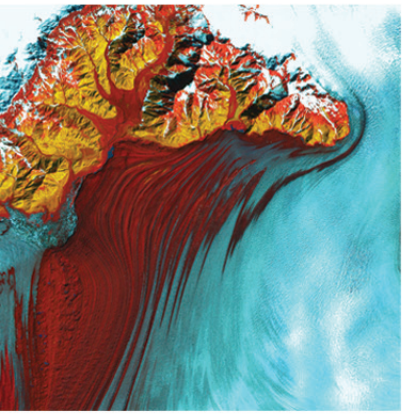
National Aeronautics and Space Administration



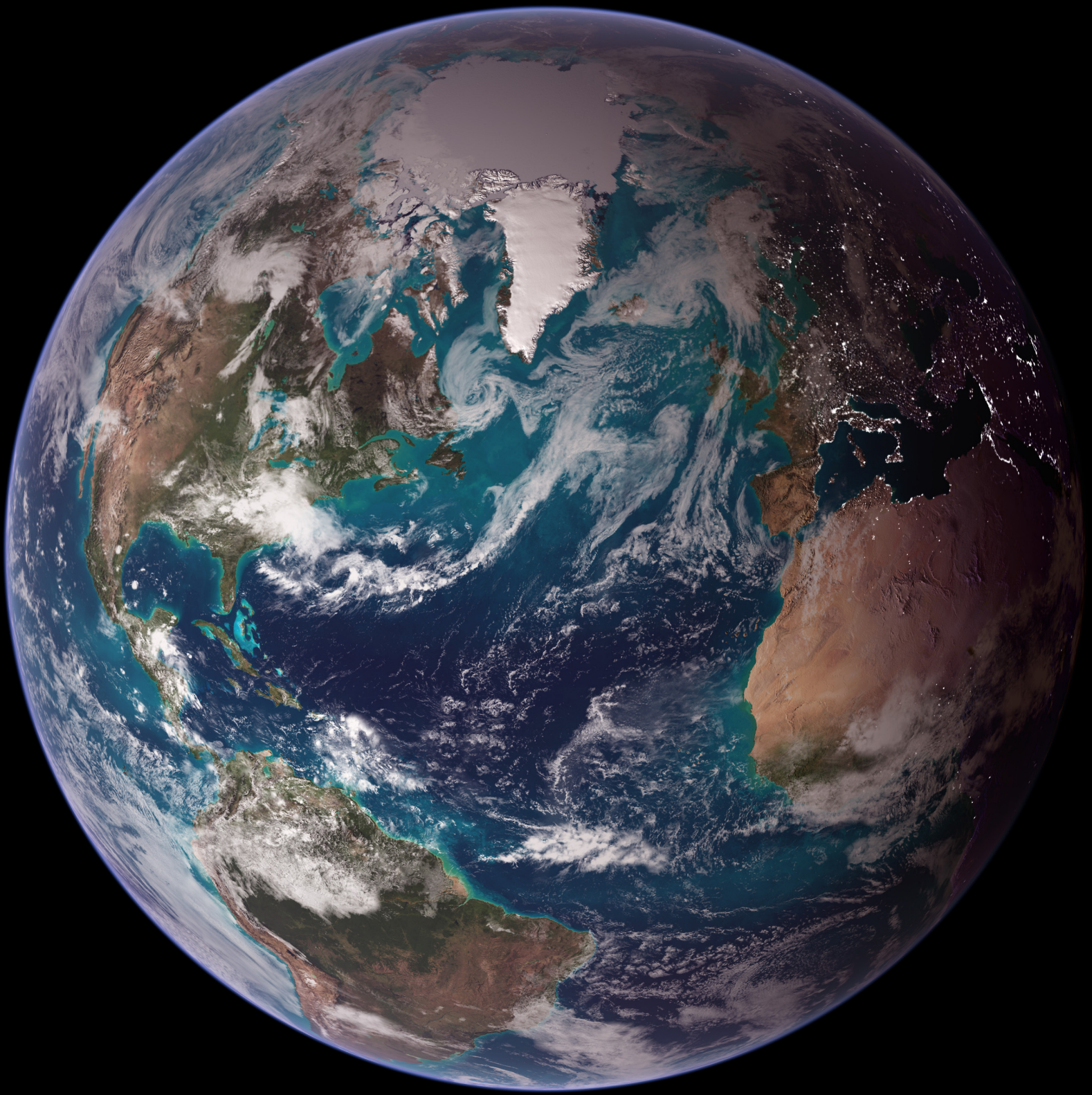
NASA Earth Science Division

Applied Sciences Program

Program Strategy

2010 to 2015

www.nasa.gov



I. INTRODUCTION

In the 21st century, the world is confronting the challenges of rising population demands, global economic development, and the impacts of global change. Our ability to meet these challenges depends, in part, on how well we understand the fundamental processes that make Earth habitable and how well we use that information to guide our actions.

Space-based observations, and the understanding of the Earth system they provide, are a tremendous source of information needed by policy makers, resource managers, forecasters, and first responders. NASA, with its mandate to observe and study Earth from space, is key to providing this knowledge. The Earth Science Division's Applied Sciences Program leverages NASA's investment in Earth science to discover and demonstrate applications that inform resource management, policy development, and decision-making. This program strategy describes NASA's approach to advancing the societal use of NASA Earth science that can improve, and sometimes revolutionize our ability to make informed decisions and policies.

NASA recognizes the urgency of responding to global change and the service that the Agency can provide in advancing the use of space-based observations to inform policy and decision makers as they adapt to the impacts of global change and plan for a sustainable future. The following program strategy addresses these needs with an implementation approach that addresses emerging problems, utilizes current research, and provides flexibility to collaborate with the broad range of users of Earth observations and research. In addition, the Applied Sciences Program will accelerate the delivery of new applications by serving as a catalyst for incorporating application needs throughout the life cycle of NASA Earth science missions.

The applicability of Earth observations to societal needs covers a broad range of issues, as recognized by the intergovernmental Group on Earth Observations (GEO)[1] and the U.S. Group on Earth Observations (USGEO).[2] The Applied Sciences Program works across the nine societal benefit areas identified by USGEO and agreed upon by its sixteen member agencies.

Nine Societal Benefit Areas

- Improve Weather Forecasting
- Reduce Loss of Life and Property from Disasters
- Protect and Monitor Our Ocean Resource
- Understand, Assess, Predict, Mitigate, and Adapt to Climate Variability and Change
- Support Sustainable Agriculture and Forestry, and Combat Land Degradation
- Understand the Effect of Environmental Factors on Human Health and Well-Being
- Develop the Capacity to Make Ecological Forecasts
- Protect and Monitor Water Resources
- Monitor and Manage Energy Resources

Two National Academy of Sciences reports contributed to the motivation for this strategy. The first, entitled *Earth Science and Applications from Space: National Imperatives for the Next Decade and Beyond* [3], recommended "a renewal of the national commitment to a program of Earth observations in which attention to securing practical benefits for humankind plays an equal role with the quest to acquire new knowledge about the Earth system." The second report, also published in 2007, *Assessment of the NASA Applied Sciences Program* [4], echoed this theme, and identified the Applied Sciences Program as a key asset for fulfilling the emerging national commitment to societal benefits.

II. NASA APPLIED SCIENCES: VISION, MISSION, AND GOALS

The 2007 report *Earth Science and Applications from Space: National Imperatives for the Next Decade and Beyond* stated, "A fundamental challenge for the coming decade is to ensure that established societal needs help to guide scientific priorities more effectively and that emerging scientific knowledge is actively applied to obtain societal benefits. New observations and analyses, … broadened community participation, and improved means for dissemination and use of information are all required. By taking up and meeting this challenge, society will begin to realize the full economic and security benefits… [of Earth science]."

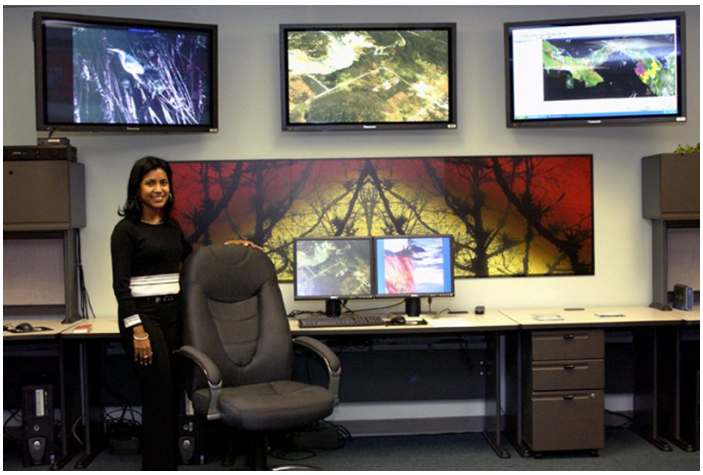
The Applied Sciences Program supports these aims by conducting research and development that enables use of NASA Earth observations and research to make better decisions and policy, mitigate risk, build resilient communities, and adapt to a changing planet.

The Vision of the NASA Earth Science Division Applied Sciences Program is to:

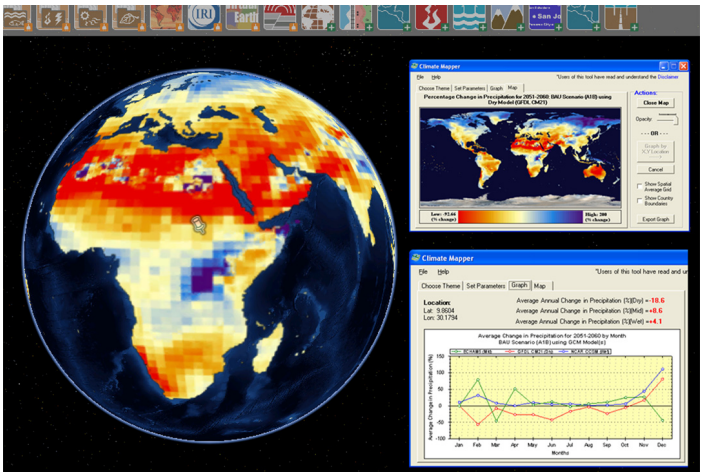
Achieve the greatest possible utility of NASA's investment in Earth science and observations by enabling its application to practical societal needs.

In support of this vision, the Applied Sciences Program Mission is to:

Advance the realization of societal and economic benefits from NASA Earth science by identifying societal needs, conducting applied research and development, and collaborating with application developers and users.



SERVIR (to serve, in Spanish) is a regional platform in the Americas and Africa developed by USAID and NASA. SERVIR uses earth observations and predictive models for environmental management, disaster management, and climate change adaptation. For more information see http://www.nasa.gov/mission_pages/servir/index.html

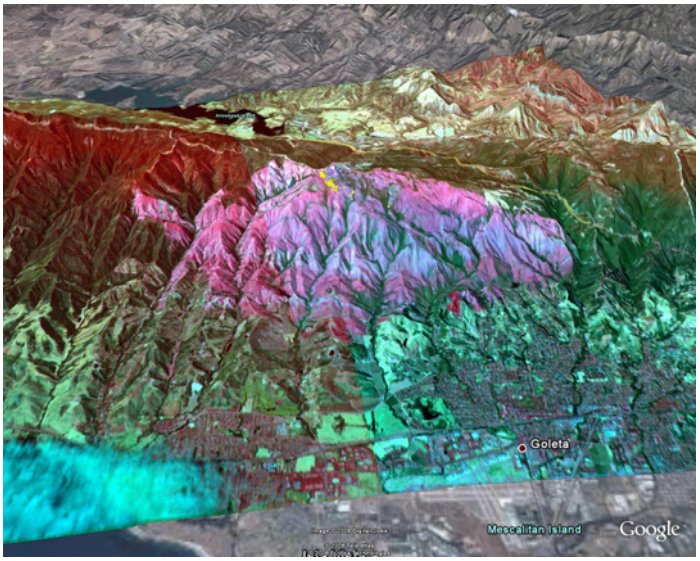


The Climate Mapper tool for SERVIR makes the results of climate change models accessible to a broad user community. With the Climate Mapper, users can assess climate change projections for the 2030s and 2050s against 3D visualizations of landscape. This can enhance vulnerability assessments for adaptation strategies. The Climate Mapper and SERVIR Viz can be downloaded at: www.iagt.org/servir/servir_viz

The following strategic goals define priority directions for the program to achieve the mission and vision. Specific actions are identified for each goal.

STRATEGIC GOAL #1. Enhance Applications Research: Advance the use of NASA Earth science in policy making, resource management and planning, and disaster response.

- Action 1.1: Identify and track evolving societal needs, particularly those needs associated with global environmental change
- Action 1.2: Identify and collaborate with organizations requiring and interested in NASA Earth applications
- Action 1.3: Assess and influence technology trends such as measurements, information technology, and visualization tools that impact society's ability to apply Earth science
- Action 1.4: Conduct research that a) solves basic challenges in applying Earth science, b) generates innovative and breakthrough applications, and c) investigates dependencies between climate change impacts and social and economic systems
- Action 1.5: Perform pilot projects, in collaboration with user organizations, of applications that demonstrate societal uses of NASA Earth science
- Action 1.6: Expand participation in interagency and intergovernmental activities that address adaptation to and mitigation of climate change to disseminate new knowledge and breakthrough techniques



The Autonomous Modular Scanner carried aboard NASA's Ikhana unmanned aircraft captured this image of the Gap Fire in Santa Barbara County, California, on July 8, 2008. Yellow areas depict actively burning areas. Red, pink and blue tones map burned areas. State agencies distributed the information to fire official's minutes after collection for analysis of new fire locations and fire size. - Credit: NASA/Google

STRATEGIC GOAL #2. Increase Collaboration: Establish a flexible program structure to meet diverse partner needs and applications objectives.

- Action 2.1: Achieve the greatest possible leverage of available budget through partnerships and relationships with organizations that provide complementary resources
- Action 2.2: Expand the number of end-users by promoting partner collaborations and networks that extend the program's reach
- Action 2.3: Establish projects that reflect a) the multidisciplinary nature of Earth applications (scientific, economic, social, technological), b) the need for multi-phase research (from basic applications research to implementation), and c) the varying technical capacity of organizations to utilize applications

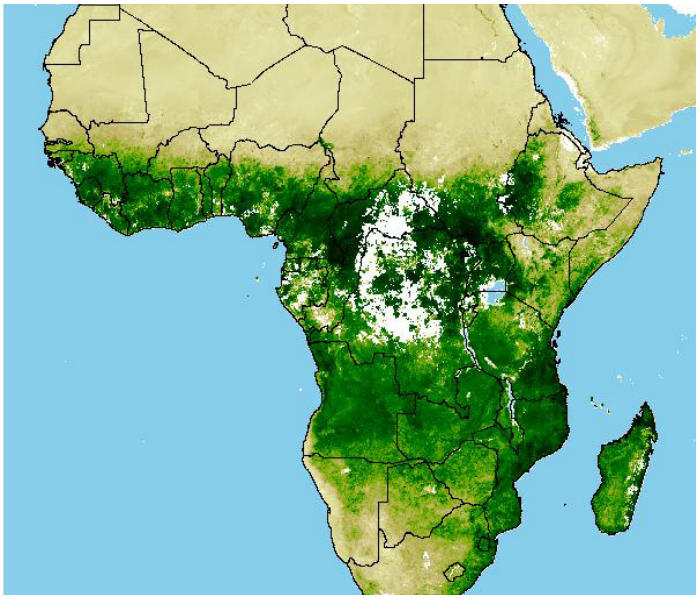
STRATEGIC GOAL #3. Accelerate Applications: Ensure that NASA's flight missions plan for and support applications goals in conjunction with their science goals, starting with mission planning and extending through the mission life cycle.

- Action 3.1: Accelerate the transition of science to applications by facilitating communication between the applications community and the basic research and flight mission communities

- Action 3.2: Assess and monitor society's upcoming observational needs over the duration of mission lifetimes

- Action 3.3: Evaluate the potential for current and planned NASA missions to meet societal needs through applied sciences participation in mission science teams

- Action 3.4: Integrate user needs and requirements into future mission planning in collaboration with the Earth Science Flight Programs and the Research and Analysis Program



Vegetation index over Africa in May 2008 as measured by the Moderate Resolution Imaging Spectroradiometer (MODIS) instruments aboard the NASA Terra and Aqua satellites. Due to their simplicity, ease of application, and widespread familiarity, vegetation indices have a wide range of usage, including agricultural monitoring and forecasting and land-use planning. In this example, close monitoring of vegetation in regions affected by increased rainfall is used to identify areas at increased risk for outbreaks of malaria.

III. PROGRAM IMPLEMENTATION

Achievement of the vision and goals described above requires innovative approaches to managing and implementing the Applied Sciences Program in a challenging environment. Among the challenges is the growing and changing demand for new types of environmental information as society adapts to and mitigates global change. In addition, growing recognition of the broad utility of remote sensing has resulted in growing demand for space-based information across societal sectors, as illustrated by the GEO's nine societal benefit areas. These demands require that the program address problems of differing technical maturity and collaborate with partners across a range of experience in using Earth observation decision tools. Also, for the program to be innovative and technically robust, it must track and incorporate advances in science and technology.

The need to incorporate a growing body of knowledge, as well as to identify and conduct applied research that addresses today's changing needs can only be met through careful program implementation. To achieve this, the program developed an implementation approach, which provides the flexibility needed to tailor projects to different societal uses, users, and collaborators by selecting from a variety of project types (see menu pg 5).

This "menu" includes project types that differ in duration, size, and collaboration requirements. This adaptable approach enables the program to:

- Address needs across the spectrum of technical maturity levels and applications areas;
- Address global change through applied research and by providing NASA research results, downscaled predictive models, and assessment and monitoring tools to inform impact assessments, adaptation and mitigation planning, and policy development;
- Conduct interdisciplinary research and development to solve complex problems and enable advanced information systems that integrate observations and information from multiple sources;
- Provide opportunities for innovation and high risk, high payoff research;
- Collaborate with user organizations of differing experience levels and technical capacities for using NASA Earth observations and research;
- Provide opportunities for the applications communities to participate in planning for Earth science flight missions.

Applied Sciences Project Menu

Earth Science Application Collaboratories
Create integrated, multidisciplinary approaches to real-world problems

Earth Science Applications Teams
Ensure that all available NASA Earth science resources are utilized for each application area

Feasibility Studies
Investigate ideas for innovative applications

Earth Science Decisions Projects
Incorporate mature applications into end-user decision making processes

Mission Applications Support
Integrate applications needs into mission planning

Joint Solicitations with Research Organizations
Create new knowledge needed for applications

Joint Solicitations with End User Organizations
Accelerate transition of applications to societal benefit

This program strategy recognizes the urgency of responding to global change and the service that NASA can provide to help the nation and world anticipate change and manage its resources. It outlines an ambitious vision and set of goals for the next five years, with an implementation approach that provides the flexibility to meet them. We have entered an era that calls for a stronger applications focus in Earth science and observations. The Applied Sciences Program leverages and complements the strong foundation of NASA's Earth science research, missions, and technology to continue NASA's legacy of contribution to mankind.

REFERENCES

1. International Group on Earth Observations: http://earthobservations.org
2. U.S. Group on Earth Observations: http://www.usgeo.gov
3. National Academies Press: http://www.nap.edu/catalog/11820.html
4. National Academies Press: http://www.nap.edu/catalog.php?record_id=11987

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