

Climate and Environmental Sciences Division

G. L. Geernaert

Workshop on Community Modeling and Long-Term Predictions
of the Integrated Water Cycle. September 24 - 26, 2012



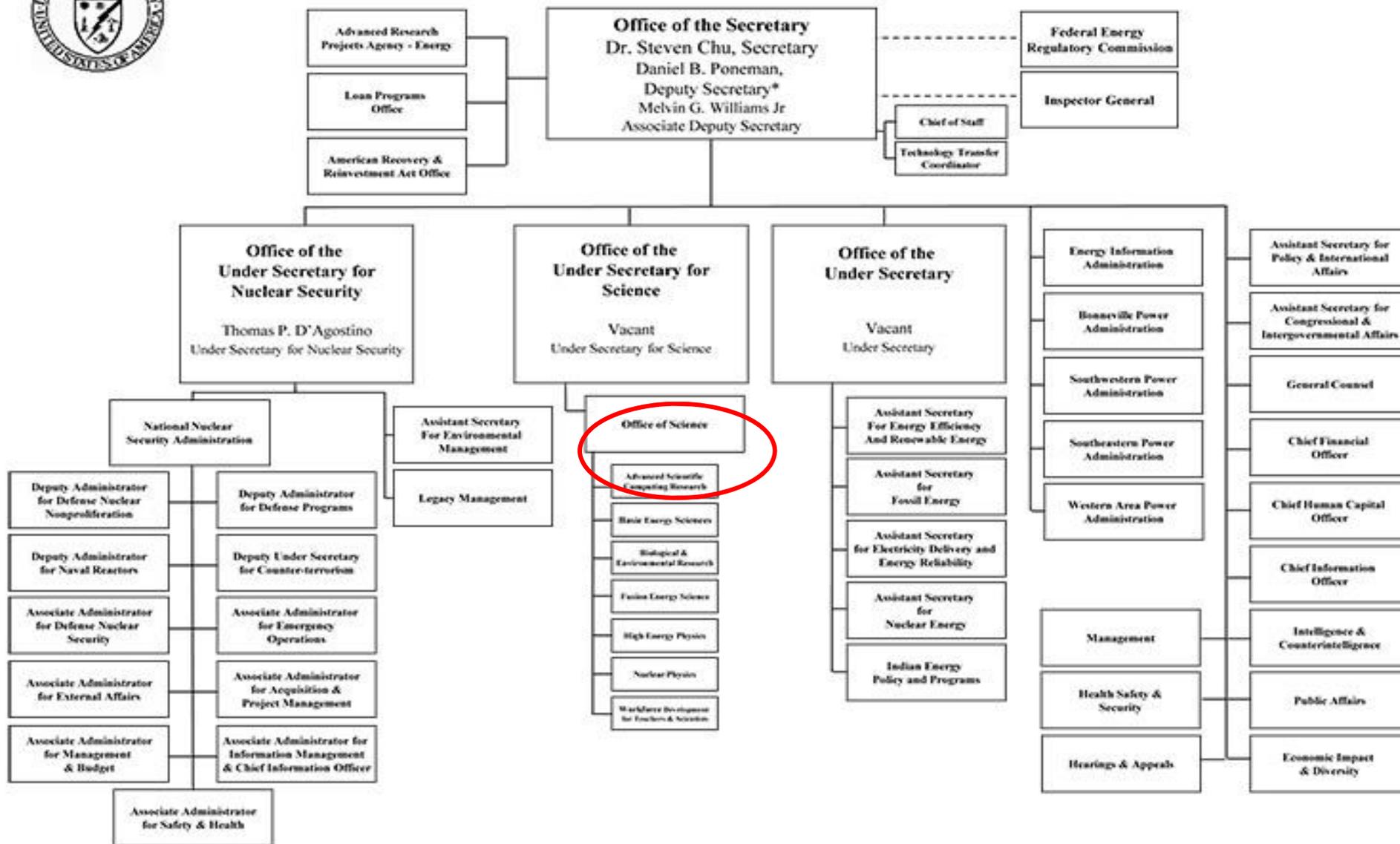
U.S. DEPARTMENT OF
ENERGY

Office of
Science

Office of Biological
and Environmental Research

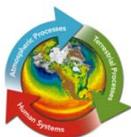


DEPARTMENT OF ENERGY

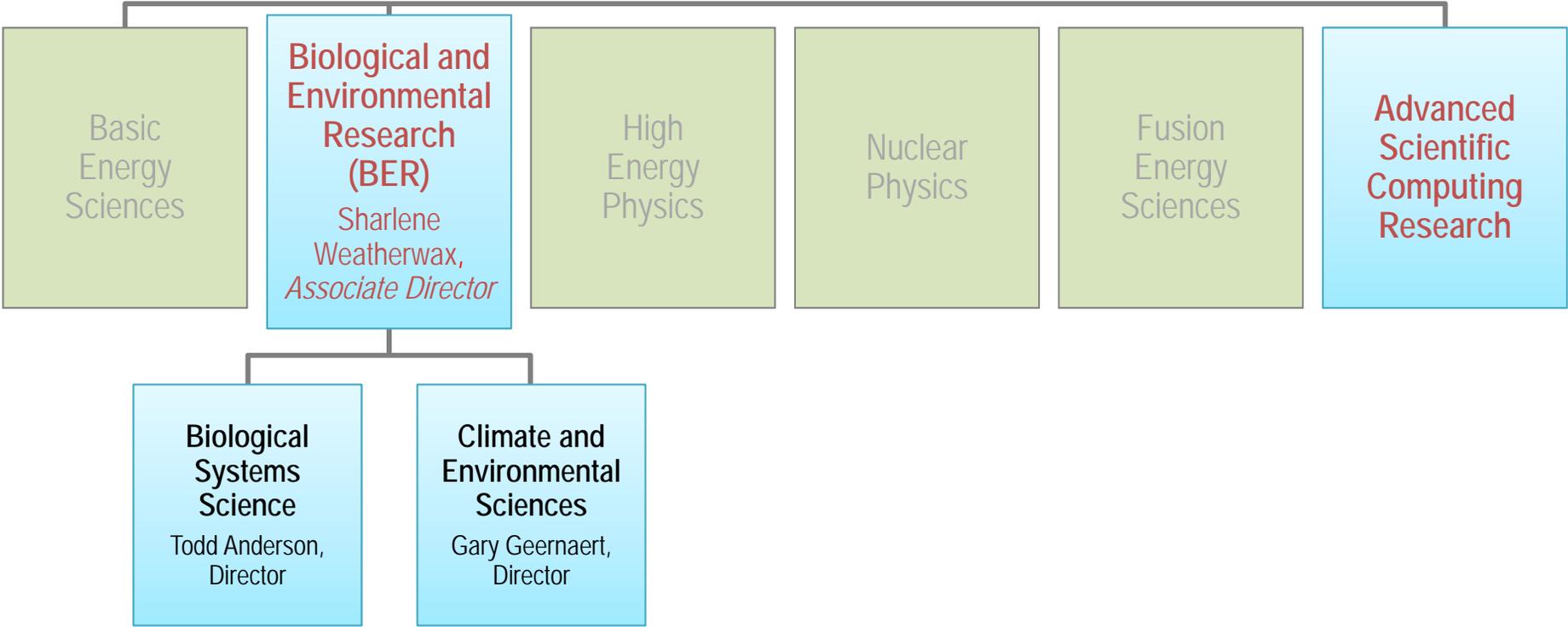


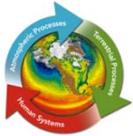
* The Deputy Secretary also serves as the Chief Operating Officer

06 Dec 11



William Brinkman
Director
Patricia Dehmer
Deputy Director





Climate and Environmental Sciences

Atmospheric Science

Atmospheric System Research
(Ashley Williamson)

Atmospheric Radiation Measurement Climate Research Facility
(Wanda Ferrell)



Climate and Earth System Modeling

Regional & Global Climate Modeling
(Renu Joseph)

Earth System Modeling
(Dorothy Koch)

Integrated Assessment
(Bob Vallario)



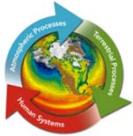
Environmental System Science

Terrestrial Ecosystem Science
(Mike Kuperberg, Dan Stover)

Subsurface Biogeochemical Research
(David Lesmes)

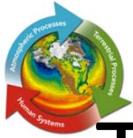
Environmental Molecular Sciences Laboratory
(Paul Bayer)





Division principles

- Science centric
- Products are “community-based”
- Scientific productivity and innovation efficient
- DOE mission relevance
- Maps to USGCRP priorities



Strategic Planning



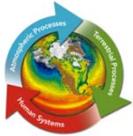
The Energy-Environment-Climate Nexus

Greenhouse gases are emitted during energy production...
and climate change will impact energy production

Building on our CESD mission:

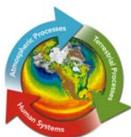
To advance a robust predictive understanding of Earth's climate and environmental systems and to inform the development of sustainable solution to the Nation's energy and environmental challenges.



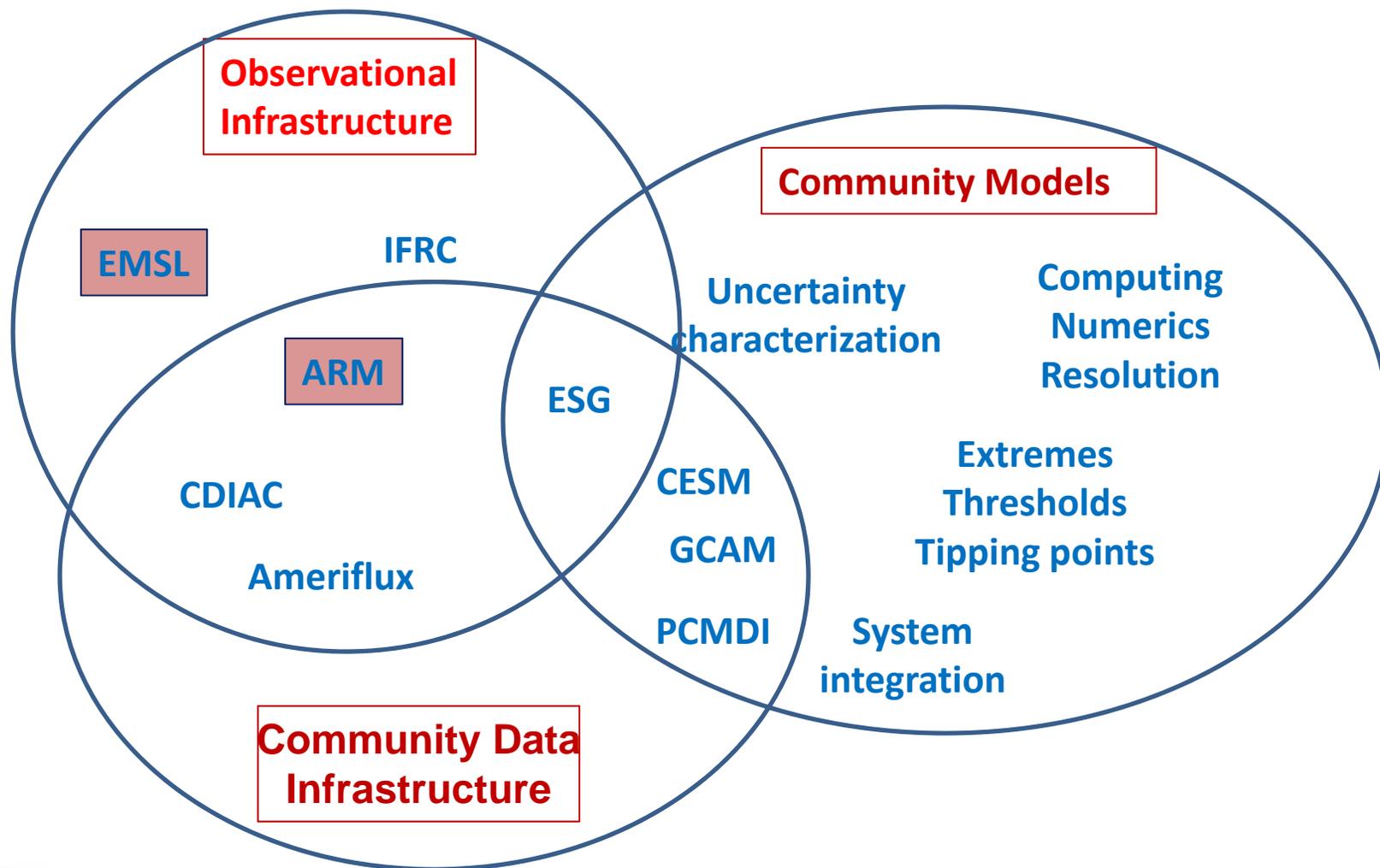


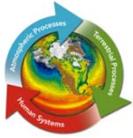
Division Strategic Goals

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 decision support.
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.



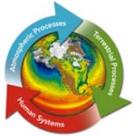
Platforms for science integration





What does society want us to predict?

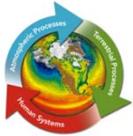
- Risk analysis
 - Rates of change of means and generic extremes
 - Multi-parameter pdf's of extreme event sets
 - Water and food supply
 - Energy supply (influenced by climate and weather)
 - Sea level rise
 - Thresholds and system tipping points
- Mitigation
 - Benefits of technology insertion
 - Policy choices



Serious gaps in earth system predictability

- Clouds/aerosols/precipitation/radiation
- Carbon cycle
- Water cycle
- Ice sheet dynamics
- Dynamical multi-scale interdependencies
- Biogeochemistry of ecosystem change (oceans and terrestrial)





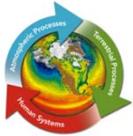
NGEE Concept (Next Generation Ecosystem “Experiment”)

- Target systems that are:
 - Globally important
 - Climatically sensitive
 - Under studied or under represented in models



- Carefully couple modeling and field/laboratory research / planning
- Representation of scale/resolution of a high resolution Earth System Model (ESM) grid cell (i.e., a maximum 30x30 km grid size)

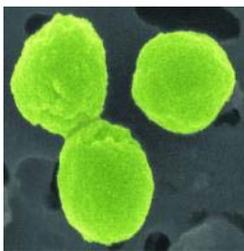
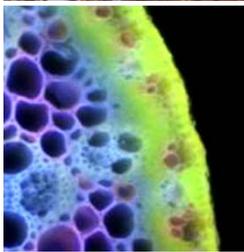
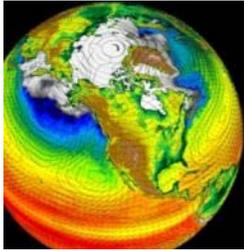




Interagency Context

- USGCRP Interagency Group on Integrative Modeling (IGIM)
 - **Thematic: extremes, thresholds, tipping points**
 - **“earth” system modeling: water, carbon, ecology**
 - **Future investments: HPC, CMIP6 infrastructure**
 - **Various agency roles: coordinate, collaborate**
 - **Response to NRC report recommendations**
- Assessment studies
 - **IPCC**
 - **National Climate Assessment**





Thank you!

Gary Geernaert

Gerald.Geernaert@science.doe.gov

<http://science.energy.gov/ber/research/cesd/>



U.S. DEPARTMENT OF
ENERGY

Office
of Science

Office of Biological
and Environmental Research