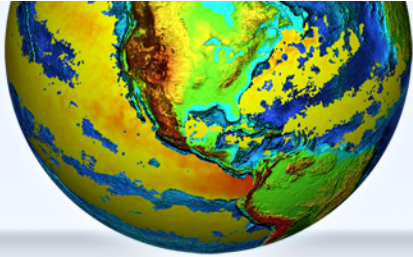


NOAA Responses to the Climate Research and Modeling Program Review

**Climate Research and Modeling Program Review
March 24-26, 2008
Hyatt Regency, Princeton, NJ**



Climate Research and Modeling Program

Overarching Goals*

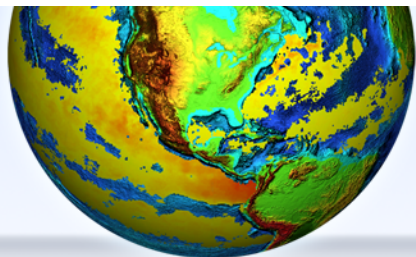
- 1) To develop and improve the capability to make predictions of climate on time scales leading up to several decades; and
- 2) To understand changes in atmospheric composition, understand past and present climate change and variability, and make decadal- to centennial-scale projections of future climate from global to regional scales.

*** Finalized just after the 2008 review**

Capabilities:

- 1) Understanding climate processes,
- 2) Earth System modeling, predictions, and projections, and
- 3) Climate analysis and attribution.

CRM funding (at time of review) was about \$78 M per year.



Climate Research and Modeling Program Review

Organization of Review

The Review was organized into Sections, defined by topic area.

Panel Reports for each Section were organized into Observations, Findings, Recommendations and Concerns.

Panel 1: Understanding Climate Processes

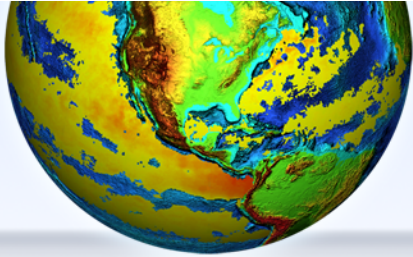
Panel 2: Reanalysis and Data Assimilation and Carbon Tracking

Panel 3: Earth System Modeling, Predictions, and Projections

Panel 4: Integration Between and Across Programs and Synthesis of Research leading to Information, and Products and Services

Panel 5: Decadal Variability and Predictability

(Sub panels not listed)



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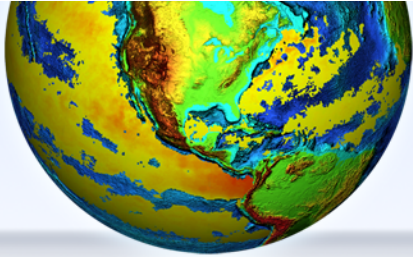
General Findings

This Report concludes that NOAA's CRM Program is **producing important, useful, and interesting research** that represents a major contribution to the extremely important and now highly visible world-wide enterprise of climate research.

NOAA scientists have made many world-class contributions to the scientific investigation of the Earth's climate and global change.

NOAA's superb contributions to recent international assessments are particularly noteworthy.

NOAA's provision of information on climate variability and the impacts of climate variability on society are also commended.



Climate Research and Modeling Program Review

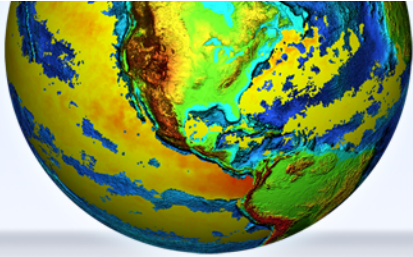
Major Challenges

A key challenge for the future is to improve the overall design and cooperative interactions of the many institutional components involved in the CRM Program.

Strategic Planning is obviously required to meet this challenge.

CRM must develop a comprehensive and in-depth Strategic Plan that defines its vision, mission, goals, and objectives, and lays out clearly the roles and required interactions of the numerous laboratories, centers, institutes and grant programs engaged in CRM-related activities.

The alignment, integration and strategy for science/research in support of model improvements are central to the **Strategic Plan**.



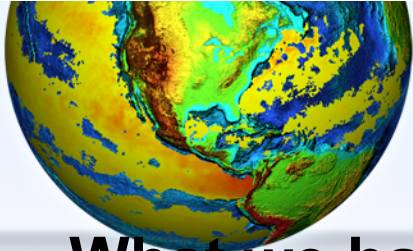
Climate Research and Modeling Program Review

What we have done:

- Strategic planning and management:
 - NOAA has developed a Next Generation Strategic Plan with a goal to support climate adaptation and mitigation.
 - A more detailed scientific and service strategy is provided in the Climate Services Vision and Strategic Framework.
- Financial management: New budgeting, reporting and incentive mechanisms have been developed through the Strategy, Execution and Evaluation process (SEE).

However:

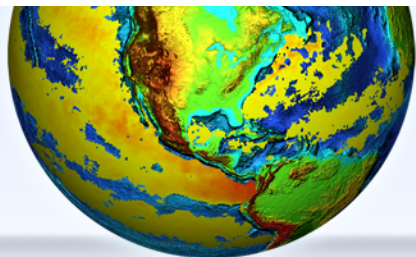
- Still need a more specific plan for how research, modeling, predictions and projections will develop.
- SEE process changes all programs, CRM is now only a part of the broader “understanding” portfolio.



Climate Research and Modeling Program Review

What we have done:

- Balanced research portfolio:
 - Maintained a balance of program funding between internal NOAA research groups, Cooperative Institutes, and the external community.
 - Continue to build collaborative program supported research teams, such as Climate Process Teams, through competitive solicitations.
 - Expanded the Regional Integrated Sciences and Assessment projects to 11 through competitive solicitations. Increased regional collaboration with appointment of NOAA Regional Climate Service Directors.
 - CRM components are increasing interactions with Decision Support Services (e.g. providing climate predictions and projections and advancing the understanding of high impact issues such as climate and air quality).
 - Evaluated the Applied Research Centers, kept focus on seasonal to inter-annual climate prediction system and observations and data stewardship.
 - Cooperative Institutes are competed on a regular basis to keep their activities aligned with strategic objectives.



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What we have done:

•Understanding:

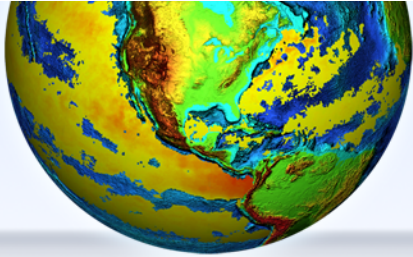
- Roles of greenhouse gases (including ozone, water vapor, nitrous oxide) and aerosols (e.g., soot, dust) in climate forcing and change.

•Modeling:

- Proposed new resources for Earth System Modeling and decadal predictability to draw upon expertise of the larger community.
- Expanded range of resolution (spatial and temporal) of climate models.
- Developed an integrated approach to high performance computing, and substantially expanded climate computing resources.
- Improved and documented land models.
- Substantial progress on reanalyses and reforecasts.

•Assessments:

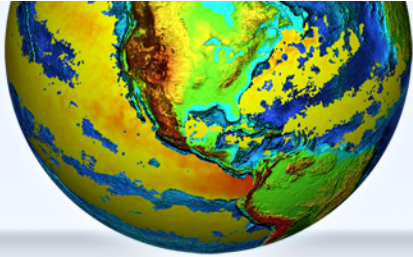
- Continued NOAA's leadership and support of policy-relevant national & major international scientific assessments & proposed increase in financial support.⁸



Climate Research and Modeling Program Review

What we are working on:

- Multi-agency services: The interagency taskforce on climate services.
- Partnership development growing:
 - Dept of Interior, Dept of Energy, Indian MoES, Australia CSIRO MOUs,
 - Sectors: NIDIS, sea level rise.
- Approaches to customer identification: “Needs Assessments”
- Science to Models:
 - Improved coordination between measurements and modeling and between process modeling and prediction, as well as transfer of research breakthroughs to operational capabilities.
 - Improved coordination of chemical and physical sciences in NOAA. Examples: carbon research and carbon tracker development, long-lived greenhouse gases, aerosol and ozone research, ocean models.

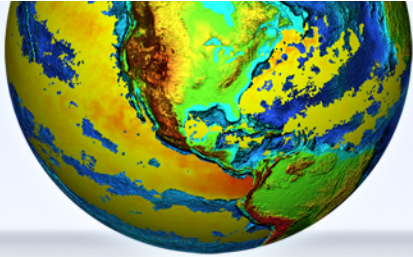


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What we are working on (*OR have requested new resources*):

- Radiative and climatic effects of water vapor and trace gases.
- Role of aerosols, aerosol-cloud interactions, and cloud feedback in climate. (*New resources requested for clouds, aerosols, and water vapor research*).
- Attribution of observed climate variations (including extremes).
- Evaluating intraseasonal-to-decadal predictability, prediction and high resolution climate models.
- Land-ice modeling under development with further increases requested.
- Terrestrial carbon cycle, including nitrogen / phosphorous soil-vegetation cycles, bio-mass burning, wetland and freshwater biogeochemistry, land-use management, and data assimilation. (*ESM request—requires new resources*)
- Arctic climate change issues: inc. sea-ice modeling, soot/dust effect on sea-ice, and analysis of causes of climate change. (*ESM request—requires new resources*)

• Real-time data ingest and data assimilation system under development.



Climate Research and Modeling Program Review

What we have not done:

- A strategic planning exercise towards (possible) operational decadal prediction.
- Develop a management strategy consistent with modern concepts of open innovation or open communities.
- Improve understanding of the interactions among coastal upwelling, advection, nutrient cycling, river inputs, and estuarine biogeochemistry and sedimentation.
- Complete climate model needs assessments to connect NOAA climate modeling to NOAAs customer base.
- Develop an Integrated Earth System Analysis capability.
- Develop a *national strategy* for climate prediction inclusive of MME, data assimilation, and forecast metrics.

Focused strategy for research and modeling not completed, but overall the CS vision and strategic framework provides direction of this effort.

Research to Applications and Operations efforts need improvements

February 15, 2011