Friday, 18 April 2008 09:48 UK

More doubt on cosmic climate link

By Richard Black
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Black hole - artist's impression. Image: BBC
Cosmic rays have their origins in hugely energetic events in space

Research has thrown further doubt on the notion that cosmic rays are a major influence on the Earth's climate.

The idea that modern global warming is due to changes in cloudiness caused by solar influences on cosmic rays is popular with "climate sceptics".

But scientists found changes in cosmic ray flux do not affect cloud formation - the second such report in a month.

Separately, other researchers have found that particles from space may affect temperatures at the poles.

Both pieces of research were presented here at the European Geosciences Union (EGU) meeting.

As a factor in climate change, we don't have any indication that this is important at all
Jon Egill Kristjansson

Cosmic rays, hugely energetic particles coming from space, smash into the top of the Earth's atmosphere, creating a cascade of charged particles lower down.

These particles may help water droplets to coalesce, and so aid the formation of clouds.

The proposed link to climate change is that cosmic rays can be partially blocked by the Sun's solar wind.

When the Sun is forceful, there are fewer cosmic rays arriving in the atmosphere, so fewer clouds form, which has a net heating effect on the Earth.

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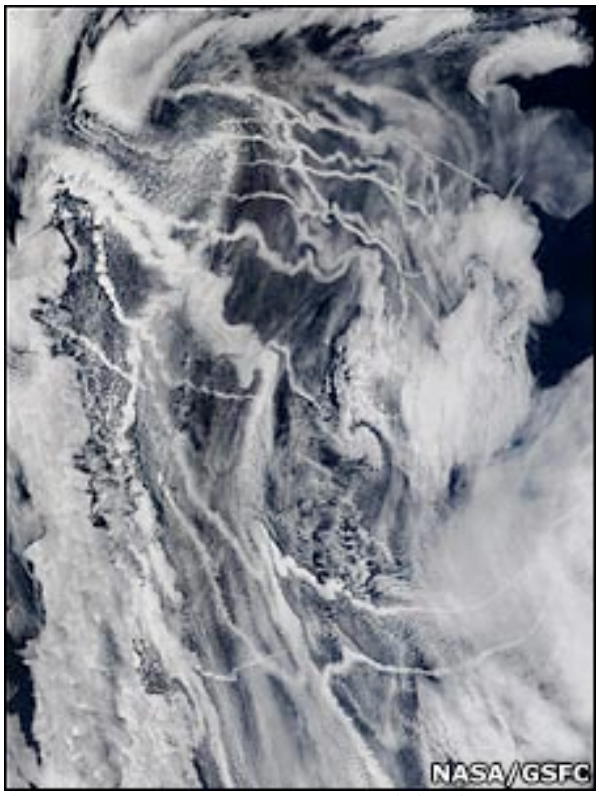
In graphics

If the mechanism has an impact today, several scientists have hypothesised, it should be possible to spot a link between the intensity of cosmic rays and the formation of clouds.

Jon Egill Kristjansson from the University of Oslo is one; and he unveiled his new results at the EGU meeting.

Human trails

Over the southern Atlantic, Pacific and Indian oceans, where air is much cleaner than in more urbanised regions of the world, particles from ship's chimneys change the properties of clouds in a way that is clearly visible to the Modis instruments (Moderate-resolution Imaging Spectroradiometers) onboard Nasa's Aqua and Terra satellites.



Ship's tracks. Image: Nasa/GSFC
Nasa satellites show the impact of shipping exhausts on cloud formation

The particles are stimulating the formation of water droplets.

If cosmic rays play a significant role in cloud formation, Dr Kristjansson reasoned, sudden changes in cosmic ray intensity should also show up, producing increases in cloud cover, changes in the size of droplets, and possibly in the total amount of water carried in the clouds.

"We have short-term changes called 'Forbush decreases', caused by eruptions on the Sun, where cosmic ray flux can decrease dramatically over one or two days and then gradually recover," he told BBC News.

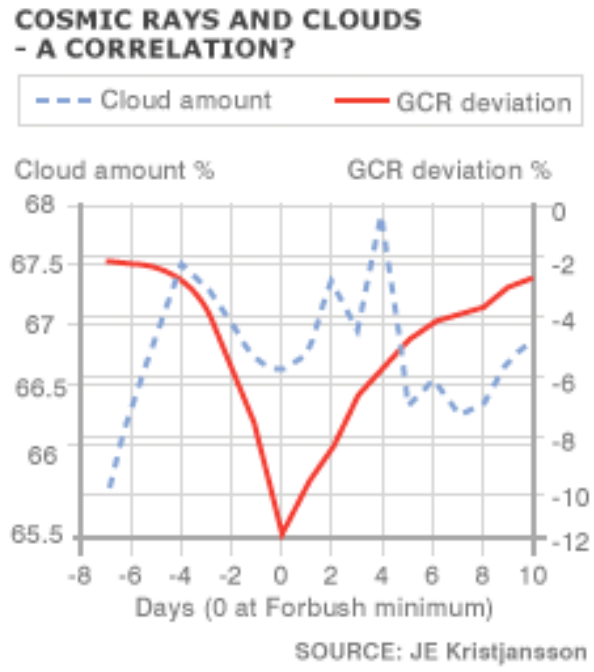
"The cosmic ray signature on clouds, if there is one, should show up here."

He identified 13 Forbush events between 2000 and 2005 and looked for evidence in Modis data of concurrent changes in could properties.

Although some of the events were followed by a decrease in cloud cover or changes in the size of cloud droplets, others preceded an increase in cloud cover, or no change at all.

Overall, the results essentially appeared random; abrupt dips in cosmic ray intensity did not produce any discernible pattern of changes in clouds, either immediately or in the four days following the Forbush decrease.

"This is a careful piece of work by Jon Egill Kristjansson that appears to find no evidence for the reputed link between cosmic rays and clouds," commented Joanna Haigh from Imperial College London, who is also attending the EGU meeting and has also studied possible links between solar variability and modern-day climate change.



Graph
Data showed no impact of galactic cosmic ray (GCR) flux on cloudiness

"It's supporting other recent work that also found no relationship," she added,

referring to a research paper published two weeks ago by a UK team which, using different sets of data and different means of analysis, also found no discernible influence of cosmic rays on cloud cover.

"I think that as a factor in climate change, it's pretty clear that we don't have any indication at this point that this is important at all," added Dr Kristjansson.

"Whereas global mean temperatures have been rising steadily over the last 30 years, we see that the cosmic ray flux has been steady."

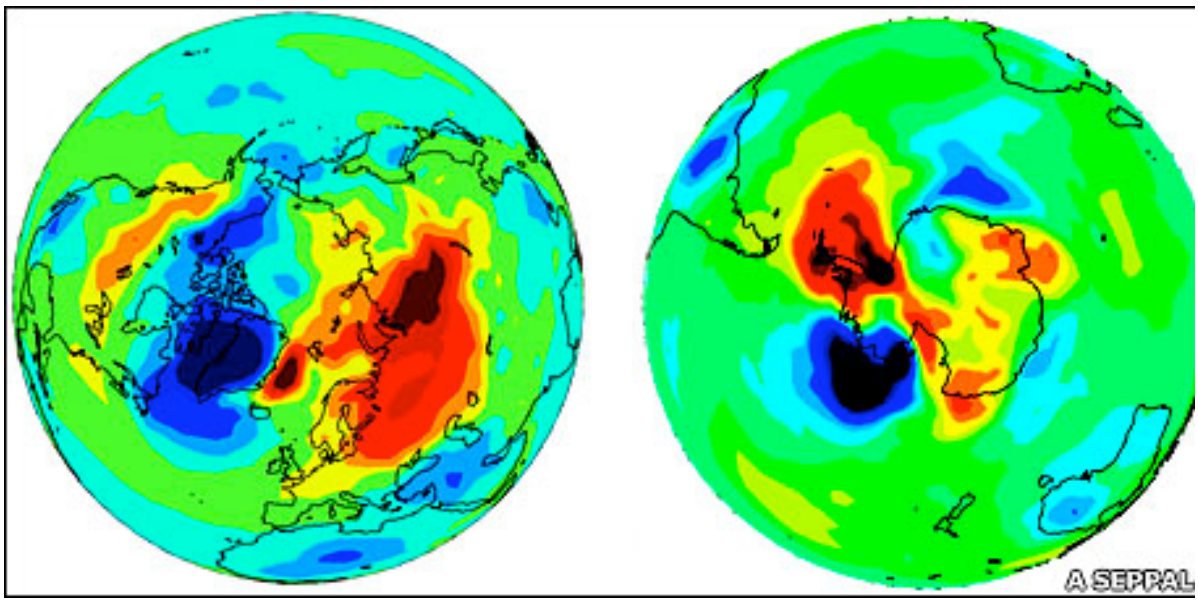
Local change

The EGU meeting also saw the first presentation of other research that could perhaps help to explain temperature variations seen between different regions of the Arctic and Antarctic.

Computer models have predicted that energetic particles hitting the top of the atmosphere in polar regions may change temperatures by stimulating the production of nitrous oxides (NOx).

"The energetic particles induce NOx production, and the NOx is then transported down to the stratosphere," explained Annika Seppala, who led the project from the Finnish Meteorological Institute and also works with the British Antarctic Survey.

"NOx destroys ozone in catalytic reaction cycles; and when you change ozone in the stratosphere, that... can then feed down to surface temperatures," she told BBC News.



Maps. Image: A Seppala
Periods of intense activity warmed (red) some regions and cooled others (blue)

Dr Seppala's observations appear to bear out the models' predictions, at least in winter in the polar regions.

In periods of relatively intense particle activity, some areas of the Earth's surface in both the Arctic and Antarctic are warmer while others become colder, showing differences of up to 2C or 3C compared to the long-term averages.

In periods of unusually low particle activity, the patterns are reversed.

The mechanism appears to be redistributing heat across the polar regions; there is no evidence for any overall warming or cooling, Dr Seppala added, nor that the scale of the effect has changed over time.

"The results were amazing, and I think it's something significant that we have to take into account," commented Katje Matthes from the Free University of Berlin, who chaired the EGU session which saw the new data presented.

"I think it's rather a local effect," she added, "and I don't think it has a big impact on global temperatures."

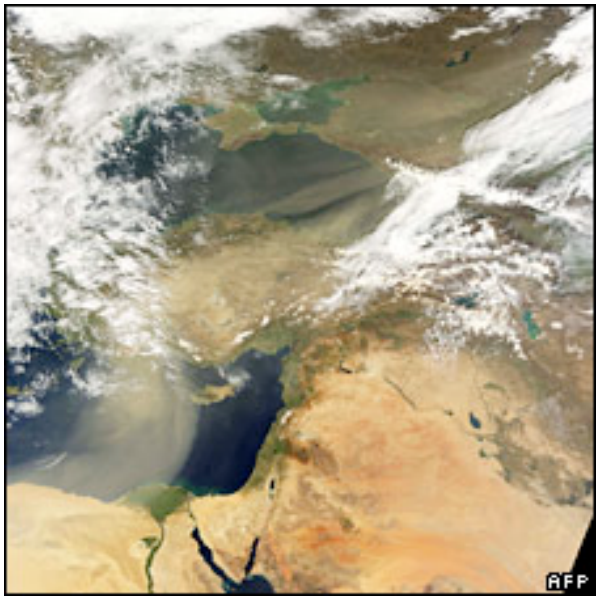
The Antarctic picture is particular fascinating. High particle flux places a big red patch, indicating warmth, over the Antarctic Peninsula, an area that is feeling the impacts of climate change faster than most other parts of the planet.

The heating and cooling from this mechanism might be short-term; but scientists studying the loss of ice from this region of Antarctica will surely want to understand whether the short-term natural highs and lows combine with the overall warming trend in a way that speeds melting.

Dr Seppala's team now intends to investigate what happens in the other seasons of the year, which will give a better understanding of the importance of this newly confirmed process.

Richard.Black-INTERNET@bbc.co.uk Thursday, 3 April 2008 14:04 UK

'No Sun link' to climate change
By Richard Black
Environment correspondent, BBC News website



Clouds over land. Image: AFP/Getty
Cloud cover affects temperature - but what determines cloud cover?

Scientists have produced further compelling evidence showing that modern-day climate change is not caused by changes in the Sun's activity.

The research contradicts a favoured theory of climate "sceptics", that changes in cosmic rays coming to Earth determine cloudiness and temperature.

The idea is that variations in solar activity affect cosmic ray intensity.

But UK scientists found there has been no significant link between cosmic rays and cloudiness in the last 20 years.

Presenting their findings in the Institute of Physics journal, Environmental Research Letters, the University of Lancaster team explain that they used three different ways to search for a correlation, and found virtually none.

The IPCC has got it right, so we had better carry on trying to cut carbon emissions
Terry Sloan

This is the latest piece of evidence which at the very least puts the cosmic ray theory, developed by Danish scientist Henrik Svensmark at the Danish National Space Center (DNSC), under very heavy pressure.

Dr Svensmark's idea formed a centrepiece of the controversial documentary The Great Global Warming Swindle.

Wrong path

"We started on this game because of Svensmark's work," said Terry Sloan from Lancaster University.

Terry Sloan has simply failed to understand how cosmic rays work on clouds
Henrik Svensmark

"If he is right, then we are going down the wrong path of taking all these expensive measures to cut carbon emissions; if he is right, we could carry on with carbon emissions as normal."

Cosmic rays are deflected away from Earth by our planet's magnetic field, and by the solar wind - streams of electrically charged particles coming from the Sun.

The Svensmark hypothesis is that when the solar wind is weak, more cosmic rays penetrate to Earth.

That creates more charged particles in the atmosphere, which in turn induces more clouds to form, cooling the climate.

The planet warms up when the Sun's output is strong.

Professor Sloan's team investigated the link by looking for periods in time and for places on the Earth which had documented weak or strong cosmic ray arrivals, and seeing if that affected the cloudiness observed in those locations or at those times.

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"For example; sometimes the Sun 'burps' - it throws out a huge burst of charged particles," he explained to BBC News.

"So we looked to see whether cloud cover increased after one of these bursts of rays from the Sun; we saw nothing."

Over the course of one of the Sun's natural 11-year cycles, there was a weak correlation between cosmic ray intensity and cloud cover - but cosmic ray variability could at the very most explain only a quarter of the changes in cloudiness.

And for the following cycle, no correlation was found.

Limited effect

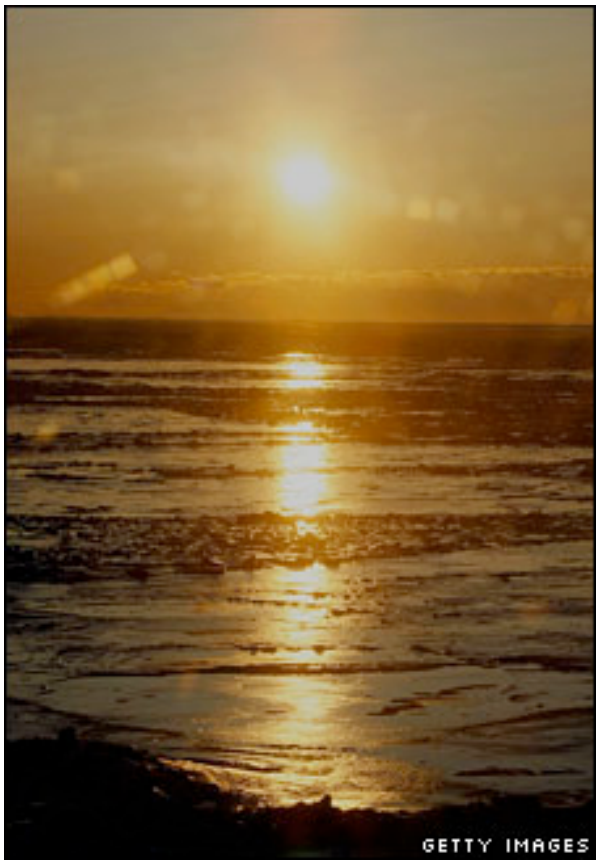
Dr Svensmark himself was unimpressed by the findings.

"Terry Sloan has simply failed to understand how cosmic rays work on clouds," he told BBC News.

"He predicts much bigger effects than we would do, as between the equator and the poles, and after solar eruptions; then, because he doesn't see those big effects,

he says our story is wrong, when in fact we have plenty of evidence to support it."

But another researcher who has worked on the issue, Giles Harrison from Reading University, said the work was important "as it provides an upper limit on the cosmic ray-cloud effect in global satellite cloud data".



Sun on ice. Image: Getty

Climate change: No Sun link
A cosmic climate connection?

Dr Harrison's own research, looking at the UK only, has also suggested that cosmic rays make only a very weak contribution to cloud formation.

The Svensmark hypothesis has also been attacked in recent months by Mike Lockwood from the UK's Rutherford-Appleton Laboratory.

He showed that over the last 20 years, solar activity has been slowly declining, which should have led to a drop in global temperatures if the theory was correct.

The Intergovernmental Panel on Climate Change (IPCC), in its vast assessment of climate science last year, concluded that since temperatures began rising rapidly in the 1970s, the contribution of humankind's greenhouse gas emissions has outweighed that of solar variability by a factor of about 13 to one.

According to Terry Sloan, the message coming from his research is simple.

"We tried to corroborate Svensmark's hypothesis, but we could not; as far as we can see, he has no reason to challenge the IPCC - the IPCC has got it right.

"So we had better carry on trying to cut carbon emissions."

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