Right: Recent climate warming and land use changes may be altering atmospheric dustiness over the Antarctic Peninsula and nearby oceans. While past studies of antarctic ice cores have linked high levels of atmospheric dust with large decreases in global air temperature at the end of the last ice age, there are few reliable records from recent decades and centuries, when natural processes and human activities have altered climate and the landscape. In a landmark study funded in part by NSF, scientists at the Desert Research Institute measured total aluminum in a 120 meter long ice core obtained from James Ross Island at the northern tip of the Antarctic Peninsula. The highly detailed record of soil dust spans the period 1832 to 1991 and shows that dust deposited from the air more than doubled during the 20th century. This increase closely paralleled measured air temperature increases of approximately 1°C in the Southern Hemisphere and southern South America over the same period, with high dust levels in the Antarctic Peninsula corresponding to warm and dry conditions during spring and summer in Patagonia and southern South America.

For more information:

www.nsf.gov/news/news_summ.jsp?cntn_id=110330&org=NSF&from=newsField

APPENDIXES

Appendix 1: DESCRIPTION OF NSF DIRECTORATES AND MANAGEMENT OFFICES

The **Directorate for Biological Sciences (BIO)** provides support for research to advance understanding of the underlying principles and mechanisms governing life. Research studies range across progressively more complex systems and scales encompassing the structure and dynamics of biological molecules, cells, tissues, organs, organisms, populations, communities, and ecosystems up to and including the global biosphere. Comprehensive concepts that span and unify the diverse areas of biology include complexity, robustness, communication, resilience, adaptability, and cooperation. Achieving a coherent understanding of the complex biological web of interactions that is life is a major challenge of the future. Meeting this challenge will require that knowledge about individual biological units, networks, sub-systems, and systems be compiled and connected from the molecular to the global level and across scales of time and space. Integral to all BIO activities is support for a broad range of research resources and a commitment to integrate research and education, to broaden participation, and to promote international partnerships. For more information, go to *www.nsf.gov/dir/index.jsp?dir=BIO*.

The **Directorate for Computer and Information Science and Engineering (CISE)** supports research in all areas of computer and information science and engineering, helps develop and maintain cutting-edge national computing and information infrastructure for research and education, and contributes to the education and training of the next generation of computer scientists and engineers. CISE supports projects designed to establish the scientific foundations of computing and communication devices and to explore their usage. For example, CISE funds advances in computing and communication theory, algorithms for computer and computational sciences, architecture and design of computers and software, and revolutionary computing paradigms based on emerging scientific ideas. At the systems level, CISE supports projects to better understand the fundamental properties of computer and network systems and to create better abstractions and tools for designing, building, analyzing, and measuring future systems. CISE programs also support advances in our understanding of the effective integration and co-evolution of social and computing systems; the capabilities of human beings and computing machines to create, discover, and reason with knowledge; the application of information technology to science and engineering problems; and the potential of computational systems to perform tasks autonomously, robustly, and flexibly. For more information, go to *www.nsf.gov/dir/index.jsp?dir=CISE*.

The **Directorate for Education and Human Resources (EHR)** supports activities that promote excellence in U.S. science, technology, engineering, and mathematics (STEM) education at all levels and in all settings, both formal and informal. The goal of these activities is to develop a diverse and well-prepared workforce of scientists, technicians, engineers, mathematicians, and educators, as well as a well-informed citizenry

For more information:

Office of the Director
www.nsf.gov/od/index.jsp

National Science Board
www.nsf.gov/nsb/

with access to the ideas and tools of science and engineering. EHR supports education research and infrastructure development in all science and engineering disciplines. Support is provided for individuals to pursue advanced study, for institutions to build their capacity to provide excellent STEM education, and for collaborations to strengthen STEM education at all levels by fostering alliances and partnerships among colleges, universities, school districts, and other institutions in the public and private sectors. For more information, go to *www.nsf.gov/dir/index.jsp?dir=EHR*.

The **Directorate for Engineering (ENG)** supports research and education activities that provide a foundation for our nation's global leadership in technology and innovation. This leadership is the key to our continued economic growth and national security. ENG investments include such emerging technologies as sensors and sensor systems, molecular electronics, photonics, cyberinfrastructure, metabolic engineering, bioengineering, manufacturing innovation, and nanotechnology. Fundamental engineering research has a profound impact on areas such as protecting the environment, improving human health, enabling science to better understand the natural world, and enhancing our standard of living. For more information, go to *www.nsf.gov/dir/index.jsp?dir=ENG*.

The **Directorate for Geosciences (GEO)** supports research in the atmospheric, earth, and ocean sciences. Basic research in the geosciences advances our scientific knowledge of the Earth and advances our ability to predict natural phenomena of economic and human significance, such as climate change, weather, earthquakes, fish-stock fluctuations, and disruptive events in the solar-terrestrial environment. GEO also supports the operation of national user facilities. For more information, go to *www.nsf.gov/dir/index.jsp?dir=GEO*.

The **Directorate for Mathematical and Physical Sciences (MPS)** supports research and education in astronomical sciences, chemistry, materials research, mathematical sciences, and physics. Major equipment and instrumentation such as telescopes and particle accelerators are provided to support the needs of individual investigators. MPS also supports state-of-the-art facilities that enable research at the cutting edge of science and research opportunities in totally new directions. For more information, go to *www.nsf.gov/dir/index.jsp?dir=MPS*.

The **Directorate for Social, Behavioral, and Economic Sciences (SBE)** supports research and education to build fundamental scientific knowledge about human cognition, language, social behavior, and culture and on economic, legal, political, and social systems, organizations, and institutions. To improve understanding of the science and engineering enterprise, SBE also supports science resources studies that are the nation's primary source of data on the science and engineering enterprise. For more information, go to *www.nsf.gov/dir/index.jsp?dir=SBE*.

The **Office of Cyberinfrastructure (OCI)** coordinates and supports the acquisition, development, and provision of state-of-the-art cyberinfrastructure resources, tools, and services essential to the conduct of 21st century science and engineering research and education. OCI supports cyberinfrastructure, such as supercomputers, high-capacity mass-storage systems, system software suites and programming environments, scalable interactive visualization tools, productivity software libraries and tools, large-scale data repositories and digitized scientific data management systems, networks of various reach and granularity, and an array of software tools and services that hide the complexities and heterogeneity of contemporary cyberinfrastructure while providing broad access and enhanced usability. OCI supports the preparation and training of current and future generations of researchers and educators to use cyberinfrastructure to further their research and education goals, while also supporting the scientific and engineering professionals who create and maintain these IT-based resources and systems and who provide essential customer services to the national science and engineering user community. For more information, go to *www.nsf.gov/dir/index.jsp?org=OCI*.

The **Office of Polar Programs (OPP)**, which includes the U.S. Polar Research Programs and U.S. Antarctic Logistical Support Activities, supports multidisciplinary research in the Arctic and Antarctic regions. These geographic frontiers—premier natural laboratories—are the areas predicted to be the first affected by global change. They are vital to understanding past, present, and future responses of Earth systems to natural and man-made changes. OPP support provides unique research opportunities ranging from studies of Earth's ice and oceans to research in atmospheric sciences and astronomy. For more information, go to *www.nsf.gov/dir/index.jsp?org=OPP*.

The **Office of International Science and Engineering (OISE)** serves as the focal point, both within and outside NSF, for international science and engineering activities. OISE promotes the development of an integrated, Foundation-wide international strategy and manages international programs that are innovative, catalytic, and responsive to a broad range of NSF interests. OISE also supports programs that provide international research experiences to students and young investigators, preparing them for full participation in the global research enterprise. In

BRAIN SURGERY

NSF-funded computer scientists at the College of William and Mary have developed a dynamic computer model of the brain to guide neurosurgeons during surgery. The three-dimensional model takes into account multiple factors, such as gravity and atmospheric pressure, that cause the brain to change shape and position.

NSF grantee and Guggenheim Fellow Nikos Chrisochoides approximates the geometry of the patient's brain by tessellating it into triangles in three dimensions, in other words, generating a mesh representing the brain. The model will help surgeons to make informed decisions about what to cut, where the critical paths are, and what areas to avoid.

For more information:

www.nsf.gov/discoveries/disc_summ.jsp?cntn_id=110646&org=NSF

REAL-TIME WEATHER FORECASTING

Tornados, floods, and other severe regional storms cause hundreds of deaths annually across the United States, disrupting transportation and commerce and causing economic loss exceeding $13 billion. These losses may be reduced through the deployment of software infrastructure that can trigger weather forecast models in response to developing weather. By mining streams of weather data, the software can "see" a storm while it is still in its early development stages and automatically launch a weather forecast. The data from the forecast are then available for visualization and further analysis from the Linked Environments for Atmospheric Discovery (LEAD) portal. LEAD makes meteorological data, forecast models, and analysis and visualization tools widely available and also provides the first searchable index of all national research weather data. This project, which demonstrates how the power of computing can help address problems of critical national importance, represents a paradigm shift for severe weather prediction and analysis, involving a multidisciplinary team of world class atmospheric and computer scientists.

For more information:

https://portal.leadproject.org/gridsphere/gridsphere

addition, OISE manages cooperative relationships with partner countries around the world and with international scientific organizations on behalf of NSF. For more information, go to *www.nsf.gov/div/index.jsp?div=OISE*.

The **Office of Budget, Finance, and Award Management (BFA)** is headed by the Chief Financial Officer, who has responsibility for budget, financial management, grants administration and procurement operations, and related policy. Budget responsibilities include the development of the Foundation's annual budget, long-range planning, and budget operations and control. BFA's financial, grants, and other administrative management systems ensure that the Foundation's resources are well managed and that efficient, streamlined business and management practices are in place. For more information, go to *www.nsf.gov/bfa/*.

The **Office of Information and Resource Management (OIRM)** provides human capital management, information technology solutions, continuous learning opportunities, and general administrative services to the NSF community of scientists, engineers, and educators. OIRM also provides logistical support functions for NSF staff as well as the general public. It is responsible for recruiting, staffing, and other human resource service requirements for all NSF staff and visiting personnel. OIRM is responsible for the management of NSF's physical infrastructure and conference facilities, the administration of its sophisticated technology infrastructure, and the dissemination of information about NSF programs to the external community through the agency's website. It is also responsible for delivery of the hardware, software, and support systems necessary to manage the Foundation's grant-making process and to maintain advanced financial and accounting systems. For more information, go to *www.nsf.gov/oirm/*.

Appendix 2: EXECUTIVE STAFF AND OFFICERS

NSF Executive Staff

Office of the Director
Arden L. Bement, Jr., Director

Office of the Deputy Director
Kathie L. Olsen, Deputy Director

National Science Board
Steven C. Beering, Chair
Kathryn D. Sullivan, Vice Chair

Directorate for Biological Sciences
James Collins, Assistant Director

Directorate for Computer and Information Science and Engineering
Jeannette M. Wing, Assistant Director

Directorate for Education and Human Resources
Cora Marrett, Assistant Director

Directorate for Engineering
Richard Buckius, Assistant Director

Directorate for Geosciences
Jarvis Moyers, Assistant Director

Directorate for Mathematical and Physical Sciences
Tony F. Chan, Assistant Director

Directorate for Social, Behavioral, and Economic Sciences
David W. Lightfoot, Assistant Director

Office of Cyberinfrastructure
Daniel E. Atkins, Director

Office of International Science and Engineering
Thomas Weber, Director

Office of Polar Programs
Karl A. Erb, Director

Office of Equal Opportunity Programs
Ronald D. Branch, Director

Office of the General Counsel
Lawrence Rudolph, General Counsel

Office of Inspector General
Christine C. Boesz, Inspector General

Office of Integrative Activities
Nathaniel G. Pitts, Director

Office of Legislative and Public Affairs
Jeff Nesbit, Director

Office of Budget, Finance, and Award Management
Thomas N. Cooley, Director

Office of Information and Resource Management
Anthony A. Arnolie, Director

NSF Officers

Chief Financial Officer
Thomas N. Cooley (Office of Budget, Finance, and Award Management)

Chief Human Capital Officer
Anthony A. Arnolie (Office of Information and Resource Management)

Chief Information Officer/Chief Privacy Officer
George O. Strawn (Office of Information and Resource Management)

NSF Affirmative Action Officer
Consuelo Roberts (Office of Equal Opportunity Programs)

Appendix 3: NATIONAL SCIENCE BOARD MEMBERS DURING FY 2007

Steven C. Beering (Chair)
President Emeritus
Purdue University

Kathryn D. Sullivan (Vice Chair)
Director, Battelle Center for Mathematics and Science Education Policy
John Glenn School of Public Affairs
Ohio State University

Mark R. Abbott
Dean and Professor
College of Oceanic and Atmospheric Sciences
Oregon State University

Dan E. Arvizu
Director and Chief Executive
National Renewable Energy Laboratory

Barry C. Barish
Maxine and Ronald Linde Professor of Physics Emeritus and Director, LIGO Laboratory
California Institute of Technology

Camilla P. Benbow
Patricia and Rodes Hart Dean of Education and Human Development
Peabody College of Education and Human Development
Vanderbilt University

Ray M. Bowen
President Emeritus
Texas A&M University

John T. Bruer
President
The James S. McDonnell Foundation

G. Wayne Clough
President
Georgia Institute of Technology

Kelvin K. Droegemeier
Associate Vice President for Research and Regents' Professor of Meteorology and Weathernews Chair
University of Oklahoma

Kenneth M. Ford
Director and Chief Executive Officer
Institute for Human and Machine Cognition

Patricia D. Galloway
Chief Executive Officer
The Nielsen-Wurster Group, Inc.

José-Marie Griffiths
Dean, School of Information and Library Science
University of North Carolina

Daniel E. Hastings
Dean for Undergraduate Education and Professor, Aeronautics & Astronautics and Engineering Systems
Massachusetts Institute of Technology

Karl Hess
Professor of Advanced Study Emeritus and Swanlund Chair
University of Illinois

Elizabeth Hoffman
Executive Vice President and Provost
Iowa State University

Louis J. Lanzerotti
Distinguished Research Professor of Physics
Center for Solar-Terrestrial Research
New Jersey Institute of Technology

Alan I. Leshner
Chief Executive Officer and Executive Publisher, *Science*
American Association for the Advancement of Science

Douglas D. Randall
Professor and Thomas Jefferson Fellow and Director, Interdisciplinary Plant Group
University of Missouri-Columbia

Arthur K. Reilly
Senior Director, Strategic Technology Policy
Cisco Systems, Inc.

Jon C. Strauss
President Emeritus
Harvey Mudd College

Thomas N. Taylor
Roy A. Roberts Distinguished Professor
Department of Ecology and Evolutionary Biology and Curator of Paleobotany in the Natural History Museum and Biodiversity Research Center
University of Kansas

Richard F. Thompson
Keck Professor of Psychology and Biological Sciences
University of Southern California

Jo Anne Vasquez
Director of Professional Development, Policy, and Outreach
Center for Research on Education in Science, Mathematics, Engineering, and Technology
Arizona State University

Arden L. Bement, Jr., (Member *ex officio*)
Director
National Science Foundation

Michael P. Crosby
Executive Officer and Office Director
National Science Board