

# CLIVAR:

CLIMATE & OCEAN  
variability, predictability and change

## WCRP Core Project on the Ocean-Atmosphere System

JSC 39

**Detlef Stammer & Annalisa Bracco (SSG co-chairs)**

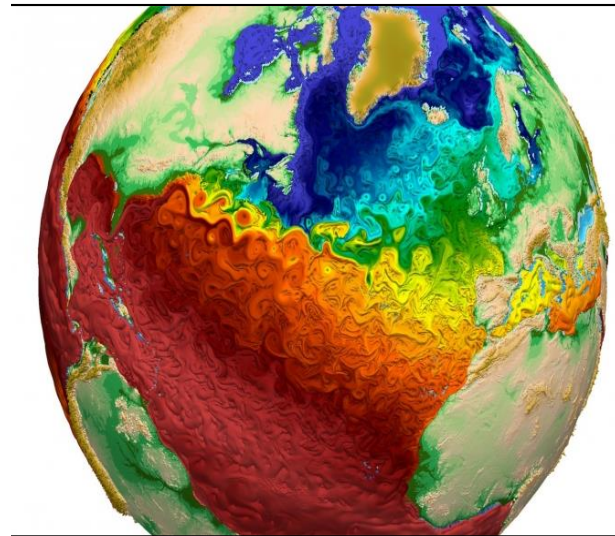


# Outline CLIVAR Report

- **Developments since CLIVAR OSC in Qingdao**
- **CLIVAR Science Plan (SP)**
- **WCRP Strategic Plan**

# CLIVAR: CLIMATE & OCEAN variability, predictability and change

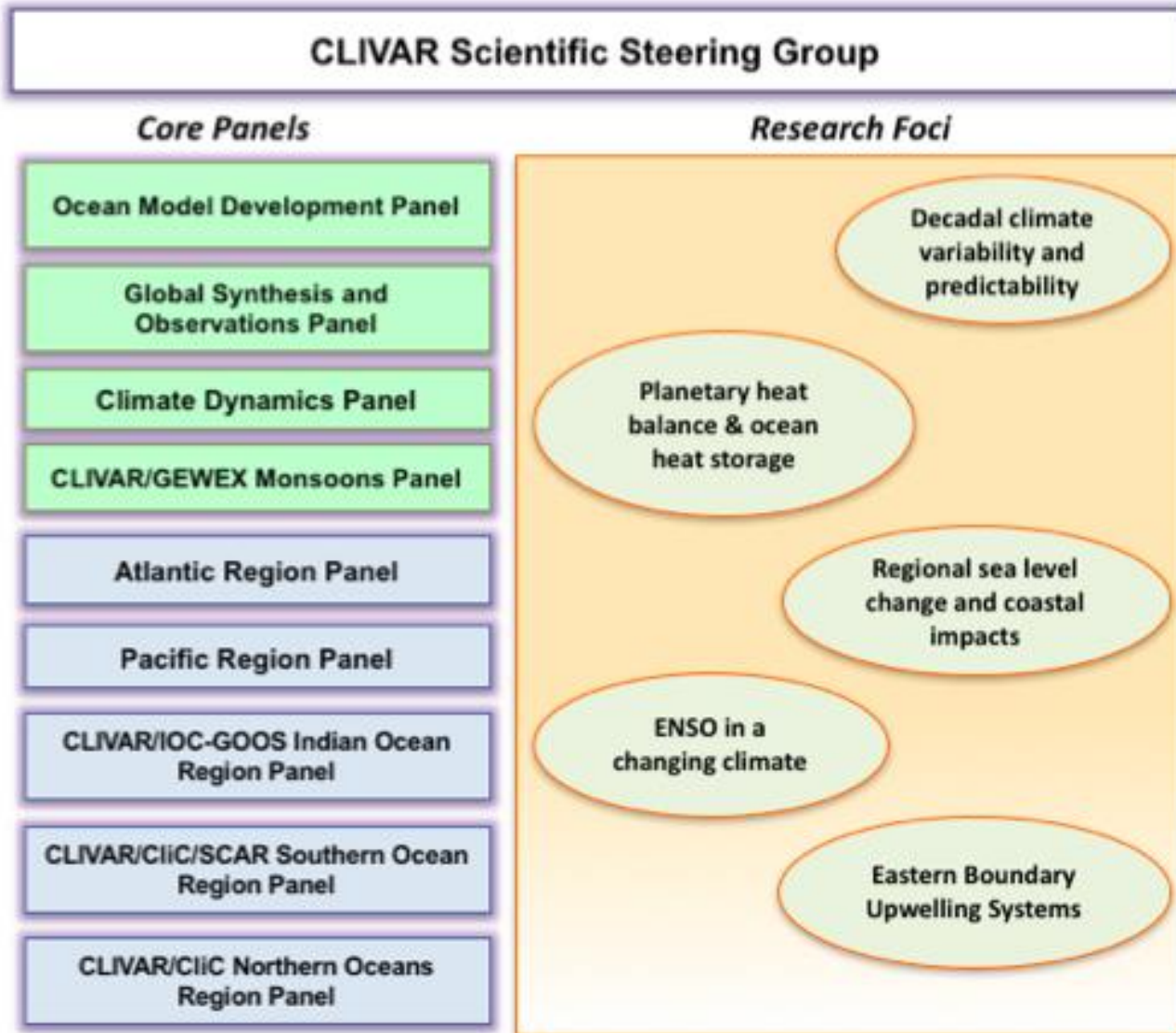
- Describe and understand the dynamics of the coupled ocean-atmosphere system,
- Identify processes responsible for climate variability, change and predictability,
- Develop - through the collection and analysis of observations - and apply models of the coupled climate system.



Credit: Los Alamos National Laboratory

# Ongoing CLIVAR Structure

## CLIVAR Panels

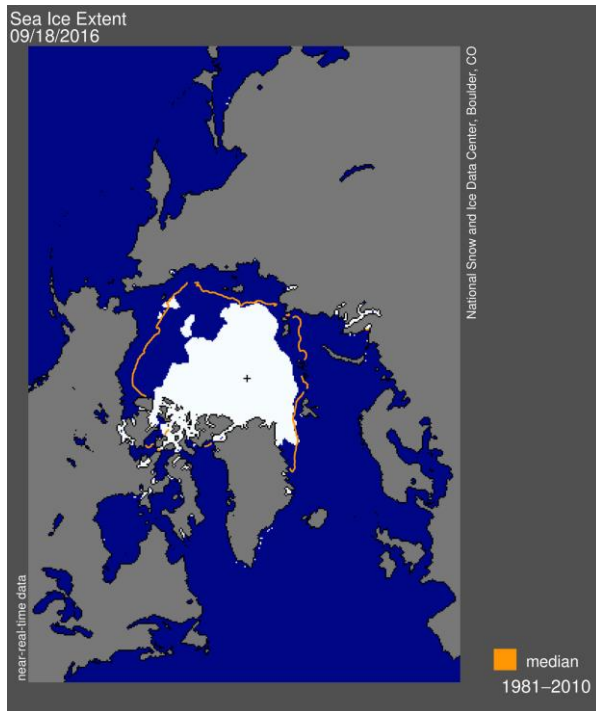


International CLIVAR Project Office

# Developments in the past year

- Panel activities
- RF
- Observing system review
- IOC interaction
- OceanObs'19
- Outreach and Summer Schools

# New CLIC/CLIVAR Panel: NORP



An International Panel to Coordinate and Facilitate Activities on the Role of the Northern Oceans in the context of the Global Climate System from a Coupled Ocean-Air-Ice Perspective

Founding Chairs:  
Amy Solomon and John Fyfe

First in-person meeting in Davos, at POLAR2018

# Research Foci

## **First RF will come to end:**

- Decadal Climate Variability & Predictability:
    - 2019 conference
    - Will become pan-WCRP effort
  - Planetary Heat Balance & Ocean Heat Storage:
    - 2018 workshop,
    - will become pan-WCRP
  - ENSO in a Changing Climate:
    - Conference in 2018
    - will move into PRP
- **New call anticipated**



# Observing System Review

- CLIVAR is reviewing its role in defining observing system requirements for climate with ongoing reviews in various basins.
- Short-term:

- **TPOS2020**

- CLIVAR PRP, ENSO RF and SSG co-chairs recommend that TPOS2020 carefully reconsider its design strategy, with emphasis of **preserving to the maximum extent possible the core elements of the TAO/TRITON array. Negative answer so far**

- **Tropical Atlantic Observing System review**

- 2nd TAOS Review Workshop being organized back-to-back with PIRATA-23 in Marseille, France October 22-26, 2018

- **Indian Ocean Observing System (IndOOS) decadal review**

- Close to completion. Last meeting in March 2018. Commented by IMBeR, OOPC, IOGOOS, IOC PPO



# Dissemination

- Town hall: OSM 2018
- OceanObs'19: +7 articles proposed by CLIVAR groups
- Exchanges
- International workshops (SL, TAOS, ENSO, S2S, C-H)



## WCRP workshop on

# “The Earth’s Energy Imbalance and its implications”

13 - 16 November 2018, Toulouse, France

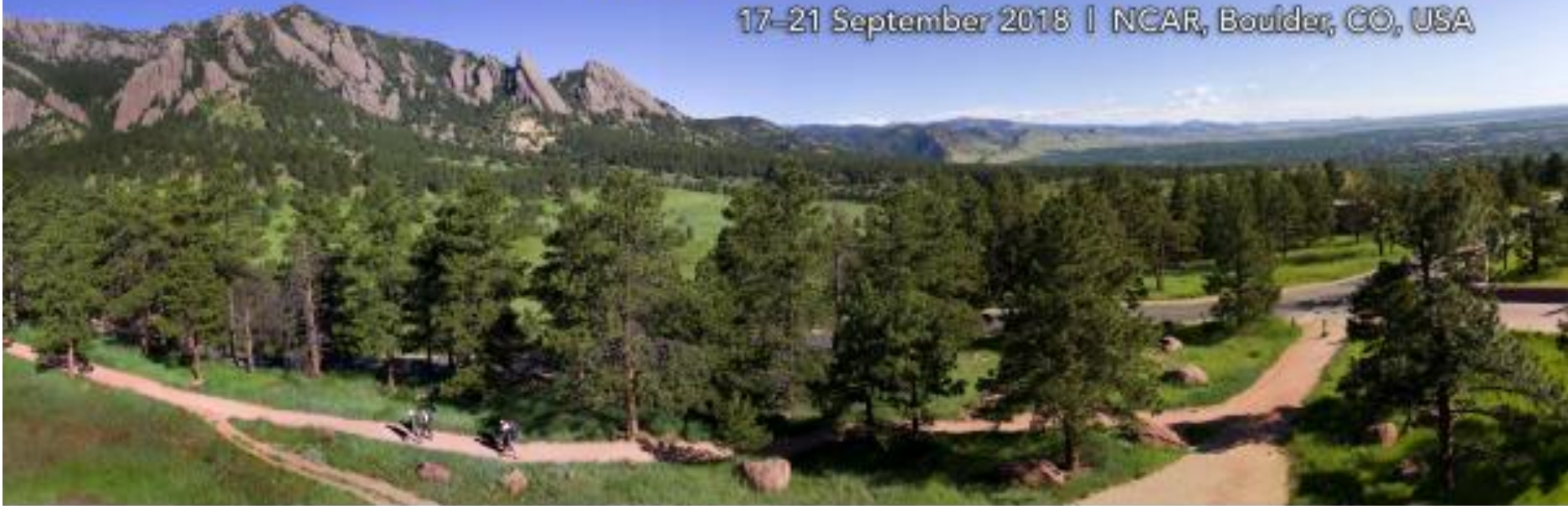
### Expected outcomes:

- Discussion and reporting on how the CONCEPT-HEAT topic could evolve into a WCRP topic, together with research goals and priorities.
- Strengthening future international scientific collaborations with experts concerned with the flow of energy through the climate system, and its implications for climate variability on multiple time scales.
- Developing plans for future assessments of the Earth Energy Imbalance and its variability with the aim of documenting uncertainties, assessing their implications for prediction, and identifying future observational needs.
- Developing a community paper on the Earth energy imbalance, or equivalent (e.g. special issue etc.).

ms and Objectives

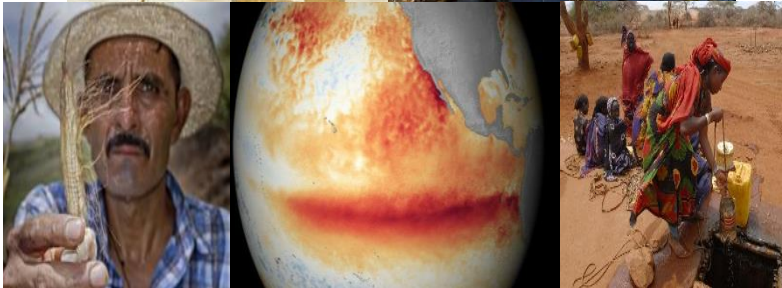
# International Conferences on Subseasonal to Decadal Prediction

17–21 September 2018 | NCAR, Boulder, CO, USA



**Second International Conference on Subseasonal to Seasonal Prediction (S2S) and  
Second International Conference on Seasonal to Decadal Prediction (S2D)**

# IV International Conference on El Niño Southern Oscillation: ENSO in a warmer Climate



16-18 October 2018. Guayaquil, Ecuador

<http://www.ensoconference2018.org/>

# Capacity Development Summer Schools

- Two MOU finalized with FIO (Qingdao, CN) and ICTP (Trieste, IT).
- Yearly schools on CLIVAR related, societally relevant science in alternating years in Qingdao and Trieste (or in a developing country).

# Capacity Development: Summer Schools

- July 2018, Qingdao with FIO: Sea level



- 2019, in collaboration with ICTP: EBUS
- 2020: Qingdao, TBD

# Capacity Development

Reflections on the CLIVAR Early Career Scientists Symposium 2016 by Swart et al. was just published in the NPJ Climate and Atmospheric Science

# New CLIVAR Science

## Identified scientific priorities

<http://www.clivar.org/news/draft-clivar-science-plan-and-implementation-strategy-available-comments>

1. Mechanisms of climate variability and change that require further investigation with the ultimate goal of better constraining the fluxes of energy and carbon in the climate system
2. Ocean processes that modulate climate variability and change for which open questions remain
3. Climate predictability challenges that exist over a broad range of space and time scales



# CLIVAR Science Goals

Mechanisms of climate variability, climate change and transient climate sensitivity

- The ocean's role in climate variability and change
- Ocean constraints on global sensitivity, air-sea exchange and Earth's energy budget
- Regional impacts of climate change
- Constraining Ocean Carbon Uptake and Storage

# CLIVAR Science Goals

Fundamental ocean processes influencing climate

- Ocean energetics and mixing
- Coastal processes and large upwelling systems
- Climate dynamics, feedbacks and regional modes of coupled variability

# CLIVAR Science Goals 2

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

- Subseasonal to interannual variability, predictability and prediction
- Seasonal-to-Decadal predictability and prediction
- Attribution of decadal-to-multidecadal changes
- Weather, climate and ocean extremes

# Long term objectives (input for WCRP SP):

- Identify ocean and coupled **climate processes** that are critical for global and regional climate variability and change
- Identify temporal and spatial scales of **climate predictability**
- Quantify constraints on **climate sensitivity**, air-sea exchange and Earth's energy budget / ocean heat content
- Quantify **regional impacts** of climate change in **sea level, cryosphere and water cycle**
- Quantify past/present/future **ocean role in CO<sub>2</sub> and heat uptake** and links between **climate and ocean ecosystems**

# Long term objectives (input for WCRP SP):

- Providing **regional climate information and seamless predictions across timescales**, from intraseasonal to multidecadal
- Quantifying predictability of the climate system, including the predictive skills of extreme events in a transient climate
- Facilitating the provision of actionable forecast information, also for developing economies

# WCRP SP

- CLIVARs science speaks to all objectives in WCRP SP (see above). In fact CLIVAR speaks to all Capability themes provided in in the WCRP review.
- The CLIVAR community has been actively involved. How that input can be accounted for most productively?
- Integrated view on climate system (heat, water, carbon) required and implemented in the CLIVAR SP.
- An extra effort is needed to bring it all together in the WCRP SP.

# Challenges Ahead

- WCRP Implementation: as before or different?
- Sustaining national funding under a new WCRP structure.
- Streamlining what is in CLIVAR with other WCRP efforts.
- Where to put integrated activities, organizationally, in new WCRP, such as heat, water, etc?
- Interaction of potential new WCRP structure with national CLIVAR activities (e.g., US CLIVAR; ICPO).
- Finances!!

# Thank you





# CLIVAR Enabling Capabilities

***International cooperation is critical to grow the infrastructure that underpins all CLIVAR science:***

- Climate and Ocean Process and Sustained Observations
- Global, Regionally Enhanced and Process Models
- Ocean Data, Synthesis and Assessment
- Capacity Development and Knowledge Exchange

# Research Foci (RF)

- Launched in 2015, RF are focused limited-lifetime initiatives (5 years or less).
- Topics of high priority in the climate research community that would benefit from enhanced international coordination.
- Initial set entailed:
  - **Decadal Climate Variability & Predictability**
  - **Planetary Heat Balance & Ocean Heat Storage (with GEWEX participation)**
  - **ENSO in a Changing Climate**
  - **Eastern Boundary Upwelling Systems**
  - **Regional Sea Level Change & Coastal Impacts (WCRP GC)**

# Capacity Development: Other

- Funds for participation of ECS in  
Sea Level Conference, NY  
ENSO Conference, Ecuador
- ICGPO intern from China, Dec-2016/July-2017
- ICGPO intern from Ecuador, April-Sept 2018