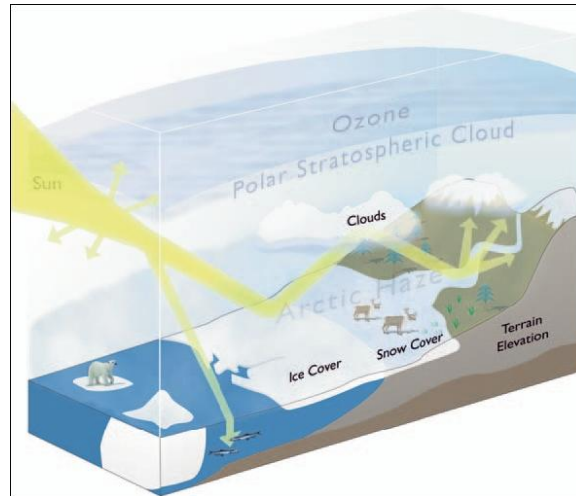


American Meteorological Society's Environmental Science Seminar Series

Changes in Cold Places Part II: The Role of Air Pollution on Arctic Warming



Public Invited

Please provide us with a business card if you would like to be on our future mailing list

Date and Time:

**Wednesday, May 31, 2006,
12:00 Noon - 2:00 pm**

**Location: Russell Senate Office Building, Room 385
Washington, DC**

Buffet Reception Following

Moderator

Dr. Anthony Socci, Senior Fellow, American Meteorological Society

Speakers

Dr. Drew Shindell, Research Scientist, NASA Goddard Institute for Space Studies, New York, NY

Dr. Dan Lubin, Research Physicist and Senior Lecturer, Center for Atmospheric Sciences, Scripps Institution of Oceanography, La Jolla, CA

Influence of Ozone (Smog) in the Lower Arctic Atmosphere

The Arctic has been warming rapidly during recent decades. In a new study, we investigated the contribution of ozone pollution to this warming. Ozone in the troposphere (lower atmosphere) is both a greenhouse gas and a primary ingredient in smog that is damaging to agriculture and natural ecosystems and to human health. It is formed chemically in the atmosphere from nitrogen oxides, carbon monoxide and hydrocarbons. These pollutants come from many sources, including natural emissions from wetlands, forests, soils and lightning. They are also emitted from human activities such as fossil fuel burning, cement manufacturing, fertilizer application and biomass burning. Emissions from human activities have increased dramatically since the industrial revolution.

Using estimates of the historical emissions as a function of time, we calculated the resulting evolution of worldwide tropospheric ozone from 1890 to the present. We then used the NASA Goddard Institute for Space Studies climate model to examine the effects of the increased ozone pollution during the 20th century.

As expected, ozone levels in the lower atmosphere increased most sharply over industrialized areas. This results in ozone causing a greater warming in those regions. During summer (June-August), tropospheric ozone led to warming of more than 0.5 °C (0.9 °F) over polluted Northern Hemisphere continental regions. During fall, winter, and spring, when ozone's lifetime is comparatively long, it can be transported efficiently from Northern mid-latitudes to the Arctic where it can also have a substantial effect on climate. The simulations indicate that tropospheric ozone increases could have contributed about 0.3 °C (~0.6 °F) annual average and about 0.4- 0.5 °C (~0.9 °F) during winter and spring to the rapid warming seen in the Arctic during the 20th century. This is roughly one-third of the observed warming in the Arctic, though the uncertainty in the current trends is large. Thus in addition to mitigating global climate warming and improving human and ecosystem health, ozone pollution controls may help to substantially reduce the rapid rate of Arctic warming and may help to slow the dramatic melting of Arctic sea ice.

Influence of Air Pollution on Clouds and Arctic Warming

The Arctic is presently exhibiting the largest and most diverse responses to anthropogenic climate warming; these include some of the largest surface temperature increases, rapid retreat of sea ice, and recently documented melting of glacial ice. We now recognize three ways by which human industrial activity warms the climate of the Arctic. First, there is the direct radiative forcing by "greenhouse" gases and related feedbacks with the reflectivity of ice and snow. Second, global climate warming is altering an atmospheric circulation pattern called the Arctic Oscillation, in such a way the warmer air from lower latitudes is more frequently transported throughout much of the Arctic. Third, Arctic air pollution from northern industrial regions is altering the microphysics of clouds, such that they trap more heat near the Arctic Earth surface.

Air pollution from northern industrial sources becomes trapped in the isolated Arctic air mass during winter and spring, resulting in large pan-Arctic concentrations of aerosol concentrations in the lower atmosphere known as the “Arctic Haze.” The high Arctic is also one of Earth’s cloudiest regions, with low-level stratiform clouds present approximately 70% of the time. Advances in cloud physics from the 1970s show that industrial aerosols can make the average liquid water droplet size smaller in clouds, which then makes the clouds reflect more solar energy to space but also trap more terrestrial thermal energy near the surface. In the high Arctic, the latter is more important because of the low levels of sunlight and greater importance of terrestrial infrared radiation in regulating the climate. Thus, while tropospheric pollution aerosol at tropical and mid-latitudes is causing a “global dimming” and partly offsetting greenhouse gas warming, industrial aerosol is adding to the warming in the Arctic. Direct observation of these predicted subtle climate changes is quite challenging; often the climate science community has only data from meteorological instruments not specifically designed to monitor multiyear and multi-decadal trends. However, the U.S. Department of Energy’s Atmospheric Radiation Measurement (ARM) program has since 1998 maintained an advanced suite of instruments at Barrow, Alaska, that have enabled scientists to observe the effects of industrial aerosols on clouds and the Arctic greenhouse effect. The aerosol-driven reduction in cloud droplet size brings about an additional surface warming equal in magnitude to the direct warming by industrial carbon dioxide increases. This additional Arctic warming contribution will persist until Eurasian industrial sources cut back their emissions.

Biographies

Dr. Drew Shindell is a research scientist at the NASA Goddard Institute for Space Studies in New York and a Lecturer in the Department of Earth and Environmental Sciences at Columbia University. His major research interests are interactions between atmospheric composition and climate change, natural modes of climate variability and detection/attribution of climate change, climate and air quality linkages and public policy, and historical and ancient climate. His work is primarily computer modeling, but he has also spent several field seasons in Greenland and Antarctica.

His awards and accomplishments include more than 70 peer-reviewed publications; Scientific American’s ‘Top 50’ scientists award, 2004; NASA publication peer awards, 1998 and 1999; and the NSF Antarctic Service Medal, 1994. He is a co-author of WMO/UNEP Ozone Assessments, 1998, 2002, 2006; Co-author US National Assessment of Climate Change, 2001; Expert Reviewer, IPCC, 2001, 2007; Co-author Arctic Climate Impact Assessment, 2002, Co-author US CCSP Future Projections Synthesis and Assessment Product, 2007. He has testified on climate change before a US Senate Committee, advised the American Museum of Natural History, and has been a visiting scientist in London and Hamburg.

Dr. Shindell received his BA from the University of California at Berkeley in 1988, and a PhD from the State University of New York at Stony Brook in 1995, both in physics.

Dr. Dan Lubin is a Research Physicist and Senior Lecturer at the Center for Atmospheric Sciences, Scripps Institution of Oceanography, La Jolla, CA. His major research interests are atmospheric science and climate change in the polar regions.

Dr. Lubin is a veteran of several field campaigns, including the National Ozone Expedition, two subsequent deployments at Palmer Station, Antarctica, the 1994 joint U.S./Canada Arctic Ocean Section (an icebreaker crossing of the Arctic Ocean via the North Pole), and the Surface Heat Budget of the Arctic (SHEBA) campaign. He has also worked on tropical atmospheric physics and aerosol-climate interactions with the Central Equatorial Pacific Experiment (CEPEX), the Indian Ocean Experiment (INDOEX), and the Maldives Aerosol Campaign (MAC). Dr. Lubin also specializes in satellite remote sensing of polar regions, and as an astronomer has worked on ultraviolet spectroscopy of quasi-stellar objects. Dr. Lubin has published 65 scientific peer-reviewed papers, and, with Australian Antarctic researcher Robert Massom, has recently coauthored a two-volume textbook entitled *Polar Remote Sensing*.

Dan Lubin completed his BA in Physics at Northwestern University in 1986, then attended the University of Chicago, where he received two MS degrees in Geophysical Science and Astrophysics before earning his PhD in Geophysical Science in 1989. For his PhD thesis work, he made the first measurements of enhanced solar ultraviolet radiation under the springtime Antarctic ozone "hole", spending four months at Palmer Station, Antarctica. In 1990 Dr. Lubin took a postdoctoral position at the Scripps Institution of Oceanography, where he has remained as a research scientist since 1993.

**This seminar series is open to the public and does not require a reservation.
Please feel free to forward this notice**

The **Next Seminar** is tentatively scheduled for the week of June 19th, Topic: Is the Alleged Difference between the Observed Climate Warming at the Surface and the Temperature in the Lower Atmosphere now Reconciled?

Please see our web site for seminar summaries, presentations and future events:
<http://www.ametsoc.org/atmospolicy>

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