

# **BERAC**

## **February 21, 2013**

**Sharlene Weatherwax, Associate Director of Science  
Biological and Environmental Research**



**U.S. DEPARTMENT OF  
ENERGY**

**Office  
of Science**

**Office of Biological  
and Environmental Research**

# Current BER Budget Status

	FY 2012	FY 2013	FY 2013	FY 2013	FY 2013
	Enacted	President's Request	House Mark	Senate Mark	6 Month CR allocation at the House Mark
<b>Biological Systems Science</b>	<b>311,458</b>	<b>309,773</b>	<b>274,879</b>	<b>309,773</b>	<b>132,379</b>
Research	228,063	225,691	197,984	225,691	94,656
Facilities	83,395	84,082	76,895	84,082	37,723
<b>Climate and Environmental Sciences</b>	<b>298,099</b>	<b>315,574</b>	<b>267,121</b>	<b>315,574</b>	<b>131,955</b>
Research	175,725	193,556	165,395	193,556	80,759
Facilities	122,374	122,018	101,726	122,018	51,196
<b>BER Total</b>	<b>\$609,557</b>	<b>\$625,347</b>	<b>\$542,000</b>	<b>\$625,347</b>	<b>\$264,334</b>

SBIR/STTR included in the Research lines

# Thank you for your service to BERAC



**Jim Tiedje**  
1999 - 2012



**Ray Wildung**  
2006 - 2012



**Gary Saylor**  
2008 - 2012



**Greg Petsko**  
2006 - 2012

# Personnel Updates



**Arthur Katz - retired, 38 ½ years**



**Sally McFarlane - Atmospheric Scientist**

## **Recruitments:**

- **Microbiologist--BSSD**
- **Science Assistants – BSSD & CESD**
- **Data Informatics Program Manager--CESD**
- **Program Manager for Bioenergy Research Centers--BSSD**

# Office of Science Facilities Planning Charge

- Prioritization of scientific facilities to ensure optimal benefit from Federal Investments. Formulate a 10-year prioritization of scientific facilities cross the Office of Science based on
  - Ability of the facility to contribute to world-leading science
  - Readiness of the facility for construction
  - Estimated construction and operations cost of the facility
- Major things only—bottom threshold \$100M total project costs
- Short letter report—due March 22, 2013
  - “Bin” the facility science (absolutely central, important, lower priority, don’t know enough yet)
  - Assign the construction (shovel ready, significant scientific/engineering challenges, not scoped yet)





## BER science

- Support experimentation and modeling that can reliably predict outcomes and behaviors of complex biological, environmental, and climate systems, enabling effective and innovative solutions for DOE missions and strategic goals
- Multidisciplinary approaches to complex systems science is emerging as the only way to gain broad insights to the system.
- Scientists will increasingly propose research by combining ARM, CDIAC, ESG, and Genomic Science data, as DOE continues to strongly encourage this type of multidisciplinary multi-data source research.



## Current BER Data Generation and Management

- Climate data to the scientific community
- Methods & tools for diagnosis and intercomparison of general circulation models and Earth system models (PCMDI)
- ARM facility and associated data
- Decadal research on non-managed ecosystems
- Large-scale genome sequencing and analysis of plants, microbes, and metagenomes relevant to DOE missions
- Systems Biology Knowledgebase, a data framework for integration, intercomparison & analysis of genomic data through access to data, analytical software & modeling tools.

# BER User Facilities

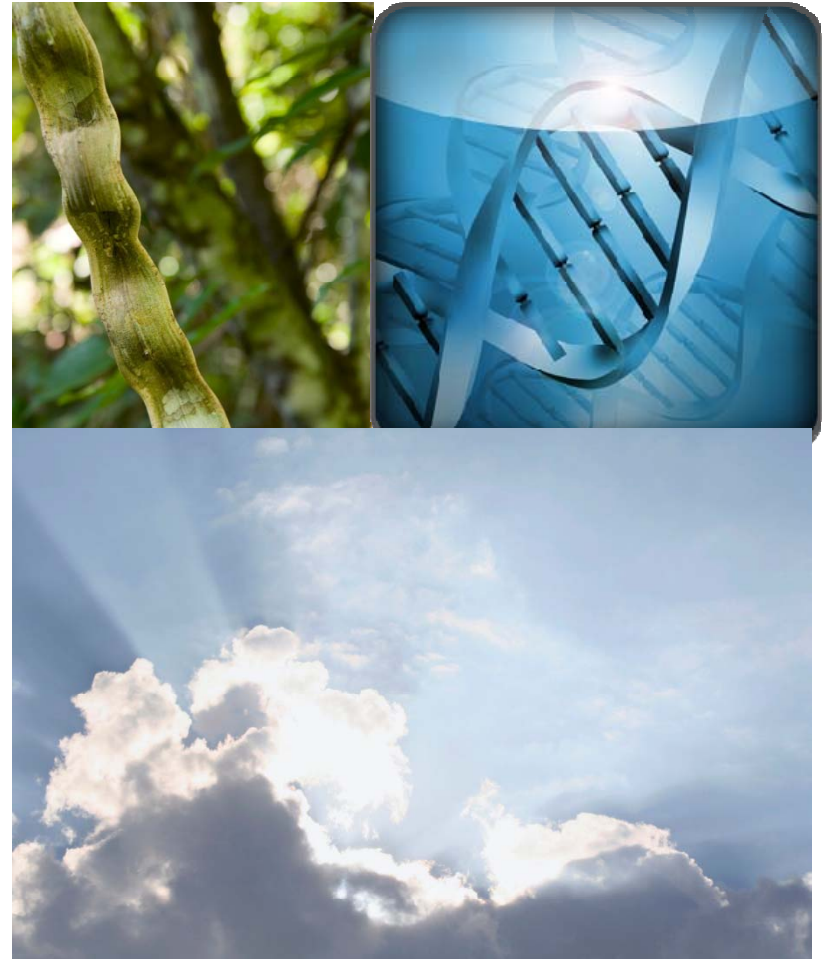
- Joint Genome Institute
- Structural Biology Infrastructure
- Environmental Molecular Sciences Laboratory
- Atmospheric Radiation Measurement Climate Research Facility
  
- **NEW:** Data Analysis and Visualization Facility

## **Proposed : BER User Facility for Biological, Climate, and Environmental Data, Analysis and Visualization**

- BERAC “Grand Challenges for Biological and Environmental Research: A Long Term Vision” report advocates the need for integrated data analysis and visualization. The companion report “BER Virtual Laboratory: Innovative Technology and Tools to Support BER” describes a facility to enable this, involving Cyberinfrastructure, Analytics, Simulation and Knowledge Discovery.
- The facility can be a single entity, as well as have components or nodes resident at several different institutions (to exploit historical strengths, ensure regional access, or provide data mirroring and quality assurance).
- Multidisciplinary approaches to complex systems science by combining ARM, CDIAC, ESG, and Genomic Science data.

# BER science portfolio

- Research
  - University grants and cooperative agreements
  - DOE National lab science focus areas (SFAs)
- Facilities
  - ARM
  - EMSL
  - JGI
  - Structural Biology
  - New: Data Analysis and Visualization



# BER Scientific Focus Area (SFA) Research at the DOE National Labs

## What we are trying to accomplish?

Encourage, facilitate, and effectively manage integrative and collaborative programs at the DOE National Laboratories to achieve scientific research and solutions of the highest quality in support of BER strategic goals.

## How do we want to engage the DOE National Labs?

“Recognition that the National Laboratories are structured for conducting coordinated, team-oriented research in a manner that is distinct from, but complementary to, research conducted via Financial Assistance (10 CFR Part 605) at other institutions such as Universities or the private sector.”

The National Laboratories are also expected to develop and evolve their research programs over time to identify, build and anticipate new areas of science and future research needs and challenges. Additionally, as BER’s strategic goals change and as science progresses, the National Laboratories are expected to reconfigure SFA programs to meet these changing research needs.

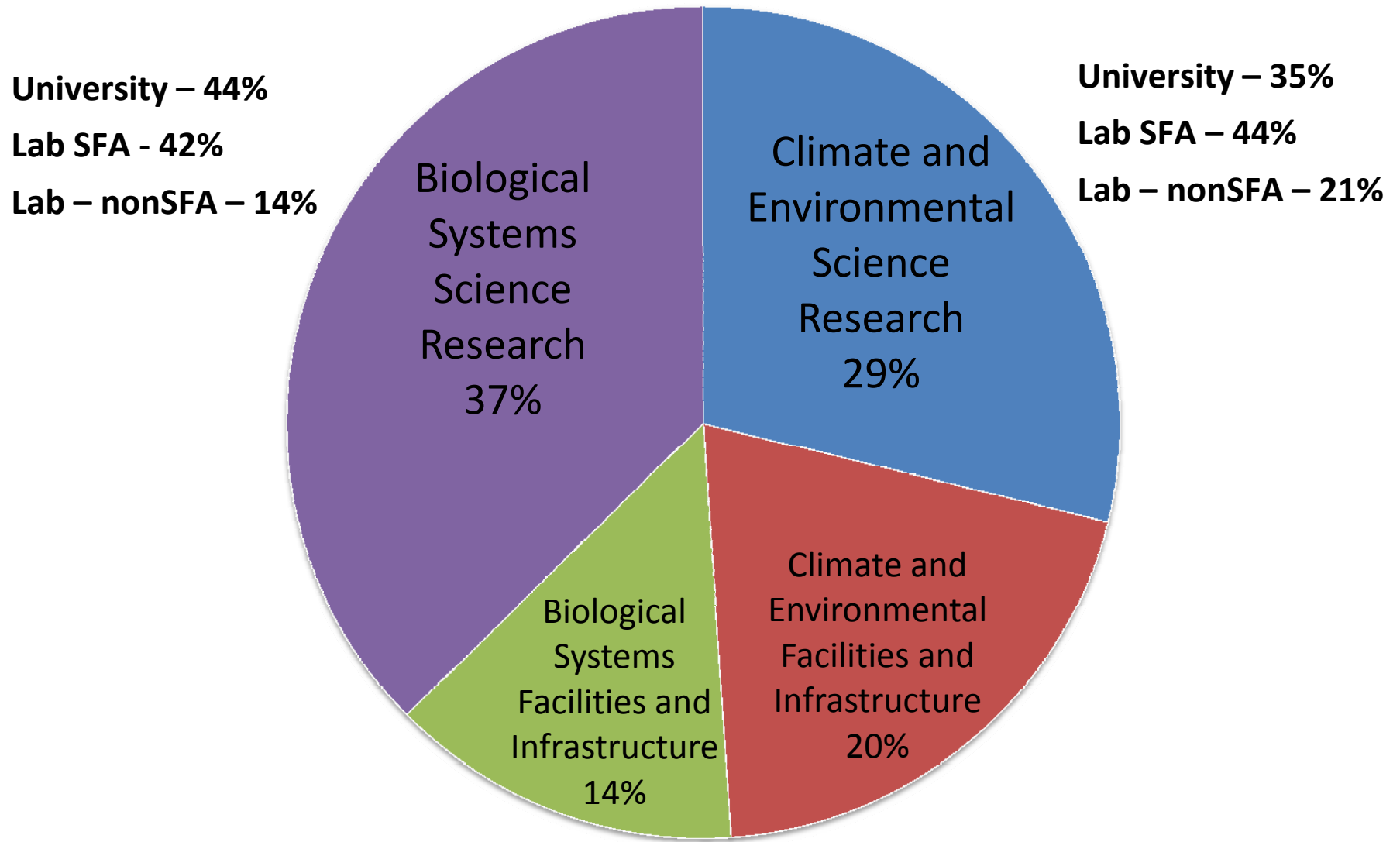
# BER Science Focus Areas

- Biological Systems Science
  - Genomic Science: Foundational Science
  - Genomic Science: Biofuels
  - Systems Biology Knowledgebase
  - Radiobiology: Low Dose Radiation Research
  - Radiochemistry and Instrumentation
- Climate and Environmental Systems Science
  - Earth Systems Modeling
  - Environmental Systems
  - Atmospheric Systems

# BER Science Focus Areas Evolution

- Both Divisions have completed their initial cycles of establishing, reviewing and adjusting SFAs
- The process will continue
- BSSD will be developing a Strategic Plan (like CESD just completed) and will adjust SFAs as necessary and appropriate
- CESD will use their new Strategic Plan to transition their SFAs so that the majority of non-facility funding to the National Labs is aligned with an SFA

# FY 2013 budget breakdown





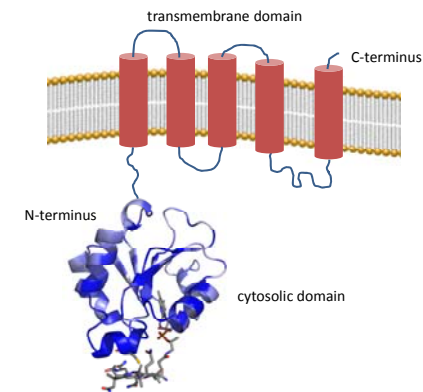
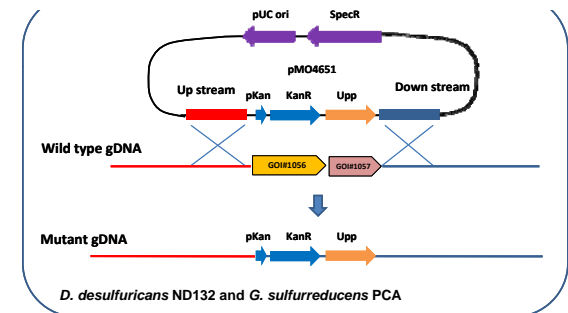
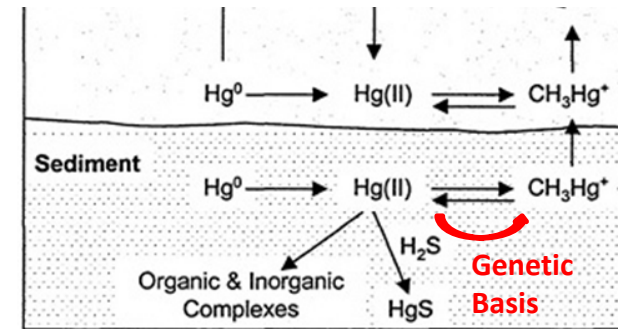
# BER Science Focus Areas--Process Updates

- Definitions
- Management
- Transitions
- Reviews
- Collaborations

# The Genetic Basis for Bacterial Mercury Methylation



- There is a history of mercury (Hg) contamination in the aquatic and soil environment associated with past DOE nuclear-weapons production activities.
- Scientists at Oak Ridge National Lab combined analyses of genomic sequence information from *D. desulfuricans* ND132, a known methylator, with knowledge of methylation biochemistry to implicate specific genes in Hg methylation.
- Two genes (*hgcA*, *hgcB*) were identified to be required for Hg methylation; found homologs in all known methylating bacteria and archaea, but not in non-methylating microbes.
- Confirmation via functional test in two different microbes: gene deletions abolished Hg methylation; activity was restored with reintroduction of both genes.
- This discovery enables detection of Hg-methylating organisms and assessment of the extent of methylmercury production in the environment, important knowledge for DOE's cleanup effort.



Homology model of *hgcA*

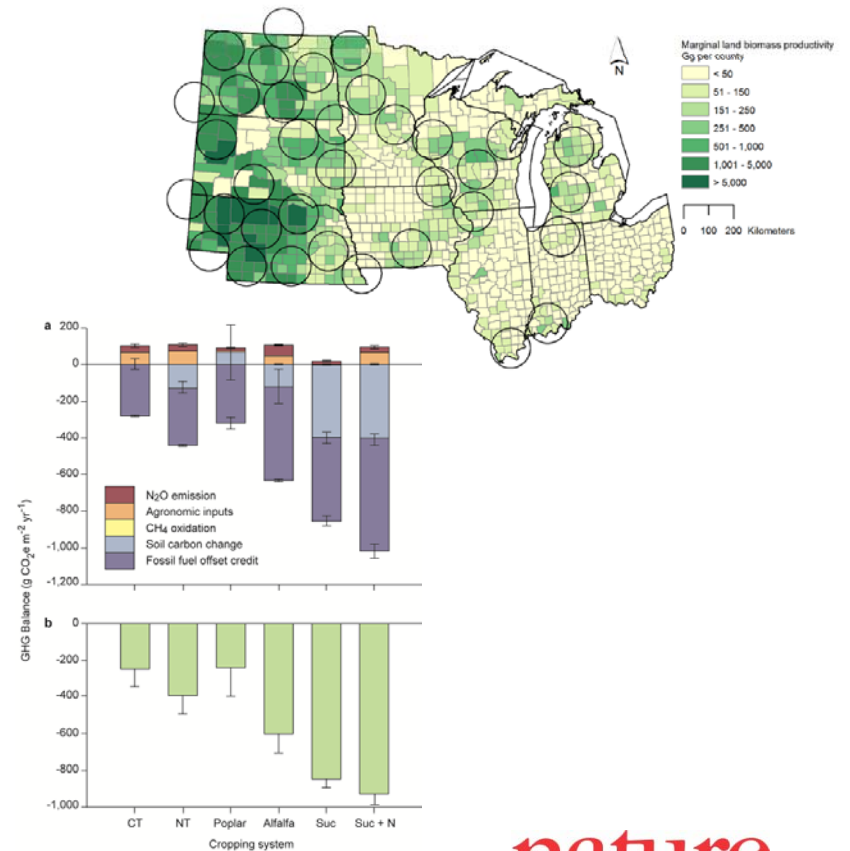
Parks, JM, et al. (2012). The Genetic Basis for Bacterial Mercury Methylation. **Scienceexpress**.

# Marginal lands are a valuable resource for sustainable bioenergy production

-Using land unsuitable for conventional agricultural crops is a promising approach to growing sufficient cellulosic biomass for the production of biofuels, but their availability as well as the potential environmental impacts from growing biofuel crops is uncertain.

-Analyzed 20 years of data from 10 Midwest states to assess total biomass potential of such lands, including GHG benefits.

-Properly managed marginal lands could provide sufficient biomass to support a viable yet environmentally beneficial cellulosic biofuel production industry.



nature

Gelfand I, Sahajpal R, Zhang X, Izaurralde RC, Gross KL, and Robertson GP. 2013. Sustainable bioenergy production from marginal lands in the US Midwest. *Nature* 2013, doi:10.1038/nature11811.

# Artificial Retina Receives FDA Approval

- Technology developed by the DOE National Labs and Second Sight Medical Products
- Manufactured and marketed by Second Sight Medical Products as the *Argus II Retinal Prosthesis System*
- First retinal prosthesis in the world to be approved to restore sight to people with retinitis pigmentosa
  - A disease that causes 1 in 4000 people in the US to go blind by destroying the light-sensitive cells in the retina
- Ten-year, \$75.2 million project funded by BER
- Cooperative Research and Development Agreement between:
  - ANL, LLNL, LANL, ORNL, SNL, Cal Tech, NC State, University of Utah, UC Santa Cruz, Doheny Eye Institute at USC and Second Sight Medical Products Inc.

## ***Argus II Retinal Prosthesis System***

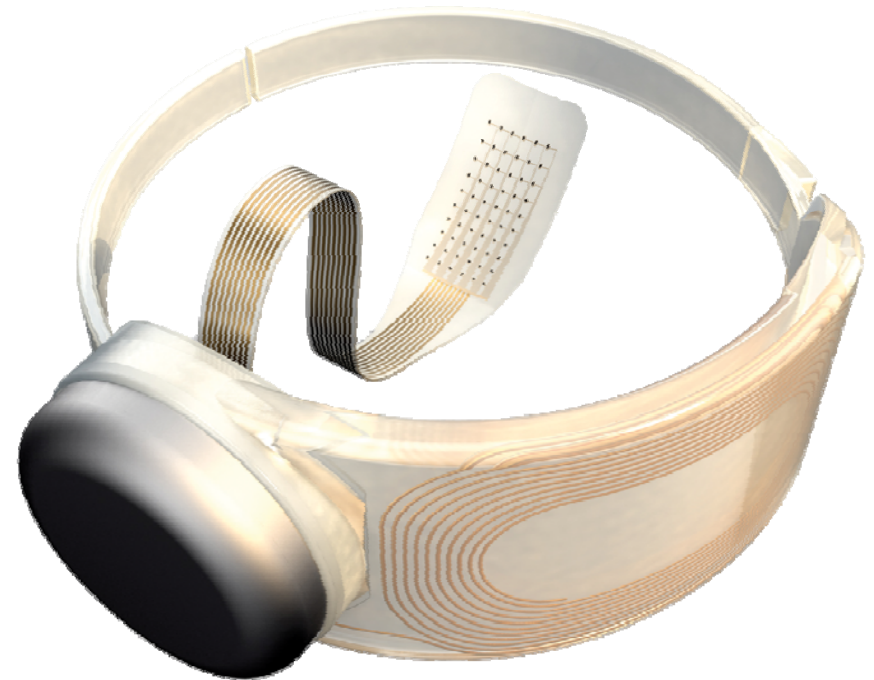


Image courtesy of  
Second Sight Medical Products Inc.

# *2011 National Medal of Science Awardees*



**Sallie (Penny) Chisholm**  
**MIT**



**Lucy Shapiro**  
**Stanford**



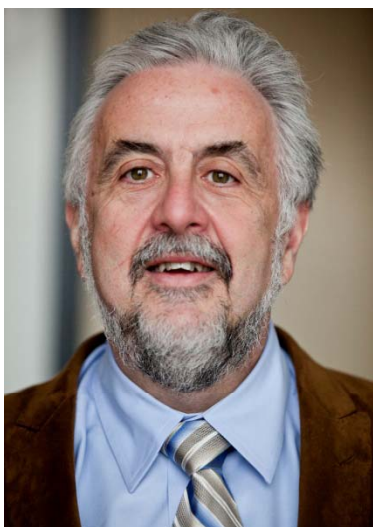
**Lee Hood**  
**Institute for Systems Biology**



# Awards



**Dr. Sabeeha Merchant elected to National Academy of Sciences**



**Dr. Tim Donohue elected incoming President of the American Society for Microbiology**

# Awards



Wanda Ferrell received the prestigious “Cleveland Abbe Award for Distinguished Service to Atmospheric Sciences” from the American Meteorological Society.

The award recognizes Ferrell "for skillful, dedicated leadership in managing the Atmospheric Radiation Measurement Climate Research Facility, which has improved knowledge about the interactions among clouds, radiation, and aerosols."

By virtue of the award, Ferrell also joined the newly elected class of AMS Fellows.

# Department of Energy and National Oceanic and Atmospheric Administration sign Memorandum of Understanding



U.S. DEPARTMENT OF  
**ENERGY**

Office of  
Science



**NOAA** NATIONAL OCEANIC AND  
ATMOSPHERIC ADMINISTRATION  
UNITED STATES DEPARTMENT OF COMMERCE

The agreement strives to exploit the unique talents and capacities of each of the agencies, in order to more efficiently develop an understanding of the climate system and science-based prediction tools in support of the nation's needs for secure energy, environment, water, food, health, and economic well-being.

It was signed in late January by NOAA Administrator Jane Lubchenco, Ph.D and DOE Office of Science director William Brinkman, Ph.D..