily blame human activity here on the Earth, blaming humans for the recent warming on Mars and Neptune would be an astronomical stretch, to say the least.

Reference:

Hammel, H. B., and G. W. Lockwood, 2007. Suggestive correlations between the brightness of Neptune, solar variability, and Earth's temperature, *Geophysical Research Letters*, **34**, L08203, doi:10.1029/2006GL028764.

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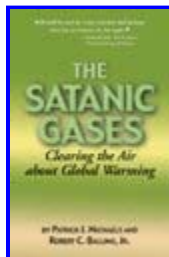
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