



Strategic Outlook for the
University Corporation for Atmospheric Research

UCAR 2020

“Understanding the complex, changing planet on which we live, how it supports life, and how human activities affect its ability to do so in the future is one of the greatest intellectual challenges facing humanity. It is also one of the most important for society as it seeks to achieve prosperity and sustainability.”

National Research Council (2005)



Our Heritage and Our Future

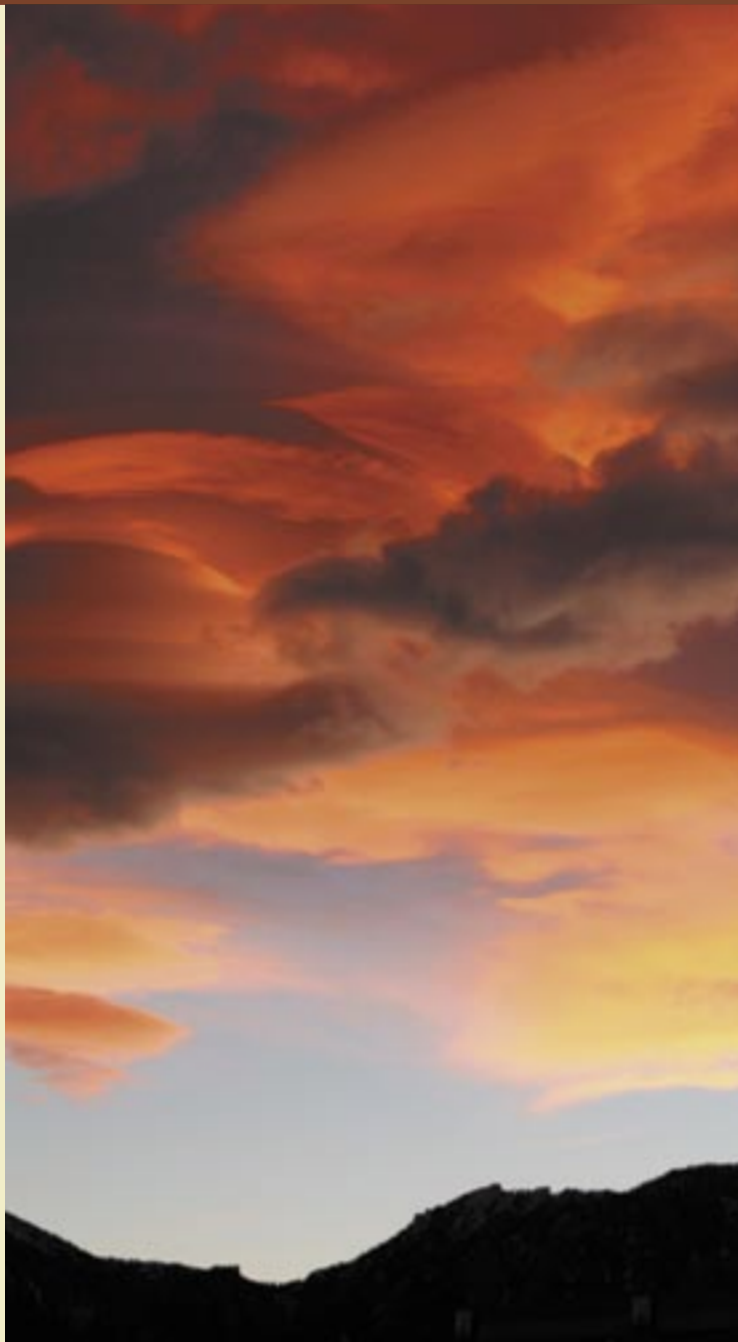
The University Corporation for Atmospheric Research (UCAR) was created in the late 1950s by faculty from 14 leading universities to support and nourish the atmospheric sciences. These visionaries recognized the need for community observational and computational facilities and a world-class research staff, which together would allow the community to carry out complex, long-term scientific programs beyond the reach of individual universities. In partnership with the National Science Foundation (NSF), they established the National Center for Atmospheric Research (NCAR). Since its inception NCAR has been managed by UCAR, on behalf of NSF, to address pressing scientific and societal needs involving the atmosphere and its interactions with the oceans, land, and Sun—what is now called Earth system science.

For almost 50 years, UCAR's stewardship has enabled NCAR to provide advanced facilities to universities, make transformative contributions to understanding weather and climate, lead the application of basic knowledge for the benefit of society, develop some of the world's leading scientists, and engage students of all ages in science, engineering, and mathematics. UCAR's role in supporting and complementing the work of academia has grown to include new research, service, and education programs in the UCAR Office of Programs (UOP) and Office of Education and Outreach (EO).

UCAR now comprises 70 member universities granting doctoral degrees in the atmospheric and related sciences and a complementary group of academic and international affiliates. Collectively, they strengthen and promote professional interactions, collaborations, and collegiality in the broader community. This partnership is unique in science and engineering and has produced some of the best research and technology in the world over the past half century.

The challenges facing society—from climate change and environmental sustainability to mitigating loss from high-impact weather—have never been greater, nor has the science enterprise been better equipped to address them. Looking to the future, UCAR stands uniquely poised to address a new generation of problems that transcend disciplines, cultures, and organizations. We marshal a broad array of facilities, management capabilities, and community engagement mechanisms to help ensure the health, safety, and vitality of future generations. This strategic outlook describes at a high level what UCAR is, its vision and values, how it serves the community, and its priorities for the future. It is based on the more detailed strategic plans and goals developed recently by NCAR, UOP, EO, and UCAR's Finance and Administration department. These plans are available at http://www.ucar.edu/strat_plan.

Our Mission



To serve and provide leadership to the atmospheric science and related communities through research, computing and observational facilities, and education programs that contribute to the betterment of life on Earth.

Our Roles

As a consortium of universities, UCAR, in partnership with the National Science Foundation, leads and manages NCAR, an NSF federally funded research and development center.

UCAR provides

Leadership and community building by

- Serving as an intellectual commons where academia, government, and industry can mutually define and collaboratively address issues of global importance
- Providing mechanisms for cross-fertilization and exchange between the academic community's education and research programs and NCAR's research and facilities
- Responding to community needs—developing, deploying, and supporting tools for education, research, and professional development
- Helping develop a diverse and educated workforce and a scientifically literate public
- Communicating to the public and policymakers the value and results of research and education

Management by

- Providing innovative, efficient, and cost-effective administrative, financial, and legal services in support of NCAR and other programs
- Developing leadership and facilitating professional growth of all staff
- Furnishing a safe, productive, and stimulating work environment
- Creating and maintaining unique physical facilities—state-of-the-art laboratories, computer systems, observing platforms, meeting facilities, and other work spaces—for use by NCAR, UOP, and the scientific community

The values that guide and inform UCAR are woven throughout this document. First and foremost is a commitment to the needs and interests of the academic community. Core principles include a dedication to innovative science and technology, integrative knowledge, and social relevance. We insist upon organizational excellence and nurture our employees and collaborators—valuing diversity of backgrounds, ideas, and approaches; promoting the highest-quality work environment; and providing wise stewardship of public funds with the highest standards of fiscal integrity.



Environmental and Social Context

Our understanding of weather and climate and ability to predict them have unprecedented societal importance in the 21st century. Global economic and population growth are placing rapidly mounting pressure on Earth's natural resources, environment, and climate. More and more people live in places vulnerable to severe weather and climate extremes. Although the challenges have never been greater, we now have the capability as a community to develop the scientific, technological, and human resources needed to address the changes and realize the opportunities they present.

Global observations, theory, and numerical models, together with advanced decision making tools, have underpinned steady advances in weather prediction and warning during the past century and now can be extended to the complete Earth system. Marshalling these resources effectively is an essential part of a national and global strategy for sustainability, quality of life, and security.

Technological and intellectual resources, by themselves, however, are not sufficient. Educating people of all ages and backgrounds and building support for science are essential for scientific excellence, innovation, competitiveness, and societal well being. It is thus critical to recruit, train, and mentor science professionals from across our diverse population. Moreover, in a complex and increasingly global world, advances in the Earth system sciences require a broad range of collaborations and international partnerships. Improving the nation's ability to observe,

understand, predict, and respond to weather and climate is a fundamental requirement for achieving prosperity and sustainability. As the 21st century progresses, UCAR, through NCAR, UOP, and EO, will address the most compelling challenges in science and education in partnership with academia and other national and international collaborators through eight strategies:

- Support and advance our university consortium
- Conduct and enable a broad research program in the atmospheric and related sciences
- Develop and employ increasingly capable observing systems that fuel discovery and understanding
- Provide innovative and powerful information technologies, services, and tools
- Translate scientific knowledge and new technologies into societal benefits
- Create, catalyze, and support world-class science education programs, resources, and communities
- Develop and engage a diverse workforce
- Cultivate an environment of organizational excellence, where science and education programs interact and thrive

The following pages discuss each of these interrelated and mutually reinforcing strategies for the next decade and beyond.



Support and Advance Our University Consortium

UCAR serves as a unique focus for university-based research and education in the atmospheric and related sciences. Society increasingly looks to academia for the creativity, understanding, and tools needed to identify and solve environmental problems, protect individuals and communities from natural hazards, strengthen the economy, and stimulate innovation.

UCAR will continue to support universities to meet these challenges through unique and widely accessible resources for students, faculty, and researchers. UCAR increases the effectiveness of the universities by providing community resources such as observing and computing facilities, data sets and analyses, models, and education and training tools.

In addition, UCAR will build leadership in the university community by creating networks of university leaders, supporting faculty and student visiting programs, enhancing the professional development of early-career faculty, convening forums to develop visions and plans, sharing innovations, creating pathfinding collaborative research projects, and educating and training a broad range of students and professionals.

Through these means UCAR will involve the universities centrally in all aspects of its work and respond to their concerns and needs. UCAR's success is inextricably tied to the health and vitality of the university community, which both created and governs it.

This unparalleled network of institutions, tools, people, and capabilities works for the common good to understand Earth as a system, to inform wise societal decision making, and to solve associated problems for the benefit of humanity.

Goals

- Provide an intellectual commons for the national and international university community that is working on topics of importance to society.
- Build and nurture a collaborative consortium of universities and research centers with unrivaled capabilities for research.
- Recruit talented and capable students from diverse backgrounds into the field.
- Help develop leadership among students, faculty, and researchers in the university community and equip them to meet the challenges of the coming century.
- Promote effective collaboration in research, education, service, and other community-building activities.



Conduct and Enable a Broad Research Program in the Atmospheric and Related Sciences

In managing NCAR and UOP, UCAR infuses these institutions with the energy and collective wisdom of the national and international scientific community. NCAR and UOP, in turn, conduct and support broad, high-quality research programs that integrate knowledge from various disciplines to understand Earth's weather, climate, and related processes.

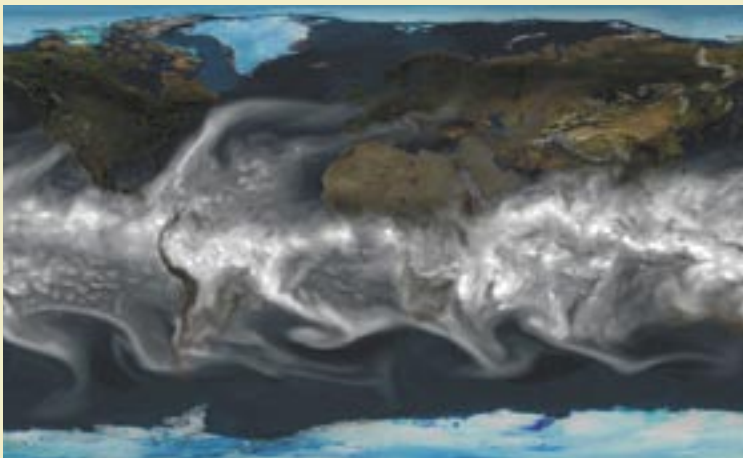
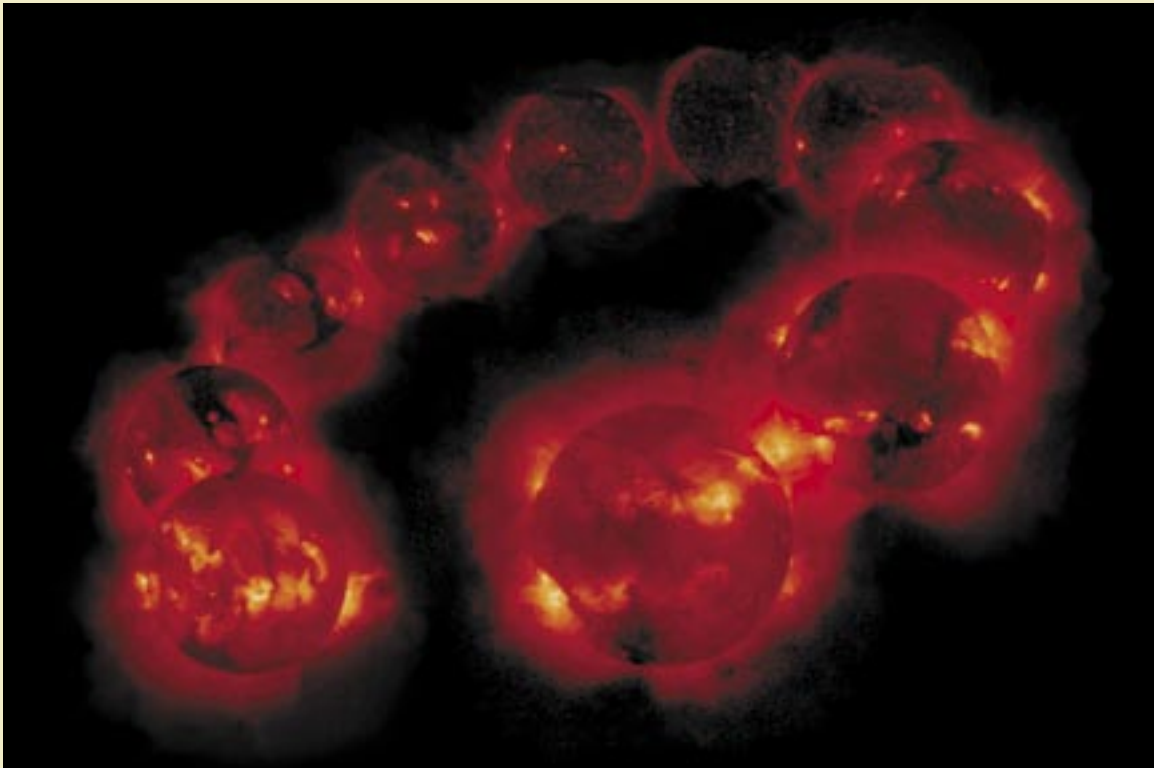
In the decade ahead, UCAR, in collaboration with its national and international partners, will enhance NCAR's observational, laboratory, modeling, and theoretical components to provide a predictive understanding of the processes that determine the sustainability and quality of life.

This new understanding will be founded on studies of the varying Sun as well as the importance of physical, chemical, biological, and societal interactions to climate, weather, air and water quality, and ecosystems.

UOP will complement and support research efforts at NCAR and in the community through provision of data, software tools, and other technologies.

Goals

- **Advance understanding of the Sun, Earth, and related weather and climate systems:**
 - Explore and understand fundamental processes, variability, and change in climate
 - Investigate the interactions among physical, biological, and chemical processes and human systems
 - Develop tools for modeling, observation, and analysis, and provide them to the community
- **Improve prediction and warning systems for high-impact weather and climate events by building:**
 - Integrated observational and analytical systems
 - Advanced community forecast models that incorporate a wide variety of observations
 - Effective methods for making observations, forecasts, and warnings useful to society



The variation in the Sun's hot outer atmosphere, or corona, over seven and a half years, as recorded by the space-borne soft x-ray telescope on board the Japanese Yohkoh satellite.

Snapshot view of global water vapor as simulated by the NCAR-based Community Climate System Model.

Develop and Employ Increasingly Capable Observing Systems that Fuel Discovery and Understanding

Observations are essential to understanding the structure and behavior of the Sun and Earth. The complexity of weather and climate and the interdependencies of human and natural processes demand sophisticated observing strategies and capabilities.

UCAR catalyzes and guides community efforts to develop and deploy groundbreaking instruments and organize field campaigns. NCAR and UOP have created advanced observing technologies to serve national and international needs. Prominent among these are radars, solar telescopes, sounding and profiling systems, lidars, atmospheric gas and particle instruments, and ground- and space-based Global Positioning System (GPS) observing techniques.

State-of-the-art instruments and networks, which often evolve into community facilities, will be developed in collaboration with universities and other laboratories. These facilities will be provided to the community to enable innovative studies on the ground, in the atmosphere and oceans, and from space to open new pathways to discovery.

Goals

- Contribute to the development of a global Earth observing system that includes GPS technologies, radar and aircraft measurements, solar coronal observations, and instruments to measure trace gases and particles.
- Insure that NCAR maintains the highest-quality instruments, platforms, and services to support scientific field programs.
- Develop HIAPER, the new NSF/NCAR Gulfstream V, into a world-class platform for scientific studies.
- Contribute to the evolution of space-based remote sensing by helping define scientific requirements, building communities, and integrating instruments and approaches.
- Develop advanced data assimilation techniques that will contribute to the improved predictive skill of Earth system models.
- Acquire, assure the quality of, and organize complex data sets and analyses, and provide open access to them through the use of advanced database tools and networking.
- Inspire, educate, and train a new generation of instrument inventors.



The NSF/NCAR High-performance Instrumented Airborne Platform for Environmental Research (HIAPER).



The UCAR-Taiwan COSMIC (Constellation Observing System for Meteorology, Ionosphere and Climate) satellites in orbit.

Provide Innovative and Powerful Information Technologies, Services, and Tools

Cyberinfrastructure has revolutionized research and education, and UCAR will continue to support this transformation. From seminal decisions in the 1960s to equip NCAR with the then-fastest computers to the latest applications of Internet technologies, UCAR has been at the leading edge of the information age, striking an evolving balance between centralized and local capabilities and between shared-memory vector and distributed-memory scalar processing.

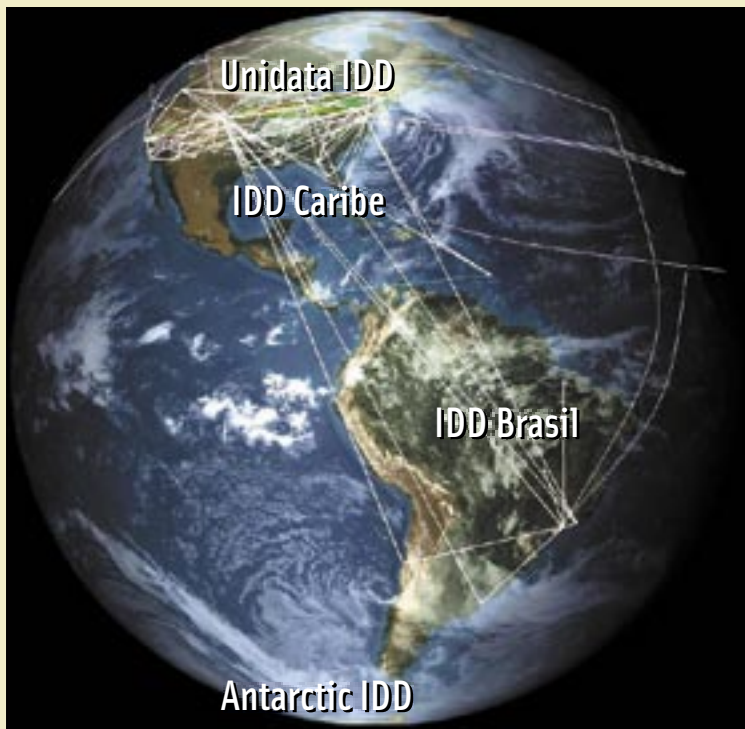
The integration, synthesis, and dissemination of Earth system knowledge require a combination of global observations; sophisticated community models; tools for data fusion, analysis, and visualization; educational materials; virtual observatories; digital libraries; and other tools of scholarly progress and communication.

Advances in Earth science are enabled by a comprehensive, shared cyberinfrastructure, including high-performance computing and data facilities, models, applications, middleware, high-speed communication networks, and training capabilities that are the technical foundation for scientific discovery.

UCAR will provide teams of experts to lead the development and deployment of information technologies for the community. We will continue to develop and support community models, data sets, and analyses, and train people in their use. UCAR's philosophy of innovation and long-term, dependable support of cyberinfrastructure rests on a core belief in openness and the free sharing of ideas and technologies. We recognize that the deep and enduring changes of the Internet age are as much social and cultural as they are technological.

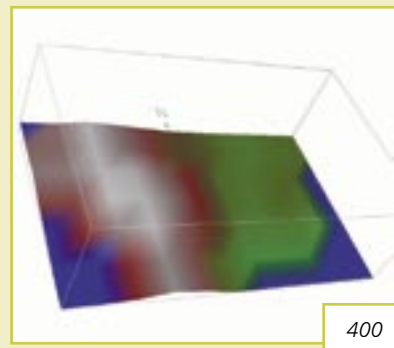
Goals

- Create a community "Earth system knowledge environment" that provides integrated modeling and data services, including data curation, analyses, and discovery mechanisms.
- Provide the most powerful computers and combine them with strategically distributed resources to build and sustain increasingly comprehensive and accurate community models of the Earth system.
- Create and advance software frameworks and standards that enable scientific communities to connect and interoperate across campuses and nations.
- Undertake leading research in computational science and applied mathematics to support scientific inquiry.
- Work with the UCAR community to create new and integrative curricula needed to develop and use the Earth system knowledge environment.
- Enrich and accelerate scholarly communication and community collaboration through enhanced data sets, software, libraries, and knowledge environments.

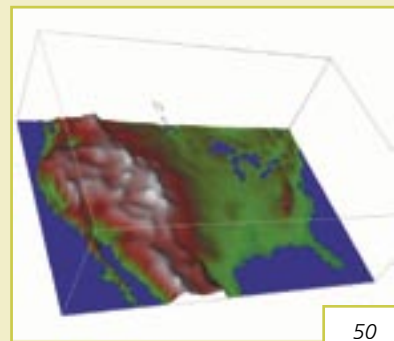


The UCAR Unidata program connects 200 universities and colleges internationally and provides them with real-time weather data and other Earth system observations and information for education and research.

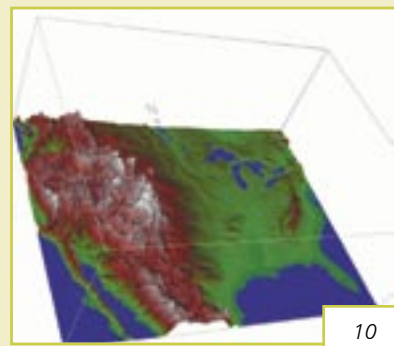
Topography of the United States at three horizontal grid spacings—400, 50, and 10 km. Weather and climate models require the highest possible resolution. Because these models operate in several dimensions, each increase in resolution by a factor of 2 requires roughly a factor of 10 increase in computer power. Cloud-resolving models will require resolutions of 1 km or better and computer systems with sustained speeds in excess of a petaflop (a thousand trillion floating point operations) per second.



400



50



10



Translate Scientific Knowledge and New Technologies into Societal Benefits

Global and national stability, sustainability, and prosperity depend on the advancement of knowledge and the development of innovative technologies to cope with natural disasters and other environmental threats.

UCAR, as a publicly funded institution, recognizes its obligation to provide a return on investment to the nation. Our accomplishments stimulate the development of groundbreaking technologies and other applications of research to the global, regional, and local issues of today and tomorrow.

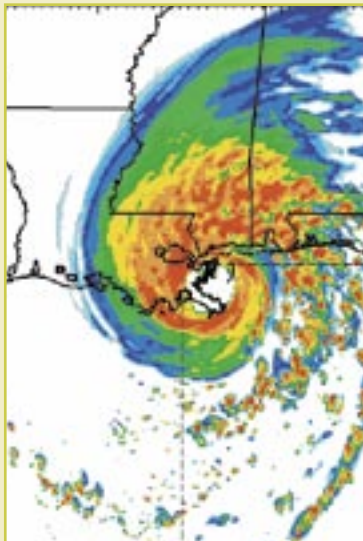
UCAR will continue to share and apply its research results to assist decision makers in business and industry; local, national, and international government; and nongovernmental organizations.

Further, UCAR will seek opportunities to transfer knowledge to the world community, and especially to developing countries, where it can help build local and regional capacity.

UCAR will continue to inform Congress and the executive branch about critical national and international issues in science and education, and will help in the creation of sound policy.

Goals

- Enhance the nation's prosperity and competitiveness by promoting scientific research and disseminating important discoveries.
- Promote and make available the intellectual property generated by UCAR for the benefit of the public and private sectors.
- Forge strategic partnerships with government at all levels and with the private sector to effectively transfer knowledge and technology that is tailored to the needs of society as it adapts to a changing world.
- Develop decision-support tools based on the best science and technology to assist leaders and managers in industry and government.
- Communicate the most important and relevant scientific results to policy and decision makers and the public to encourage informed choices and plans.
- Provide leadership and a forum for universities to develop and employ best practices in technology transfer and dissemination of scientific knowledge.



Weather decision support tools assist in deicing aircraft.

Radar observations of precipitation in Hurricane Katrina (far left) and forecasts from the NCAR-based Weather Research and Forecasting community model (left).

Create, Catalyze, and Support World-class Science Education Programs, Resources, and Communities

As an institution with mandates in research, education, and service, UCAR leads and supports the community to integrate scientific research into educational programs of national and international scope. UCAR's unique strengths—including broad expertise in science, education, engineering, and information technology—allow it to act as an intellectual hub for the university community, bringing together the diverse professional sectors needed to effectively meet the world's most pressing environmental challenges.

UCAR's educational programs reach learners, educators, other diverse professionals, and the public through unique collaborative programs that broaden access to and participation in the sciences, deepen scientific understanding, and enhance science literacy. We will continue to build and sustain a broad national and international network of communities engaged in the effort to connect science and education. Through these programs and activities we will engage and nurture future generations of scientists, engineers, educators, and civic leaders.

Goals

- Inspire the public and advance science literacy in the area of the Sun-Earth system.
- Develop resources and programs that enhance scientific understanding and support education at all levels.
- Broaden participation in science by including diverse and historically underrepresented populations in our science education programs.



Students on Barbuda watch an NCAR balloon launch during the RICO field program.



Young visitors learn about paleoclimate at the NCAR Mesa Laboratory.



Develop and Engage a Diverse Workforce

The discoveries that will transform Earth system science and enable society to respond to a planet under stress will be made by people with diverse and global perspectives.

Excellence requires the input and ideas of people from all parts of society. Science is increasingly interdisciplinary and depends on strong collaborations. UCAR will continue to build and sustain partnerships, nationally and internationally, among scientists and other stakeholders, to advance science and serve our diverse society. This broad alliance will include scientists, engineers, civic leaders, and informed citizens who are committed to addressing global issues.

In recruiting and nurturing tomorrow's scientists, UCAR will identify the young and talented students and professionals, especially those from nontraditional backgrounds, who can expand our perspectives, challenge traditional thinking, and work collaboratively to ensure maximum effectiveness.

UCAR will invest in people who collectively bring the depth and breadth of perspectives, backgrounds, and experiences that are necessary to address the scientific challenges of the 21st century.

Goals

- As a model institution, recruit and retain a diverse and interdisciplinary workforce to address scientific and societal problems of highest importance.
- Create multiple opportunities and open pathways to those from nontraditional backgrounds to build an inclusive community of diverse and global perspectives.
- Build strong interdisciplinary science partnerships with people and institutions representing varying points of view.
- Build and sustain national and international partnerships including capacity building in developing countries.



Uruguayan students study cloud types as part of the UCAR-based GLOBE program (Global Learning and Observation to Benefit the Environment).

Protégés in the UCAR SOARS program (Significant Opportunities in Atmospheric Research and Science), which provides research and mentoring in a four-year bridge program between undergraduate and graduate study.

Cultivate an Environment of Organizational Excellence Where Science and Education Programs Thrive

UCAR takes pride in its stewardship of resources—human, physical, and financial—that support the scientific enterprise. We provide a safe and environmentally friendly workplace with state-of-the-art laboratories and conference facilities that meet the needs of the community and are consistent with our core value of excellence. High ethical standards and integrity are foundations that govern everything we do.

UCAR will continue to support and mentor its employees through competitive salaries and benefits as well as progressive policies that encourage advancement and development.

UCAR will maintain its commitment to excellence in management and administration, and to strengthening partnerships, both internally and externally. We will continue to improve the efficiency and effectiveness of all business practices and provide cost-effective financial and administrative services.

Goals

- Provide responsive and results-oriented administration by actively developing and promoting best business practices and instilling the importance of careful planning in all of our activities.
- Construct, equip, and enhance work spaces that encourage scientific collaboration, including conference facilities and multimedia technologies.
- Provide state-of-the-art financial management tools to enable our leaders and managers to make informed decisions.
- Encourage excellence in leadership through novel and progressive staff development programs.
- Maintain a safe and environmentally friendly environment, and encourage a healthy work-life balance.
- Continue to spend funds wisely, with the highest standards of fiscal integrity.
- Use innovative financing methods in the development and maintenance of facilities.



Left: The NCAR Mesa Laboratory.

Top: A newly built state-of-the-art chemistry laboratory.

Bottom: The UCAR Center Green campus and conference center.





A sustainable, healthy future for all people and life on Earth depends on establishing and maintaining a balance between human needs and aspirations and nurturing the planet's support systems. UCAR and our community will do our part in realizing this vision.



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Richard Anthes, President of UCAR
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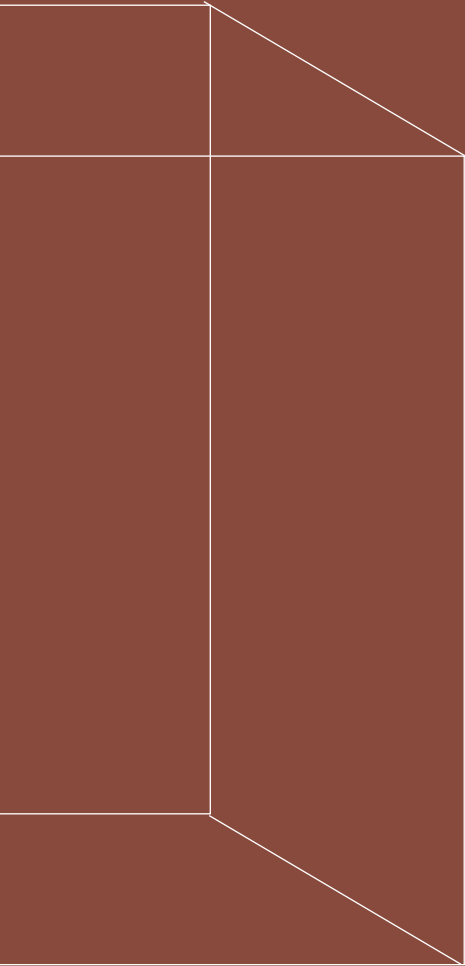
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