

## The sun moves climate change

*The Deniers -- Part VI*

*Lawrence Solomon, Financial Post*

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Man produces greenhouse gases and greenhouse gases cause global warming, most scientists agree, but how, exactly, do greenhouse gases cause global warming? While theories abound, as do elaborate computer models incorporating a multitude of gases and other climatic factors, none has been conclusive. And if greenhouse gases aren't responsible, what else could be? A clear, verifiable mechanism showing how a greenhouse gas or other physical entity can drive climate change has eluded science. Until now.

For more than a decade, Henrik Svensmark of the Danish National Space Center has been pursuing an explanation for why Earth cools and warms. His findings -- published in October in the Proceedings of the Royal Society -- the mathematical, physical sciences and engineering journal of the Royal Society of London -- are now in, and they don't point to us. The sun and the stars could explain most if not all of the warming this century, and he has laboratory results to demonstrate it. Dr. Svensmark's study had its origins in 1996, when he and a colleague presented findings at a scientific conference indicating that changes in the sun's magnetic field -- quite apart from greenhouse gases -- could be related to the recent rise in global temperatures. The chairman of the United Nations Intergovernmental panel on Climate Change, the chief agency investigating global warming, then castigated them in the press, saying, "I find the move from this pair scientifically extremely naive and irresponsible." Others accused them of denouncing the greenhouse theory, something they had not done.

Svensmark and his colleague had arrived at their theory after examining data that showed a surprisingly strong correlation between cosmic rays --high-speed atomic particles originating in exploded stars in the Milky Way -- and low-altitude clouds. Earth's cloud cover increased when the intensity of cosmic rays grew and decreased when the intensity declined.

Low-altitude clouds are significant because they especially shield the Earth from the sun to keep us cool. Low cloud cover can vary by 2% in five years, affecting the Earth's surface by as much as 1.2 watts per square metre during that same period. "That figure can be compared with about 1.4 watts per square metre estimated by the Intergovernmental Panel on Climate Change for the greenhouse effect of all the increase in carbon dioxide in the air since the Industrial Revolution," Dr. Svensmark explained.

The Danish scientists put together several well-established scientific phenomena to arrive at their novel 1996 theory. The sun's magnetic field deflects some of the cosmic rays that penetrate the Earth's atmosphere, and in so doing it also limits the immense amounts of ions and free electrons that the cosmic rays produce. But something had changed in the 20th century: The sun's magnetic field more than doubled in strength, deflecting an extraordinary number of rays. Could the diminution of cosmic rays this century have limited the formation of clouds, making the Earth warmer?

That was a plausible theory. But exactly how cosmic rays might create clouds was a mystery -- an unprovable theory, many said. Some even claimed that it was inconceivable for cosmic rays to influence cloud cover.

To discover a mechanism, a team at the Danish National Space Center assembled by Dr. Svensmark undertook an elaborate laboratory experiment in a reaction chamber the size of a small room. The team duplicated the chemistry of the lower atmosphere by injecting the gases found there in the same proportions, and adding ultraviolet rays to mimic the actions of the sun.

What they found left them agape: A vast number of floating microscopic droplets soon filled the reaction chamber. These were ultra-small clusters of sulphuric acid and water molecules -- the building blocks for cloud condensation nuclei-- that had been catalyzed by the electrons released by cosmic rays.

We were amazed by the speed and efficiency with which the electrons do their work," Dr. Svensmark remarked. For the first time ever, researchers had experimentally identified a causal mechanism by which cosmic rays can facilitate the production of clouds in Earth's atmosphere. "This is a completely new result within climate science."

Dr. Svensmark has never disputed the existence of greenhouse gases and the greenhouse effect. To the contrary, he believes that an understanding of the sun's role is needed to learn the full story, and thus determine man's role. Not only does no climate model today consider the effect of cosmic particles, but even clouds are too poorly understood to be incorporated into any serious climate model.

Because of the work of Dr. Svensmark, other agencies are now building on the Danish findings. CERN, the European Organization for Nuclear Research in Geneva, has just started a multi-phase project that begins with a rerun of the Danish experiment, only CERN will use an accelerator rather than relying on natural cosmic rays. This multinational project will provide scientists with a permanent facility for studying effects of cosmic rays and charged particles in the Earth's atmosphere.

The clouds may be lifting on scientific inquiry into climate change.

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#### CV OF A DENIER:

Henrik Svensmark is director of the Centre for Sun-Climate Research at the Danish Space Research Institute (DSRI). Previously, Dr. Svensmark was head of the sunclimate group at DSRI. He has held post doctoral positions in physics at University California Berkeley, Nordic Institute of Theoretical Physics, and the Niels Bohr Institute. In 1997, Dr Svensmark received the Knud Hojgaard Anniversary Research Prize and in 2001 the Energy-E2 Research Prize.

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