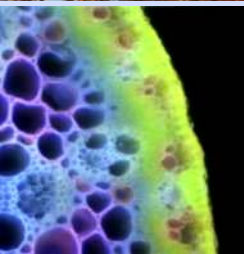


Regional and Global Climate Modeling

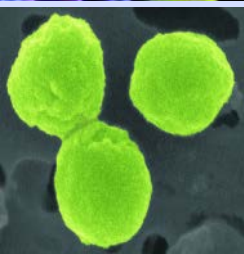


Renu Joseph

Climate Earth System Modeling Program
CESD, US DOE



DOE's Integrated Climate Modeling Meeting
September 20, 2011



U.S. DEPARTMENT OF
ENERGY

Office of Science

Office of Biological
and Environmental Research

The Science That We Focus on...

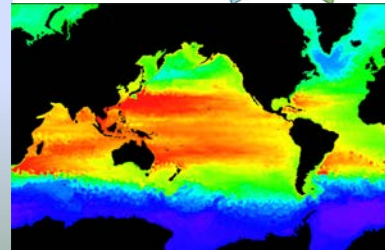
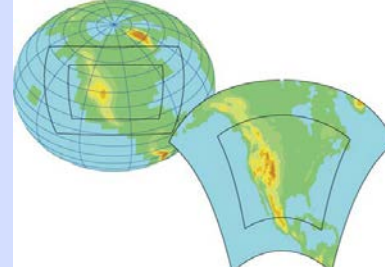
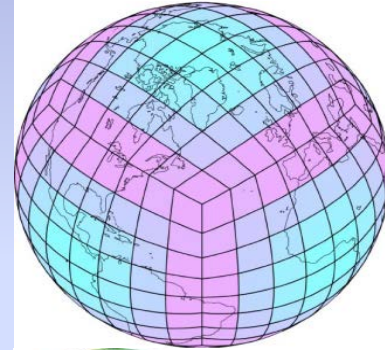
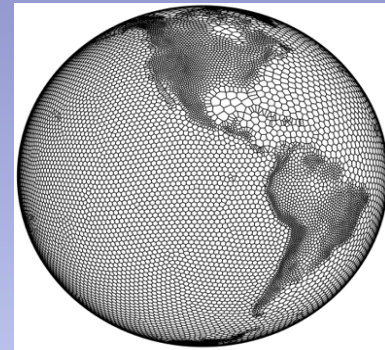
And Why?

Regional

- High Resolution Modeling to obtain reliable climate predictions/projections to enable us to understand climate and energy impacts and interactions at regional scales
- Focus on regions vital for assessing future climate
 - (e.g., Arctic, Tropics)

Regional and Global

- Model Analyses to improve our understanding of the climate system including
 - Distinction between natural variability and anthropogenic climate change
 - Extreme event representation and attribution
 - Understanding the feedbacks and interactions between processes within the climate system
- Quantification of the uncertainties and feedbacks in the climate system to understand how reliable the projections/predictions are



How we get there...

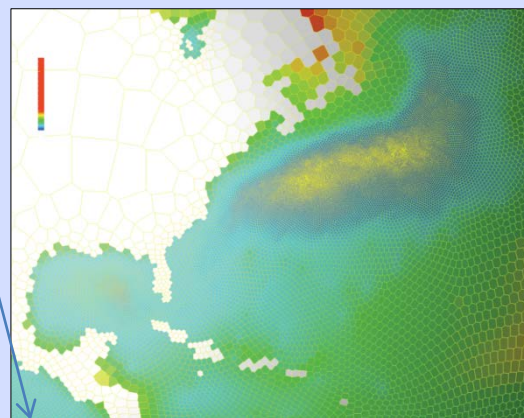
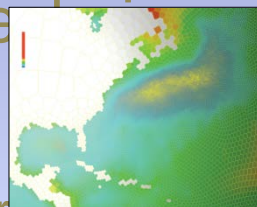
- Model development
 - High resolution and Scale Aware Modeling
 - Arctic System Components
- Evaluation/Intercomparison of techniques
- Model Diagnostics
 - Global Model intercomparison efforts
 - Development of Metrics
 - Quantification of Model Uncertainties
 - Projects on Extremes
 - Detection and Attribution efforts
 - Feedbacks within the Natural system
 - Development of Testbeds
- Model and observational data dissemination

How we get there...

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 - High resolution and Scale Awareness
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High Resolution Model Development:

- Model Prediction Across Scales(LANL: COSIM) efforts
- University Projects through the SciDAC solicitation with the ESM program



How we get there...

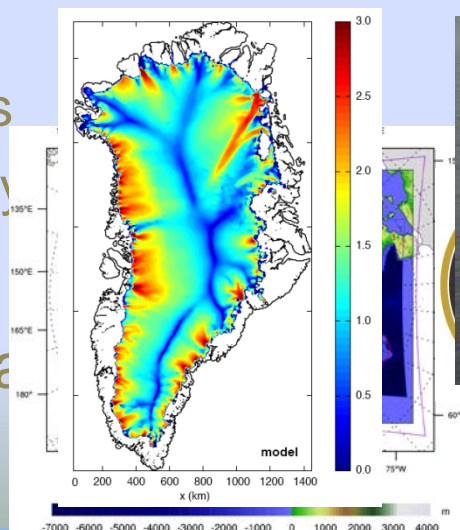
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Arctic Model Development:

- Permafrost modeling efforts (University Projects through the SciDAC solicitation of ESM program)
- Sea and Land Ice Model (LANL COSIM);
- Regional Arctic System Model (Large Collaborative Project)



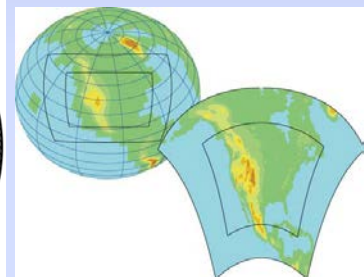
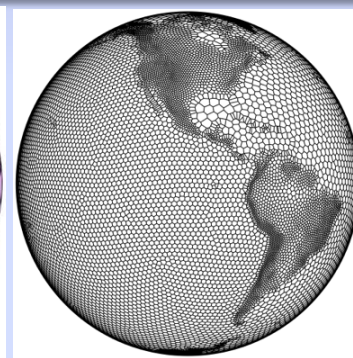
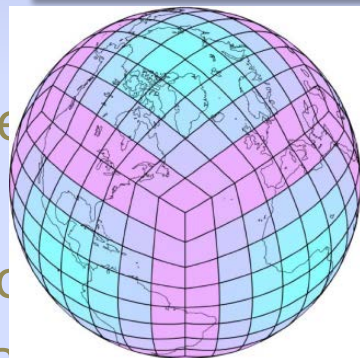
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Frameworks for Robust Regional Climate Modeling

(PNNL, LANL, LBNL, ORNL)

- Utilize a suite of techniques ranging from idealized dynamics-only experiments to fully coupled simulations, to evaluate robustness of regional climate.
- Focusing on capturing hydrology right in North and South America



How we get there...

- **Model development**
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PCMDI - Scientific leadership of “community modeling” activities (e.g., AMIP, CMIP)

UCAR - Through the leadership provided in the WGCM

How we get there...

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LLNL - Development and application of “broad brush” climate model performance metrics

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PCMDI - Scientific leadership of “community modeling” activities (e.g., AMIP, CMIP)

LLNL - Development and application of “broad brush” climate model performance metrics

NCAR - Through the leadership provided in the WGCM

University projects funded through the solicitation on Modes of Variability

- Focused on Modes of Variability
- Extremes
- Understanding Uncertainties

Decadal and Regional Climate Prediction using Earth System Models (EaSM)



How we get there...

- **Model development**
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PCMDI: Climate change detection and attribution research

Annual joint solicitation with NOAA's Climate Observations and Monitoring Program



International detection and attribution group

Lab projects funded through a solicitation

- Cloud Climate Feedbacks (LLNL)
- Carbon-Cycle Climate Feedbacks (ORNL, LANL, LBNL)

UCAR: D & A, Modes of Variability

PCMDI: CAPT project (Cloud Associated Project Testbed)

PCMDI: Leadership of software development and infrastructure support for "community modeling" activities - **ESGF**

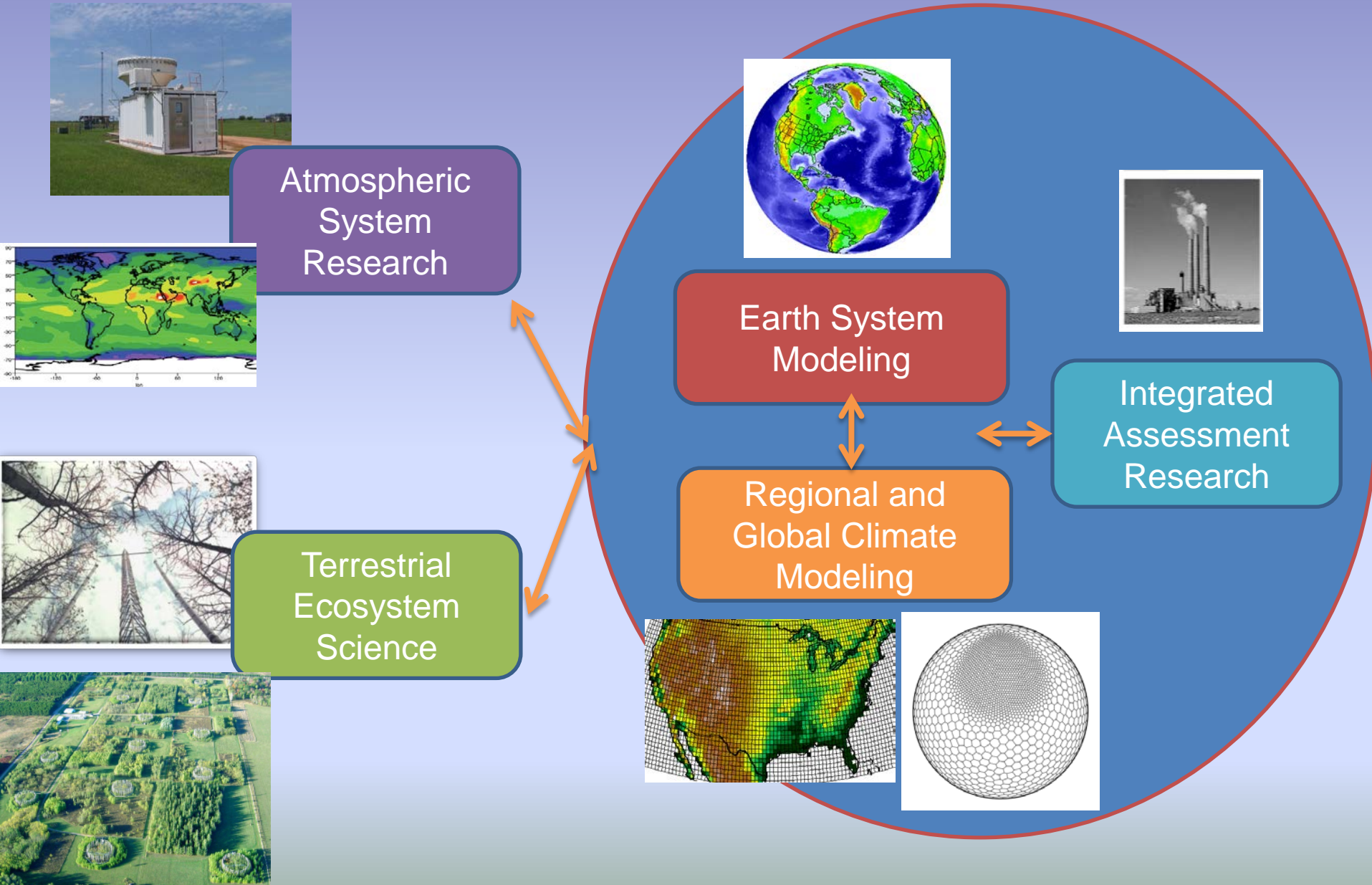
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Facilitated through...

- Peer-reviewed Solicitations
 - Universities
 - Labs
- SFA's
- Cooperative Agreements
- Inter-Program Activities within CESD

Inter Program Linkages within CESD



Facilitated through...

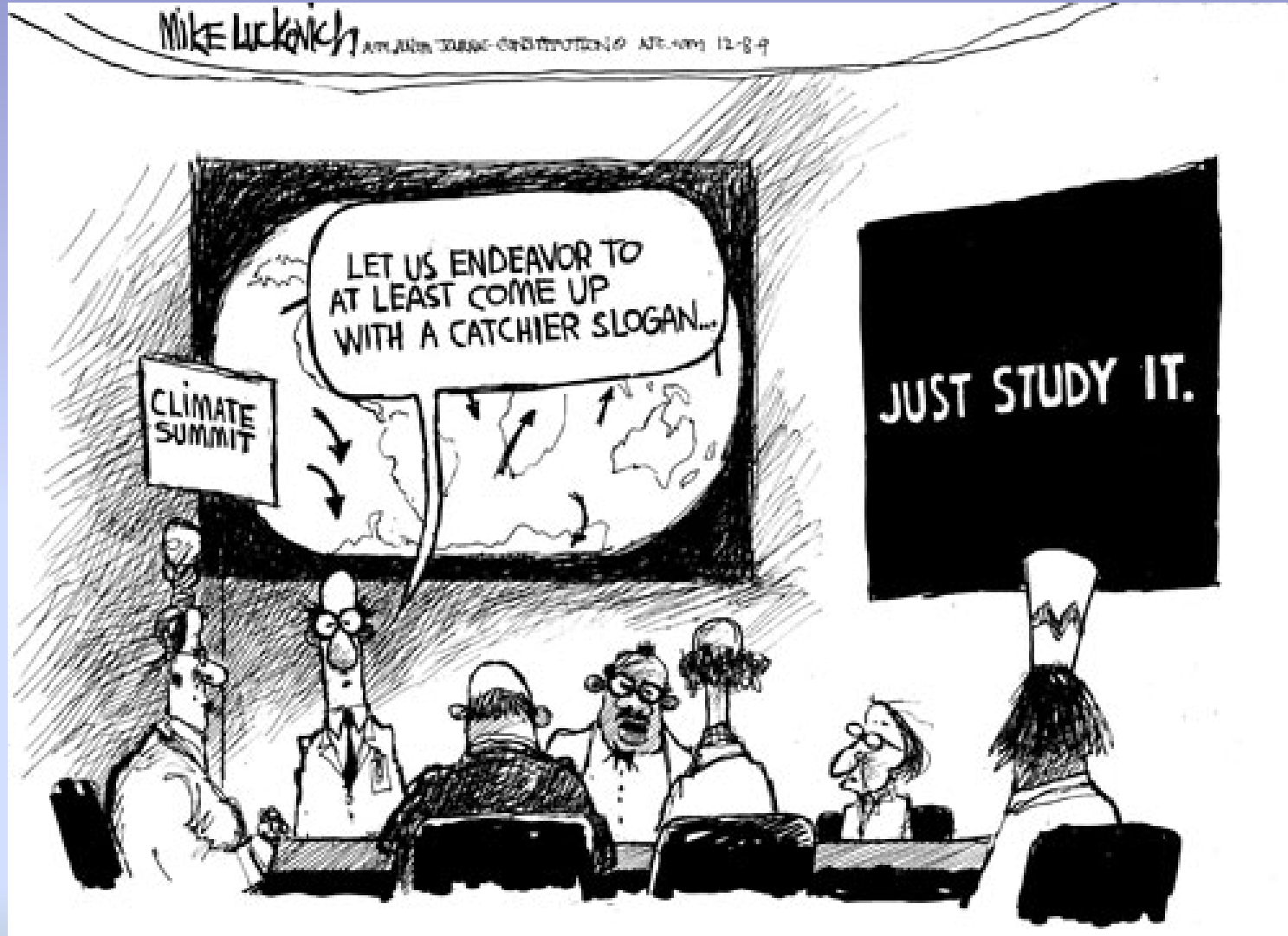
- Peer-reviewed Solicitations
 - Universities
 - Labs
- SFA's
- Cooperative Agreements
- Inter-Program Activities within the CESD
- Interagency cooperation
- Participation in strategic planning efforts (includes interagency, and inter-program efforts)

What we need from you...

- Communicate results
 - Research highlights
 - Accomplishments & successes
 - Website <http://climatemodeling.science.energy.gov/>



Without your input....



What we need from you...

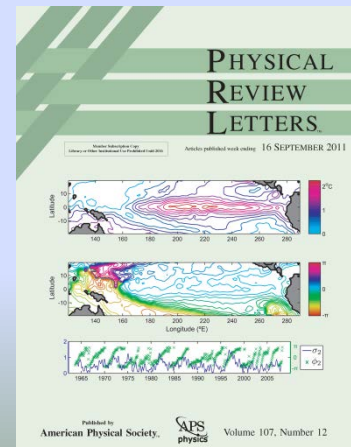
- Communicate results
 - Research highlights
 - Accomplishments & successes
 - Website <http://cmscidev.pnl.gov/>
- Acknowledge DOE funding source

Our program's success depends on you and your success!



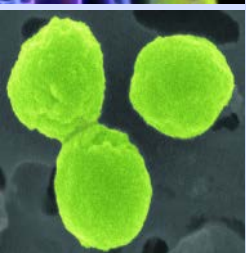
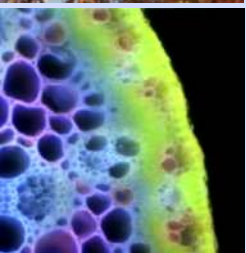
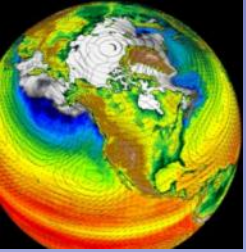
Achievements...

- National Medal of Science
 - Warren Washington
- Elected to US National Academy of Sciences
 - Ben Santer
- AMS Fellow 2011
 - Xubin Zeng
- AGU Fellow 2011
 - Ben Santer
- AMS Nicholas Fofonoff award
 - Annalisa Bracco
- AGU Roger Revelle Medal
 - Jorge Sarmiento
- Fellow of the Geological Society of America
 - Slawek Tulaczyk



Computing Resources

- National Energy Research Scientific Computing (NERSC)
<http://www.nersc.gov/>
 - 2012 Call for Proposals typically ~ August
 - Allocation period is typically the calendar year
- The Innovative and Novel Computational Impact on Theory and Experiment (INCITE)
<http://hpc.science.doe.gov/>
 - 2012 Call for Proposals typically ~ August
- ASCR Leadership Computing Challenge (ALCC)
<http://science.energy.gov/ascr/facilities/alcc/>
 - 2012 allocation for applications from Sept '11 to February '12



Questions?

Regional and Global Climate Modeling

What: Development, evaluation and application of Regional and Global Climate Models to understand high resolution patterns and causes of climate change

Why: Need to understand climate variability and change as evidenced in model projections; need to provide feedback on improving model components and coupled system to model developers

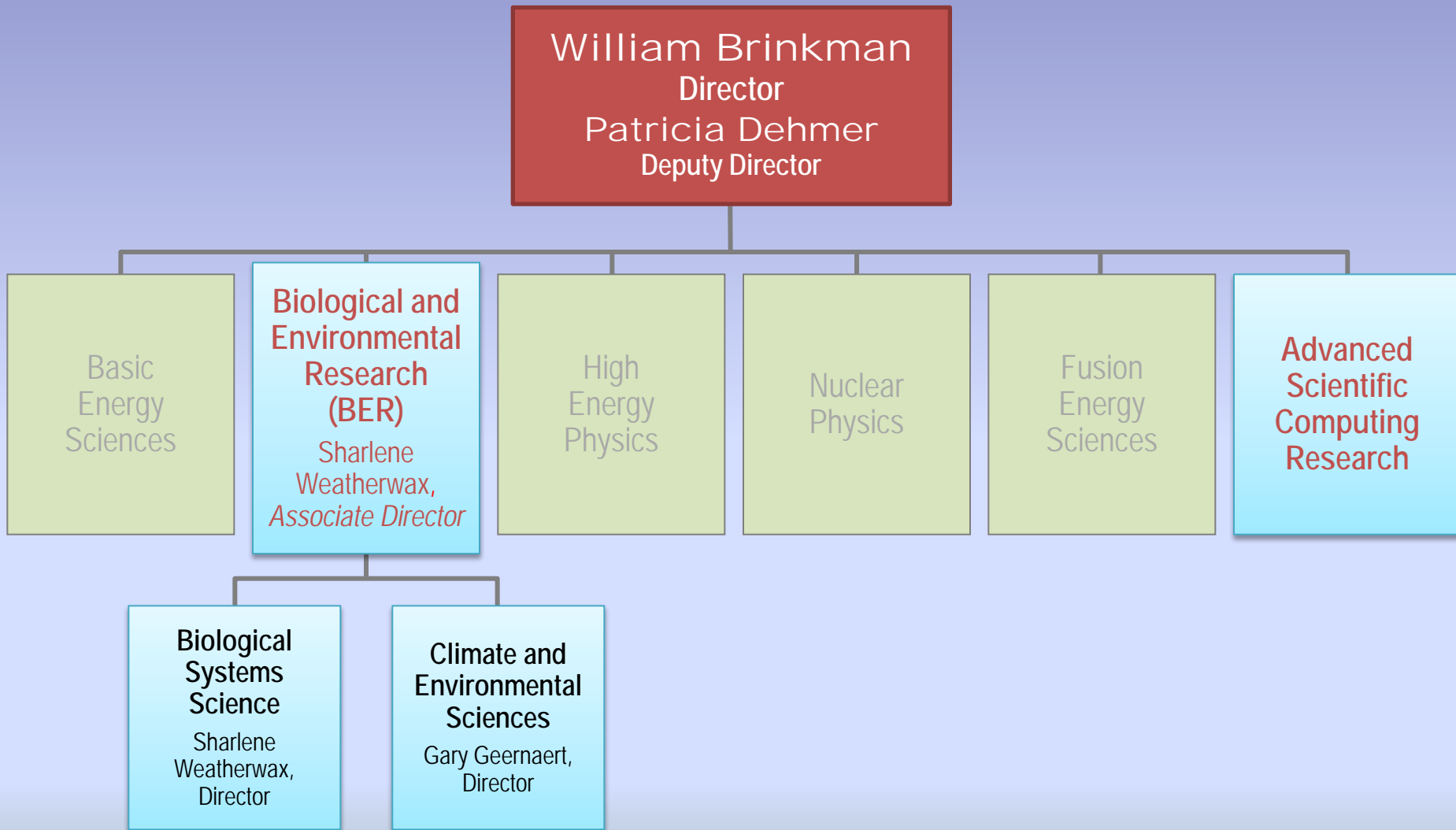
DOE Niche:

- High resolution eddy-resolving ocean modeling
- metrics for evaluation of climate models
- detection and attribution
- model output data management and dissemination

Collaborations: NSF, NOAA & USDA

If successful, impact: Credible scientific input to decision makers at a local scale.

Department of Energy Office of Science



Climate and Environmental Sciences Division

