U.S. CLIVAR Overview

July 17, 2012
Newport Beach, California

Mike Patterson, Director
U.S. CLIVAR Project Office

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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- Interagency Group
- Scientific Steering Committee
- Project Office

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Interagency Group

Comprised of U.S. funding agency program managers who meet regularly to coordinate implementation of research activities in support of U.S. CLIVAR goals.

NASA Physical Oceanography (Eric Lindstrom, Peter Hacker)
NASA Modeling, Analysis & Prediction Program (David Considine)

NOAA Climate Variability & Predictability (Sandy Lucas, Jim Todd)
NOAA Modeling, Analysis, Pred. & Proj. (Annarita Mariotti, Don Anderson)
NOAA Climate Observations (David Legler)

NSF Physical Oceanography (Eric Itsweire)
NSF Climate & Atmospheric Dynamics (Eric DeWeaver, Anjuli Bamzai)

DOE Global & Regional Modeling (Renu Joseph)
DOE Earth System Modeling (Dorothy Koch)

ONR Physical Oceanography (Scott Harper)
ONR Earth System Prediction Capability (Daniel Eleuterio)

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Scientific Steering Committee

- Members include chair and 2 co-chairs (appointed by IAG) and the co-chairs of 3 Panels. (Lisa Goddard, Jay McCreary, Janet Sprintall, Annalisa Bracco, Nick Bond, Mike Bosilovich, Baylor Fox-Kemper, Arun Kumar, Rob Wood)

- Provides overall scientific and programmatic guidance to ensure that U.S. CLIVAR progresses toward achieving its scientific objectives using individual experts or expert groups as necessary.

  - Establishes Science Plans for the U.S. CLIVAR Program
  - Develops and updates as needed an implementation strategy to prioritize and sequence U.S. CLIVAR activities, and comments on agency implementation
  - Identifies scientific gaps and promotes balance within the various elements (theory, modeling, empirical studies, long-term observations and field campaigns
  - Coordinates U.S. CLIVAR with international CLIVAR and other USGCRP elements
  - Provides oversight and guidance to U.S. CLIVAR working groups and science teams
  - Identifies opportunities for effective transition of sustained observations initiated during CLIVAR to operational entities when utility is demonstrated
  - Apprises the National Research Council on the status of U.S. CLIVAR
  - Provides oversight of and guidance to the U.S. CLIVAR Project Office

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Project Office

- Responsible for ensuring all scientific and programmatic coordination is completed as guided by the U.S. CLIVAR SSC and supported by IAG
- Specific activities:
  - Arrange and support meetings of IAG, SSC, Panels, WGs, Teams
  - Manage science planning
  - Organize summits, workshops, colloquia, meetings, briefings
  - Establish new and support existing WGs and Science Teams
  - Fund 2.5 staff positions in International CLIVAR Office and support travel of U.S. members of International CLIVAR Panels and Working Groups
  - Develop and maintain websites
  - Promote communication through reports, newsletters, news-grams
  - Liaise with other programs (e.g., OCB, GEWEX, IARPC, USGCRP)
  - Oversee budget and progress reporting
- Funded by NASA, NOAA, NSF and DOE through annual award to UCAR
- Located in Washington DC and staffed by Mike Patterson (Director), Jennifer Mays (Program Specialist), Jill Reisdorf (Project Coordinator)

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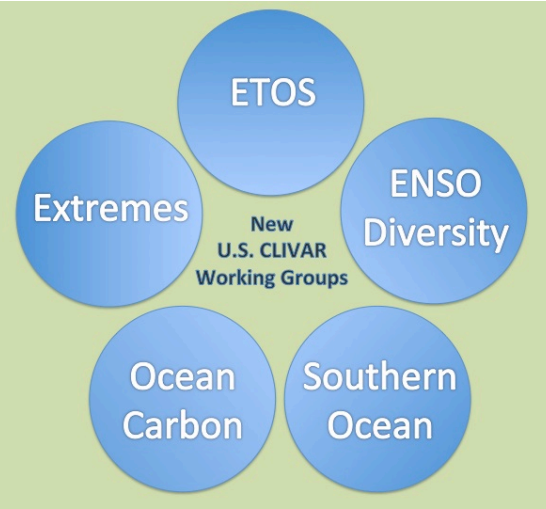
Project Office Update

- Five New Working Groups Launched
- Introduced Integrated Visual Teleconferencing
- New U.S. CLIVAR Website Launched (usclivar.org



- improved navigation, new electronic subscription options, new format allows real-time updates
- coming soon: more features specifically for WG members, updated U.S. AMOC webpages, additional information on science achievements

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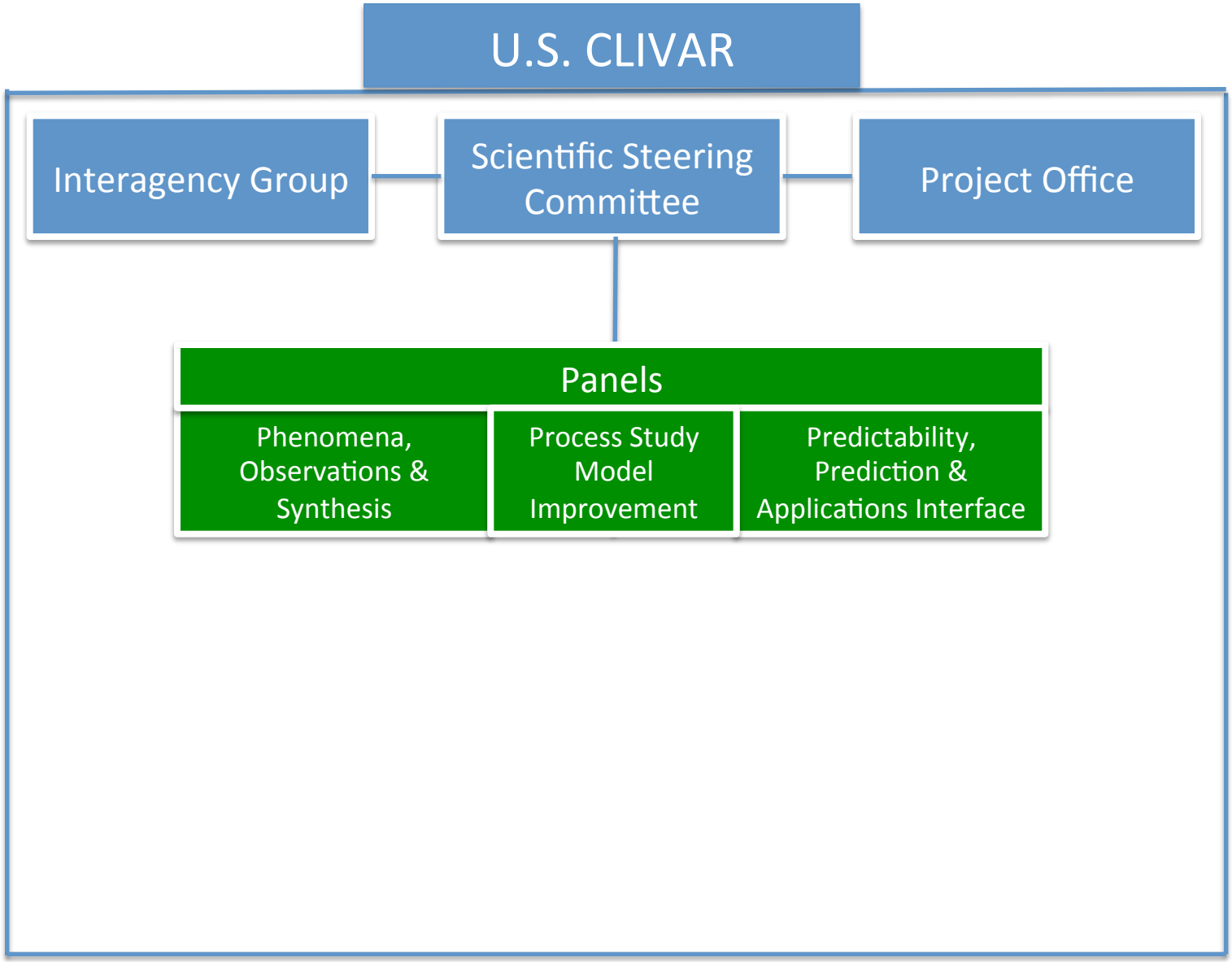

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Panels

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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Climate System Analyses & Reanalyses

- Identification and understanding of modes/patterns of climate variability:
  - El Nino-Southern Oscillation
  - Tropical Atlantic Variability
  - Monsoon Systems
  - Madden Julian Oscillation
  - Arctic Oscillation/North Atlantic Oscillation
  - Pacific Decadal Variability
  - Atlantic Multidecadal Variability
  - Antarctic Oscillation

- Determining and understanding ocean state, variability and change, and its influence on climate
  - Atlantic Meridional Overturning Circulation
  - North Pacific Gyre Oscillation
  - Western Boundary Currents
  - Southern Ocean/Antarctic Circumpolar Current

- Development of assimilated ocean and atmospheric analyses and reanalyses
  - evaluation of degree to which reanalyses are improving
  - impact of observing system changes
  - merit of coupled atmosphere-ocean versus uncoupled reanalyses
  - challenges with developing an integrated Earth system analyses capability

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Sustain Climate Observing System

- Design and expansion of *in-situ* observing system
  - Sheparded repeat hydrography and ENSO observing systems
  - Advocated for deployment of global Argo Array and development of ocean data assimilation systems
  - Launched PIRATA expansion of tropical moored array into Atlantic
  - Initiated deployment of ocean reference sites
  - Coordinated U.S. contributions to AMOC observing sytem
  - Identified surface met and upper-air observing needs

- Use of data from remote sensing platforms
  - GOES/NPOESS, SST, altimetry, scatterometry, ocean color, salinity, precipitation, clouds, GPS/integrated water vapor

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Process Studies

- Review and coordinate U.S. plans for CLIVAR process studies:

✧ EPIC	Eastern Pacific Investigations of Climate
✧ SALLJEX	South American Low Level Jet Experiment
✧ NAME	North American Monsoon Experiment
✧ AMMA	African Monsoon Multidisciplinary Analysis
✧ KESS	Kuroshio Extension System Study
✧ CLIMODE	CLIVAR Mode Water Dynamics Experiment
✧ VOCALS	VAMOS Ocean-Cloud-Atmosphere-Land Study
✧ DIMES	Diapycnal and Isopycnal Mixing Experiment
✧ DYNAMO	Dynamics of the Madden-Julian Oscillation
✧ IASCLIP	Intra-Americas Studies of Climate Processes
✧ SPURS	Salinity Processes in the Upper Ocean Regional Study

- Established 'Best Practices' for Process Studies, BAMS 2009

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Model Evaluation Projects

- Climate Model Evaluation Projects (CMEP)
  - Promote diagnostics of late 19th -20th century simulations through intercomparisons and comparisons with observations
  - Focus on regional climate, climate variability and trends, modes of natural variability, hydrological cycle behavior, and extreme events
  - 18 projects awarded in 2004 for CMIP4; 25 papers
  - 27 projects awarded in 2011 for CMIP5
- Drought in Coupled Models Project (DRICOMP)
  - Increase community-wide diagnostic research into the physical mechanisms of drought, including the role of the oceans and land, and to evaluate drought simulation in coupled climate models.
  - 16 projects awarded in 2007; 26 papers through 2010

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Assessment and Applications Interface

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  - To grow the pool of scientists qualified to transfer advances in climate science and climate prediction into climate-related decision framework(s) and decision tools
  - Sponsored by NOAA, Solicitations in 2008-2011, 9 Fellowships awarded
  - Topics include western water & climate, climate change risk quantification, extreme heat events and mortality prevention, land use planning, shorefast sea ice monitoring, intraseasonal oscillations and ocean biology impact, drought monitoring & prediction
- Researcher Colloquium on Climate Extremes
  - Assembled climate experts, statisticians, decision & policy makers to discuss statistical methods and climate model capabilities to provide useful information on extremes under climate change across a range of sectors
- National Climate Assessment
  - Contributions for 2013
  - Plans for future collaboration

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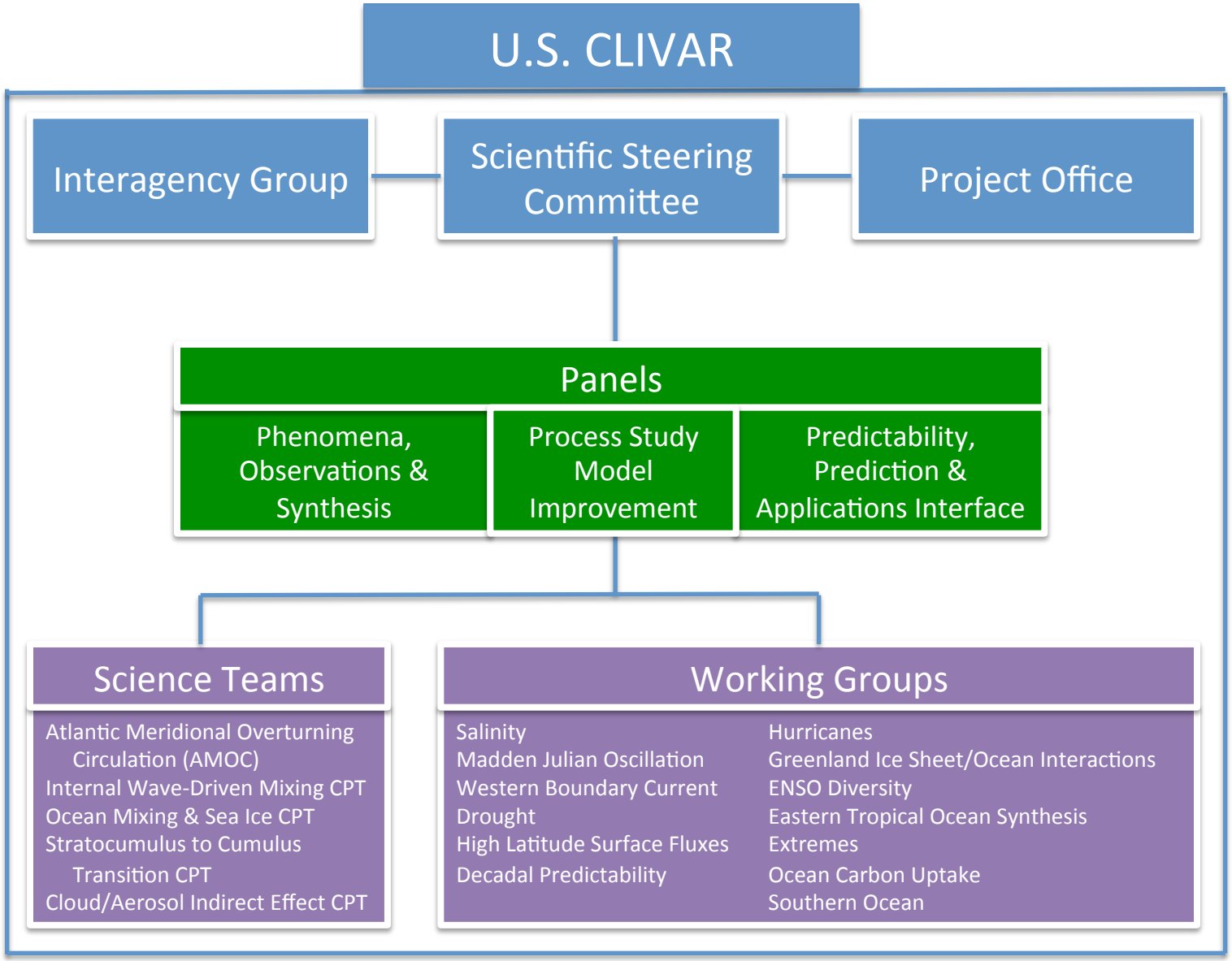

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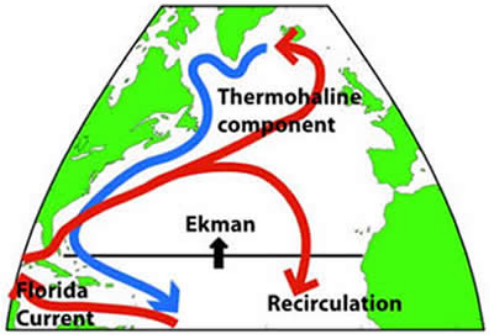
Science Teams

Atlantic Meridional Overturning Circulation

- Established as Ocean S&T Priority in 2007
- Supported by NASA, NSF, NOAA & DOE
- 50+ projects and 50 PIs on Science Team
- Organized into four Task Teams
  - Observations
  - State, Variability, Change
  - Mechanisms and Predictability
  - Impacts on Climate and Ecosystems
- Annual PI meeting to share science and plan future activities
- Annual report summarizing individual projects progress and collective program advances



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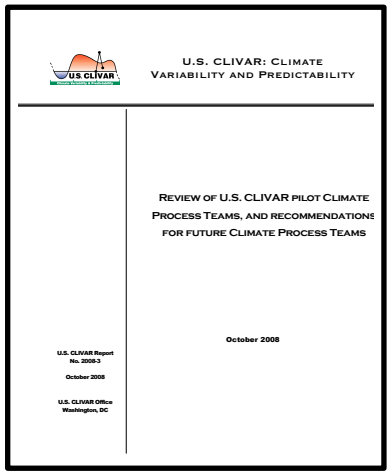
Climate Process Teams

- Funded group of observationalists, theorecticians, process and GCM modelers working closely together to improve parameterizations of a particular process in one or more IPCC-class models
- Three pilots in 2003
  - Low-Latitude Cloud Feedbacks on Climate Sensitivity
  - Ocean Eddy Mixed Layer Interactions
  - Gravity Current Entrainment
- CPT Review in 2008
- Four new CPTs established in 2010
  - Internal Wave-Driven Mixing in Global Ocean Models
  - Ocean Mixing Processes Associated with High Spatial Heterogeneity in Sea Ice
  - Cloud Parameterization and Aerosol Indirect Effects
  - Stratocumulus to Cumulus Transition


U.S. CLIVAR: Climate Variability and Predictability

Review of U.S. CLIVAR pilot Climate Process Teams, and recommendations for future Climate Process Teams

October 2008

U.S. CLIVAR Report No. 2008-3

October 2008

U.S. CLIVAR Office Washington, DC

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Working Groups

Limited-lifetime action-oriented groups of scientists (typically ~8-12 core members) to:

- Expedite coordination and implementation of focused activities for the benefit of the broader scientific community.
  - Assess existing or developing new data and modeling products
  - Lead analyses or syntheses of current state of understanding
  - Develop scientific and implementation recommendations
- Foster wider support of and participation in activities addressing critical scientific challenges and/or CLIVAR needs (e.g., Themes)
- Facilitate joint activities between U.S. CLIVAR and other national and/or international programs
- Serve as a basis for follow-on community activities nationally and internationally

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Working Groups

Salinity	2005-2007
Madden-Julian Oscillation (MJO)	2006-2008
Drought	2006-2008
Western Boundary Current	2007-2009
High Latitude Surface Flux	2008-2012
Decadal Predictability	2009-2012
Greenland Ice Sheet-Ocean Interactions	2010-2013
Hurricane	2011-2013
ENSO Diversity	2012-2013
Eastern Tropical Ocean Synthesis	2012-2014
Extremes	2012-2014
Ocean Carbon Uptake (Joint with OCB)	2012-2015
Southern Ocean (Joint with OCB)	2012-2015

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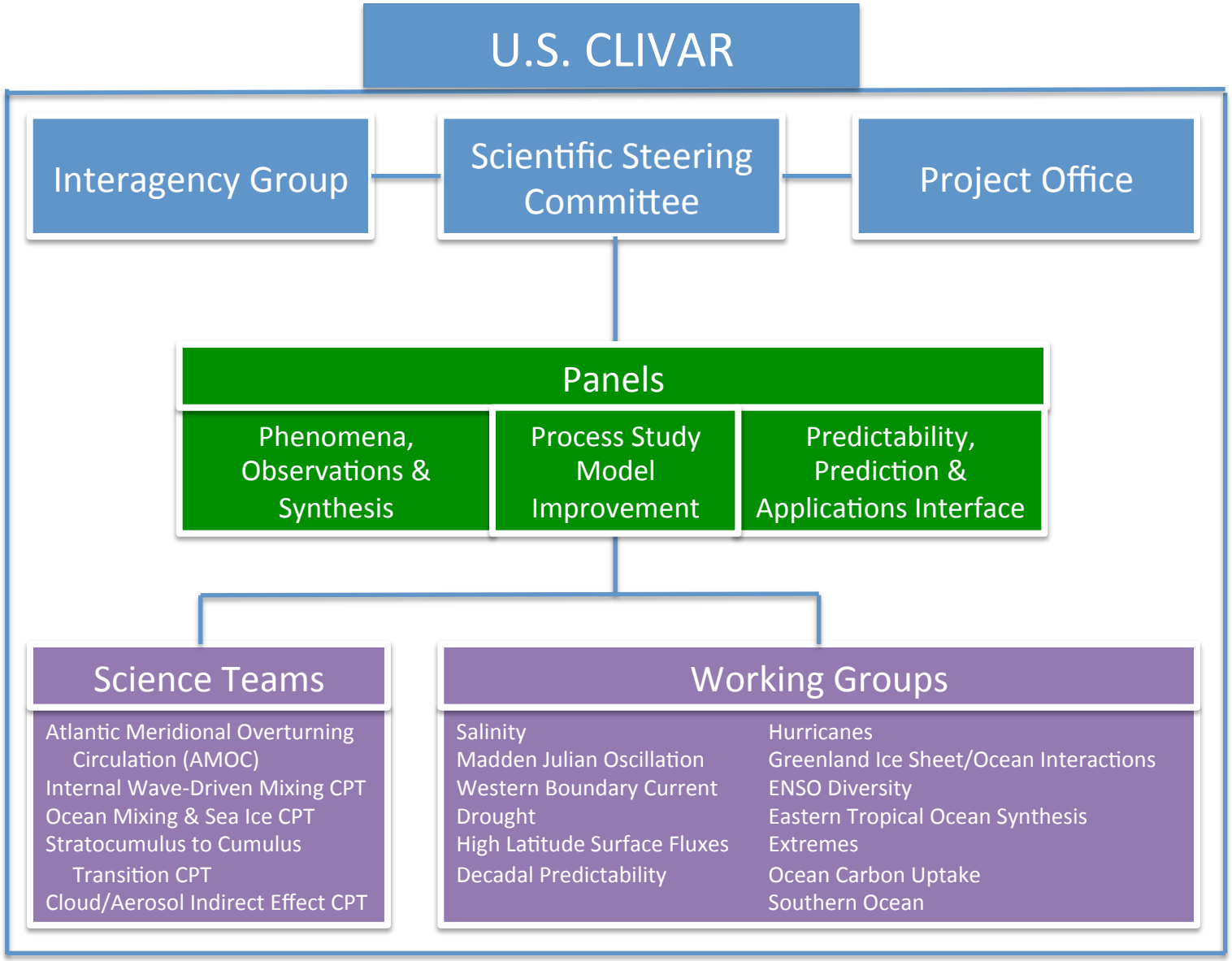

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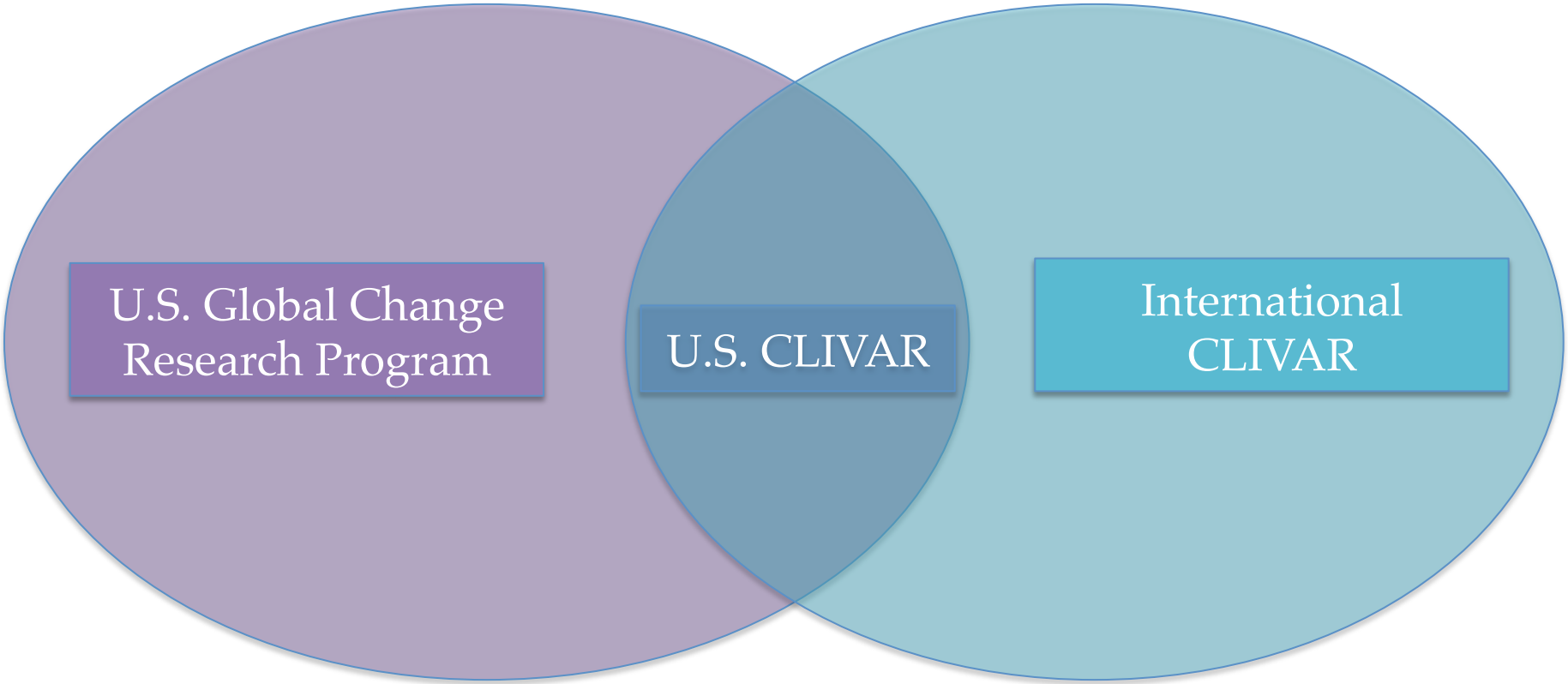
Intersection of U.S. and International Programs



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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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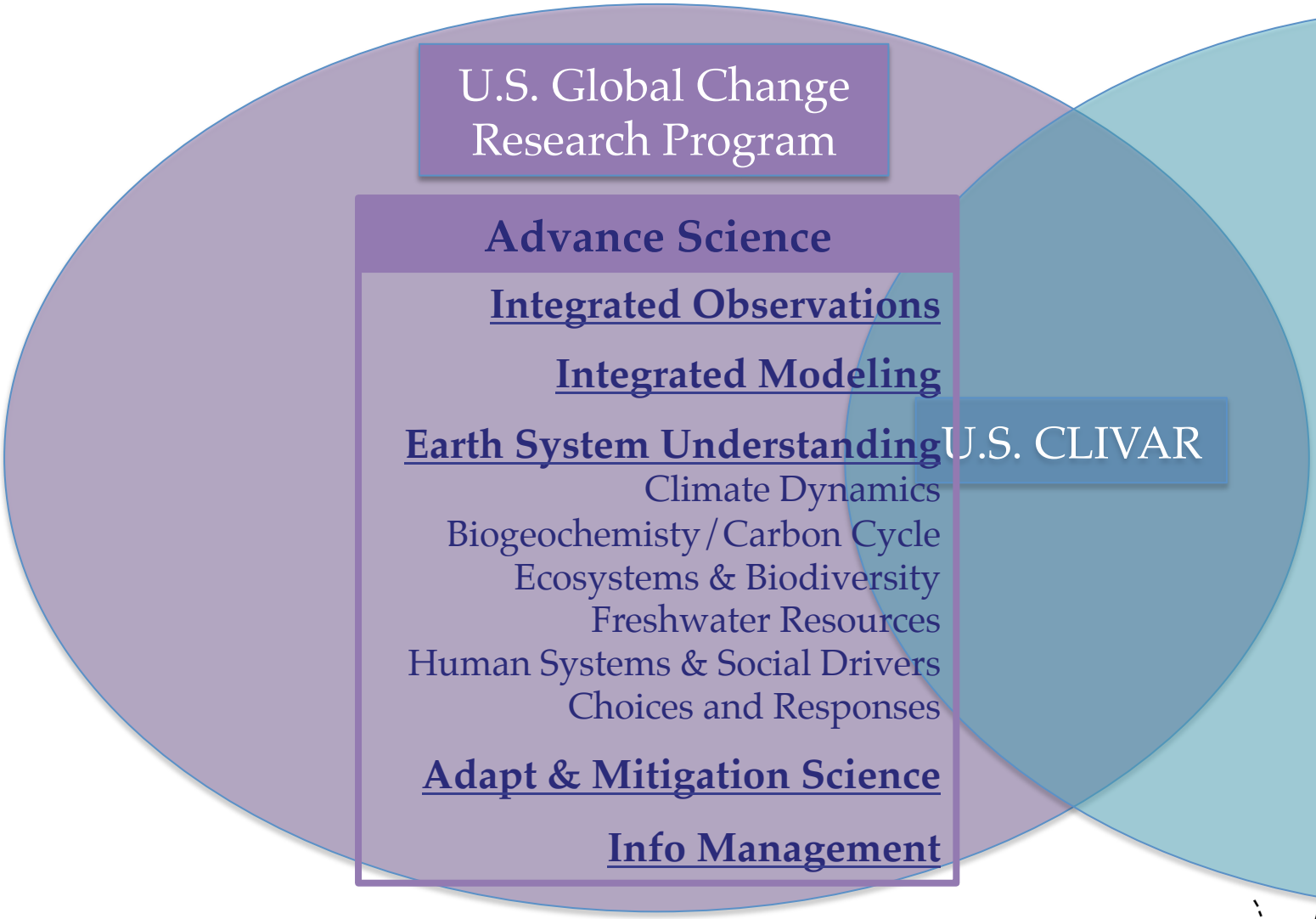
Core Climate Research Contribution to USGCRP



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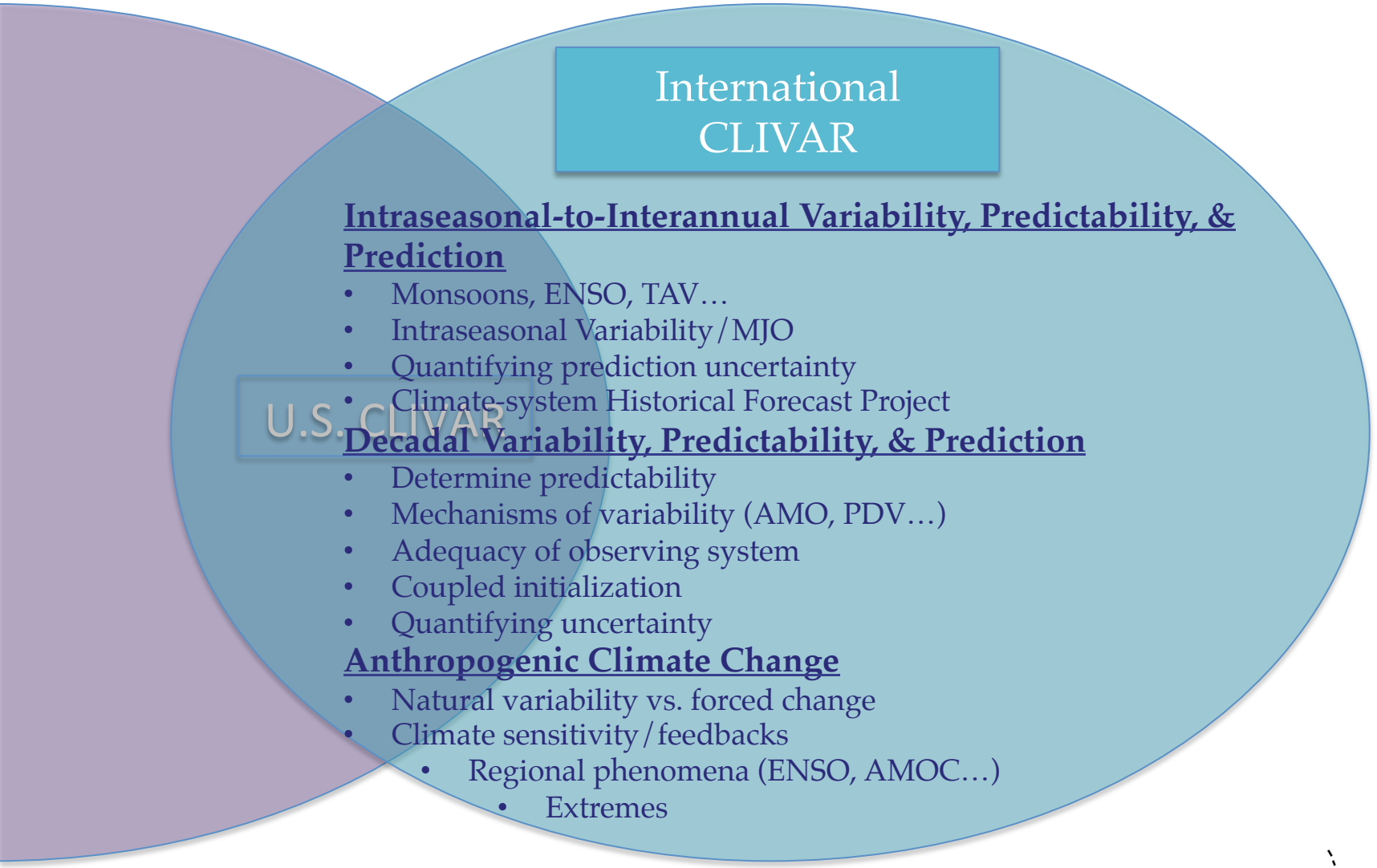
Core U.S. Contribution to International CLIVAR



Intraseasonal-to-Interannual Variability, Predictability, & Prediction

- Monsoons, ENSO, TAV…
- Intraseasonal Variability/MJO
- Quantifying prediction uncertainty
- Climate-system Historical Forecast Project

Decadal Variability, Predictability, & Prediction

- Determine predictability
- Mechanisms of variability (AMO, PDV…)
- Adequacy of observing system
- Coupled initialization
- Quantifying uncertainty

Anthropogenic Climate Change

- Natural variability vs. forced change
- Climate sensitivity/feedbacks
    - Regional phenomena (ENSO, AMOC…)
        - Extremes

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Agency Presentations

Summary by each of the U.S. Sponsoring Agencies, covering:

- Relevant agency missions / goals
- Supported U.S. CLIVAR activities over past 3-4 years
- Top five long-range (5-10 years) climate research areas of interest that intersect with U.S. CLIVAR
- Intangibles - How to engage and provide value

Eric Lindstrom

Sandy Lucas

Eric Itsweire

Renu Joseph

Dan Eleuterio

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