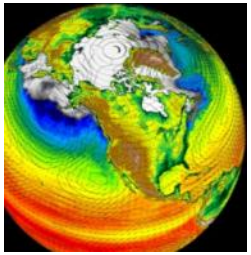
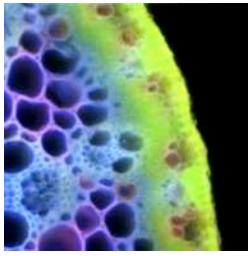
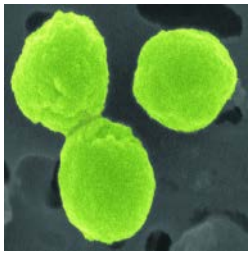


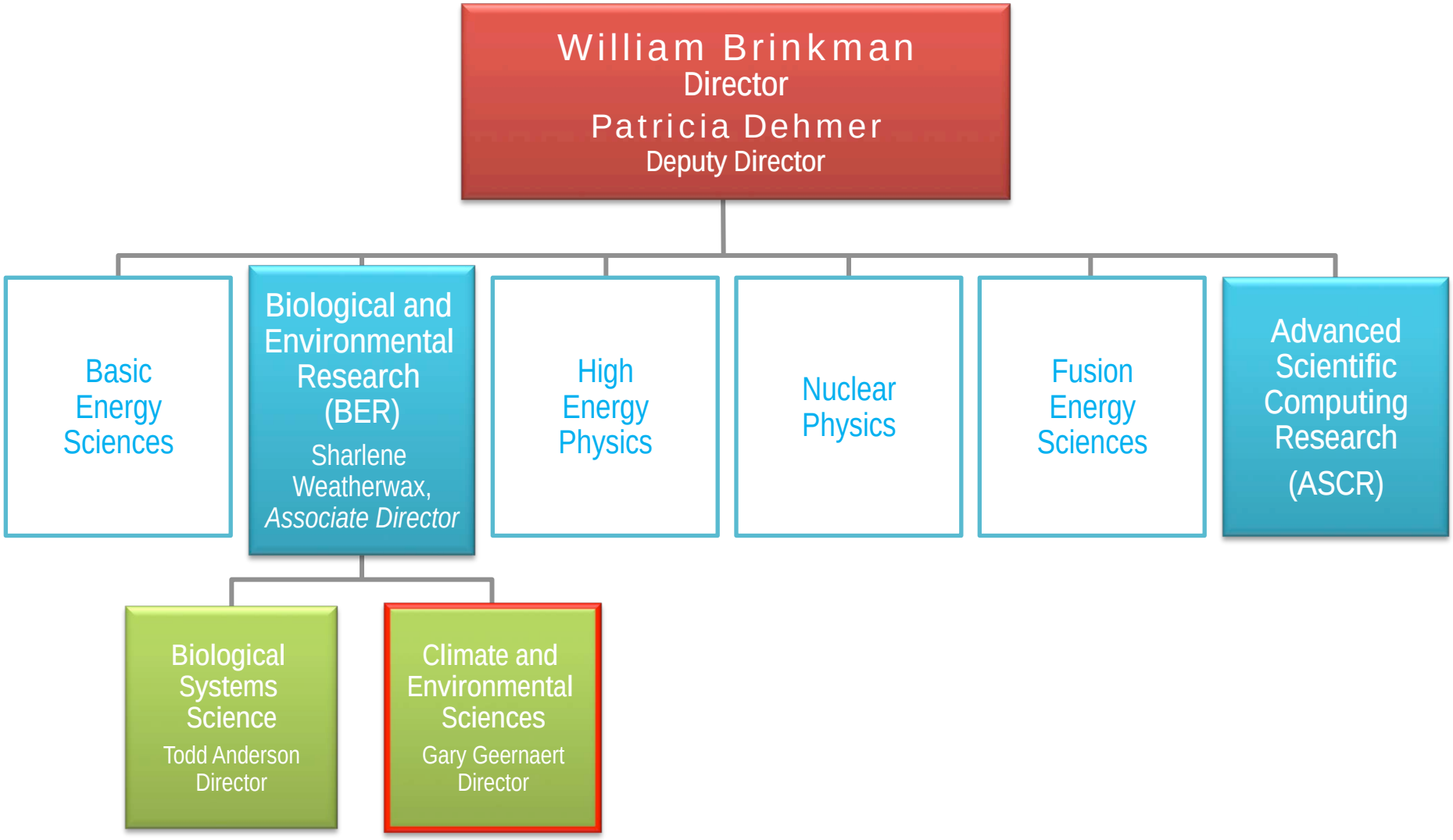




SciDAC BER Climate Modeling

Dorothy Koch

Earth System Modeling
Climate and Environmental Sciences Division
Biological and Environmental Research

Department of Energy Office of Science



Climate and Environmental Sciences Division

Gary Geernaert

Atmospheric Science

- Atmospheric System Research
- Atmospheric Radiation Measurement Facility

Climate and Earth System Modeling

- Earth System Modeling
- Regional & Global Climate Modeling
- Integrated Assessment

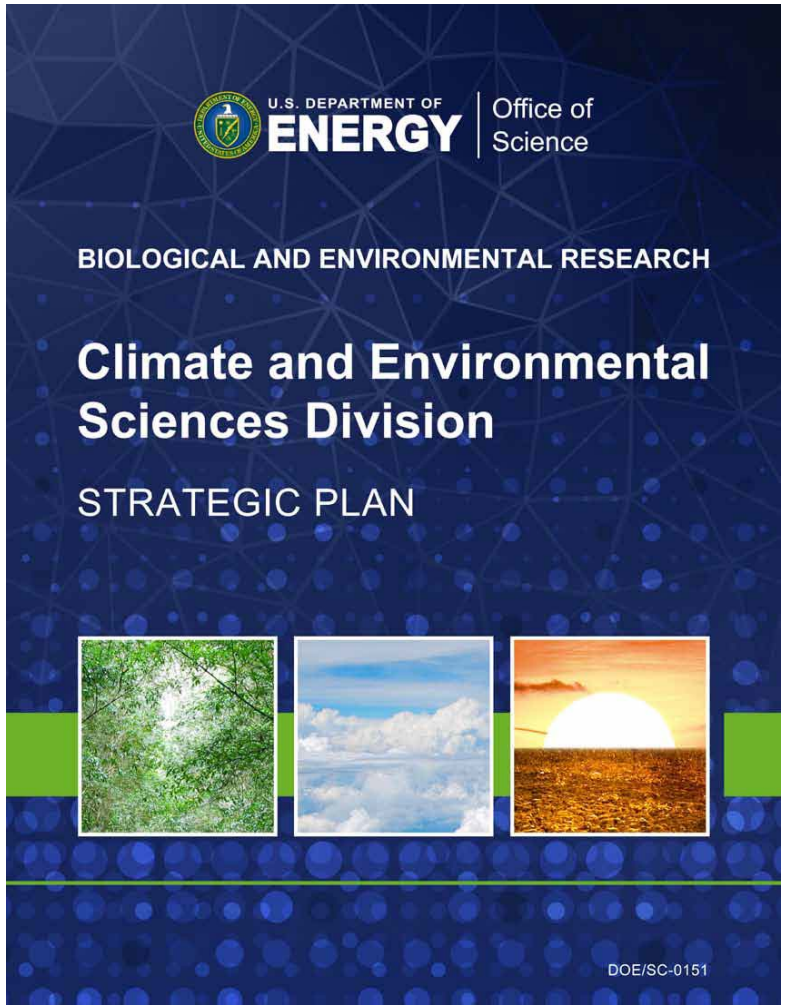
Environmental System Science

- Terrestrial Ecosystem Sciences
- Subsurface Biogeochemical Research
- Environmental Molecular Sciences Laboratory Facility

Mission: To advance a robust predictive understanding of Earth's climate and environmental systems and to inform the development of sustainable solutions to the Nation's energy and environmental challenges

CESD Strategic Plan is just released:
http://science.energy.gov/~/media/ber/pdf/CESD-StratPlan-2012.pdf
Goals:

1. **Synthesize new process knowledge and innovative computational methods advancing next generation, integrated models of the human-earth system.**
2. **Develop, test and simulate process-level understanding of atmospheric systems and of terrestrial ecosystems extending from bedrock to the top of the vegetative canopy.**
3. **Advance fundamental understanding of coupled biogeochemical processes in complex subsurface environments to enable systems-level prediction and control.**
4. **Enhance the unique capabilities and impacts of the ARM and EMSL scientific user facilities and other BER community resources to advance the frontiers of climate and environmental science.**
5. **Identify and address science gaps that limit translation of CESD fundamental science into solutions for DOE's most pressing energy and environmental challenges.**

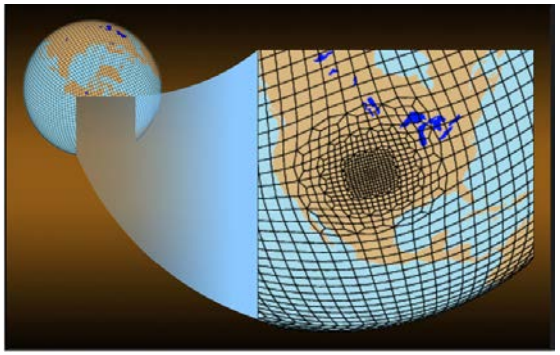


BER invests in the Community Earth System Model (CESM)

CESM is supported by NSF and DOE

DOE-BER builds *advanced codes* to run on DOE LC computers

ASCR partnership is crucial for our success!



Examples:

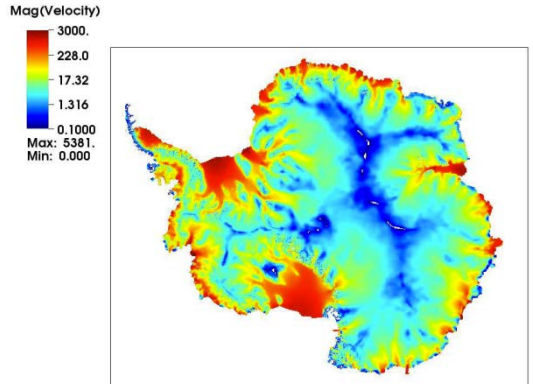
- **Very-high resolution climate simulation**

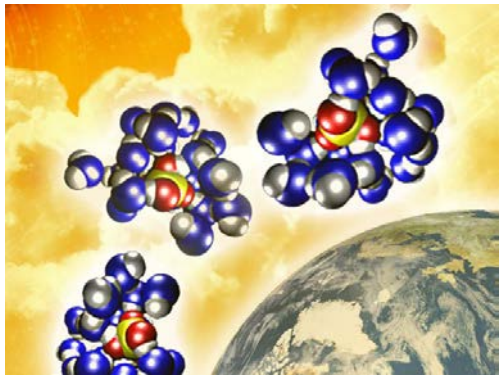
Adaptive-mesh dynamical cores:

- **Atmosphere: CAM-SE**
- **Ocean: MPAS**
- **Ice sheets: BISICLES**

Advanced tracers, atmospheric aerosols:

- **Aerosols: MAM (size and chemistry)**





SciDAC Announcement 11- 588, FY2012

DOE-Laboratory-led efforts (University-led efforts were solicited and funded in 2011) to:

• Develop physics and dynamics for atmosphere, ocean or ice sheets to run efficiently and accurately using high resolution or unstructured grids.

• Develop efficient and accurate schemes for simulating atmospheric or oceanic chemical or biogeochemical tracers.

Should include:

- UQ/V&V
- SciDAC Institute Partnerships

Panel of climate and computational experts convened January 18, 2012

3 Projects funded, 2011-2016

7M/yr (64% BER 36%ASCR)

SciDAC
Scientific Discovery through Advanced Computing

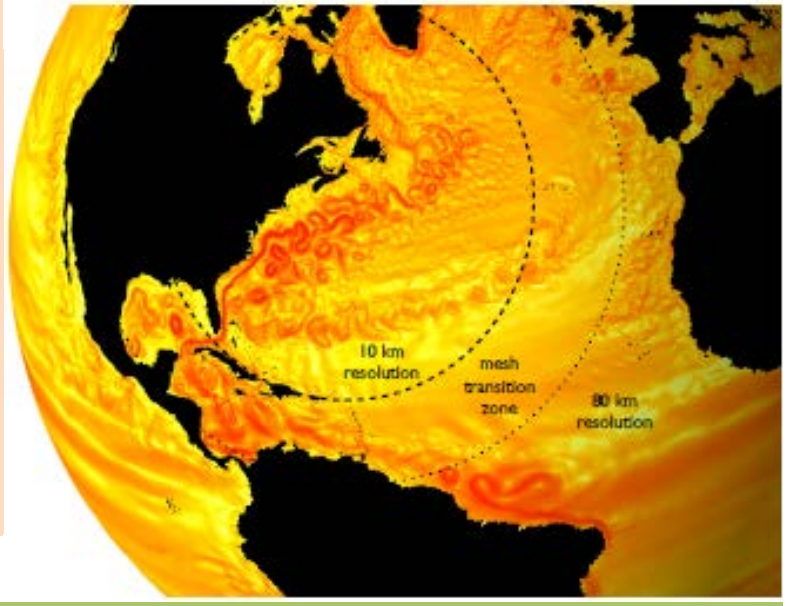
1. Multiscale Methods for Accurate, Efficient, and Scale-Aware Models of the Earth System

Bill Collins, PI

LBNL, LANL, PNNL, ORNL, LLNL, SNL, UCAR, UW-M, CSU, UCLA

Accurate and computationally efficient clouds, convection and eddies over resolutions from 2 to 1/16 degrees.

➢**Critical for use of adaptive mesh in atmosphere/ocean**



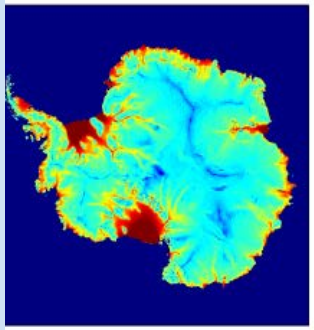
2. Predicting Ice Sheet and Climate Evolution at Extreme Scales (PISCEES)

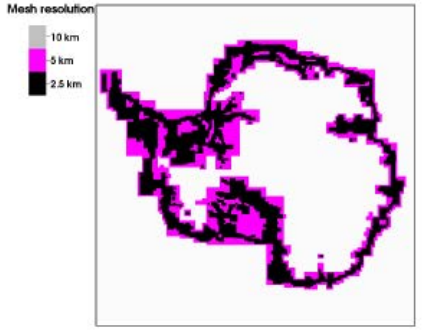
Steve Price (Bill Lipscomb) PI

LBNL, LANL, ORNL, SNL, UCAR, MIT, FSU, U-SC, UT-Austin

Develop two ice sheet dynamical cores:

1) finite-volume, structured, Chombo adaptive mesh
2) finite-element, unstructured MPAS mesh





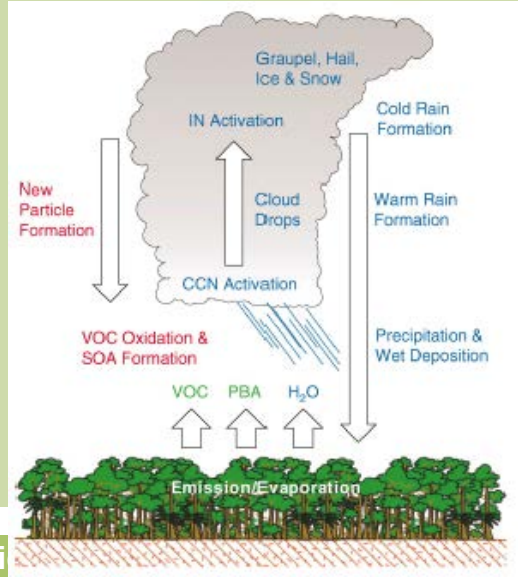
➢ **Critical for projecting sea-level rise**

3. Applying Computationally Efficient Schemes for BioGeochemical Cycles (ACES4BGC)

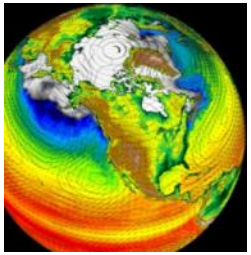
Forrest Hoffman, PI

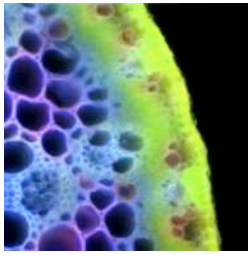
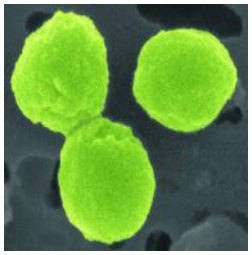
ORNL, SNL, LLNL, PNNL, LANL, ANL, UCAR

1) New tracer advection scheme
2) Improve organic emissions, chemistry



➢ **Critical for chemistry-climate interactions**



Thank you!

Dorothy Koch
Dorothy.Koch@science.doe.gov

http://www.climatemodeling.science.energy.gov/