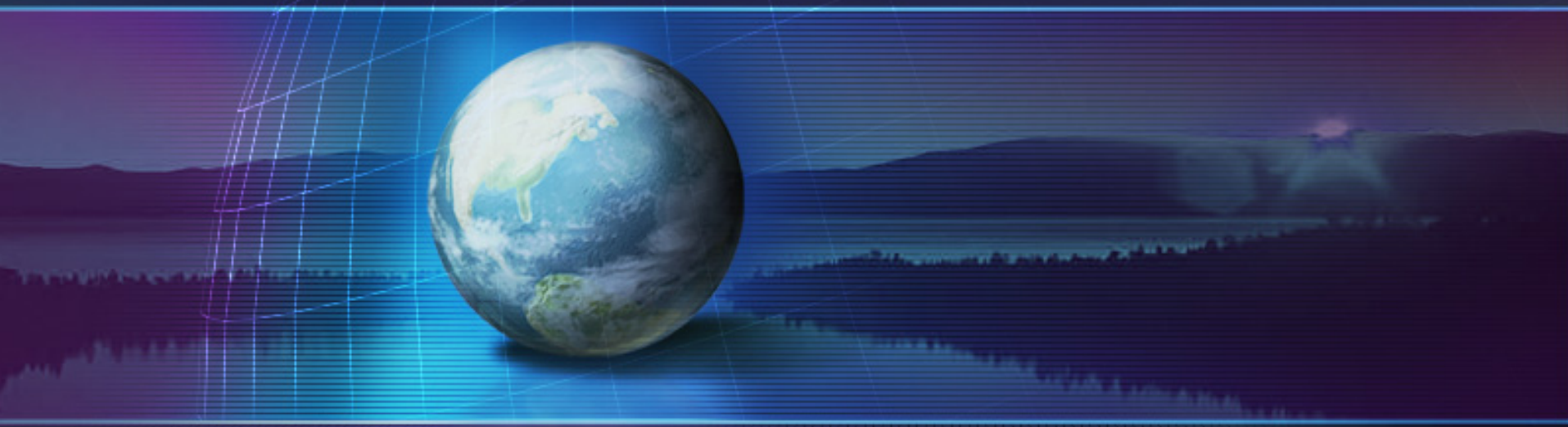
NOAA Supporting Climate through Space-based Observations



Linda V. Moodie
Senior Advisor
National Oceanic and Atmospheric Administration (NOAA)
United States of America
6 December 2007
"Space Supporting UNFCCC," Bali, Indonesia

From Climate Observations to Decision Support

Climate Observations

- NOAA is the U.S. focal point for operational environmental observations, for which climate is a large part
- We continue to develop strong observation and data management infrastructure
  - Satellites
  - Atmospheric observations
  - Ocean observations
  - Land observations
- Assure integration of these systems

Decision Support

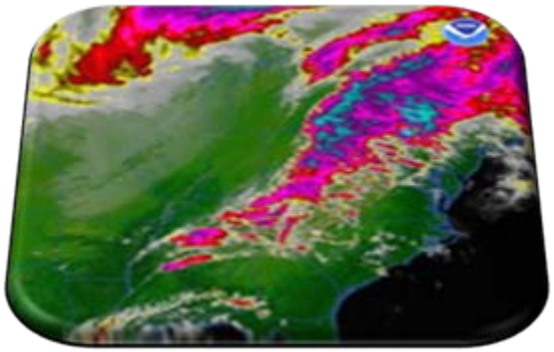
- NOAA produces a broad suite of climate information and tools to help business, industry, and governments plan for and adapt to future climate and inform the decision making process

NOAA Satellite and Information Service Supports NOAA

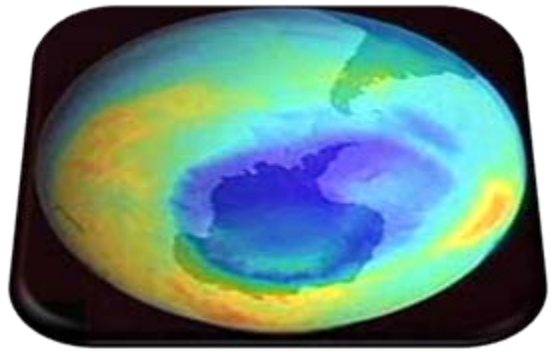
NOAA's Satellite and Information Service supports NOAA's mission and goals by:

- Acquiring and managing the Nation's civil operational environmental satellites
- Developing and disseminating satellite data products
- Operating the NOAA National Data Centers

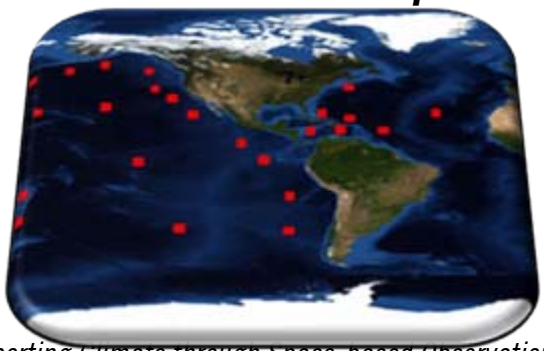
Weather and Water



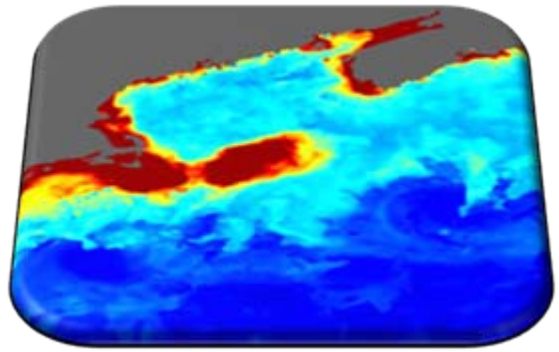
Climate



Commerce and Transportation

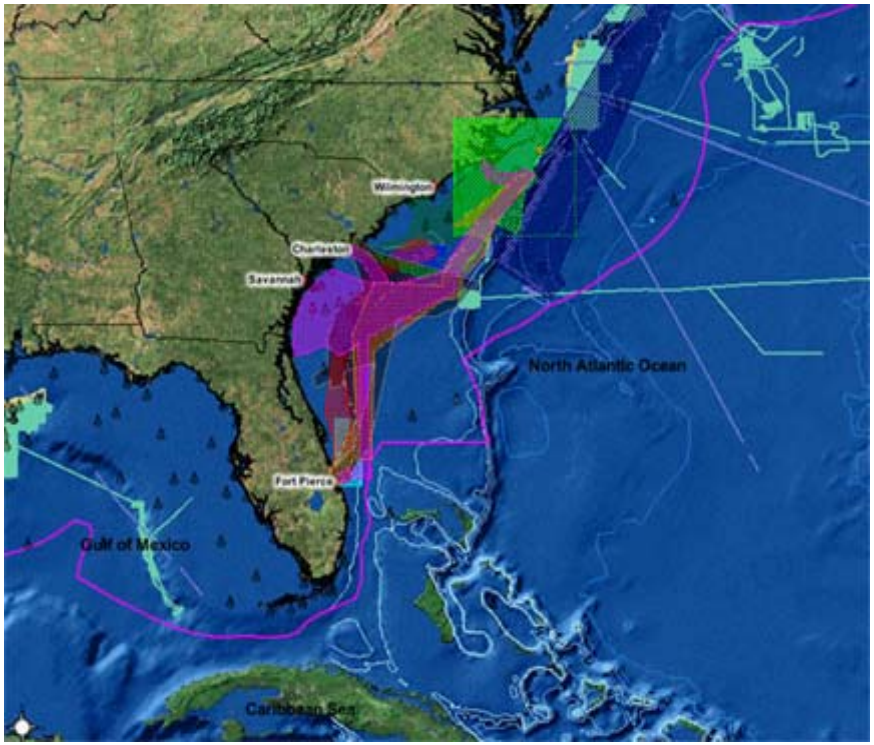


Ecosystems

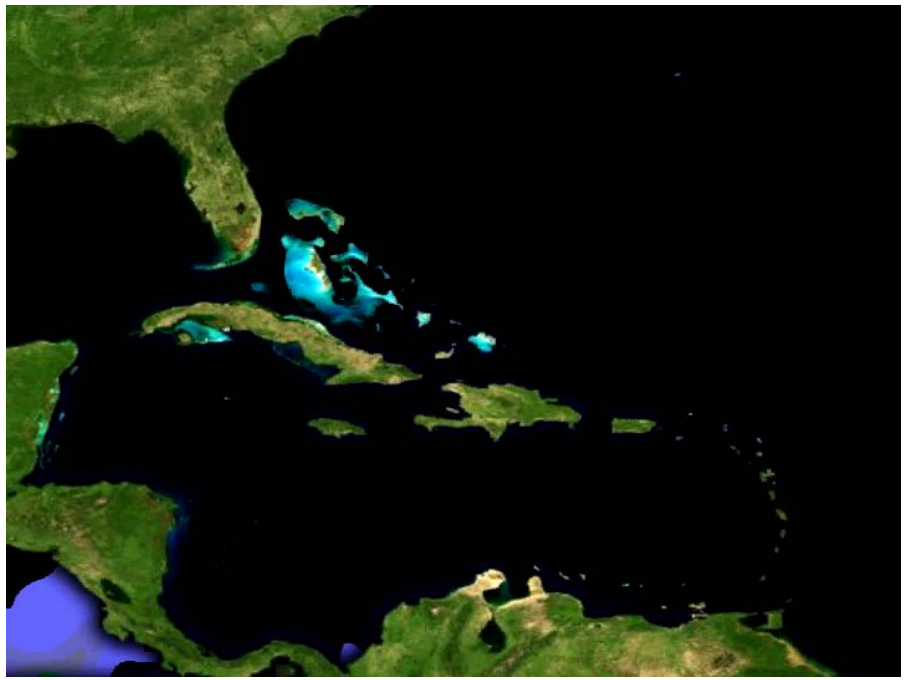


NOAA Satellite and Information Service Supports NOAA

Protect, restore, and manage coastal ecosystems…



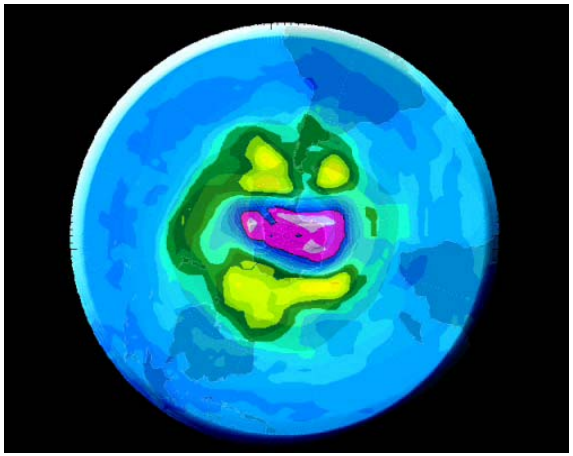
Online data management systems provide information to coastal managers at real time



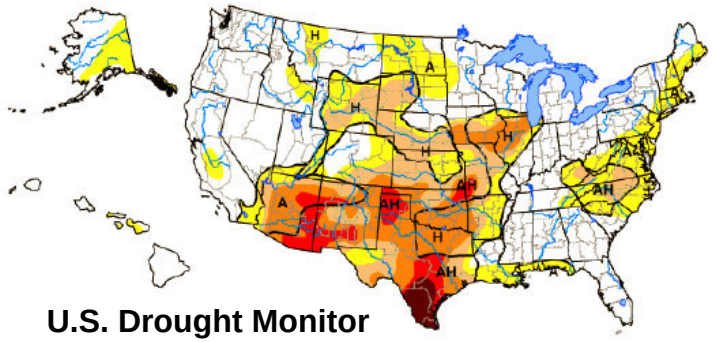
Coral Reef Watch's Satellite Degree Heating Weeks monitors for bleaching potential

NOAA Satellite and Information Service Supports NOAA

Understand global climate variability…

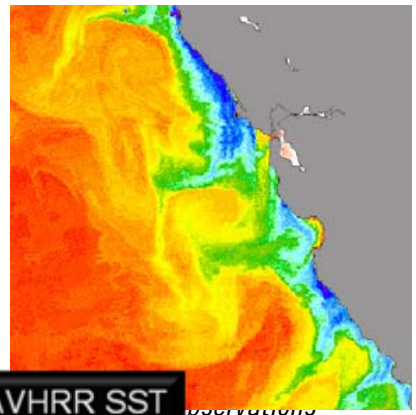


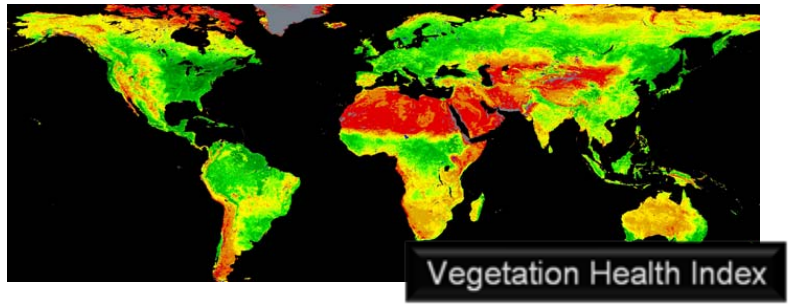
Ozone layer is monitored by the NOAA polar orbiting satellites



U.S. Drought Monitor

Ocean surface temperature and wind data more accurately determine areas of reduced nutrient upwelling during El Niño.



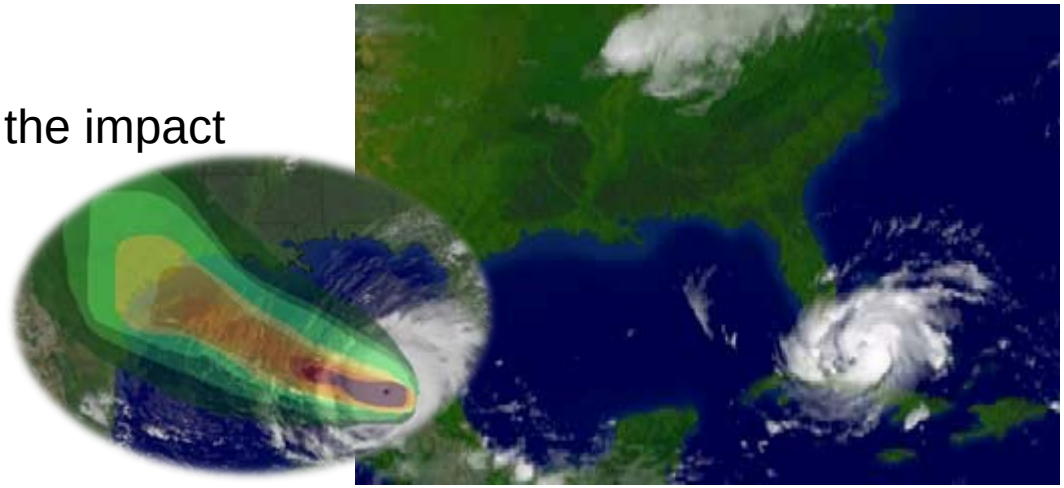


Vegetation health maps help to produce drought forecasts for agriculture and famine preparedness.

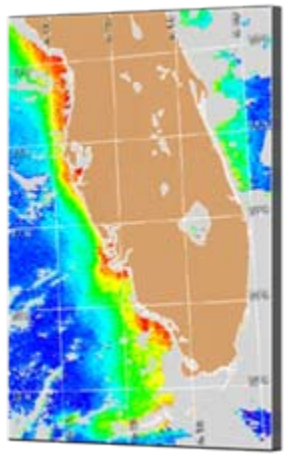
NOAA Satellite and Information Service Supports NOAA

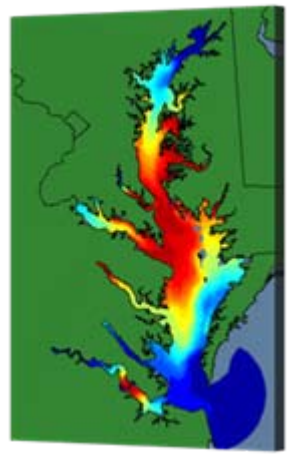
Serve society's needs for weather and water information…

Improved models for predicting the impact of intense hurricanes.



Ability to now-cast the occurrence of oceanic blooms, including jellyfish and harmful algae.

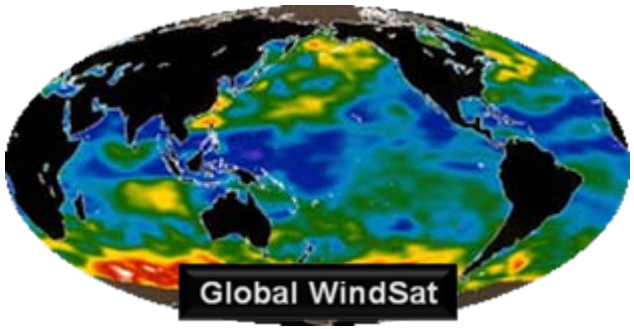




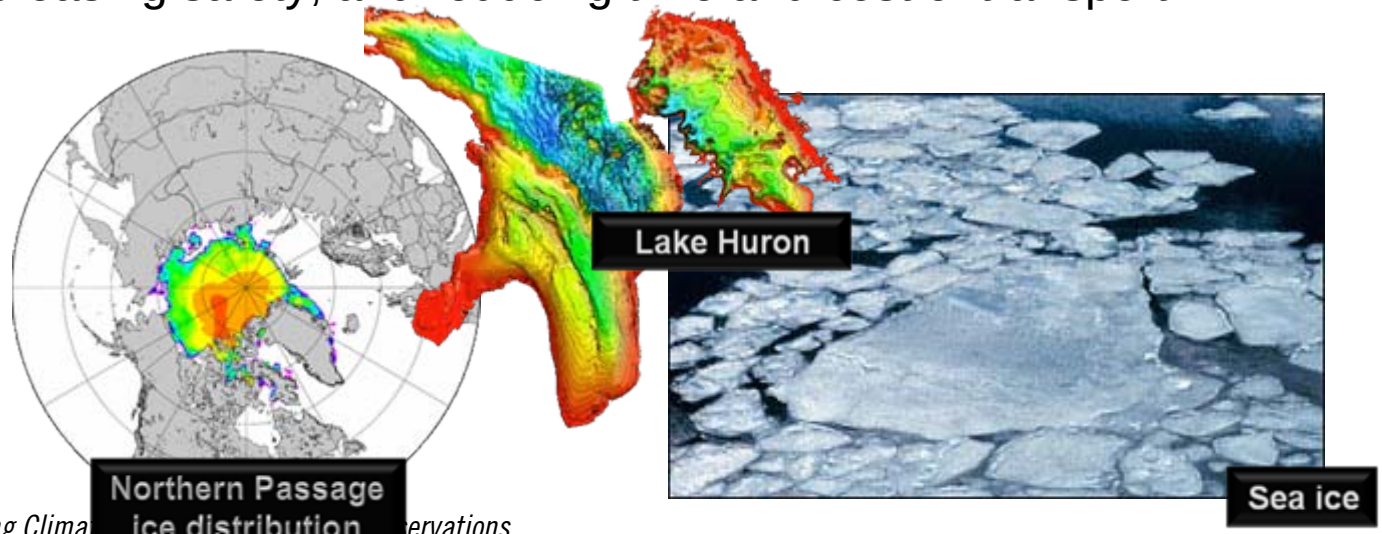
NOAA Satellite and Information Service Supports NOAA

Support the Nation's commerce and transportation..

More advanced wind forecasts, reducing costs to airline operations

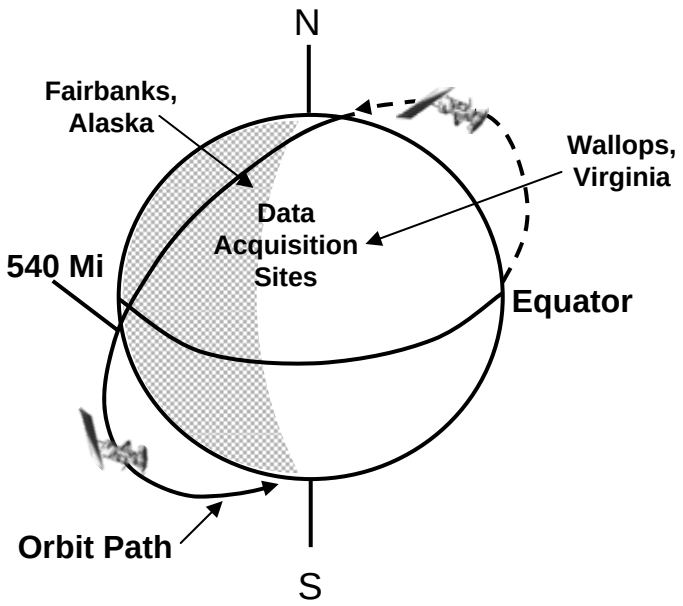


Ice and bathymetry maps plot navigable areas through the world's shipping lanes, increasing safety, and reducing time and cost of transport



NOAA Satellite Programs

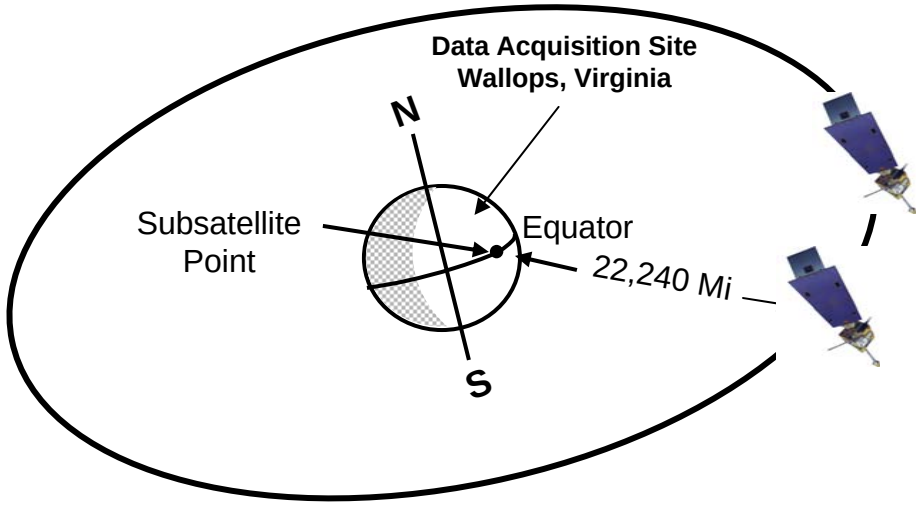
Polar-orbiting Operational Environmental Satellites (POES)



Each satellite covers the entire Earth twice per day

- Each orbit is 102 minutes
- Global coverage every 12 hours with 1 satellite
- Images are global and include the poles
- Information is used for long-term weather forecasting and climate monitoring

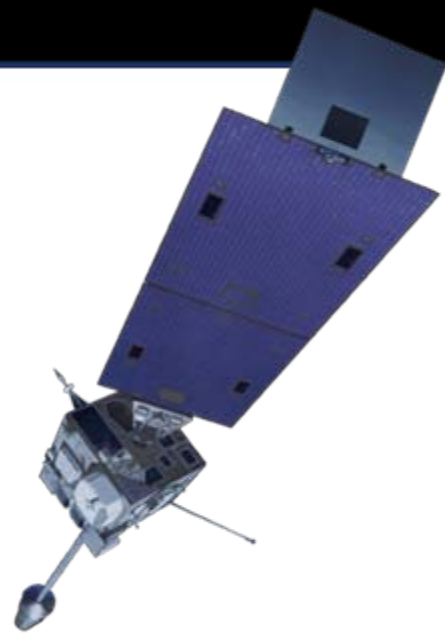
Geostationary Operational Environmental Satellites (GOES)



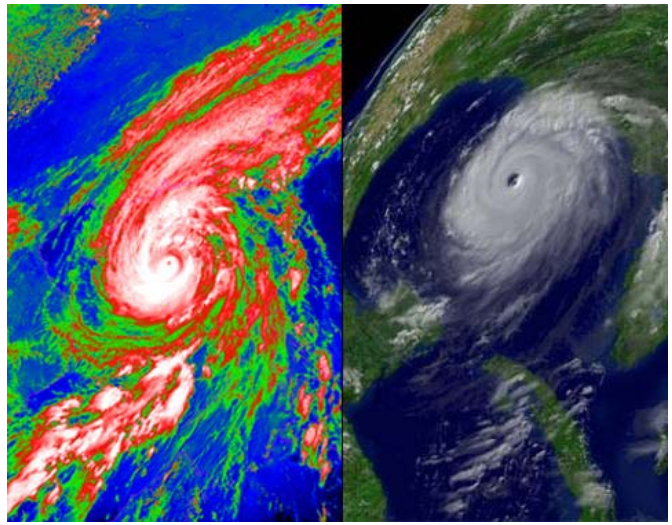
Continuously monitors the Western Hemisphere

- Same geographic image over time
- Full image every 30 minutes
- Northern Hemisphere imaged every 15 minutes
- Usable images between 60°N and 60°S
- Information is used for short-term weather forecasting and severe storm warning/tracking

GOES Satellites



- Weather sentinel – constant monitoring of:
  - Hurricanes
  - Severe storms
  - Flash floods
- Input to weather models, forecasts and warnings
- Sea surface temperature monitoring for fisheries and climate
- Winds for aviation
- Solar imagery for communication satellites, utility companies, and astronaut safety
- Environmental data collection–buoys, rain gauges, etc.
- Search and Rescue
- GOES data shared globally

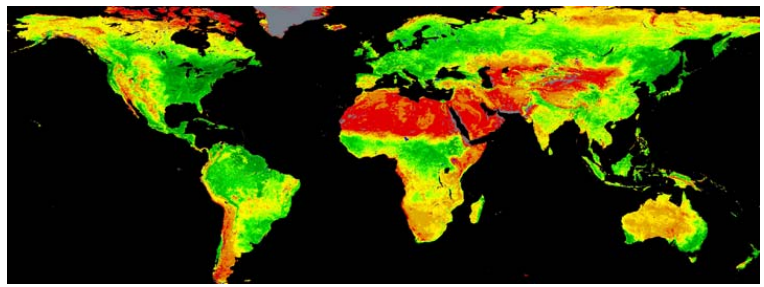


POES Satellites

POES Satellites provide global environmental observations in support of operational requirements for:

- Weather Forecasting and Space Environment
- Detection of significant environmental events (e.g., fires, oil spills, volcanic eruptions)
- Measurement of climate variables (e.g., atmospheric ozone)
- Ocean observations (e.g., sea surface temperature)
- Collection of data from surface platforms (e.g., buoys)
- Search and rescue

POES data shared globally



GOES-R: Next Generation Geostationary Satellites

Program is timed to ensure continuity of geostationary satellite coverage

Provides significant improvements over current satellites:

- More timely and accurate weather forecasts
- Better spatial and spectral resolution
- Improved operation

NPOESS: The Next Generation Polar-orbiting Satellites

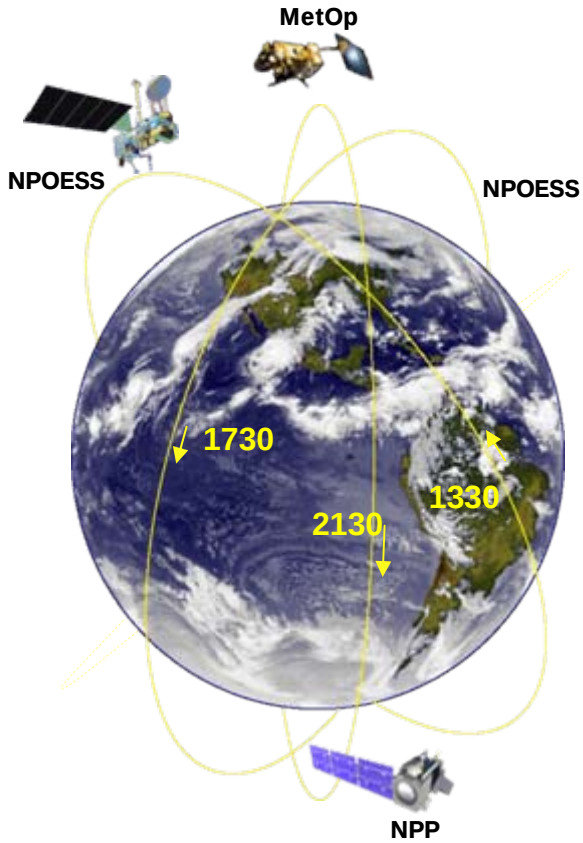
Provide a national, operational, polar-orbiting remote-sensing capability, exceeding the capabilities of past systems

Converges separate NOAA and Air Force satellite programs into a single joint program

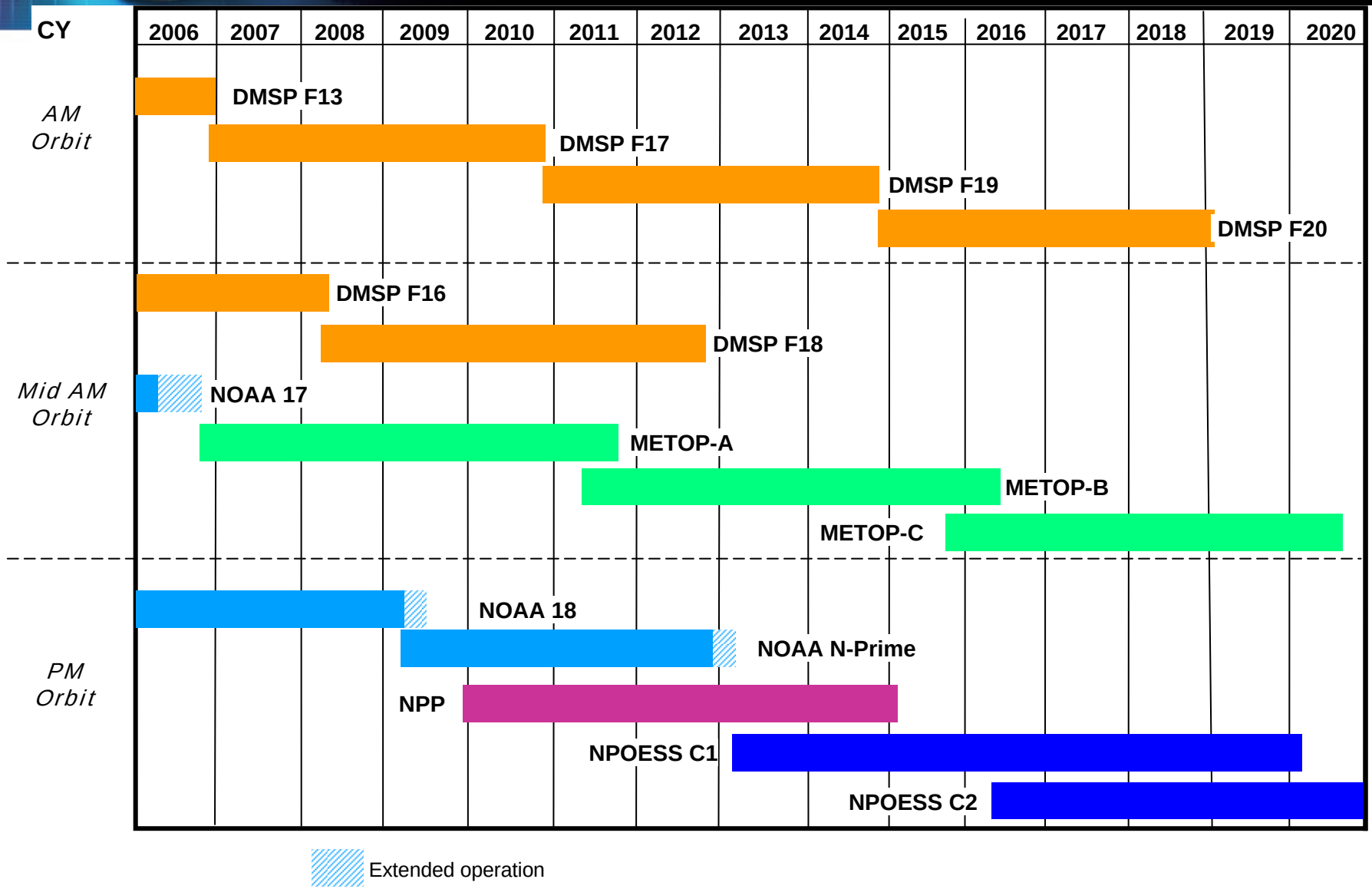
Improve the country's weather forecasting ability and climate research

Encourage international cooperation

NPOESS data will be shared globally



Continuity of Polar Operational Satellite Programs



Restoring Climate Measurements

NOAA and NASA working with OSTP to address de-manifested NPOESS climate sensors

- Total Solar Irradiance Sensor (TSIS)
- Earth Radiation Budget Sensor (ERBS)
- Ocean Altimeter (ALT)
- Ozone Mapping and Profiler Suite (OMPS) – Limb Subsystem
- Aerosol Polarimetry Sensor (APS)

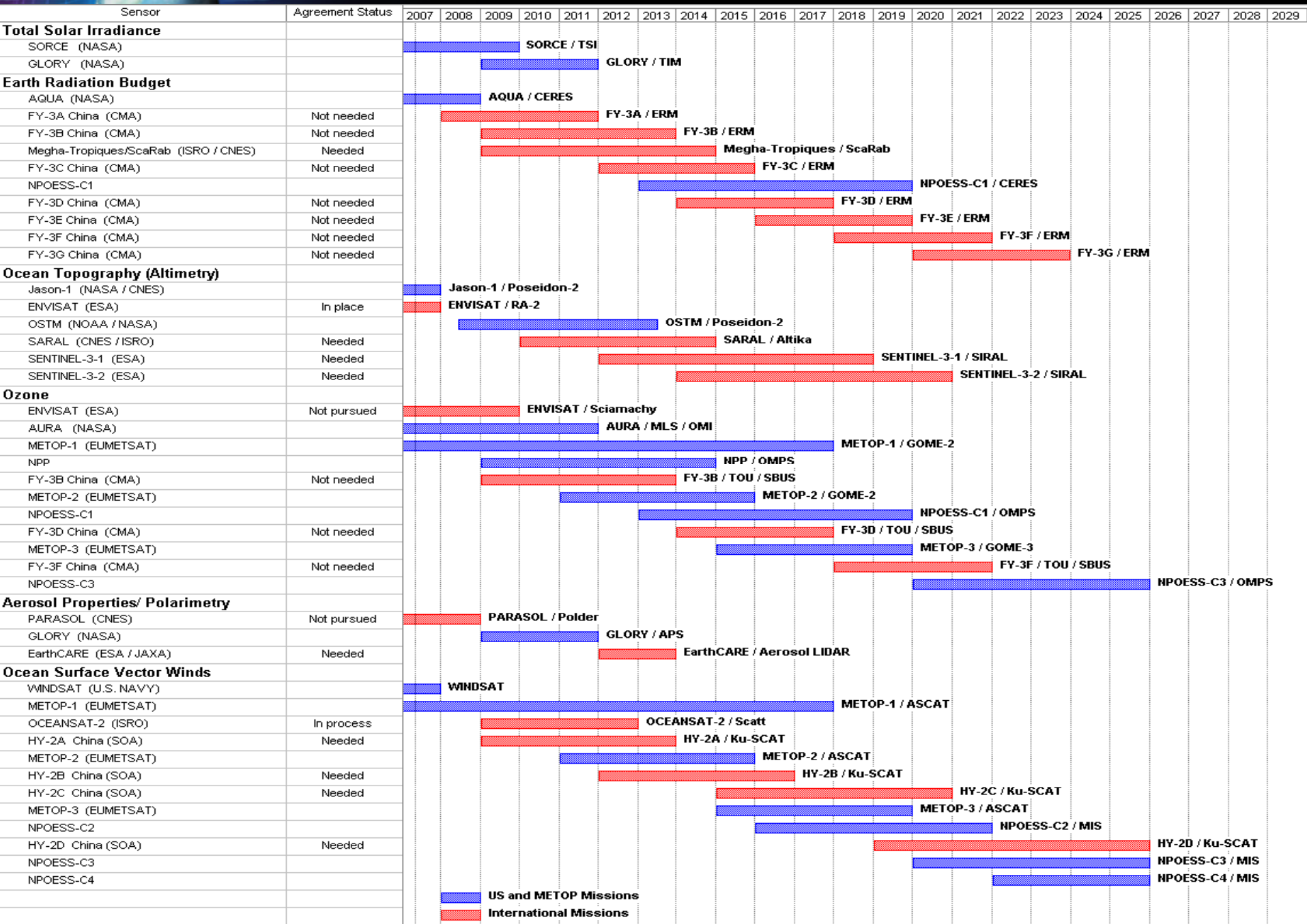
Several options under consideration, including returning instruments to the NPOESS platform or flying instruments on other spacecraft.

- Also providing accompanying assessment of requirements for associated Climate Data Record science and stewardship

National Research Council held workshop, Options to Ensure the Climate Record from the NPOESS and GOES-R Spacecraft, on June 19-21, 2007, to review options to recover measurement capabilities

- Workshop Report released in October 2007; final report and recommendations expected in early 2008

Climate Sensor Schedule



Satellite Data Processing and Distribution

24-hour Operational Support for Severe Weather & Environmental Forecasting

Operational Products

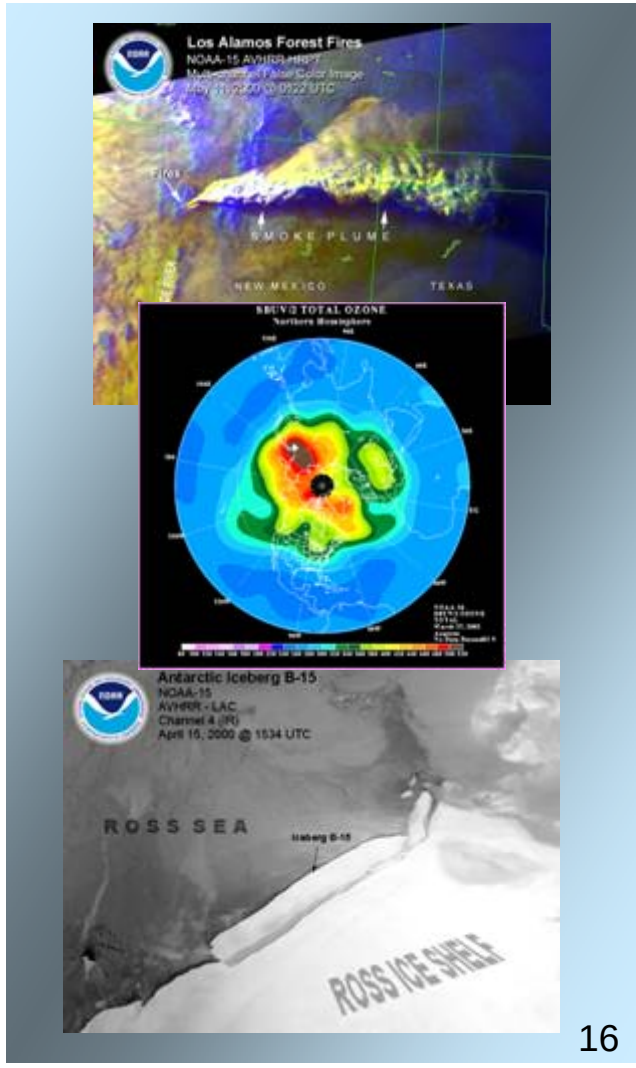
- Atmospheric Temperature & Moisture Profiles
- Gridded Earth Images
- Measure Solar Radiation
- Sea Surface Temperature
- Winds
- Fire Detection
- Vegetation Index
- Volcanic Detection
- Snow & Ice Cover

Environmental Monitoring

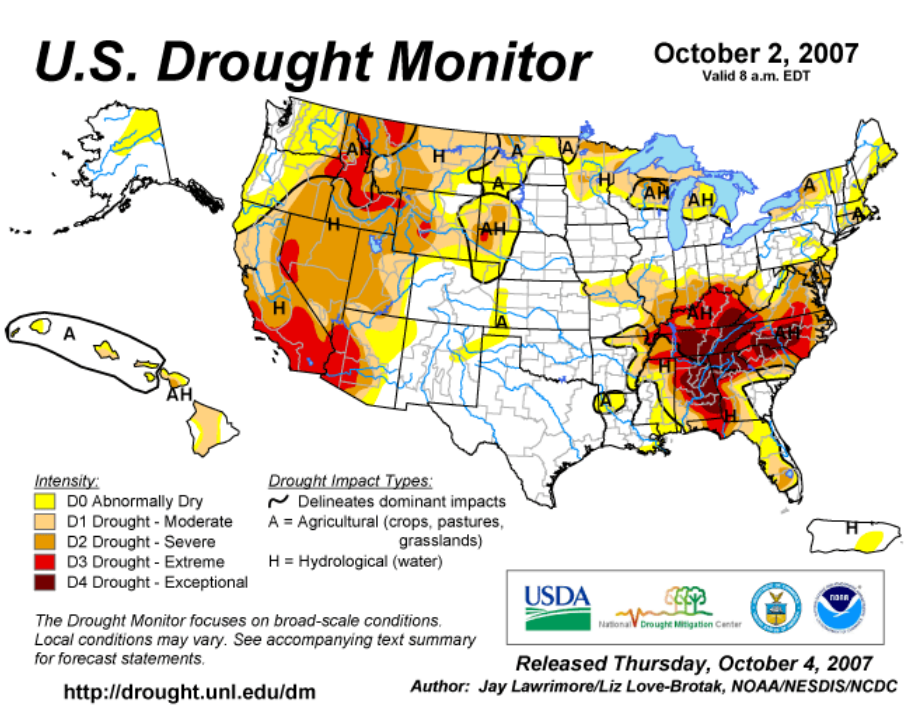
- Ozone Retrievals & Products

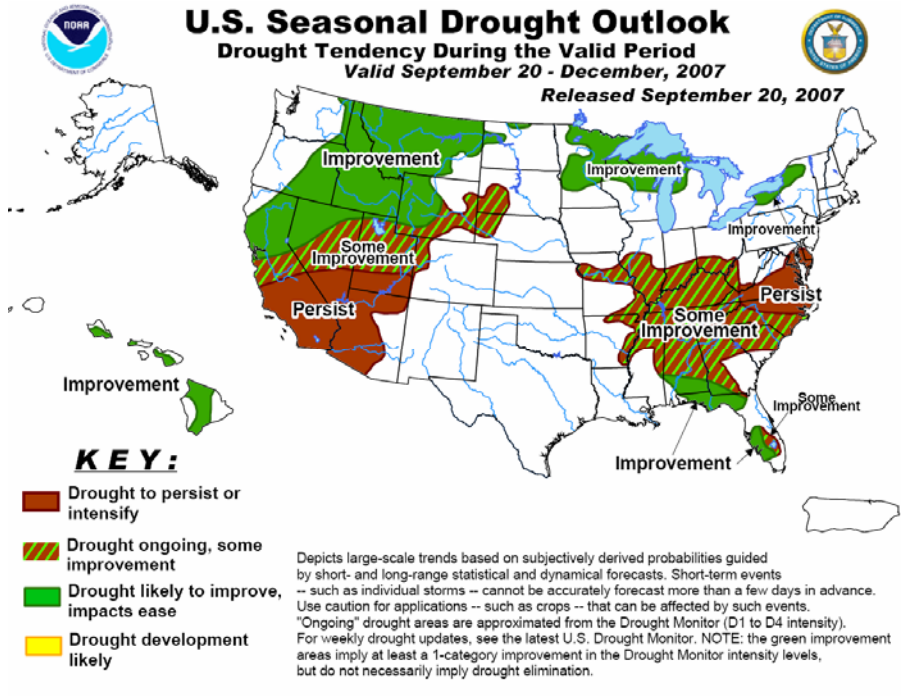
Distribution Services

- Distribution of NOAA satellite data sets via satellite rebroadcasting

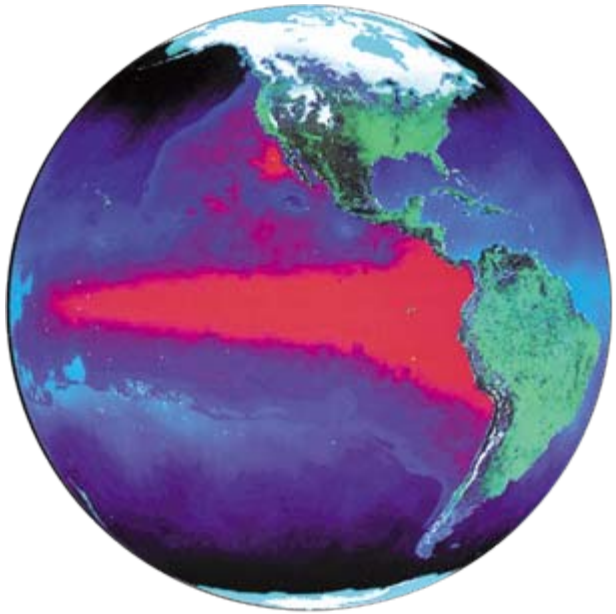


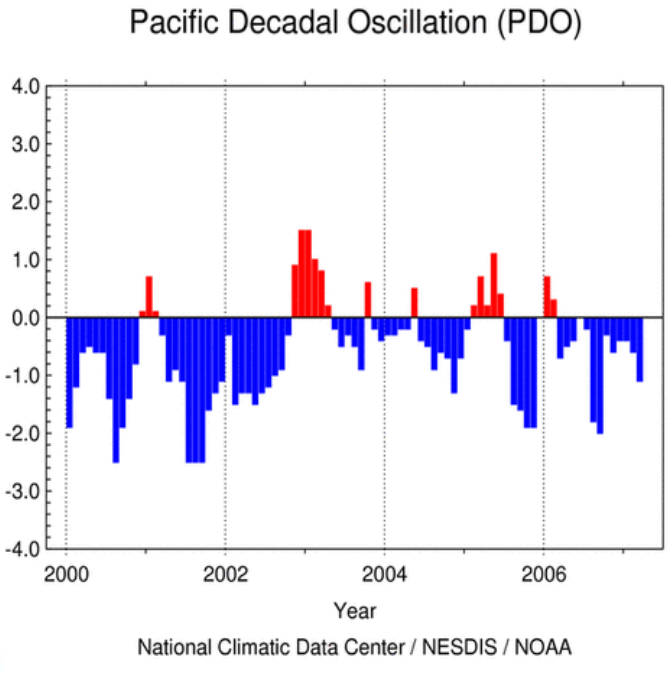
Early Warning Systems Example: *National Integrated Drought Information System*

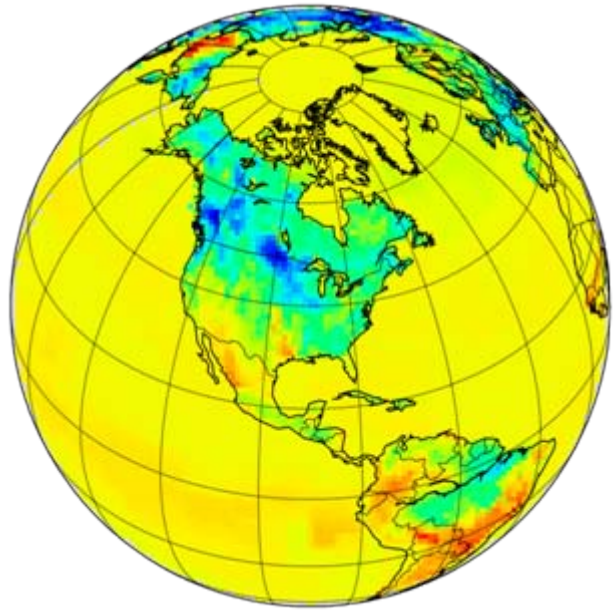




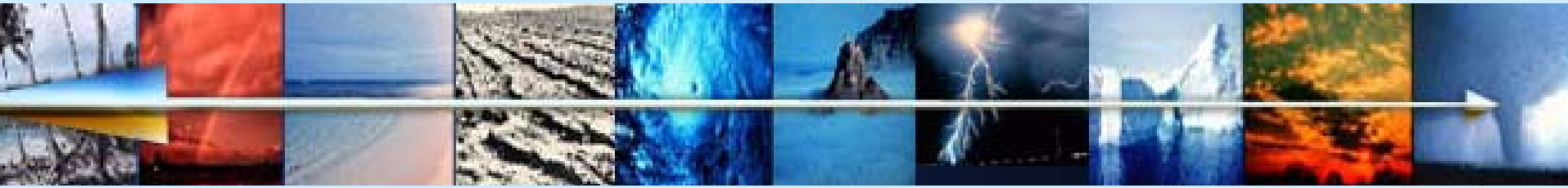
State of the Art Climate Science

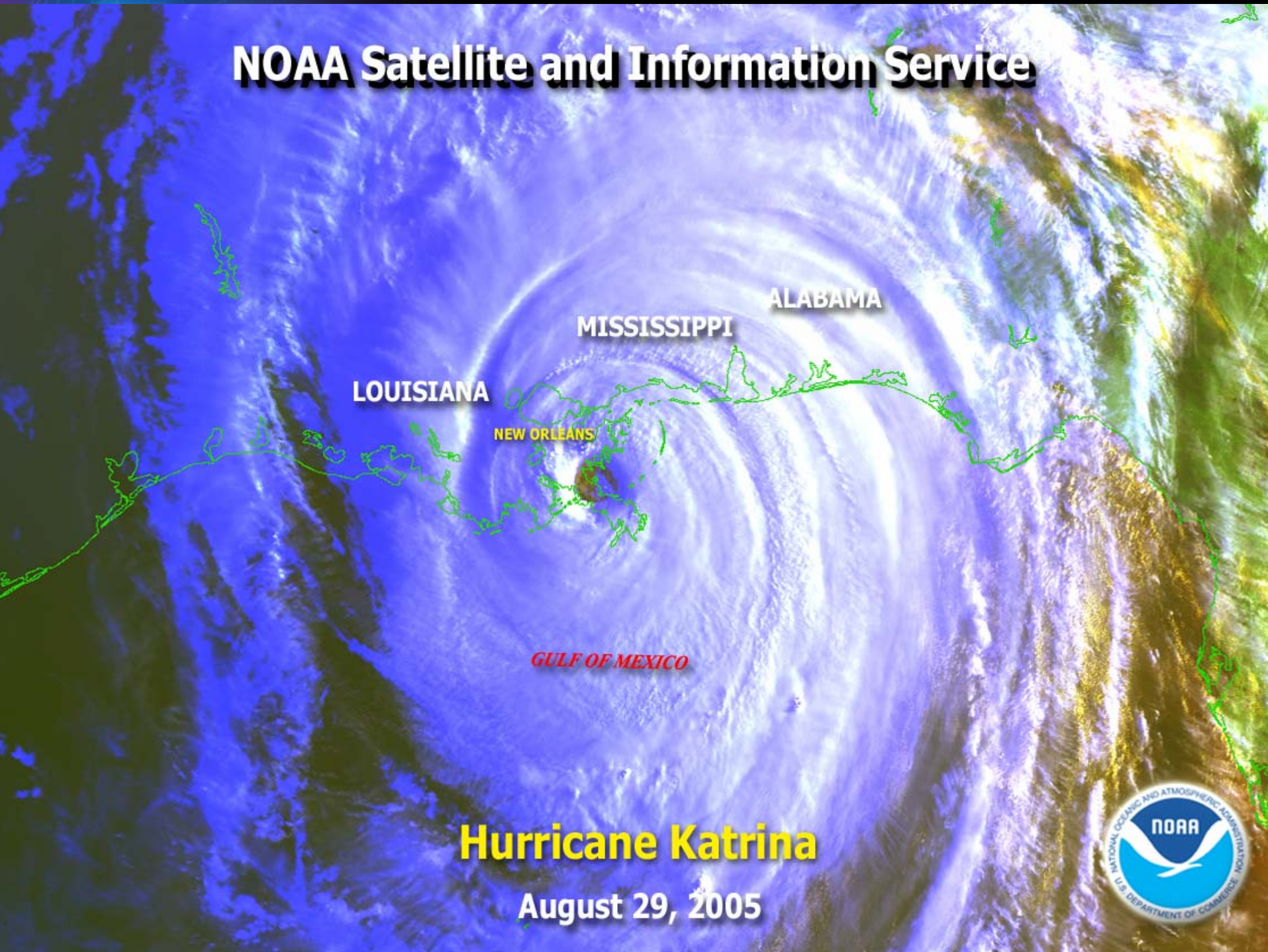




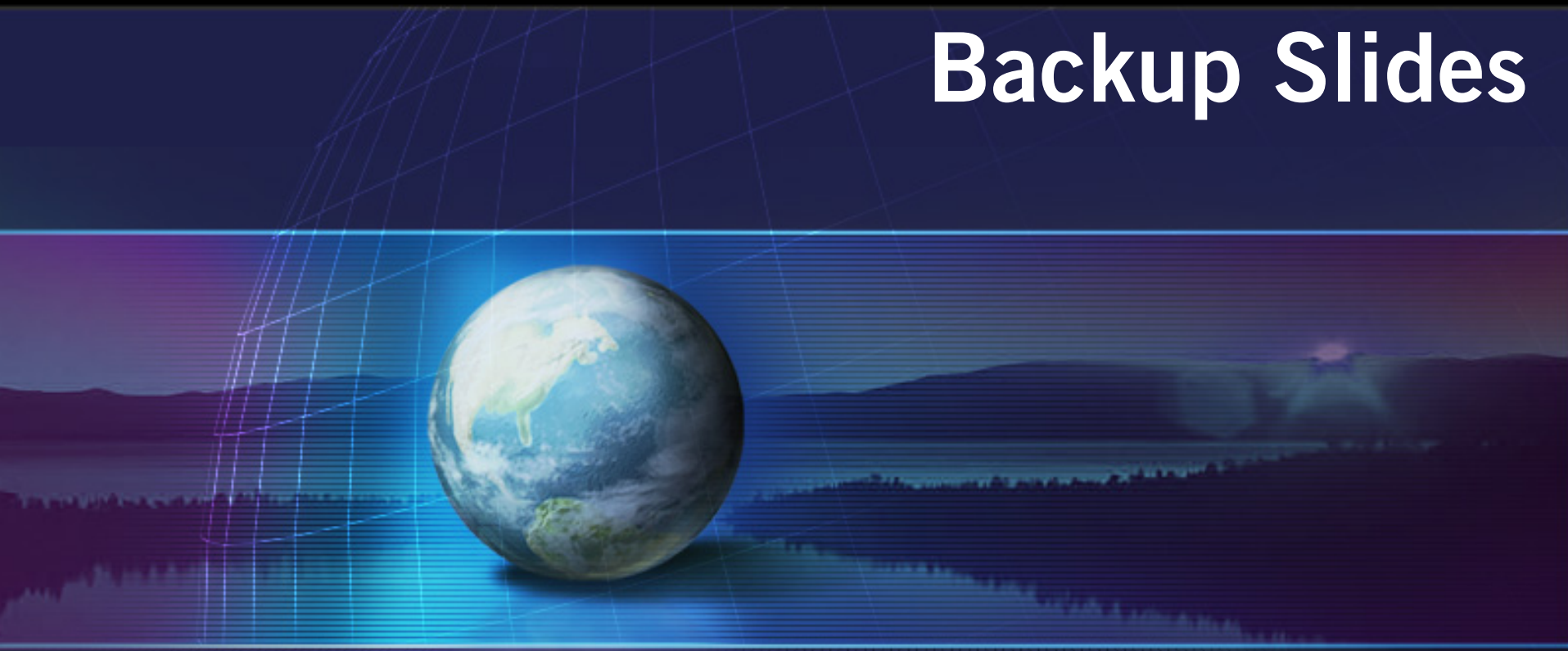


El Niño **PDO** **CarbonTracker**




NOAA Satellite and Information Service
ALABAMA
MISSISSIPPI
LOUISIANA
NEW ORLEANS
GULF OF MEXICO
Hurricane Katrina
August 29, 2005
NOAA
U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

Backup Slides



6 December 2007
"Space Supporting UNFCCC," Bali, Indonesia

NPOESS Instruments

Visible/Infrared Imager/Radiometer Suite (VIIRS)
- Implementation phase
- Contractor: Raytheon, Santa Barbara/El Segundo, CA

Cross-track Infrared Sounder (CrIS)
- Implementation phase
- Contractor : ITT Corporation, Ft Wayne, IN

Ozone Mapping and Profiler Suite (OMPS)
- Implementation Phase
- Contractor: Ball Aerospace, Boulder, CO

Advanced Data Collection System (ADCS)
- Implementation phase
- Contractor: Centre National d'Etudes Spatiales (CNES), Paris, France

Cloud and Earth's Radiant Energy System (CERES)
- Completed
- Contractor: NASA

Advanced Technology Microwave Sounder (ATMS)
- Implementation Phase
- Contractor: Northrop Grumman Electronic Systems, Azusa, CA

Space Environment Monitor (SEM)
- Contract to be awarded during FY 2008

Search And Rescue Satellite Aided Tracking (SARSAT)
- Contract to be awarded during FY 2008

Microwave Imager Sounder (MIS)
- Contract to be awarded during FY 2008

Climate Change Science Program

World's largest Climate Change Scientific Research Program

- $1.7 Billion in 2006 ($10.7 Billion 2001-2006); $1.7 Billion requested for 2007

Includes 13 Federal Departments, Agencies, and White House Offices:

- DOC, DOD, DOE, DOI, DOS, DOT, EPA, HHS, NASA, NSF, OMB, OSTP, USAID, USDA, Smithsonian, CEQ

Goals:

- Improve knowledge of the Earth's past and present climate variability and improve understanding of the causes of observed variability and change.
- Improve quantification of the forces bringing about changes in the Earth's climate
- Reduce uncertainty in projections of how climate systems may change
- Understand the sensitivity and adaptability ecosystems to climate
- Inform policymakers and manage risks related to climate variability and change

CCSP Assessment Activities

CCSP agencies and scientists participate in a wide range of international assessments

21 CCSP Synthesis and Assessment Products

- Scenarios of GHG Emissions and Atmospheric Concentrations and Review of Integrated Scenario Development and Application
- SAP 4.5: Effects of Climate Change on Energy Production and Use in the United States

IPCC

- ~120 U.S. scientists are IPCC authors; 15 are Review Editors
- US Co-Chairs and Hosts IPCC WG I
- WMO/UNEP Ozone assessments (234 US contributors to 2006 report)
- Arctic Climate Impacts Assessment (87 US contributors to 2004 report)
- Millennium Ecosystem Assessment (219 US contributors to 2005 report)