Climate and Ocean - Variability, Predictability, and Change

US CLIVAR 2019 Annual Meeting

Annalisa Bracco & Wenju Cai

May 2019

Geneva, Switzerland

WORLD METEOROLOGICAL ORGANIZATION | United Nations Educational, Scientific and Cultural Organization | Intergovernmental Oceanographic Commission | International Science Council | WCRP World Climate Research Programme

Progress and achievements

Advancement in Science and major activites

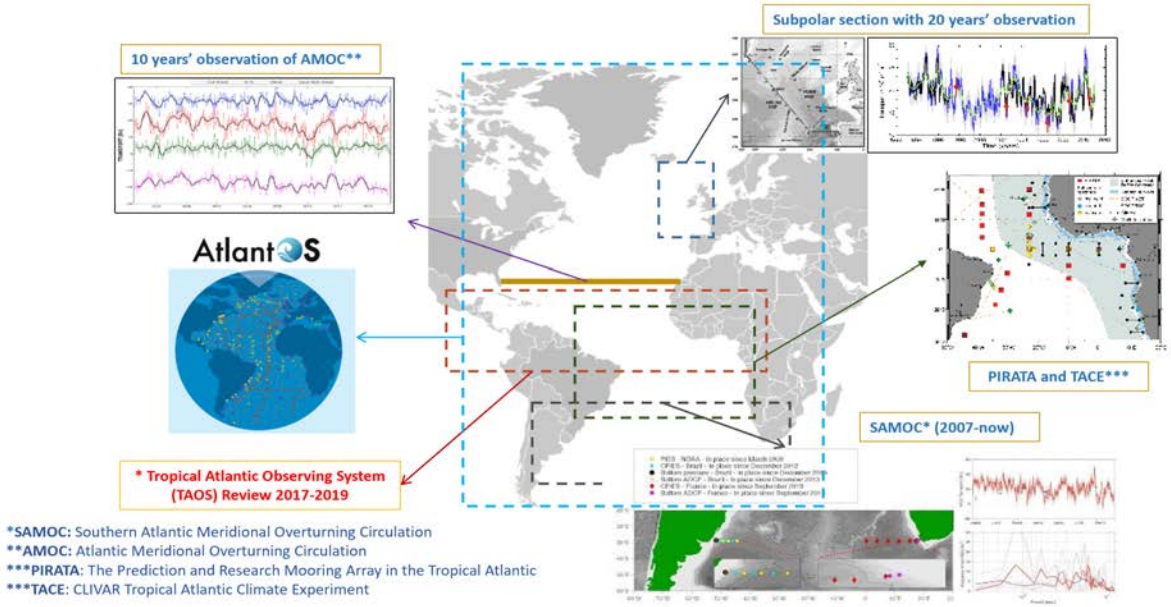
Published (SSG work related to the CLIVAR and WCRP Science Plans:

1. **Science Directions in a Post COP21 World of Transient Climate Change: Enabling Regional to Local Predictions in Support of Reliable Climate Information** (*Earth's Future,* D. Stammer D., Bracco A. et al.) – by (most of the CLIVAR) SSG
2. **Ocean Climate Observing Requirements in Support of Climate Research and Climate Information** (*Frontiers*, Ocean Obs special Issue (CLIVAR SSG and co-chairs)
3. **Stormtracks 2018 workshop**: Alternative perspectives on storm tracks in a changing climate. Stockholm, Sweden. 27-31 August 2018 (CDP)
4. **IV International Conference on El Niño Southern Oscillation: ENSO in a warmer Climate**, 16-18 October 2018. Guayaquil – Ecuador
5. **2018 Pre-AGU Workshop on Greenland Freshwater Fluxes**, 9 December, 2018, Washington DC, USA (co-hosted by CLIVAR OMDP, CLIVAR/CliC NORP, ISMIP6)
6. **Workshop on Sources and Sinks of Ocean Mesoscale Eddy Energy**, and 5th Session of CLIVAR OMDP, 11-15 March 2019, Tallahassee, USA
7. **US CLIVAR/CLIVAR Joint Workshop on Atmospheric Convection and Air-Sea Interactions over the Tropical Oceans**, 7-9 May 2019, Boulder, USA
8. **ICTP-CLIVAR Summer School on Oceanic Eastern Boundary Upwelling Systems**, 15-19 July 2019, Trieste, Italy

Planned activities for next 12 months:

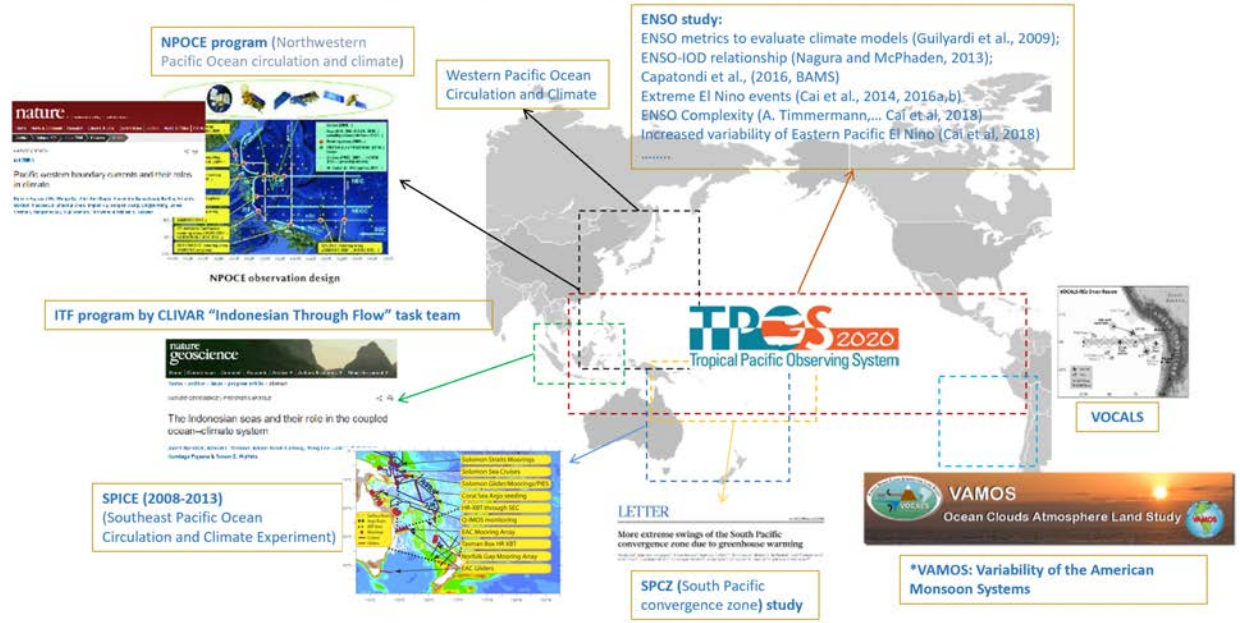
1. **CLIVAR PRP/PICES WG-40 Joint Meeting on Climate and Ecosystem Predictability**, 19 October 2019, Victoria, Canada
2. **Workshop** on WCRP Grand Challenge **on Regional Sea Level Change and Coastal Impacts and Climate Service**, 12-13 November, 2019, Orléans, France
3. **CLIVAR-FIO Summer School on Ocean Macroturbulence and Its Role in Earth's Climate**, June 2020, Qingdao, China
4. **CLIVAR NORP Workshop on "Role of Freshwater in Polar Ocean Climate Change and Global Linkages"**, USA, Spring, 2020 (Venue is pending)
5. A one day joint **SORP/SOOS side meeting alongside the SCAR OSC**, Hobart, Tasmania, Australia, during 31 July to 11 August 2020
6. **Three SORP/NORP joint sessions** on 'Sea ice, ocean and climate connections in the Northern oceans and the Southern Ocean' in the international glaciological society - sea ice symposium, Winnipeg, Canada, 19-23 August, 2019

CLIVAR Atlantic Region Panel (ARP)

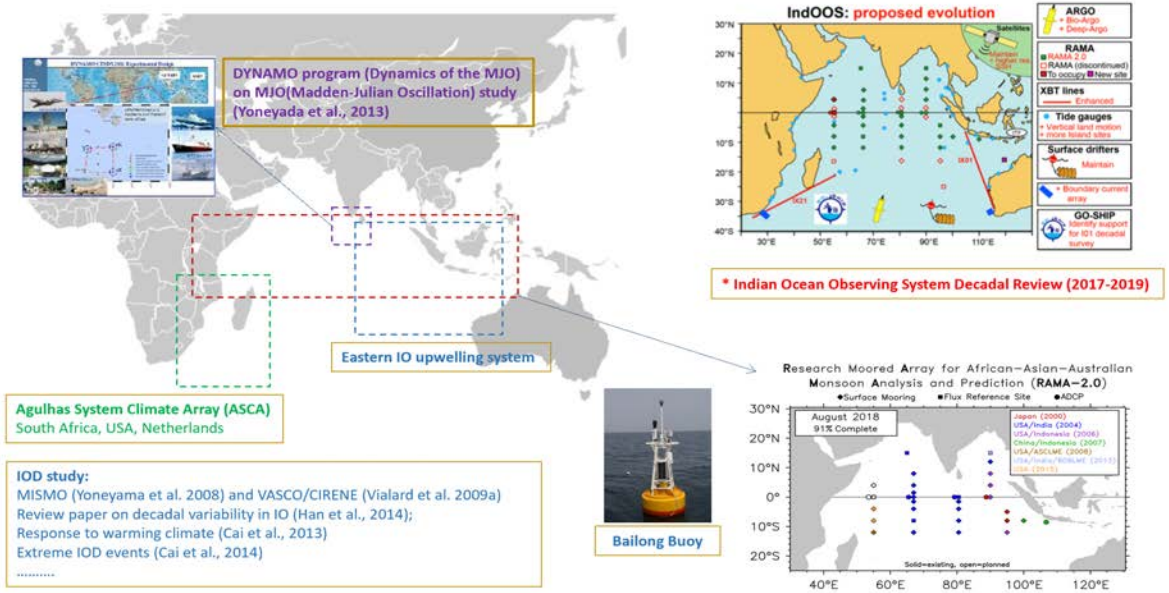


*SAMOC: Southern Atlantic Meridional Overturning Circulation
**AMOC: Atlantic Meridional Overturning Circulation
***PIRATA: The Prediction and Research Mooring Array in the Tropical Atlantic
***TACE: CLIVAR Tropical Atlantic Climate Experiment

CLIVAR Pacific Region Panel (PRP)



CLIVAR/IOC-GOOS Indian Ocean Panel (IORP)



CLIVAR/CliC Northern Oceans Region Panel (NORP)

1. Ddeveloping new tools and methods to observe the Arctic Ocean and neighbouring seas and their climate impacts: further design of buoy and radiosonde in the Arctic (MOSAiC).

MOSAiC
International Arctic Drift Expedition

2. Standardizing and archiving observations of the Arctic Ocean and the coupling with other components of the climate system.

CLIVAR/CliC/SCAR Southern Ocean Region Panel (SORP)

SOOS
SOUTHERN OCEAN OBSERVING SYSTEM

- ✓ Coordination with SOOS (national planning, ship planning, and data management)
- ✓ SORP national reports.

Download the National reports on Activities in the Southern Ocean:
2015: China
2016: Belgium, Brazil, Canada, China, Finland, Italy, Japan, New Zealand, Russia, South Africa.
2017: Argentina, Belgium, Canada, China, Finland, Italy, Japan, New Zealand, Norway, Russia, South Africa

CLIVAR Endorsed Project

Workshop in discussion: Towards a sustainable Global Ocean Observing System

(1) Discuss the current most important **societal and scientific drivers** of regional observing systems.

(2) Discuss challenges/outcomes of reviewing/designing regional observing systems for the next decade, including (i) transition to more **multidisciplinary observing systems**, (ii) need for regional-scale forecasting and expansion into the **coastal zone**, (iii) lobbying for **resources, capacity-building**, and developing partnerships, (iv) **data** archiving, and **sharing**.

(3) Discuss how these **efforts combine** and how the panels can prepare for the UN's upcoming International Decade of Ocean Science for Sustainable Development, 2021-2030

WCRP
Implementation Plan

WCRP Strategic Plan 2019-2028

- Developed 2017-2019 with extensive consultation
- Approved June 2019

Our Vision

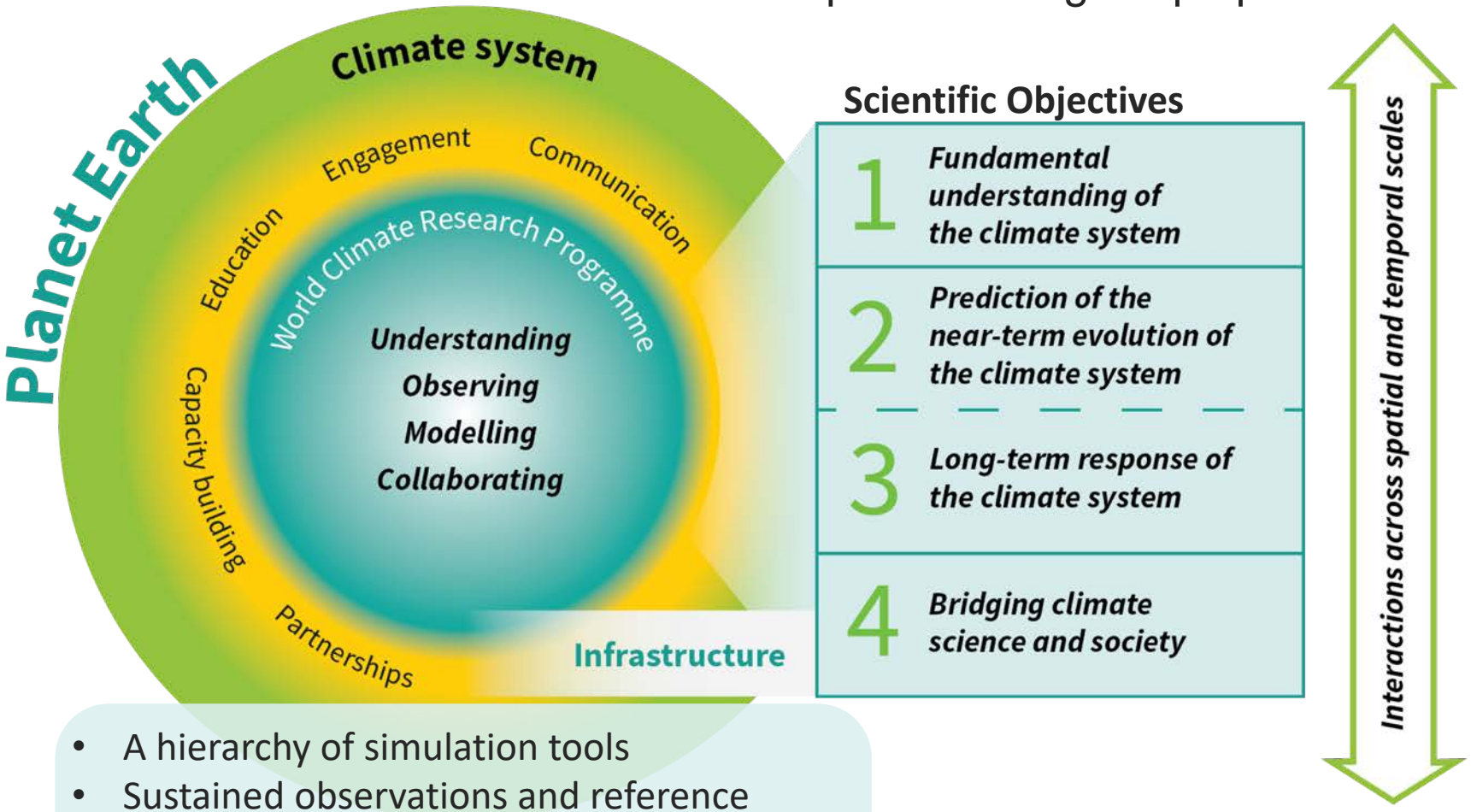
A world that uses sound, relevant, and timely climate science to ensure a more resilient present and sustainable future for humankind.

Our Mission

The World Climate Research Programme (WCRP) coordinates and facilitates international climate research to develop, share, and apply the climate knowledge that contributes to societal well-being.

WCRP Strategic Plan: Overview

www.wcrp-climate.org/wcrp-sp



- A hierarchy of simulation tools
- Sustained observations and reference data sets
- Need for open access
- High-end computing and data management

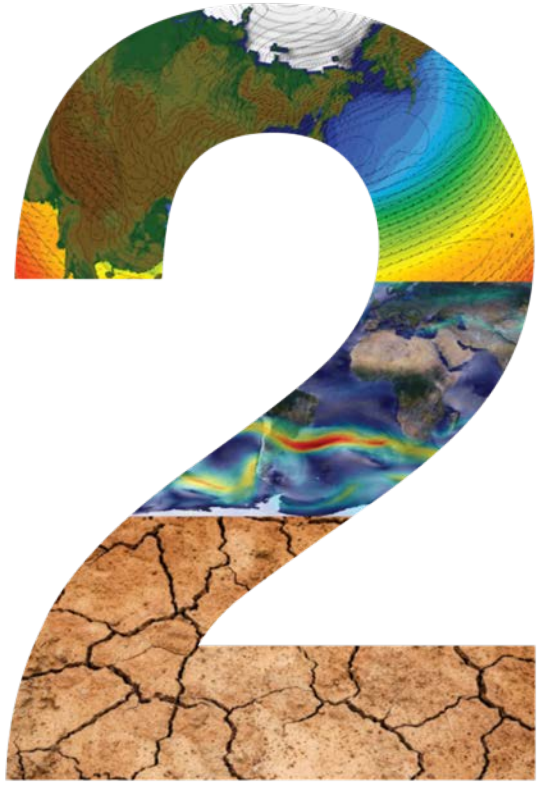
Scientific Objectives

We will **support and facilitate the advancement of sciences that enable an integrated and fundamental understanding of the climate, its variations and its changes, as part of a coupled physical, biogeochemical, and socio-economic system.**

Emphases:

- **Climate dynamics**: past and future global and regional changes in oceanic and atmospheric circulations
- **Reservoirs and flows**: radiative, hydrologic, cryospheric and biogeochemical changes to the reservoirs and flows of energy, water, carbon, and other climate-relevant compounds

Scientific Objectives



We will **push the frontiers of predictions and quantify the associated uncertainties for sub-seasonal to decadal time scales** across all climate system components.

Emphases:

- **Advancing prediction capabilities** of component systems and their coupling: Deterministic, statistical and machine learning approaches. Data assimilation, complex networks, and ensemble generation
- **Predicting extreme events**: regional climate hotspots and potential for crossing thresholds. Interactions between fast and slow extremes

Scientific Objectives

We will **quantify the responses, feedbacks, and uncertainties intrinsic to the changing climate system on longer (decadal to centennial) timescales**.

Emphasis:

- **Simulation capabilities:** Development of integrated models that account for the slowly varying interactions and highly non-linear processes. Representation of the complex interactions between aquifers, vegetation and soil carbon, permafrost, glaciers, and ice sheets, and human activities

Scientific Objectives

We will **support innovation in the generation and delivery of decision-relevant information and knowledge about the evolving Earth system**.

Emphases:

- **Interactions with social systems**: Social processes and emergent behaviour in the Earth System. Interactions and feedbacks between climatic and socioeconomic systems
- **Engaging with society**: Actionable climate information, scientific assessments, educational approaches and public communication strategies

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Critical Infrastructure

I. A hierarchy of simulation tools

II. Sustained observations and reference data sets

III. Need for open access

IV. High-end computing and data management

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WCRP Implementation Plan: Background

What is an Implementation Plan?

- It will put the WCRP Strategic Plan into action
- It will include: resources, structures, milestones, deliverables, measures of success, risk assessment

Development of the Implementation Plan must:

- Be a transparent «bottom-up» approach involving the entire community
- Include consultation with the scientific community, agencies, academies, sponsors and other stakeholders
- Ensure a fit-for-purpose structure, an effective governance, required resources, budgets and finance management.

WCRP Implementation Plan: Timeline

Phase I: From now to April 2020

- Refine science questions and conceptual framework
- Refine key elements for operations, delivery and engagement
- Identify science, funding, and infrastructure needs
- Undertake consultation
- Produce the first draft of the Implementation Plan by the time of the 41st Session of the JSC, April 2020

Phase II: April 2020 to April 2022

- Undertake further consultations and evolution of the Implementation Plan
- Develop structure and governance model
- Clarify the future of Core activities and Project Offices
- Initiation of new, joint activities
- Expand and consolidate partnerships for mutual benefits
- Adopt Implementation Plan and agree on Transition Approach by the 43rd Session of the JSC, April 2022

WCRP Implementation Plan: Progress

Implementation and Transition Meeting, 4-5 May 2019

Representatives of the WCRP community discussed how to implement the WCRP Strategic Plan, starting with the:

- WCRP Strategic Plan
- Feedback from the WCRP Review
- Responses to an on-line survey

WCRP Joint Scientific Committee Session (JSC-40), 6-10 May 2019

Further discussion and refinement, with the main outcomes of:

- Engagement, dialogue and discussion: community-building and a community effort
- Development of draft Key Science Question areas and key elements
- A “Conceptual Framework” for implementing the WCRP Strategic Plan

Key Science Question areas

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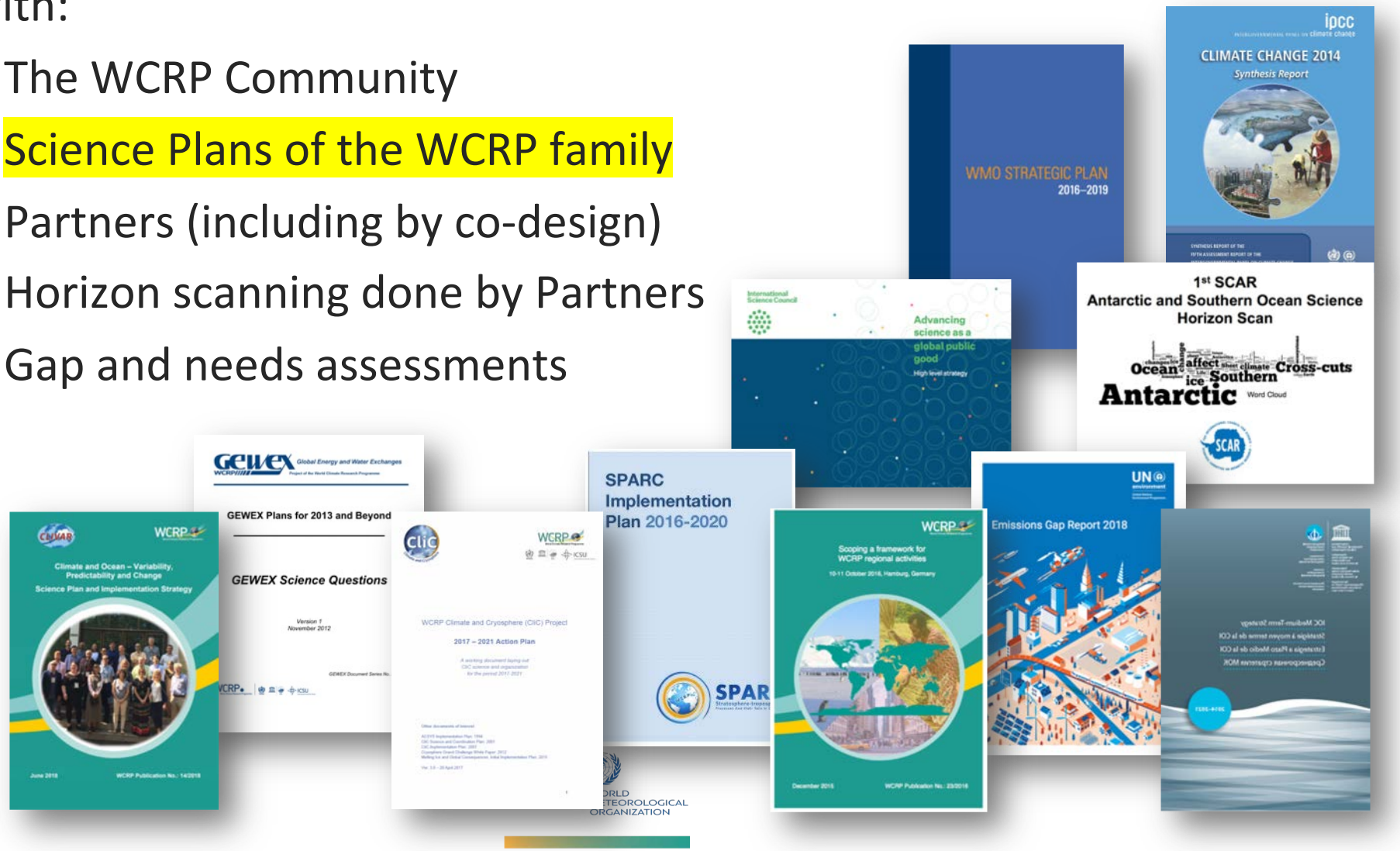
Refining Key Science Question areas

We will refine science question areas via consultation with:

- The WCRP Community
- Science Plans of the WCRP family
- Partners (including by co-design)
- Horizon scanning done by Partners
- Gap and needs assessments



Implementation Plan Elements

Research Projects

- Lifecycle (start and end) with a clear timeline and deliverables
- Joint and co-designed with Partners outside WCRP
- Deliver to Strategic Plan Objectives
- WCRP attributes: Integration; Scale; Relevance; Climate Change; Discovery and Innovation

Jointly through dialogue and co-design

Conferences, Workshops, WCRP Forum

Enduring capability - people: Climate System Elements Infrastructure and Integration

Projects and fora to engage and empower ECRs; and regional partners: part of the WCRP family

Regular Syntheses, Assessments, Gap Analyses Rapid Assessments and Reports

Reference data sets (observed, modelled)

Evaluations, Inter-comparisons, Benchmarking, Standards

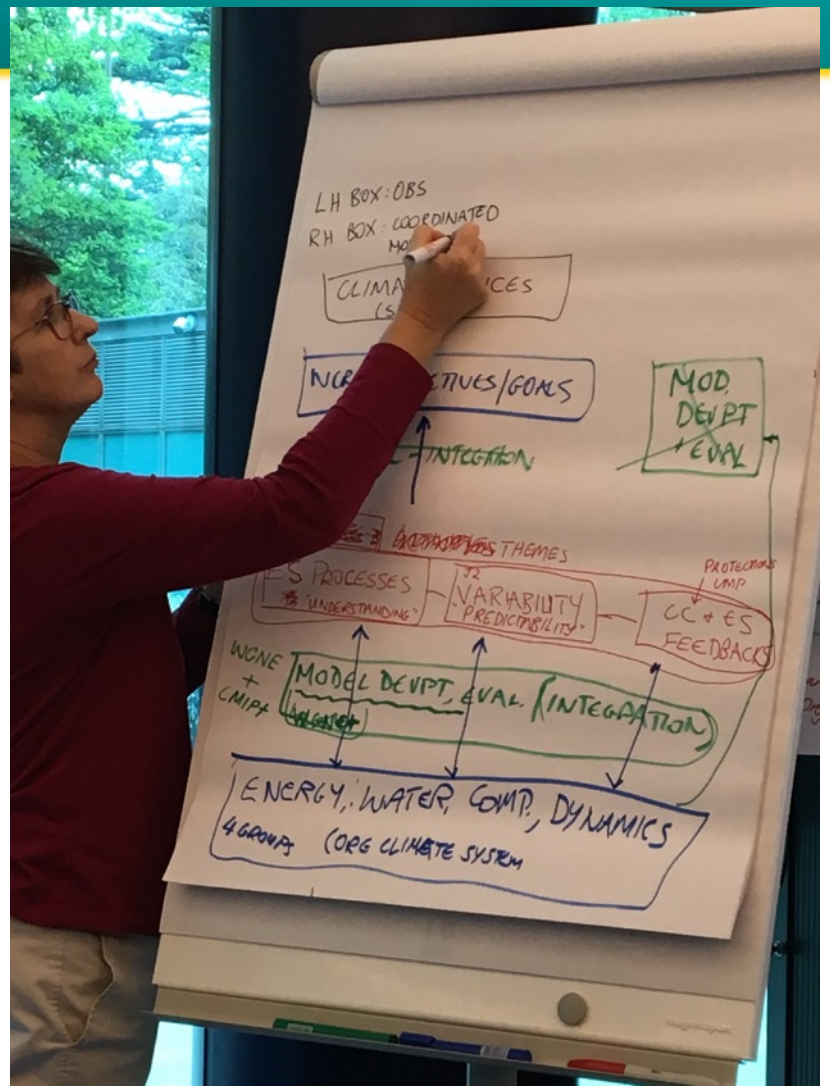
Coordination

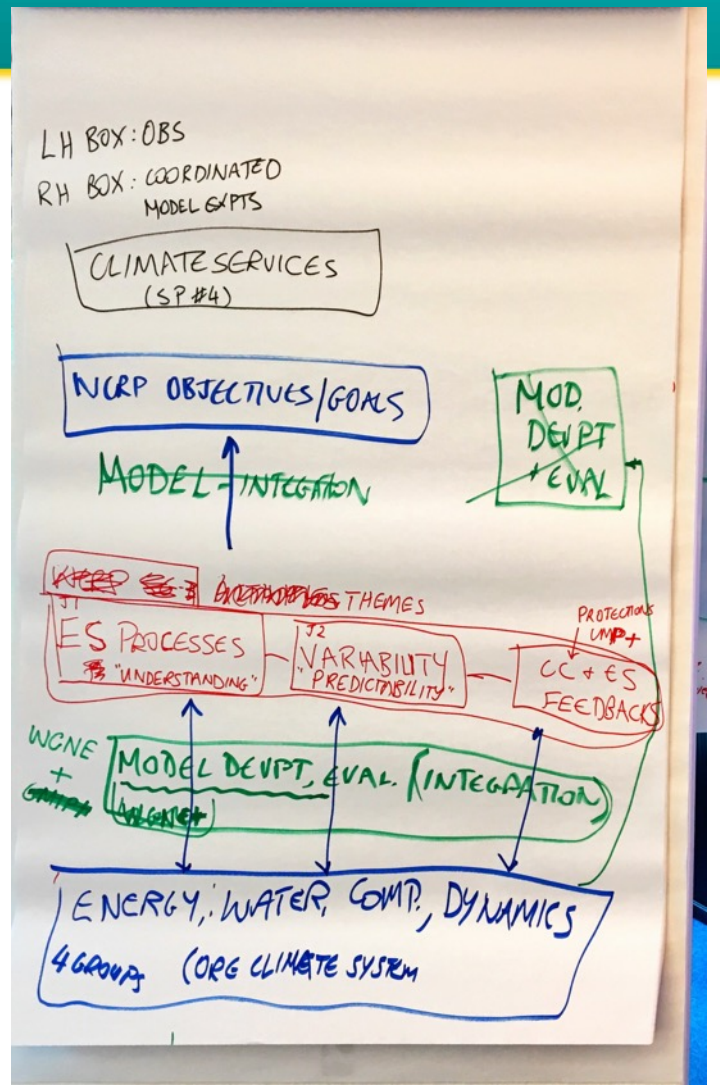
Educational services and activities

Stakeholder engagement and outreach

Capacity building and communication

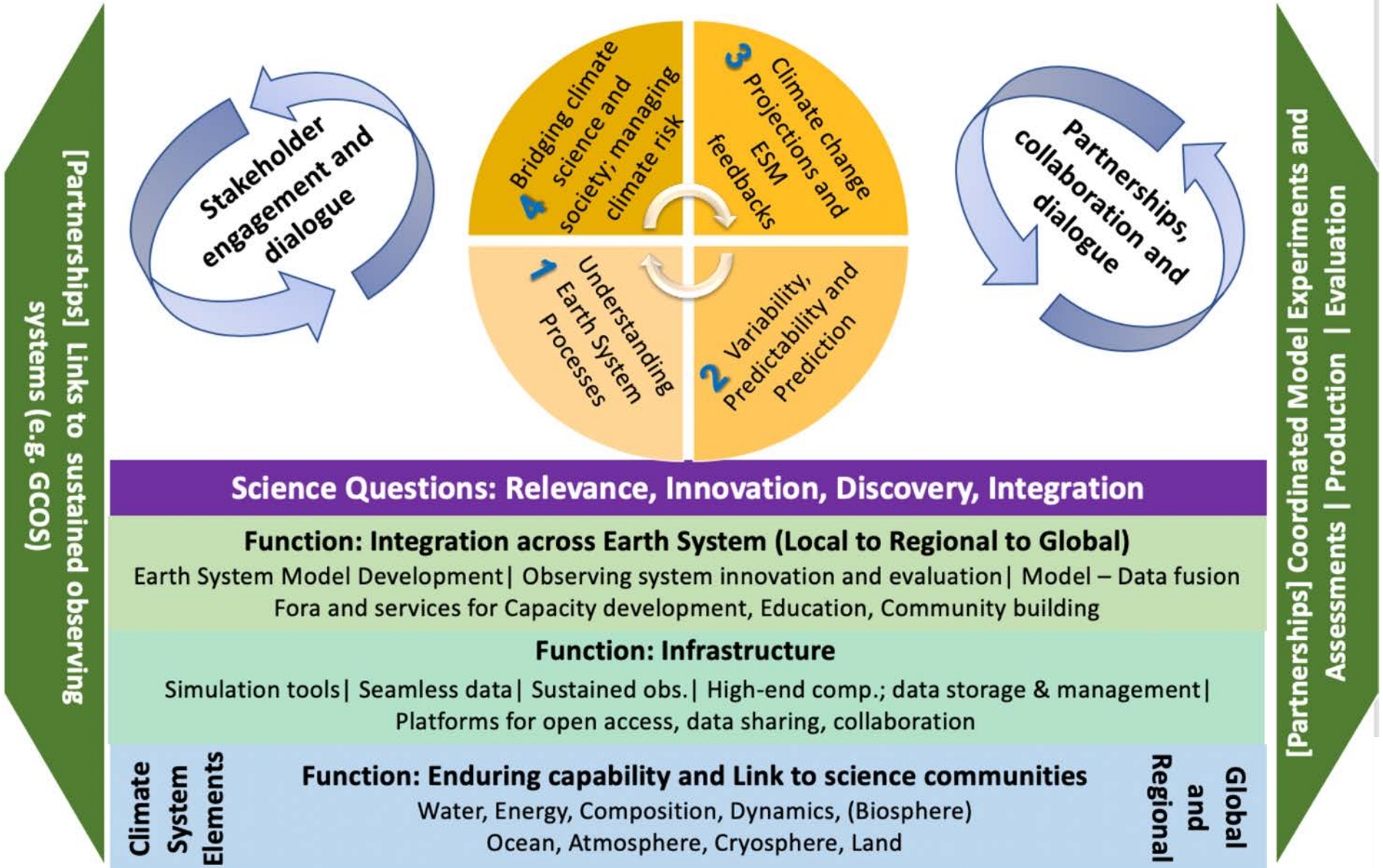
search Programme





Conceptual Framework: from this to ...

WCRP Mission: Societally-relevant knowledge and information to inform mitigation, adaptation and risk management



Implementation Plan: Draft Structure

1. Introduction
2. The WCRP Strategy: Vision, Mission and Objectives
3. Engagement
4. Framework
5. Partnerships
   - Identifying key partners
   - Co-designing science questions
   - Identifying common infrastructure
   - Clarifying their role in the Strategy
   - Reaffirming current, and building new
6. Implementation
   - Transition Plan
   - Schedule: Gantt chart, milestones, deliverables
7. Measures of success
8. Risks and contingencies

Phase I
(by April 2020)

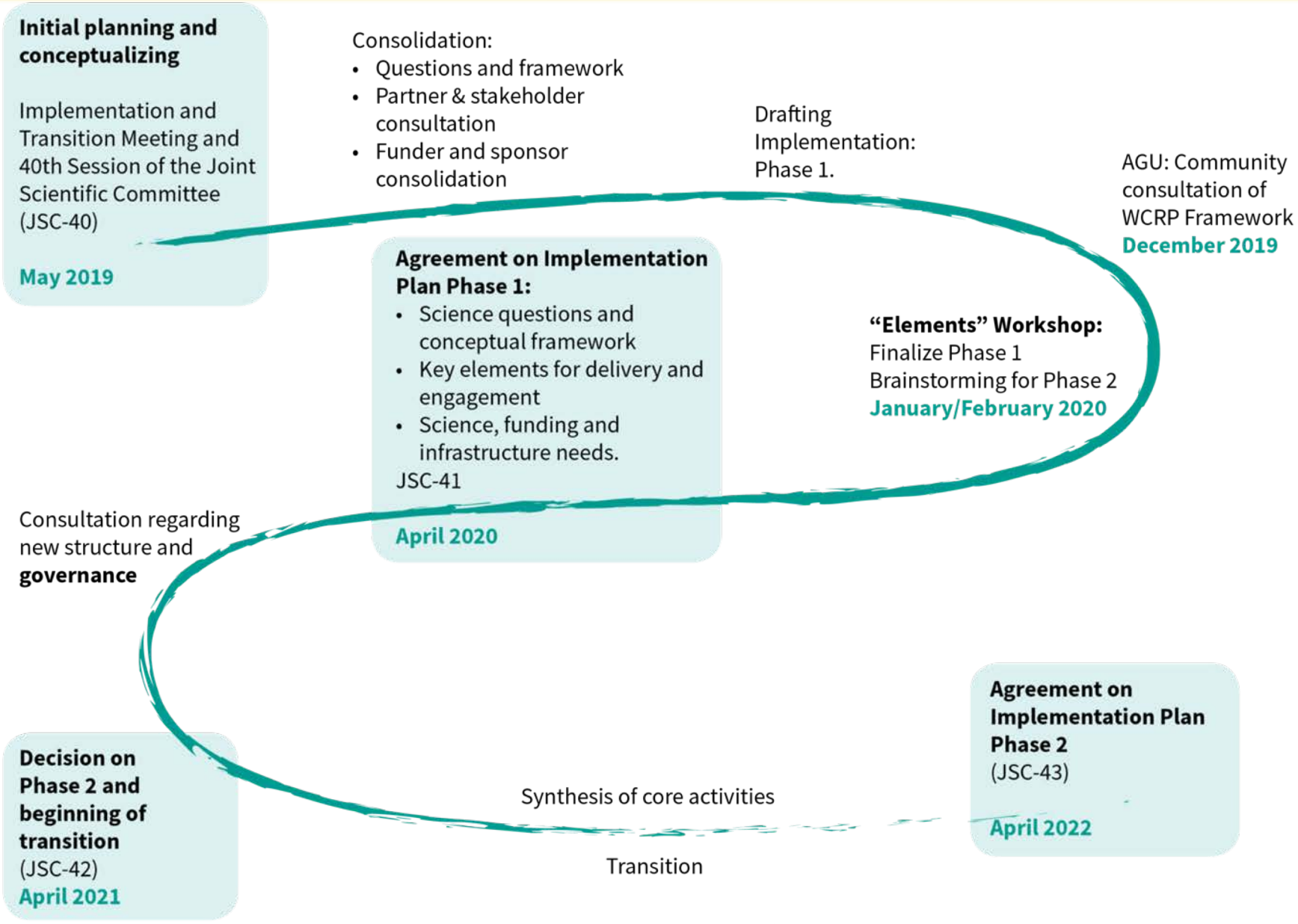
Phase II
(by April 2022)

Fully consultative development

Will include:

- Support functions (including support offices)
- External governance: sponsors, Joint Scientific Committee, Governing Board, Joint Planning Staff (Secretariat)
- Internal structure and governance
- Resources, budgets, finance management

Implementation Plan: Milestones



Thank You