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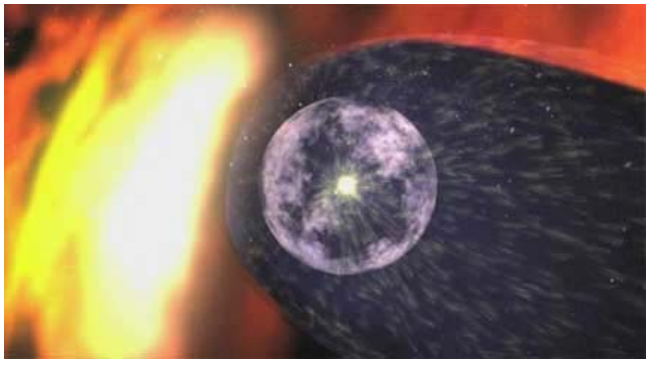
Solar Wind Pressure Lowest in 50 Years

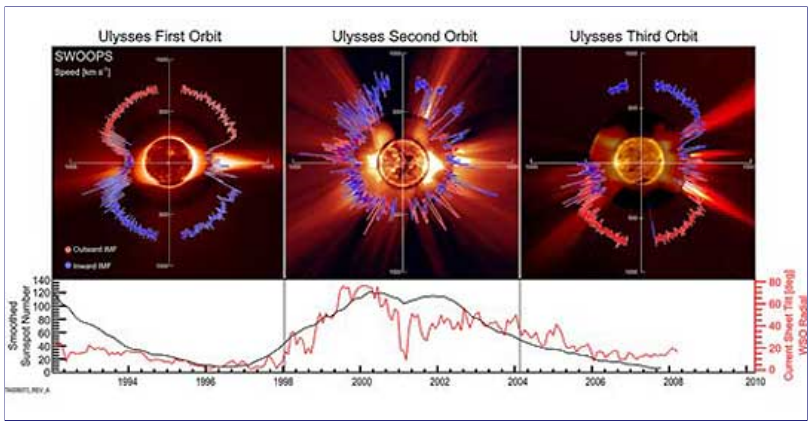
"The entire sun is blowing solar wind significantly less harder, about 20% to 25% less harder and 13% lower temperature, than it was during the previous solar minimum a decade ago. ...Over the entire record of solar wind observations (about 50 years), this is the lowest prolonged pressure that we've ever observed." – Dave McComas, Ph.D., Solar Wind Principal Investigator, Ulysses



Sun depicted as bright white-yellow object on left blowing off electrons, protons and some heavy ions at nearly 1 million mph (400 kilometers/second) past the earth and out through the solar system. NASA's and ESA's Ulysses spacecraft has measured the pressure of the solar wind decreasing 20% to 25% since 1990. Implications for Earth and solar system are unclear. Graphic illustration by NASA Goddard Space Flight Center.

September 23, 2008 Pasadena, California - NASA produced a media teleconference today with Ulysses spacecraft scientists to announce, "The entire sun is blowing significantly less hard, about 20% to 25% less hard, than it was during the previous solar minimum a decade ago and its solar wind temperature has lowered 13%." Ulysses is the first spacecraft from Earth to orbit around the poles of the sun. Since its launch on October 6, 1990, from the Space Shuttle Discovery (mission STS-41) as a joint venture of NASA and the European Space Agency, Ulysses has completed almost three orbits around the sun's poles that began with the 1990 solar minimum, included the 2000 solar maximum and is running out of heat and power as it nearly completes a third orbit during this 2008 solar minimum that has had a prolonged period without sunspots.

During the press conference, Dave McComas, Ph.D., Principal Investigator of the Ulysses Solar Wind Instrument at the Southwest Research Institute in San Antonio, Texas, showed a graphic comparison between the sun's solar wind in 1990, the sun's solar wind in 2000 and the significantly reduced solar wind now. The solar wind escapes primarily through coronal holes near the sun's poles, over which Ulysses has orbited with its solar wind instruments.



Left: 1990 first solar polar orbit by Ulysses during solar maximum. Middle: Ulysses second orbit during 2000 solar maximum. Right: 2008 Ulysses third orbit during prolonged solar minimum without sunspots. Comparison by Dave McComas et al.

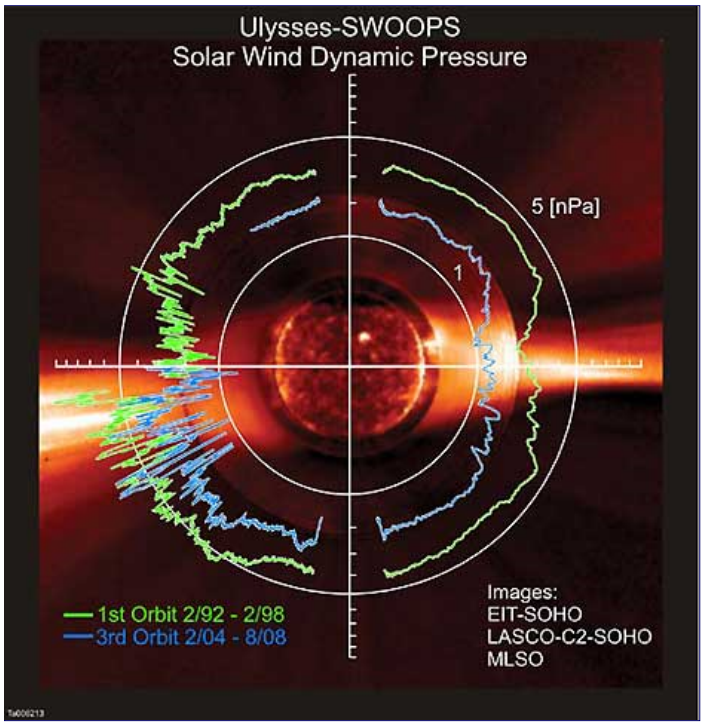
Teleconference excerpt:

Dave McComas, Ph.D., Principal Investigator, Ulysses Solar Wind Instrument, Southwest Research Institute, San Antonio, Texas: "For the first time, we've had a spacecraft fly over the poles of the sun. The black line going down and up and down below the images is the sunspot number from 1990 to 2008. You can see that the black line went through a minimum back in the mid-1990s and maximum around 2000 and now is back to minimum conditions. The spacecraft Ulysses has completed almost three full orbits around the sun over the poles of the sun, perpendicular to the plane where all the planets are.

The top three images are a combination of images of the sun characteristic of solar minimums on the left and right and a solar maximum in the middle. Superimposed on those three images is a radial plot of the solar wind velocity. Starting on the top left, what we saw in Ulysses's first orbit was very fast and steady solar wind at high latitudes in both the northern and southern hemispheres and a much more variable and slower solar wind at the sun's equatorial regions.

In the Ulysses second orbit during the 2000 solar maximum, we observed fast and slow solar winds at all helio latitudes and that's consistent with a much more complicated coronal structure that you can see underneath the radial plot.

Today, as Ulysses has made its third orbit, the sun is back to solar minimum conditions – in fact a deep and prolonged solar minimum – where the solar wind structure has re-emerged as fast and steady at high latitudes and slower and more variable at lower and mid-latitudes.



Green lines represent solar wind dynamic pressure measured by Ulysses in February 1992 to February 1998 first orbit. Blue lines represent third orbit between February 2004 and August 2008.

The pressure of the solar wind is sort of like air filling up a tire. There's a million miles per hour wind blowing off from the sun in all directions in space all the time, the solar wind, and it pushes material from our local part of the galaxy outward and inflates kind of a bubble in space, using the tire analogy. The harder the solar wind blows, the bigger the bubble is and the less hard it blows, the smaller the bubble is. What you can see here is the difference between the two orbits of Ulysses at solar minimum a decade ago and the most recent solar minimum now.

The solar minimum a decade ago is the green lines between 1992 and 1998. Now the most recent solar minimum's orbit is the blue line and you can see that it's significantly smaller at all helio latitudes.

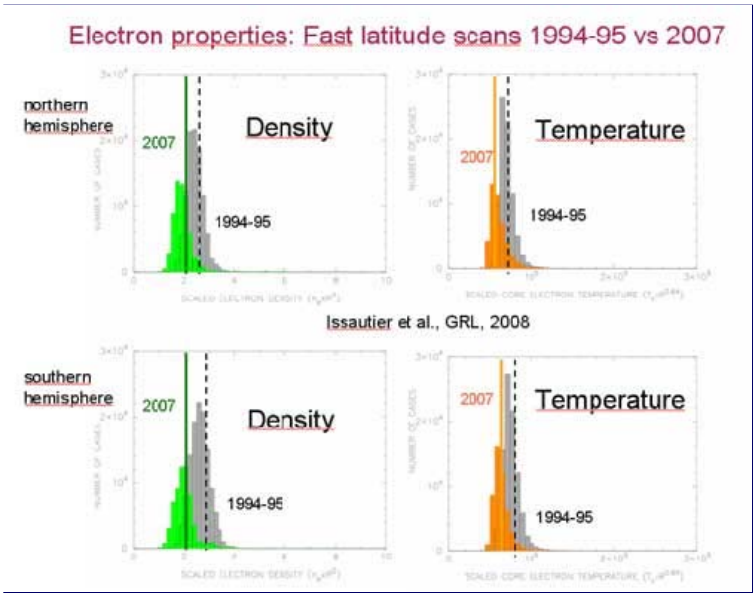
This is a whole sun phenomenon. The entire sun is blowing significantly less harder, about 20% to 25% less harder and 13% lower temperature, than it was during the previous solar minimum a decade ago. That's a very significant change. In fact, the solar wind that we are seeing now is blowing the least hard we've ever seen it for a prolonged time since the start of such observations in the early 1960s at the start of the Space Age. So, over the entire record of solar

wind observations (about 50 years), this is the lowest prolonged pressure that we've ever observed.

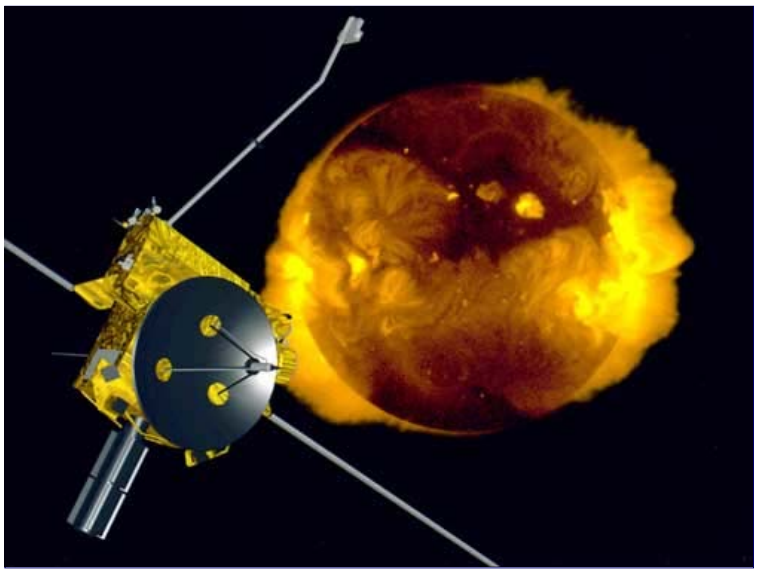
Implications - "We don't yet understand"

This long-term trend we have been observing the past fifteen years from Ulysses with this slow and continuous decrease in the solar wind power – is that about to end with the beginning of the next solar cycle? Is that going to turn around and this has just been a phase we passed through? Or is it the start of a trend that's going to extend longer into the next solar maximum and next solar minimum when the cosmic ray ions are able to come in?

The longer it goes on decreasing like this, the more important the effects of the deflation in the heliosphere will become. We don't yet understand the implications of the decreasing solar wind and deflating heliosphere on Earth and the solar system."



The 2007 solar wind density was about 20% to 25% less and 13% cooler than 1994 to 1995 Ulysses solar wind measurements. Graphic by Karine Issautier, Ph.D., Ulysses Radio Wave Lead Investigator, Observatoire de Paris, Meudon, France.



NASA graphic of Ulysses spacecraft and active sun. Ulysses is expected to "freeze to death" by December 2008, after nearly twenty years of sending data from the sun to Earth.

More Information:

For further reports about solar phenomena, please see reports in the **Earthfiles Archive:**

- 08/29/2008 — Still No Sunspot Action on the Sun
- 01/10/2008 — Solar Cycle 24 Has Begun
- 01/13/2007 — Confusing Sun: Will Solar Cycle 24 Be Most Intense On Record?

- 08/23/2006 — Solar Cycle 24 - Headed for Intense X Flares by 2010-2012?
- 11/18/2005 — Is the Sun Heating Up?
- 09/23/2005 — 9 X-Class Solar Flares Between September 7 - 19, 2005.
- 03/20/2005 — Astronaut John Young: "The Moon Can Save Earth's Civilization."
- 02/11/2005 — Sunspot Region 720 Emitted Strongest Solar Radiation Since October 1989.
- 10/29/2003 — Fifth Intense Solar X-Flare - What's Happening On the Sun?
- 10/25/1999 — A Blast of Solar Wind Provokes Aurora Over Northern U. S.

Websites:

NASA: http://ulysses.jpl.nasa.gov/

European Space Agency: http://www.esa.int/esaSC/120395_index_0_m.html

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