# Climate and Ocean: Variability, Predictability and Change (CLIVAR)

**WCRP** — World Climate Research Programme

Learn more about CLIVAR at *clivar.org* or

## Introduction of CLIVAR

Established in 1995, Climate and Ocean: Variability, Predictability and Change (CLIVAR) is one of the four core projects of the World Climate Research Programme (WCRP). CLIVAR's *mission* is to understand the dynamics, the interaction, and the predictability of the climate system with emphasis on ocean-atmosphere interaction. To this end, it facilitates observations, analysis, predictions and projections of variability and changes in the Earth's climate system, to the benefit of society and the environment in which we live.

CLIVAR published its new Science Plan and Implementation Strategy in 2018, with an updated *objective:* to describe, understand and model the dynamics of the coupled climate system emphasizing ocean-atmosphere interactions and to identify processes responsible for climate variability, change and predictability on subseasonal-to-seasonal, interannual, decadal and centennial time scales.

Currently, CLIVAR is fully involved in the restructuring process of WCRP for better implementing the new scientific objectives of WCRP (Fig. 1), including carrying out internal assessment to better align itself into the new structure of WCRP and cooperate with other components of the WCRP; co-designing of WCRP Lighthouse Activities; and participating in the regional consultation process to engage communities from all regions of the world.
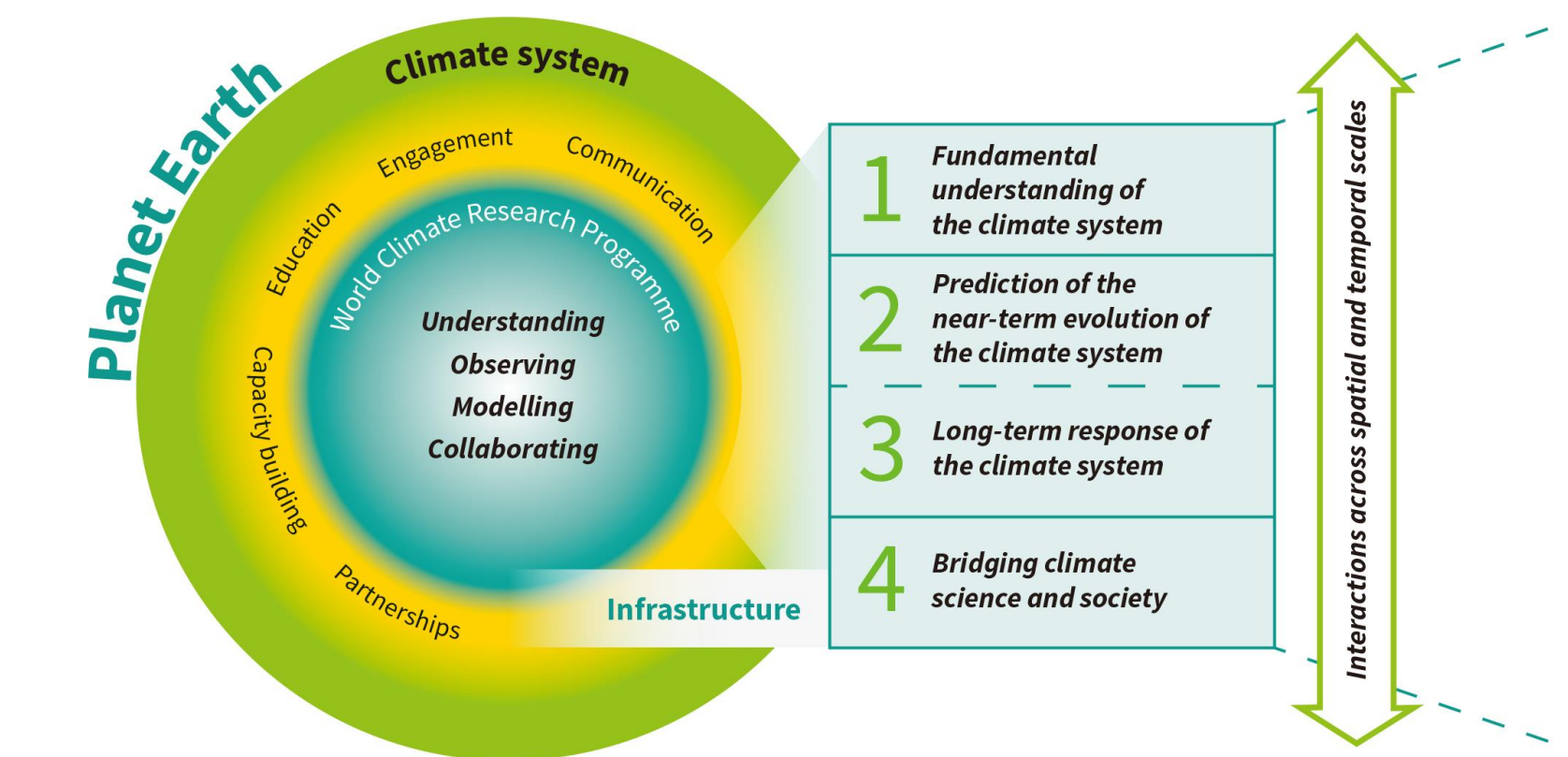


Fig 1. The four Scientific Objectives of the WCRP Strategic Plan 2019-2028
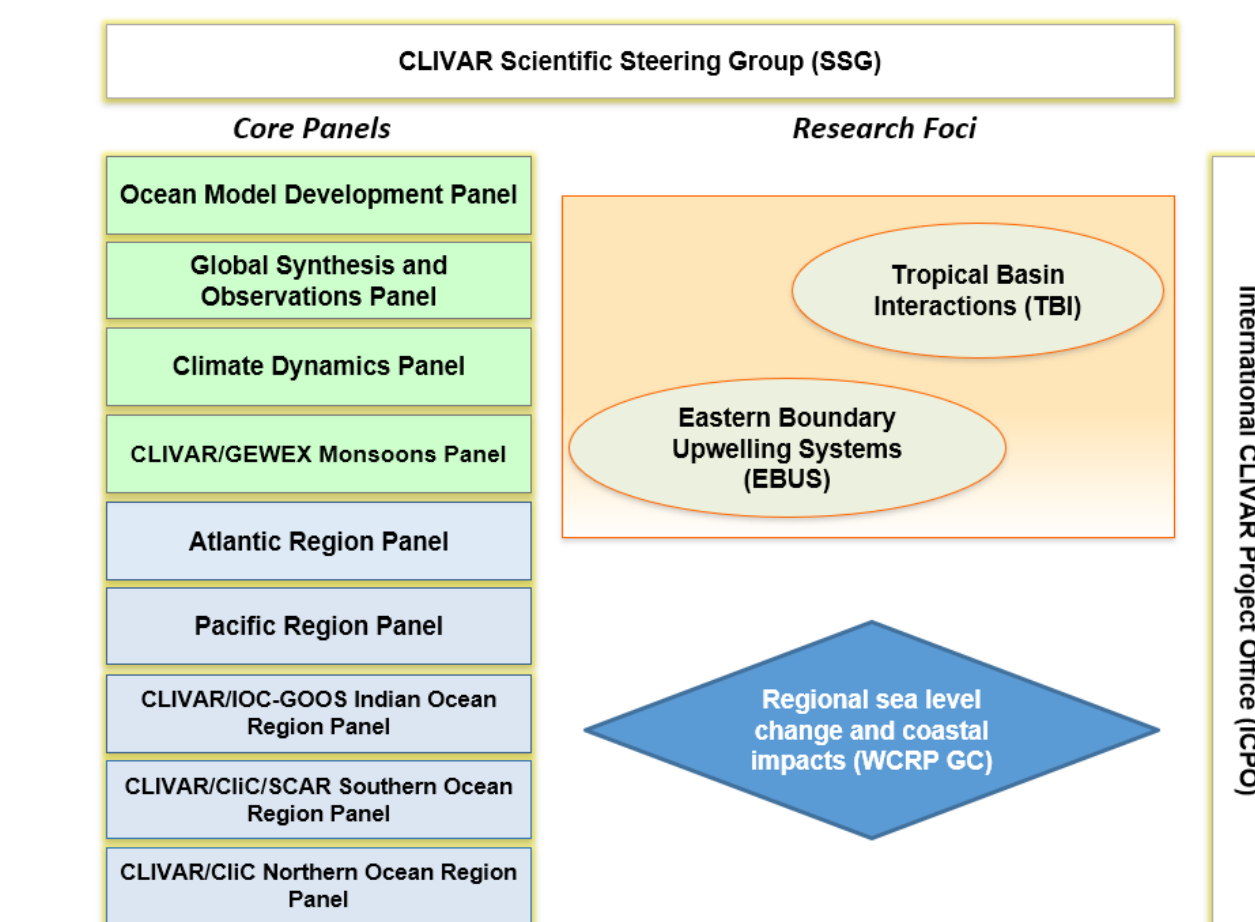


Fig 2. CLIVAR Organization Diagram

## Highlighted existing cooperation between CLIVAR and PICES

CLIVAR and PICES have demonstrated long-time successful interdisciplinary cooperation, mainly on the North Pacific Climate Variability and Change (WG-27), Regional Climate Models (WG-29), Mesoscale and Submesoscale Processes (WG-38), Climate and Ecosystem Predictability (WG-40) (Fig 3).
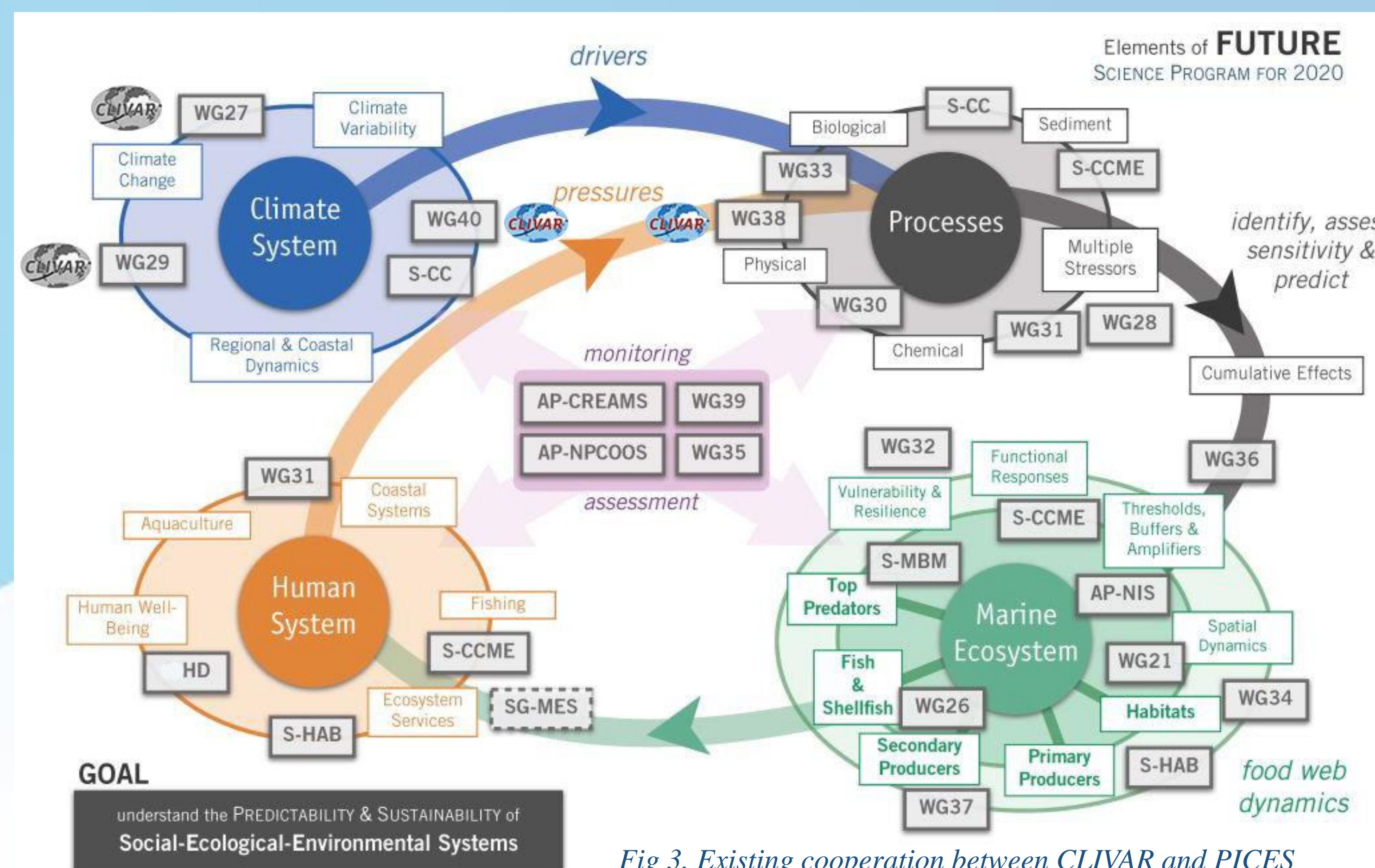
The ongoing effort between CLIVAR and PICES is mainly through the joint Working Group on Climate and Ecosystem Predictability (WG-40), which aims to identify, diagnose and quantify predictable response in North Pacific marine ecosystems that arise from regional- and large-scale climate processes. Two joint workshops were organised in 2019 and a special issue on 'North Pacific Climate and Ecosystem Predictability on Seasonal to Decadal Timescales' in *Frontiers in Marine Science* is being coordinated.



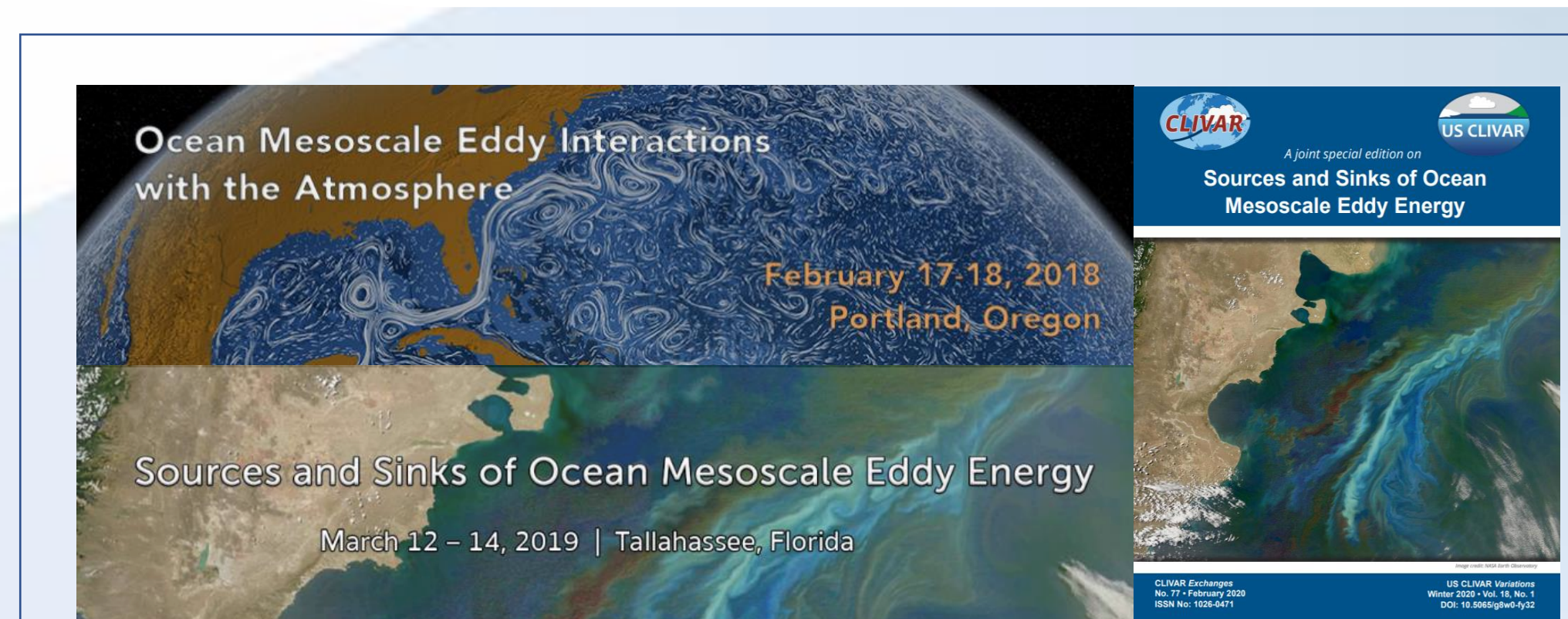Fig 3. Existing cooperation between CLIVAR and PICES



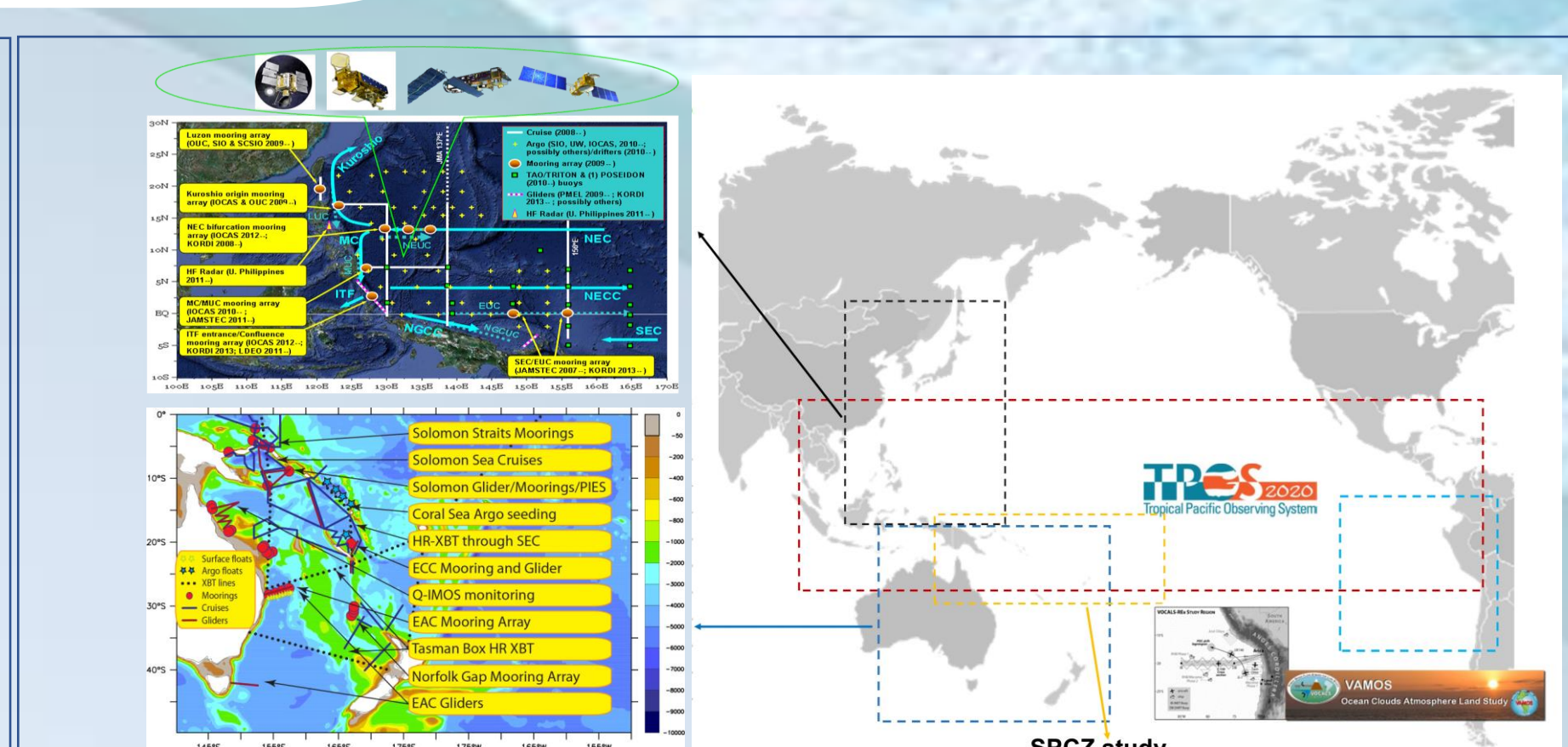Fig 4. CLIVAR's effort in advancing the understanding of ocean mesoscale eddies



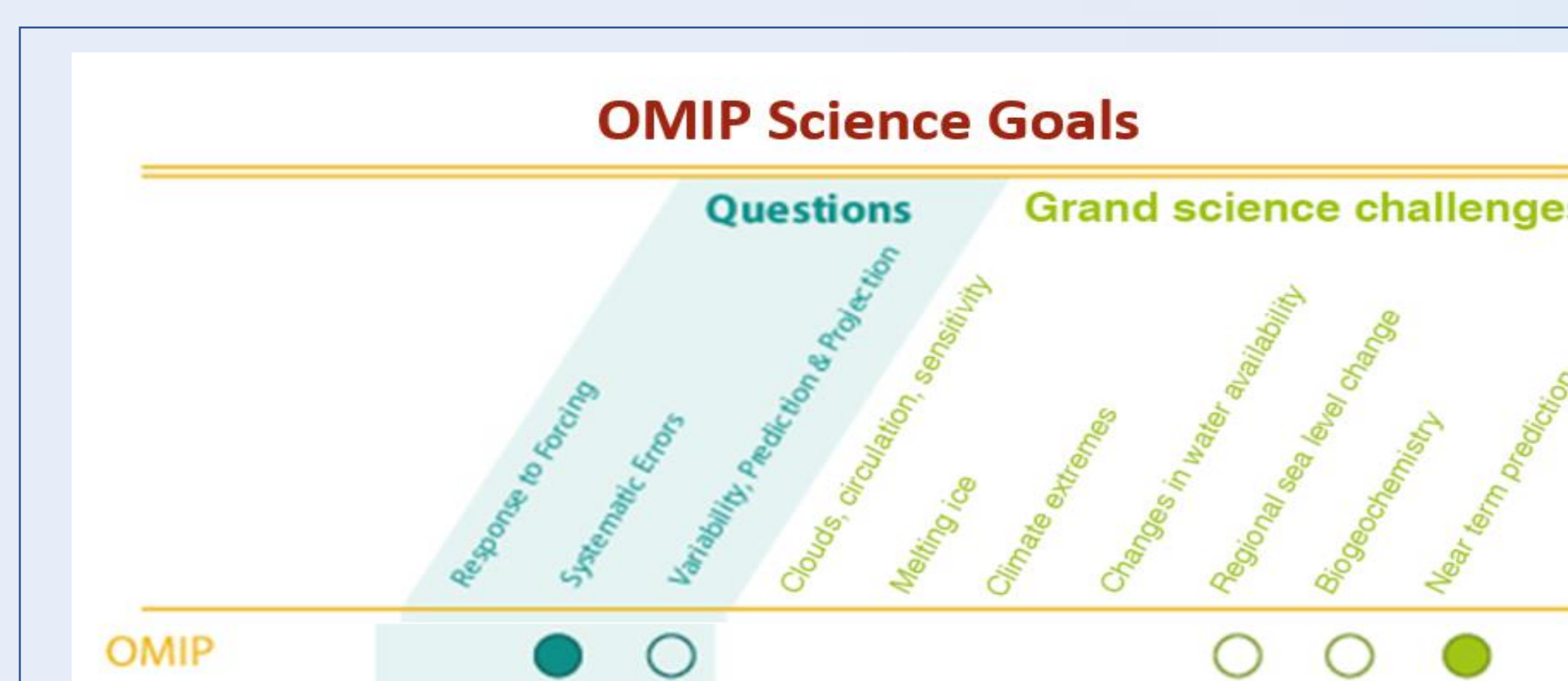Fig 6. CLIVAR's contribution to the ocean observing system in the Pacific



Fig 5. CLIVAR promotes the ocean model development

OMDP has been enhancing the development of an ocean circulation model through identifying the challenges and prospects in ocean circulation models, organizing the Co-ordinated Ocean-Ice Reference Experiments (CORE-I and CORE-II) and the newest variants, the Ocean Model Intercomparison Projects (OMIP-1 and OMIP-2). The panel was involved through the coordinated development of forcing datasets: CORE-I, CORE-II, and now JRA55-do.

## Future cooperation between CLIVAR and PICES

PICES has always had a link with CLIVAR Pacific Regional Panel (PRP), which dates back more than 10 years ago. In the future, CLIVAR and PICES will continue the inter-disciplinary cooperation under the auspices of UN Decade of Ocean Science for Sustainable Development to generate knowledge and understanding of ocean, and to provide solutions to the sustainable development through capacity building. This can be done through **co-designing and co-implementing working groups and capacity building activities** with PICES, to advance the understanding of the status and trend of the ocean environment and its interactions with human activities under the changing climate. Potential cooperation may include:

1. Mechanisms of formation of **marine heat wave in the Pacific basin, as well as their impact on marine ecosystem** (PICES WG-40 with PRP).

a. Ocean meso- and submeso-scale eddies – the dynamics, the predictability and sensitivity of ocean models to include those processes, and their impact on the transport of heat, carbon and other biologically and climatically important tracer in the upper ocean (Fig 4).

b. Further investigation in **boundary current and coastal processes** to facilitate a better understanding of the physical factors that influence primary biological productivity, oxygen and carbon fluxes (with EBUS and PRP).

c. Inter-basin teleconnection and tropical-extratropical interactions, such as relations between ENSO and the Pacific Decadal Oscillations (with TBI RF, NORP, PRP, IORP). NORP is organizing a review paper on the freshwater assessment in Arctic and adjacent area, which might be of interest to the PICES.

2. To promote ocean **modelling/prediction capability** through seamless prediction, model downscaling, model interacomparison as well as coordinating experiments, etc (Fig 5).

3. To identify the observational needs in supporting marine ecosystem understanding, modeling and forecasting (Fig 6).

4. To better address the societal needs for climate and marine ecological services (WCRP/CLIVAR).

5. To enhance capacity building and data, technology and knowledge sharing, in particular for early career scientists and less developed states (WCRP/CLIVAR).