REVIEW OF
WORLD CLIMATE RESEARCH PROGRAMME
NEW WMO STRATEGY

Terms of Reference for WCRP Review

- To ascertain the effectiveness of WCRP in delivering its mandate to determine:
  - To what extent climate can be predicted;
  - The extent of man's influence on climate.
- To assess how well it partners with other organisations.
- To advise on the future structure, governance and resourcing of the programme.

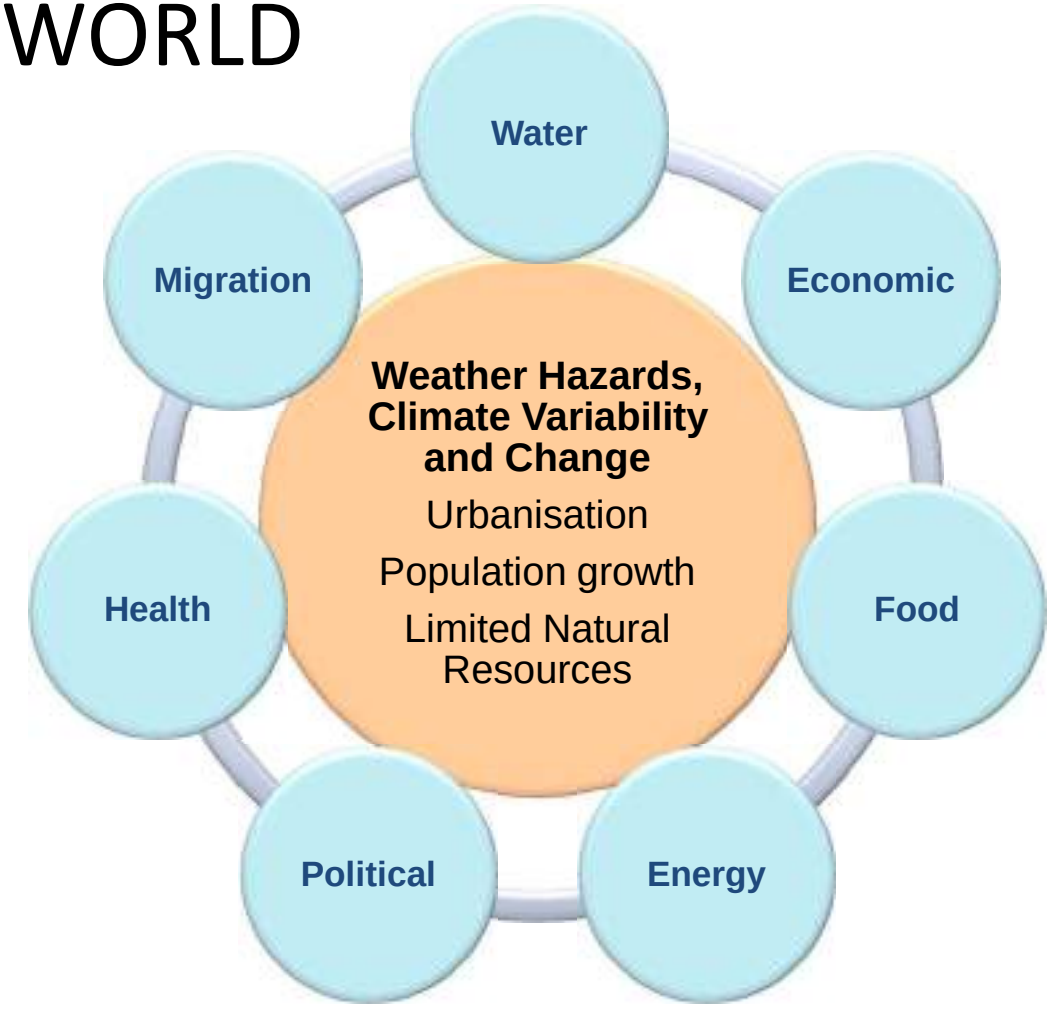
2015: A Landmark Year

- Over 190 countries signed up to reduce emissions, with the target to stay within a 2ºC world.
- 15-year agreement for the substantial reduction of disaster risk and losses in lives, livelihoods and health.
- 2030 agenda with 17 goals to end poverty and hunger, improve health and education, making cities more sustainable, combating climate change, and protecting oceans and forests.

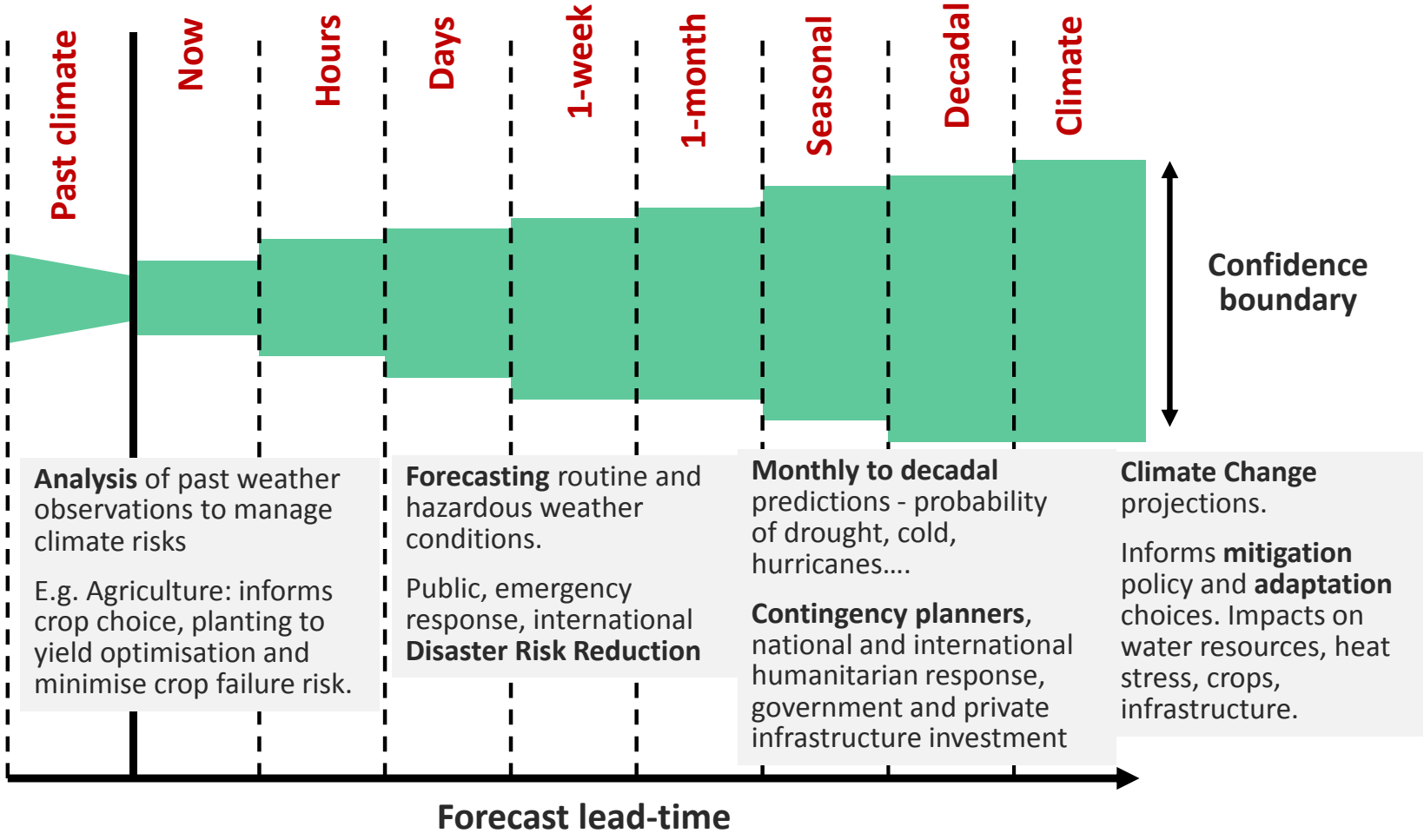
Understanding and Quantifying Weather and Climate Risk are at the Core of these Actions

21st CENTURY CHALLENGES IN AN INTERCONNECTED WORLD

Exposure to extreme weather and climate events threatens to derail the sustainability of economic development and social welfare across the globe, and to threaten the securities on which we rely for our health and well-being.



New Tools in the Toolbox:
Seamless Prediction Across Timescales



Analysis of past weather observations to manage climate risks

E.g. Agriculture: informs crop choice, planting to yield optimisation and minimise crop failure risk.

Forecasting routine and hazardous weather conditions.

Public, emergency response, international **Disaster Risk Reduction**

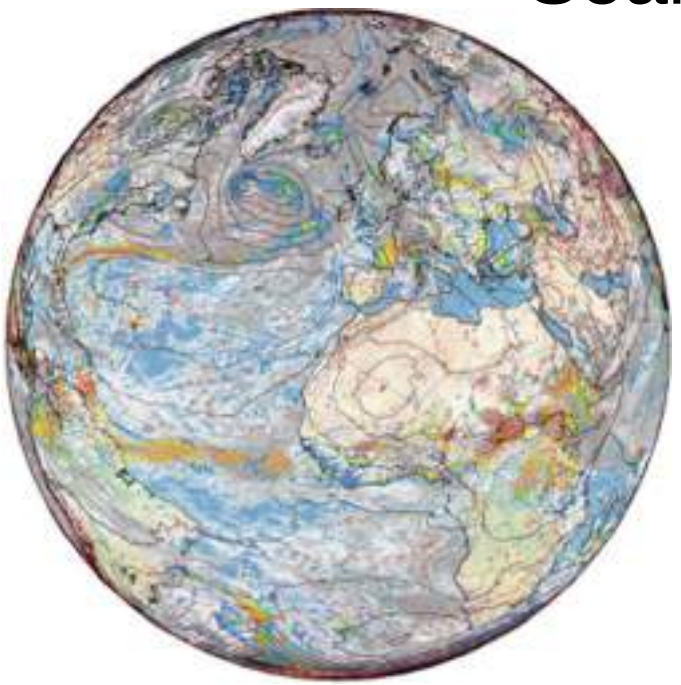
Monthly to decadal predictions - probability of drought, cold, hurricanes….

Contingency planners, national and international humanitarian response, government and private infrastructure investment

Climate Change projections.

Informs **mitigation** policy and **adaptation** choices. Impacts on water resources, heat stress, crops, infrastructure.

New Tools in the Toolbox:
Seamless Prediction Across Space Scales



N x Global predictions at ~10km with lead times of days to years:

Synoptic drivers

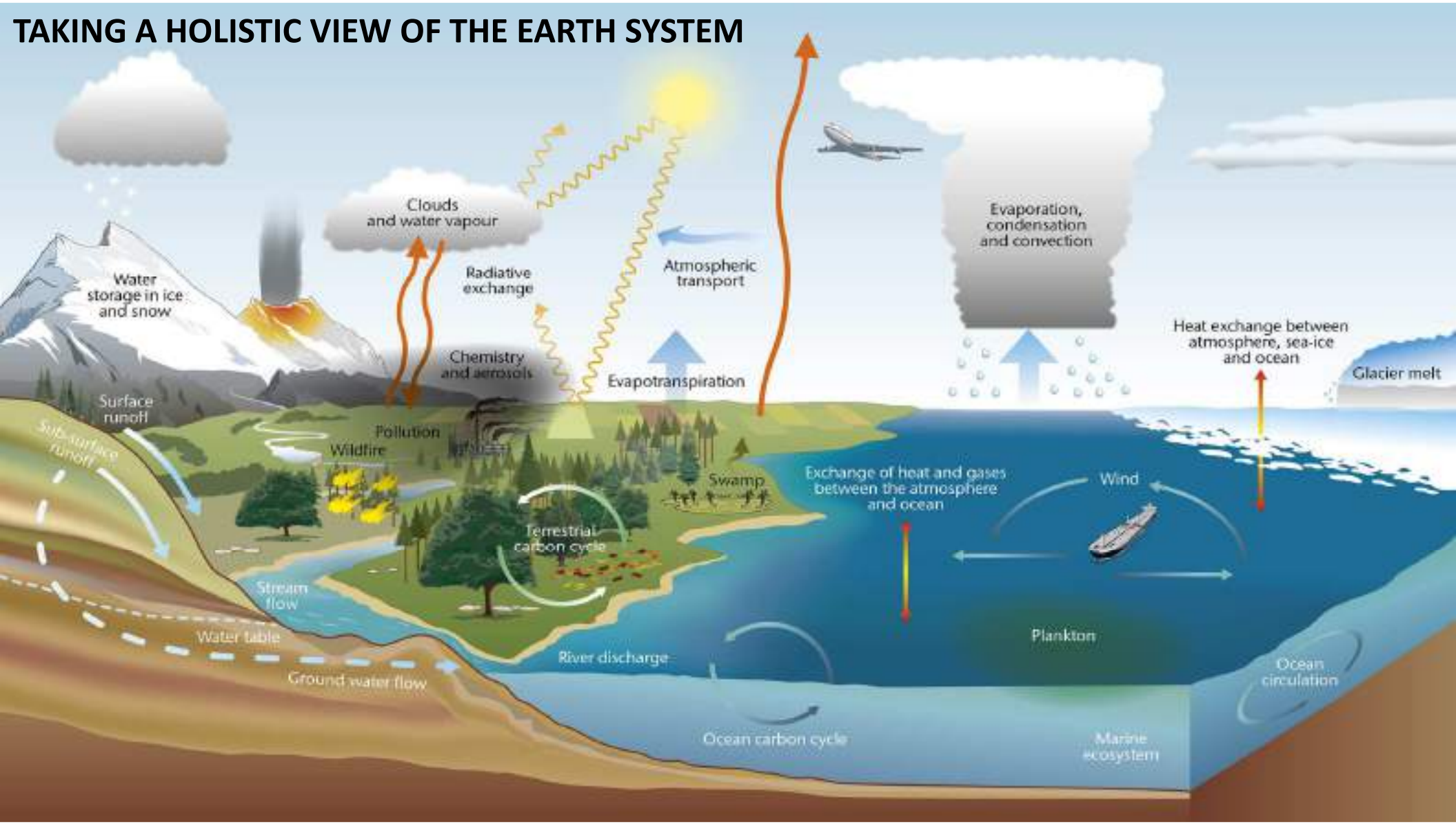
<N x Regional predictions at <1km with lead times of hours to years:

Local meteorology

Probability of local hazards:

Impact Scenarios & Narratives

TAKING A HOLISTIC VIEW OF THE EARTH SYSTEM



Overarching Conclusions of the Review Panel

- WCRP is at a critical point in its history, and **significant changes are required in its governance, structure and delivery** for it to fulfil its mission in the context of 21st century challenges.
- Without a strong foundation in climate science and prediction, none of these challenges can be addressed in a robust, cost-effective and durable way.
- Since its inception, the key strength of WCRP has been its focus on cutting-edge physical climate science **where international coordination enables scientific advances that would not happen otherwise**. This must continue to be its focus; that means prioritising what it does and recognising where **its unique role as a facilitator and integrator of climate research makes a difference**.
- WCRP needs to articulate and demonstrate its core values more effectively, along with the societal relevance of its work. It is **not the role of WCRP to deliver the end products and services**, but it should provide the bedrock knowledge on which these can be developed.

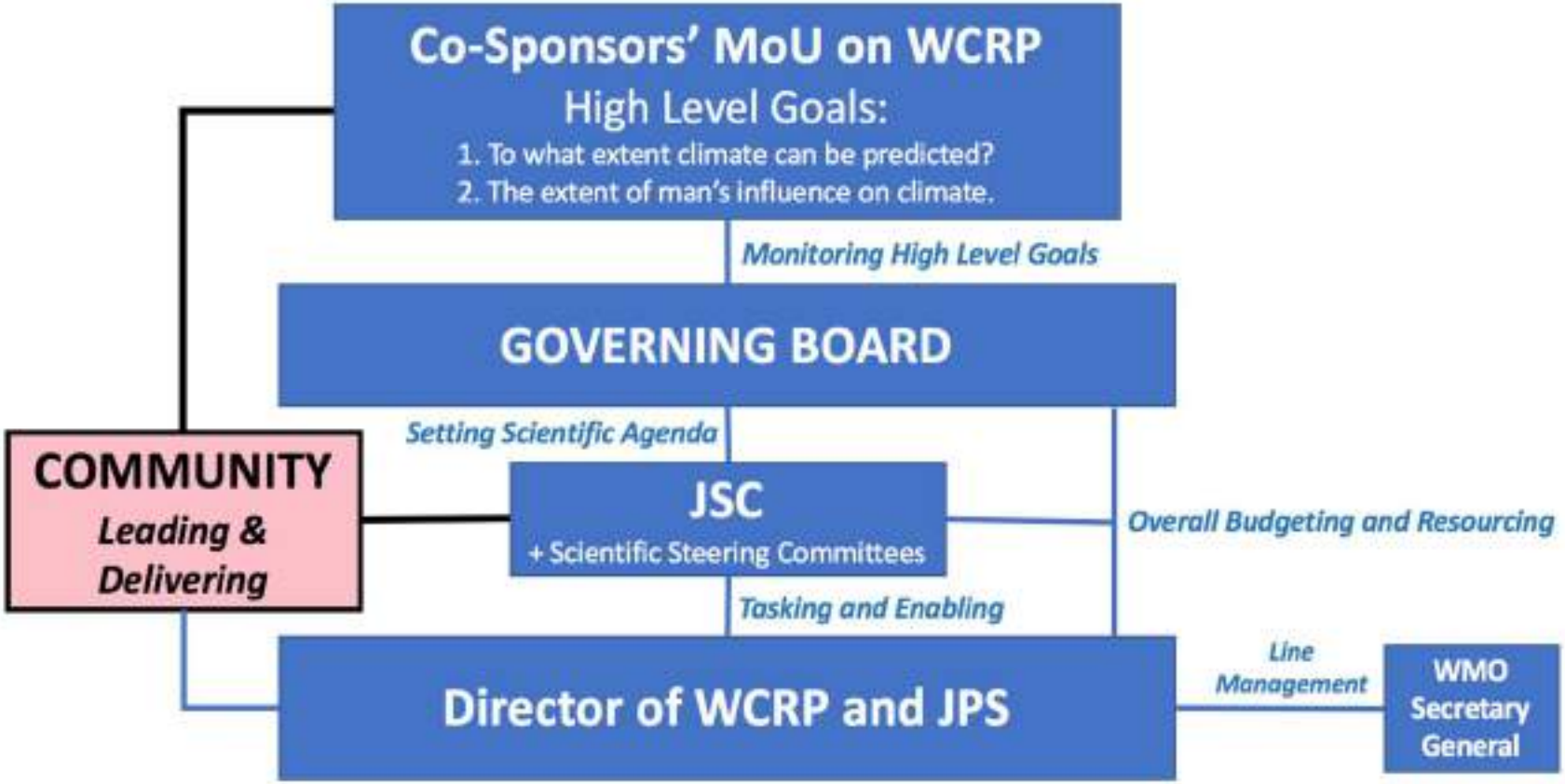
Recommendation 1: Science Strategy

A new 10-year WCRP science strategy and related 5-year implementation plan must be developed as soon as possible in discussion with the sponsors and with wide consultation and community buy-in.

Recommendation 2: Governance and the MoU

The Review Panel recommends that a formal high-level Governing Board for WCRP be established to enable more effective engagement with the co-Sponsors and enable them to fulfil their responsibilities for the programme. A new MoU should be put in place to reflect changes in governance, operations and structure.

A formal high-level Governing Board should be established by the sponsors, with the overall responsibility for the WCRP residing with this Board and its Chairperson.



Recommendation 3: Scientific Leadership

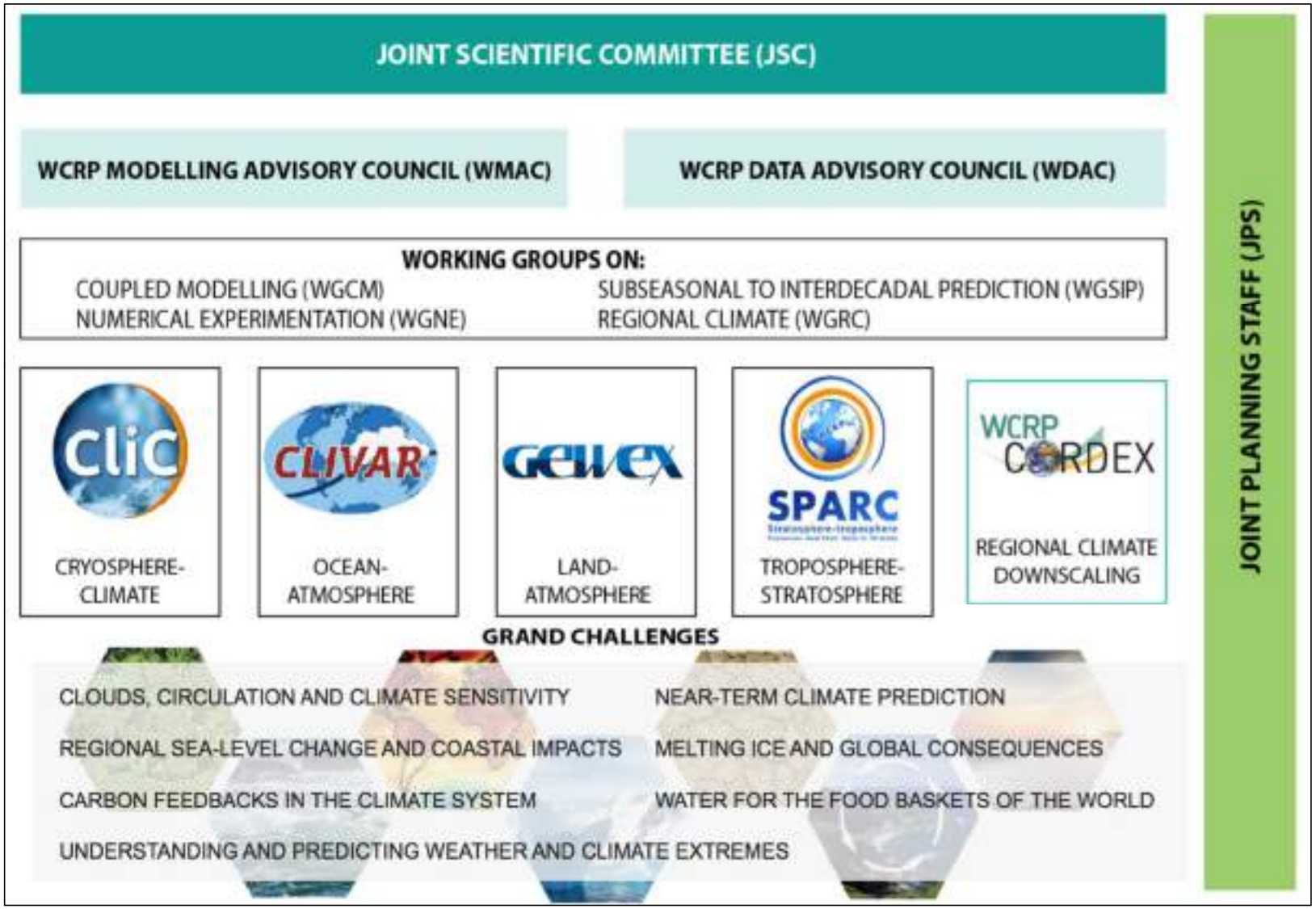
The Review Panel recommends that the JSC should be re-invigorated to focus on providing science leadership, setting the science strategy and overseeing its implementation, including establishing partnerships, and building a strong community of international scientists to work on grand challenge research problems that require international coordination.

Recommendation 4: Operations

The Review Panel recommends that additional clarity be provided in the terms of reference, structure and functions of the Joint Planning Staff (JPS) and the Director of the WCRP , to ensure that the JPS works effectively with the Joint Scientific Committee to support its scientific activities, to facilitate international engagement and partnerships, and to manage WCRP's resources.

Recommendation 5: Structure

The JSC, in consultation with the newly created Governing Board, should work with the science community to establish a new structure for the WCRP research effort that best serves its new strategy and involves a simplified set of delivery mechanisms.



CURRENT WCRP STRUCTURE

Unwieldy, complex and confusing.

Core Projects stuck in the past?

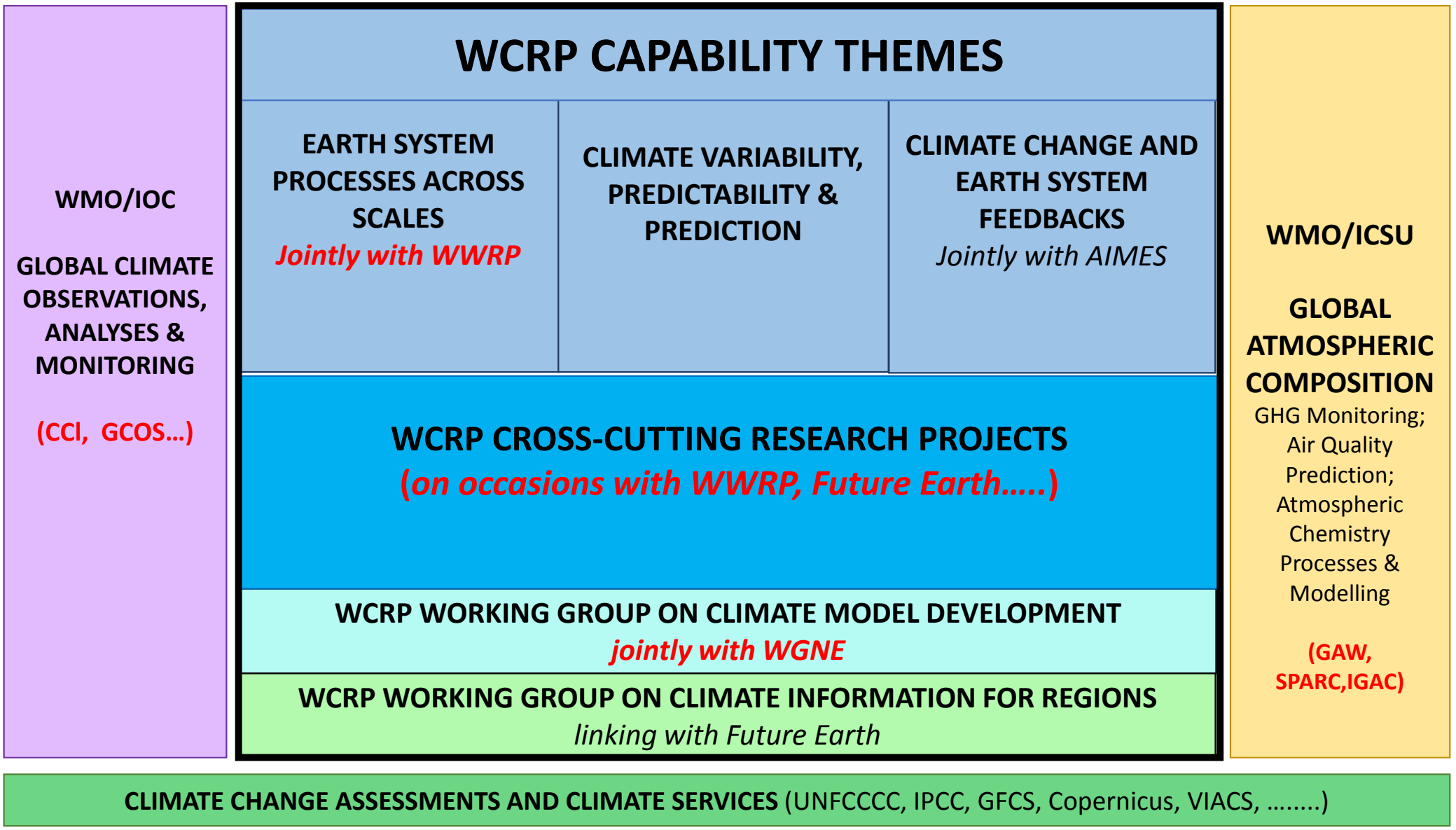
Where is whole system approach?

Where is next generation model development?

Where is the pathway to climate services?

Where is climate change?

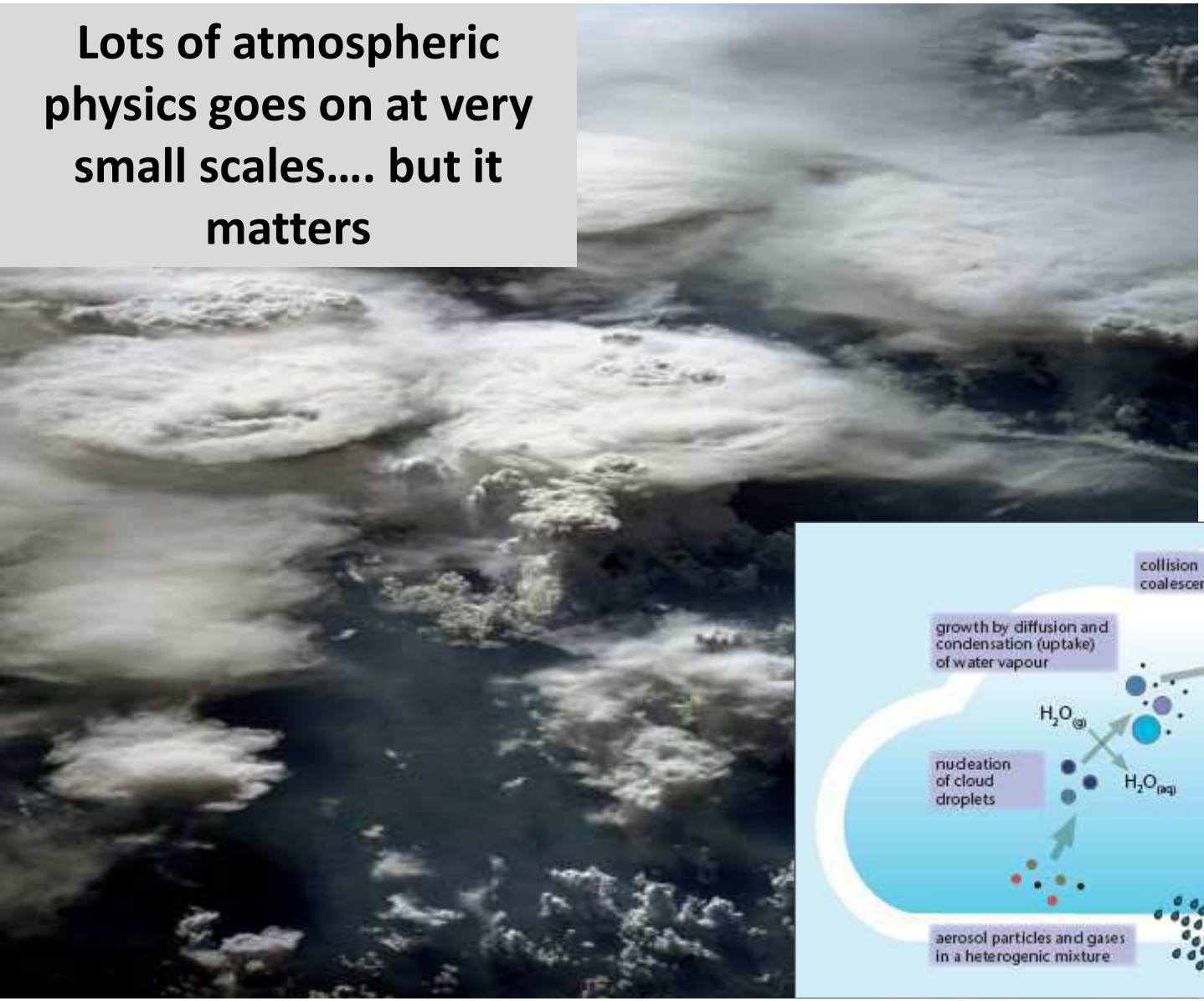
CURRENT STRUCTURE IS NOT THE STRUCTURE FOR THE FUTURE


WMO/IOC
GLOBAL CLIMATE OBSERVATIONS, ANALYSES & MONITORING
(CCI, GCOS…)
WCRP CAPABILITY THEMES
EARTH SYSTEM PROCESSES ACROSS SCALES
Jointly with WWRP
CLIMATE VARIABILITY, PREDICTABILITY & PREDICTION
CLIMATE CHANGE AND EARTH SYSTEM FEEDBACKS
Jointly with AIMES
WCRP CROSS-CUTTING RESEARCH PROJECTS
(on occasions with WWRP, Future Earth…..)
WCRP WORKING GROUP ON CLIMATE MODEL DEVELOPMENT
jointly with WGNE
WCRP WORKING GROUP ON CLIMATE INFORMATION FOR REGIONS
linking with Future Earth
WMO/ICSU
GLOBAL ATMOSPHERIC COMPOSITION
GHG Monitoring; Air Quality Prediction; Atmospheric Chemistry Processes & Modelling
(GAW, SPARC,IGAC)
CLIMATE CHANGE ASSESSMENTS AND CLIMATE SERVICES (UNFCCCC, IPCC, GFCS, Copernicus, VIACS, ……..)

WCRP CAPABILITY THEMES

EARTH SYSTEM PROCESSES ACROSS SCALES *Jointly with WWRP*	CLIMATE VARIABILITY, PREDICTABILITY & PREDICTION *Jointly with WWRP S2S*	CLIMATE CHANGE AND EARTH SYSTEM FEEDBACKS *Jointly with ICSU AIMES*
Energy, Water & Carbon Cycles; Fundamental Atmospheric Physics (e.g. Convection); Land Surface Processes & Land-Atmosphere Coupling; Ocean Processes & Ocean-Atmosphere Coupling; Cryosphere Processes	Ocean, Land, Cryosphere, Atmosphere & Solar Drivers; Climate Dynamics, Modes of Variability & Teleconnections; Monthly to Decadal Predictability & Prediction	Climate Change Forcing & Sensitivity; Climate Change Attribution; Climate Change Projections (Global & Regional) for Mitigation & Adaptation; Abrupt Climate Change; Geoengineering Assessment

Lots of atmospheric physics goes on at very small scales…. but it matters



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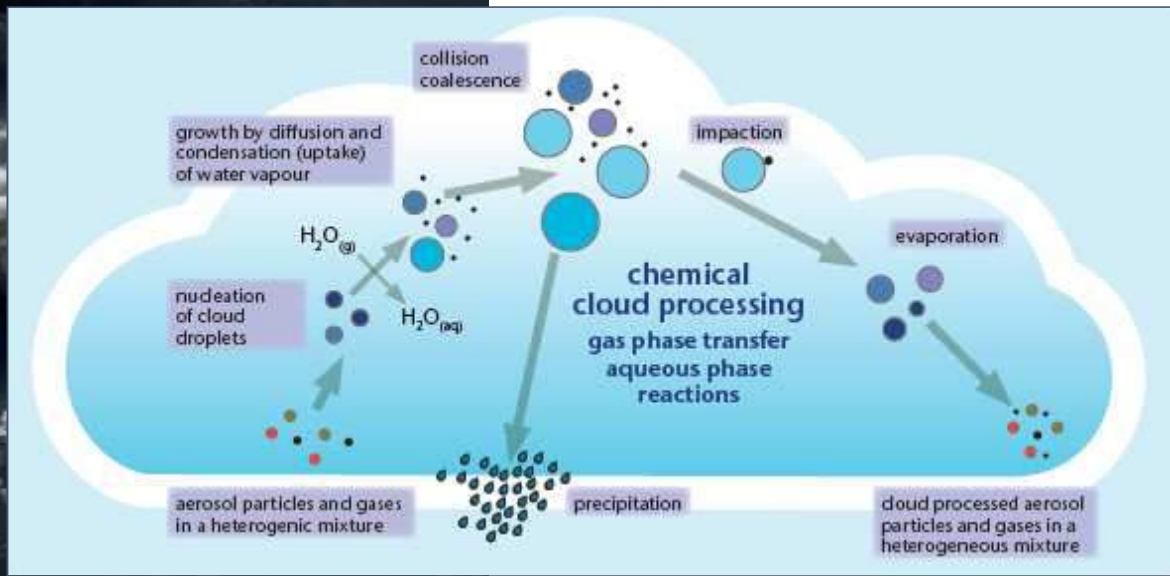
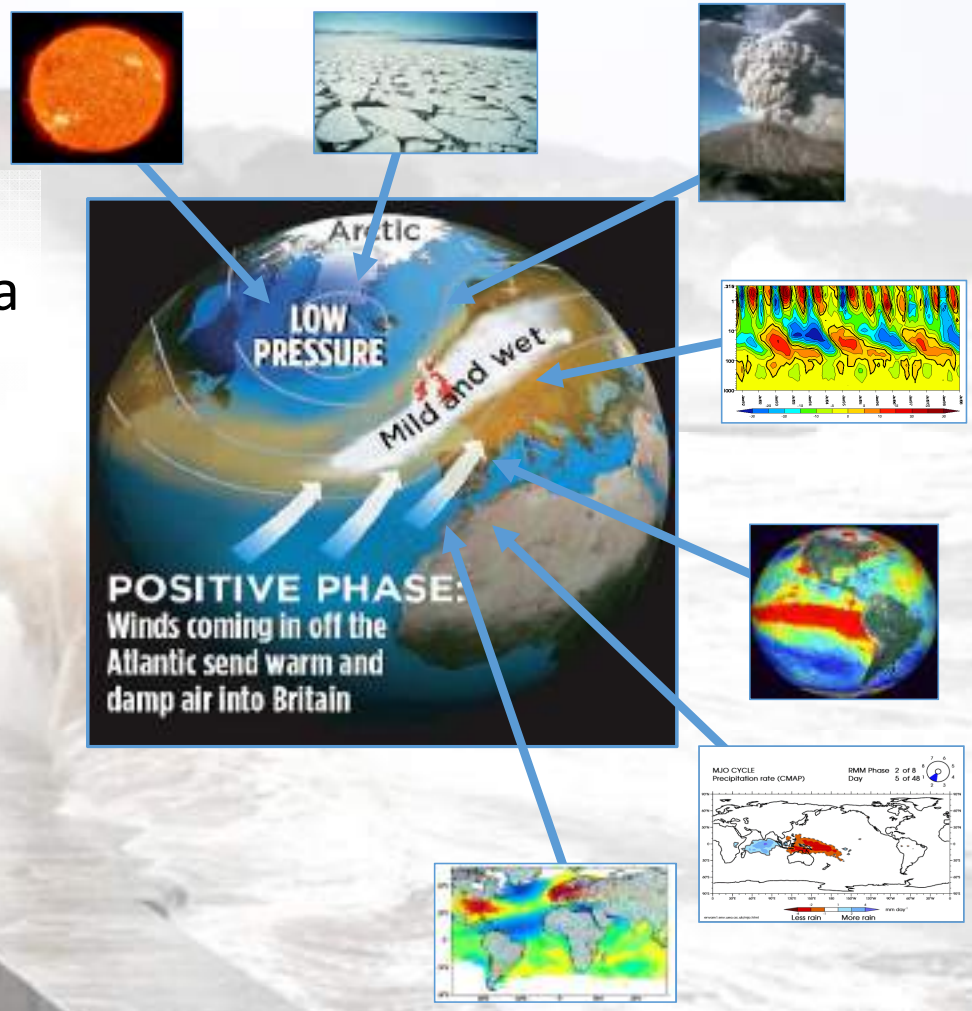


Monthly to Decadal Prediction: Understanding near-term risks

There are many drivers of seasonal weather and each 'loads the dice' in a different way.

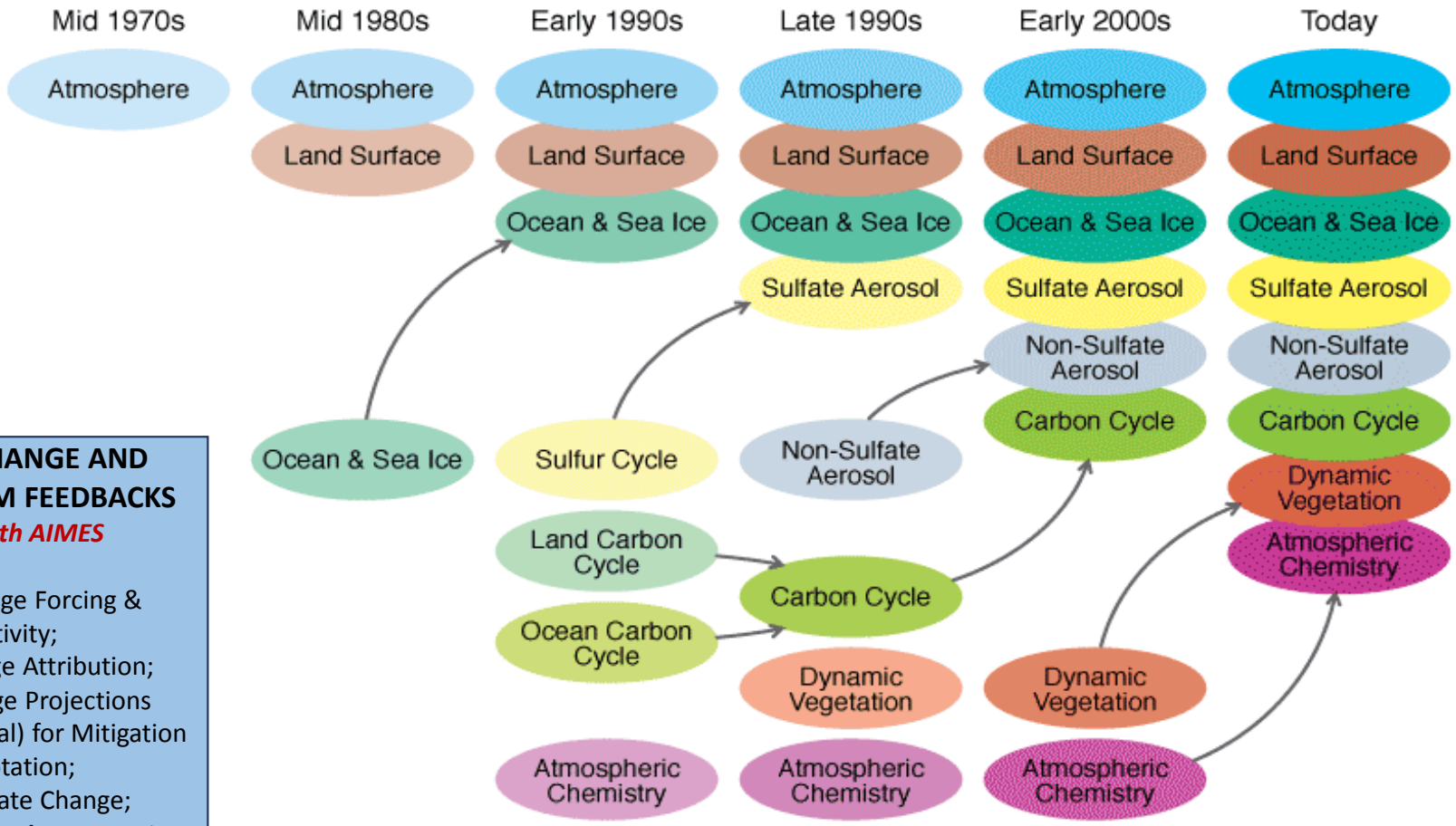


CLIMATE VARIABILITY, PREDICTABILITY & PREDICTION

Ocean, Land, Cryosphere, Atmosphere & Solar Drivers; Climate Dynamics, Modes of Variability & Teleconnections; Monthly to Decadal Predictability & Prediction

There is no logical scientific argument for separating the physical climate system from full Earth system science

Evolution of Climate Models to Earth System Models



CLIMATE CHANGE AND EARTH SYSTEM FEEDBACKS

Jointly with AIMES

Climate Change Forcing & Sensitivity;
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WCRP CAPABILITY THEMES

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WCRP CROSS-CUTTING RESEARCH PROJECTS (*on occasions with **WWRP**, Future Earth…..*)

Examples: Regional Sea Level Rise, Coastal Impacts and Cities,
Weather and Climate Extremes, now and in the future
Water Cycle and the Food Baskets of the World
Fate of the Antarctic and Greenland Icesheets
Is the Jet Stream changing its Behaviour?
Climate Change and Human Health

WCRP CAPABILITY THEMES

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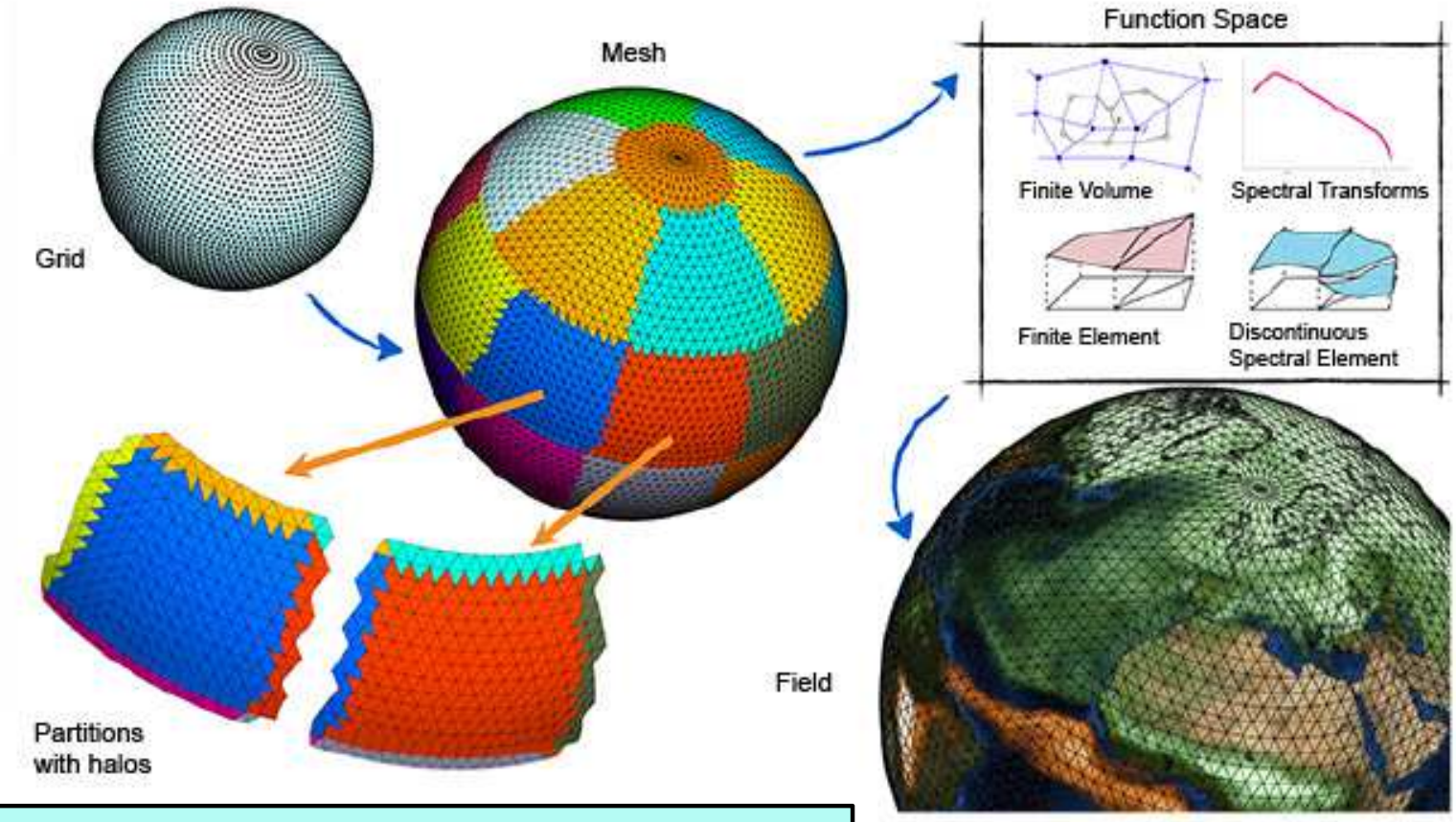
WCRP WORKING GROUP ON CLIMATE MODEL DEVELOPMENT *jointly with **WGNE***

Identifying Systematic Errors; Improving Climate Models & Building Next Generation Earth System Models; Planning for Exascale Computing

Is there a need now to distinguish between science for model development and using models for science?

Next Generation Codes and Exascale Computing



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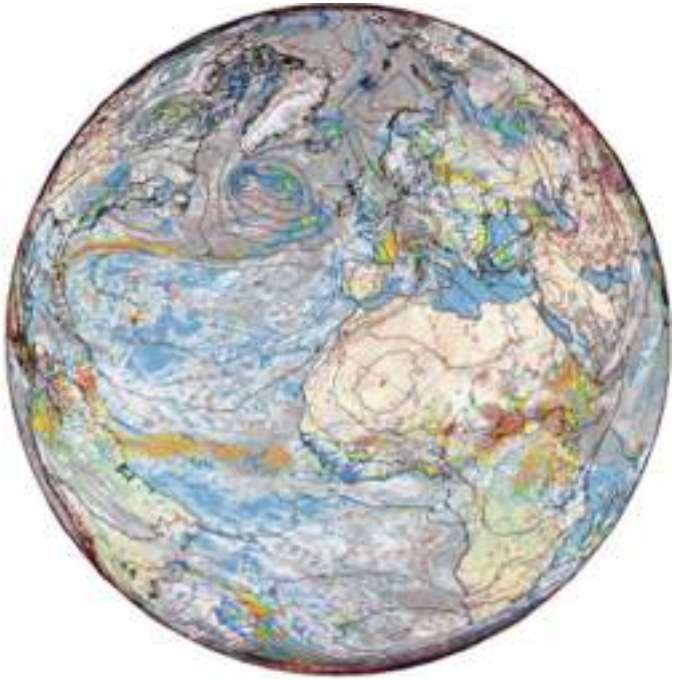

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Synoptic drivers

<N x Regional predictions at <1km with lead times of hours to years:

Local meteorology

Probability of local hazards:

Impact Scenarios & Narratives

Recommendation 6: Financing

In light of the importance to society of the goals of WCRP and the precarious level of current financial support for the programme, the co-sponsors should re-double their efforts to support WCRP financially at a higher level of enabling funding so that it can operate more effectively.

- Funding is shared between the co-sponsors based on their ability to contribute. Funding has been declining over the years, with only WMO maintaining its funding to WCRP of around 1.5 million CHF per year, covering staff positions.

- WCRP Governing Board should examine the enabling funding annually and be pro-active in making the case for that funding within the co-sponsor organisations, in accordance with their capacities.

- WCRP via its co-sponsors should encourage countries to make appropriate national contributions to the enabling funding, such as continuing to support International Project Offices and sponsoring Research Projects.

Recommendation 7: Science to service

WCRP should take action to ensure its knowledge is brought to the service of society, especially in supporting the development of climate services.

- WCRP should not be diluted by moving away from underpinning, fundamental climate science into the translational, applied science required for climate services. However, WCRP does need to be cognizant of what the users and stakeholders require from climate science, and should therefore maintain an active dialogue with them, directly and through its co-sponsors.

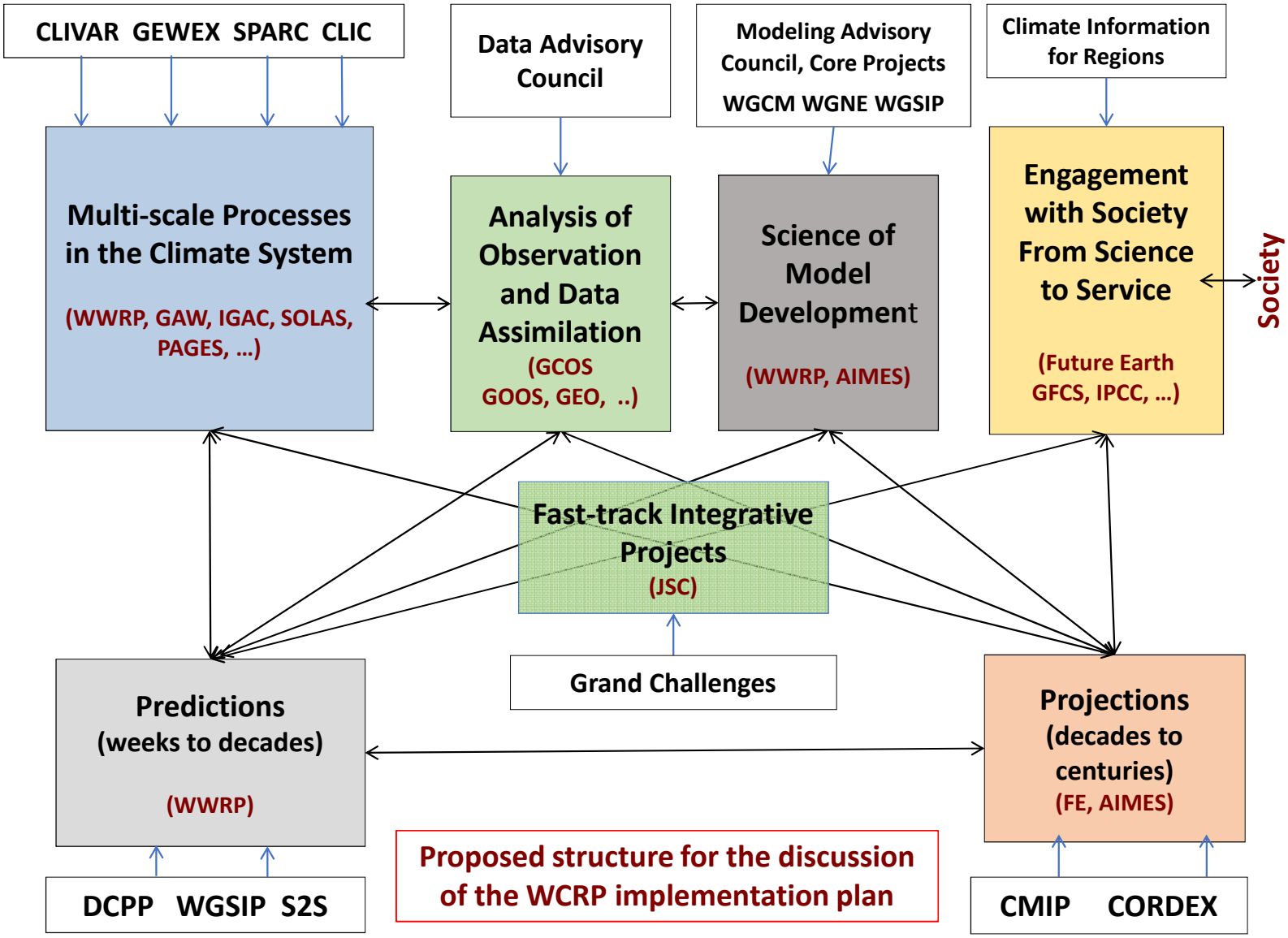
Recommendation 8: Partnership

WCRP should seek to develop strategic and strong partnerships with other WMO research programmes (specifically WWRP and GAW), with GCOS, and with Future Earth.

- WCRP urgently explores the option of the co-design and co-production of projects that address key scientific challenges of common interest to WCRP, WWRP, GAW and Future Earth.

CONCLUDING REMARKS

1. The panel commended WCRP for its long and vital contribution to international climate research, noting that the return on the investment by its sponsors is massive.
2. This review should help WCRP to plan its future and ensure that fundamental climate research continues to thrive and serve the needs of society as it tackles major 21st century challenges.
3. But this can only happen if WCRP has stronger governance and is placed on a more secure footing financially.
4. Co-sponsorship should continue. It brings together inter-governmental, service and academic perspectives in a unique way, and ensures that one organization does not dominate the agenda of the programme.
5. There are opportunities for stronger links, even consolidation, of some ICSU and WMO science programmes and activities.


CLIVAR GEWEX SPARC CLIC
Data Advisory Council
Modeling Advisory Council, Core Projects
WGCM WGNE WGSIP
Climate Information for Regions
Multi-scale Processes in the Climate System
(WWRP, GAW, IGAC, SOLAS, PAGES, …)
Analysis of Observation and Data Assimilation
(GCOS GOOS, GEO, ..)
Science of Model Development
(WWRP, AIMES)
Engagement with Society From Science to Service
(Future Earth GFCS, IPCC, …)
Society
Fast-track Integrative Projects
(JSC)
Grand Challenges
Predictions
(weeks to decades)
(WWRP)
Projections
(decades to centuries)
(FE, AIMES)
DCPP WGSIP S2S
CMIP CORDEX
Proposed structure for the discussion of the WCRP implementation plan

Constituent Body Reform

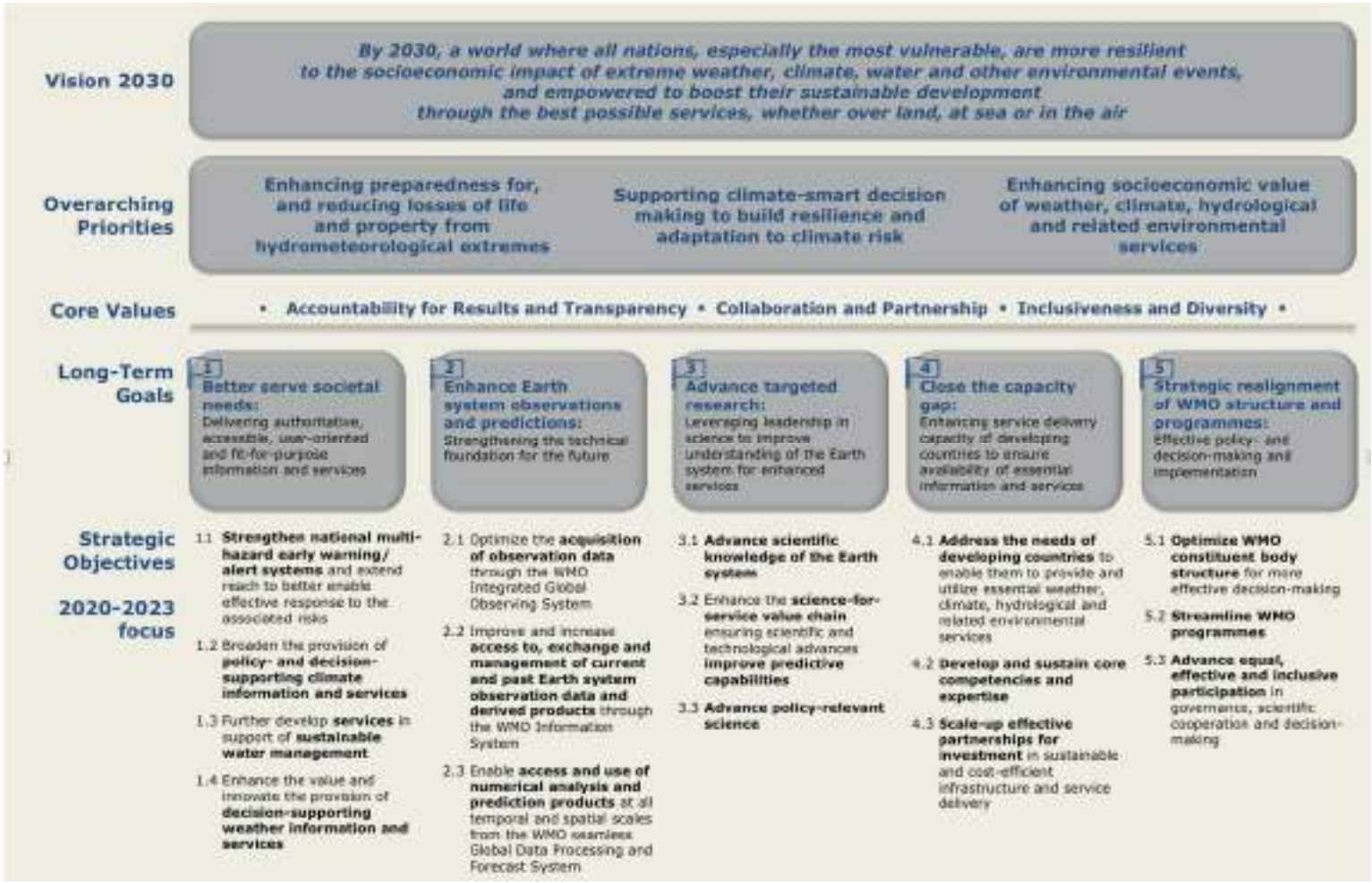
Congress-17 decision 2015

"Congress requested the Executive Council to provide recommendations to the Eighteenth Congress on constituent body constructs, as appropriate, including possible new structures for TCs, RAs, EC, and also to provide recommendations on rules, procedures, processes, working mechanisms, and duties, of constituent bodies, WMO Officers (President, vice- presidents, PRAs and PTCs) and the relationship between them and the WMO Secretariat to enhance the efficiency and effectiveness of the Organization and good governance."

⇒**REFORM IS NOT A MATTER OF WILL, IT IS A MUST**

EC/Member driven process, Secretariat as facilitator

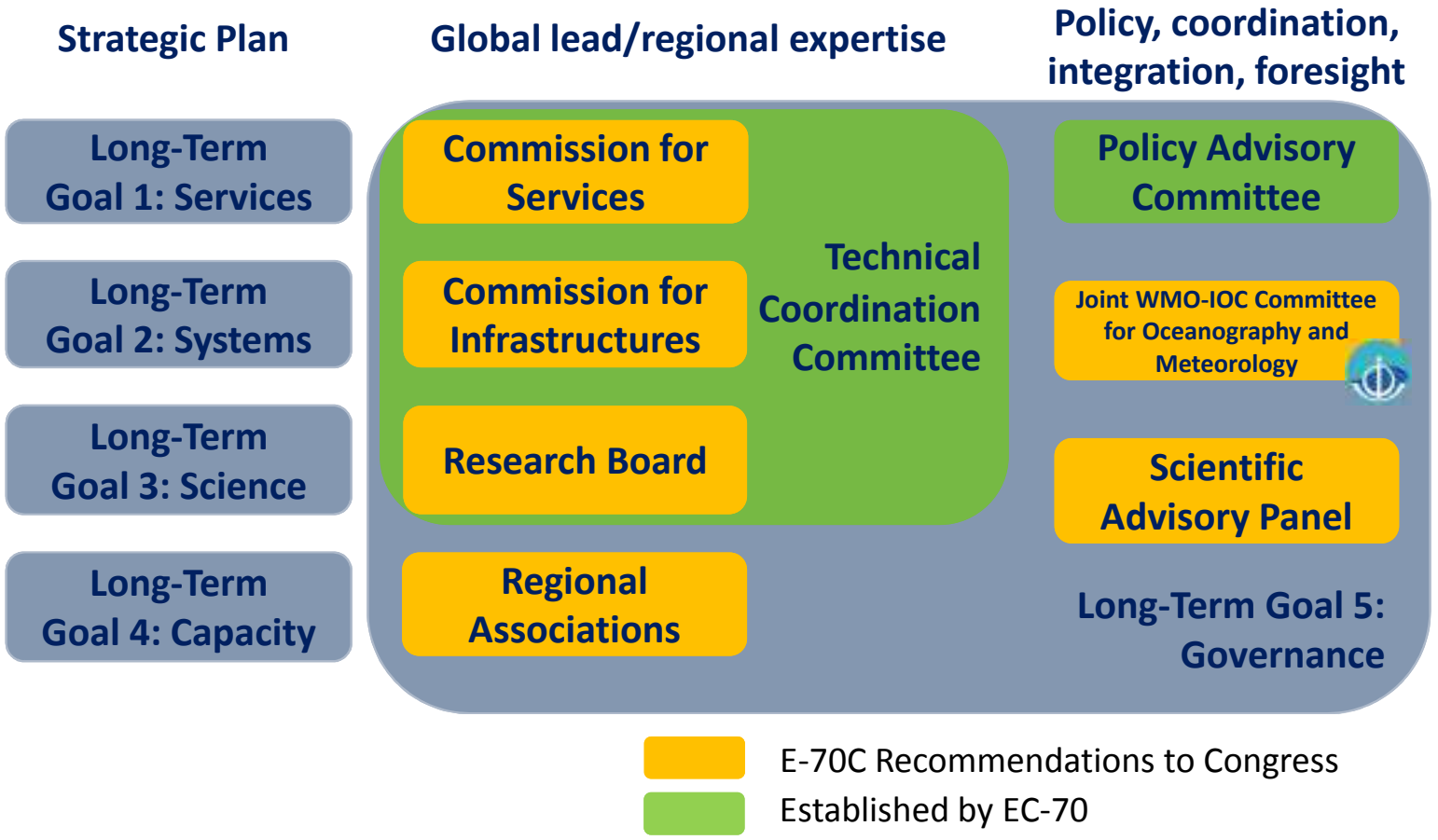
WMO Strategic Operating Plan



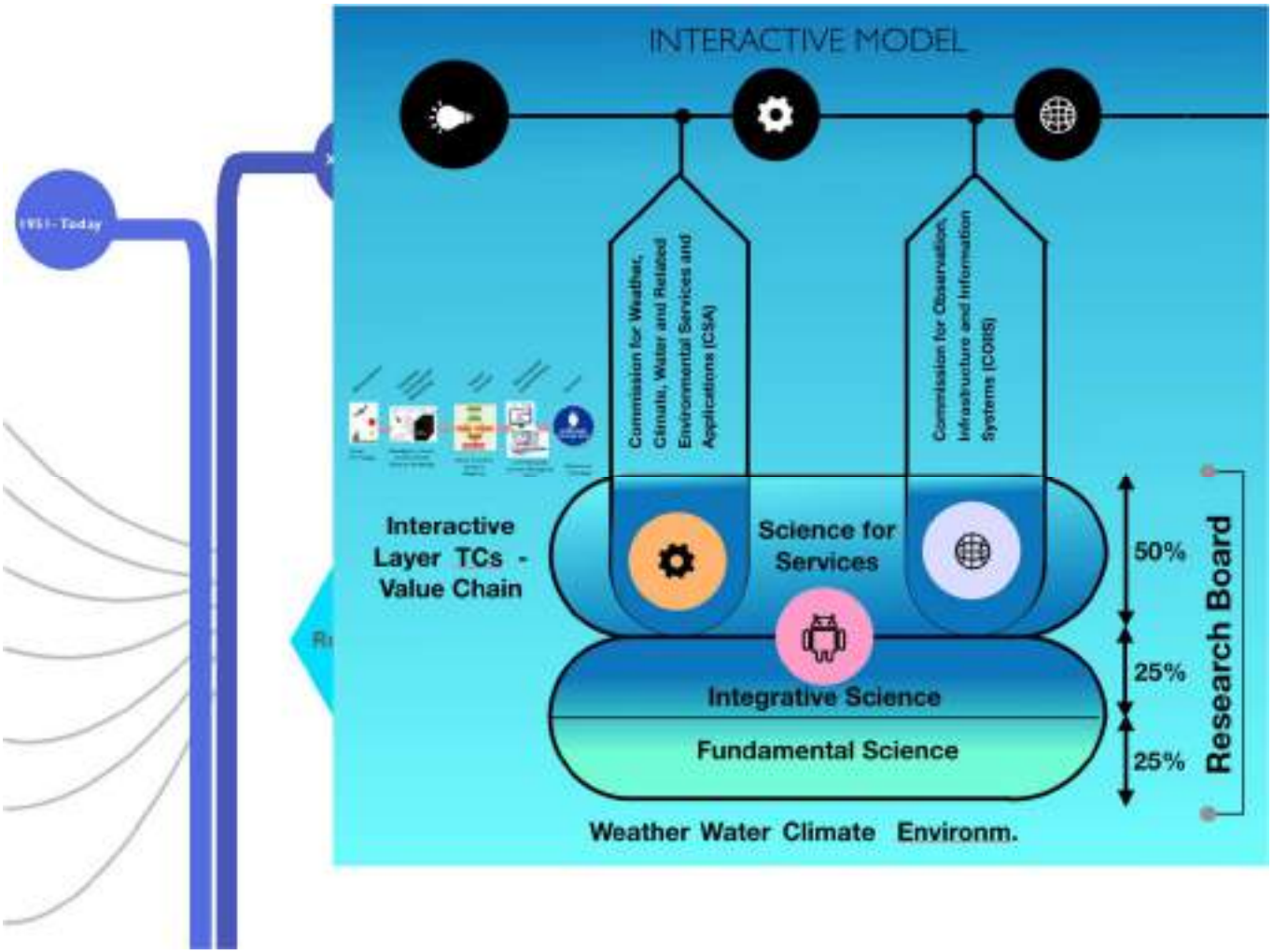
Objectives of CB Reform

- Effectiveness and efficiency
- Seamless integrated approach (spatial, temporal):
  - Earth System approach
  - WMO acting as one
- Wider engagement of Members & national experts
- Agility to uptake new challenges and tasks
- Improved collaboration with partners

Alignment of WMO Structure



1. Interactive Model for Innovation



WMO Research:
‘CATALYSING INNOVATION IN ENVIRONMENTAL SCIENCE’

WMO SCIENCE ADVISORY PANEL
WMO RESEARCH BOARD