



## Environmental Security DOE perspectives

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## DOE mission

*To ensure America's security and prosperity by addressing its energy, environmental, and nuclear challenges through transformative science and technology solutions*

### DOE activities associated with environmental security and societal threats

- Assessing vulnerabilities of energy infrastructures and societal impacts
- Risks associated with nuclear contaminants due to extreme events
- Vulnerabilities associated with nuclear materials and weapons

## Infrastructure

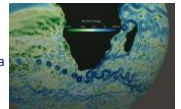
- **Infrastructure resilience**
  - existing infrastructure to extreme events
    - Energy-water interdependencies
    - Weather extremes
    - Terrorism
  - Future infrastructure
    - Design criteria utilizing climate change
    - System dynamics and network theory
- **DOE's approach emphasizes predictive science, simulation, and risk analysis**
  - Weather time scales
    - Exploit NWS model outputs and partnerships
    - Data derived from, e.g., DOE, DHS, and utilities
  - Climate time-scales
    - Uses DOE in-house modeling and simulation: climate; energy and related sectors; societal sector
    - Data derived from, e.g., DOE, DHS, NGA

## Accelerated Modeling For Energy



### FAST FACTS

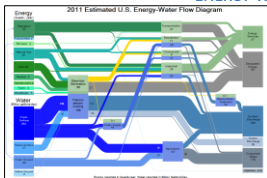
- Multi-lab project. Of order \$20M/yr
- Part of DOE exascale computing strategy; started as branch of CESM
- Focus on extremes; SLR cryogenic; water cycle
- v1 release on track for summer 2017
- features MPAS ocean at 10km resolution, coupled to MPAS sea-ice and land-ice.
- Atmosphere will be 25km, with CLUBB convection and full set of aerosols
- Land will include PFLOTRAN, and C-N-P biogeochemistry
- Has secured ALCC, INCITE awards, as well as early access for SUMMIT and CORI
- Plans beyond FY17
  - Academic engagement on council and model development
  - Much higher spatial resolutions to resolve extreme phenomena
  - Incorporation of IAMs and IAV models (all sectors)
  - Routine access to SUMMIT (ORNL); prepare for OLCF5



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## ENERGY-WATER NEXUS



- Data, Modeling and Analysis**
- Test Beds with teleconnections
  - Priorities: drought stress; infrastructure vulnerability
  - More details evolving to Integrated Field Laboratory (IFL)
  - Regional locations and scales TBD

## Vulnerability and risk modeling (with ESMs)

- **Integrated Assessment Models (IAMs)** – coarse grid; multiyear time steps; all economic and energy sectors
  - Applications – climate feedbacks; agriculture; cascading impacts
  - Model types: climate and earth system; deterministic/stochastic
  - Use cases – water supply and sector dependencies
  - Agency collaborators – USDA, EPA, USACE
- **Impact, adaptation, and vulnerability (IAV) models**
  - Applications – shock modeling and response; population and behavior; socioeconomics
  - Model types: hybrid – deterministic, stochastic, networks, agents, sub-agents, ...
  - Use cases – drought; migration; energy-water-land interactions, health, other sectors, behaviors
  - Agency collaborators – DHS, NGA, EPA, USDA, NSF, DARPA, (IARPA), etc.

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