Message from the Director

Dear Colleagues:

Since the last edition of this BASC e-newsletter, we have been incredibly busy. We released four reports that are part of the America's Climate Choices (ACC) suite of studies, a report on CO2 stabilization targets, and another on how to verify greenhouse gas emissions. We also released a report on weather research in the United States. All of these reports are highlighted in this newsletter and links are provided to help you obtain copies. These reports convey some powerful messages, such as:

- A strong, credible body of scientific evidence shows that climate change is occurring, is caused largely by human activities, and poses significant risks for a broad range of human and natural systems. (*Advancing the Science of Climate Change*)

- Emissions of carbon dioxide from the burning of fossil fuels have ushered in a new epoch where human activities will largely determine the evolution of Earth's climate. Because carbon dioxide in the atmosphere is long lived, it can effectively lock the Earth and future generations into a range of impacts, some of which could become very severe. (*Climate Stabilization Targets: Emissions, Concentrations, and Impacts over Decades to Millennia*)

- Meeting internationally discussed targets for limiting atmospheric greenhouse gas concentrations and associated increases in global average temperatures will require a major departure from business as usual in how the world uses and produces energy. (*Limiting the Magnitude of Future Climate Change*)

- Adaptation to climate change calls for a new paradigm — one that considers a range of possible future climate conditions and associated impacts, some well outside the realm of past experience. (*Adapting to the Impacts of Climate Change*)

- While demand for information to support climate-related decisions has grown rapidly as people, organizations, and governments have moved ahead with plans to reduce greenhouse gas emissions and to adapt to the impacts of climate change, the nation lacks comprehensive, robust and credible information systems to inform climate choices and evaluate their effectiveness. (*Informing an Effective Response to Climate Change*)
There is a cumulative lesson to these reports: our understanding of the atmosphere and related systems, particularly climate, is critically important to society. We are working hard in the next months to disseminate the reports widely — briefings here in Washington to Congress, the Executive Branch, and Agencies; talks at professional meetings; webinars for the public and specialized audiences; and distribution of the reports and Reports in Brief. Please let us know if you see an opportunity for us to engage with your staff or organization.

And speaking of interacting with the community, the next BASC meeting will be October 28-29 in Norman, Oklahoma. We are continuing in our tradition of visiting leading institutions in the atmospheric and climate sciences to learn about their work and interact with a broad range of colleagues.

Chris Elfring, Director

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**AGU Session to Reflect on America’s Climate Choices and Next Steps**

**Call for Abstracts**

A proposed session at the American Geophysical Union (AGU) Fall Meeting being held December 13-17 in San Francisco will focus on America’s Climate Choices. The session will include summaries of and reactions to the ACC suite of reports, including reflections on their conclusions and recommendations, thoughts on how the recommendations might be implemented, and the roles and obligations of scientists and scientific organizations such as AGU in shaping and supporting the national discourse.

Visit the [AGU site](#) for further information about the session and how to submit an abstract.

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**NEW STUDIES: Calls for Nominations**

**Assessment of the National Weather Service’s Modernization Program**

During the 1980s and 1990s, NOAA launched a major program to modernize the National Weather Service (NWS), investing $5 billion to modernize NWS technologies to advance weather forecasting. Because no complete assessment of the entire end-to-end NWS modernization enterprise has been done, Congress has asked the National Academy of Sciences to conduct an assessment of the now-completed National Weather Service modernization. The project should not only address the past modernization, but also focus on lessons learned to support future improvements to NWS capabilities. It should address high-impact weather and new science and technologies that allow for even better forecasts; the integration of new technologies and better models into NWS operations; and improving current partnerships with private industry, academia, and other governmental agencies. Finally, the project
should provide advice on how NWS can best plan, deploy, and oversee these future improvements based on lessons learned from the NWS modernization. Work will be carried out in two phases, each phase concluding with a report. Phase 1 will provide a comprehensive assessment of the entire end-to-end NWS modernization enterprise with a focus on lessons learned from the effort to plan, deploy, and oversee the NWS modernization. Phase 2 will apply the lessons learned in phase 1 to advise NWS on future directions.

**Expertise Needed:**

Desired committee member expertise includes: operational weather and water forecasting, emergency management, organizational management and development, data systems and analysis, IT and modern system architecture, decision analysis, decision support systems, communication, and social sciences (economics, history). The committee will include an appropriate balance of backgrounds from the public and private sectors, academia, and the stakeholder community for NWS products and services, including concerns of the NWS workforce as one of these stakeholder communities. It will reflect the key sectors served by the NWS (energy, aviation/transportation, public health and safety) and core partners (emergency managers, media, the commercial weather industry).

**To Submit Nominations:**

Please submit the nominee's name, contact information, and a description of the nominee's qualifications to Maggie Walser via email at mwalser@nas.edu. Please include a description of the nominee's unique qualifications to serve on this committee, not just the person's name and resume.

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**A National Strategy for Advancing Climate Modeling**

Climate models are the foundation for understanding and projecting climate and climate-related changes and are critical tools for supporting climate-related decision making. The NRC's Board on Atmospheric Sciences and Climate is convening a study committee charged to evaluate and develop a strategy for improving the nation's capability to simulate local-to-global climate and climate-related changes on decadal to centennial timescales. The committee's report is envisioned as a high level, comprehensive, and integrated analysis that spans both scientific and management issues, providing a strategic framework to guide progress in the nation's climate modeling enterprise over the next 10-20 years.

**Expertise Needed:**

Desired committee member expertise includes: global climate and Earth system modeling, regional climate modeling and downscaling, atmosphere and ocean dynamics, biogeochemical cycles, climate forcing and feedbacks, parameterization development, observations and validation approaches, ensemble methods, data management and access, high performance computing, uses and applications of
model output, integrated assessment, and institutional and management issues. Nominees can include individuals from private, public, and non-profit institutions (including foreign nationals and federal employees not in policy-making positions) who are willing to participate in a dynamic, interdisciplinary, consensus-oriented activity.

To Submit Nominations:

Please submit the nominee's name, contact information, and a description of the nominee's qualifications to JaNeise Sturdivant via email at jsturdivant@nas.edu. Please include a description of the nominee's unique qualifications to serve on this committee, not just the person's name and resume.

New Report: Near-Term Emissions Choices Could Lock In Climate Changes for Centuries to Millennia

Report Estimates Impacts from Various Levels of Warming

The new report from the National Research Council, Climate Stabilization Targets: Emissions, Concentrations, and Impacts Over Decades to Millennia, concludes that emissions of carbon dioxide from the burning of fossil fuels have ushered in a new epoch where human activities will largely determine the evolution of Earth's climate. Because carbon dioxide in the atmosphere is long lived, it can effectively lock the Earth and future generations into a range of impacts, some of which could become very severe. Therefore, emissions reductions choices made today matter in determining impacts experienced not just over the next few decades, but in the coming centuries and millennia. Policy choices can be informed by recent advances in climate science that quantify the relationships between increases in carbon dioxide and global warming, related climate changes, and resulting impacts, such as changes in streamflow, wildfires, crop productivity, extreme hot summers, and sea-level rise. The report quantifies several future impacts per degree (°C) of global warming. The report also demonstrates that emissions reductions larger than about 80%, relative to whatever peak global emissions rate may be reached, are required to approximately stabilize carbon dioxide concentrations for a century or so at any chosen target level. It also estimates the average temperature increases that would be likely if CO₂ were stabilized in the atmosphere at various target levels. However, the report does not recommend any particular stabilization target, noting that choosing among different targets is a policy choice rather than strictly a scientific one because of questions of values regarding how much risk or damage to people or to nature might be considered too much.

Increased Confidence About Future Impacts
Although some important future effects of climate change are difficult to quantify, there is now increased confidence in how global warming of various levels would relate to several key impacts, says the report. It lists some of these impacts per degree Celsius (or per 1.8 degrees Fahrenheit) of global warming, for example (these apply for 1°C to 4°C of warming):

- 5 percent to 10 percent less total rain in southwest North America, the Mediterranean, and southern Africa per degree Celsius of warming.
- 5 percent to 10 percent less streamflow in some river basins, including the Arkansas and Rio Grande, per degree Celsius of warming.
- 5 percent to 15 percent lower yields of some crops, including U.S. and African corn and Indian wheat, per degree Celsius of warming.

While total rain is expected to decrease in some areas, more of the rain that does occur is expected to occur in heavy falls in most land areas (3 percent to 10 percent more heavy rain per degree Celsius). In addition, warming of 1°C to 2°C (1.8°F to 3.6°F) could be expected to lead to a twofold to fourfold increase per degree in the area burned by wildfire in parts of western North America, the report says. Warming of 3°C (5.4°F) would put many millions more people at risk of coastal flooding and lead to the loss of about 250,000 square km of wetlands and drylands. And warming of 4°C (7.2°F) would lead to far warmer summers; about nine out of 10 summers would be warmer than the warmest ever experienced during the last decades of the 20th century over nearly all land areas.

Read/Purchase at the National Academies Press

Report in Brief

America's Climate Choices Panel Reports Released

In order to meet national needs for state-of-the-art information on
climate change, its impacts, and response options, a coordinated system of climate services is needed; such a system would require the involvement of multiple agencies and regional expertise, with very clear leadership at the highest level of government. A federally supported and credible system for greenhouse gas monitoring, reporting, verification, and management from multiple sources and at multiple scales is also a priority. The majority of Americans are concerned about climate change and are willing to respond, but would like more information. Therefore, the report recommends the creation of a national task force on climate communication and education.

Read/Purchase at the National Academies Press

Report in Brief

Climate change is occurring, is caused largely by human activities, and poses significant risks and in many cases is already affecting a broad range of human and natural systems. The compelling case for these conclusions is provided in Advancing the Science of Climate Change. While noting that there is always more to learn and that the scientific process is never closed, the book shows that hypotheses about climate change are supported by multiple lines of evidence and have stood firm in the face of serious debate and careful evaluation of alternative explanations.

As decision makers respond to these risks, the nation's scientific enterprise can contribute through research that improves understanding of the causes and consequences of climate change and also is useful to decision makers at the local, regional, national, and international levels. The book identifies decisions being made in 12 sectors, ranging from agriculture to transportation, to identify decisions being made in response to climate change.

Advancing the Science of Climate Change calls for a single federal entity or program to coordinate a national, multidisciplinary research effort aimed at improving both understanding and responses to climate change. Seven cross-cutting research themes are identified to support this scientific enterprise. In addition, leaders of federal climate research should redouble efforts to deploy a comprehensive climate observing system, improve climate models and other analytical tools, invest in human capital, and improve linkages between research and decisions by forming partnerships with action-oriented programs.

Read/Purchase at the National Academies Press

Report in Brief

Climate change, driven by the increasing concentration of greenhouse gases in the atmosphere, poses serious, wide-ranging threats to human societies and natural ecosystems around the world. The largest overall source of greenhouse gas emissions is the
burning of fossil fuels. The global atmospheric concentration of carbon dioxide, the dominant greenhouse gas of concern, is increasing by roughly two parts per million per year, and the United States is currently the second-largest contributor to global emissions behind China.

*Limiting the Magnitude of Future Climate Change* focuses on the role of the United States in the global effort to reduce greenhouse gas emissions. The book concludes that in order to ensure that all levels of government, the private sector, and millions of households and individuals are contributing to shared national goals, the United States should establish a "budget" that sets a limit on total domestic greenhouse emissions from 2010-2050. Meeting such a budget would require a major departure from business as usual in the way the nation produces and uses energy—and that the nation act now to aggressively deploy all available energy efficiencies and less carbon-intensive technologies and to develop new ones.

With no financial incentives or regulatory pressure, the nation will continue to rely upon and "lock in" carbon-intensive technologies and systems unless a carbon pricing system is established—either cap-and-trade, a system of taxing emissions, or a combination of the two. Complementary policies are also needed to accelerate progress in key areas: developing more efficient, less carbon-intense energy sources in electricity and transportation; advancing full-scale development of new-generation nuclear power, carbon capture, and storage systems; and amending emissions-intensive energy infrastructure. Research and development of new technologies that could help reduce emissions more cost effectively than current options is also strongly recommended.

[Read/Purchase at the National Academies Press](http://www.nap.edu/openbook.php?bookid=12244)

[Report in Brief](http://www.nap.edu/openbook.php?bookid=12244)

Across the United States, impacts of climate change are already evident. Some extreme weather events such as heat waves have become more frequent and intense, cold extremes have become less frequent, and patterns of rainfall are likely changing. The proportion of precipitation that falls as rain rather than snow has increased across the western United States and Arctic sea ice has been reduced significantly. Sea level has been rising faster than at any time in recent history, threatening the natural and built environments on the coasts. Even if emissions of greenhouse gases were substantially reduced now, climate change and its resulting impacts would continue for some time to come.

To date, decisions related to the management and protection of the nation's people, resources, and infrastructure have been based on records in the recent past, when climate was relatively stable. [*Adapting to the Impacts of Climate Change*](http://www.nap.edu/openbook.php?bookid=12244), part of the congressionally requested America's Climate Choices suite of studies, calls for a new paradigm—one that considers a range of
possible future climate conditions and impacts that may be well outside the realm of past experience.

Adaptation requires actions from many decision makers in federal, state, tribal, and local governments; the private sector; non-governmental organizations; and community groups. However, current efforts are hampered by a lack of solid information about the benefits, costs, and effectiveness of various adaptation options; climate information on regional and local scales; and a lack of coordination. *Adapting to the Impacts of Climate Change* calls for a national adaptation strategy that provides needed technical and scientific resources, incentives to begin adaptation planning, guidance across jurisdictions, shared lessons learned, and support of scientific research to expand knowledge of impacts and adaptation.

Read/Purchase at the National Academies Press

Report in Brief

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Weather matters for life, health, safety, property, and economic prosperity. Weather forecasts provide information that people and organizations can use to enhance these societal benefits and to reduce weather-related losses. Investing $5.1 billion annually in public weather forecasts and warnings has brought an estimated $31.5 billion dollars in benefits. Yet between 1980 and 2009 there were 96 weather disasters that each cost more than $1 billion—and cost many lives. *When Weather Matters: Science and Services to Meet Critical Societal Needs* puts forward the most pressing high level, weather-focused research challenges and needs to transfer research results into operations. Cutting across these challenges are socioeconomic considerations that are fundamental in determining how, when, and why weather information is, or is not, used. The report calls for a partnership of social scientists and meteorologists to ensure that weather research and forecasting meet societal and economic needs. The report also identifies predictions of very high impact weather, urban meteorology, and weather information for renewable energy development as important emerging issues in need of greater research to develop understanding and reach implementation. Priorities among established—or recognized but unrealized—goals include global non-hydrostatic coupled modeling; quantitative precipitation forecasting; hydrologic prediction; and mesoscale observations.

Read/Purchase at the National Academies Press Website

Report in Brief
Other Recent Reports

**Verifying Greenhouse Gas Emissions: Methods to Support International Climate Agreements**

The world's nations are moving toward agreements that will bind us together in an effort to limit future greenhouse gas emissions. With such agreements will come the need for all nations to make accurate estimates of greenhouse gas emissions and to monitor changes over time. In this context, the present book focuses on the greenhouse gases that result from human activities, have long lifetimes in the atmosphere and thus will change global climate for decades to millennia or more, and are currently included in international agreements. The book devotes considerably more space to CO2 than to the other gases because CO2 is the largest single contributor to global climate change and is thus the focus of many mitigation efforts. Only data in the public domain were considered because public access and transparency are necessary to build trust in a climate treaty.

The book concludes that each country could estimate fossil-fuel CO2 emissions accurately enough to support monitoring of a climate treaty. However, current methods are not sufficiently accurate to check these self-reported estimates against independent data or to estimate other greenhouse gas emissions. Strategic investments would, within 5 years, improve reporting of emissions by countries and yield a useful capability for independent verification of greenhouse gas emissions reported by countries.

**Global Sources of Local Pollution: An Assessment of Long-Range Transport of Key Air Pollutants to and from the United States**

Recent advances in air pollution monitoring and modeling capabilities have made it possible to show that air pollution can be transported long distances and that adverse impacts of emitted pollutants cannot be confined to one country or even one continent. *Global Sources of Local Pollution* examines the impact of the long-range transport of four key air pollutants (ozone, particulate matter, mercury, and persistent organic pollutants) on air quality and pollutant deposition in the United States. It also explores the environmental impacts of U.S. emissions on other parts of the world. The book recommends that the United States work with the international community to develop an integrated system for determining pollution sources and impacts and to design effective response strategies.

**Scientific Value of Arctic Sea Ice Imagery Derived Products**

**Press Release**

During the 1990s, environmental scientists and members of the intelligence community collaborated to consider potential uses of classified assets and data to advance the understanding of
environmental change. This program collected classified overhead imagery at six sites around the Arctic basin. Hundreds of unclassified products derived from those images have been produced but not yet released to the public. The National Research Council has reviewed the derived products, and reports that they show detailed processes that are important for studying effects of climate change on sea ice and habitat—data that are not available elsewhere. The report recommends that the products be released as soon as possible to the scientific research community.

Studies in Progress

**Climate, Energy, and National Security.** The National Academy of Sciences is helping facilitate the increased involvement of scientists in answering questions related to climate, energy, and environmental change. The goal is both to advance scientific understanding of global climate and other environmental and disaster-related phenomena, and consider the implications for both fundamental scientific understanding and national security.

**Assessment of Intraseasonal to Interannual Climate Prediction and Predictability.** This study will review the current state of knowledge about estimates of predictability of the climate system on intraseasonal to interannual timescales, assess in what ways current estimates are deficient, and recommend ways to improve upon the current predictability estimates. The study will also recommend research and model development foci and efforts that will be most beneficial in narrowing the gap between the current skill of predictions and estimated predictability limits. The review of predictability estimates to be addressed will include oceanic and atmospheric variables such as sea surface temperature, sub-surface heat content, surface temperature, precipitation, and soil moisture, as well as indices like Nino 3.4 sea surface temperatures or the phases of the Madden-Julian Oscillation.

**America’s Climate Choices.** In response to Public Law 110-161, the National Academies is conducting a series of coordinated activities to study issues associated with global climate change, including the science and technology challenges, and provide advice on the most effective steps and most promising strategies that can be taken to respond. Collectively, the activities will produce a broad, action-oriented, and authoritative set of analyses to inform and guide responses to climate change across the nation. Four reports from the focused panels are discussed above. A final, integrated report will answer four overarching questions:

- What short-term actions can be taken to respond effectively to climate change?
- What promising long-term strategies, investments, and opportunities could be pursued to respond to climate change?
- What are the major scientific and technological advances (e.g., new tools, research priorities, etc.) needed to better understand and respond effectively to climate change?
- What are the major impediments (e.g., practical, institutional, economic, ethical, intergenerational, etc.) to responding
effectively to climate change, and what can be done to overcome these impediments?

**Indicators for Understanding Global Climate Change.** The National Academy of Sciences (NAS), through its National Research Council (NRC), will facilitate the increased involvement of scientists in answering questions related to climate and environmental change, energy, natural disasters, and national security. The goal is both to advance scientific understanding of global climate and other environmental and disaster-related phenomena, and consider the implications for both fundamental scientific understanding and national security.

As part of a broader suite of activities, the Committee will develop a framework document that proposes a tentative suite of indicators, measurements (including locations around the globe), and metrics that are most important for understanding global climate change and for assessing environmental sustainability issues. This information could be useful in consideration of a coordinated climate observing strategy.

**Progress and Priorities of US Weather Research and Research-to-Operations Activities.** During the 1990s, the federal government supported a number of weather research and research-to-operations planning activities (e.g., the US Weather Research Program; USWRP), to identify key gaps in the understanding and simulation of severe weather of all types and their societal impacts, seeking to accelerate the rate at which weather forecasts were improved. Priorities developed by the USWRP were the starting point for a number of efforts including field campaigns and testbeds. However, these priorities, which were identified in documents published by the USWRP "Prospectus Development Teams" (PDTS), were developed more than a decade ago.

This study will explore the status of weather research and the research-to-operations activities at the federal level. It will discuss whether USWRP priorities remain relevant and how they might evolve to better meet current interagency needs. The goal is not to critique USWRP documents written more than a decade ago or to provide a formal review of current planning documents, but rather to identify emerging agency priorities and opportunities for interagency collaboration.

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.

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