National and International Funding Scope for Sustainability Science Research

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Symposium on Partnerships, Science and Innovation for Sustainability Solutions

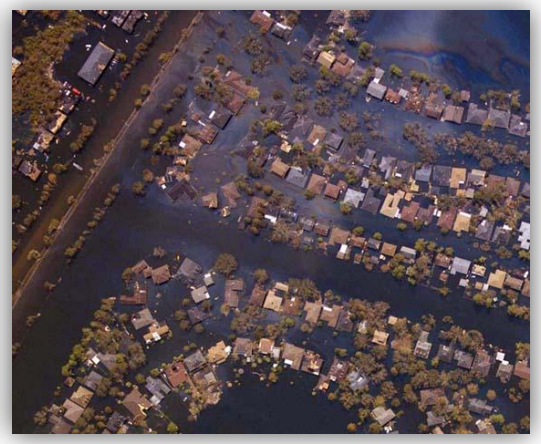
National Academies

May 2012

Outline

- Introduction
- NSF Science, Engineering and Education for Sustainability (SEES)
- Interagency Global Change Research Partnerships
- International Global Change Research Partnerships

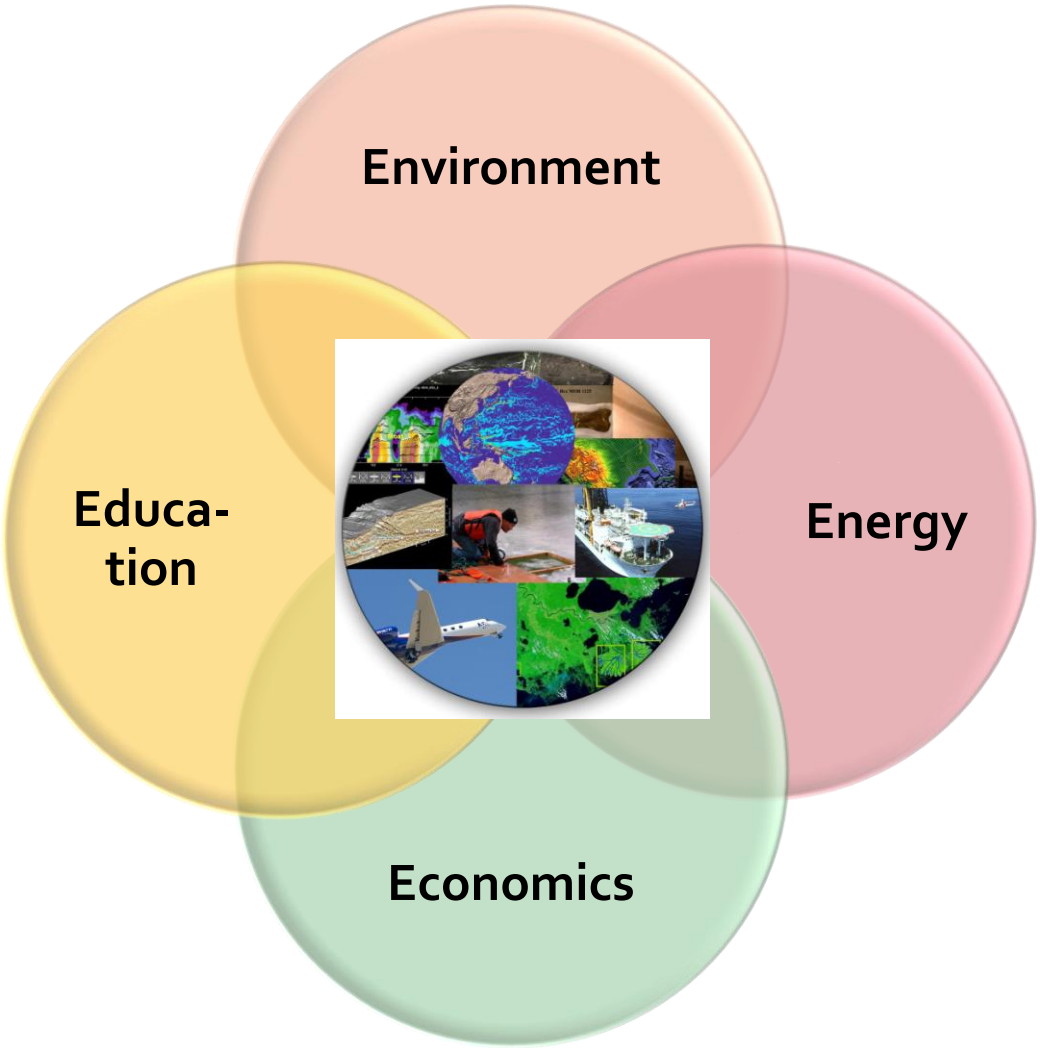
Rapid, multi-faceted global change is challenging human well-being



Ships take to Arctic Ocean as Sea Ice Melts. Journey time between Europe and China can be reduced by half. MSNBC.com

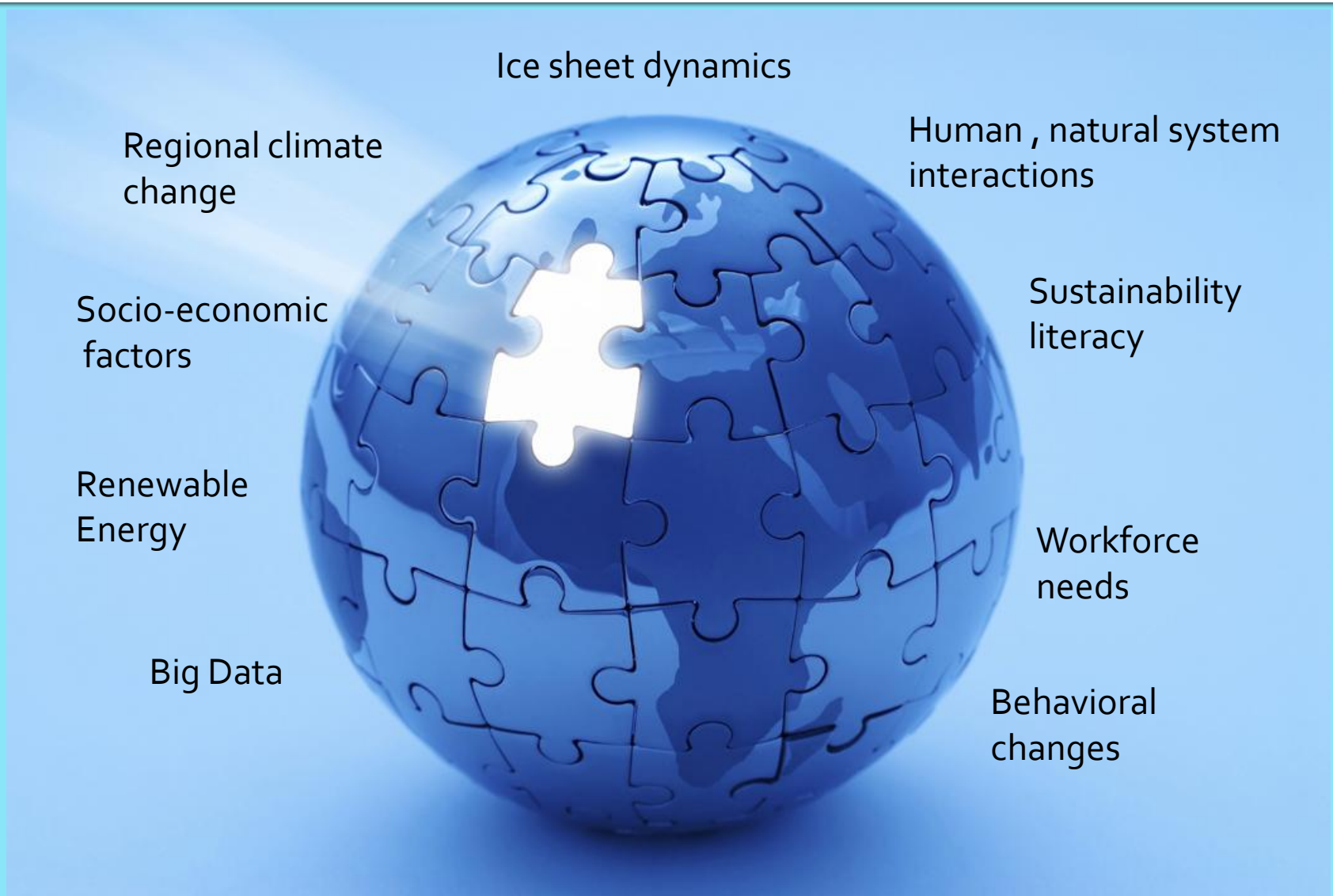
Sustainability Issues Remain at the Forefront

Meeting Sustainability Challenges…



… requires multi-faceted approaches and research at the nexus of societal needs and behavior, environmental impact, and economic demands.

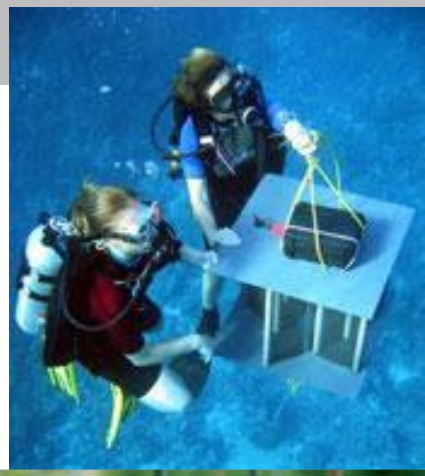
Opportunity Space



NSF's Science, Engineering and Education for Sustainability (SEES) Portfolio

SEES Overview

Mission: *to advance science, engineering, and education to inform the societal actions needed for environmental and economic sustainability and sustainable human well-being*



- Established in Fiscal Year 2010
- Portfolio of existing and new programs
- All NSF Directorates and Offices involved
- Partnerships

SEES Goals

1. **Interdisciplinary research and education**…towards global sustainability
2. Link projects and **partners** and add **new participants** to sustainability endeavors
3. Develop the **workforce**…to address…sustainability.

SEES Characteristics

- **Systems Thinking**

  holistic approaches that link human, built and natural systems, and reach across disciplines

- **Partnerships & Networks**

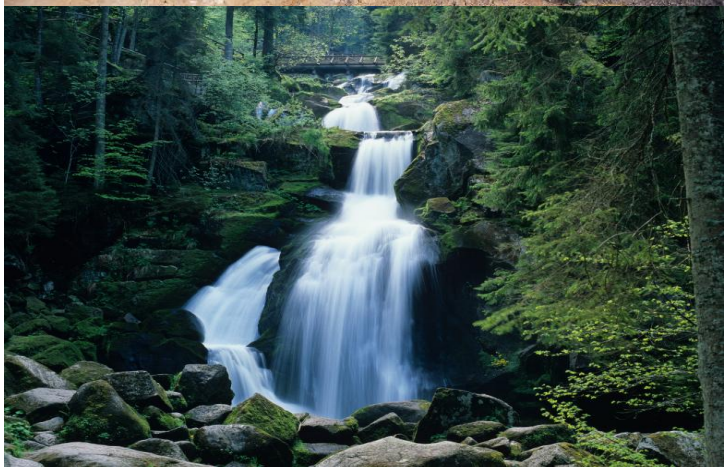
  connect intellectually and spatially disparate communities, institutions and organizations.

- **Workforce & Education**

  development and education of new researchers and students on critical aspects and issues of sustainability.

SEES Themes

- Natural Systems
- Human Systems
- Built Systems
- Energy and Materials
- Adaptation and Resilience



SEES Programs – FY 2010 /2011

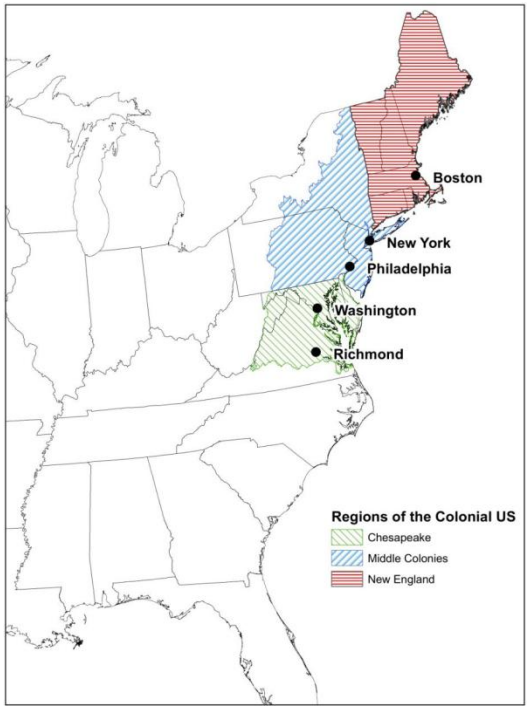
- Dimensions of Biodiversity
  - ***NSF China co-funder***
- Water Sustainability and Climate
  - ***USDA co-funder***
- Ocean Acidification
- Regional and Decadal Earth System Modeling
  - ***Dept. of Energy and USDA co-funders***
- Climate Change Education
- Research Coordination Networks
- Dynamics of Coupled Natural & Human Systems

~ $158M 2-year investment

Research Example – *Earth Systems Modeling*

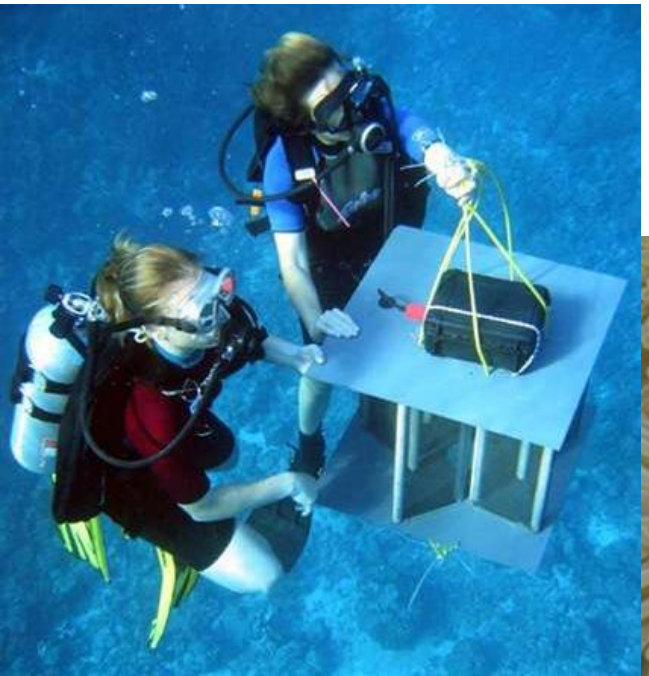
- Studying links among human and ecological systems
- Improving ability to forecast implications of planning decisions on environment, energy use, economy

Regional Earth System Model of the Northeast Corridor: Analyzing 21st Century Climate and Environment. PI, Charles J. Vorosmarty CUNY City College. Co-funded by the Department of Energy, Office of Science.



Research Example – *Ocean Acidification*

- Effects of ocean acidification on corals and other calcifying organisms
- How to sustain healthy coral reefs when oceans are acidifying



The effects of ocean acidification on the organismic biology and community ecology of corals, calcified algae, and coral reefs. Peter Edmunds and Robert Carpenter of California State University at Northridge

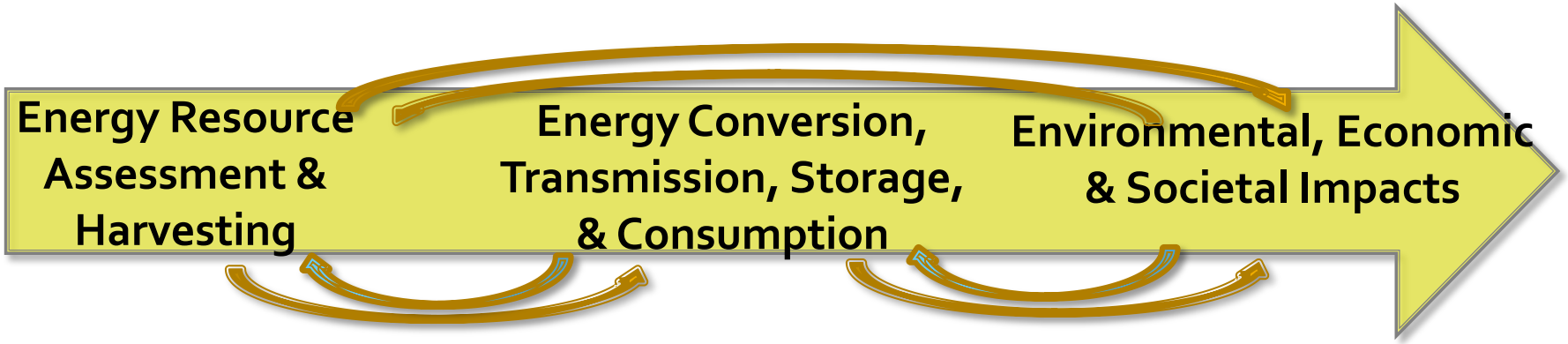
FY 2012 SEES Activities

- Sustainability Research Networks
- Sustainable Energy Pathways
- SEES Fellows
- SEES focus in Partnerships for International Research and Education (PIRE)
- Arctic regions ("ArcSEES")

Estimated $157M NSF investment

Sustainable Energy Pathways

- Sustainability - from Resource to Realization
- Interdisciplinary and System Approach
- Addresses Science and Engineering Challenges
- Informed by Environmental, Societal, Economic Aspects



SEES Fellows - Workforce Development

- Interdisciplinary, research partnerships, professional development
- >180 proposals, 20 awards, ~$9M, 10 new grads, 6 PhDs since 2010. (pending final approvals)

Selected topics of recommended support

- Atmospheric water transport
- Soil sustainability
- Food security
- Shale-gas resources
- Biodiversity
- Wastewater treatment
- Energy infrastructure
- Resilience of coastal ecosystems
- Biogeochemical cycling
- Agricultural greenhouse gas emissions
- Biological control agents
- Impacts of urbanization
- Natural resource management

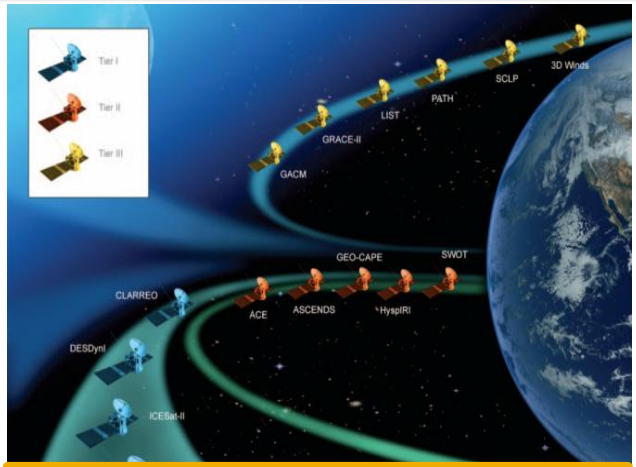
Future SEES Focus Areas

- Hazards, Vulnerability and Resilience
- Coastal Zone Systems
- Information Science and Engineering
- Chemistry, Materials and Engineering

FY13 Budget Request: $202.5M

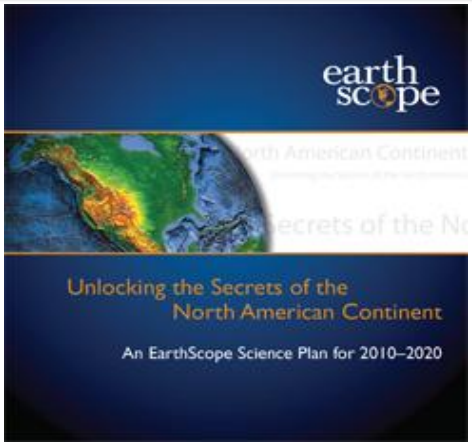



Era of Observation and Simulation



Satellites

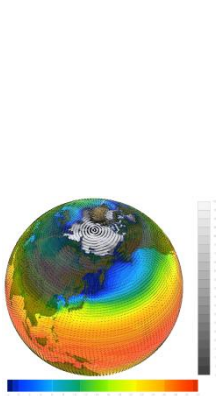
Arctic Sea Ice

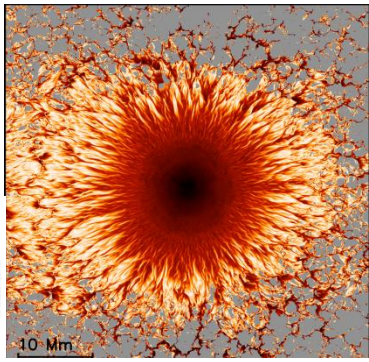


EarthScope Observatory Network

National Ecological Observatory Network (NEON)

Oceans

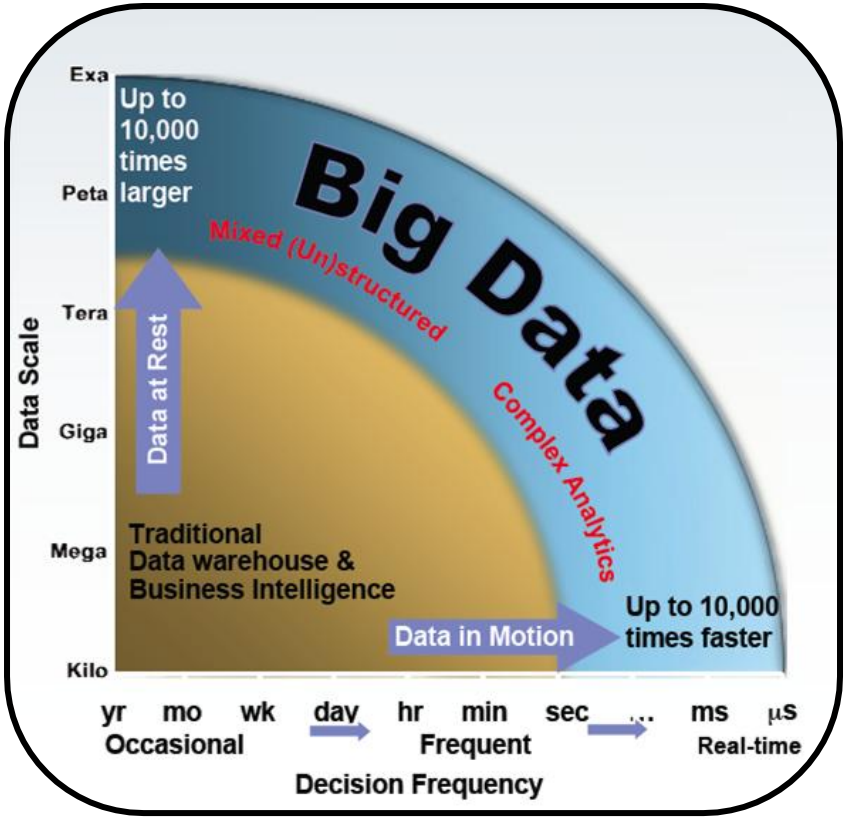




Earth System Modeling

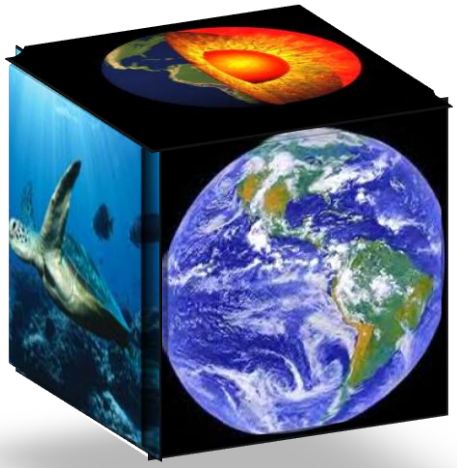
Science and Society Transformed by Data

- Sustainability Science and Engineering
  - Data- and compute-intensive
  - Integrative, multi-scale
- Multi-disciplinary Collaborations To Address Complexity
  - Individuals, groups, communities
- Sea of Data
  - Age of Observation
  - Distributed, central repositories, sensor- driven, diverse
  - Open access and data citation

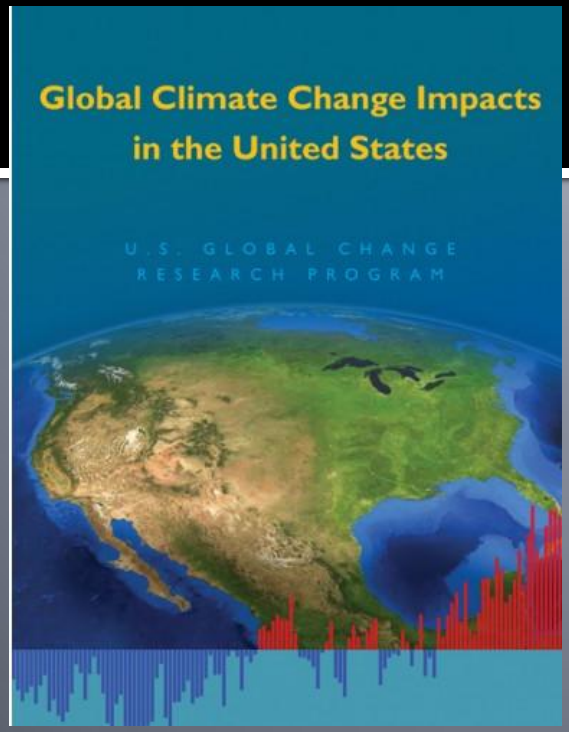


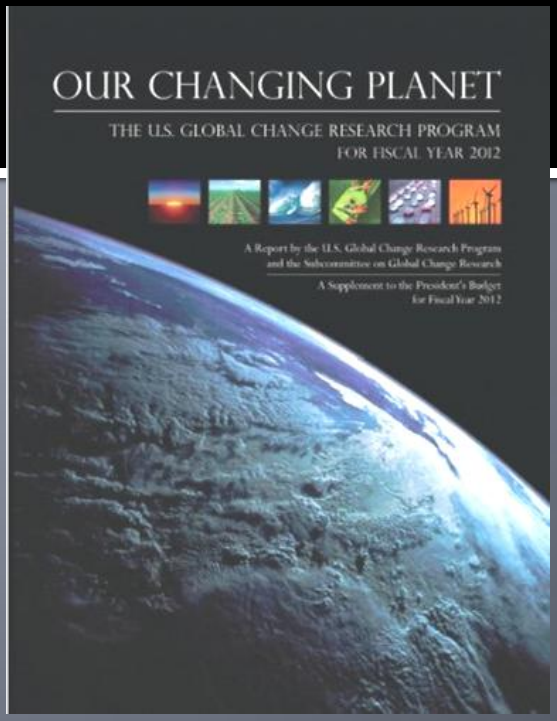
EarthCube – Not Just More, But Different

- >900 expert participants on social media site
- >100 white papers with designs, requirements, use case examples on line with discussion threads
- First awards underway: total ~$2M; next year >$20M
- Community designed, community owned, community governed
- An open cyberinfrastructure, envisioning a 10-year building effort



Interagency Partnerships





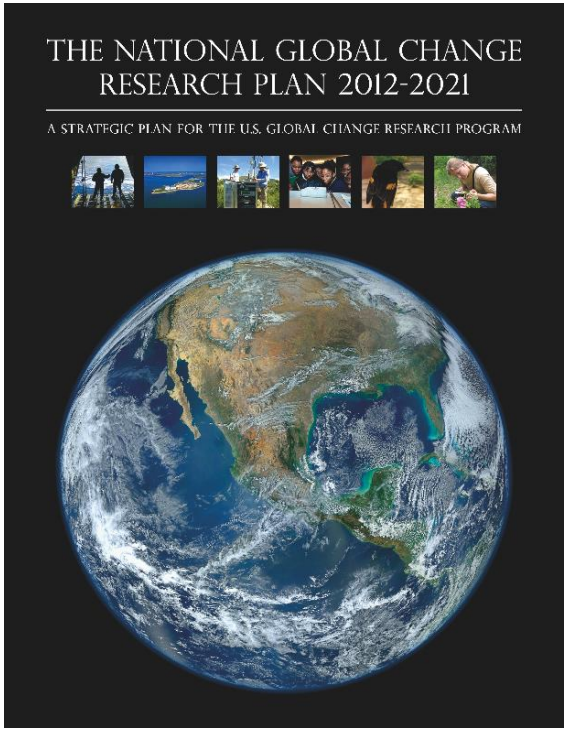
United States Global Change Research Program (USGCRP)

Vision - "A nation, globally engaged and guided by science, meeting the challenges of climate and global change."

Mission - "To build a knowledge base that informs human responses to climate and global change through coordinated and integrated federal programs of research, education, communication, and decision support."

13 agency, $2.6B investment

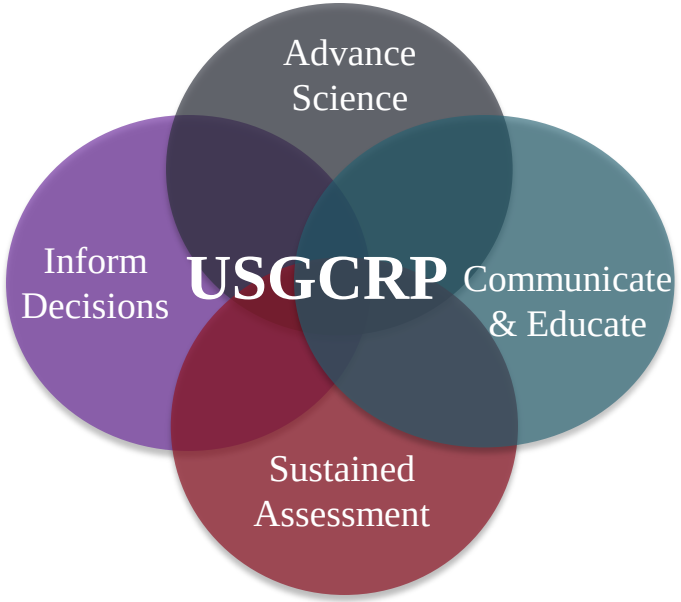
USGCRP Decadal Strategic Plan



- Released April 27, 2012
- Outlines how program will advance fundamental, use-inspired research
- Provides:
  - Direction for USGCRP for next ten years
  - Guidance for USGCRP to be an integrated "end-to-end" program
  - Links Program's vision and mission to its goals and outcomes
- Emphasizes:
  - Human-natural systems
  - End-to-end science: from basic research to decision support

Strategic Plan Characteristics

Strategic Plan goals provide the framework to implement USGCRP's Vision and Mission



Current Strategic Plan Outline

I. Introduction

II. Vision and Mission

III. Goals and Objectives

- Goal 1 - Advance Science
- Goal 2 - Inform Decisions
- Goal 3 - Sustained Assessments
- Goal 4 - Communicate and Educate

IV. International Cooperation

V. Implementation Planning

International Partnerships

ipcc

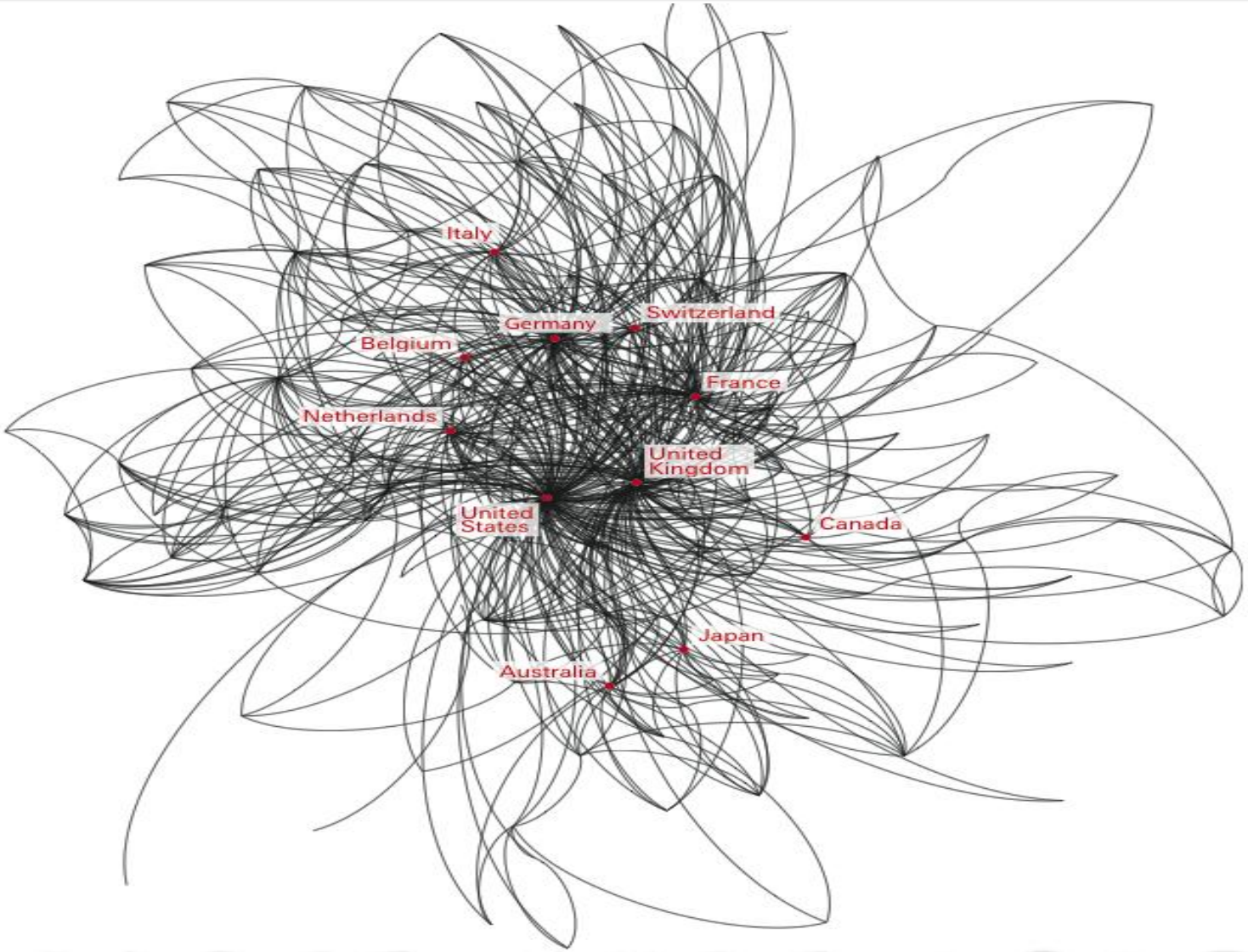
WCRP World Climate Research Programme

Earth System Science Partnership

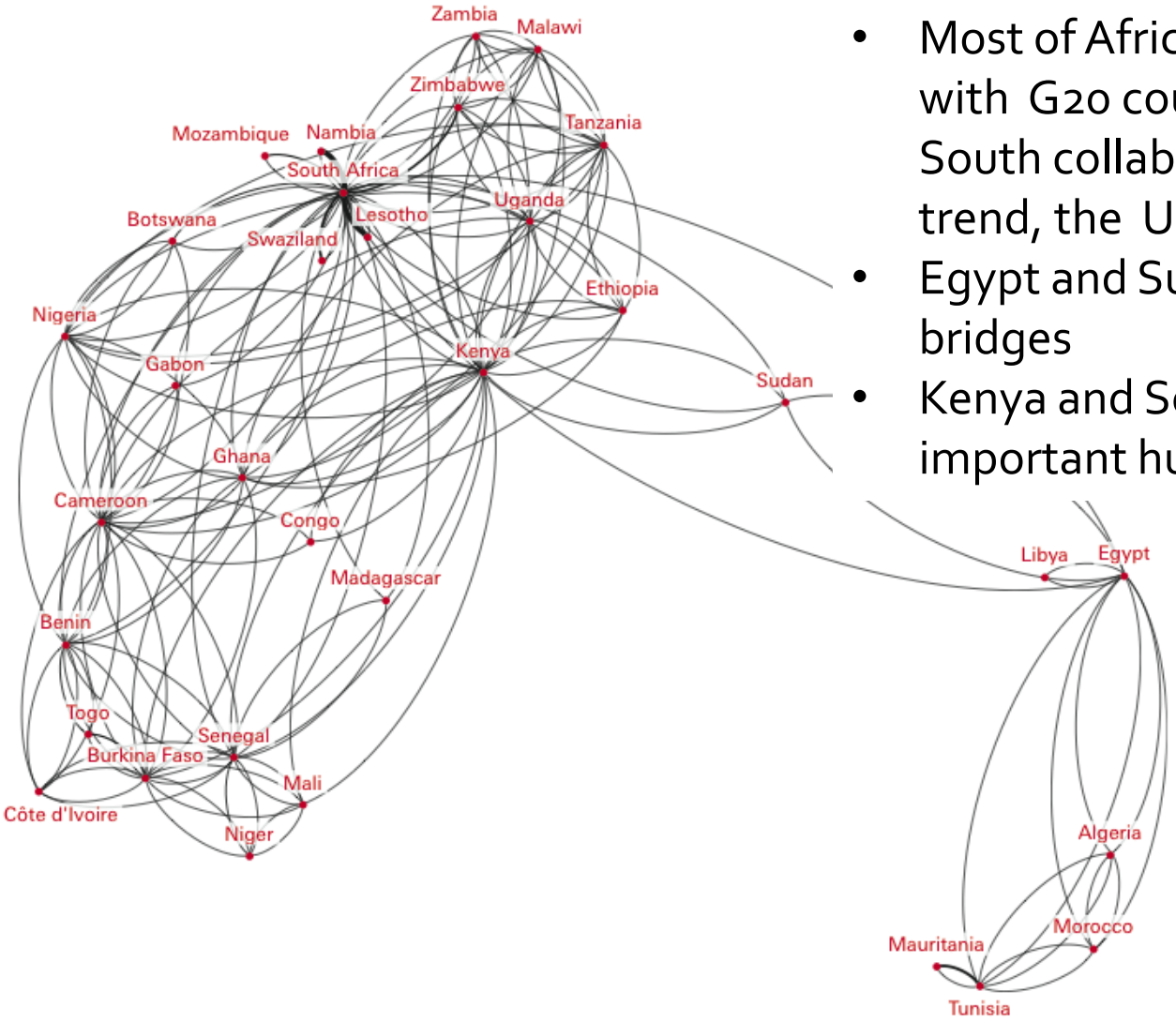
ICSU International Council for Science

IGFA

International Partnerships
Who is Collaborating with Who?



What about the developing world?



- Most of Africa's collaboration is with G20 countries, but South-South collaboration is a growing trend, the US could amplify.
- Egypt and Sudan - important bridges
- Kenya and South Africa - important hubs

Belmont Forum - Current Membership

- Australia
- Austria
- Brazil
- Canada
- China
- European Commission
- France
- Germany
- India
- Japan
- Norway
- Russia
- South Africa
- United Kingdom
- United States
- ***International Council for Science (ICSU)***
- ***International Social Sciences Council (ISSC)***

Belmont Challenge

To deliver knowledge needed for action to mitigate and adapt to detrimental environmental change and extreme hazardous events.

- advanced observing systems
- risks, impacts and vulnerabilities assessments
- regional and decadal analysis and prediction
- Inter- and transdisciplinary research
- integration and coordination mechanisms

BELMONT FORUM

International Opportunities Fund

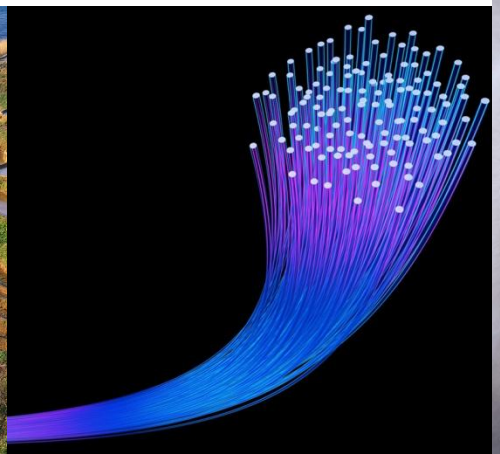
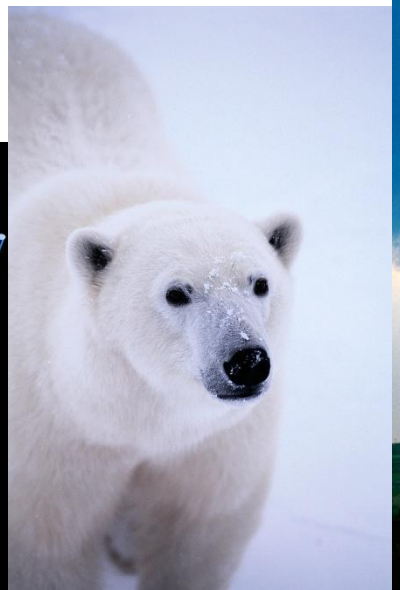
- Single call for proposals – April 2012
- First round Thematic Foci:
  Coastal Vulnerability & Freshwater Security
  - Synergies in Coastal Vulnerability Theme with planned EC FP7 Programme (>$20€) and NSERC CCAR programme
- Joint with G8 Heads of Research Councils (HORCs)
- Commitment from 11 countries



Belmont Forum - Collaborative Research Actions

2013/14 Priorities (under discussion)

- Food security and energy usage - (Brazil)
- Arctic Science - (Canada)
- Rural to urban transition (Japan)
- Data fusion and cyberinfrastructure (US)


ICSU
International Council for Science

BELMONT FORUM

ISSC
international social science council

IGFA
International Group of Funding Agencies for Global Change Research

An International Alliance to Create a 10-year Earth System Global Sustainability Initiative

UNESCO

UNITED NATIONS UNIVERSITY
ACADEMIC ARM OF THE UNITED NATIONS

UNEP

Alliance's *Future Earth*

International research community, funders, operational service providers, and users of global environmental change science.

- **Current Members** – Belmont Forum, ICSU, ISSC, UNEP, UNESCO, UNU

Goal: "Establish a joint strategy and work together on common priorities that create and use knowledge societies need to adapt and mitigate to hazardous global environmental change."

Alliance – Future Earth
New Conceptual Framework

- Governance - international, multi-sectoral partnership
- Collaborative Research
- Building, Enhancing Capacity in Developing Countries
- Emphasis on regional networks
- Next Generation Sustainability scholars
- Enhanced mechanisms for transnational funding

Future Earth: Critical Endeavors

- A trans-disciplinary enterprise co-designed in an alliance
- Reorganizing international global environmental change research structure, and way of doing research
- Step change in research funding and coordination
- Integrating understanding of how the Earth system works with finding solutions for a transition to global sustainability

Towards a Sustainable Future…

A sustainable world is one in which human needs are met without harm to the environment, and without sacrificing the ability of future generations to meet their needs.

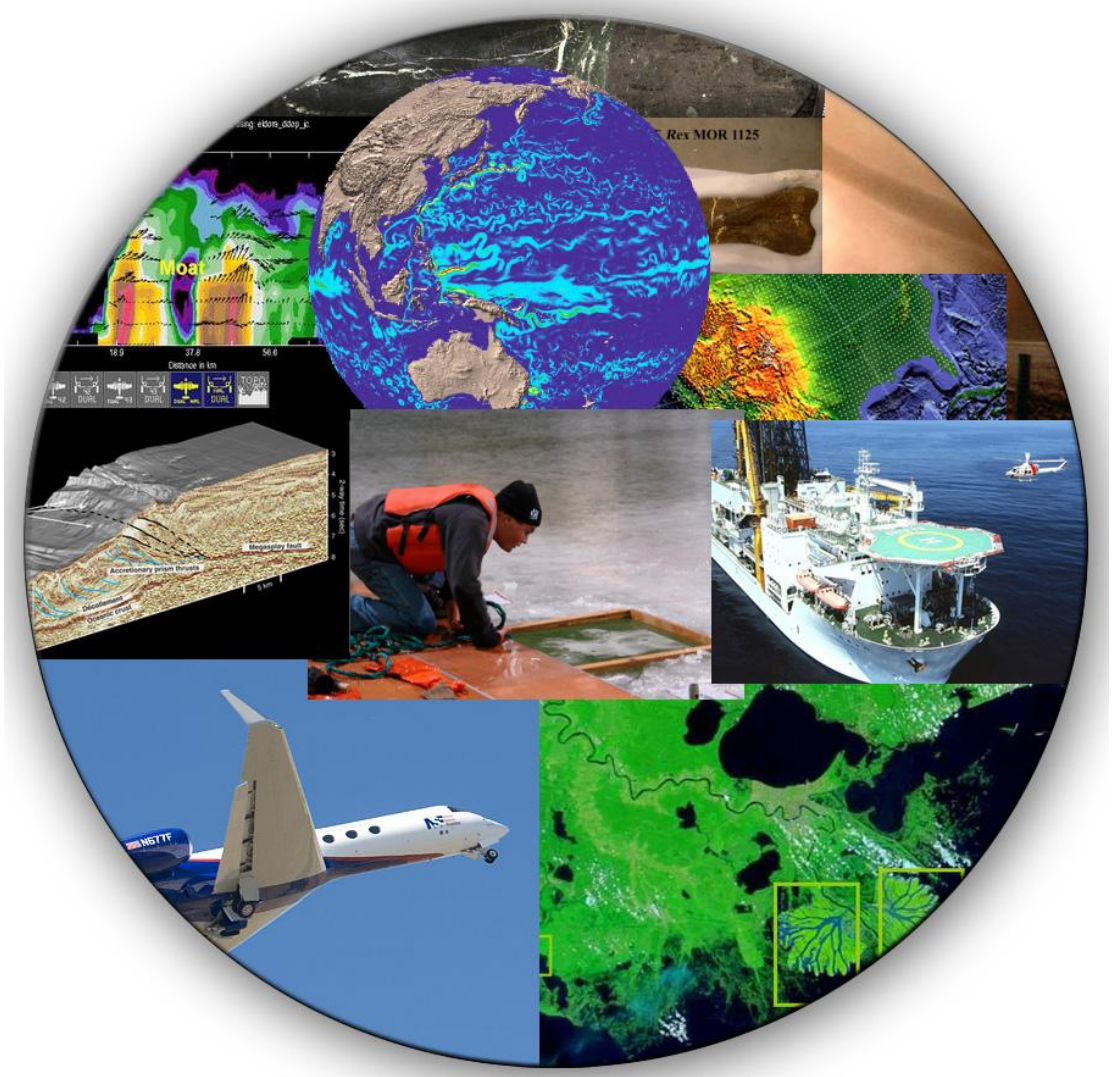
www.nsf.gov/sees

Why do we scientists and engineers do this?

"Nature intended me for the tranquil pursuits of science, by rendering them my supreme delight. But the enormities of the times in which I have lived have forced me to commit myself on the boisterous ocean of political passions."

-Thomas Jefferson,
In retirement

Thanks


Moat
Distance in km
Rex MOR 1125
Megasplay fault
Accretionary prism thrusts
Décollement
Oceanic Crust
N577F