Testimony by
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Mr. Chairman, Ranking Member Wolf, and members of the Subcommittee: Thank you for inviting me to testify on this important subject. My name is Richard Anthes, and I am the President of the University Corporation for Atmospheric Research (UCAR), a consortium of 73 research universities that manages the National Center for Atmospheric Research (NCAR), on behalf of the National Science Foundation, and additional scientific education, training and support programs.

I also served as co-chair of the first ever Earth Sciences *Decadal Survey*,[1] the National Research Council (NRC)'s Committee on Earth Science and Applications from Space: A Community Assessment and Strategy for the Future, which established priorities in Earth observations from space for NASA, NOAA and USGS. In that report we put forth the vision:

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 challenges for society as it seeks to achieve prosperity, health, and sustainability.

As detailed in the committee's final report, and by the latest set of reports from the International Panel on Climate Change (IPCC), we are reminded on almost a daily basis that the world faces significant and profound environmental challenges: shortages of clean and accessible freshwater, degradation of terrestrial and aquatic ecosystems, global air pollution, declines in fisheries, devastating floods and droughts, heat waves and wildfires, and above all the accelerating pace of substantial changes in climate. These changes and stresses are not isolated; they interact with each other and with natural variability in complex manners that affect local, regional, and global scales in unpredictable ways. Addressing these societal challenges requires that we confront key scientific questions related to ice sheets and sea level change; large-scale and persistent shifts in storm tracks and hence precipitation, droughts, and water availability; transcontinental air pollution; and impacts of climate change on ecosystems, human health, and occurrences of extreme weather events such as hurricanes.

[1] A free download of this report is available at: http://www.nap.edu/catalog.php?record_id=11820.

Yet at a time when the need for observations and information about our planet has never been greater, we are faced with an Earth observation program that is in trouble and will dramatically diminish in capability over the next 10-15 years.

As requested, I will summarize my views regarding current interagency collaboration between NASA and NOAA and its impact on our nation's ability to monitor and respond to global climate change in the future. NASA and NOAA are the leading agencies responsible for global observations and prediction models based on these observations, and it is important to make these agencies healthy and their collaborations as strong as possible.

LONG-TERM SUSTAINABLE EARTH OBSERVATION SYSTEM

There is a crisis not only with respect to climate change and the associated changes in weather patterns, which really matter to people, but also the absence of a coherent, coordinated Federal environmental policy to address the challenges. In the nearest term possible, aging space- and ground-based environmental sensors must be replaced with technologically improved instruments. Beyond replacing aging instruments, there is a need to enhance continuity in the observations, so that policy makers, informed by science, will have the necessary tools to detect trends in important Earth indicators and craft wise and effective long-term policies. However, continuity, or *sustained* long-term observations, is not an explicitly stated requirement for either the "operational" or "research" space systems that are typically associated with NASA and NOAA programs, respectively.

Overall, Earth science and many applications depend on long-term, sustained measurement records garnered from an Earth satellite observation system that is efficient, economical, and predictable. This concept has been reinforced by numerous NRC panels and most recently by the decadal survey report which stated, "NASA should develop a science strategy for obtaining long-term, continuous, stable observations of the Earth system that are distinct from observations to meet requirements by NOAA in support of numerical weather prediction."

Moreover, long time series are required to advance Earth system science. Assured data streams are also required to encourage private sector investment in application-oriented products and services that provide direct societal benefits. The system must be robust and sustained to ensure accurate and timely products for operational predictions and other valuable applications.

CURRENT ISSUES IN THE NOAA/NASA RELATIONSHIP

The present federal agency paradigm with respect to NASA and NOAA is obsolete and nearly dysfunctional, in spite of best efforts by both agencies. This paradigm currently has NASA developing and demonstrating new observational techniques and measurements deemed useful for prediction or other applications. These are then transitioned to NOAA (or sometimes DoD) and used on a sustained, multi-decadal basis. However, this paradigm is not working for a number of reasons. The two agencies have responsibilities that are in many cases mismatched with their authorities and resources: institutional mandates are inconsistent with agency charters; budgets are not well matched to the needs; agency responsibilities are not clearly defined, and shared responsibilities are supported inconsistently by ad hoc mechanisms for cooperation.

The traditional focus on "research to operations," which has been the subject of many NRC studies, often neglects the need for long-term, consistently processed time series of Earth observations in favor of emphasis on weather forecasts. While weather forecasts are critically important, this focus may lead to the neglect of measurements that have high climate value but low direct support for weather forecasting. In the past, NASA has occasionally flown multiple research missions to generate long, continuous data records which NOAA uses to improve "operational" forecast products and services. In addition, NASA and NOAA, working together, have invested in instrument development and implementation. However, these efforts have been ad hoc at best and not sustained over a long period of time.

While NASA and NOAA collaborate effectively at some very important operational and administrative levels, NASA's role, as both a research and development agency and a leader in Earth system observations from space, is only consistent and sustainable if there are clear, efficient mechanisms for ensuring the continued acquisition of selected environmental measurements whose need and value have been demonstrated. Theoretically this responsibility could be turned over to NOAA, but NOAA's budget and capabilities are totally inadequate to assume new satellite responsibilities. NOAA's responsibilities for civil weather forecasts and warnings, along with its desires to lead the nation's climate services, are inconsistent with its demonstrated inability to garner resources to ensure a robust satellite constellation, even for legacy short-term prediction measurements, let alone the ability to expand the system to include new and sustained climate observations.

OVERALL STRATEGY NEEDED TO STRENGTHEN NASA AND NOAA

The required system of Earth observations from space requires missions to extend and build off one another. In many instances, it is desirable for each mission to overlap slightly with other missions providing the same observations to give us a continuous record for establishing trends, for calibration and intercomparison of different instrument and processing systems, and ultimately to supply the necessary information for responding on both a regional and local policy level. While increased funding for Earth science, as approved in the economic stimulus legislation is welcomed, as are increases in the FY09 and FY10 budgets, they are insufficient to close the gap between what is needed and what may become available to meet the decadal survey recommendations. And new observations are not the only observations needed – we also must ensure continued operations for existing aging satellites. In addition, it is critical that we support the necessary infrastructure, particularly supercomputers, to process and use the observations to produce better and more relevant forecasts and other information products. It will also be essential to develop a long-term strategy to plan for and incorporate new missions.

Our ability as a nation to sustain climate observations has been complicated by the fact that no single agency has both the mandate and requisite budget for providing ongoing climate observations, prediction, and services. While interagency collaborations are sometimes valuable, a robust, effective program of Earth observations from space requires specific responsibilities to be clearly assigned to each agency and adequate resources provided to meet these responsibilities.

As a first step, the decadal survey specifically recommended that the White House Office of Science and Technology Policy (OSTP), in collaboration with the relevant agencies and in consultation with the scientific community, should develop and implement a plan for achieving and sustaining global Earth observations. This plan should recognize the complexity of differing agency roles,

responsibilities, and capabilities as well as the lessons from implementation of the Landsat, EOS, NPOESS, and GOES programs. I reiterate the importance of this recommendation and urge its implementation in the new administration.

ADEQUATE BUDGETS

I recognize that this Committee, like the country, is faced with difficult decisions. In a time in which missions being developed by NASA and NOAA are frequently over budget (sometimes due to an expansion in scope), additional resources for this type of strategy are hard to find. With that in mind I commend this Committee for supporting the more robust funding levels in the recent FY 2009 appropriations process. However, while funding in Earth science is improving, we are still well short of what is called for in the Decadal Survey. An examination of current budget projections and the increasing scope and costs of the Tier 1 decadal survey missions (SMAP and ICESat-II) makes it clear that the first phase of decadal survey missions cannot be completed before 2016-2017.

CONCLUDING REMARKS

I note that the NRC is about to start a study titled "Assessment of Impediments to Interagency Cooperation on Space and Earth Science Missions" that will address these issues once again. The study will assess impediments, including mission cost growth, to the successful conduct of interagency cooperation on space science missions and recommend steps to help facilitate successful interagency collaborations on space science missions. However, we should not wait for this study, which follows many similar studies over the past decade. It is simply time to move forward with implementing the consistent set of recommendations from these previous studies.

I sincerely thank the members of the Committee for your stewardship of the nation's scientific enterprise and your understanding that the future strength of the nation depends on the investments we make in science and technology today.