

# Agency Guidance

U.S. CLIVAR Summit  
2012

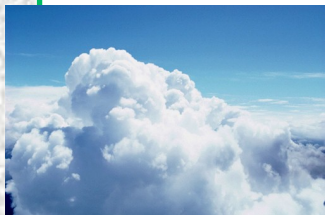


# Climate and Environmental Sciences Division (Gary Geernaert)

## 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)





# 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.**



# Relevant Agency Missions/ 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.





# Supported US CLIVAR Activities Over the Past 3-4 Years

- Model diagnostics and analyses through
  - solicitations focusing on **modes of climate variability, extremes, understanding uncertainties and feedbacks within the climate system**
  - PCMDI at LLNL and through joint support of NCAR's CGD with NSF
- CMIP5 support through support of CESM, PCMDI, ESGF
- Model development activities [Fund the **CESM/CCSM** jointly with NSF]
- Support the development of ocean models: **POP and MPAS ocean models**
- Support of the Ice components: **CICE, and Land-ice models**
- ARM infrastructure and process research support of **VOCALS, DYNAMO (AMIE)**



# Long-range (5-10 years) climate research areas of interest that intersect with US CLIVAR

- Develop a new generation **high and variable resolution Earth system models** based on advancing and testing scale-aware schemes **for oceanic, cryospheric, terrestrial, and atmospheric systems**
  - Improve understanding and predictability of **dynamical processes governing sea level rise.**
  - **Cloud-climate interactions**, to reduce largest climate response uncertainty, and to improve precipitation and hydrology
- Establish advanced model metrics to guide model development and to guide selection of experimental sites
  - **Detect and attribute sources** of climate change discern evolving patterns of **extremes within a changing climate**
  - Refine analytical methods to distinguish **climate feedbacks**
- Develop more sophisticated frameworks and **software for model and measurement analysis, comparison, and visualization** for the community through mechanisms such as the **Earth System Grid Federation**



# Long-range (5-10 years) climate research areas of interest that intersect with US CLIVAR

- Support integrated studies of key processes driving aerosol-cloud-precipitation-radiation interactions
- Advance ARM capabilities and aggressively exploit the unique DOE facilities to understand cloud, aerosol, and radiative properties over land, sea, and ice
- Continue investigations into dominant atmospheric processes in tropical, marine and arctic environments
  - AMIE ,VOCALS
- Exploit existing and new ARM facilities and recently procured ARRA 2009 instrumentation to provide high-resolution, 3-dimensional documentation of evolving cloud, aerosol and precipitation characteristics in climatically sensitive regions.
  - A new site in the Azores
  - An extended duration deployment of a new mobile facility at Oliktok, AK
  - TCAP (two columns: Cape Cod and in the Atlantic)
  - GoAmazon tropical and MAGIC marine campaign





# Intangibles - How to Engage and Provide Value

- Coordination/ Collaboration for
  - ocean model development through interagency expertise in ocean process understanding
  - land and sea-ice model development
  - for data dissemination of models and observations through ESGF
- Development of the next generation of visualization tools
- Examining processes in a comprehensive and integrated earth system
- Collaboration for ARM and ASR programs like GoAmazon
- Inform us of publications as soon as they are accepted so that we can highlight them to our management.





# Thank You



# Relevant Agency Mission or Goals

- While not supporting a formal global change research mission, the US Navy continues a history of interest in USGCRP and USCLIVAR through sponsored research in underlying environmental physical processes that concurrently satisfy maritime and expeditionary national security requirements as well as USCLIVAR goals.
- The Navy Task Force Climate Change (TFCC) was established in May 2009 at the direction of the Chief of Naval Operations (CNO) and includes extended range forecast needs.
- Quadrennial Defense Review (QDR, 2010): “Climate change, energy security, and economic security are inextricably linked”. “DOD will work to foster efforts to assess, adapt to, and mitigate the impacts of climate change”
- Naval S&T Strategic Plan (2011): “Match Environmental Predictive Capabilities to Naval Planning Requirements - Fully coupled (ocean-atmosphere-wave-ice) global, regional and local prediction for operational planning at tactical, strategic and climate scales.

# Supported US CLIVAR-Related Activities Over the Past 3-4 Years

- Selected **Departmental Research Initiatives** (5-year efforts)
  - Arctic Waves (2013)
  - Bay of Bengal (2013)
  - Arctic Sea Ice (2012)
  - Seasonal Prediction (2012)
  - Unified Parameterizations (2011)
  - Origins of the Kuroshio and Mindanao Current (2011)
  - LASP/DYNAMO (MJO) (2010)
  - ITOP (TC Air-Ocean) (2008)
  - TCS-08/T-PARC (TC genesis, intensification, ET) (2008)
- **CMIP5** Analysis support
- Irreducible Uncertainty **BRC** (2010)
- Extended-Range Environmental Prediction **MURI** (2012)



# Long-range (~5-10 years) research areas that intersect with CLIVAR interests

- Predictability of the earth system on various time and space scales
- Studies of physical processes relevant to Marine Meteorology, Physical Oceanography, Arctic, and Littoral Geosciences
- New observing techniques and technologies
- Quantification of forecast uncertainty
- Diagnostics and model improvement and evaluation (Component and coupled models)
- Unified modeling approach: ocean/ weather/ ice/ space on appropriate time and spatial scales

# Long-range research areas of interest that intersect with CLIVAR

- **Integrated Global Prediction**

- Fully-integrated coupled ocean-wave-ice-atmosphere-stratosphere model systems (towards seamless goal).
- Provide improved short-term ( $< 7$  days) predictions of the physical environment in support of safe, efficient, and effective naval operations
- Provide extended-range predictions (sub-seasonal to annual) for Navy strategic resource decisions
- Understand relevant physical processes and sources of predictability to inform longer (decadal+) predictions

- Define the limits of predictability for different maritime physical variables and processes

# Top five long-range research areas of interest that intersect with CLIVAR

- **Arctic Prediction**

- Improved basic understanding of the physical environment and processes in the Arctic region
- Development of new Arctic system models for improved prediction in high-latitudes at longer lead times
- Utilization of satellite SAR data for assimilation into integrated models
- Exploration of new technologies (platforms, sensors, communications) that will be required for persistent observation and operation in the harsh Arctic environment



# Top five long-range research areas of interest that intersect with CLIVAR

- **Earth System Prediction Capability (ESPC)**
- Major partner with NOAA, NASA, DoE, NSF in coordinated Demonstrations
  - Extreme Weather Events: Predictability of Blocking Events and High Impact Weather at Lead Times of 1-6 Weeks
  - Seasonal Tropical Cyclone Threat: Predictability of Tropical Cyclone Likelihood, Mean Track, and Intensity from Weekly to Seasonal Timescales
  - Arctic Sea Ice Extent and Seasonal Ice Free Dates: Predictability from Weekly to Seasonal Timescales
  - Coastal Seas: Predictability of Circulation, Hypoxia, and Harmful Algal Blooms at Lead Times of 1-6 Weeks
  - Open Ocean: Predictability of the Atlantic Meridional Overturning Circulation (AMOC) from Monthly to Decadal Timescales for Improved Weather and Climate Forecasts

# Intangibles - How to Engage and Provide Value

- Connection with ONR-sponsored Principal Investigators to CLIVAR WGs and TFs (e.g. MJO diagnostics)
- Identification of critically important scientific questions, especially in maritime process studies and applications, and the facilities and research required to address them.
- Observation and prediction activities, such as common observational tools, datasets, modeling architectures, and coupling standards (e.g. ESMF) that enhance the productivity of investigators
- Providing information and fostering interactions that lead to the submission of stronger research proposals
- Unified taxonomy across related disciplines at the climate/weather interface