NOAA's Climate Program Office: A 7-Year Retrospective

Observations & Monitoring

Understanding & Modeling

Informing Decisions

Chet Koblinsky, Director

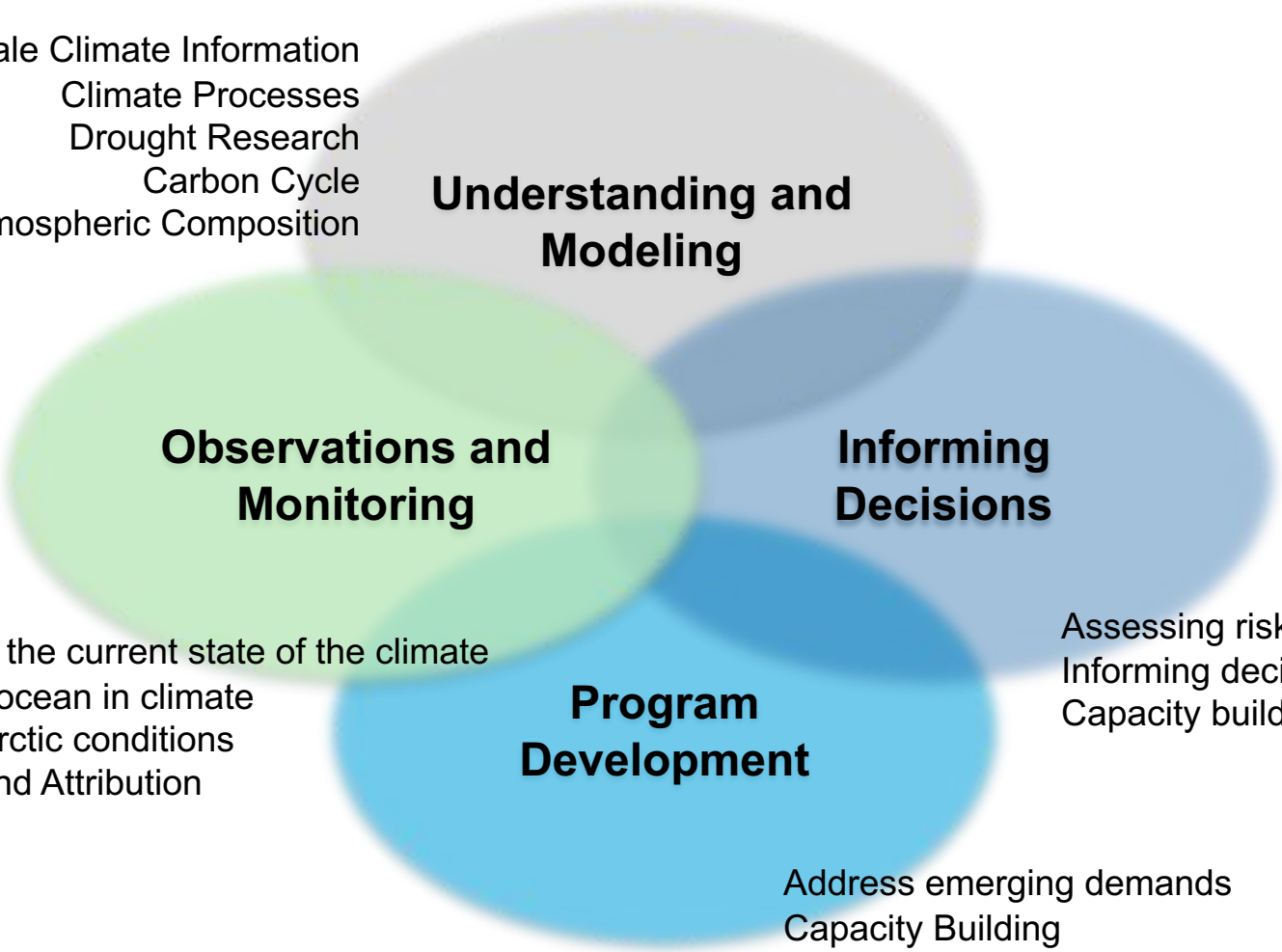
www.climate.noaa.gov

Climate Working Group Meeting

July 30, 2012

Overview: CPO Program Foci

Regional-scale Climate Information
Climate Processes
Drought Research
Carbon Cycle
Atmospheric Composition



Understand the current state of the climate
Role of the ocean in climate
Changing Arctic conditions
Detection and Attribution

Assessing risks & impacts
Informing decisions
Capacity building

Address emerging demands
Capacity Building
International Support
Formulation and Planning
Communication and Education

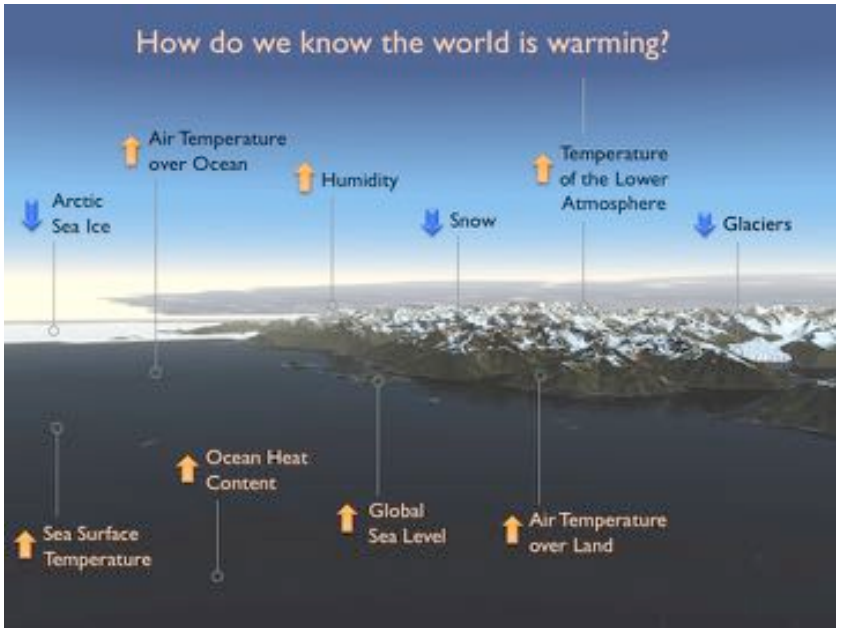
Observations & Monitoring

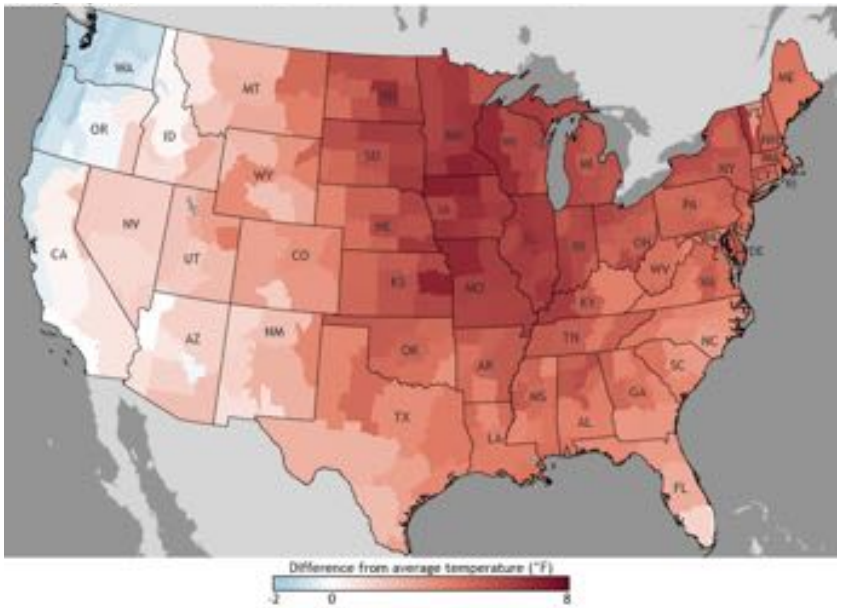
Can we detect the direction, magnitude, and rate of global and regional climate change?

Can we provide data sets that accurately quantify the nature and scope of climate variations and trends?

If so, how?

Meeting these objectives requires sustained, long-term observation and monitoring of the global climate system.





January to May 2012 marked the warmest such span in U.S. recorded history

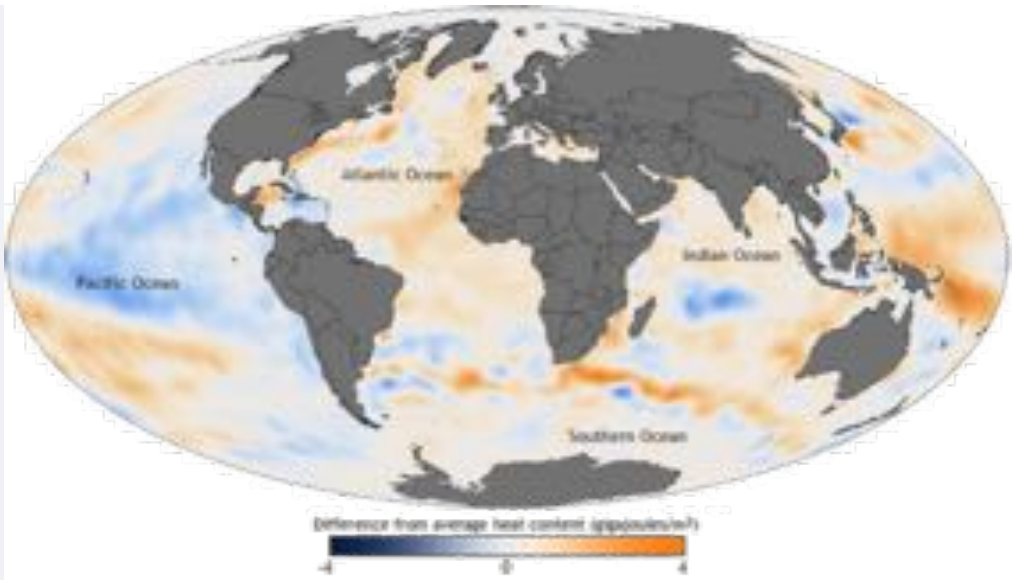
Observations & Monitoring: Ocean Observation System

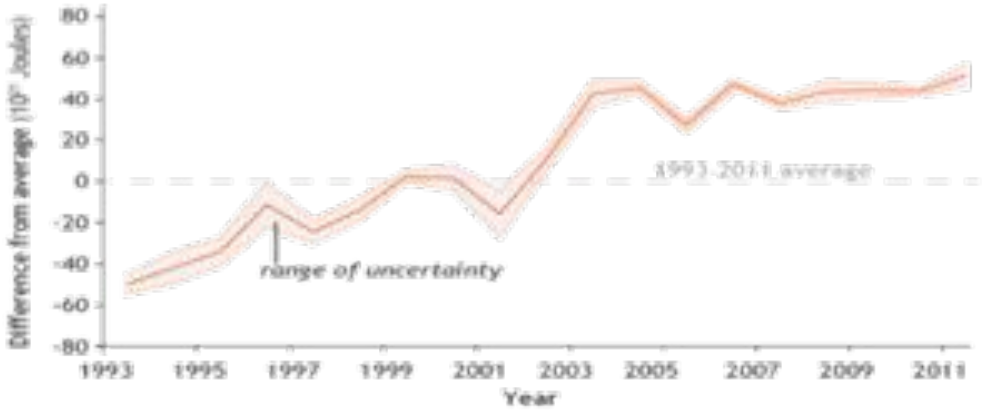
Thirteen observing systems (e.g., Argo, tide gauge network, repeat cruises) produce:

- Sustained global observations of essential climate variables in the ice-free ocean to 2000m depth
- Data systems for integration, provision of data and products, & data quality assurance
- Products for essential climate variables (e.g., SST and ocean heat content)
- International infrastructure and coordination → multi-national global observing systems

Outcomes:

- Useful climate and weather predictions on intra- to inter-annual timescales leading to adaptation in multiple sectors (e.g., water, agriculture, commerce)
- Long-term climate records quantifying and describing the ocean's role in global energy balance, carbon cycle, and sea-level change
- Characterizing trends and variability in Earth's climate





"Today's global ocean observing system, including the Argo Program which has produced over 900 research publications, simply would not exist without the profound and enduring partnership between NOAA's Climate Program Office and the academic institutions and NOAA labs that collaborate in implementation."

—Dean Roemmich, Professor, Scripps Institution of Oceanography, U.S. Argo Lead Principal Investigator

Observations & Monitoring: Global Monitoring Division Accomplishments

Carbon Cycle Science supports the N. American Carbon Program

- Goal: Develop and interpret a high quality, independent atmospheric GHG observing network over North America
- Tall Towers - 13 sites added or upgraded since 2005
- Aircraft - 11 sites added since 2004

CarbonTracker is the only global inversion of atmospheric CO2 measurements to date

- Provides 24/7 column averages of CO2 for validating remotely sensed measurements.
- Computes 1x1º surface fluxes of CO2 for initializing and verifying regional model results

NOAA Atmospheric Baseline Observatories form the backbone of national and international observing systems for climate change

- In 2005, CPO funding averted the closure of the four NOAA Baseline Observatories when their funding was removed.
- Two emerging observatories have survived owing to CPO funds (Summit, Greenland; Trinidad Head Observatory, California)

Antarctic UV network transitioned from NSF to NOAA

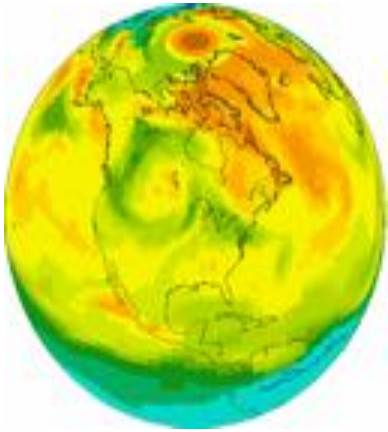
- Provides long-term data sets for research on radiative transfer, atmospheric chemistry, ecosystem impacts & ozone-depletion.

SURFRAD supports climate research with accurate, continuous, long-term measurements of the surface radiation budget over the US

- A primary surface radiation network for validation of GOES and NASA EOS satellite products
- Primary data source for 16-year surface radiation budget climatology of the US
- Instrumental in confirming and documenting solar brightening over the US since the1990s

Tall Towers

CarbonTracker



Mauna Loa Observatory

Observations & Monitoring: U.S. Climate Reference Network

NOAA's benchmark United States climate observing network is designed to answer questions about temperature & precipitation changes with the highest confidence.

Siting:

- 114 CONUS stations at pristine sites that shouldn't change in >50 years

Instruments:

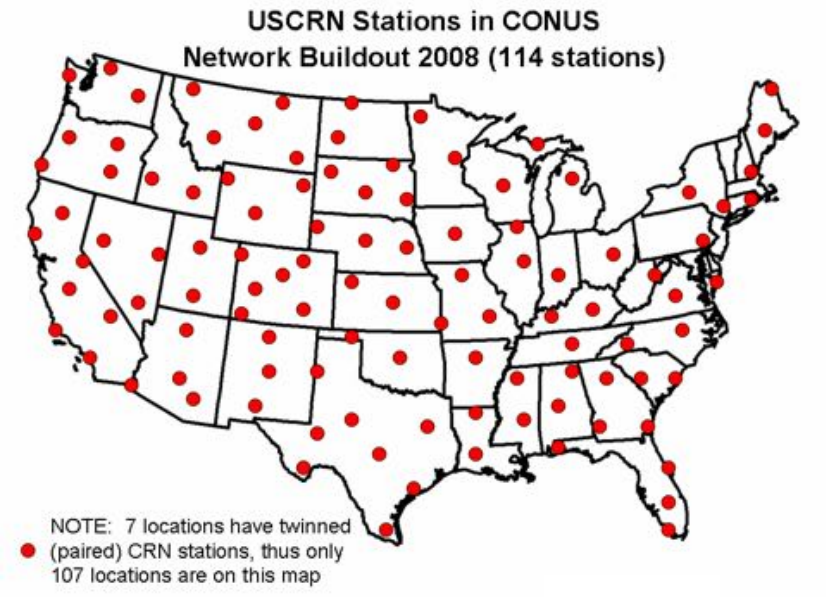
- Triple configuration temperature and precipitation sensors & other measurements

Observations every 5 minutes

- Hourly satellite data transmissions

Standards

- Meets or exceeds GCOS & CCSP monitoring principles
- NIST calibration standards



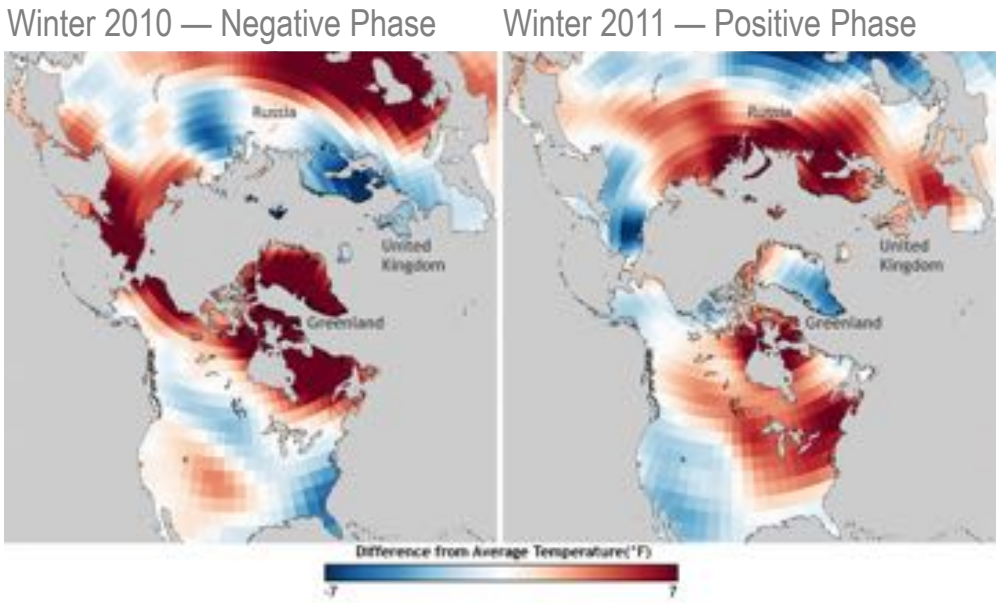
Understanding & Modeling

Can we explain the processes that are responsible for observed variability?

What knowledge do we need to improve climate models and predictions?

How can we improve Earth system models to help scientists better understand the climate system?

Arctic Oscillation's effects on land surface temperatures



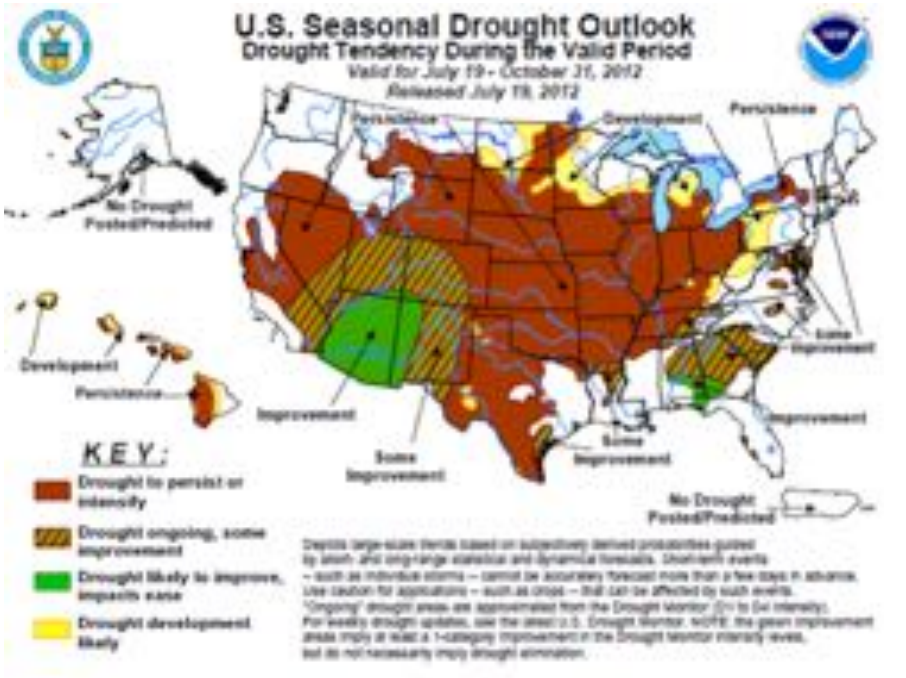
The top pair of maps compares the AO's influence on surface temperatures in subsequent winters. The bottom map shows CPC's U.S. Winter Outlook for 2011-12 surface temperatures.

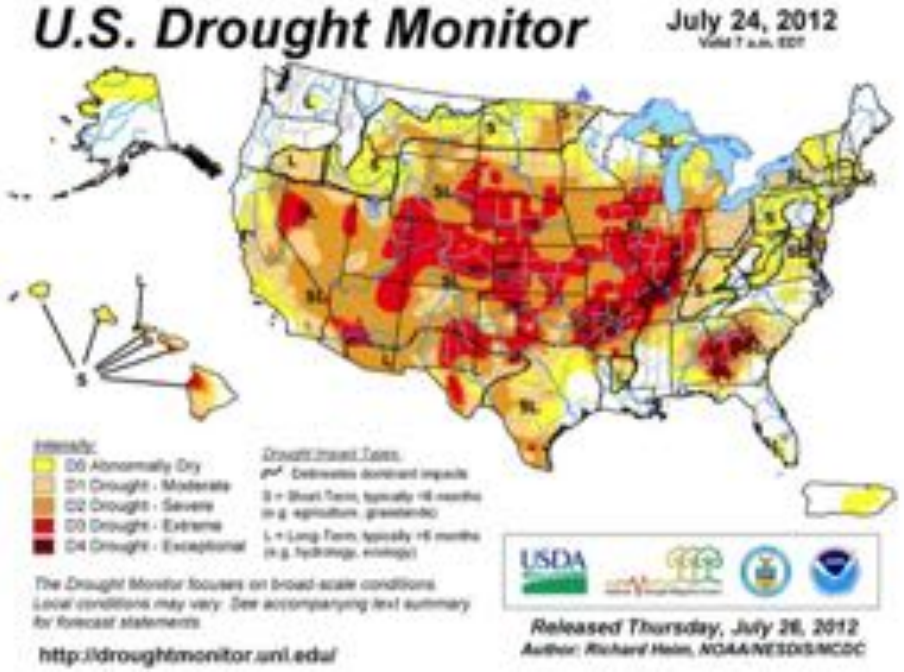
Understanding & Modeling

Can we improve intra-seasonal to seasonal climate and drought monitoring and prediction?

How well do we understand long-term future changes in climate?

How can we understand and anticipate the global and regional impacts of climate variability and change?





The top map shows CPC's U.S. Seasonal Drought Outlook for the period from July 19 – October 31, 2012. The bottom map shows actual drought conditions in the U.S. on July 24, 2012.

Understanding & Modeling: CalNex

Research at the nexus of air quality and climate change

Extramural research highlights: measuring and modeling black carbon absorption; investigating solubility of aerosols; verifying emissions of ammonia, N_2O, methane; improving understanding of nighttime air chemistry

CPO's role: supporting extramural research and NOAA-academia partnership with $7 million of funding for measurements, modeling and analysis

May-June 2010 measurements of trace gases (including greenhouse gases) and aerosols

Understanding & Modeling: Regional-Scale Climate Information

Key Activities:

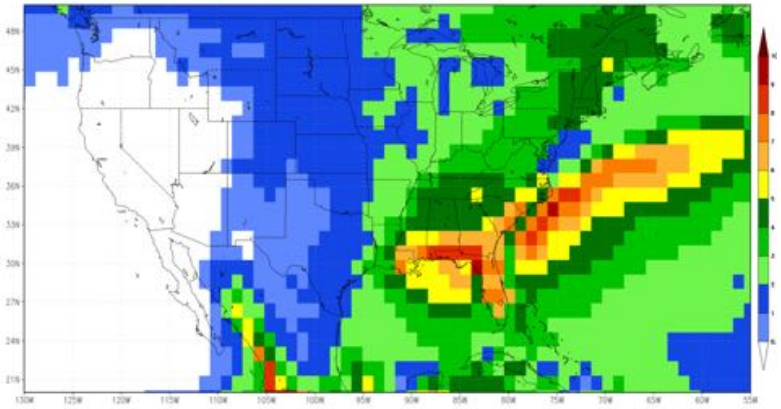
- Understand causes and predictability of regional-scale climate extremes (e.g., floods)
- Evaluate the benefits of higher resolution global models and improved physical parameterizations (e.g., MJO project involving GFDL, ESRL, NCAR, & NASA)
- Experiment with novel regional downscaling approaches (e.g., 2-way nesting)
- Develop higher-resolution and improved analysis products, coupling higher resolution models with improved observations
- Experiment with higher resolution predictive systems (e.g., MRED project involving NCEP)
- Derive regional-scale climate projections/uncertainties based on CMIP5 experiments

Outcomes/Payoffs:

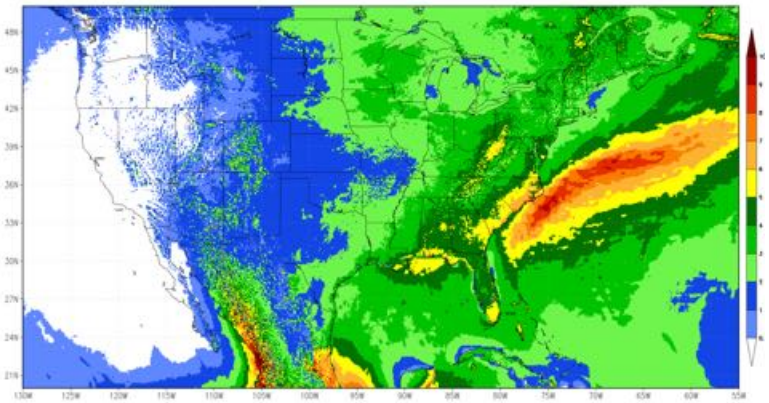
•Improved understanding of major drivers for regional extremes

•Improved models and systems to monitor and predict regional-scale climate

•CMIP5-generation regional-scale projections



125Km GCM



10Km GCM

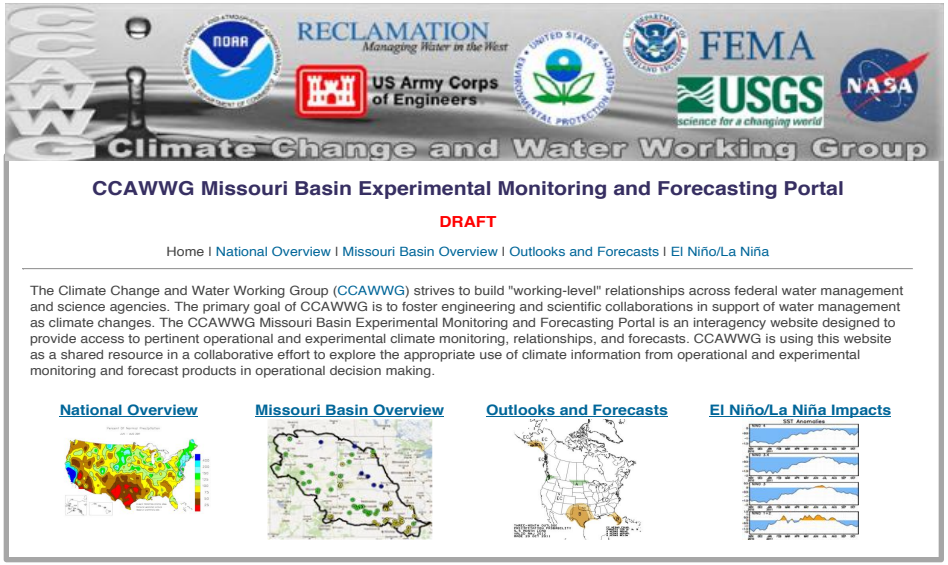
Improving model resolution at a regional scale

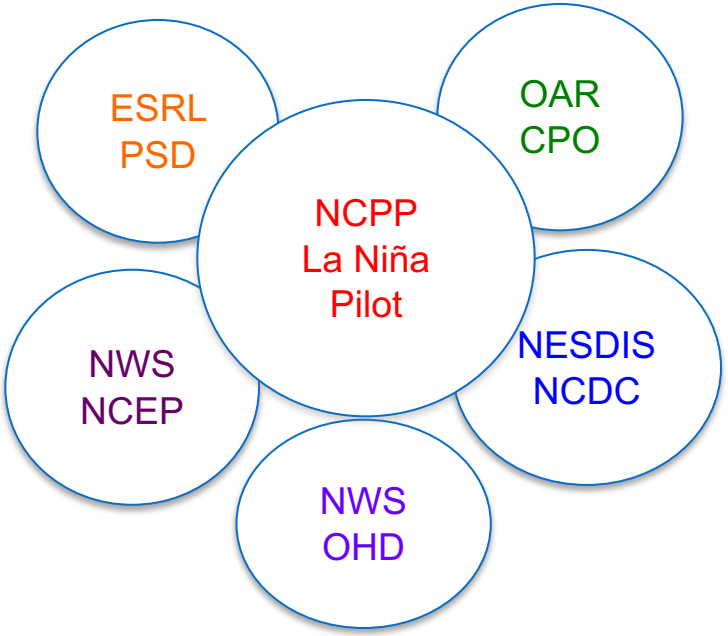
Program Development: National Climate Predictions & Projections

NCPP develops and delivers comprehensive regional climate information and facilitates its use in decision making and adaptation planning

Pilot Objectives

- Prototype use of NOAA national outlooks in regional decision making
- Connect to *water* and *extremes* NGSP challenges / needs assessments
- Provide climate information to states, tribes, feds, private stakeholders





Program Development: From Science to Services

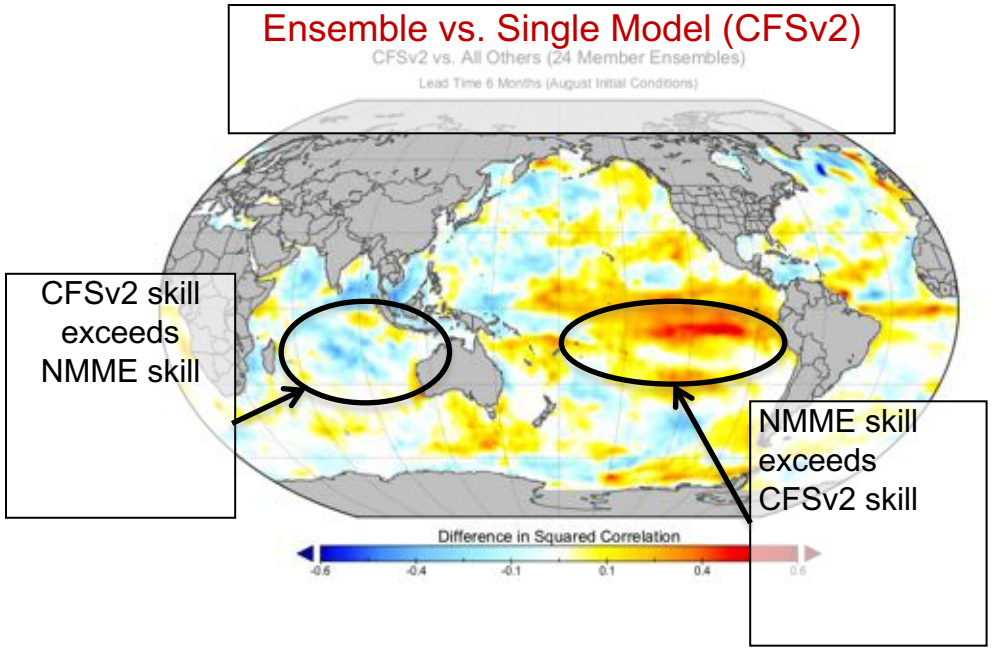
NOAA Center for Weather and Climate Prediction

A **CPO-NCEP Partnership** is now defined by an MOU for competitive research that helps improve NOAA's operational climate activities.

Climate Test Bed research themes:
Model development, MME prediction, drought monitoring and prediction.

Accomplishments:

-Model development toward the release of CFSv2, March 2011.
-R&D for the preparation of CFSR, latest generation re-analyses released in 2010.
-A Climate Process Team to improve the representation of clouds in next generation NCEP model.
-NMME experimental system to improve climate and drought prediction.
-Development of an experimental drought monitoring and prediction system



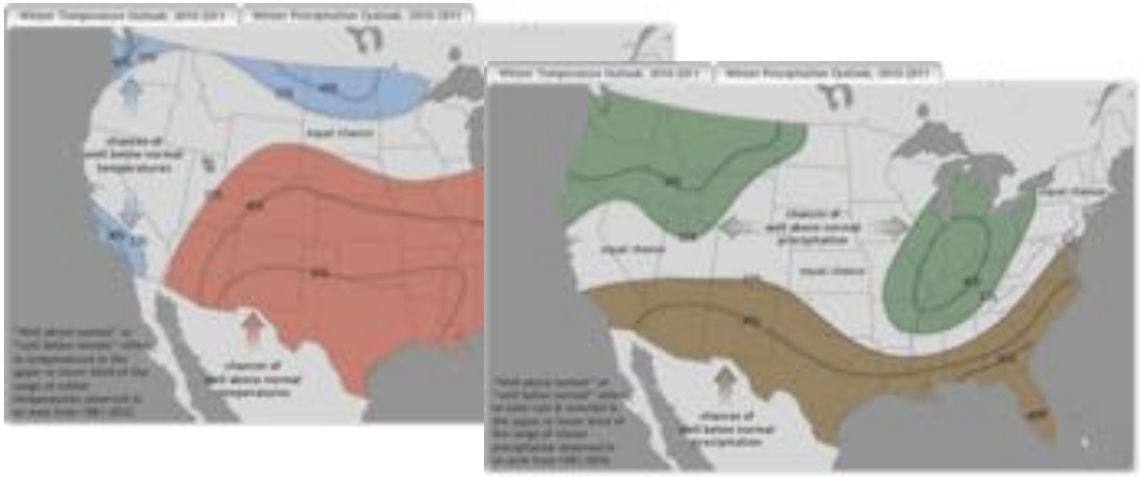
NMME: An experimental U.S. multi-model ensemble to improve ISI climate and drought prediction

Informing Decisions

Climate affects thousands of decisions everyday from deciding when to plant crops to providing water for a growing city.

How can climate science inform these decisions and provide benefits to society and ecosystems?

Where can water resource managers, farmers, forestry officials, and other planners get the information they need to plan for or mitigate drought conditions?

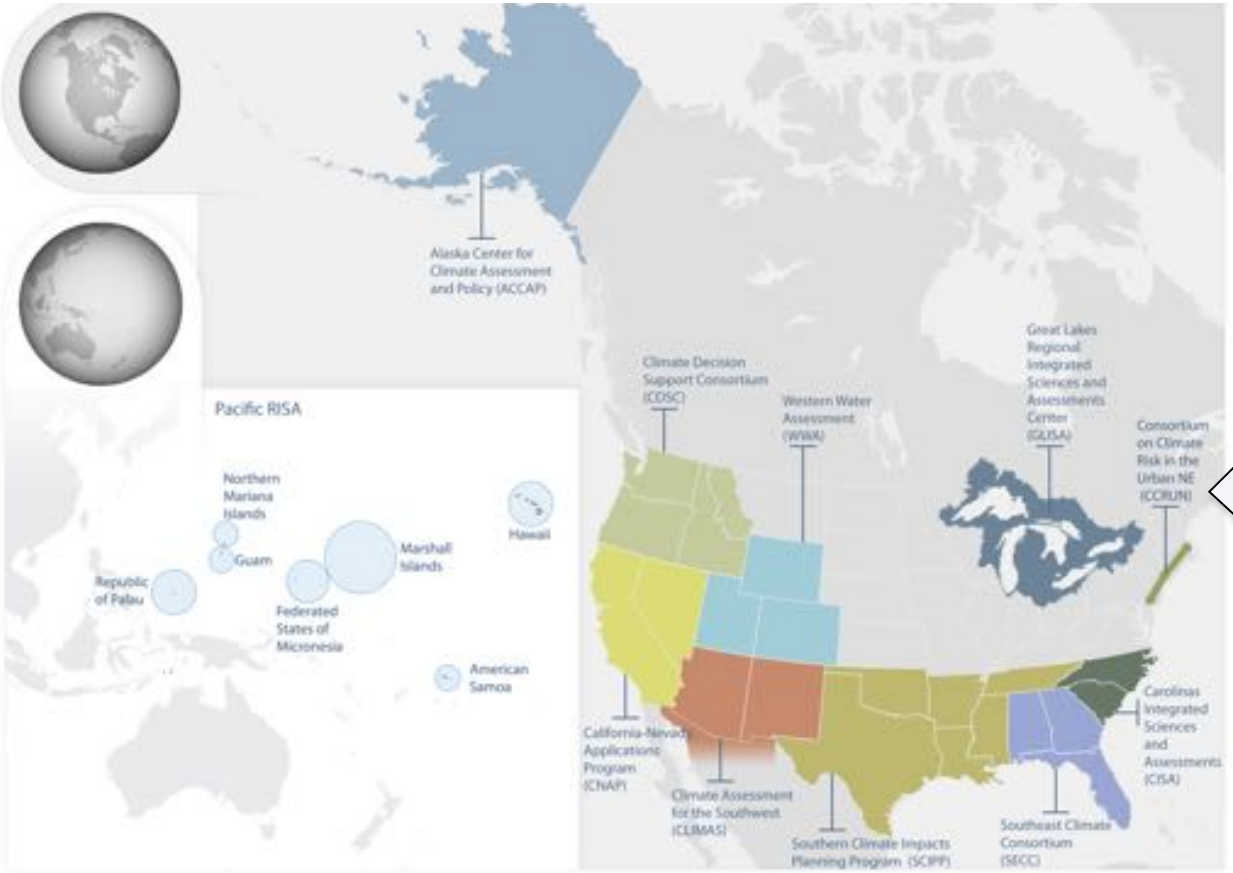


"As a dryland farmer, you've got to do what you can to stay in business because there's going to be those tough times. What I learn over the next two to three years [about seasonal forecasts], long-term it's going to make me money."

—Kirk Brock, Florida farmer

Program Development: Regional Integrated Science and Assessments (RISA)

Adam Parris,
Program Manager
Caitlin Simpson,
Program Manager



"New York City faces real and significant risks from climate change. The CCRUN will be a critical partner in our ongoing efforts to analyze our climate vulnerabilities and increase our resilience. "

—Adam Freed, New York City Office of Long-Term Planning and Sustainability

RISA supports teams that conduct interdisciplinary, regionally relevant research that informs natural resource planning and management. Since 2004, RISA has **expanded** from 6 to 11 centers.

National Integrated Drought Information System (NIDIS)

Roger Pulwarty,
Program Director

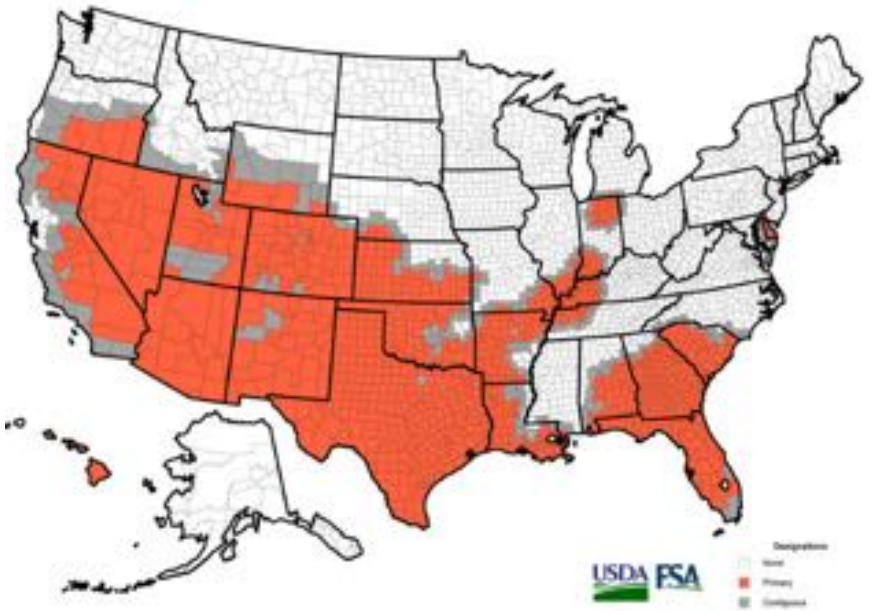
www.drought.gov

NIDIS provides dynamic and easily accessible drought information for the Nation.

- Implementing regional drought early warning systems
- Funding impacts assessments and decision support research grants through RISA and SARP
- Integrating monitoring and forecasting capabilities through Climate Forecast Test-Beds

"…the drought forecasts issued by the National Integrated Drought Information System, are very useful to farmers, water planners, and other state and local officials."

—Rep. Ralph Hall (R-Tex) (6-22-2011)



U.S. counties designated under drought fast-track

Coastal and Marine Ecosystems

How can we help coastal communities become more resilient to the impacts of a changing climate?

Recent Partnerships:

FY12 funding opportunity on ecosystem resilience and sustainability

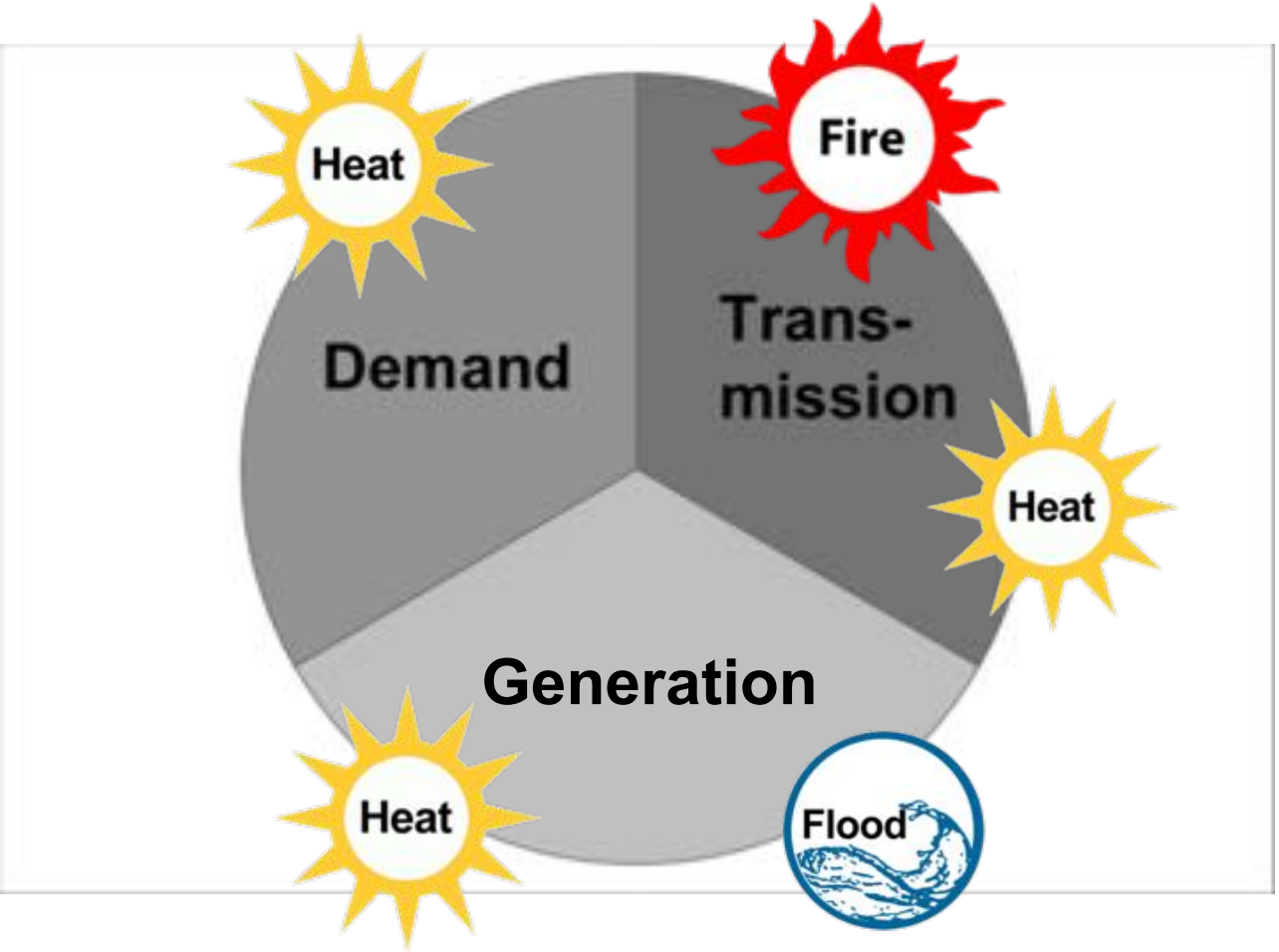
National Marine Sanctuaries' Climate-Smart Sanctuary Initiative: Fagatele Bay, Gulf of the Farallones, and Olympic Coast.

Supporting analysis of biophysical and socio-demographic climate sensitivity across entire National Estuarine Research Reserve System (28 sites), vulnerability assessments and adaptation planning at two NERRS sites.

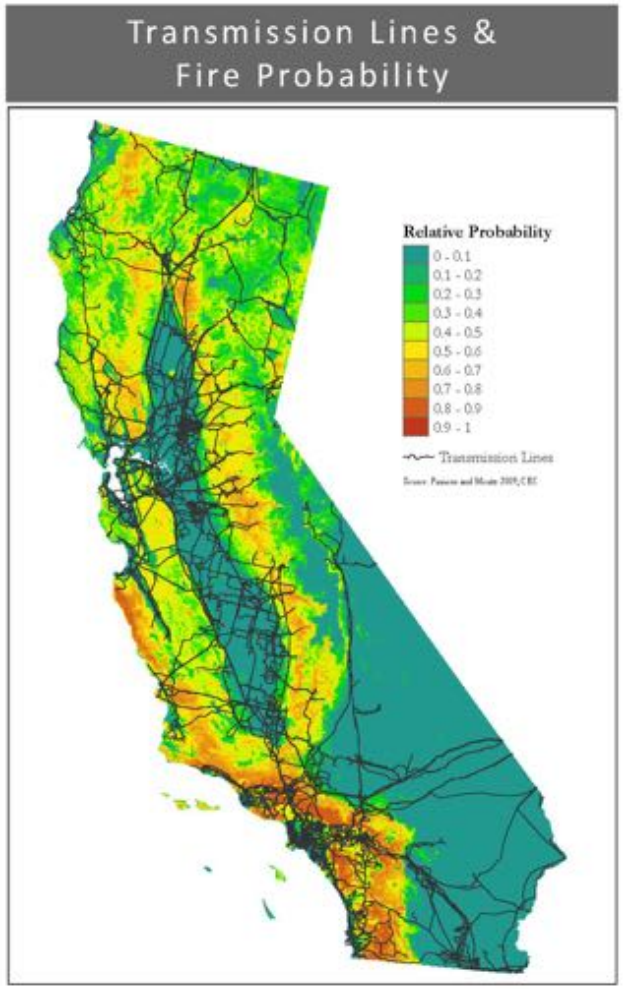
California Current Large Marine Ecosystem (CCLME) partnership to improve understanding and prediction of the impacts of climate change in the CCLME.

Potential Impacts of Extreme Events On Electricity Demand and Energy Infrastructure

Maximilian Auffhammer (UC/Berkeley), *Jayant Sathaye (LBNL), Larry Dale (LBNL), Joshua Viers (UC Davis), Sebastian Vicuna (U of Chile), Guido Franco (CEC).*



Existing Transmission Lines Under Increased Fire Risk



Engaging the Public

How can we cultivate a new generation of students pursuing advanced degrees in STEM and encourage them to consider careers in climate science and service fields?

How can we improve public climate literacy in ways that help people manage climate-related risks and opportunities they face in their lives, communities and livelihoods?

How can we make NOAA's climate data products and services more accessible to the public, and more obviously beneficial to society in decision-making contexts?

Program Development: NOAA Climate.gov

www.climate.gov

Climate.gov provides a well-integrated, online presentation of NOAA's and partners' climate science data & information.

The prototype features four audience-focused sections:

- **ClimateWatch Magazine** for the climate science-interested public
- **Data & Services** for scientists and users who want to find & use climate data
- **Understanding Climate** for policy leaders and decision makers seeking authoritative resources
- **Education** for formal & informal educators seeking resources to teach climate science
- The **Dashboard** is an interactive, data-driven overview of the state of the global climate system

"I am impressed by the content, breadth and generally how interesting the [Climate Portal] is. I like the balance of topical resources—it shows the breadth of climate effects across disciplines."

—Dr. Patrick Long, Director, Ctr for Sustainable Tourism, ECU

Program Development: Tri-Agency Partnership in Climate Change Education

Fostered through NOAA CPO leadership in USGCRP Education Interagency Working Group

Anticipated benefits:

-Provide professional development opportunities & build capacity in education community

-Avoid duplication of investment / effort

-Promote synergy among projects

-Optimize return on investments — $109M & 166 grants since 2008

-Provide real-world climate data and tools for interpretation for formal and informal educators

CLEAN
CLIMATE LITERACY & ENERGY AWARENESS NETWORK

K-12 teacher professional development and instructional materials

Citizen science related to climate

Spherical displays & data visualizations to help the public understand climate

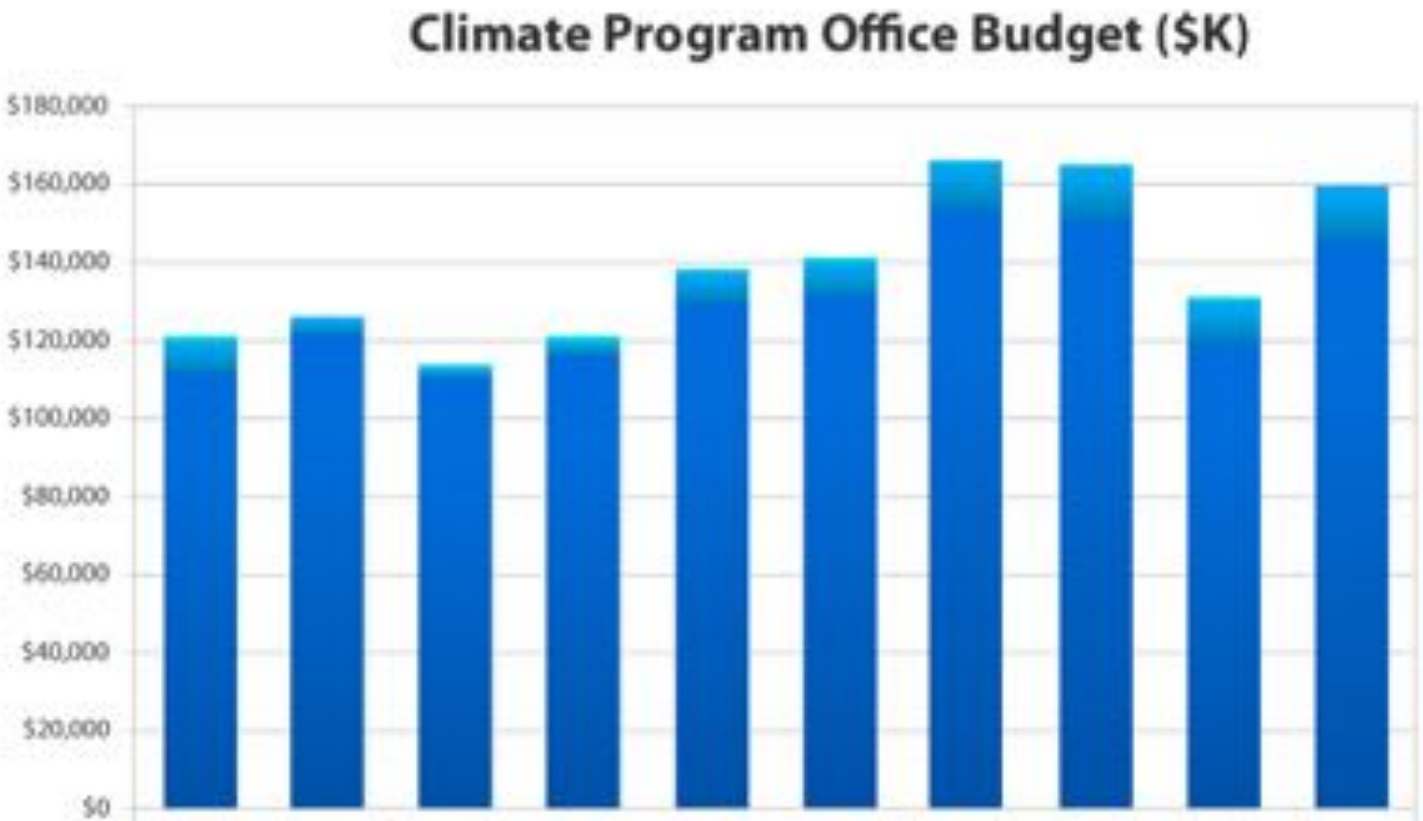
Program Development: Climate & Global Change Postdoctoral Fellowship Program

- Highly competitive program aimed at developing the next generation of scientists needed for climate studies
- Recognized as one of the most prestigious programs in the world in this field
- Up to 125 applicants per year for 10 positions
- 100th Postdoctoral Fellow appointed in 2005
- 176 Postdoctoral Fellows to date
- Celebrated 20th Anniversary in May 2011
- Strong NOAA research laboratory involvement

"When academic departments are hiring new faculty in climate science, the first place they look is the list of NOAA Climate and Global Change Postdoctoral Program alumni."

—Elizabeth Moyers, Assistant Professor, University of Chicago

Overview: Funding Sources



	2004 Enacted	2005 Enacted	2006 Enacted	2007 Enacted	2008 Enacted	2009 Enacted	2010 Enacted	2011 Enacted	2012 Enacted	2013 Proposed
Climate Operations	$900	$-	$363	$890	$500	$900	$913	$911	$908	$-
Climate Data & Information	$7,878	$3,943	$2,401	$3,194	$7,560	$8,299	$12,080	$13,049	$10,406	$13,003
Competitive Research Program	$112,26	$121,63	$110,58	$116,59	$129,98	$132,00	$153,19	$151,49	$119,61	$146,33
Climate Program Office Total	**$121,04**	**$125,57**	**$113,35**	**$120,68**	**$138,04**	**$141,19**	**$166,19**	**$165,45**	**$130,93**	**$159,33**

Overview: Funding Sources

How were reduction choices in FY12 made (~$35M)

a. Protect observations at all costs (-5% reduction max)
b. Protect NCA, NIDIS, RISA (-5% reduction max)
c. Reduce research programs (up to 30% reductions)
d. Minimize new grant starts (save ~21M), no new start for IRAP

The following were used to guide the targeted reductions across the CPO Portfolio:

1. Protect long-term observations and the observational record.
2. Protect unique research/modeling initiatives in support of NOAA's mission not undertaken elsewhere in government or in the scientific community.
3. Support regional research.
4. Reduce support for post-doctoral and graduate student fellowships.
5. Provide a balance of across the board reductions for all other activities, including NOAA labs and centers.
6. (Minimize) new grant starts.
7. Reduce support for research activities undertaken elsewhere in government and instead strengthen appropriate collaborations.

FY13/FY14 Plan for additional reductions (if HR amendment comes to be)

1. Protect long-term observations and the observational record.
2. Protect unique research/modeling initiatives in support of NOAA's mission not undertaken elsewhere in government or in the scientific community.
3. Support mandates for National Climate Assessment and NIDIS
4. Support Regional integrated research - e.g. RISA
5. Support for societal challenge areas
6. Reduce support for research activities undertaken elsewhere in government and instead strengthen appropriate collaborations.

Origins

- NOAA 1971
- Global Atmospheric Research Program 1967-1980 (e.g. BOMEX, GATE, FGGE) $$
    - NOAA Office of Special Programs (OSP) 1971 – 1981?
- National Climate Program Act 1978 $$;
    - National Climate Program Office 1982 – 1990
    - → NWS Climate Prediction Center; NESDIS Regional Climate Centers
- World Climate Conference 1 (1979)
    - World Climate Research Program
        - World Ocean Circulation Experiment (WOCE) $$
        - Tropical Ocean Global Atmosphere experiment (TOGA) $$ 1985-95
        - → OSP → Office of Climatic and Atmospheric Research (OCAR) 1981? - 1990
- US Global Change Research Act 1990
    - → OCAR → NOAA Office of Global Programs (OGP) 1990 - 2005
- World Climate Conference 2 (1992)
    - Intergovernmental Panel on Climate Change; Global Climate Observing System
- President Bush Climate Change Research Initiative 2001
    - Climate Observations and Services $$; NOAA Climate Office (2001 – 2005) →
- NOAA Climate Goal 2003 - 2011
- NOAA Climate Program Office and consolidated budget 2005
    - → Merges Office of Global Programs, Climate Office, Arctic Research Program, and Climate GoaL

Our Products

Observations and Monitoring

- *50%* of the sustained Global Ocean Observing System (70+ partners)
- Annual “State of the Climate” Report: among Top 10 downloads from AMS website

Understanding and Modeling

- *Over 300* active grants
- Over *700* published papers/year citing CPO support, contributing to the growing understanding of climate variability and change
- Improved operational systems through CPO-supported research (e.g., CFSRR, NMME)

Informing Decisions

- Drought.gov, and pilot NIDIS early warning systems for drought
- Climate Training workshops, and reports directed to needs of resource managers
- Fund National Research Council reports, including *America’s Climate Choices* to provide advice to the nation on responding to climate change

Program Development

- Implementation plan for all climate activities across NOAA
- *360* budget operating plan actions (BOPs) in FY11
- *44, 815* unique visits to Climate.gov in Sept., communicating climate science to the public
- *176* NOAA Climate and Global Change Postdoctoral Fellows, *35* AMS Graduate Fellows, and *9* Postdocs Applying Climate Expertise (PACE) since inception of programs
- Addressing emerging needs through new programs (e.g., NCPP, COCA)

Ocean Obs Notes

Systems: tide gauge network, sfc drifters, Argo, XBT, repeat-hydro, ORS, tropical array (2), carbon on buoys, carbon on VOS, arctic sea ice drifters, ice mass balance buoys, CCE,

From the bottom of the ocean to the top of the atmosphere, NOAA's instruments are part of an international **system** to monitor the Earth's climate system.

The Climate Observations and Monitoring (COM) Program designs, deploys, and maintains an integrated global network of oceanic and atmospheric observing instruments to produce continuous records and analyses of a range of ocean and atmosphere parameters. COM coordinates observing efforts across NOAA and other federal agencies, as well as internationally. The monitoring portion of the Program ensures that the data sets researchers need to understand the climate system are available for analysis. The Program documents and studies variations in climate on time scales ranging from less than one year to periods of 100 years and longer, i.e., both instrumental and paleoclimate eras. The monitoring effort also provides data and information management support for national and international climate assessment projects. Analysis products support other Climate Program Office efforts in modeling of the climate system and development of targeted services to better inform society about climate impacts and response options.

Support of NCS through monitoring

- Production of data sets from research through operations
- Production of data sets at global and regional scales
- Provision of data sets for initialization/validation of model predictions at global and regional scales (e.g., the Arctic)
- Long, continuous, high resolution data for impacts analysis (e.g., weather/climate extremes)

GMD Obs Notes

~0% of GMD's funding comes from CPO and we've made significant accomplishments in 5 or six areas

Tall Towers
Accomplishments & Status: 13 sites added or upgraded since 2005
10 sites with continuous CO2 & CO
3 sites with continuous CH4
11 sites with automated flask sampling (~50 species, near daily)
29+ papers since 2006, with many more in progress
9 published + 6 submitted or in press in 2012
Effort underway to establish ongoing comparisons with Earth Network
Effort relies heavily on partnerships

Aircraft Accomplishments and Status: 11 sites added since 2004
15 sites operating in North America now
50+ gases and isotopes measured in each flask
12 flight levels (one flask per level) from ground to 8 km
~3400 vertical profiles since 2005
30+publications have used our data

CarbonTracker – the only global inversion of atmospheric CO2 measurements to date
Launched in 2007 with publication in PNAS
Provides 24/7 column averages of CO2 for validating remotely sensed measurements
Computes 1x1° surface fluxes of CO2 for intializing and verifying regional model results
Highly popular nationally and globally, e.g., CarbonTracker EU and CarbonTracker Asia
CWG reviewed it in 2008 and launched a scientific review later in the year.
Improvements being made in line with reviewer recommendations

NOAA Atmospheric Baseline Observatories (ABOs) form the backbone of national and international observing systems for climate change.
In 2005, CPO funding averted the closure of the four NOAA Baseline Observatories when their funding was removed from the NOAA budget.
319 Scientific publications have used or cited ABO data between 2005 and 2012; 4199 have done so since 1957.
Two emerging observatories have survived owing to CPO funds
Summit, Greenland was established as the sole high elevation Arctic Atmospheric Baseline Observatory.
Trinidad Head Observatory, California, was established to monitor long-range transport of Asian effluents entering the Western USA.

GMD Obs Notes

Antarctic UV network transitioned from NSF to NOAA

- The NOAA Antarctic UV monitoring program provides long-term data sets for research on radiative transfer, atmospheric chemistry, ecosystem impacts, and ozone-depletion.
  - Detection of possible spectral changes in solar extraterrestrial radiation during the declining years of solar cycle 23 and their implications for stratospheric ozone
  - PAR and UV Radiation for characterization studies of photosynthetic characteristics of phytoplankton at several locations
  - UV Index data for numerous sites and partners

SURFRAD supports climate research with accurate, continuous, long-term measurements of the surface radiation budget over the United States.

- A primary surface radiation network for validation of GOES and NASA EOS satellite products
- Primary data source for 16-year surface radiation budget climatology of the US
- 46+ formal publications since 2005
- Instrumental in confirming and documenting solar brightening over the US since the1990s

RISA Notes

- From 2004 – 2009, CPO increased the resources and size of the RISA network from 7 to 11 teams, expanding into Alaska, the Southern Plains, the Great Lakes watershed, and the Northeastern Urban corridor…..and instituted an open competitive selection process

- RISA practice and research have largely formed the basis of reports by the National Academy of Sciences, including the Informing Effective Decisions and America's Climate Choices reports

- RISAs are the backbone for research endeavors of the National Climate Assessment and the National Integrated Drought Information System

- More recently, CPO is enhancing integration of RISA research into NOAA:
    - Annual funding opportunities that stimulate regional research collaboration (FY12 = $165,000 from federal and NGO partners, including NOAA NCDC, USGS, USFS, and the Nature Conservancy, and federal gov't versus $500k from CPO)
    - Building NOAA science policy objectives into the proposal evaluation criteria
    - Working across NOAA and USGCRP to develop regional science priorities
    - Working across RISA teams to publish a book on RISA methodologies through Wiley & Sons
    - Providing content for NOAA's Climate Portal to communicate the value of climate research to Congress and other national policy makers
    - Advancing the NIDIS Pilots through drought outlook fora, evaluation of predictions and projections, and engagement with decision makers

Coast and Eco Notes

Image: Gulf of the Farallones, Southeast Farallon Island and West End Island, aerial photo

FIRST BULLET:

In 2011, the Coastal and Ocean Climate Applications (COCA) program was developed to expand the previous coastal portfolio of the Sectoral Applications Research Program (SARP). The COCA program builds upon SARP-Coasts efforts to include issues related to coastal and marine ecosystems. This expansion will improve the programs ability to support NOAA's coastal and marine stewardship responsibilities. To start this focus area, COCA, in partnership with NMFS and NOS, held a funding opportunity in FY12 on climate and coastal and marine ecosystems. The following three projects have been recommended for funding:

1. Multidisciplinary project, to examine the effect of future climate conditions on the sustainability of key commercial and recreational fishery species of south Florida, focusing on Florida Bay, a major nearshore nursery ground for many fishery species.

2. Promoting climate change awareness and adaptive planning in Atlantic fisheries

Coast and Eco Notes

3. Development of Coastal Zone Management Tools and Strategies for Coastal Ecosystems Adaptation to Climate Change and Sea Level Rise”

SECOND BULLET

In FY11 funding support from CPO ($200,000) for the NERRS to conduct a climate sensitivity analysis across all 28 sites to characterize the climate sensitivity of reserve estuaries and adjacent communities to:

- Synthesize data and information about biophysical and social climate relevant attributes of reserves
- Identify the direct and indirect climate stressors that impact reserves
- Categorize reserves based on their key climate relevant attributes
- Define climate stressor-reserve attribute functional relationships to better understand overall climate sensitivity
- Use project results to guide vulnerability assessment and adaptation and focus research and monitoring to better understand climate change impacts on estuaries

Coast and Eco Notes

In partnership with the NERRS, COCA held a funding opportunity for specific reserves to conduct comprehensive vulnerability assessments, develop adaptation plans at spatial scales relevant to each reserve, and disseminate results to decision-makers. An emphasis was places on projects that establish a true partnership between individual reserves and their relevant state, Federal, and non-Federal partners and intended users of information and products. Funding came from the CPO Directors office ($500,000) as well as in kind support from the Reserves themselves. Two projects have been recommended for funding:

The first is with the Mission-Aransas Reserve (Texas) titled " Climate change in the Mission-Aransas Reserve: Evaluating vulnerability of coastal ecosystem and communities using long-term data sets and development of relevant adaptation strategies." The PI team plans to use long-term onsite data to identify climate sensitivities, use a series of established community tools for vulnerability assessment in both habitat, species, and the built environment, and update an existing report on community vulnerability for use by partners.

The second project is with the Tijuana River National Estuarine Research Reserve (California) and the Southwest Wetlands Interpretive Association: "Living with the Water: Climate Change Adaptation in the Tijuana River Valley." The PI team plans to build on the existing efforts developed within the watershed to 1) continue to engage stakeholders with the broad Tijuana River Valley Restoration Vision, 2) develop a focused climate change Vulnerability Assessment, and 3) include this Assessment as the central component in the development and implementation of a place-based Adaptation Strategy.

Coast and Eco Notes

THIRD BULLET:

CPO contributed to the advancement of the "Climate-Smart Sanctuaries" effort at 3 sites. The Climate-Smart Sanctuary process helps NMS sites cope with climate change impacts in their regions and communities. Through this effort, each site prepares a climate change site scenario/story, then develops and implements a climate change action plan in response to priority impacts identified in the scenario. The completion of these steps, along with others (e.g. adaptation training, greening practices) result in a site becoming certified as "Climate-Smart."

CPO funding at Gulf of the Farallones is being used to support a PACE Fellow, who is developing climate indicators and a subsequent monitoring plan for the site.

CPO funding at Fagatele Bay is being applied to conduct economic valuation analyses of the costs of climate change to coastal communities in American Samoa, enhance sentinel site capacities, achieve LEED silver certification, and develop education and outreach materials for other Pacific Island nations.

CPO funding at Olympic Coast is being used to develop the draft climate change site scenario, in consultation with academic, state, tribal, and local partners.

THIRD BULLET:

This is joint project between NOAA Climate Program and NOAA Fisheries to support three postdocs to better understand and predict impacts of climate

Coast and Eco Notes

THIRD BULLET:
This is joint project between NOAA Climate Program and NOAA Fisheries to support three postdocs to better understand and predict impacts of climate change and variability in the California Current Large Marine Ecosystem (CCLME). The project will improve the environmental forcing and scaling of ecosystem models to better understand the past, current and possible future impacts of climate change in CCLME.

Sponsors include CPO and NMFS (Office of Science and Technology, SW Fisheries Science Center, NW Fisheries Science Center). Postdocs are at the following locations:

GFDL: Helping to interface the GFDL climate and regional ROMS model results with Atlantis (or similar model used in management of CCLME). A task will be to help extend the Atlantis model south of Point Conception to fully cover the north-south extent of the CCS IEA.

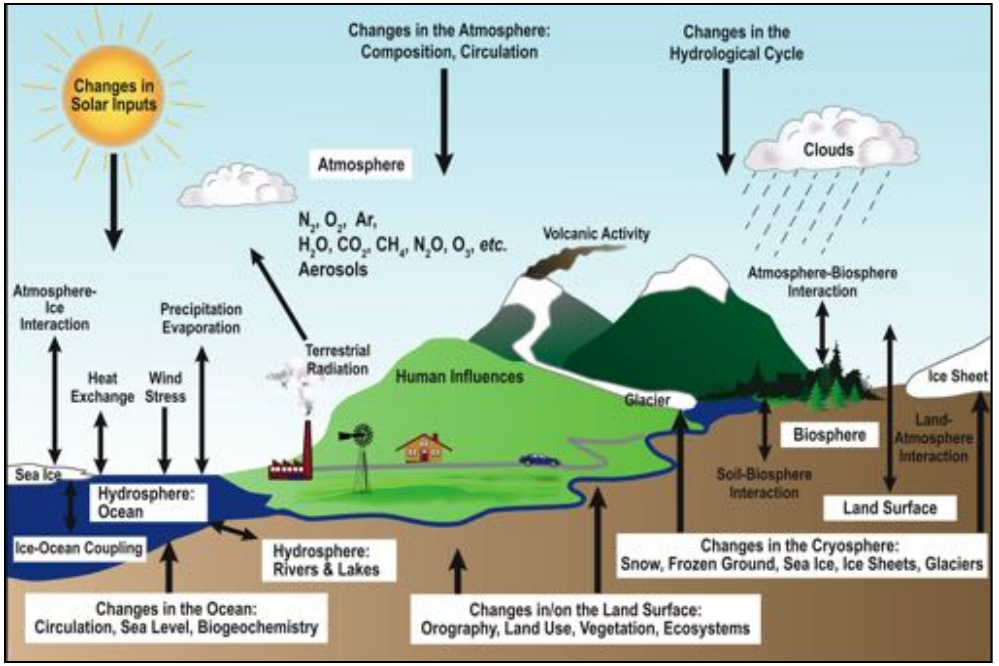
UC Santa Cruz: Mining existing data sets, conducting hindcast analyses (assimilative when possible) and implementing OSSEs for the CCLME to recommend new measurements that will best help in future modeling implementations.

NWFSC/JISAO: Systematically analyzing the downscaling results and the coupled climate/ROMS high-resolution formulation for the CCLME. This will include the implementation of ecosystem models such as the NEMURO family of models, as well as Individual Based Models (IBMs) that include more mechanistic descriptions of organisms and population dynamics and their responses to the changing environment.

Understanding & Modeling

Jim Todd, Acting Division Chief
Don Anderson, MAPP Program Lead

- Understanding climate processes
- Drought and extremes predictability, monitoring, analysis and prediction
- Climate predictability and prediction on intra-seasonal to decadal time-scales
- Analysis of state-of-the-art centennial climate projections (e.g., CMIP5)
- Climate/Earth system model development for regional-scale climate prediction
- Data assimilation and development of re-analysis datasets
- Quantification and understanding of carbon fluxes from observations and models
- Atmospheric composition, aerosols and climate



Supports mission-directed competitive research that will enhance NOAA's ability to understand and predict Earth's climate system in support of the Nation's needs for science and services.

"The Climate Program Office support for extramural research provides excellent visibility of climate science worldwide. In particular it helps to address high-priority science as defined by the international WCRP-CLIVAR project."

—Dr. Martin Visbeck, Deputy Director, IFM-GEOMAR, Kiel, Germany