



WORLD CLIMATE RESEARCH PROGRAMME

42nd Session of the WCRP Joint Scientific Committee (JSC42)

CLIVAR

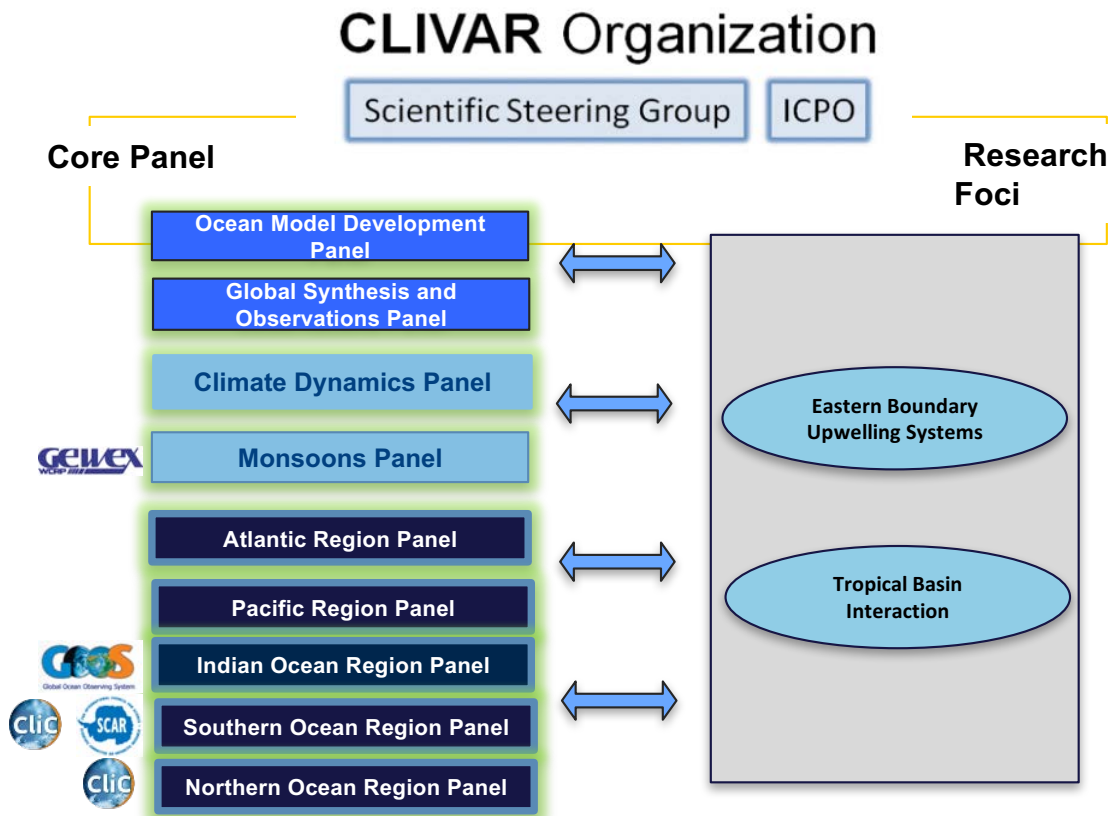
Sonya Legg & Wenju Cai
SOG Co-chairs



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CLIVAR Organization Chart



The **CLIVAR SSG** provides overall guidance for CLIVAR activities, in concert with WCRP objectives, and establishes CLIVAR Panels and Working Groups and their term of reference.

Research Foci address urgent and actionable research challenges. RFs have a limited life-time (3-5 yrs)

The Sea Level Grand Challenge (ending 2022) is cross-cutting between CLIVAR & WCRP, and includes modeling & observations



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Science Highlight

New CLIVAR initiatives

- **Tropical Basins Interaction Research Foci** launched in March 2020;
- **CLIVAR AMOC Task Team** launched in April 2021 (led by PRP, with close cooperation with other CLIVAR panels and US CLIVAR AMOC ST, UK RAPID, AtlantOS);
- **PRP ENSO Conceptual Model WG** launched in June 2020;
- **PRP Tropical Pacific Decadal Variability WG** launched in May 2021;

Other science priorities from CLIVAR panels/RFs

- Air-sea interaction from the high-latitudes to the tropics (CDP & ARP);
- Ocean heat and freshwater storage and transport (NORP, SORP);
- Constrain the Southern Ocean's role in global carbon cycling (SORP);
- The role of the Southern Ocean in the planet's heat and freshwater balance (SORP);
- Ice-ocean interaction, e.g. progression of warm water into ice-shelf cavities (SORP);
- Organisation of storms, blocks and jet streams on seasonal and longer time scales (CDP);
- Ocean basin to ocean basin and tropical-extratropical teleconnections (CDP, ARP & TBI);
- Regional impacts of climate variability and change, e.g. sea level, ecosystems, extreme events, etc (all region panels and SL GC and EBUS RF).



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Other highlights from CLIVAR panel/RF/GC

- **IORP:** IndOOS-2 implementations; RAMA-OMNI coordination; partnership and capacity building across the IO basin, particularly for WIO and ECS;
- **SORP:** Contributed to YOPP-SH summary article in *BAMS*; SOOS science plan; Synthesis from national reports of 2019;
- **PRP:** ENSO Conceptual Model; ENSO metrics; TPDV; Feedback to TPOS2020 report;
- **ARP:** TAOS review; AMOC; AtlantOS, EUREC⁴A-OA/ATOMIC; Coastal Resilience tools; Air-sea interaction from the high-latitudes to the tropics;
- **NORP:** MOSAiC activities, Arctic freshwater review paper, WWRP Polar Prediction Project;
- **MP:** CLIVAR Exchanges special issue on India's Monsoon Mission, and GEWEX Newsletter special edition; Monsoons Climate Change Assessment in *BAMS*;
- **GSOP:** Assessment of COVID impacts on observing system with GOOS;
- **OMDP:** 5 publications on OMIP-2; how the OMIP simulations and diagnostics can play an increasingly significant role within the CMIP projects; discussions with DAO, WGNE, ESMOC to form a strong scientific basis to make restructuring decisions and to fit into the LHAs.
- **CDP:** 10 conference sessions;
- **TBI RF:** TBI workshop; coordinated GCM experiment; CLIVAR Exchanges special issue;
- **EBUS RF:** EBUS perspective paper; session proposals submitted to OSM 2022;
- **SL GC:** 2022 sea level conference (Singapore).

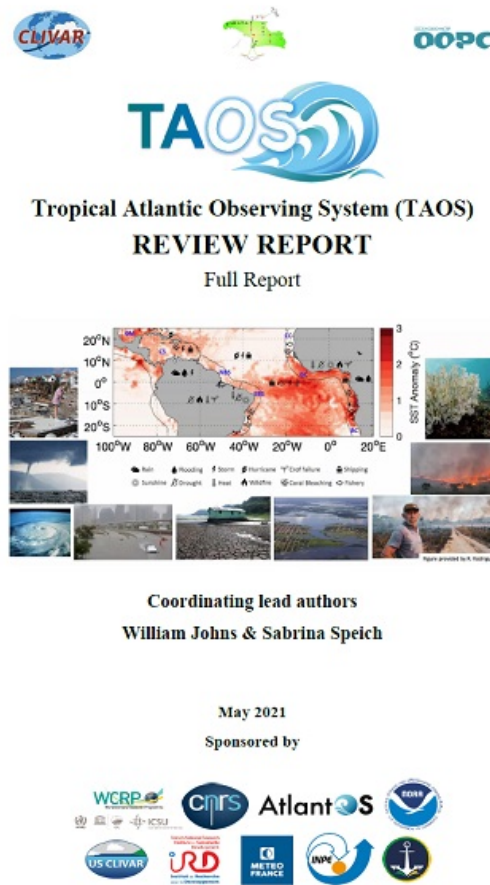


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Publications

Tropical Atlantic Observing System (TAOS) Review Report (published in May 2021)



A 3-year comprehensive review led by CLIVAR ARP (co-chairs: Bill Johns & Sabrina Speich).

Major content:

- A concise review of TAOS societal, scientific and operational drivers;
- A summary of the current TAOS observing network;
- Recommendations on the evolution of the TAOS;
- Information on the actual TAOS data flow and products and recommendations for their evolution; and
- Recommendations on the future governance of the TAOS.

<https://www.clivar.org/documents/tropical-atlantic-observing-system-taos-review-report-final-draft>

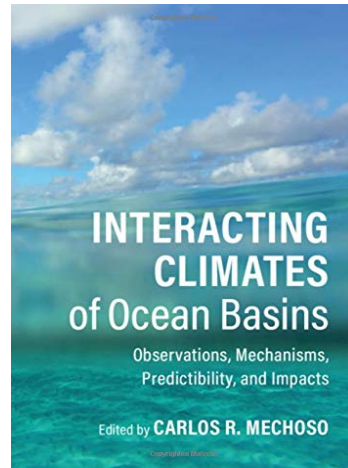
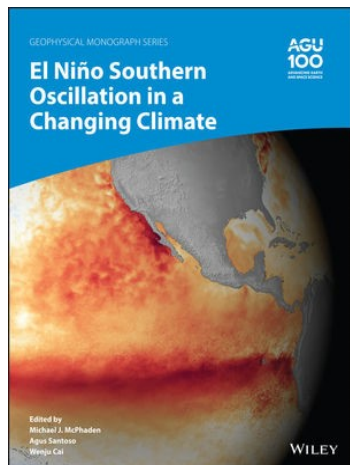


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Publications – cont.

Monographs & Special issues



Monographs

- McPhaden, M.J.(Editor), A. Santoso (Editor), W. Cai (Editor), El Niño Southern Oscillation in a Changing Climate, Wiley, (2020), 528pp
- Mechoso C.R. (Editor), Interacting Climates of Ocean Basins: Observations, Mechanisms, Predictability, and Impacts, Cambridge University Press, 2020, 358pp,

Special issues at *Frontiers in Marine Science*

- North Pacific Climate and Ecosystem Predictability on Seasonal to Decadal Timescales (Jan. 2021);
- Climate Services for Adaptation to Sea-Level Rise (May 2021).



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Publications – cont.

Papers

Published

- L. M. Beal, et, al., A roadmap to IndOOS-2: Better observations of the rapidly-warming Indian Ocean, *Bull. Amer. Meteor. Soc.* (2020).
- B. Want, et, al., Monsoons Climate Change Assessment, *Bull. Amer. Meteor. Soc.* (2020)
- Cai, W., Ng, B., Geng, T. et al. Butterfly effect and a self-modulating El Niño response to global warming. *Nature*, 585, (2020). 68–73
- A. Solomon et al., Freshwater in the Arctic Ocean 2010-2019. *Ocean Sci. Discuss.* [preprint], <https://doi.org/10.5194/os-2020-113>, in review, 2020.
- Tsujino H, Urakawa L S, Griffies S M, et al. Evaluation of global ocean–sea-ice model simulations based on the experimental protocols of the Ocean Model Intercomparison Project phase 2 (OMIP-2). *Geoscientific Model Development*, 2020, 13(8): 3643-3708.

Ongoing:

- EBUS Perspective Paper (reactivate, final outcome before sunseting)
- TPDV paper (submitted to *Science*)

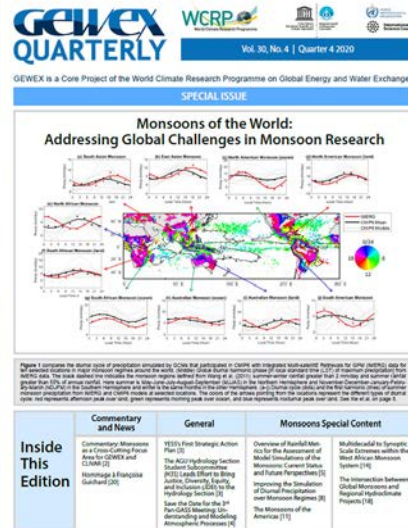


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Publications – cont.

CLIVAR Exchanges



CLIVAR & GEWEX joint publications on Monsoon

Exchanges #79: Indian's Monsoon Mission
GEWEX Quarterly: Monsoons of the World: Addressing Global Challenges in Monsoon Research.

BAMS: Monsoons climate change assessment, 2021

Upcoming special issues of *CLIVAR Exchanges*:

- Tropical Basin Interaction (July 2021)
- AI and Climate and ocean forecasting (End of 2021)
- Tropical Atlantic Observing System (Early 2022)
- CLIVAR Endorsed projects and activities (??)



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Meetings and Workshops in 2020/2021

SSG and Panel Meetings (all online)

- SSG-26 (8-11 March 2021, 3 hours * 3 days)
- IORP-17 (28 April 2021, 3 hours * 1 day)
- Regular panel/RF telecons on bi-annual (OMDP), quarterly (ARP, IORP), bi-monthly, monthly (MP, NORP, SORP) or ad hoc (PRP, GSOP, CDP) basis.

Workshops and conference sessions organised by panel/RF

- WCRP-CLIVAR Workshop on Climate Interactions among the Tropical Basins (24-26 February 2021, Online) (TBI RF)
- International Workshop for Mid-latitude Air-Sea Interaction: Advancing Predictive Understanding of Regional Climate Variability and Change across Timescales. (June 8-9 & 12-14, 2021, Online + Sapporo, Japan) (CDP)
- Co-organized the Cloud Feedback Model Intercomparison Project (CFMIP) 2020 Virtual meeting (CDP)
- “New Arctic and Southern Oceans” and “Extratropical and High-latitude Storms”, Joint Session with WGNE35 2-5 Nov., 2020 (OMDP)
- Co-sponsored 2020 EGU Session: Changes in the Arctic Ocean, sea ice and subarctic seas systems: Observations, Models and Perspectives (NORP)
- Co-sponsored AGU 2020 sessions on “Sea Ice–Ocean–Atmosphere Interactions in the Teleconnections, Extreme Events, and the Rapidly Changing Polar Climate” (NORP)
- Co-organized TRIATLAS/Tropical Atlantic Variability/PIRATA virtual meeting(CDP)
- Co-organized the Nansen Tutu TRIATLAS Summer School on Ocean Climate, and Marine Ecosystems, Cape Town, South Africa, 14-21, Jan., 2020 (CDP)



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WCRP-CLIVAR Workshop on Climate Interactions among the Tropical Basins



- 3-day online workshop held on 24-26 February 2021
- Over 200 participants from 30 countries;
- Support from WCRP, US CLIVAR, NOAA, NSF.

- First big online event organized by CLIVAR,
- Different online platforms had been tested for plenary talks & breakout sessions (Webex), poster sessions (virtualpostersession), and offline communication (slack);
- Plans: special issue of CLIVAR exchanges, coordinated GCM experiments.



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Upcoming Events

2022 Sea Level Conference



1. To provide an opportunity to share the present status of climate-related sea-level research;
2. To have a strong focus on application of sea-level science for adaptation and stakeholder needs.
3. To consider the future of sea-level rise research within the new structure of WCRP, including the lighthouse activities and the new "Core Projects" focusing on "Regional Information for Society" and "Earth System Modelling and Observations".

To register your interest: <https://www.wjx.top/vj/wAPKGX7.aspx>



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Upcoming Events

Summer School



**CLIVAR– FIO Summer School on
Ocean Macroturbulence and Its Role in
Earth's Climate**

19-25 June 2022
Qingdao, China

The summer school is intended for early career scientists with research interests in ocean and climate. It will focus on the interactions of ocean meso- and sub-mesoscale motions with Earth's climate system, including the following topics:

- **Observations:** How are remote and in situ observations made on these scales, what new technologies (e.g. autonomous vehicles) are becoming available, and what are the challenges in analyzing and interpreting these data?
- **Dynamics:** What are the dynamical mechanisms that produce meso- and sub-mesoscale motions? How do they interact with larger-scale circulations?
- **Modeling:** How are meso- and submeso-scale motions represented in numerical models? What are the computational challenges to simulating these scales?
- **Role in climate:** How do meso- and submeso-scale motions influence air-sea interactions and fluxes of energy and nutrients between the near-surface and deeper ocean? How do they shape marine ecosystems? What is the importance of ocean macroturbulence for simulating and projecting climate change?

Further information: <http://www.clivar.org/events/clivar-fio-summer-school-ocean-macroturbulence-and-its-role-earth%E2%80%99s-climate>

Director:
W. Robinson, N. Carolina State Univ., US

Lecturers:
E. Chassignet, Florida State Univ., US
A. Dellapenna, Univ. of Washington, US
G. Evans, NOC, UK
X. Ma, Ocean Univ. of China
F. Qiao, FIO-MNR, China
W. Robinson, N. Carolina State Univ., US
S. Speich, IPSL, France

Local Organisers
J. Santos, ICPO, jsantos@clivar.org
J. Li, ICPO, jing.li@clivar.org



1. CLIVAR-FIO Summer School on Ocean Macroturbulence and Its Role in Earth's Climate (**New date, 19 -25 July 2022**)

- Designed for in-person training, virtual participation will be facilitated;
- Lecturers being recontacted;
- New schedule being discussed.

2. Third Summer School on Theory, Mechanisms and Hierarchical Modeling of Climate Dynamics: Tropical Oceans, ENSO and their Teleconnections (**Pending**, originally planned from 3 to 14 August 2020)



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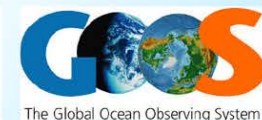


Upcoming Events

Pan-CLIVAR workshop on ocean observations

From global to coastal: Cultivating new solutions and partnerships for an enhanced Ocean Observing System in a decade of accelerating change

- Activity type: 4-day Advanced School/Workshop
- Venue: ICTP, Trieste, Italy
- Dates: **May, 2022**
- Organising Committee: Lisa Beal (IORP, OOPC, USA), Riccardo Farneti (SORP, Italy), María Paz Chidichimo (ARP, OOPC, Argentina), Weidong Yu (Chair OOPC, China), Antonietta Capotondi (PRP, USA), Benjamin Rabe (NORP, Germany), Nick Hardman-Mountford (Commonwealth Secretariat, UK).
- Participants: CLIVAR Atlantic, Pacific, Indian Ocean, Northern Ocean and Southern Ocean region panels; Global Synthesis and Observations Panel; US CLIVAR Phenomena, Observations, and Synthesis panel; GOOS Ocean Observations for Physics and Climate panel; **plus invited developing nation scientists.**



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Upcoming Events

Other workshops

- **Workshop on Multi-annual to Decadal Climate Predictability in the North Atlantic-Arctic Sector** (20-22 September, 2021, online) – CDP & ARP
- **International Workshop on Future Directions in High-resolution Ocean Modelling** (Sep. 29 - Oct. 1, 2021, online) - OMDP
- **Ocean Heat and Freshwater Storage and Transports in Observations and Climate Models** (Pending, Originally planned in October, 2021, Met Office, Exeter, UK) - NORP
- **Training workshop on observing the coastal and marginal seas in the western Indian Ocean** (Winter 2021 or Spring 2022, Hybrid meeting with physical locations in Mozambique and Kuwait and global virtual attendance) - IORP



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Other updates from CLIVAR

- Sunsetting of EBUS RF and SL GC;
- Changes of ICMPO to the International Monsoons Project Office (IMPO)
- Enhanced Early Career Scientists engagement;
 - Recruit ECS members in all CLIVAR panels;
 - Promote ECS networks in Eastern Asia (through WCRP CRF) and Indian Ocean;
 - Involve ECS via contributing to the national reports (SORP).
 - Collaborate with the YESS community.
- Strengthened interaction with partners
 - OOPC/WCRP-CLIVAR Joint session during OOPC-24 (22 April 2021, online)
 - CLIVAR contributed to the publication of Integrated Ocean Carbon Research Report;
 - PICES/CLIVAR joint working group on 'Climate and Ecosystem Predictability';
 - IORP-SIBER collaboration on IndOOS-2 implementation and knowledge sharing in Western Indian Ocean.
 - IORP-SOLAS collaboration in Indian Ocean.



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Future Plans

- **Future meetings:** Encouraging virtual meetings where possible, prioritizing travel for ECS-focused activities. TBI workshop has given CLIVAR valuable virtual meeting experience.
- Encourage more cross-panel activities, and **model-obs connections;**
- Encourage **ECS** to engage in activities benefiting their careers;
- Enhance connection with the **WCRP LHAs and other WCRP core projects**, including the new 'homes';
- Better cooperate and contribute to the **UN Decade of Ocean Science for Sustainable Development**
 - ✓ Currently involved in: 1) DITTO; 2) Ocean Observing Co-Design: evolving ocean observing for a sustainable future
 - ✓ To develop UN Decade Programme/Project led by CLIVAR



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Connection to WCRP

With WCRP LHAs

LHAs	Connection with CLIVAR
LHA1: Explaining and predicting earth system change	CLIVAR panels bring detailed understanding of processes and phenomena of climate specific to different regions, and observational and modelling requirements necessary to understand and predict them. The importance of ocean should be emphasized in the description of this LHA.
LHA2: My climate risk	Coastal risks, sea-level rise, risks associated with coupled interactions as well as the ocean health risk are identified as areas relevant to CLIVAR panels.
LHA3: Safe landing climates:	Importance of ocean, monitoring, coupled climate phenomena, sea-level rise, heat and carbon sequestration should be highlighted in this LHA.
LHA4: Digital earths:	Region panels of CLIVAR connect to the observation datasets, and coordinate model and data management. The expertise in the CLIVAR panels needs to be connected to this LHA. GSOP is particularly relevant to this LHA, e.g. observation impact studies.
LHA5: WCRP Academy:	Two main categories for interaction: 1) summer schools and workshops organised by CLIVAR - maintain archive of materials and make available to a broader community; 2) capacity building, including the inclusion of ECS, regional connections for capacity building and connection to user communities - need to understand the needs from different countries/communities.



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Connection to WCRP

With new core projects

New core project	Connection with CLIVAR
Earth system modeling and observational capacity	Region panels of CLIVAR have expertise in observational data, model assessment, and connecting models and observations for their region. GSOP and OMDP have strong connections, via global obs synthesis and models.
Regional climate information for societies (RifS)	Coastal risks, sea-level rise, risks associated with coupled interactions as well as the ocean health risk are identified as areas relevant to CLIVAR panels.

Issues:

- GSOP and OMDP are more relevant to the 'Model-data' new core project, there is a potential to be joint panel and/or organising joint activities together;
- CLIVAR region panels can link more closely to RifS ;
- SL GC expertise and legacy activities need to be integrated into the new structure of WCRP.
- Future CLIVAR Research Foci: Waiting to see how LHA activities develop, to align future RF with LHAs, avoiding overlap while contributing to ocean-specific areas related to LHA science.



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Connection to WCRP

CLIVAR supported the WCRP Climate Research Forum

WCRP Climate Research Forum (CRF) in the Eastern Asia region: Climate Research Priorities for the next decade (7 April 2021)

- Over 200 participants;
- ICPO provided logistic support to the Forum in close collaboration with RFPs in Eastern Asia, S2S ICO and WCRP Secretariat;
- Closed caption embedded in Webex

CLIVAR will also support the organisation of the CRF in the South America & in Europe and Western Asia (video presentation on AMOC).

CLIVAR also advertises other WCRP activities via its network (e.g. WCRP Open Science Conferences in 2023; Sea Level Conference in 2022; and series of workshops organised by WCRP LHAs).



<https://www.clivar.org/events/wcrp-climate-research-forum-climate-research-priorities-next-decade>



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Connection to WCRP

- **Sunsetting of SL GC and integrating into new WCRP Structure**
 - ✓ 2022 Sea Level Conference is being prepared;
 - ✓ Legacy activities may be integrated into CLIVAR, RifS and LHAs (EPESC and My climate risk) .
- **Interaction with WCRP Community**
 - ✓ Participated in IPOs and WCRP Secretariat telecons and leadership meetings
 - ✓ Special Issues of CLIVAR and GEWEX Newsletters on Monsoons
 - ✓ Attended core project SSG meetings;
 - ✓ Coordinate for the Asia node for SPARC General Assembly in 2022;
 - ✓ OMDP with WGNE, WGCM, CMIP, ;
 - ✓ CDP with WCRP Decadal Climate Prediction Project (DCPP);
 - ✓ Co-sponsor panels: 1) with CliC: NORP, SORP; 2) with GEWEX: Monsoons.
- **Are there additional elements you would like to see in the new WCRP?**
 - ✓ Enhanced communication among core projects, LHAs and other components within WCRP;
 - ✓ Continued engagement with regional stakeholders and ECS communities after Climate Research Forums.



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WCRP Core Project: CLIVAR

1. Highlights for JSC

- **Scientific highlight:** Tropical Basins Interaction; AMOC; Air-sea interaction from high latitude to tropics; heat and freshwater storage and transport; Ocean's role in carbon cycling; Tropical Pacific Decadal Var, ENSO, Monsoons;
- **Contributing to the scientific design and implementation of global observing system:** TAOS Review report published; COVID impact on observations; IndOOS-2 implementation progress report; input to TPOS2020 final reports; strengthened collaboration with OOPC and GOOS;
- **Strengthened cooperation with BGC communities:** IOC-R report; PICES; IMBeR/SIBER;
- **Enhanced Early Career Scientists engagement:** ECS as panel members; National Report with ECS contribution; ECS network in IO; collaboration with YESS;
- **Strengthened interaction with partners:** WCRP (LHA, RifS, CRF); US CLIVAR (TBI, AMOC TT); SOLAS (IO); OOPC; UN Ocean Decade.

2. Primary Science Issues

- Processes and mechanisms of ocean and climate variability and change, and the regional impacts;
- Ocean only or coupled climate model improvement;
- Explicitly connecting observation/modeling;
- Scientific design and implementation of global observing systems.

3. Issues and Challenges

- **Proposed changes:** Future Research Foci may connect with LHAs; Encourage virtual meetings, prioritize travel for ECS-focused activities; Encourage more cross-panel activities, and model-obs connections
- **Work with the new "Core Projects":** GSOP and OMDP to organise joint activities with 'Model-data' new core project; region panels to link to RifS;
- **Work with LHAs:** **EPESC** (Workshops, SL GC); **My Climate Risk** (SLR, Extremes, coastal impacts); **Safe Landing Climate** (ocean heat and freshwater flux and carbon cycling, coastal resilience); **Digital Earth** (observing system design, coordinate model and data management); **WCRP Academy** (understand the needs from target audience)
- **Additional elements of WCRP:** Enhanced communication; Continued engagement with regional stakeholders and ECS communities after CRFs;
- **Community evolving:** new AMOC TT, ENSO Conceptual Model WG and TPDV WG; sunset of EBUS RF and SL GC.

4. Other – anything else?

- **Upcoming CLIVAR capacity building activities:** 2nd SLC; pan-CLIVAR workshop on ocean observations; 2nd CLIVAR-FIO summer school; training workshop in WIO.
- Extend engagement with ECR networks after CRFs.