U.S. CLIVAR Town Hall

AGU Fall Meeting
December 4, 2012
San Francisco, California

Mike Patterson, Project Office Director
Lisa Goddard, SSC Chair
Janet Sprintall, SSC Co-chair
Jay McCreary, SSC Co-chair

Outline

Introduction of U.S. CLIVAR Science Plan - Mike Patterson

Drivers for New Plan, Achievements and Research Challenges - Lisa Goddard

Fundamental Science Questions, Mission, Goals and Cross-cut Strategies - Janet Sprintall

Implementation Approaches and Infrastructure - Jay McCreary

Timeline for Plan Preparation - Mike Patterson

Questions

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Purpose of a New Science Plan

- to organize research in the U.S. to improve understanding and prediction of global climate variability and change

- to reinvigorate the U.S. science community interest in and engagement of U.S. CLIVAR; particularly stressing grass-roots efforts and the creation of opportunities for young scientists

- to bolster funding commitments by U.S. agencies to achieve their mission objectives

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Launching the Planning Effort

In **January 2012** the U.S. CLIVAR SSC initiated a **two-year effort** to draft, edit and publish a new Science Plan to guide climate research for the 15-year period post-2013.

To inform the planning effort, the SSC invited presentations on:

- funding agency interests and needs,
- changing international and national program directions and priorities, and
- progress achieved over the past 15 years toward stated goals/objectives
- priority research topics and science questions framing the future program

In light of this information, the SSC and Panels

- determined the scope and presentation format of the Plan
- developed a timeline and set of activities necessary to develop the Plan
- began drafting chapters

During the planning process, the SSC endeavors to engage broader research community input and review

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Plan Writing Team

Chapter Leads

Nicholas Bond, U. Washington
Michael Bosilovich, NASA GSFC
Annalisa Bracco, Georgia Tech
Lisa Goddard, IRI/Columbia U.
Baylor Fox-Kemper, U. Colorado
Arun Kumar, NOAA NCEP
Jay McCreary, U. Hawaii
Mike Patterson, Project Office
Janet Sprintall, SIO/UCSD
Rob Wood, U. Washington

Writing Team Members

Bruce Anderson, Boston U.
Matthew Barlow, U. Mass.
Tony Barnston, IRI/Columbia U.
Antonietta Capotondi, U. CO
Donald Chambers, USF
Judah Cohen, AER/MIT
Simon de Szoeke, Oregon State U.
Curtis Deutsch, UCLA
Tom Farrar, WHOI
Joshua Xiouhua Fu, U. Hawaii
Gregg Garfin, U. Arizona
Benjamin Giese, Texas A&M
Alexander Gershunov, SIO/UCSD
Michael Gregg, U. Washington
Richard Grotjahn, UC Davis
Markus Jochum, formerly NCAR
Meibing Jin, U. Alaska
Igor Kamenkovich, U. Miami
David Lawrence, NCAR
Sukyoung Lee, Penn State U.
Gad Levy, NW Res. Associates
Ron Lindsay, U. Washington
Rick Lumpkin, NOAA AOML
Dimitris Menemenlis, NASA JPL
Joel Norris, SIO/UCSD
Balaji Rajagopalan, U. Colorado
Joellen Russell, U. Arizona
Cristiana Stan, COLA
Liqiang Sun, NC State U.
Gabriel Vecchi, NOAA GFDL
Yan Xue, NOAA NCEP
Xiao-Hai Yan, U. Delaware
Rong Zhang, NOAA GFDL
Xiangdong Zhang, U. Alaska

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Drivers for New Plan, Achievements and Research Challenges

Lisa Goddard

Current U.S. CLIVAR Science Goals

- Identifying and understanding the major patterns of climate variability on seasonal, decadal and longer time scales and evaluating their predictability
- Evaluating and improving the models used for prediction and projection to project climate change due to human activity, including anthropogenically induced changes in atmospheric composition
- Expanding our capacity in short term (seasonal-to-interannual) climate prediction and searching for ways to provide information on decadal variability
- Better documenting rapid climate changes and the mechanisms for these events, and evaluating the potential for abrupt climate changes in the future
- Detecting and describing high impact climate variability and change

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Context and Drivers

Over 10 years since the 1st U.S. CLIVAR Implementation Plan

- Significant increases in understanding of the climate system
- Commitments to sustained observing and prediction infrastructure;
- Integrated earth-system science and modeling, which broadens the interdisciplinary perspective of climate science;
- Regular assessments of the changing climate system, its impacts on human and natural systems, and mitigation and adaptation options;
- Increased attention to the uncertainties and confidence limits of climate information;

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Key Achievements of U.S. CLIVAR

- Promoted sustaining U.S. contributions to **the tropical Pacific observing system, global drifter array and repeat hydrography** following TOGA and WOCE
- Promoted expansion of ***in-situ*** **observing systems**, including plans for global ARGO, tropical moored arrays in the Atlantic and Indian Oceans, ocean reference sites, the AMOC observing system, surface met and upper air networks
- Engaged evaluation and use of **existing and new satellite products** of SST, altimetry, scatterometry, ocean color, salinity, precipitation, clouds, GPS/integrated water vapor
- Coordinated activities leading to development of assimilated **ocean and atmospheric analyses and re-analyses**
- Identified and explored **modes & patterns of climate variability, and ocean state**, variability and change, and its influence on climate
- Reviewed and coordinated U.S. plans for CLIVAR **process studies** to advance process understanding of the ocean, atmosphere and coupled climate system: EPIC, SALLJEX, NAME, AMMA, KESS, CLIMODE, VOCALS, DIMES, DYNAMO, IASCLIP, & SPURS
- Established new paradigm of **Climate Process Teams** bringing together observationalists, theorecticians, process and GCM modelers in a focused project to improve parameterizations of a particular process in one or more IPCC-class models

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Key Achievements of U.S. CLIVAR

- Sponsored **diagnostics of late 19th -20th century simulations and 21st century projections** through inter-comparisons of CMIP model simulations and comparisons with observational data
- Increased community-wide diagnostic research into the **physical mechanisms of drought**, including the role of the oceans and land, and evaluated drought simulation in coupled climate models
- Coordinated U.S. plans to **characterize predictability, and demonstrate improved prediction capabilities**, on sub-seasonal, seasonal, inter-annual and decadal timescales
- Designed and **promoted Postdocs Applying Climate Expertise (PACE) fellowships** to grow the pool of scientists qualified to transfer advances in climate science and prediction into climate-related decision frameworks and tools
- Began exploring **user requirements for useful climate information** to help guide research questions

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Research Challenges

Timely, Complex, and Societally-relevant Issues

1) Decadal variability and predictability;
2) Climate extremes;
3) Polar climate; and
4) Climate and carbon/biogeochemistry.

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Research Challenges: Decadal Variability

CONTEXT: Decadal-scale variability may dominate anthropogenic trends regionally on the timescale of planning and adaptation investments. Many across the range of scientific and development communities are thus seeking decadal-scale climate information to guide decisions for the future.

Question:

- What are the physical mechanisms responsible for low frequency variability and can they be exploited for decadal climate prediction?

Key Science Challenges:

- What are the processes that give rise to decadal variability and which of these are sources of predictability?
- Does oceanic variability have atmospheric relevance outside the tropics? If so, what are the processes and timescales of that?
- Do we have the proper tools to realize the predictability?
  - Adequacy of Ocean Observing System
  - Advanced Models, Assimilation, Initialization, Prediction and Verification Techniques

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Research Challenges: Climate Extremes

CONTEXT: By their very nature, extremes in any location are rare, making attribution of variability and change difficult. Similarly, these are the aspects of climate most damaging to society and ecosystems.

Question:

- What are the physical processes responsible for extremes, and what is the capability of models to simulate their statistical properties?

Key Science Challenges:

- What is the relative role of the ocean in effecting the risks of extremes, regionally?
- What can be said about future changes in the character (location, duration, intensity, etc,) of extremes?
- Do we have the proper tools to realize the predictability?
  - Adequacy of Observing Systems and historical records
  - Advanced Models, Prediction and Verification Techniques

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Research Challenges: Polar Climate

CONTEXT: The polar regions are historically not well observed, and therefore many physical processes are not well understood. We do know that polar regions feel the greatest effects of climate change, which impacts diverse ecosystems there, as well as greatly alters our planet's energy balance.

Question:

- What are the impacts of polar climate change on global and lower-latitude climate, and via what processes?

Key Science Challenges:

- What processes affect sea-ice conditions, such as ice-shelf stability?
- What are the large-scale polar/subpolar/subtropical interactions and processes involved in affecting polar climate variability and change?
- What processes are involved in the exchange of polar (and subpolar) water masses with lower latitudes?
- Do we have the proper tools to simulate polar climate and realize the predictability?
  - Adequacy of Observing Systems and historical records
  - Advanced Models, Prediction and Verification Techniques

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Research Challenges: Carbon & Climate

CONTEXT: The ocean has historically been a net sink for CO2. Climate variability influences both sources and sinks of CO2.

Question:

- How will marine carbon sources and sinks affect, and be affected by future atmospheric concentrations of CO2, and other carbon-containing greenhouse gases?

Key Science Challenges:

- How do changes in ocean circulation and heat content affect the magnitudes and distributions of ocean carbon sources and sinks on seasonal-to-centennial time scales?
- What are the coupled physical/biogeochemical processes and feedbacks that contribute to the heat and carbon sources and sinks, and to ecosystem structure?
- Do we have the proper tools to simulate carbon-climate interaction?
  - Adequacy of Observing Systems and historical records
  - Advanced Models, Prediction and Verification Techniques

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Fundamental Science Questions
Mission Statement
Goals and Cross-Cut Strategies

Janet Sprintall

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Fundamental Science Questions

The over-arching questions that define the Research Challenges are:

1) How **predictable** is the climate on different time and space scales?

2) What **climate processes** are critical for **improving simulation** of climate variability in climate models?

3) What changes in climate variability will determine the **regionalization** of climate change?

4) What are the **connections and feedbacks** between climate variability and other components of the climate system?

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Mission Statement

The U.S. CLIVAR mission is to foster the **understanding, modeling and prediction** of climate variability and its impacts on **intraseasonal-to-centennial timescales**, with emphasis on the **role of the ocean** and its interaction with other elements of the Earth system, and to serve the climate community through the **coordination and facilitation** of research on outstanding climate questions.

U.S. CLIVAR Goals

1) Improve our understanding of the **role of the oceans** in climate variability on different time scales.
2) Improve understanding of the **processes** that contribute to climate change and variability in the past, present and future.
3) Better **quantify uncertainties** in the simulations of climate variability and change.
4) Improve the **development and evaluation of climate simulations.**
5) Improve **collaboration and communication** between communities that develop and use climate information.

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Cross-Cut Strategies

1) Identify necessary **observations and synthesis products**
2) Carry out the critical **process studies** to improve climate models
3) Continue to foster **model development** strategies
4) Assess best practices **for quantifying improvements** in predictions and projections
5) Develop effective strategies for **communication of climate variability information**

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Implementation Approaches and Infrastructure

Jay McCreary

Implementation Approaches

U.S. CLIVAR will continue its current organizational structure designed to facilitate close cooperation between the climate-science community and the funding agencies that support climate research.

It consists of:

- **Scientific Steering Committee and Panels** of representatives drawn from range of subdiscplines to guide science planning and implementation to ensure progress toward program goals, identify gaps, and promote balance across the program
- **Interagency Group** of Program Managers from sponsoring agencies (**NASA, NOAA, NSF, DoE and ONR**) to coordinate resources and implementation of research projects and activities responsive to U.S. CLIVAR goals
- **Project Office** with a Director and staff to manage the day-to-day planning and implementation of activities of the program, communicate research advances and needs, and support international engagement and collaboration

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Implementation Approaches

U.S. CLIVAR will achieve its goals through PI participation in:

- **Working Groups**
- **Science Teams**
- **Climate Process Teams (CPTs)**
- **Science Meetings/Workshops**
- Agency-supported **Research Calls** to implement coordinated observation and data projects; field campaign and process research; modeling, prediction and applications projects
- Opportunities for **Students, Postdocs, and Early-career Scientists**

U.S. CLIVAR actively seeks participation of both professionally young and well-established scientists in its activities.

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U.S. CLIVAR Panels

Phenomena Observations & Synthesis (POS) Panel

Mission is to improve understanding of climate variations in the past, present and future, and to develop syntheses of critical climate parameters while sustaining and improving the global climate observing system.

Process Study & Model Improvement (PSMI) Panel

Mission is to reduce uncertainties in the general circulation models used for climate variability prediction and climate change projections through an improved understanding and representation of the physical processes governing climate and its variation.

Predictability, Predictions & Applications Interface (PPAI) Panel

Mission is to foster improved practices in the provision, validation and uses of climate information and forecasts through coordinated participation within the U.S. and international climate science and applications communities.

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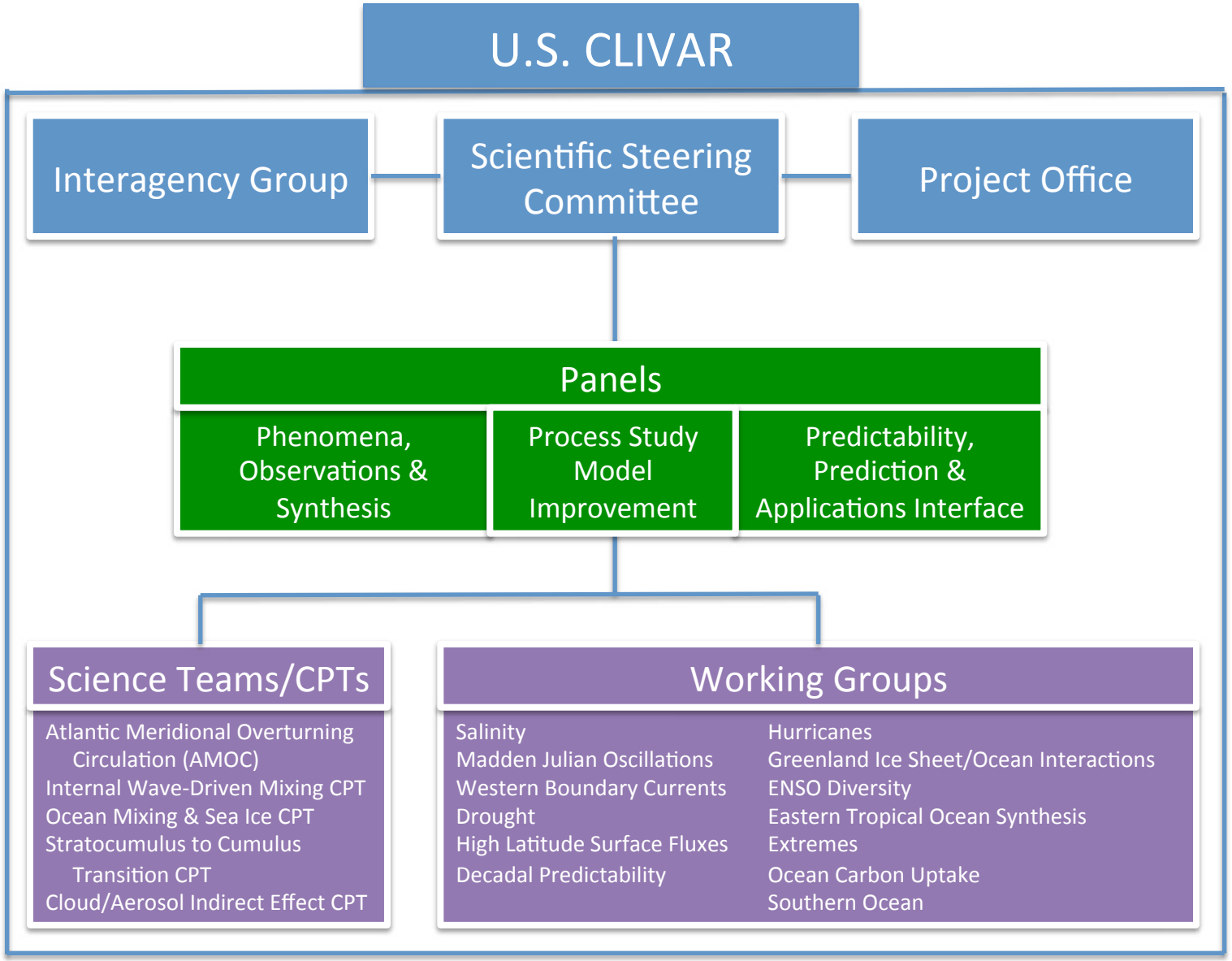
Enabling Infrastructure

U.S. CLIVAR *depends* on the viability of enabling infrastructure that is provided under other programs and supported by other means. They include:

- Sustained in-situ and satellite observing systems
- Data centers
- Ship and aircraft
- Modeling centers and high-performance computing
- Operational prediction centers
- Regional application projects
- International and national assessments

U.S. CLIVAR intends to develop strong links with these programs, helping to provide new scientific information for their justification and enhancement.



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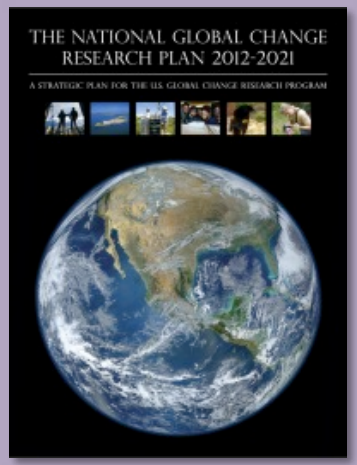
Core Climate Research Contribution to USGCRP

U.S. Global Change Research Program

New 10-Year Strategic Plan Goals

1. **Advance Science**
2. **Inform Decisions**
3. **Conduct Sustained Assessments**
4. **Communicate and Educate**



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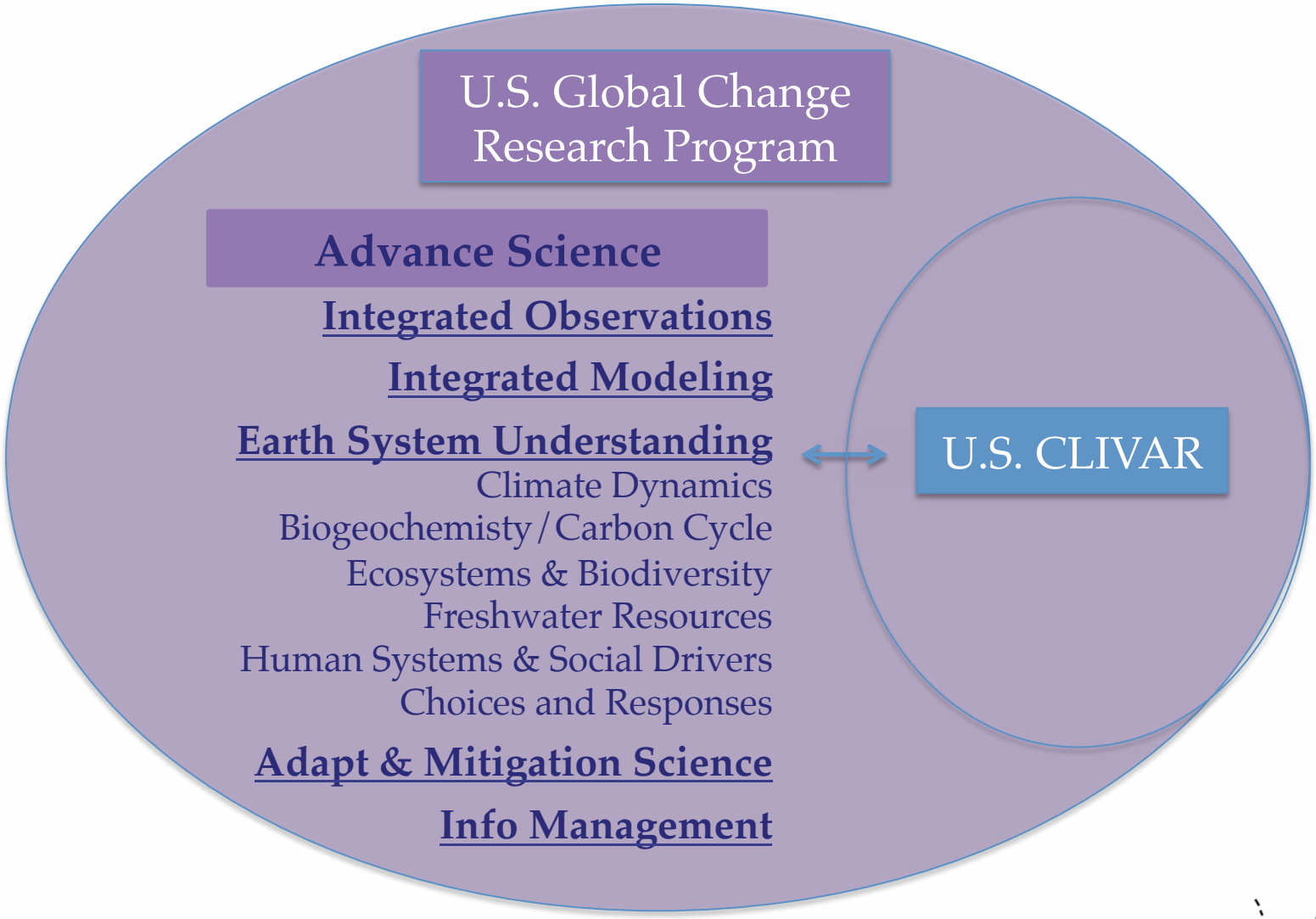
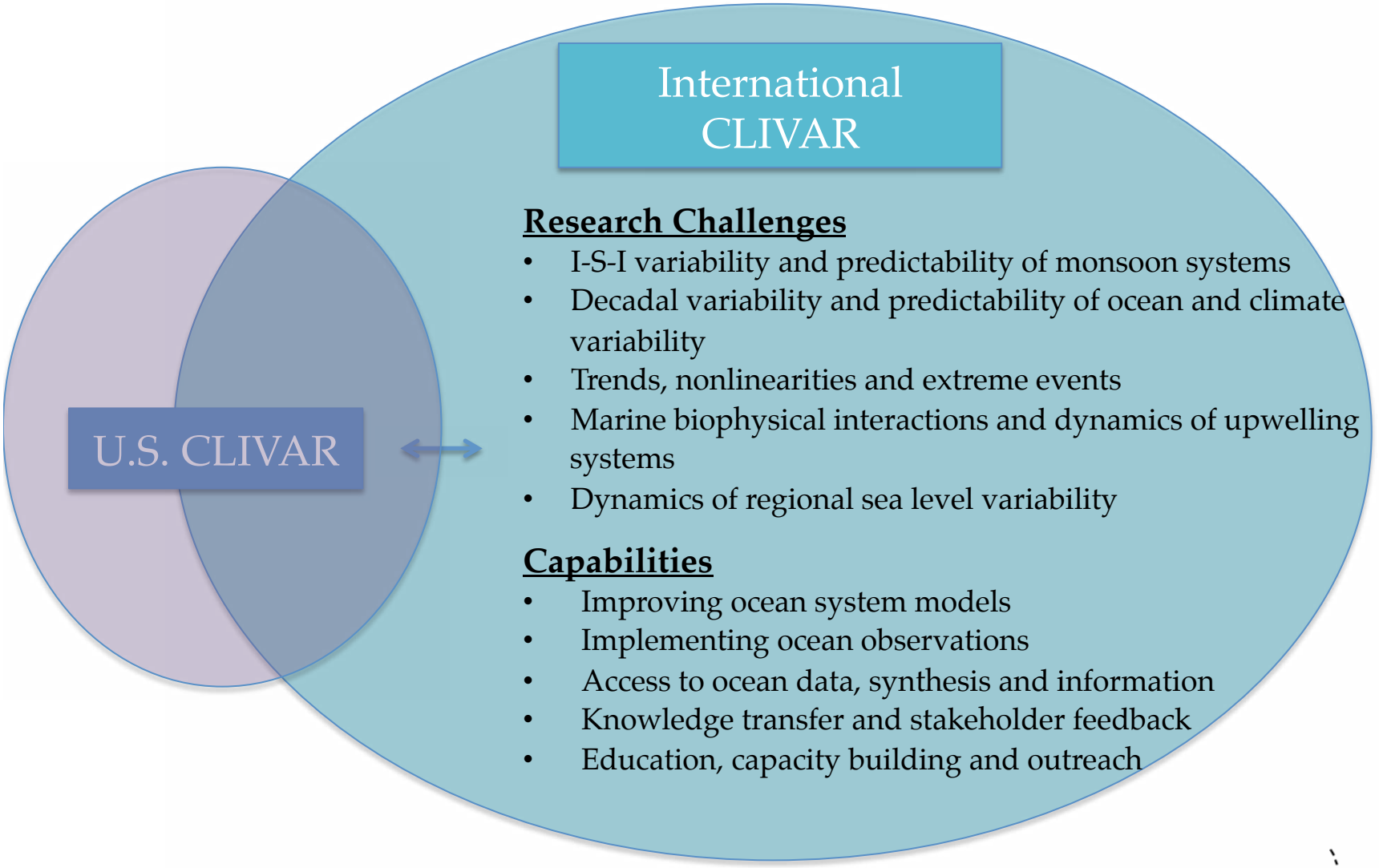
Core Climate Research Contribution to USGCRP



Core U.S. Contribution to International CLIVAR



Research Challenges

- I-S-I variability and predictability of monsoon systems
- Decadal variability and predictability of ocean and climate variability
- Trends, nonlinearities and extreme events
- Marine biophysical interactions and dynamics of upwelling systems
- Dynamics of regional sea level variability

Capabilities

- Improving ocean system models
- Implementing ocean observations
- Access to ocean data, synthesis and information
- Knowledge transfer and stakeholder feedback
- Education, capacity building and outreach

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Schedule for Finalizing Plan

Plan Drafting, Review & Publication Schedule

✓	Jan 2012	SSC Meeting	Initially scope, outline, draft mission statement & goals
✓	Spring	SSC & Panel Telecons	Refine mission/goals, draft subgoals
✓	July	Summit	Identify accomplishments; review & further develop subgoals
✓	Aug-Sep	SSC	Draft annoted outline
	Oct-Dec	SSC & Panels	Draft chapters
	Dec	**AGU Town Hall Mtg**	**Present draft plan overview to community**
	Jan 2013	SSC Meeting	Consider full first draft
	Feb-Mar	SSC & Panels	Complete editing of review-version
	Apr-May	**Community**	**Open public review**
	July	Summit	Review comments
	Aug-Nov	SSC & Panel Telecons	Final editing
	Dec	**SSC**	**Publish and promote**

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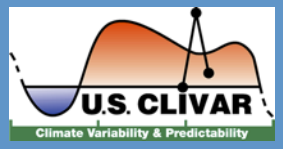
Questions and comments are invited for consideration by the SSC and Writing Teams.



uscpo@usclivar.org

@usclivar

Thank You

and Stay Tuned

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