

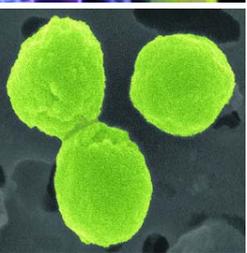
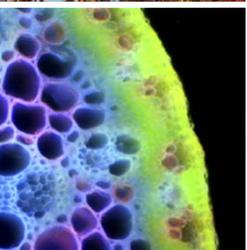
# Green Ocean Amazon 2014 Workshop



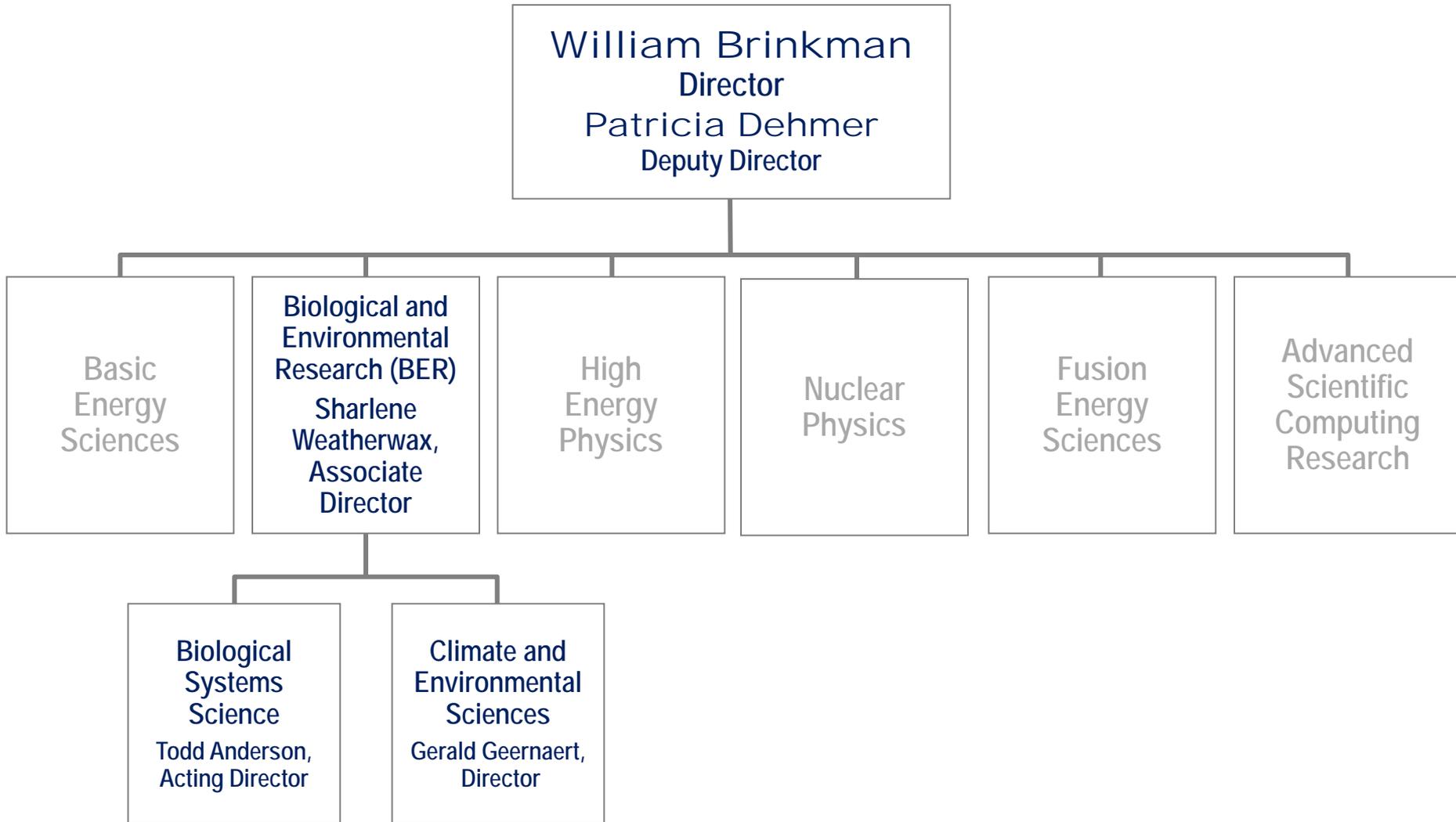
**Gary Geernaert**



**Hyatt Regency Crystal City  
July 26, 2011**



# Department of Energy Office of Science



# BER climate research mission

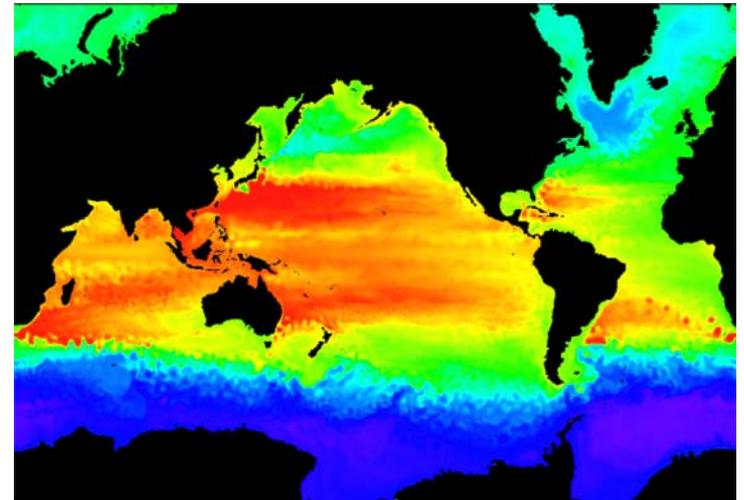
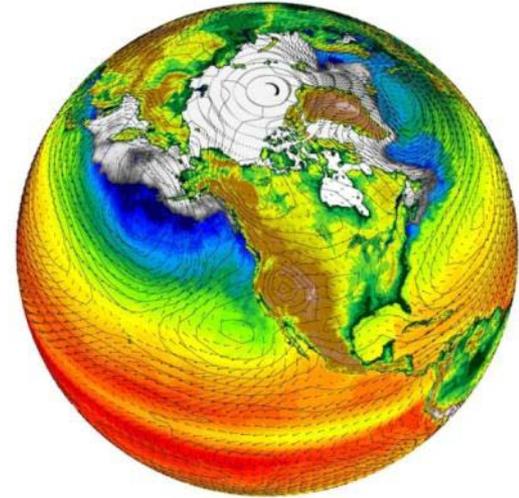
“to advance a predictive understanding of earth’s climate system, with sufficient certainty and spatio-temporal resolution that model outputs have ... value to the DOE mission.”

## Elements:

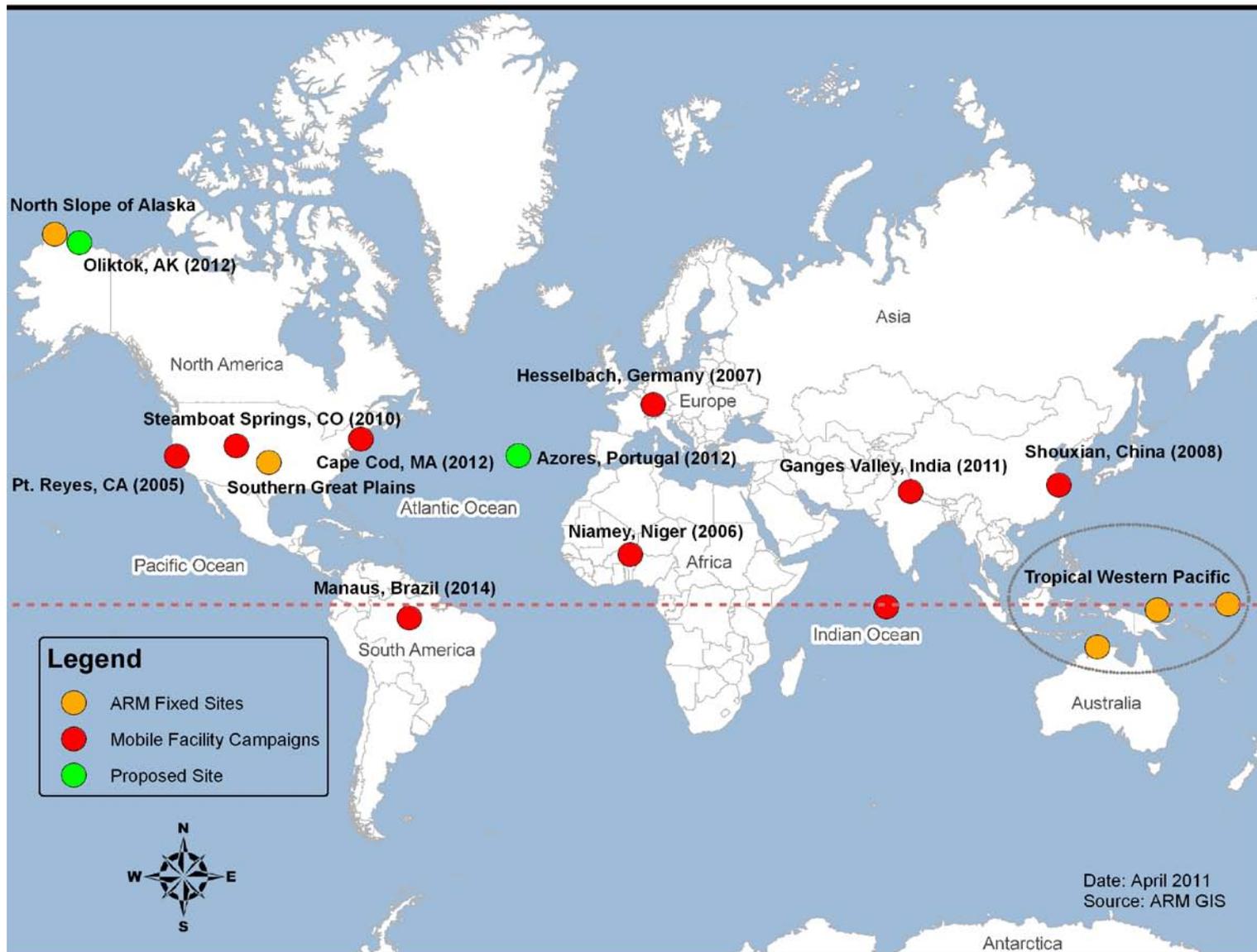
- Understand forcing, feedbacks, interdependencies
- Advance uncertainty quantification methodologies
- Sustained long term experiments
- Teams, user facilities, high performance computing

# Climate and Earth System Modeling

- Develop models based on definitive **theoretical foundations**
- Develop better representations of key **climate processes**
- Develop **diagnostic methods** and tools to evaluate models
- **Test and apply coupled climate and Earth System models** that stay at the leading edge of scientific knowledge
- Increase **fidelity and throughput** of climate change projections
- Examine issues related to climate **change detection and attribution**

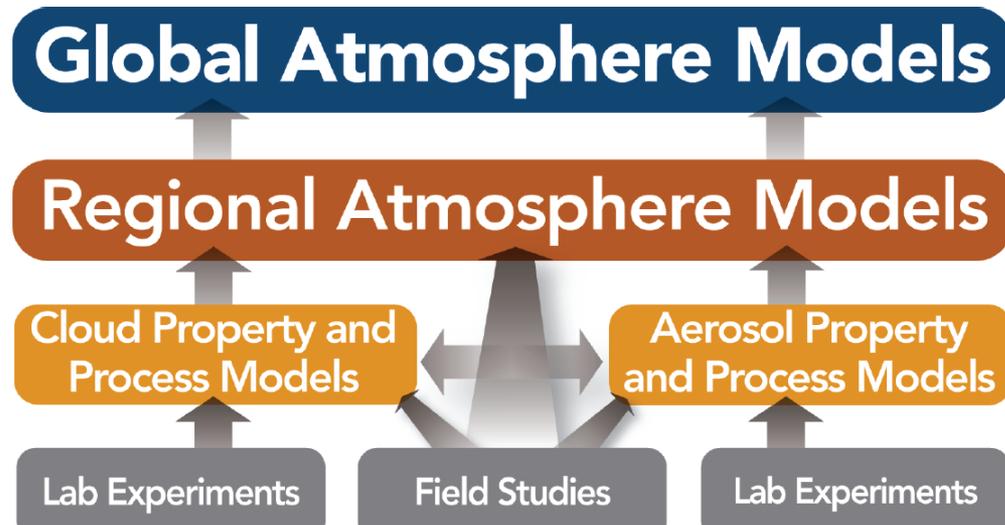


# Atmospheric Radiation Measurement (ARM) Climate Research Facility



# Atmospheric System Research

- Use of ARM short- and long-term climate measurements
- Analysis, theory, process modeling, and retrospective climate simulations and evaluations
- Enhanced cloud and radiation formulations used to improve decadal climate predictions
- Improved scientific understanding of the atmospheric processes that drive aerosol radiative forcing of climate, including laboratory and field experiments, modeling, and instrumentation



# Terrestrial Ecosystem Science

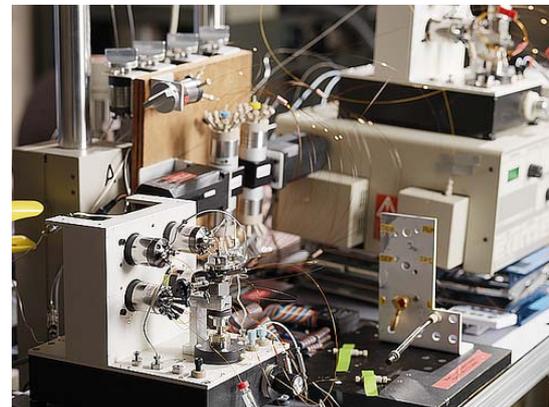
Foundational science to improve our predictive understanding of terrestrial ecosystems in the context of a changing climate

- Crossing scales of time & space
- Observations
- Manipulations
- Large-scale, long-term field studies
- Process modeling with ties to earth-system models



# Environmental Molecular Sciences Laboratory

- EMSL science themes:
  - Biological interactions and dynamics
  - Geochemistry/biogeochemistry and subsurface science
  - Science of interfacial phenomena
- Unparalleled capabilities:
  - Integrated experimental and supercomputing capabilities enable users to study molecular-level processes underpinning energy, science, and environmental challenges
  - Expert staff and 60+ leading-edge capabilities are available to university, DOE laboratory, and industry scientists



# Why the Amazon Basin

- **A primary Southern Hemisphere heat engine**
- **Tropical deep convection poorly understood**
  - **insufficient observational data to constrain models**
  - **Parameterizations currently inadequate**
- **Future climate scenarios show**
  - **drying of Amazon**
  - **conversion of rain forest to savanna**
  - **Major impacts across globe**
- **Uncertainty in projections can induce major mid-century economic vulnerabilities across the globe**

# BER/CESD “tropical” research focus

- **Conduct an integrated experiment to look at the coupled atmosphere-cloud-terrestrial tropical systems**
- **Scientific focus on climate change uncertainties**
  - **Atmosphere**
    - **Aerosols: clean and polluted conditions**
    - **Cloud-aerosol-precipitation interactions**
    - **Life cycles**
  - **Terrestrial ecosystems**
  - **Carbon cycle**
  - **Coupling questions**

# BER Observing Systems

- **Datasets: clean, polluted conditions**
  - organic aerosols
  - cloud and convection schemes
  - terrestrial vegetation components
- **Facilities and observations**
  - ARM
  - Environmental Molecular Sciences Laboratory
  - Terrestrial Ecosystem Science (TES) will support observations

# Observations

**The experiment : January 1 – December 31, 2014.**

## DOE

- **ARM Mobile Facility; G-1 aircraft, aerosol observ system**
- **EMSL: mass spectrometers, laboratory study support**
- **Terrestrial Ecosystem Science will provide carbon cycle instruments and others identified in this workshop**

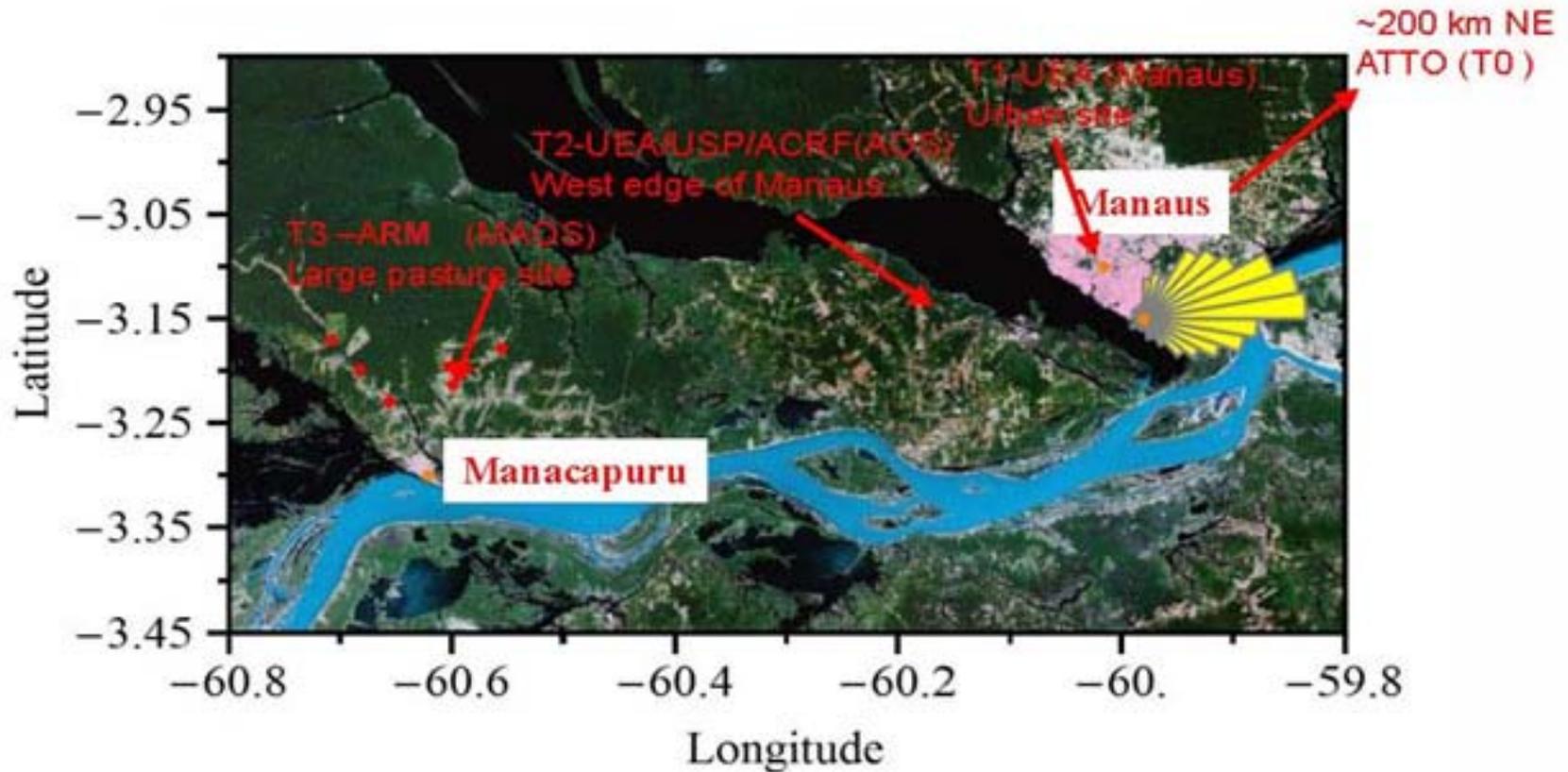
## Brazil

- **aerial measurements by the twin engine turboprop Embraer Bandeirante EMB-110B1 operated by INPE**

## Other...?

- **MPI tower upwind of study area**

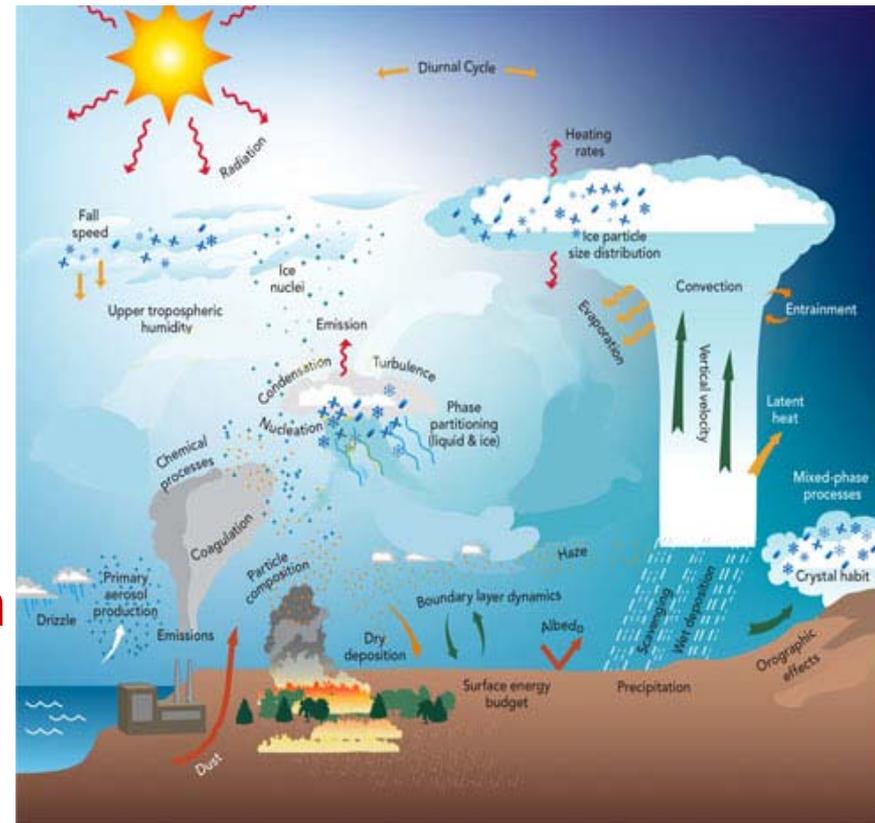
# Experiment Locations



111 by 60.8 km represented by this box. Wind speeds at 1 km altitude are typically 10 to 30 kph.

# Research Support to PIs

- **BER/CESD**
  - Climate/Earth system modeling
  - ASR
  - TES programs
- **Joint calls for proposals are being planned with a focus on integrated science**



# Workshop Goals

- **Identify important unresolved science questions concerning relationships between aerosols and cloud properties under pristine and polluted conditions in the target region.**
- **Identify cross-cutting science questions that involve ecological dynamics, ecology interactions with tropical climate, and interdependencies.**
- **Identify and discuss observation and modeling strategies to address gaps in understanding.**

# Workshop Product

- **CESD will publish on the web and in hardcopy a report on the findings of the workshop**
- **The rapporteurs will draft summary of the discussion**
- **CESD program managers will edit and finalize the report for editorial review and publication**

