measurements of sunlight declines recorded from the 1960s to direct solar radiation reaching the surface decreased. The gases and aerosols, the planet warmed at the same time that three from GISS, showed that due to increasing greenhouse century climate to investigate the dimming trend. The combined The GISS research team conducted the most comprehensive opposing forces of global warming and global dimming can occur at the same time.

The NASA study also sheds light on the puzzling observations of NASA's Goddard Institute for Space Studies (GISS), New York. "Knowing what aerosols are doing globally gives us an important missing piece of the big picture of the forces at work on climate." The study uses the longest uninterrupted satellite record of aerosols in the lower atmosphere, a unique set of global estimates funded by NASA. Scientists at GISS created the Global Aerosol Climatology Project by extracting a clear aerosol signal from satellite measurements originally designed to observe clouds and weather systems that date back to 1978. The resulting data show large, short-lived spikes in global aerosols caused by major volcanic eruptions in 1982 and 1991, but a gradual decline since about 1990. By 2005, global aerosols had dropped as much as 20 percent from the relatively stable level between 1986 and 1991. The NASA study also sheds light on the puzzling observations by other scientists that the amount of sunlight reaching Earth's surface, which had been steadily declining in recent decades, suddenly started to rebound around 1990. This switch from a "global dimming" trend to a "brightening" trend happened just as global aerosol levels started to decline, Mishchenko said. While the Science paper does not prove that aerosols are behind the recent dimming and brightening trends -- changes in cloud cover have not been ruled out -- another new research result supports that conclusion. In a published paper March 8 in the American Geophysical Union's Geophysical Research Letters, a research team led by Anastasia Romanou of Columbia University's Department of Applied Physics and Mathematics, New York, also showed that the apparently opposing forces of global warming and global dimming can occur at the same time. The GISS research team conducted the most comprehensive experiment to date using computer simulations of Earth's 20th-century climate to investigate the dimming trend. The combined results from nine state-of-the-art climate models, including three from GISS, showed that due to increasing greenhouse gases and aerosols, the planet warmed at the same time that direct solar radiation reaching the surface decreased. The dimming in the simulations closely matched actual measurements of sunlight declines recorded from the 1960s to 1990.
20th-century global dimming. "Much of the dimming trend over
the Northern Hemisphere stems from these direct aerosol
effects," Romanou said. "Aerosols have other effects that
contribute to dimming, such as making clouds more reflective
and longer-lasting. These effects were found to be almost as
important as the direct effects."

The combined effect of global dimming and warming may
account for why one of the major impacts of a warmer climate --
the spinning up of the water cycle of evaporation, more cloud
formation and more rainfall -- has not yet been observed. "Less
sunlight reaching the surface counteracts the effect of warmer
air temperatures, so evaporation does not change very much," said Gavin Schmidt of GISS, a co-author of the paper.

"Increased aerosols probably slowed the expected change in
the hydrological cycle."

Whether the recent decline in global aerosols will continue is an
open question. A major complicating factor is that aerosols are
not uniformly distributed across the world and come from many
different sources, some natural and some produced by
humans. While global estimates of total aerosols are improving
and being extended with new observations by NASA's latest
generation of Earth-observing satellites, finding out whether the
recent rise and fall of aerosols is due to human activity or
natural changes will have to await the planned launch of

"One of Glory's two instruments, the Aerosol Polarimetry
Sensor, will have the unique ability to measure globally the
properties of natural and human-made aerosols to
unprecedented levels of accuracy," said Mishchenko, who is
project scientist on the mission.

Aerosols May Have High Impact On Rainfall, Climate Change (Feb. 23, 2009)

--- Aerosols may have a greater impact on patterns of
Australian rainfall and future climate change than
previously thought, according to a leading
scientist's new model.

Tiny Airborne Particles Found To Be A Major Cause Of Climate Change (July 19, 2008) --- How
do tiny airborne particles affect our climate?

Study Links 'Smog' To Arctic Warming (Mar. 19, 2006) --- In a global assessment of the impact of ozone on
cloud warming, scientists at the NASA Goddard Institute for Space Studies, New York,
evaluated how ozone in the lowest part of the atmosphere...

New Study Turns Up the Heat on Soot's Role in Himalayan Warming (Dec. 18, 2009) --- A new modeling
study from NASA confirms that when tiny air pollution particles we commonly call soot --
also known as black carbon -- travel along wind currents from densely populated south Asian...

Adapted from materials provided by NASA/Goddard Space Flight Center.

Email or share this story: More

Copyright © 1995-2009 ScienceDaily LLC  —  All rights reserved  —  Contact: editor@sciencedaily.com

Part of the InVillage Your Total Health Network