An NRC Study of

A Framework for Analyzing Satellite Measurement Continuity Needs for Critical Remote Sensing Observations of the Earth from Space

Committee on Continuity of Satellite Remote Sensing Observations of the Earth

October 29, 2013

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Background

Instruments on NASA research and NOAA "operational" spacecraft measure numerous variables relevant to Earth's biosphere, hydrosphere, atmosphere, and oceans —and their interactions on various spatial and temporal scales.

Such data streams are critical components of Earth Science research programs

There is diminished fiscal resources, coming loss of heritage assets, and increasing societal needs for information products derived from Earth observations,

Creating a growing tension between the need for measurement "continuity" and the development of new measurement capabilities.

Resulting in a request from NASA's ESD to the Space Studies Board (through its CESAS) that a committee be formed to recommend a framework for determining when a measurement(s) or dataset(s) should be collected for extended periods.

Schedule of Committee Activity

Committee Appointments, Aug 22, 2012

Telecon on September 30, 2012

Telecon on October 22, 2012

First Meeting, November 12-14, 2013

Second Meeting, Late January, 2014

Final Meeting, Mid April, 2014

Draft Report for Review, May 31, 2014

Report Submission , July 31, 2014

COMMITTEE MEMBERS

MEMBERS

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STAFF

Art Charo, *Study Director*, Senior Program Officer
Lewis Groswald, Associate Program Officer
Anesia Wilks, Senior Program Assistant
Andrea Rebholz, Program Associate

Michael Moloney, Director, Space Studies Board

Statement of Task

- *Consider the current and planned Earth observation programs of NASA, NOAA, and the USGS; existing NASA policy regarding the scope of its Earth Science Program, the 2007 NRC Earth Science Decadal Survey;and the 2010 NASA Plan for a Climate-Centric Architecture for Earth Observations and Applications from Space.*
  - NASA Science Plan 2007-2016
  - Draft NASA Science Plan 2014- ?
  - NOAA and USGS Science Plans
  - NRC 2007 Decadal Survey
  - NASA ESD 2010 Plan for Climate-Centric Architecture

- The committee will *seek to provide guidance that will be broadly applicable under a variety of scenarios that might unfold over decadal timeframes*.

OTHER CLIMATE DATA RECORD REPORTS

Climate Data Records from Environmental Satellites, NRC; 2004

Ensuring the Climate Record from the NPOESS and GOES-R Spacecraft, NRC; 2008

Satellite Observation of the Climate System, CEOS 2006

Systematic Observation Requirements for Satellite-Based Data, GCOS; 2011

Strategy Towards an Architecture for Climate Monitoring from Space, CEOS, CGMS, WMO; 2013

Strategy Towards an Architecture for Climate Monitoring from Space

Committee on Earth Observation Satellites (CEOS), Coordination Group for Meteorological Satellites (CGMS) and World Meteorological Organization (WMO)

Proposes requirements:

- To develop a strategy, bringing together space agencies and their coordinating bodies, to create an end-to-end system for the delivery of long term and sustained observations of the Earth's climate system.
- To define both a logical and physical architecture for the sustained delivery of these observations of the Earth's climate system.
- To ultimately create a global observing system for climate which builds upon existing systems including international agreements for standards, contingency planning, quality assurance and quality control, inter-calibration and broad, open, data-sharing policies.

ELEMENTS OF TASK

Within the constraints of expected budgets for the NASA-ESD program, *the committee will:*

1. *Provide working definitions of, and describe the roles for "continuity" for the ESD measurements and data sets*

1. *Establish methodologies and/or metrics that can be used to:*
   a. *Determine whether a measurement(s) should be collected for extended periods;*
   b. *Prioritize the relative importance of measurements that are to be collected for extended periods;*
   c. *Identify the characteristics of and extent to which data gaps and/or performance degradation are acceptable for given measurement(s);*

ELEMENTS OF TASK (Cont)

3. *Provide guidance concerning methods to determine the appropriate balance between cost, risk, and performance when addressing continuity needs ;*
4. *Assess the feasibility to achieve continuity, or near-continuity, to acceptable levels (see items 1-2) of data products derived from satellite instruments by means other than re-flight of such instruments. In addition to examining non space-based instrument platforms, consider the potential role of enhancements in data sampling and/or data reprocessing. Also, consider steps that might improve the scientific utility of data streams composed of multiple measurements sources;*
5. *Considering the upcoming decadal survey in Earth science and applications from space, provide an illustration of how the proposed framework might be applied to determine the relative importance of continuity versus new or improved measurements.*

ELEMENTS OF TASK(Cont)

6. *Considering the program plan as defined in the NASA-ESD Climate-Centric Architecture:*
   - *Identify and prioritize opportunities to improve alignment with the existing program and continuity needs identified above; and,*
   - *For selected examples chosen from the Climate-Centric Architecture, evaluate the robustness of continuity plans—including consideration of contributions from NASA surface and airborne assets, as well as contributions from other U.S. and foreign agencies*. In considering the robustness of these plans the committee will:
     - Determine the robustness of the combined programs for providing the needed data over continuous periods with acceptable data gaps, coverage, and resolution; and
     - Determine the capabilities of these programs to provide calibrated and consistently processed data records that are both made publically available and archived;

NASA Priorities for Continuous Measurements

NASA priorities for sustained measurements :

- Responsive to Executive Branch and Congressional Directives
- Responsive to Decadal Survey Recommendations
- Depend primarily on Climate Quality Measurements
- Consistent with interagency and international commitments
- Consistent with plans developed by international bodies (GCOS, CEOS, WMO)
  - To ensure complete coverage of measurement suite by international community