The heat's in the sun

LAWRENCE SOLOMON, Financial Post

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We live in extraordinarily hot times, says Sami Solanki of the Max Planck Institute for Solar System Research in Germany. In 2004, he led a team of scientists that, for the first time, quantitatively reconstructed the sun's activity since the last Ice Age, some 11,400 years ago. Earth hasn't been this hot in 8,000 years and, he predicts, the hot spell will carry on for a few more decades before the sun turns down the heat.

The 19th and 20th centuries are especially noteworthy. "The sun is in a changed state. It is brighter than it was a few hundred years ago and this brightening started relatively recently -- in the last 100 to 150 years," he says. "The sun has been at its strongest over the past 60 years and may now be affecting global temperatures."

Dr. Solanki gives cold comfort to those who claim that global warming took off with the Industrial Revolution, and that the warming we've seen over the last century is mostly man-made. To demonstrate how unlikely this is, Dr. Solanki shows an almost perfect correlation between solar cycles and air temperatures over the land masses in the Northern hemisphere, going back to the mid 19th century.

For example, when the length of solar cycle increased dramatically, as it did in from 1910 to 1940, so did the temperature on Earth; when it decreased, as it did from the 1940s to the 1960s, so too did Earth temperatures. Dr. Solanki's startling correlation marked a pivotal point in the climate change debate: Its publication, more than any other single event, caused researchers around the world to examine the role that the sun plays in heating and cooling our planet.

Not that Dr. Solanki discredits the role of man-made greenhouse gases, such as carbon dioxide. These have probably played a large role in Earth's climate, he believes, but only since 1980 or so, when the sun's almost perfect correlation with Earth temperatures ended. He also believes that evidence that greenhouse gases have played a larger role in climate change may some day turn up, because his near-perfect correlation does not constitute proof. To date, however, he hasn't seen anything compelling that undermines his own findings.

The answer to most of the global warming we have seen over the past century, Dr. Solanki believes, will likely be somehow associated with the sun, and involve one or more of its parameters. It could be the sun's total irradiance, he states, citing work by others that he respects, or it could be the solar spectral irradiance, in particular with regard to ultraviolet radiation in the stratosphere. Or it could be the sun's open magnetic flux, which modulates the galactic cosmic-ray flux. Or it could be other factors -- many potential solar drivers of our climate exist.

Dr. Solanki is especially taken with the work of the Danish National Space Agency, which demonstrated the dramatic effect that cosmic rays can have on cloud formation, and thus temperatures -- "the mechanism is just too beautiful to ignore," he offers.

Among the factors that he believes hold great promise, and that cry out for investigation, are the sun's irradiance and its magnetic field, which underlie all solar activity. "Unfortunately, regular and detailed measurements of the sun's surface magnetic field are only available for a few decades, not long enough for comparison with climate," he says on his Web site. "Records of the solar irradiance are available for an even shorter length of time" -- accurate measurements began in 1978 using instrumentation aboard

spacecraft. With knowledge of these fundamental determinants of Earth's climate still in their infancy, we cannot act with confidence on climate change.

Dr. Solanki's recommendation: more research, and lots of it. To uncover a possible connection between solar irradiance and magnetic-field variations and climate, he thinks it necessary to extend the irradiance record to earlier times with the help of models. To understand the mechanisms responsible for variations in solar brightness, it is necessary to study solar variability on time scales of days to centuries.

Until the research is in, he believes, the story of what drives climate change remains unknown.

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Sami Solanki is director and scientific member at the Max Planck Institute for Solar System Research in Germany. Previously, he was appointed professor of astronomy at the University of Oulu in Finland in 1998 and Minnaert Professor at the University of Utrecht in the Netherlands in 1999. Among his research interests are solar physics, the physics of cool stars, radiative transfer and astronomical tests of theories of gravity. Dr. Solanki obtained his doctorate from the ETH in Zurich in 1987. His Web site is www.mps.mpg.de/homes/solanki.

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