The BASC Newsletter, Volume 3, Number 2, is your update on the activities of the Board on Atmospheric Sciences and Climate of the National Academies. The Board seeks to advance understanding of the Earth's atmosphere and climate, to help apply this knowledge to benefit the public, and to advise the federal government on issues within the Board's areas of expertise. This newsletter can be viewed in its entirety at the BASC website.

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August 2006
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1. Message from the Chair

Dear Colleagues:

The NRC recently published a report entitled *Surface Temperature Reconstructions for the Last 2,000 Years*. This report was produced by a committee chaired by Gerald North of Texas A&M University. I call your attention to this report because of the unusually short duration of the study and its policy implications. Recognizing that the temperature-record issue has stimulated considerable controversy and become politically sensitive, in late 2005 NAS president Ralph Cicerone suggested to the U.S. Congress that the Academy undertake a fast-response study to provide an objective evaluation of the state of the science of surface temperature reconstructions for the last 2,000 years. In December Congressman Sherwood Boehlert, Chairman of the House Committee on Science, asked that the study be undertaken. The committee began meeting in March 2006 and delivered its report to Congress in June.

Normally, the Academy shies away from commitments to provide quick assessments of the state of any aspect of science because there is concern that quality might be compromised. And the Academy's divisions and boards share these concerns. My own experience has been that the Academy process, while often time consuming, results in exceptional documents that stand the test of time and serve as useful references for many years.

The Academy process involves careful reviews at all phases of a study, beginning with the statement of task to ensure that the study is doable and will be useful. The study committee must be knowledgeable and well-balanced to ensure that all aspects of the topic are covered and that alternative opinions are considered. And the Academy review of reports is quite extensive; for the *Surface Temperature* report there were thirteen independent reviews. Clearly, all of this takes time and the Academy wants to "do it right." Occasionally the Academy will undertake short

studies, and when it does, all phases of the process are accelerated, but quality is not compromised. In order for these fast-response reports to be effective, the topic must be sharply focused and the highest priority given to all phases of the study. Short studies place additional demands on the staff from the Academy presidents to the study director, the committee members, and especially the committee chair.

The *Surface Temperature Reconstructions* study is an example of a job very well done. It has received a great deal of attention in the press and Congress, with more than 200 pre-publication copies distributed. Committee members spent three days briefing congressional staff and members, and the Subcommittee on Oversight and Investigations of the House Committee on Energy and Commerce subsequently held two days of hearings on the issue. The committee, Chairman North, and the BASC study staff have my sincere thanks and congratulations. Please take a few moments to peruse the report at http://www.nap.edu/catalog/11676.html. I know that you will find it interesting.

Let me conclude by reminding you that BASC will be holding its tri-annual, brainstorming workshop August 8-9. At these workshops, described by Chris Elfring in the April, 2006 newsletter, BASC and several community representatives informally discuss interesting, promising, challenging, and policy-relevant issues facing the atmospheric sciences in the future. In her April message Chris asked that you, the community, provide us with your thoughts on the future. If you have not done so please take a few moments to send a short email to Chris at celfring@nas.edu. All we ask is a short paragraph describing what you consider to be an important issue and why. It can be a basic or applied science topic, broad or narrowly focused, technological in nature, or science-policy related.

Thanks very much for your help.

Sincerely,
Bob Serafin
serafin@ucar.edu

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2. Upcoming Meetings

-- Board on Atmospheric Sciences and Climate, August 8-9, 2006, Woods Hole, Massachusetts
-- Analysis of Global Change Assessments, August 16, Boulder, Colorado
-- Analysis of Global Change Assessments, September 21-22, 2006, Washington, D.C.
-- Archiving and Accessing Environmental and Geospatial Data at NOAA, October 3-5, Washington, D.C.
-- Board on Atmospheric Sciences and Climate, November 30-December 1, 2006, Washington, D.C.
-- Climate Research Committee, November 30-December 1, 2006, Washington, D.C.

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3. What's New

-- New Study: "Developing Multipurpose Meteorological Observational Capabilities to Meet Multiple National Needs" will develop an overarching vision for an integrated, flexible, adaptive, and multi-purpose mesoscale meteorological observation network and seek to identify specific steps to help develop a network that meets multiple national needs in a cost-effective manner. The official poll for nominations will be forthcoming; we will be seeking suggestions for potential committee members in the areas of weather forecasting, observational technology, network design, data quality control and archival, data assimilation, atmospheric dispersion, air quality monitoring, aviation weather, weather information for surface transportation, coastal waterways, and urban meteorology. Nominations can be sent to Ian Kraucunas at ikraucunas@nas.edu.

-- New Study: "Scientific Accomplishments of Earth Observations from Space" will document major scientific accomplishments resulting from the unique vantage point provided by satellite observations of the Earth system. The study's main objective will be to document, using examples and explanation, how satellite observations uniquely contributed to scientific understanding of the atmosphere, ocean, land, biosphere, and cryosphere. The study will also address how satellite observations have contributed to the ability to predict variations in the Earth system (e.g., weather, climate variability, water availability, earthquakes, volcanoes, and tsunamis) and comment on opportunities to improve future Earth science research enabled by the vantage point of space. Opportunities for the Earth science community to suggest accomplishments to the committee will be provided in the near future.

-- New Report: *Surface Temperature Reconstructions for the Last 2,000 Years* assesses the state of scientific efforts to reconstruct surface temperature records for the Earth over approximately the last 2,000 years and the implications of these efforts for our understanding of global climate change. See "Special Feature" below for more information about this report.

-- New Report: *Completing the Forecast: Characterizing and Communicating Uncertainty for Better Decisions Using Weather and Climate Forecasts* explores how to improve the generation, communication, and potential use of uncertainty information for hydrometeorological forecasts and makes recommendations for improvements. Uncertainty is a fundamental characteristic of weather, seasonal climate, and hydrological prediction and no forecast is complete without a description of its uncertainty. Effective communication of uncertainty helps people better understand the likelihood of a particular event and improves their ability to make decisions based on the forecast.

-- New Report: *Preliminary Principles and Guidelines for Archiving Environmental and Geospatial Data at NOAA: Interim Report* provides preliminary principles and guidelines that NOAA and its partners can use to begin planning specific archiving strategies for the data streams they currently collect. For example, the report concludes that the decision to archive environmental or geospatial data should be driven by its current or future value to society, and that funding for environmental and geospatial measurements should include sufficient resources to archive and provide access to the data these efforts generate.

-- The next meeting of the Board on Atmospheric Sciences and Climate will be held August 8-9, 2006, in Woods Hole, Massachusetts. The purpose of this meeting is to step back from our regular routine, hear from the community we serve regarding challenges and opportunities in the field, and develop a set of priority issues to guide BASC's activities over the next three years. If you are not able to attend, you can still participate by submitting your ideas in writing, which we will introduce during group discussions. Please send us up to three topics that you consider of importance to the atmospheric sciences and climate by Friday, August 4, 2006. We would greatly appreciate if you could include the following for each topic: (1) A sentence or two describing the issue, challenge, or opportunity; and (2) key questions that an academy-style study might address.

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4. Special Feature: *Surface Temperature Reconstructions for the Last 2,000 Years*

Because widespread, reliable instrumental records are available only for the last 150 years or so, scientists estimate climatic conditions in the more distant past by analyzing proxy evidence from sources such as tree rings, ice cores, corals, ocean and lake sediments, historical documents, glacier length records, and borehole temperature measurements. This research, and especially the reconstructions originally published by Mann et al. (1998, 1999) and featured in the Intergovernmental Panel on Climate Change Third Assessment Report (IPCC, 2001), attracted considerable attention because the authors concluded that the Northern Hemisphere was likely warmer during the late 20th century than at any other time during the past millennium. Controversy arose because many people interpreted this result as definitive evidence of

anthropogenic causes of recent climate change, while others criticized the methodologies and data that were used. This report attempts to diffuse this controversy by providing a comprehensive assessment of surface temperature reconstructions for the last 2,000 years, as well as the implications of these efforts for our understanding of global climate change.

This report concludes that large-scale surface temperature reconstructions are important tools in our understanding of global climate change that allow us to say, with a high level of confidence, that global mean surface temperature was higher during the last few decades of the 20th century than during any comparable period during the preceding four centuries. Less confidence can be placed in large-scale surface temperature reconstructions for the period from A.D. 900 to 1600, although available proxy evidence indicates that temperatures at many, but not all, individual locations were higher during the past 25 years than during any period of comparable length since A.D. 900. Very little confidence can be assigned to statements concerning the hemispheric mean or global mean surface temperature prior to about A.D. 900 or in statements regarding the warmth of individual years and decades in the context of the past millennium, primarily because of the scarcity of precisely dated proxy evidence.

Surface temperature reconstructions also provide a useful source of information about the variability and sensitivity of the climate system. However, the report emphasizes that surface temperature reconstructions for periods prior to the industrial era are only one of multiple lines of evidence supporting the conclusion that climatic warming is occurring in response to human activities, and they are not the primary evidence. Large-scale surface temperature reconstructions have the potential to further improve our knowledge of temperature variations over the last 2,000 years, particularly if additional proxy evidence can be identified and obtained from areas where the coverage is relatively sparse and for time periods before A.D. 1600 and especially before A.D. 900. It would also be helpful to update proxy records that were collected decades ago, in order to develop more reliable calibrations with the instrumental record. Finally, because some of the most important potential consequences of climate change are linked to changes in regional circulation patterns, hurricane activity, and the frequency and intensity of droughts and floods, the committee suggests that regional and large-scale reconstructions of changes in other climatic variables, such as precipitation, over the last 2,000 years would provide a valuable complement to those made for temperature.

To read or order a copy of the pre-publication version of the report online, please visit http://www.nap.edu/catalog/11676.html.

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5. Recently Released Reports

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should be driven by its current or future value to society, and that funding for environmental and geospatial measurements should include sufficient resources to archive and provide access to the data these efforts generate.

Strategic Guidance for the National Science Foundation's Support of the Atmospheric Sciences: An Interim Report provides preliminary guidance to the National Science Foundation's Division of Atmospheric Sciences (ATM) on its strategy for achieving its goals in the atmospheric sciences. The report reviews how the atmospheric sciences have evolved over the past several decades, analyzes the strengths and limitations of the various modes of support employed by ATM, and offers some preliminary recommendations regarding future directions for ATM.

Review of NOAA's Plan for the Scientific Stewardship Program provides input to NOAA on its draft "Scientific Data Stewardship (SDS) Implementation Plan." The SDS program will be responsible for processing, archiving, and distributing observations from satellite and supporting ground-based platforms for monitoring, diagnosing, understanding, predicting, modeling, and assessing climate variation and change. This report outlines ways to improve the draft plan.

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6. Studies in Progress: For more information about a specific project, click on the link.

Analysis of Global Change Assessments will identify lessons learned from past assessments to guide future global change assessment activities of the U.S. Climate Change Science Program (CCSP). To do so, the committee will conduct a comparative analysis of past assessments that have stated objectives similar to those of the CCSP and identify approaches and products that are most effective for meeting the CCSP's stated objectives for assessments.

Archiving and Accessing Environmental and Geospatial Data at NOAA will assist NOAA as it develops plans to meet its data archiving and data access requirements. This preliminary set of principles and guidelines for data archiving developed in the Committee's interim report (*Preliminary Principles and Guidelines for Archiving Environmental and Geospatial Data at NOAA: Interim Report*) will be refined and expanded using community input in a final report that will also address the extent to which a wide variety of data sets should be made available. The final committee report will also include specific examples of how these principles and guidelines could be applied to existing and planned data streams across NOAA.

Earth-Atmosphere Interactions: A Workshop on Understanding and Responding to Multiple Environmental Stresses will explore current understanding of multiple environmental stresses in the earth-atmosphere system on natural, managed, and socio-economic systems, and discuss the types of research needed to improve integrated understanding of these kinds of complex, nonlinear problems.

The Future of Rainfall Measuring Missions will provide advice on potential follow-on research and operational missions. In Phase I, the committee addressed how best to use the remaining TRMM spacecraft life (see *Assessment of the Benefits of Extending the Tropical Rainfall Measuring Mission: A Perspective from the Research and Operations Communities*). Phase II will focus on needs for satellite-based measurements of rainfall in 2006 and beyond.

Strategic Guidance for the National Science Foundation's (NSF) Support of the Atmospheric Sciences will provide guidance to NSF's Division of Atmospheric Sciences (ATM) on its strategy for supporting research to achieve the nation's scientific and education goals in the atmospheric sciences. In essence, the committee will consider how ATM can best accomplish its mission of stewardship of the atmospheric sciences into the future. (See the committee's interim report *Strategic Guidance for the National Science Foundation's Support of the Atmospheric Sciences: An Interim Report*.)

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7. BASC in the Past: Atmospheric Effects of Stratospheric Aircraft

In the early 1990s interest in high-speed civil transport aircraft (HSCTs) was increasing. The National Aeronautics and Space Administration (NASA) initiated research into the potential stratospheric impacts of a substantial increase in the use of HSCTs. The principal atmospheric impacts expected were depletion of stratospheric ozone, redistribution of stratospheric ozone, and climate effects. The NRC Panel on Atmospheric Effects of Stratospheric Aviation was established at NASA's request to ascertain whether key uncertainties had been identified by the NASA program and whether the program would reduce those uncertainties sufficiently that policies regarding environmental constraints on high-speed transports could be formulated. The panel was chaired by Thomas Graedel and included Daniel Cariolle, Marvin Geller, Jack Kerrebrock, David Lister, Konrad Mauersberger, Stuart Penkett, Ulrich Schmidt, Stephen Schwartz, and Susan Solomon.

In their 1994 report, *Atmospheric Effects of Stratospheric Aircraft: An Evaluation of NASA's Interim Assessment,* the panel praised NASA's efforts at building emissions scenarios, supporting laboratory studies of relevant chemical mechanisms, conducting field measurements, and developing numerical models. It recommended that efforts in these areas be continued, with more attention to improving three-dimensional chemical models, especially by incorporating data from satellites; conducting parameter space sensitivity studies in two-dimensional models; examining the HSCT effects on climate; studying organic chemistry in the upper troposphere; and undertaking additional, independent studies of plume and wake processes.

BASC panels published five more reports reviewing NASA's research efforts on atmospheric effects of aircraft during the 1990s. The final report in this series, *A Review of NASA's Atmospheric Effects of Stratospheric Aircraft Project*, was released in 1999. It found that NASA's research efforts had "improved the understanding of the atmospheric effects of stratospheric aircraft and [had] made important contributions to the fundamental understanding of stratospheric chemistry and dynamics." The report also noted that the Environmental Protection Agency was considering changing some of its regulations covering aircraft engine emissions and that early in 1999 Boeing Company had suspended its efforts to develop a fleet of HSCTs.

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We encourage your comments on this newsletter as well as on the reports and activities of BASC. To provide input, contact basc@nas.edu. To unsubscribe, contact basc@nas.edu.

BASC is a unit of the National Academies. The nation turns to the National Academies -- National Academy of Sciences, National Academy of Engineering, Institute of Medicine, and National Research Council -- for independent, objective advice on issues that affect people's lives worldwide. BASC members include: Robert J. Serafin (chair), National Center for Atmospheric Research; M. Joan Alexander, NorthWest Research Associates; Frederick R. Anderson, McKenna Long & Aldridge LLP; Michael L. Bender, Princeton University; Rosina M. Bierbaum, University of Michigan; Mary Anne Carroll, University of Michigan; Carol Anne Clayson, Florida State University; Walter Dabberdt, Vaisala Inc.; Kerry A. Emanuel, Massachusetts Institute of Technology; Dennis L. Hartmann, University of Washington; Peter R. Leavitt, Weather Information Inc.; Jennifer A. Logan, Harvard University; Vernon R. Morris, Howard University; F. Sherwood Rowland, University of California, Irvine; Thomas H. Vonder Haar, Colorado State University; Roger M. Wakimoto, National Center for Atmospheric Research; Chris Elfring (director, BASC).

We encourage you to share this newsletter with colleagues. If they would like to be added to the email list, a simple request to basc@nas.edu is all that is needed.