

Solar wind blows at 50-year low

By Jonathan Amos, Science reporter, BBC News
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The solar wind - the stream of charged particles billowing away from the Sun - is at its weakest for 50 years.

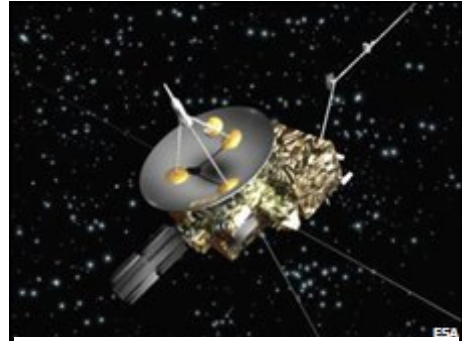
Scientists made the assessment after studying 18 years of data from the Ulysses satellite which has sampled the space environment all around our star.

They expect the reduced output to have effects right across the Solar System.

Indeed, one impact is to diminish slightly the influence the Sun has over its local environment which extends billions of kilometres into space.

Confirmation of that prediction should come from the far-distant Voyager spacecraft which were launched in the 1970s and are now bearing down on the edge of the heliosphere - the great "bubble" of wind material that surrounds the Sun.

Scientists now predict the Voyagers will hit the edge and cross over into interstellar space - that region considered to be "between the stars" - sooner than anticipated.



Engineers expect contact to be lost with Ulysses very soon

Space age

The solar wind, which originates in the Sun's hot outer atmosphere known as the corona, gusts and calms with the star's familiar 11-year cycle of activity (but also over its less well known longer cycles, too).

Calmer wind conditions would be expected to prevail right now, but the Ulysses data indicates circumstances unprecedented in recent times.

"This is a whole Sun phenomenon," said Dave McComas, Ulysses solar wind instrument principal investigator, from Southwest Research Institute, San Antonio, US.

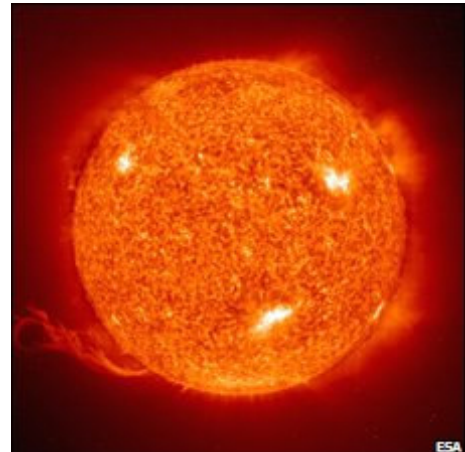
"The entire Sun is blowing significantly less hard - about 20-25% less hard - than it was during the last solar minimum 10-15 years ago.

"That's a very significant change. In fact, the solar wind we're seeing now is blowing the least hard we've see it for a prolonged time, since the start of those observations in the 1960s at the start of the space age."

In addition to being calmer, the wind measured at Ulysses is 13% cooler.

However, judging from Sun activity data collected by non-satellite methods over the past 200 years, the current behaviour is thought to be well within the long-term norm.

Nonetheless, scientists expect the weakened wind to have a wide range of impacts.



The Sun is a variable star; activity rises and falls in cycles

Energetic rays

The charged wind particles also carry with them the Sun's magnetic field, and this has a protective role in limiting the number of high-energy cosmic rays that can enter the Solar System.

More of them will probably now make their way through.

Many of these rays, which include electrons and atomic nuclei, originate in exploding stars and at black holes, and move at colossal speeds.

They pose no major risk to people on Earth because our atmosphere also works to reduce their intensity; but they are a consideration for space operations.

The rays can damage satellite electronics, and if current solar wind conditions persist, engineers would have to take this into account when deciding how to "harden" their spacecraft. Astronauts, too, are at risk from the higher doses of radiation associated with cosmic rays.

"The Sun also puts out cosmic rays in the form of bursts and these bursts are much less frequent at solar minimum. However, when they do occur at solar minimum, they are more lethal, so this is not a good time to be travelling in space owing to both kinds of cosmic rays," explained Professor Nancy Crooker, from Boston University, Massachusetts, US.

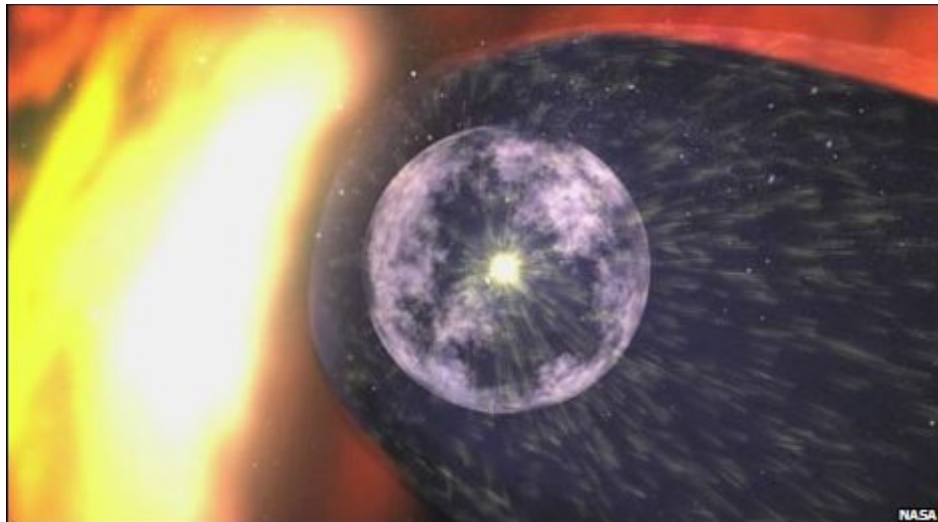
"Reduced solar activity also leads to the cooling of Earth's upper atmosphere and if Earth's upper atmosphere is cooler then there is less drag up there on satellites and this means we are left with much more debris up there - which is also something astronauts have to look out for."

Some researchers have attempted to link the intensity of cosmic rays at Earth to cloudiness and climate change. Current conditions may be a good opportunity to test these ideas further.

The Ulysses mission is a co-operative venture between the US space agency and the European Space Agency (Esa). Launched by the shuttle in 1990, it was the first satellite to study the space environment above and below the Sun's poles.

It samples the solar wind and solar magnetic field as it circles the star in a six-year orbit that also carries it out to Jupiter and back.

But the harsh conditions of space are now slowly taking their toll on the spacecraft.



Artist's impression: The wind forms a bubble of material around the Sun

Ulysses' main transmitter no longer works and it is struggling to put enough power into its heating systems. With the satellite currently moving away from the Sun, it is gradually getting colder; and engineers expect the hydrazine fuel used in its thrusters to freeze very soon.

When this happens, Ulysses will no longer be able to orientate itself and its antenna, and contact will be lost with Earth.

"Even though the end is now in sight, every day's worth of new data is adding to our knowledge of the Sun and its environment; and it's been a great and exciting mission," said Richard Marsden, Esa's Ulysses project scientist and mission manager.



The Voyager spacecraft will move beyond the solar wind's influence