



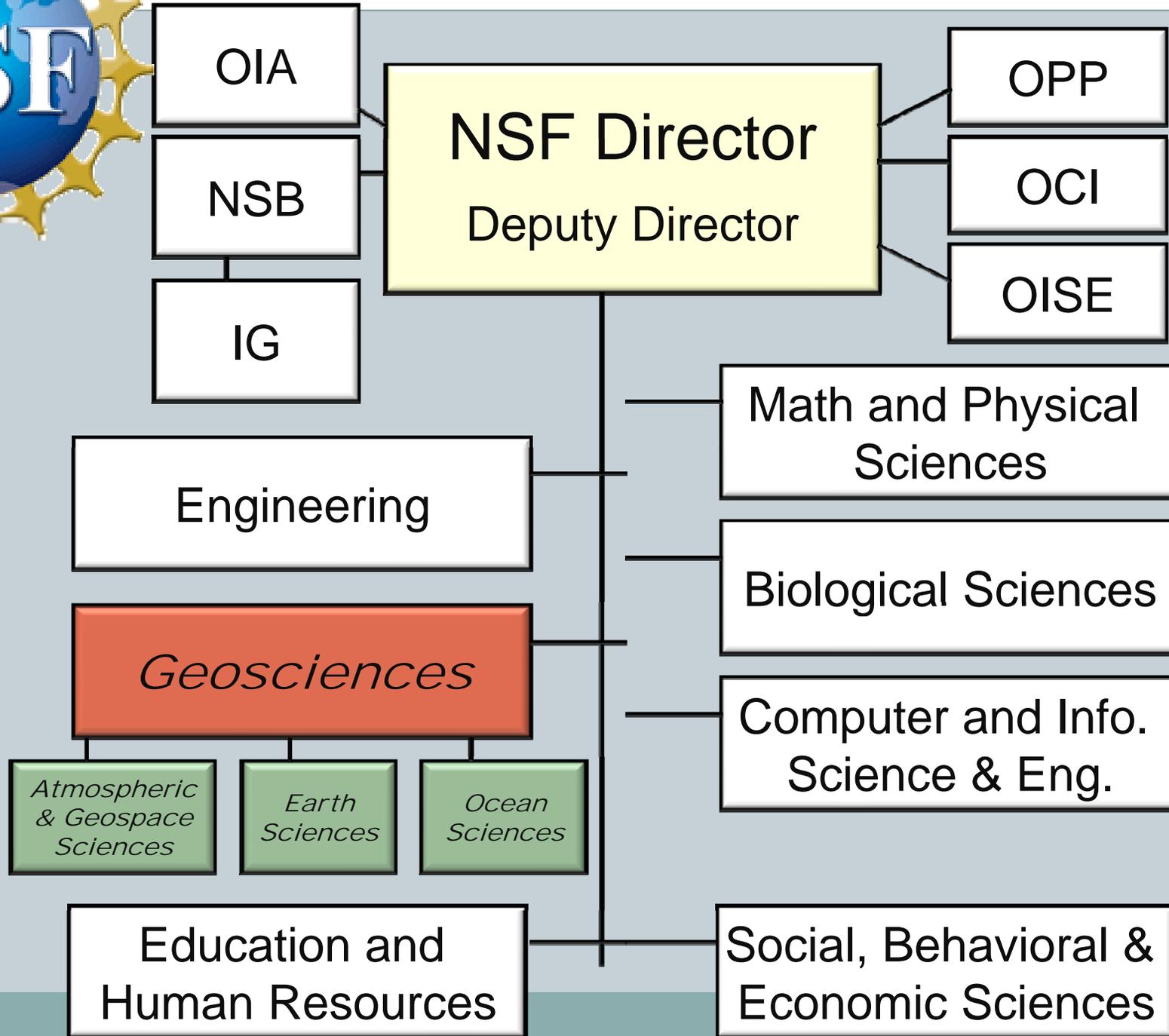
**NSF Regional Conference  
Case Western Reserve  
University**



**NSF GEOSCIENCES DIRECTORATE**

**ENRIQUETA BARRERA  
DIVISION OF EARTH SCIENCES  
EBARRERA@NSF.GOV**







## Division of Earth Sciences

### Surface Earth Processes Section

Education & Human Resources

Hydrologic Sciences

Geomorphology & Land Use  
Dynamics

Sedimentary Geology &  
Paleobiology

Geobiology & Low-Temperature  
Geochemistry

### Deep Earth Processes Section

Instrumentation & Facilities

Continental Dynamics

EarthScope

Geophysics

Petrology & Geochemistry

Tectonics





## Division of Ocean Sciences

### Marine Geosciences Section

Ocean Drilling Program

Marine Geology and Geophysics Program

### Integrative Programs Section

Ship Operations Program

Oceanographic Facilities Program

Oceanographic Instrumentation and Technical Services

Oceanographic Technology and Interdisciplinary Coordination Program

Ocean Sciences Education

### Ocean Section

Biological Oceanography Program

Physical Oceanography Program

Chemical Oceanography Program





## Division of Atmospheric and Geospace Sciences

**UCAR & Lower Atmospheric  
Facilities Oversight Section**

**Lower Atmosphere Research  
Section**

**Upper Atmosphere Research  
Section**

**Atmospheric Chemistry  
Program**

**Cross-Disciplinary Activities  
Program**

**Physical & Dynamic  
Meteorology Program**

**Climate & Large-Scale Dynamics  
Program**

**Paleoclimate Program**

**Aeronomy Program**

**Magnetospheric Physics  
Program**

**Solar Terrestrial Research  
Program**

**Upper Atmospheric Facilities**



# The Mission of the Directorate for Geosciences



- Support research in the atmospheric, earth and ocean sciences
- Address the nation's need to understand, predict and respond to environmental events and changes in order to use the Earth's resources wisely

# Division of Atmospheric and Geospace Sciences (AGS)

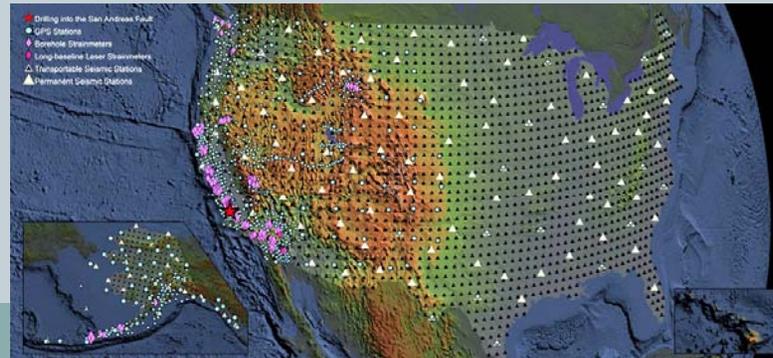
- Furthers understanding of weather, climate and the solar-terrestrial system by expanding the fundamental knowledge of the composition and dynamics of the Earth's atmosphere and geospace environment
- Supports large, complex facilities required for research in the atmospheric and solar-terrestrial sciences



# Division of Earth Sciences (EAR)



- Improves the understanding of the structure, composition, and evolution of the Earth, the life it supports, and the processes that govern the formation and behavior of the Earth's materials
- Supports theoretical, computational, experimental and observational research including field stations and state-of-the-art scientific infrastructure



# Division of Ocean Sciences (OCE)

- Enhances understanding of all aspects of the global oceans and their interactions with the solid earth and the atmosphere
- Supports major shared-use oceanographic facilities including research vessels and manned deep diving submersibles

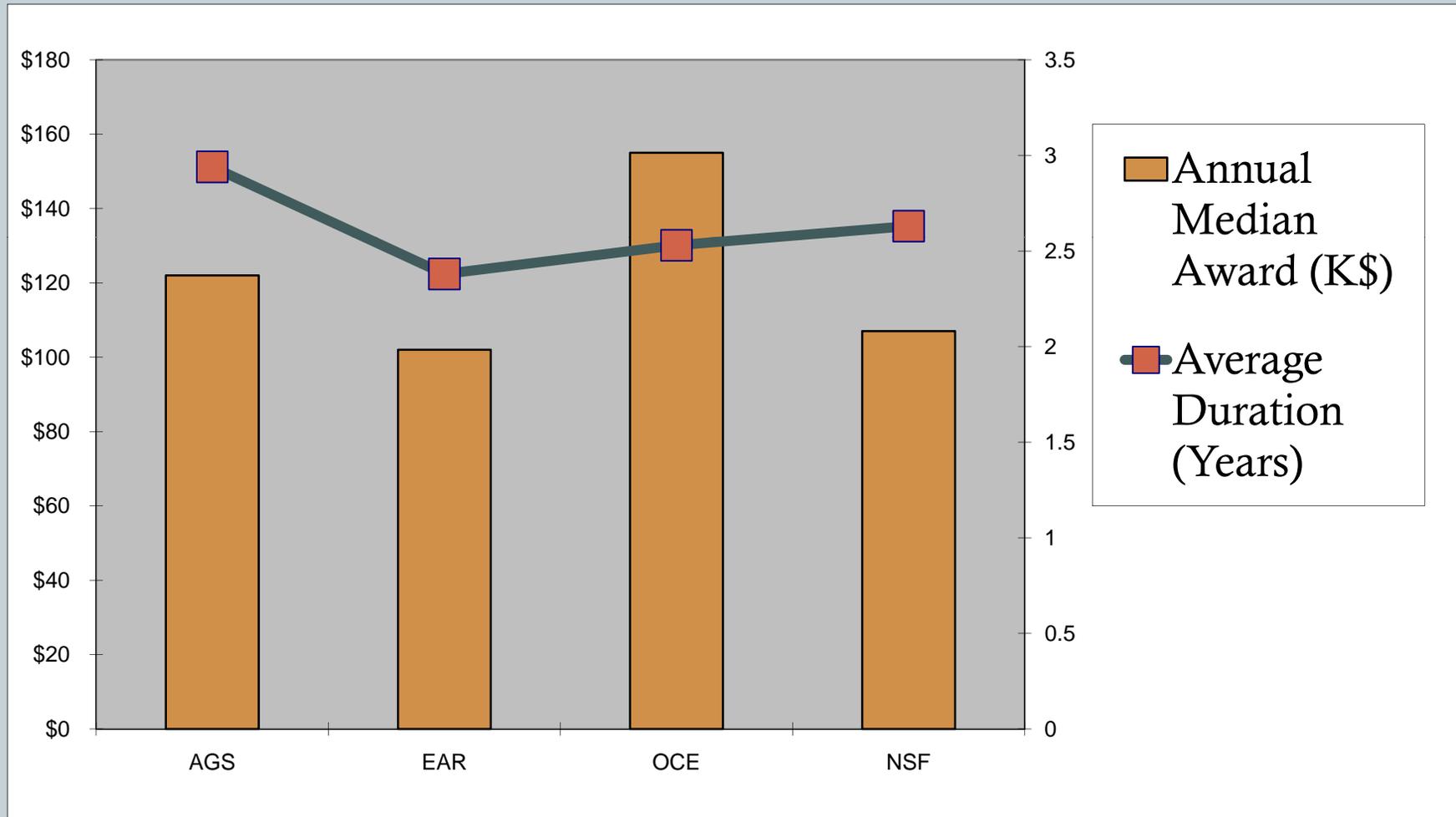


# Modes of support



- **unsolicited proposals from all scientists with interests in the geosciences**
  - individual investigator-initiated research projects
  - investigator-initiated collaborative research programs
- **special competitions, often interdisciplinary**
- **promote collaborations with scientists in other disciplines, funding agencies, and nations**
- **promote the integration of research and education**

# GEO Median Award Size and Duration



# Long-term support for shared resources



- **Observational platforms**
- **Analytic facilities**
- **Computational facilities**
- **Data archiving**
- **Experimental facilities**

# Recent and Ongoing Major Facility Investments

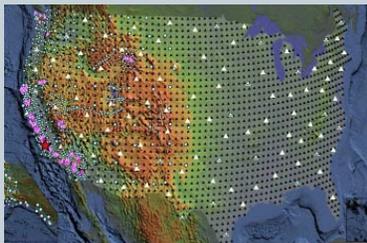


- HIAPER: Operations began in 2005



- AMISR: Poker Flat, AK: operational;  
Resolute Bay, Canada: under construction.

- EarthScope: Operational



- Scientific Ocean Drilling Vessel: Operational

- Ocean Observatories Investment: under construction



- Alaska Region Research Vessel: under construction

# HIAPER

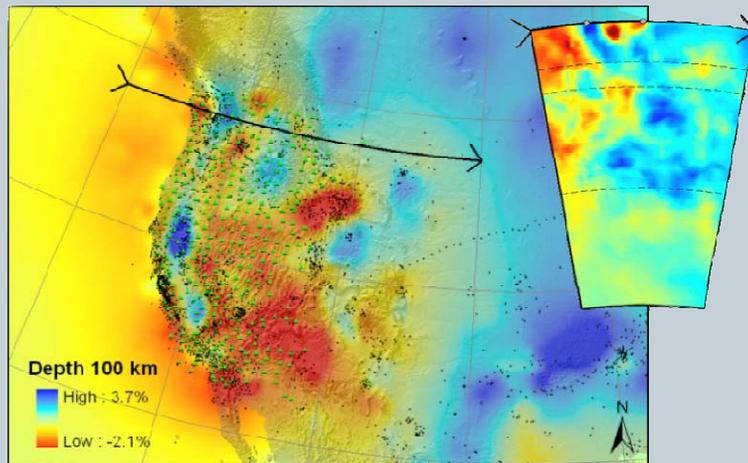
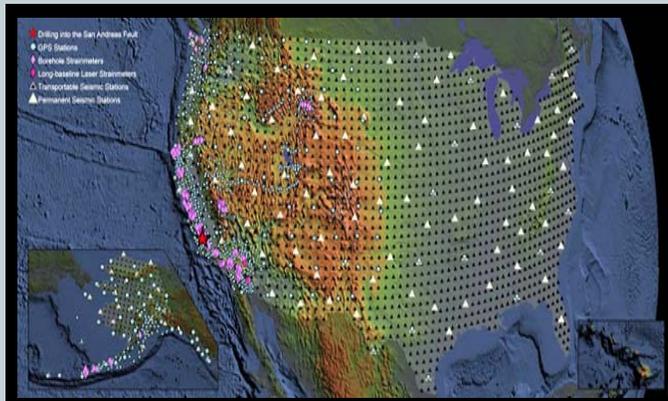


HIAPER is the High-performance Instrumented Airborne Platform for Environmental Research, a Gulfstream V jet modified to serve the NSF environmental research needs for the next several decades. HIAPER is maintained and operated for the NSF by the National Center for Atmospheric Research in Boulder, Colorado.



NSF's Gulfstream V jet made its first flights during T-Rex (Terrain-induced Rotor Experiment) in Spring 2006.

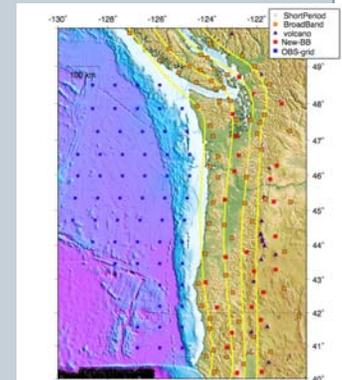
# EarthScope Fully Operational!



- USArray is 2605 seismic and 27 magnetotelluric stations
- PBO is 1200 geodetic and 79 strain/seismic stations
- SAFOD is an instrumented 3.1 km borehole into the San Andreas fault

# EarthScope/MARGINS Cascadia Margin Facility Augmentation (ARRA)

- \$10M in ARRA funding for facility enhancements
- \$5M OCE (MARGINS), \$5M EAR (EarthScope)
  - EarthScope: Roughly 50/50 split PBO/USArray
  - OCE: ~50-60 new OBSs
- Joint onshore/offshore work
- Initial focus on Cascadia
- Deployments start in 2010, migrate away in 2014
- Future: eastern US, Alaska, Gulf of Mexico, etc.



# Alaska Region Research Vessel (ARRV)



Approved by NSB in March 2009.

- First NSF award using ARRA funding
- MREFC (\$51.4M) and ARRA funding (\$148.1M) in hand to complete project
- Shipyard selection process underway, expect shipyard contract Nov. 09
- Expect science operations late 2013-2014

## Ice-strengthened vessel purpose-built for interdisciplinary science at ice edge

- Climate and ecosystem change at high latitudes, ocean acidification
- Natural hazards and anthropogenic environmental change
- Under-ice ROV and AUV support

# Scientific Ocean Drilling Vessel for IODP

- \$25M in ARRA funds to support increased drilling in 2010
- Part of 24 country international consortium
- Scientific Ocean Drilling Vessel (SODV) now refit and investigating:
  - Abrupt and extreme climate change
  - Past ocean acidification
  - Deepest biosphere and how it survives
  - Methane hydrate stability, hazards and climate change
  - Earthquake and tsunami generation



SODV studying Earth's warmest greenhouse conditions, from seafloor sediments recovered near the Equator. Refit provides:

- 34% more lab space with new science equipment
- More microbiology capability
- More berths for educators & engineers as well as scientists
- New/refurbished drilling equipment
- More efficient core recovery, logging & analysis shipboard

# Ocean Observatories

Approved by NSB May 2009.

CI linked network of sensors in critical areas of the coastal & open ocean, measuring chemical, physical and biological properties 24/7

- Carbon cycling & ocean acidification
- Ocean circulation & climate change
- Coastal ecosystem health
- Deep methane fluxes to ocean
- Cascadia margin geodynamics, and seismic processes
- Education & public engagement



## Construction started in Oct. 2009

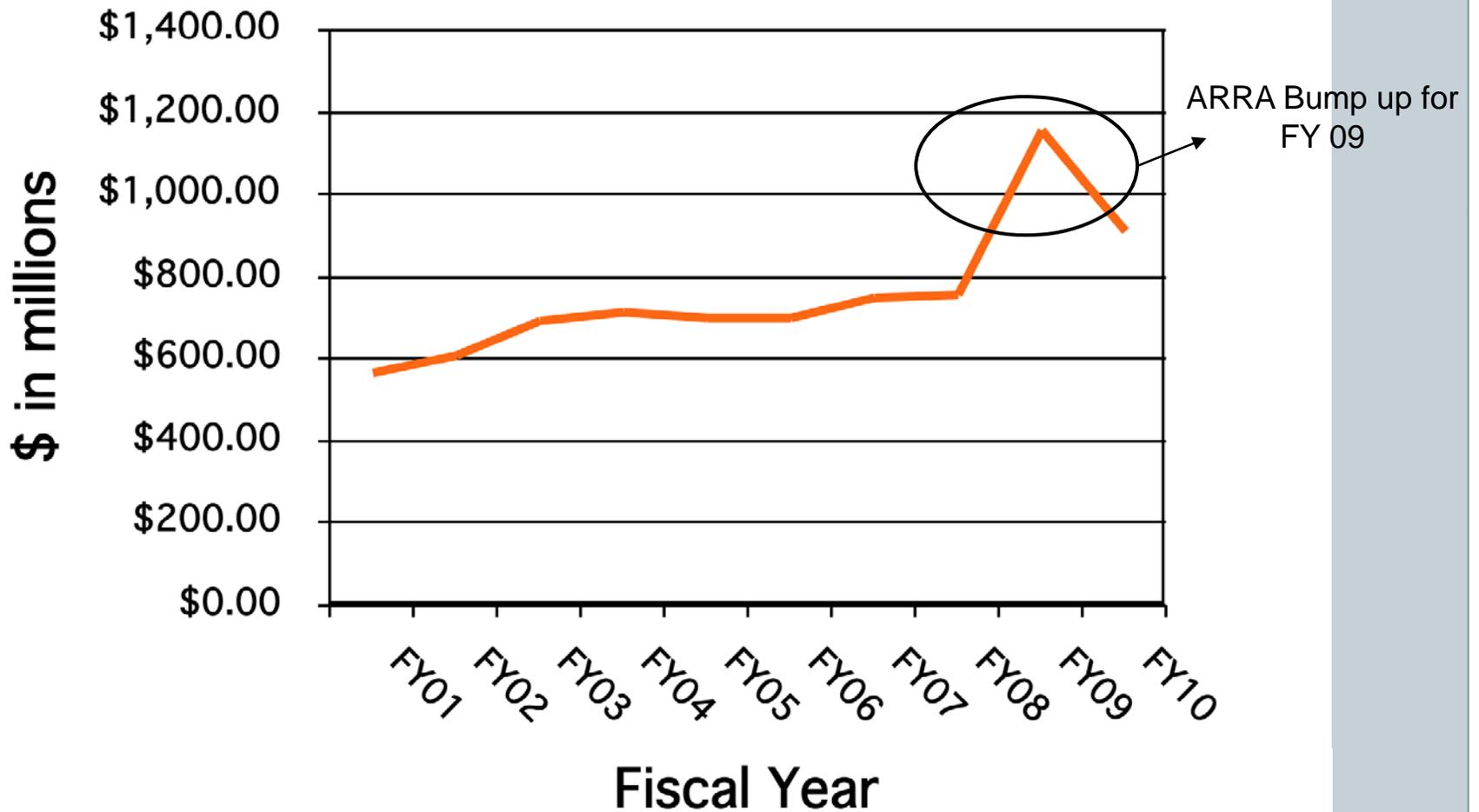
- ARRA funding = \$105.9M
- MREFC funding = \$280.4M
- Anticipate 6 yr construction period
- Data streams from earliest global moorings expected 2013

# GEO Budgets

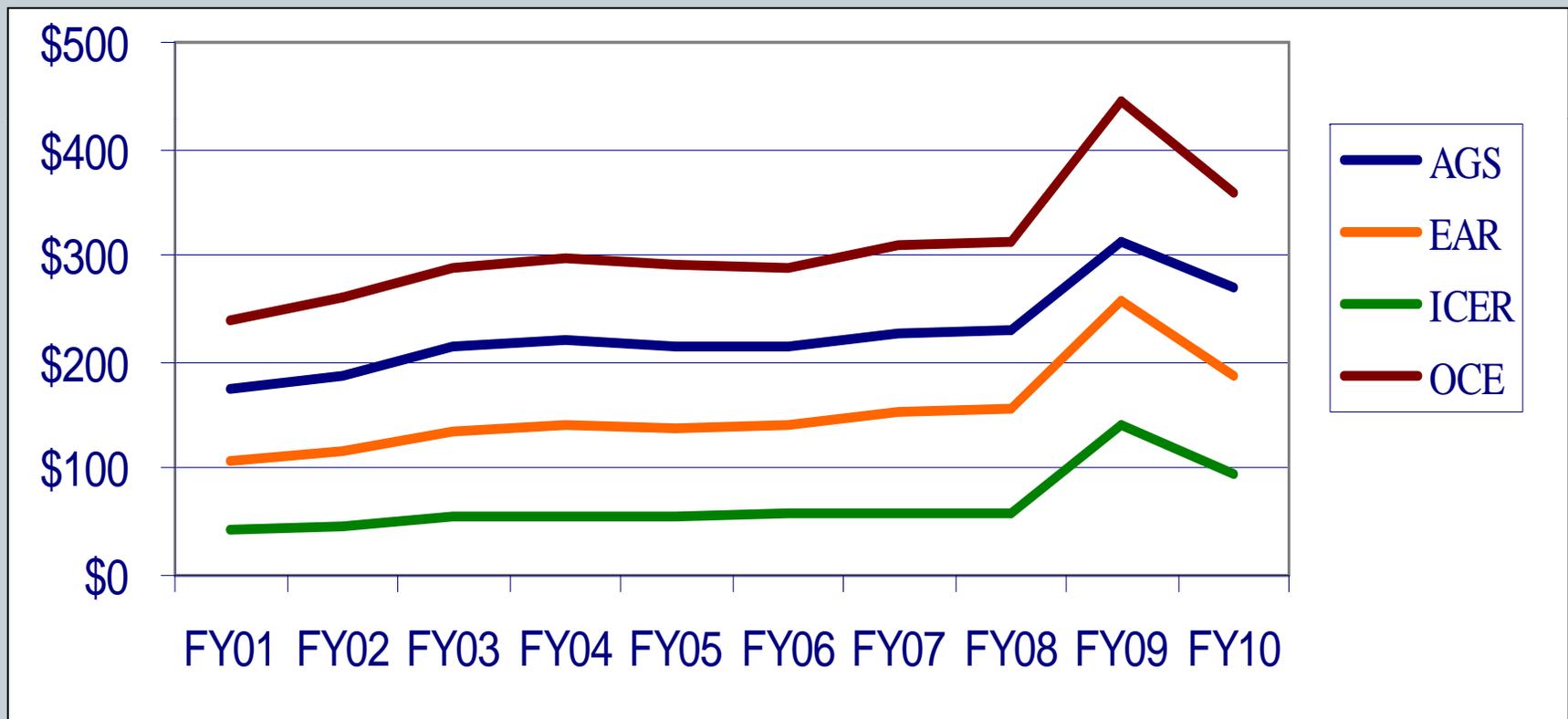


- **FY 09: \$807M (+\$49/FY 08)**
- **FY 09 ARRA (American Reinvestment & Recovery Act) : \$601M (~20% of NSF funds)**  
**(\$347M for Research and Education grants and \$254M for MREFC projects)**
- **FY 10: \$890M (+\$83/FY 09)**
- **Await Final FY10 Congress approval**

# GEO Funding Trend



# Geosciences Funding



# GEO Priorities for ARRA 2009

R&RA: \$347 million



- Jump-start Climate Research
- Explicitly focus on raising overall success rates
- Emphasize early career investigators and graduate research fellows
- Focus on GEO education, IGERT and Earth System Science Education
- Make strategic investments in infrastructure to offset anticipated future costs
  - Maintenance and Upgrade of Academic Fleet
  - Avionics Upgrades
  - IODP Operations
  - EarthScope O&M

# GEO ARRA Investments



- **MREFC (Major Research Equipment and Facilities Construction)**
  - Alaska Region Research Vessel (ARRV): \$ 148M
  - Ocean Observatories: \$106M

# FY 2010 GEO Priorities – additional funds:

- \$46.0M NSF's new Climate Research activity  
*5 new solicitations FY10*
  - [Water Sustainability and Climate \(WSC\)](#)
  - [Ocean Acidification \(OA\)](#)
  - [Dimensions of Biodiversity](#)
  - [Climate Change Education Partnership \(CCEP\)](#)
  - Modeling
- \$1.5M for climate change education (new FY 2010)
- \$6.0M GEO/EHR Collaborations  
Enhance activities to broaden participation and education in the geosciences
- Additional \$1.69M to CAREER for total of \$12.22M
- \$1.0M for graduate research fellowships (new 2010)

# Cross-Cutting Activities in GEO



- Emerging Topics in Biogeochemical Cycles
- Environment, Society, and the Economy (with SBE)
- Collaborations in Mathematical Geosciences (with DMS)
- CNH: Dynamics of Coupled Natural and Human Systems (SBE solicitation)
- Paleo Perspectives on Climate Change )-- GEO
- Geoscience Education & Diversity-- GEO
- **Climate Research Initiative** (broad NSF- new 2010)

# Climate Research Investment: Water Sustainability and Climate (WSC)

- **GEO, SBE, BIO, ENG (NSF 10-524)**
- The goal of the Water Sustainability and Climate (WSC) solicitation is to understand and predict the interactions between the water system and climate change, land use, the built environment, and ecosystem function and services through place-based research and integrative models.
- Proposals that do not broadly integrate across the biological sciences, engineering, geosciences, and social sciences may be returned without review. Successful proposals are expected to study water systems to enable a new interdisciplinary paradigm in water research.
- Letters of Intent: March 15, 2010
- Full proposals: April 15, 2010
- \$16M available

# Climate Research Investment: Ocean Acidification (OA)

## **GEO, BIO, OPP (NSF 10-530)**

- Basic research concerning the nature, extent and impact of ocean acidification on oceanic environments in the past, present and future. Full research proposals, exploratory proposals, and community-development efforts such as workshops and symposia all are encouraged.
- Letters of Intent: March 29, 2010
- Full proposals: April 26, 2010
- \$12-15M available

# Climate Research Investment: Dimensions of Biodiversity



## **GEO, BIO (NSF 10-548)**

- Characterization of biodiversity on Earth - genetic diversity, taxonomic diversity, and functional diversity - ranging from genes through species to ecosystems in an effort to integrate both descriptive and functional aspects. Projects must integrate all three of these dimensions.
- An individual may appear as Principal Investigator (PI), co-PI, or other senior personnel on **only one proposal**
- Letters of Intent: May 7, 2010
- Full proposals: June 8, 2010
- \$20 M available

## **Climate Change Education (CCE): Climate Change Education Partnership (CCEP) Program, Phase I (CCEP-I)**

- **OPP, EHR, BIO and GEO (NSF 10-542)**
- **The Climate Change Education Partnership (CCEP) program seeks to establish a coordinated national network of regionally- or thematically-based partnerships devoted to increasing the adoption of effective, high quality educational programs and resources related to the science of climate change and its impacts.**
- **Letter of Intent Deadline Date: April 23, 2010**
- **Phase I Partnership Proposals \$10M/yr**
- **Full Proposal Deadline Date: May 24, 2010**
- **Full Proposal Deadline Date: March 15, 2011**

# Emerging Topics in Biogeochemical Cycles (ETBC)

- GEO
- quantitative and/or mechanistic understanding of biogeochemical cycles, including the water cycle.
- Integrate physical, geological, chemical, and/or hydrologic processes with biological processes over various temporal and/or spatial scales and/or various levels of biological organization.
- increase our understanding of how biological systems respond to changing physical and chemical conditions and how biological systems influence the physical and chemical characteristics of soils and sediments, air, or water.
- Submit to regular core programs, \$8M funding available
- <http://www.nsf.gov/pubs/2009/nsf09030/nsf09030.jsp>

# Environment, Society, and the Economy (ESE)



- SBE and GEO (NSF 09-031)
- Goal to increase collaboration between the geosciences and the social and behavioral sciences
- Examples of Prospective topics:
  - Decision-making strategies related to ongoing or predicted global, regional, and local environmental changes;
  - Economic and geosciences evaluation of technology and practices linked to climate change;
  - Development and implementation of mitigation strategies within political and economic constraints;
  - Interplay of environmental change and inequality of income, access to resources, etc.;
  - Politics and economics of resource agreements;
  - Environmental change and its impact on the evolution of human behavior

<http://www.nsf.gov/pubs/2009/nsf09031/nsf09031.jsp>

# Paleo Perspectives on Climate Change (P2C2)



- Geological, chemical, and biological records of climate system variability to provide insights into the mechanisms and rate of change that characterized Earth's past climate variability, the sensitivity of Earth's climate system to changes in forcing, and the response of key components of the Earth system to these changes.
- GEO Solicitation 08-505 Last Deadline: Oct. 15, 2009
- Re-issuance of Earth System History solicitation
- Expect new solicitation summer, 2010 ~\$9M

## GEO Contacts:

Candace Major (OCE)

[cmajor@nsf.gov](mailto:cmajor@nsf.gov)

David Verardo (AGS)

[dverardo@nsf.gov](mailto:dverardo@nsf.gov)

Paul Filmer (EAR)

[pfilmer@nsf.gov](mailto:pfilmer@nsf.gov)

# Collaborations in Mathematical Geosciences (CMG)

- DMS, OPP and GEO
- Goal to increase collaboration between the geosciences and mathematics
- Supported Topics
  - (1) mathematical and statistical modeling of complex geosystems,
  - (2) understanding and quantifying uncertainty in geosystems, or
  - (3) analyzing large/complex geoscience data sets
- Program Officers in GEO: Robin Reichlin (EAR), Baris Uz (OCE), Eric DeWeaver (AGS)
  - Solicitation: early Fall, 2010

[http://www.nsf.gov/funding/pgm\\_summ.jsp?pims\\_id=503342](http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=503342)

# Dynamics of Coupled Natural and Human Systems (CNH) Program

- SBE, BIO, GEO and USFS (NSF 07-598)
- Goal is to promote quantitative, interdisciplinary analyses of relevant human and natural system processes and complex interactions among human and natural systems at diverse spatial, temporal and organizational scales.
- Proposals cannot focus solely or largely on either human systems or on natural systems and must demonstrate how the research is well grounded in relevant theory from a range of appropriate fields.
- Program Officers in GEO: Sarah Ruth (AGS)
  - Proposal Deadline: November 16, 2010
  - \$9M

# Cross Disciplinary Programs within GEO



## **CSEDI:** Cooperative Studies of Earth's Deep Interior

### Themes:

Deep earth water and carbon cycles

Path to the present: Evolution of the earth

The deep earth engine

- NSF 06-578 - EAR Solicitation
- Deadline September 25th, annually
- Multidisciplinary
- Single or multiple Institution

## **Critical Zone Observatories-- EAR**

## **MARGINS:** OCE and EAR

“Futures” planning meeting February, 2010

# Critical Zone Observatories (CZO)

Critical Zone Observatories operate at the watershed scale and will significantly advance our understanding of the integration and coupling of Earth surface processes as mediated by the presence and flux of fresh water.

Observatories include field and analytical research methods, as well as theoretical techniques, each providing the impetus for advances in the other, as well as substantial and novel plans for education, outreach and broader impacts

EAR investment: ~ \$30M

(\$14M ARRA)

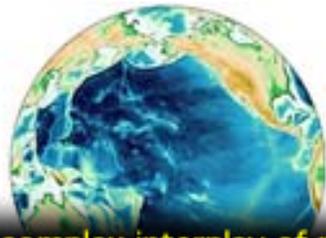


## Critical Zone Observatories (2009)



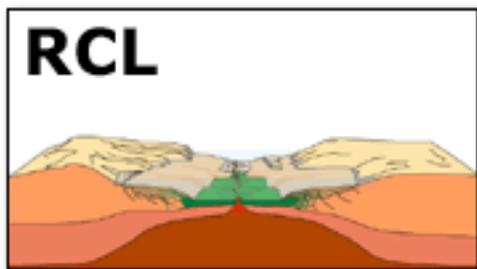
- Southern Sierra CZO (California, UC Merced)
- Boulder Creek CZO (Colorado, University Colorado)
- Susquehanna-Shale Hills CZO (Pennsylvania, Penn State)
- Jemez River Basin – Sta. Catalina CZO (New Mexico/Arizona, University of Arizona)
- Christina River Basin CZO (Pennsylvania/Delaware, University of Delaware)
- Luquillo CZO (Puerto Rico, University of Pennsylvania)

- **Platforms for research of critical zone community**
- Organization of cross-site working groups: Cross-testing of sampling, analytical and modeling protocols
- Cross-cutting workshops (e.g., DOC Meeting, LIDAR, Data, Infrastructure)
- Common portal and data management ([www.criticalzone.org](http://www.criticalzone.org))
- Steering Committee
- Annual PI meeting; CZ sessions at national & international meetings
- International Partnerships



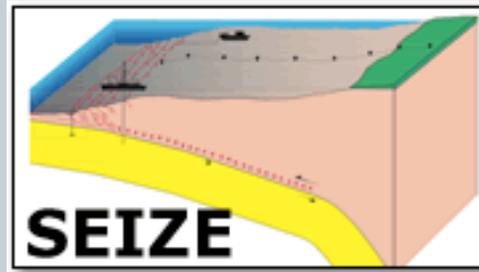
to understand the complex interplay of processes that govern the evolution of continental margins

## Initial program components:



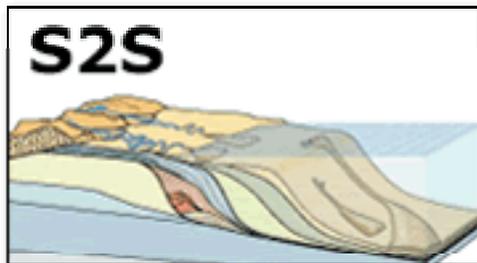
**RCL**

Rifted continental lithosphere



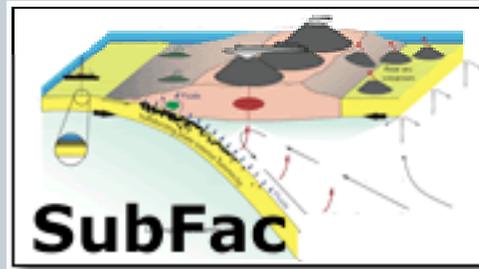
**SEIZE**

Seismogenic zone



**S2S**

Source to Sink



**SubFac**

Subduction Factory

Future to be determined at  
**MARGINS Successor Program  
Planning Meeting**

San Antonio, Texas  
February 15 - 18, 2010

## Other NSF Activities of Interest “Crosscutting and NSF-wide”

- Faculty Early Career Program (CAREER)\*\*
- Research in Undergraduate Institutions (RUI)
- Research Experiences for Undergraduates (REU)\*\*
- Early Concept Grants for Exploratory Research (EAGER)\*\*
- Grants for Rapid Response Research (RAPID)\*\*

\*\*contact Program Director before submitting

# Faculty Early Career Development Program (CAREER)

- CAREER proposals are submitted to a disciplinary program
- They are reviewed according to the relevant Program guidelines - Talk to Program Officer or Division Contact for more information
- Make sure to check on typical award sizes in your program
- Ask about expectations for scope of research and education plans
- Assessment of Departmental endorsement letter is part of the review criteria for CAREER
- Funding rates follows trend for regular proposals in the program of interest

*(<http://www.nsf.gov/crssprgm/career/contacts.jsp>)*

# Faculty Early Career Development Program (CAREER)



- A compelling research plan
- Innovative but doable education plan
- A plan for the effective integration of both sets of activities (evaluation plan is a plus)

**Education activities** – curriculum, pedagogy, outreach, mentoring at any level, majors and non-majors, teacher preparation or enhancement, K-12 students, and/or the general public.

# **GEO CAREER Proposals**



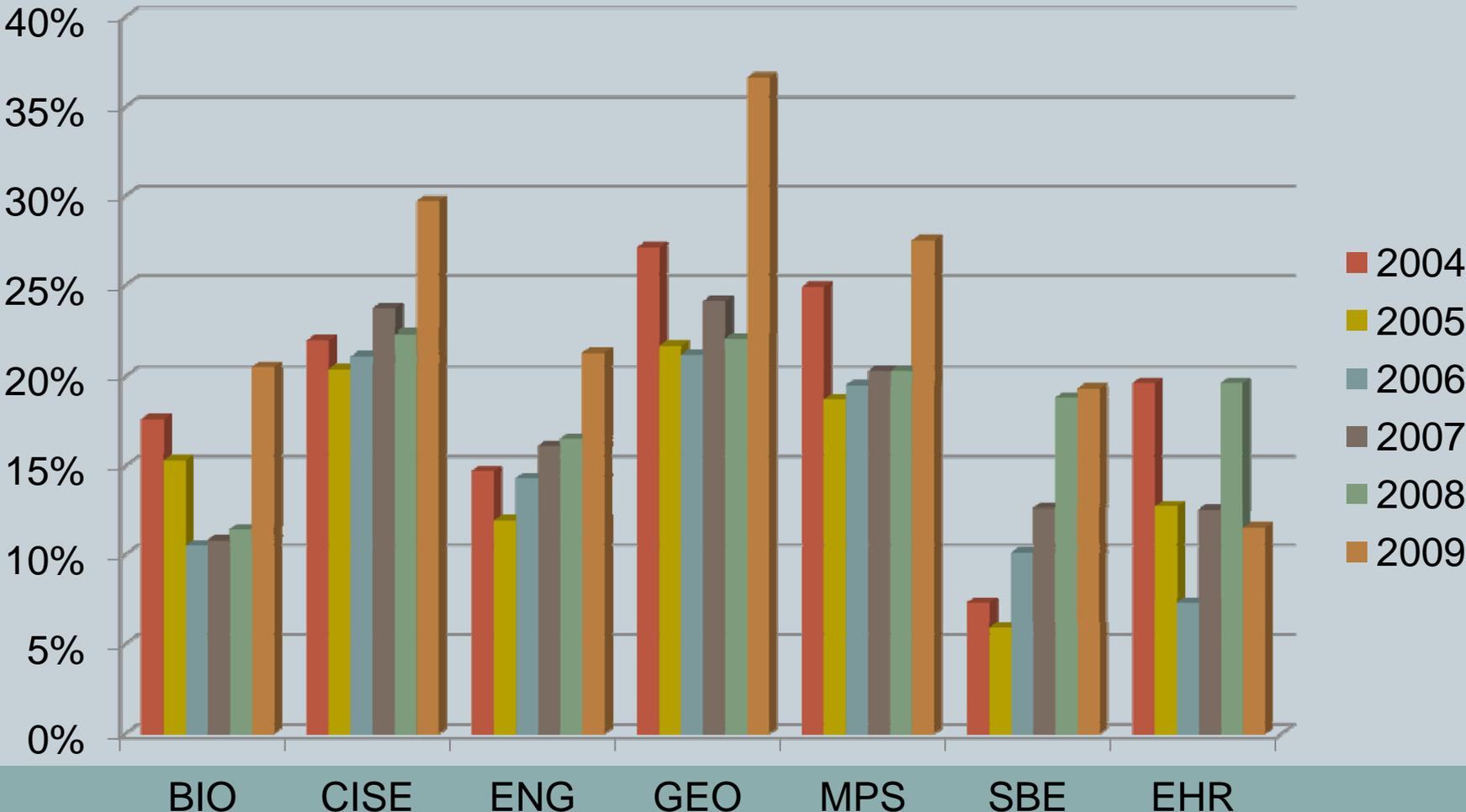
- Provide stable support for 5 years ( $\geq$ \$400K in GEO)
- Support the career development of outstanding new teacher-scholars in the context of the mission of their organization.
- GEO has about  $>5\%$  of NSF Submissions
- GEO awardees on average have 1 or more awards prior to submitting to CAREER
- GEO Submission Deadline: July 22, 2010

***Program Solicitation NSF 08-557***

# Faculty Early Career Development Program (CAREER)



## Success Rate



# Other NSF Activities of Interest: Instrumentation and Facilities

- **Major Research Instrumentation (MRI) NSF 10-529**

\$100,000 to \$4M -- proposals requesting less than \$100,000 will be considered only from SBE proposals and non-Ph.D. granting organizations

Dateline: April 21, 2010

- **Earth Sciences: Instrumentation and Facilities (EAR/IF)  
NSF 09-517**

David Lambert: [dlambert@nsf.gov](mailto:dlambert@nsf.gov)

Russell Kelz: [rkelz@nsf.gov](mailto:rkelz@nsf.gov)

- **EPSCoR Research Infrastructure Improvement Program:  
Track-1**

Up to \$4M/yr for up to 5 years to support physical, human, and cyber infrastructure improvements in research areas to improve future R&D competitiveness

# FY 2010: GEO Education & Diversity Investments



- **Opportunities for Enhancing Diversity in the Geosciences (OEDG)**  
\$4.6 M/yr, biennial
- **Geoscience Education (GeoEd)**  
\$2.5 M/yr, including \$1 M to foster linkages with LSAMP
- **Geoscience Teacher Training (GEO-)Teach**  
\$3.0 M/yr, FY2011
- **Global Learning and Observations to Benefit the Environment (GLOBE)**  
\$1.1 M/yr, every 4 yrs (2011)
- **Centers for Ocean Science Education Excellence (COSEE)**  
\$5.55 M, variable

In addition, most facilities, centers, and many individual investigator awards include strong education and outreach programs.

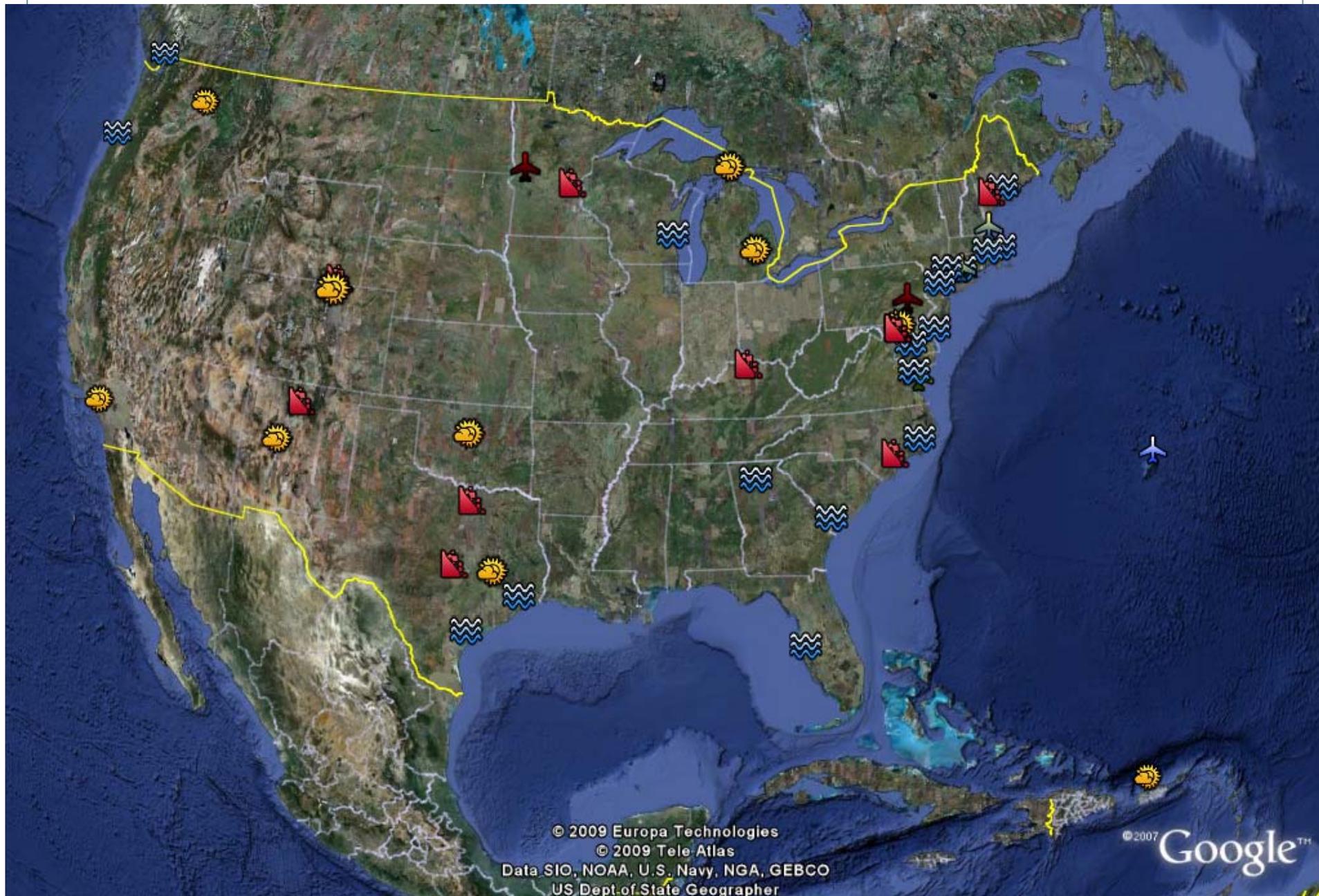
# Opportunities for Enhancing Diversity in the Geosciences (OEDG)



Addresses the problem of underrepresentation of certain groups across the geosciences as compared to their proportion of the general population. The primary goal of the OEDG program is to increase the participation in geoscience education and research by students from these groups.

Contact Jill Karsten for further information at (703) 292-8500 or at [jkarsten@nsf.gov](mailto:jkarsten@nsf.gov)

# NSF GEO REU Sites 2009



# GEO Education



GEO Directorate-wide program to fund formal (K-16) and informal geoscience education activities.

Contact: Jill Karsten

[jkarsten@nsf.gov](mailto:jkarsten@nsf.gov)

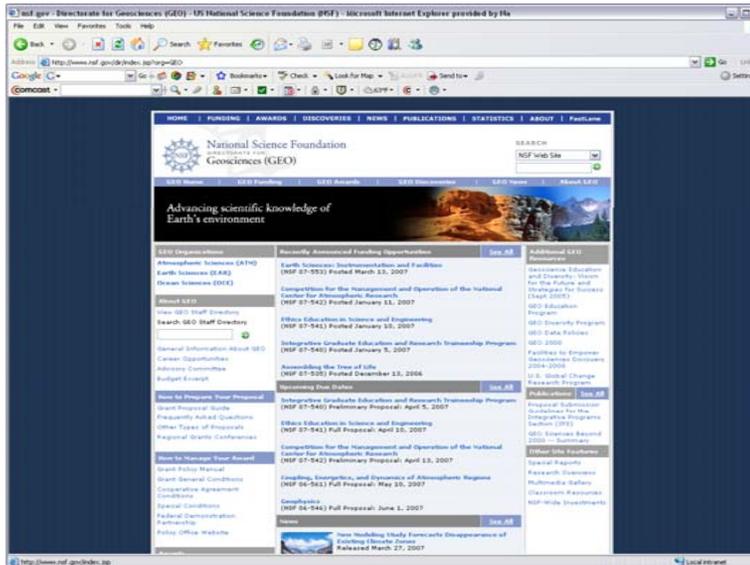
- AGS Contact: Sue Weiler [cweiler@nsf.gov](mailto:cweiler@nsf.gov)
- EAR Contact: Lina Patino [lpatino@nsf.gov](mailto:lpatino@nsf.gov)
- OCE Contact: Lisa Rom [erom@nsf.gov](mailto:erom@nsf.gov)

Includes Centers for Ocean Science Education Excellence (COSEE)

# Earth Sciences Post-Doctoral Fellowships (EAR-PF)

- Integrated program of independent research and education that address scientific questions within the scope of EAR disciplines.
- Fellowship program may be conducted at any appropriate U.S. or foreign host institution
- 2 year long fellowships, \$170k/2years
- Eligibility within 3 years of PhD
- Fellowships are awards to individuals, not institutions, and are administered by the Fellows.
- 2 months parental leave can be requested

***NSF 10-500 \*\*\* Deadline: July 1 annually***



# Proposal Preparation



*www.nsf.gov*

- Proposal and Award Policies and Procedures  
[http://www.nsf.gov/publications/pub\\_summ.jsp?ods\\_key=papp](http://www.nsf.gov/publications/pub_summ.jsp?ods_key=papp)
- NSF HomePage -- Guide to Programs
- Program Solicitations – eligibility, goals, special requirements
- Program Officers – current or former rotators
- NSF Custom News Service – what's new

# NSF Merit Review



## NSF Review Criteria

- Intellectual Merit
- Broader Impacts
- Programs can also have *additional* review criteria – read the Program Solicitation!

Merit Review is conducted through ad hoc peer review and/or panel review

# Attributes of Successful Proposals

- 
- New and original ideas
  - Articulate importance of the science
  - Sound, succinct, detailed focused plan
  - Preliminary data and/or feasibility study
  - Relevant experience and facilities
  - Clarity concerning future direction
  - Well-articulated broader impacts

# Words of Wisdom



- **Talk to your Program Director(s)**-ask early, ask often AGU or GSA booth, email, phone, visit NSF, meetings
- **Read the funding opportunity** (program descriptions, solicitations) carefully, and ask a Program Officer for clarifications if needed
- **Learn the culture**- each Division/solicitation is different
- **Know and follow** the *current* Grant Proposal Guide (GPG) - it changes! (*e.g., Postdoc mentoring*)
- **Explicitly** address Intellectual Merit and Broader Impacts in both the Project Summary **and** Project Description.

# Words of Wisdom



- **Know the audience** for your proposal's review!
- **Compelling Project Summary**-big picture
- Match and **justify the budget** to the scope of the proposed work - ask for what you need!
- Be familiar with projects that have succeeded - Award Abstracts at <http://www.nsf.gov/awardsearch>
- Download your completed proposal back to you to check it's what you sent!
- Submit proposals before the last day/hour

# NSF GEOsciences: Questions?

