2017 US CLIVAR Summit
Meeting Objectives and Outcomes

Sonya Legg, SSC Chair

US CLIVAR
Climate Variability & Predictability

Meeting Objectives

The Panels at this meeting will consider **near-term implementation priorities** to make tangible progress in addressing science goals over the next year.

- Context – Update on US and International programs
- Special Science Sessions
  - Understanding and Predicting Climate Teleconnections
  - Polar Ocean and Sea Ice Interactions
- Panel Business – Review progress, identify gaps and opportunities
- Cross-Panel Interaction – Foster dialogue on topics of common interest
- Plan Implementation – Identify action items to advance US CLIVAR goals and research challenges

US CLIVAR Goals

1) Understand the **role of the oceans** in climate variability on different time scales.

2) Understand the **processes** that contribute to climate change and variability in the past, present, and future.

3) Better **quantify uncertainties** in the observations, simulations, predictions and projections of climate variability and change.

4) Improve the **development and evaluation of climate simulations and predictions.**

5) **Collaborate with research and operational communities** that develop and use climate information.

Research Challenges

Decadal Variability & Predictability	Climate & Extreme Events	Polar Climate Changes	Climate & Carbon/ Biogeochemistry
• Decadal modes (e.g., AMV, PDO) • Warming hiatus • Expanding tropics • Initalized predictions	• Tropical Cyclones • Heavy waves/storm surge • Heavy precip/floods • Drought • Heat waves/cold outbreaks	• Arctic-subpolar gyre exchanges • SO/ACC stratif. & transport • Ocean-ice sheet & ocean-sea ice interactions • Arctic-midlatitude atmos. connections	• Carbon cycle sensitivity • Marine ecosystem and fisheries response to climate variability & change

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US CLIVAR also supports **core research foci** to advance its mission:

- **intraseasonal-to-interannual** predictability
- understanding **climate response to changing boundary conditions**

US CLIVAR InterAgency Group

US funding agency program managers meet quasi-monthly to coordinate implementation of research activities in support of US CLIVAR goals.

NASA Physical Oceanography (Eric Lindstrom)

NASA Modeling, Analysis & Prediction Program (David Considine)

NOAA Climate Variability & Predictability (Sandy Lucas)

NOAA Modeling, Analysis, Pred. & Proj. (Heather Archambault, Dan Barrie, Annarita Mariotti)

NOAA Climate Observations (David Legler, Jim Todd)

NSF Physical Oceanography (Eric Itsweire, Xujing Jia Davis)

NSF Climate & Atmospheric Dynamics (Eric DeWeaver, Ming Cai)

DOE Regional and Global Climate Modeling (Renu Joseph)

DOE Earth System Modeling (Dorothy Koch)

ONR Physical Oceanography (Scott Harper)

ONR Earth System Prediction Capability (Daniel Eleuterio)

Highlights of Program Implementation

- Late 2013 – New Science Plan

- 2014-2015 Initial Implementation
  - Convened **Summits** to engage panel planning to implement Science Plan
  - Convened US and International **AMOC science meetings** and extended sunset of US AMOC Science Team to 2020
  - Completed 5 Working Groups
    - **ENSO Diversity** (2015 BAMS Paper)
    - **Eastern Tropical Ocean Synthesis** (2016 BAMS Paper)
    - **Extremes** (2015 Climate Dynamics Paper)
    - **Ocean Carbon Uptake** (joint with OCB; 2015 GRL Paper)
    - **Southern Ocean** (joint with OCB; 2015 report and CMIP metrics)
  - Initiated WG on **Arctic-Midlatitude Interactions** (through 2018)
  - Provided input to **OPCC survey on use of sustained obs** and to inform **CMIP6 and endorsed MIPs**
  - Conducted surveys and organized workshop for **translating process understanding to improve climate models** (resulting white paper in 2016)
  - Organized US CLIVAR sessions at **Fall AGU, AMS, and Ocean Sciences**

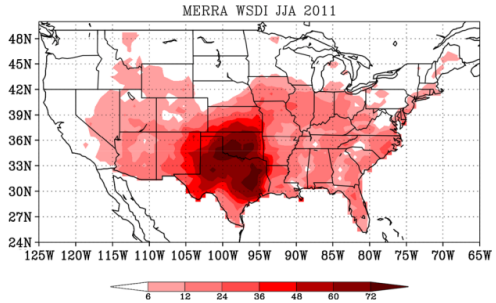


Fig. 10 Warm Spell Duration Index from MERRA for 2011 summer over the United States. WSDI is computed from the 90th percentile of daily mean temperatures for the summer season

Highlights of Program Implementation

- 2016-2017 Update
  - Separate **panel meetings** allowed focused exploration of implementation opportunities
  - Provided input for **TPOS2020 1st Report** and **IPCC AR6 WGI Outline**
  - Launched WG on **Changing Width of the Tropical Belt** (through 2019)
  - Organized community workshops and conferences
    - **Connecting paleo and modern oceanographic data to understand AMOC over decades to centuries**, Boulder, June 2016
    - **Forecasting ENSO impacts on marine ecosystems**, La Jolla, September 2016
    - **Arctic change and its influence on mid-latitude climate and weather**, Washington, February 2017
    - **US AMOC Science Team**, Santa Fe, May 2017
    - **Regional sea level changes and coastal impacts**, New York, July 2017
    - **Ocean carbon hot spots**, MBARI/Moss Landing, September 2017
    - **Ocean mesoscale eddy interactions with the atmosphere**, planning for Portland, February 2018
  - Continued organizing panel-related **sessions at scientific conferences**

US CLIVAR
Climate Variability & Predictability

Context

US CLIVAR operates in connection with US and international science programs and organizations that provide context for our work to plan, organize, and advocate for climate science.

International CLIVAR, WCRP, and IOC

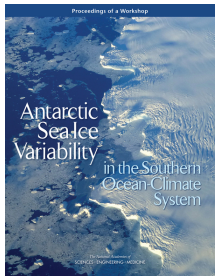
- International global and basin panels
- CLIVAR research foci and WCRP grand challenges
- Projects: CMIP6, Coordinated Ocean-Ice Reference Experiments, Ocean Reanalysis Intercomparison Project, numerous process studies
- International science conferences: CLIVAR2016, Regional Sea Level (2017), ENSO (2018), Subseasonal to Decadal (2018), Ocean Obs '19

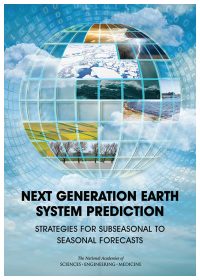
US Global Change Research Program

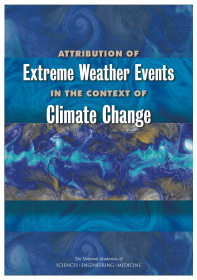
globalchange.gov
U.S. Global Change Research Program

- Interagency Working Groups for Observations, Intergrative Modeling, Advancing Science, Carbon Cycle
- OSTP Research Priorities on Arctic Climate Change, Water Cycle, Methane
- National Climate Assessment and ongoing assessments (e.g., upcoming 2nd State of the Carbon Cycle Report)

Context







National Academy of Sciences

- Reports prioritizing research for Antarctic Sea Ice Variability in the Southern Ocean (2017), Subseasonal-to-Seasonal Forecasts (2016), Frontiers in Decadal Climate Variability (2016), and Attribution of Extreme Weather Events (2016)
- Studies underway: Sustaining Ocean Observations, Decadal Survey of Earth Science & Applications from Space

Other Research Programs

TPOS 2020 · OCB Ocean Carbon & Biogeochemistry · SEARCH · PAGES · PICES

- Internationally-organized observation programs, including TPOS2020, AtlantOOS, IndOOS, Arctic Observing Network, Southern Ocean Observing System, as well as GOSHIP, Argo (including deep and bgc), OceanSites, Global Drifter Program
- US science and agency programs: Ocean Carbon Biogeochemistry (OCB), Study of Environmental Arctic Change (SEARCH), NSF Arctic Natural Sciences, NSF Marine G&G, NOAA Southwest Fisheries Service
- International science programs: Polar Prediction Project (PPP), Past Global Changes (PAGES), North Pacific Marine Science Organization (PICES), International Council for the Exploration of the Seas (ICES)

Additional Context

With the new Administration and Congress in 2017, there may be a shift in priorities and funding at agencies for climate research.

The FY 2017 agency budgets held steady at approximately 2016 levels.

2018 President's Budget includes reductions for climate and Earth system research at NASA, NOAA, and DOE, with across-the-board reduction for NSF.

Senate and House FY2018 appropriations bills have less severe reductions.

US CLIVAR should continue to organize and implement community science activities to advance/accelerate progress on understanding, observing, modeling, and predicting climate variability across the range of timescales.

Winter 2017 SSC Meeting

Evaluating Panel Progress

Panel co-chairs reported progress since 2014 in addressing goals, cross-cutting strategies, and research challenges

Generated specific guidance to each of the panels plus overall recommendations for program

Feedback for POS

- Informing the understanding of **data gaps** is of key value
- Expand evaluation of observing systems to **atmospheric**
- Foster **obs-model synthesis**, e.g., data assimilation, reanalysis, diagnostics of models
- Engage **decadal surveys** early and nominate members
- Consider white paper for **Ocean Obs '19** in collaboration with Intl CLIVAR

Winter 2017 SSC Meeting

Evaluating Panel Progress

Feedback for PSMI

- Effective effort to evaluate opportunities for future **Climate Process Teams**
- Process study webinar approach effective for **sharing best practices**
- Engage in **decadal timescale process** activities (e.g., GO-SHIP review)
- Recognize that constrained agency budgets favor **smaller, self-organized field campaigns** with ~1 large campaign per decade

Feedback for PPAI

- Strong engagement of **S2S modeling and prediction** opportunities
- Important to address intersecting interests of multiple agencies; interest in **S2S timescale** is primarily with NOAA (e.g., NOAA S2S Task Force) and to some degree with NSF
- Need to **ensure broader panel agenda** across timescales (e.g., decadal, climate change) is addressed

Winter 2017 SSC Meeting

Addressing Progress across Program

Measuring progress

- Develop **approach to synthesize** information from US CLIVAR activities
- Organize an **external review** at mid-point of 15 years (~2022)

Gaps in achieving goals

- Provide guidance on **quantifying uncertainties** in obs data sets, reanalyses, predictions, projections
- Push **applications interface** by engaging boundary orgs and focusing narrowly on specific applications target (e.g., ecosystems)

Assessment of implementation activities

- WGs are of value to accelerate community progress; Stronger ones tackle topics with **global imprint** (e.g., MJO and ENSO Diversity) and **multi-agency interest** in future investment
- Agency-funded projects (e.g., CPTs and Science Team) are effective for **coordinating research**

Plenary Agenda

Tuesday, August 8		Presenters
08:00	Welcome, introductions, objectives & outcomes	Mike Patterson & Sonya Legg
08:25	International CLIVAR	Annalisa Bracco
08:50	Agency manager engagement	Agency Managers
09:45	**Science Session: Climate Teleconnections**	Emanuele Di Lorenzo, Dan Vimont
	High-latitude teleconnection to tropical mean climate	Alyssa Atwood
	Predicting teleconnections and regional impacts under anthro forcing	Daniel Swann
	ENSO diversity, teleconnections, and impacts	Antonietta Capotondi
	Methods to quantify uncertainty in coupled climate models teleconnections	Samantha Stevenson
13:15	Panel breakouts	
17:45	Dinner & **Science Session: Polar Ocean and Sea Ice Interactions**	Sonya Legg
	Recent changes in Arctic sea ice and ocean circulation	Ron Kwok
	An Arctic Ocean in transition	Julienne Stroeve
	Improving understanding of Antarctic sea ice with IceBridge & ICESat-2	Alek Petty
	What processes drive Southern Ocean sea ice variability and trends?	Aaron Donohue

Plenary Agenda

Wednesday, August 9		Presenters
08:00	**Coupled Data Assimilation and Reanalysis**	
	Introduction	Tony Lee
	What we need from observations and modelers to make coupled data assimilation the new standard for prediction and reanalysis	Steve Penny
	Discussion	
10:00	Panel breakouts	

Thursday, August 6		
08:00	Panel breakouts continue	
10:20	Breakout reports	Panel Co-chairs
11:20	Conclusions and Next Steps	Sonya Legg
11:45	Adjourn	

Panel Breakouts (Tues pm-Thurs am)

Phenomena, Observations, and Synthesis (POS)

- Panel business
- High-latitude circulation, ocean-sea ice interface
- Atlantic Meridional Overturning Circulation

(w/ PSMI)

- Health of the climate observing system

Process Study and Model Improvement (PSMI)

- Panel business
- Tropical Pacific Observing System 2020
- Teleconnections
- Decadal variability

(w/ PPAI)

- Stratosphere

Predictability, Predictions, and Applications Interface (PPAI)

- Panel Business
- Obs and synthesis requirements for characterizing contemporary sea level rise and predictability **(w/ POS)**
- Subseasonal-to-seasonal extremes and predictability
- S2S climate-ocean linkage with fishery and marine ecosystems
- CMIP6 horizon

Anticipated Outcomes

- **Identification of near-term panel priorities, explicitly considering uncertainty quantification across topics, and addressing program goals and research challenges regarding:**
  - Observing and analyses systems
  - Climate variations and impacts
  - Process study opportunities and feedback
  - Implementing process understanding in models
  - Predictability and prediction across timescales
  - Advancing the interface with applications, connecting prediction and communicating climate information

- **Recommendations to address:**
  - Challenges in understanding and predicting climate teleconnections
  - Observing, understanding, and modeling ocean and sea-ice interactions
  - Strategies for evaluating and improving coupled data assimilation and reanalysis

Anticipated Outcomes

- **Specific action items and recommended implementation activities**
  - Working Groups (for focused actions with interagency appeal; only one possible new start)
  - Workshops and conferences (for broad community engagement)
  - Opportunities for students and early career scientists (e.g., training programs)
  - Panel-organized sessions at scientific conferences (coordinating with Intl. CLIVAR)
  - Website content, esp. for accomplishments and core science activities
  - Webinars and editions of Variations
  - White papers and reports
  - Review papers and special journal collections
  - Input for external requests and opportunities (e.g., NAS reviews, CMIP6/AR6, Ocean Obs '19)

- **Concise Summit Report**
  - To better communicate with community and sponsoring agencies
  - To shift focus from summary of presentations (posted on website)
  - To emphasize key findings, discussion, and conclusions
  - To list resulting recommendations and action items (with panelist leads) for coming year

Thank You and Enjoy Baltimore!

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