

Statement to SBSTA 57: World Climate Research Programme

The World Climate Research Programme¹ (WCRP) is taking the lead in ensuring that the global to national climate research communities create the rigorous scientific foundation required to meet the urgent demand for robust and useful regional climate information. WCRP is pursuing – through international coordination – frontier scientific questions related to the climate system that are too large and too complex to be tackled by a single nation, institution, or scientific discipline. In doing so, WCRP brings together scientists from around the world at all stages of their careers. WCRP contributes to the development of policies and operationally focused climate services and advises on the definition of requirements for the observing system, which are set by the Global Climate Observing System (GCOS). WCRP also promotes science capacity building and education, which is done through partnerships with other programs such as Future Earth.

WCRP has committed itself to establish the science, knowledge and understanding required to target frontier problems, such as disaster risk reduction, climate adaptation, mitigation, and intervention strategies, that need to be solved together with partners, for which WCRP's core research continues to be essential for developing answers. The integral role of WCRP in developing knowledge of the climate system will result in an increased understanding of the Earth system, including the complex interactions between the physical environment and human society.

WCRP's Coupled Model Intercomparison Project² (CMIP) provides the climate change scenarios used by the Intergovernmental Panel on Climate Change (IPCC) assessment process. Planning for the next phase (CMIP7) is well underway and is supported by WCRP's CMIP International Project Office hosted by the European Space Agency.

Building on CMIP, the Coordinated Regional Downscaling Experiment (CORDEX)³ is WCRP's modelling framework to produce regional climate information. CORDEX now has four new *Flagship Pilot Study*⁴ proposals: 'Rainfall responses to climate change in a convective-permitting model over Western Cape (HighResWC)', 'URBan environments and Regional Climate Change (URB-RCC)', 'Dynamical downscaling experiments and hydrological modelling for Canada and Mexico' and 'North America: Assessing the Use of Regional Models in a Storyline Framework for Understanding Climate Hazards'. CORDEX is the basis for the climateinformation.org service supported by the Green Climate Fund, WCRP, WMO and the Swedish Meteorological and Hydrological Institute that provides the climate science basis for climate adaptation and mitigation activities.

WCRP's Strategic Plan⁵ reorients WCRP's core research towards providing the science, knowledge and understanding needed to target and provide answers to frontier problems – such as disaster risk reduction, climate adaptation, mitigation, and intervention strategies. A sustainable future for society presupposes a stable and amenable climate and requires salient and credible information on current and future states of the climate system. The timescales in which society requires this information range from near-term extreme events to long-range planning horizons, while spatial scales range from local to global. Within this framework, WCRP has a Scientific Objective that aims at "bridging climate science and society". To implement this, WCRP's new core project "Regional Information for Society (RifS)" strengthens the science and capability needed for providing societally-relevant climate information for regions, including our flagship service-oriented CORDEX project.

¹ WCRP is co-sponsored by the International Science Council (ISC), and the Intergovernmental Oceanographic Commission (IOC) of the United Nations Educational, Scientific, and Cultural Organization (UNESCO). See: <https://www.wcrp-climate.org/>

² <https://www.wcrp-climate.org/wgcm-cmip>

³ <https://cordex.org/about/>

⁴ <https://cordex.org/experiment-guidelines/flagship-pilot-studies/endorsed-cordex-flagship-pilot-studies/>

⁵ <https://www.wcrp-climate.org/wcrp-sp-overview>

WCRP has also established a new core project on Earth System Modelling and Observations (ESMO) to address critical scientific and technological priorities in the coming decade regarding modelling, observations and model-data fusion. ESMO will unite and strengthen global research activities on coupled modelling, including CMIP, numerical experimentation and near-term prediction, as well as observations and data. ESMO will also work to strengthen the strategic partnerships with GCOS, and with space agencies such as the European Space Agency (ESA) and European Organisation for the Exploitation of Meteorological Satellites (EUMETSAT).

WCRP has developed five new “Lighthouse Activities” that will make critical near-term progress towards meeting WCRP’s Vision, Mission, and Scientific Objectives⁶. The WCRP Lighthouse Activities are designed to be ambitious and multidisciplinary (integrating across WCRP and collaborating with partners) so that they can rapidly advance some of the new science and technologies, and institutional frameworks, that are needed to manage climate risk and meet society’s urgent need for robust and actionable climate information more effectively. The Lighthouse activities draw on WCRP’s core scientific and technical capabilities, and strategic partnerships.

Safe Landing Climates: Is exploring the routes to climate-safe landing ‘spaces’ for human and natural systems, on multi-decadal to millennial timescales; connecting climate, Earth System and socio-economic sciences. It is exploring present-to-future pathways for achievements of key SDGs.

Explaining and Predicting Earth System Change: Is designing and taking major steps towards delivery of an integrated capability for quantitative observation, explanation, early warning and prediction of Earth System Change on global and regional scales, with a focus on multi-annual to decadal timescale. It includes a theme on “Understanding High Risk Events” from low-probability, high-impact possibilities with global-scale ramifications

My Climate Risk: Is developing a new framework for assessing and explaining regional climate risk to deliver climate information that is meaningful at the local scale.

Digital Earths: Is developing a digital and dynamic representation of the Earth System, optimally blending models and observations, to enable an exploration of past, present and possible futures of the Earth System.

The WCRP Academy: Is determining the requirements for climate research education and building enabling mechanisms.

As well as its current foci, WCRP is also investing effort in several new activities that will gather momentum over the next few years. WCRP will address major science gaps in the field of precipitation through the international coordination of a Global Precipitation Experiment (GPEX). It will help accelerate advances in precipitation knowledge and prediction at different temporal and spatial scales, to enhance public access to relevant datasets, and to benefit society, by coordinating national and international activities. An international year of precipitation is proposed to coordinate field experiments in different regions around the world as well as to promote and coordinate related research. It will be embedded in a decade of water dealing with water issues in an end-to-end way.

While adaptation is important to manage climate change impacts that we cannot avoid, noting that the planet is already committed to a certain amount of climate change, only effective climate mitigation – especially net zero emissions - can keep global warming below 1.5 degrees. It becomes increasingly unlikely that society can make this transition in time to avoid exceeding the Paris temperature goals. The question of whether climate intervention technologies should be considered as part of a mitigation strategy has been raised, noting the inherent risks this may involve. Given the urgent and growing risks of climate change, it is important to understand the feasibility, efficacy, risks, and benefits of Carbon Dioxide Removal (CDR) and Solar Radiation Modification (SRM) as possible response strategies in addition to emission reductions and climate adaptation. It is clear that the current state of understanding of CDR and SRM is not sufficient for supporting informed

⁶ <https://www.wcrp-climate.org/about-wcrp/wcrp-overview>

decisions. WCRP has set up a task team that is working on documenting current research efforts, both internal and external to WCRP, in CDR and SCI (Solar Climate Intervention). The task team will determine the value WCRP could add to existing research efforts as well as identify research gaps that WCRP can help fill in working together with other international research programs and partners.

Following WCRP's assessment of science gaps in 2019, The subject of budgets and cycles of energy, water and carbon and their interconnections, has been a major focus of discussions within WCRP. While research into energy and water coupling is strong and obvious over all time scales, carbon is also tightly coupled to the energy and water cycles across all time and space scales and therefore it is essential for WCRP to explore this cross-cutting theme. This coupling between energy, water and carbon also includes the fluxes between the oceans, atmosphere, and land. A limited duration task team has been set up within WCRP and is working on producing a strategy as to how research into coupled energy, water and carbon cycles, across all time scales and across land, atmosphere and ocean domains of the Earth system can be best coordinated and facilitated as a cross-cutting theme across WCRP and with partners, such as the Global Climate Observing System (GCOS)

Partnerships are critical to the success of WCRP, which works with many different organisations, nations and institutions. As an example, the 2022 edition of the 10 New Insights in Climate Science (10NICS) has been prepared as a joint initiative between Future Earth, the Earth League and WCRP.

A WCRP Open Science Conference⁷ "Advancing Climate Science for a Sustainable Future" will be held in Kigali, Rwanda on 23-27 October 2023 and will focus on three overarching themes:

- **Theme 1: Advances in Climate Research**
Showcasing progress and future challenges in understanding Earth's climate system and advances in climate science capacity around the world. *Sessions will cover, inter alia, climate processes; gaps identified by IPCC; energy, water and carbon cycles; climate modelling, observations and model-data fusion.*
- **Theme 2: Human Interactions with Climate**
Analyzing key drivers and impacts of climate change (past, current and future), identifying risks to human and ecosystem health. *Sessions will cover, inter alia, climate extremes and associated risks and impacts; water availability, food, ecosystems, health and cities in a changing climate.*
- **Theme 3: Co-produced Climate Services and Solutions**
Connecting scientific knowledge, planning, decision-making and policy processes. *Sessions will cover, inter alia, near-term regional and climate change information for adaptation and mitigation; climate scenarios; climate intervention research.*

WCRP's community stands ready to work with our co-sponsors and partners, and to support nations, to ensure that society has the climate knowledge and information needed to meet the challenges of our changing climate. To achieve this, we rely on countries to provide long-term support for fundamental science, model development and a sustained climate observing system.

⁷ <https://wcrp-osc2023.org/>

