Testimony prepared by
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Subcommittee on Energy and Water Development, and Related Agencies of the
House Committee on Appropriations
Regarding Fiscal Year 2013 Appropriations
for the Department of Energy

On behalf of the University Corporation for Atmospheric Research (UCAR) and the university communities engaged in Earth systems research and education, I submit this written testimony for the record of the Senate Committee on Appropriations, Subcommittee on Energy and Water Development, and Related Agencies. UCAR is a consortium of 77 research universities that manages and operates the National Center for Atmospheric Research (NCAR) on behalf of the National Science Foundation (NSF) and the university community. I urge the Subcommittee to fund the FY 2013 budget request of $4.992 billion for the DOE Office of Science, including $625.3 million for Biological & Environmental Research, and $2.337 billion for the DOE Office of Energy Efficiency & Renewable Energy (EERE).

With the following, I highlight several science research and development programs that represent DOE’s critical contributions to American leadership in science and technology:

DOE Office of Science

The DOE Office of Science directly supports university and laboratory research, increasing the nation’s capacity to understand and advance numerous fields of science, including the atmospheric sciences. More broadly, the DOE’s world-class laboratories, the research conducted at the labs, and the scientific facilities accessible to the larger research community through the labs, are centerpieces of the robust innovation ecosystem that keeps the U.S. an international leader in science and technology and that stimulates the economy through technology development.

Biological and Environmental Research (BER). The BER program within DOE Science makes fundamental contributions to the nation’s premier Earth system models and data analysis infrastructure that provide the scientific foundation for future decision-making on environmental change. Without BER-supported work, we would not know the level of risk that cities, states, and businesses face from long-term weather trends and what societal preparation and adaptation might be needed.

In particular, the Climate and Environmental Sciences program within BER provides indispensable support to the Community Earth System Model (CESM), a comprehensive computer model supported by DOE and NSF to analyze Earth’s past, present, and project future climate. CESM is a major contributor to national and international assessments of environmental change. And while CESM is housed and managed at NCAR, it is an open source climate model, involving contributions and improvements from scientists across the nation and around the world.
Thanks in part to BER support, CESM is incorporating more complex and realistic representations of the natural and human processes that shape the global climate. For example, the model now has a dynamically coupled carbon and nitrogen cycle component that allows representation of realistic exchanges of CO₂ between the atmosphere, the oceans, and the land surface. This new capability will allow realistic studies of the role of the ocean in absorbing and releasing CO₂ to the atmosphere, thereby obtaining more accurate predictions of future CO₂ concentrations that are fundamental to understanding the nature and magnitude of future changes in global climate. Carbon and nitrogen cycling in CESM provides the means to study in detail the contributions of land use change and vegetation disturbance to local, regional and global climate change. These new capabilities will allow the climate science community to address societally-relevant questions in a way that has not been possible in the past.

CESM performs exceptionally well on DOE’s modern supercomputers, having been run at high resolutions in one experiment on more than 100,000 processors of the Cray Jaguar-PE system at Oak Ridge National Laboratory. CESM scenario runs are now underway on this and other supercomputers to make projections for the U.N. Intergovernmental Panel on Climate Change’s Fifth Assessment Report, expected to be released in 2014.

New in FY 2013, climate and Earth system modeling research at DOE will develop an enhanced validation and verification capability to compare models and measurements against a unified framework using sophisticated software tools. This initiative promises to improve the efficiency of data management and analysis in the field. As in FY 2012, atmospheric scientists will continue to receive grant funding for cutting edge research on aerosols, clouds, and aerosol-cloud interactions, in order to improve estimates of how these feedbacks impact climate, an area of atmospheric research that can be better understood.

In order to develop more accurate, increasingly realistic, and higher resolution Earth system models, with better environmental predictive capabilities for businesses, stakeholders such as water resource managers, and communities, I urge you to fund the Office of Biological and Environmental Research within the DOE Office of Science at the requested $625.3 million for FY 2013, including $315.6 million for Climate & Environmental Sciences within BER.

Advanced Scientific Computing Research (ASCR)

According to a 2011 National Research Council report The Future of Computing Performance, Game Over or Next Level?, “Virtually every sector of society—manufacturing, financial services, education, science government, the military, entertainment, and so on—has become dependent on continued growth in computing performance to drive new efficiencies and innovation.” Within the atmospheric sciences, the advancement of our science rests on the continued growth of computing performance and capabilities. DOE Science’s ASCR delivers needed leading edge computational and networking capabilities to scientists nationwide, enabling the Office of Science and the larger university community to address and answer major scientific questions.
In particular, the atmospheric sciences community depends on the ASCR Leadership Computing Facilities (LCFs), which are available to all researchers for scientific discovery and to address critical engineering challenges. The continued support of these programs is of particular importance to Earth system model development. Representing the complex processes and feedbacks of the Earth’s systems, while efficiently harnessing the enormous amount of computing power necessary, requires very advanced software engineering, computer science, and numerical techniques. Because the climate simulations using the CESM (described above) are too computationally intensive to be run at NCAR alone, many computational experiments are run at the LCF’s.

At the Oak Ridge National Laboratory Leadership Computing Facility (OLCF), for example, a new 2.33-petaflop Cray XT5 system is already available to the scientific community, and OLCF plans to upgrade it to a 10-petaflop Cray XK6 system in upcoming years. The Argonne National Laboratory Leadership Computing Facility (ALCF) plans to upgrade its IBM Blue Gene/Q supercomputer to a 10-petaflop system this year. Alongside the NCAR-Wyoming Supercomputing Center and its 1.6-petaflop Yellowstone system soon to be delivered to this new facility, these DOE supercomputers will empower atmospheric scientists to push the boundaries of Earth systems modeling science.

In the same way that more powerful telescopes enable new discoveries in astronomy, each major supercomputer upgrade enables new numerical experiences that reveal more details regarding how the Earth system works. This information is critical to efforts to understand and predict regional climate, as well as to develop and assess mitigation and adaptation strategies. A failure to maintain and continue to upgrade these LCFs would seriously undermine the steady progress in this and many other areas of science.

Another important cross-cutting computing program that operates in partnership with ACSR and other programs within DOE Science is the Scientific Discovery through Advanced Computing (SciDAC) program. SciDAC accelerates scientific progress by breaking down the barriers between disciplines and fostering more dynamic partnerships between basic researchers and computational science applications. A SciDAC effort in partnership with BER, for example, is quantifying the uncertainty in next generation integrated Earth system models in order to dramatically improve our ability to characterize the drivers of global climate and quantify the impact of energy production and use on the environment and human health.

I urge you to fund the Advanced Scientific Computing Research within the DOE Office of Science at the FY 2013 requested level of $455.6 million and to support SciDAC program throughout the Office of Science budget.

Energy Efficiency and Renewable Energy Research & Development (EERE)

Renewable energy research, development, and technology transfer are among the most important investments we can make to ensure long run economic and environmental sustainability. Renewable energy technology contributes numerous cross-cutting benefits to society, including reducing our dependence on foreign oil and providing energy security, driving innovation and job creation in the energy economy, decentralizing the energy market, providing new high-tech
jobs, reducing the human toll on the environment, and improving air quality and public health outcomes. DOE’s EERE is at the heart of this transformation.

Our national research universities, in collaboration with DOE laboratories and the private sector, are driving the country’s innovation in renewable energy and energy efficiency. One example of such collaboration includes a partnership between NCAR, DOE’s National Renewable Energy Laboratory (NREL), and Xcel Energy, Colorado’s largest utility company, to develop sophisticated wind forecasts for operational use. These forecasts provide critical information to utilities to, (1) help them predict how much wind power will be generated over the next 24 to 72 hours, (2) enhance their ability to better integrate wind-generated electricity into the grid, and (3) assist with decision-making processes regarding whether to power down coal- and natural gas-fired plants when sufficient winds are predicted. To reduce the costs of integrating wind and solar energy into the electrical grid and make renewable energy more cost effective, significant improvements in weather forecasting technologies will be required, and additional weather observations in the lower atmosphere will be needed.

**Given the critical importance to the nation of developing economically and environmentally sustainable technologies for energy production, I urge the Subcommittee to fund the FY 2013 request of $2.337 billion for the Office of Energy Efficiency and Renewable Energy.**

I want to thank the Members of the Subcommittee in advance for supporting, through DOE, basic and applied scientific research in the environmental and other Earth sciences. By doing so, you advance the nation’s economic recovery, help stakeholders manage irreplaceable natural resources, and sustain the nation’s global scientific leadership.