NOAA Climate Goal
Climate Service Development (CSD) Program

NOAA Scientific Advisory Board, Climate Working Group Meeting
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Presenter: Chet Koblinsky
Program Manager: Margaret Davidson

OUTLINE

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2. Current Activities and Highlights
3. FY11-15 Priorities and Alternatives
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Program Overview: NOAA’s Climate Goal

Mission: Understanding Climate Variability and Change to Enhance Society’s Ability to Plan and Respond

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<td>Describe and understand the state of the climate system through integrated observations, monitoring, and data management</td>
<td>A predictive understanding of the global climate system on time scales of weeks to decades to a century with quantified uncertainties sufficient for making informed and reasoned decisions.</td>
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<tr>
<td>Climate Research and Modeling</td>
<td>Understand and predict climate variability and change from weeks to decades to a century</td>
<td>Climate-sensitive sectors and the climate-literate public effectively incorporating NOAA’s climate products into their plans and decisions.</td>
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<td>Climate Service Development</td>
<td>Improve the ability of society to plan for and respond to climate variability and change</td>
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Programs Overview: Structure of Program

The Climate Service Development (CSD) Program – assesses impacts of climate variability and change, supports regional adaptation strategies, and develops and delivers operational climate information products, tools, and services.

- National Integrated Drought Information System (NIDIS)
- North Pacific Climate Regimes and Ecosystem Productivity (NPCREP)
- Sectoral Applications Research Program (SARP)
- NWS Climate Services Division (CSD)
- Transition of Research Applications to Climate Services (TRACS)
- Coastal Services Center (CSC)
- Regional Climate Centers (RCC)
- Regional Integrated Sciences and Assessments (RISA)
- International Institute for Climate and Society (IRI)
Program Overview: Program Drivers

Legislation:
- National Climate Program Act of 1978
- Global Change Research Act of 1990
- Coastal Zone Management Act
- Coastal Zone Enhancement Grants
- Magnuson-Stevens Fishery Conservation and Management Act
- Marine Protection, Research, and Sanctuaries Act of 1972

Policy Decisions:
- Grand Challenges for Disaster Reduction
- NOAA 5-Year Research Plan
- Policy on Transition of Research to Applications (NOAA Administrative Order (NAO) 216-105)
- U.S. Ocean Action Plan
- Charting the Course for Ocean Science for the United States for the Next Decade: An Ocean Research Priorities Plan and Implementation Strategy
- Strategic Plan of the U.S. Climate Change Science Program 2003
- 2007 NIDIS Implementation Plan
- Creating a Drought Early Warning System for the 21st Century: The National Integrated Drought Information System (NIDIS)
- A Climate Services Vision: First Steps Toward the Future (National Research Council, 2001)
- Research Networks for Decision Support in the NOAA Sectoral Applications Research Program (National Research Council, 2007)

Current Activities and Highlights: Recent products and services from CSD

Synthesis and Assessment Product (SAP) 5.3 – Water Resources and Climate Prediction: Linking Science with Decisions. Assessment that focuses on the scientific ability to predict climate on seasonal and year-to-year timescales and the opportunity to incorporate such information into water resource management decisions.

The Interagency U.S. Water Monitor Streamflow – Reservoirs – Groundwater – Forecasts – Snow
http://watermonitor.gov

NOAA Online Weather Data (NOWdata): public interactive access to "past weather". By clicking on the NOWData tab, users can access a wide range of climate products provided for nine different climate variables for nearly 3,900 locations.
Current Activities and Highlights: Recent products and services from CSD

**AgroClimate**
(transferred from RISA to the Extension Service through TRACS)

An interactive website with climate, agriculture, and forestry information that allows users to assess resource management options with respect to their probable outcomes under forecast climate conditions.

NPCREP develops guidance about ecosystems status and trends for the NPFMC (North Pacific Fishery Management Council). Significant relationships between climate forcing and ecosystem response, observed and predicted, are published annually in the Alaska Fisheries Science Center's Stock Assessment and Fisheries Evaluation.

Northward shift (km) in center of distribution of multiple species from 1982-2006

Current Activities and Highlights: National Integrated Drought Information System (NIDIS)

Drivers: NIDIS Act of 2006, NIDIS Implementation Plan

**What is it?**
- Led by NOAA, it is a multi-agency partnership of Federal, State, and local cooperators
- NIDIS offers a framework for integration of vulnerability and hazard information for planners and decision makers
- Provides an information system for drought early warning and adaptation

**What does it do (elements of NIDIS)?**
- U.S. Drought Portal: Developing a clearinghouse for drought mitigation and response innovations
- Drought Early Warning System
  - Coordinating drought plans among states, communities of a common river basin (Pilots)
  - Strengthening monitoring networks
- Climate Test Beds:
  - Integrating data and forecasts
- Coping with Drought in support of NIDIS
  - Integrated research and applications
  - Engaging preparedness communities
Current Activities and Highlights: 
\textit{NIDIS in Action}

2008 Workshops – Prepping for ‘09 pilot projects:
- “Remote Sensing Contributions to Drought Monitoring”, February 6-7, 2008, Boulder
- “NIDIS Southeast Drought Workshop” – April 29-30, 2008, Peachtree City, Georgia

Current Activities and Highlights: 
\textit{International Research Institute (IRI)}

\textbf{International Research Institute for Climate and Society}

\textbf{What is it?}
- IRI is part of the Earth Institute at Columbia University; it functions as an Institutional Agreement between NOAA’s Climate Program Office and Columbia University
- IRI catalyzes the creation and provision of science information that meets the needs of the developing world

\textbf{What does it do?}
- Assist in the improvement and delivery of climate science that responds to the demands of decision makers in different economic sectors
- Develop, explore, and evaluate climate risk management strategies
- Strengthen development through the integration of climate risk management
- Capture and manage knowledge, and train and share information in support of managing climate related risks
Current Activities and Highlights:
IRI in Action

- Training on the use of climate and GIS tools for enhanced natural resource management
- Use of remotely sensed data to establish regional climate patterns where direct observations are missing
- Sectoral analysis of climate impacts (e.g., malaria early warning tool)
- Basic research to unravel and understand climate mechanisms

Current Activities and Highlights:
Climate Impacts on Living Marine Resources

North Pacific Climate Regimes and Ecosystem Productivity (NPCREP)

What is it?
• NPCREP seeks to understand climate patterns and their impact on ecosystem dynamics in the North Pacific and Bering Sea

What does it do?
• Maintains an on-going observing system to monitor changes and add to a long-term record of biophysical measurements in these regions

• NPCREP is dedicated to:
  • Development of climate-forced models used to improve recruitment prediction and stock assessments
  • Development and generation of indices and assessment tools used in fisheries management
  • Research that provides accessible environmental and ecosystem data for the eastern Bering Sea
  • Development of guidance about ecosystems status and trends for the North Pacific Fishery Management Council

NPCREP study area focused on the eastern Bering Sea. Secondary effort is aimed at the western Gulf of Alaska, Aleutian Islands and other neighboring regions
Current Activities and Highlights:  
**NPCREP in Action**

**Current activities include:**

- Providing high quality data products from the NPCREP observing network to our stakeholders

- Refining a southeastern Bering Sea marine ecosystem hypothesis relating climate to productivity

- Forecasting transport of snow crab larvae in the eastern Bering Sea

- Conducting a Bering Sea ecosystem forecast workshop to produce an ecosystem forecast

(left) Mooring site 2 in the eastern Bering Sea can be covered by sea ice as in this photograph from the late 1990s. (right) Walrus are threatened by the shrinking ice pack over the continental shelf.

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Current Activities and Highlights:  
**Sectoral Applications Research Program (SARP)**

**What is it?**

- SARP is a competitive grants program that supports interdisciplinary research on the affects of and potential responses to climate variability and change in specific sectors of society

- Current SARP projects serve the Coastal and Water sectors: sub-foci within the water sector include drought and urban water resources

- SARP supports the Coping with Drought in support of NIDIS initiative by managing competitive grants for drought impacts research

**What does it do?**

- Identify potential impacts and societal vulnerabilities in specific sectors of society in order to enhance their capacity to cope with and adapt to climate variability and change

- Enhance the use of climate information and decision support resources in various sectors on scales from local to international

- Provide sector-specific insight and feedback on stakeholder needs and capabilities to contribute to relevant research and decision support efforts

- Develop intra- and inter-agency linkages to infuse climate information into sector-specific decision making processes

- Guidance for future activities provided through the 2007 National Research Council review of the program
Current Activities and Highlights:  
*SARP in Action*

**The Climate Change LEADS Project**
- **Who** - World Wildlife Federation’s Climate Change LEADS Project (Linking Environmental Analysis to Decision Support) is working to enhance resilience in the valuable yet vulnerable coral ecosystem of the Florida Keys and South Florida.
- **What** - Uniting concerned people, resource managers, and researchers in an informed dialogue to explore ways of adapting coral reef conservation for climate change.
- **Product** - A Geographic Information System (GIS) will eventually allow anyone to explore patterns in environmental conditions that relate to reef resilience.
- **Why** - Coral assemblages that are more “resilient” are better able to resist, tolerate, or recover from climate change stresses, including coral bleaching caused by high water temperatures.

*Sensitivity of Boulder Colorado’s Water Supply to Climate Change - Using Climate Forecast Information in Water Resource Management*

Used the paleoclimate record and climate change models to evaluate the risks from both climate change and climate variability to produce an improved tool for water resources planning.

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Current Activities and Highlights:  
*NWS- Climate Services Division (CSD)*

**What is it?**
- **Oversee** NWS climate prediction operations plans, policies, and procedures.
- **Provides a link** to the public and the climate prediction community to identify and validate climate needs, mitigate climate-related disasters, and establish operational requirements for climate products.
- **NWS Climate Services Mission**: To ensure NWS develops and delivers an end-to-end suite of climate information through strategic planning, user engagement, product and policy development, integration of research and assessments, partnerships, outreach, and training.

**What does it do?**
- **Provide** oversight and strategic vision for NWS climate services.
- **Develop** and maintain NWS polices, directives, and requirements for climate products and services.
- **Develop and administer** training courses and modules for NWS field staff.
- **Facilitate**, coordinate, and develop local climate products, outreach activities and materials.
- **Develop and maintain** online climate tools for local applications.
- **Provide stewardship** for the national climate record.
- **Provide resource and support** to the NWS Regions for the provision of local climate activities.
- **Collect user requirements** for climate data and products.
**Current Activities and Highlights:**

**NWS-CSD in Action**

- Standardized local office climate public web sites with Local 3 Month Temp Outlooks: user centric formats and interpretations
- Tools for effective outreach:
  - xmACIS
  - Factsheets on ENSO, Climate Change, Drought, etc
- Local staff participation in NOAA climate observation stewardship activities
- Annual Climate Prediction Application Science Workshops bringing climate user and provider communities together
- NOAA Climate Test Bed accelerates transition of research to operations
- NOAA climate personnel training residence course on Operational Climate Services, virtual course on Climate Variability and Change and 30 hours of online interactive training materials
- Work on developing more intuitive presentation format of NOAA climate forecast products with regional outlook interpretations
- Established wide climate services partnership network between NOAA local offices, RISAs, RCCs and State Climatologists

**Current Activities and Highlights:**

**Regional Integrated Sciences and Assessments (RISA)**

**What is it?**

- RISA supports applied interdisciplinary research & innovative outreach activities at local and regional scales
- The nine RISA teams collaborate with stakeholders on enhancing their capacity to use climate information and related decision-support resources

**What does it do?**

- Develop interdisciplinary knowledge about climate impacts and integrate it into the design and support of effective responses to climate variability and change
- Develop climate impacts tools for use in resource management and planning: 1) Dynamic Drought Index Tool; 2) Forecast Evaluation Tool; 3) AgroClimate tools; 4) Streamflow reconstruction tools.
- Work with communities, resource managers, planners, and end-users such to help them prepare for and adapt to climate variability and change
NEW RISA - The Southern Climate Impacts Planning Program. This new RISA project will work to assess the risks associated with climate variability and change and drought in Arkansas, Louisiana, Mississippi, Oklahoma, Tennessee, and Texas.

- The project will work closely with regional managers to develop climate-risk profiles of communities in the region
- Working with a range of community stakeholders, the RISA will develop tools and resources that can assist local and regional community managers in their long-range planning

Sample RISA workshops and training sessions in their regions:

- Seasonal Forest Fire Assessment workshops in the west and east
- Alaska Climate Impacts monthly conference calls with stakeholders
- Pacific Islands climate impacts training
- Water Resource forecast workshops in the Pacific Northwest
- Regional Climate Change impacts assessment conferences
- Climate impacts trainings for US Forest Service and Bureau of Reclamation personnel

What is it?

- TRACS moves experimentally mature climate information from research mode into operational settings
- The primary goal is to generate sustained delivery of useful climate information products and services to local, regional, national, and international decision and policy makers

What does it do?

- Transition experimentally mature climate tools to operations for public goods applications and improved risk management
- Learn from partners which methods best complete the technology transition process for improved decision support
- Provide a path for research tools to transfer to societal benefit by accommodating four types of transition project partnerships:
  - Within NOAA units
  - From external partners to NOAA
  - From NOAA to external partners
  - Among NOAA's external partners
Current Activities and Highlights: TRACS in Action

AgroClimate Web-based Tool

- AgroClimate is a web-based climate information system developed by the Southeast Climate Consortium RISA
- The tool presents resource management options and probable outcomes based on forecast climate conditions and crop simulation models
- TRACS funding established the necessary personnel and infrastructure to operationalize and maintain the site
- TRACS is also funding the development and implementation of additional climate, crop yield, and forestry tools in addition to overall improvement, through user feedback
- Maintained by the Florida Agricultural Weather Network (FAWN) of the Florida Cooperative Extension Service

Current Activities and Highlights: Regional Climate Centers (RCC) link to CSD

What is it?

- NOAA's Regional Climate Centers (RCCs) are a federal-state cooperative effort
- The RCC Program is managed by the NCDC and supported by both NCDC and NWS
- Six Regional “hubs” for user-centric climate services, interdisciplinary climate research, applications and education that provide a regional focus to addressing societal needs
- Timely production and delivery of useful climate data, information and knowledge for decision makers and other users at the local, state, regional and national levels

Examples of collaborations with CSD programs and Activities

- RCCs collaborate with the many CSD programs (e.g. NWS-CSD, RISAs) on the development of climate information, tools, and services
- NOWdata (the CSD highlight) is powered by xmACIS, which is maintained by NRCC. This is an example of NOAA line office collaborations, NWS conduct observation, NCDC make quality control and archive data, RCCs develop easier access to the data analysis, NWS local offices use it in serving customer needs
- Southern Regional Climate Center (SRCC) is an active participant in developing Datzilla, a data quality control tool that is used to track errors in climate observations, an example of an effective partnership between NWS, NCDC, and RCC
**CSD Emerging linkages within NOAA**

Example of climate service activities outside but linked to the Climate Goal

**Coastal Services Center**

- CSC and Sea Grant work with USDA EDIN (Extension Disaster Information Network) on RiskWise training modules and education materials
- CSC community resilience pilots in GOMEX: some lead by local Chamber of Commerce (Mobile), others as a result of a joint RFP by Sea Grant and CSC
- CSC and NERRs have developed a couple of demo pilot projects – Development of climate toolkit in Waquoit Bay
- USGS and NOAA collaboration on 'coastal climate products' to support decisions affected by coastal inundation and accelerated SLR

**FY11-15 Priorities and Alternatives**

*Climate Service Development Program (CSD)*

Alternatives were developed to

- Respond to NOAA Executive Panel and NOAA Executive Council requests for the development of strategies and mechanisms for a climate service and to support requirements for regional climate services in the FY11-15 planning process
- Respond to broad demand for climate information at local to regional scales
- Support emerging demand for climate services in sector specific areas particularly drought and water resources, coastal management, living marine resources, and extremes
- Provide consolidated and coordinated national to regional climate communication, outreach, education, and training through a web portal

Top three alternatives from CSD:

- Implementing the NIDIS Drought Early Warning Information System
- Regional Adaptation Strategies
- Climate Portal
FY11-15 Priorities and Alternatives

*Climate Service Development Program (CSD)*

Other CSD Alternatives:

- Climate Impacts and Adaptation in Coastal Regions
- Climate Training, Education, and Public Outreach Program
- Precipitation Frequency Estimates and New Climate Products for a Changing Climate

Alternatives were developed to:

- Ensure professional competency of NOAA climate services staff and respond to user needs for NOAA education and outreach activities
- Better coordinate existing CSD activities
- Enhance public outreach and coordination of climate information
- Develop new capabilities in sectors relevant to NOAA (e.g. coasts, extreme events)
- Address shortcomings in regional climate service structure
- Complete NIDIS implementation plan

Why?

- US drought losses are an estimated $6-8B/year and could grow
- Informed policy and management decisions reduce socioeconomic and ecosystem losses
- Further research and applications to aid in drought-related risk management and adaptation are needed
- The NIDIS Act mandates a drought early warning system
- This increase would bring NIDIS close to the level authorized by Congress
- Build on NIDIS Pilot Projects and the new drought-focused RISA

What?

- Coordinated and authoritative early warning systems for water, agriculture and ecosystem management
- Transfer of newly developed, timely knowledge, products, and tools to other drought-prone regions
- Expanded efforts to communicate and refine climate information in support of early warnings and drought management, research and socioeconomic assessments, and analyses of mitigation and preparedness
- Regional climate extension transition projects that support partners’ needs
- Completion of a national early warning information system for drought
FY11-15 CSD Alternatives: Regional Adaptation Strategies

Why?
- Pending legislation directs NOAA to work with federal partners to address climate change adaptation
- Most adaptation decisions are made at the local/regional levels
- Regional climate change information on impacts and adaptation is scarce
- Regional climate services are beginning to emerge, but fledgling efforts are distributed and not coordinated
- Need to engage/coordinate users and partners, define regional needs for the National Climate Service

What?
- Five regional “Cores” would serve as integrators and bodies of regional climate impacts experts
- Build regional capacity to access climate impacts and adaptation information and tools
- Expanded and strengthened RISAs, including two new RISAs focused on high-priority issues (e.g., coasts)
- New regional and local integrated products, early warning tools, impacts and adaptation research
- Improved partnerships and collaboration with existing NOAA regional efforts and with external partners
- “Cores” could provide needed training for NOAA’s regional staff and intermediaries on climate impacts

Also: 122 WFOs; 15 WSOs; 13 RFCs; ~50 State Climatologists; 8 Regional Teams

FY11-15 CSD Alternatives: Climate Portal

Why?
- Citizens increasingly seek authoritative climate data on-line; NOAA is the logical source
- NOAA information on climate variability and change is distributed across many different Websites
- According to the National Research Council, up to 40 percent of the United States’ $10 trillion economy is affected by climate and weather events annually

What?
- Improved integration of NOAA’s climate data and information into a single, comprehensive Web Portal containing four interfaces for different audiences: (1) decision makers and policy leaders; (2) scientists, decision managers, and applications-oriented data users; (3) formal and informal educators and educational institutions, and (4) the public
- Content that can readily be extended by others to television, science centers, and other venues
- A comprehensive assessment and evaluation program covering Portal impacts and user feedback
Near Term Opportunity: *NOAA Climate Portal*

To better serve users, NOAA is developing a comprehensive, one-stop climate services portal prototype to provide a single interface to NOAA's climate datasets, products, & services.

**Goal:**
- Develop a “one-stop” Web portal for discovery & delivery of NOAA's climate information & resources, which are developed and maintained across multiple offices and platforms

**Objectives:**
- Promote a user-focused view & consistent delivery of climate services across NOAA
- Enhance the discoverability, accessibility, and usability of climate data, products & services
- Enhance interoperability & leveraging of software & products
- Implement metadata standards

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**CSD Issues and Challenges**

- **What is the role of NOAA Facilities?**
  - Climate information is developed in several different parts of NOAA (e.g. NCDC, GFDL, NCEP)
  - The provision of climate services also occurs in many different areas of NOAA (e.g. Fisheries service, Coastal Services Center, NWS-Climate Services Division, RISA, new NOAA Regional Teams)

- **What is the role of the external community?**
  - Key to developing cutting-edge impacts and adaptation research and tools; leveraging years of research, expertise and work with regional/local stakeholders
  - Key to tapping into expertise outside NOAA and other federal agencies
    - NOAA does not have all the capabilities for climate services

- **Emerging challenges**
  - Increasing demand from public and other mission agencies for climate information and services
  - Better understanding of climate variability and change and its associated impacts
  - Ability to develop impacts and vulnerability information on a consistent basis

- **Next Steps for CSD**
  - Strategic plan
  - Review
Spring 2009 CWG Meeting: Review of CSD Program

Dates and Location
• Boulder, Co.
• March 11-13, 2009

Suggested Chairs/members for Review Team:
• Bill Hooke, AMS
  Trade Associations, Professional Societies
• David Carter, Delaware DNR
  State, Local or regional
• Jim Lopez, King County, Washington
  Private Sector
• Susan Moser
  Private Sector
• Jonathan Overpeck, UArizona
  International
• Edward Miles, UWashington - CIG
  Other Federal Agencies
• Jeanine Jones, California DWR
  AASC, Extension
• Katherine Jacobs, Arizona Water Institute
• Susan Avery, WHOI

Plan for meeting:
• Develop draft strategy
• Develop Terms of Reference

Back up Slides
**FY11-15 CSD Alternatives Above Core: Climate Impacts and Adaptation in Coastal Regions**

**Why?**
- Harness existing NOAA capabilities to help coastal communities address natural hazards
- Piloting the “issue-focused” approach has been identified as an emerging need and a cross-goal priority
- Better connect NOAA’s resource management constituencies, create stakeholder-scientist partnerships
- Promote “risk wise,” resilient coastal communities, building on previous efforts
- Consistent with report on, “Managing the Nation’s Living and Marine Resources and Coasts in a Changing Climate: Findings and Recommendations from NOAA 2008 Workshops”

**What?**
- Problem focused research and assessments, decision support resources, and applications
- Region-specific, interdisciplinary climate research focused on vulnerability, impacts and adaptation
- Regional workshops on hazards, user needs, and ways to address them
- Guidebook on lessons learned, training opportunities, and products available via the Internet
  - “Toolkits” (integrated suites of products) for use by emergency managers, mitigation planners, etc.

**FY11-15 CSD Alternatives Above Core: Climate Training, Education, and Public Outreach Program**

**Why?**
- Constituents indicate NOAA must expand and improve training, education, communication, and extension
- Climate and weather variability can cause yearly swings in the nation’s economy of +/- $100 billion
- In *Engaging NOAA’s Constituents: A Report from the NOAA Science Advisory Board* (SAB EOE Report, 2007), the SAB reported that NOAA’s engagement activities are so diffuse that they are almost invisible and that NOAA’s return on investment to society is reduced because it does not present an understandable vision
- Fulfill NOAA’s legislative mandate for climate education provided by the America Competes Act of 2007

**What?**
- Develop an Educator’s Climate Science Resources interface accessible via the New NOAA Climate Portal
- New training opportunities and public outreach materials on climate variability and change
- Residence courses, issue-based workshops, and distance learning tools to accelerated training of and professional development for NOAA personnel, intermediaries, and users
- Evaluations of the impact, effectiveness, and reach of the program, as well as further needs
**Why?**
- Updated precipitation frequency estimates (PFEs) exist for 60% of the US; others are up to 40 years old.
- PFEs used for designing civil infrastructure; revised PFEs reduce the cost of damage from design failures.
- This research will address important sources of error in PFEs, such as climate change and non-stationarity.
- In older studies, error could be as high as 45%.
- Will lead to a suite of new products that better quantify the natural variability (temperatures, wet-dry spells, etc.), to be used in future issue-focused research, applications, and product development.
- Direct translation of research to operations.

**What?**
- Accelerated delivery of underlying science required for next generation PFEs.
- Grants to incorporate “non-stationary” probabilistic models and, later, climate change into PFEs.
- New climate products using PFE production techniques and data.