Annual Report of the World Meteorological Organization (WMO)

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*An Information Paper submitted by WMO*

The World Meteorological Organization[[1]](#footnote-1) (WMO) is a specialized agency of the United Nations and is the UN system's authoritative voice on the state and behaviour of the Earth's atmosphere, its interaction with the oceans, the climate it produces and the resulting distribution of water resources.

WMO covers a range of activities of relevance to the Antarctic Treaty System, including *Antarctic Science* via the World Climate Research Programme[[2]](#footnote-2) and World Weather Research Programme; *Antarctic Observations and Infrastructure*, for example via the Global Cryosphere Watch; and *Antarctic Services* via, for example, the Antarctic Regional Climate Centre network.

Antarctic Science activities of the World Climate and World Weather Research Programmes

Through the World Climate Research Programme2 (WCRP), WMO carries out several research and modelling activities in which the climate of the Antarctic region is a key aspect. Its activities are often conducted in partnership with other organisations, such as SCAR.

*WCRP’s Climate and Cryosphere Core Project (CliC)*

WCRP’s CliC project, with a new international office hosted by the University of Massachusetts Amherst in the US, focusses on the cryosphere component of the climate system. CliC is a connector and integrator of cryosphere research worldwide, coordinating research and modelling activities (often in partnership with SCAR) on ice sheet mass balance and sea level, ice shelves and alpine glaciers, sea ice, and permafrost. With a vision of cultivating future leaders in cryospheric research, CliC has also established a grant program, particularly aimed at early career scientists.[[3]](#footnote-3) See accompanying IP for further details.

WCRP also coordinates several modelling activities of relevance to Treaty Parties, including Antarctic CORDEX[[4]](#footnote-4) (the Coordinated Regional Downscaling Experiment, with an office at the Swedish Meteorological and Hydrological Institute), and CMIP (the Coupled Model Intercomparison Project, with a project office hosted by the European Space Agency in the UK) that generates the scenario runs that are integral to the Intergovernmental Panel on Climate Change (IPCC)[[5]](#footnote-5) assessment reports.

*Antarctic CORDEX*

Antarctic CORDEX[[6]](#footnote-6) was initiated by WCRP to develop regional climate downscaling of Antarctica to provide an accurate description of regional-to-local scale climate phenomena and their variability and changes. This project strengthens cooperation and knowledge exchange between polar climate modelling groups throughout the world, for the delivery of these simulations. A coordinated set of simulations enables regional model inter-comparison studies, which are required to characterise uncertainties. Output from the project also contributes to studies assessing the impact of climate change on Antarctica and the development of adaptation and mitigation strategies, which are required by a diverse range of stakeholders, in particular by the cryosphere community in order to produce an improved understanding of how ice sheets, glaciers, ice shelves, and sea ice respond to climate change. See IP for further details.

*Antarctica 2300 Projections*

The Ice Sheet Model Intercomparison Project for CMIP6 (ISMIP6) is a crucial part of the WCRP Climate Model Intercomparison Project Phase 6 (CMIP6), which focuses on ice sheets. The goal of ISMIP6 is to provide processed-based projections of ice sheet contribution to sea level rise for the 21st century, and to assess the uncertainties associated with these projections and their origins. It is also essential to consider ice sheet projections beyond the 21st century, as instability mechanisms have the potential to rapidly destabilize ice sheets, and several regions may reach tipping points, potentially leading to much larger sea level contributions.

Antarctica 2300 Projections is a continuation of the successful ISMIP6 project, and is open to the international community. This project extends previous simulations of ISMIP6 until 2300, using climate forcings from both CMIP5 and CMIP6 under different scenarios. It evaluates the stability of basins around Antarctica until 2300 using an ensemble of ice sheet models and assesses the uncertainty from ice flow models and climate forcings. It also analyzes the role of ice shelf collapse in future projections and compares the results obtained using climate forcings until 2300 with those from simulations based on forcings from the end of the 21st century repeated after 2100. The analysis of results is ongoing with expected publication in the coming year. See accompanying IP for details.

*The YOPP/PPP final summit and next steps*

The Polar Prediction Project (PPP) of WMO’s World Weather Research Programme (WWRP) formally concluded on 31 December 2022 but activities in three key areas (Year of Polar Prediction in the Southern Hemisphere (YOPP-SH), the Model Intercomparison and Improvement Project, and the PPP Societal and Environmental Research Applications group) will continue during 2023. WWRP is finalising plans for a follow-on project on polar research, as part of their new Implementation Plan for 2024-2027.

The YOPP Final Summit[[7]](#footnote-7) took place in Montreal, Canada, 29 August - 1 September 2022, and brought together the polar prediction community – from operational centres, academia, environment services, polar prediction users and northern communities. The Summit showcased the successes of YOPP and included Science-to-Service sessions where key users described their engagement with environmental predictions. The discussions around the Science and Service sessions identified that, whilst good progress had been made in identifying key user groups and their needs, more effort is needed to expand research around identifying the range of information needs of a greater diversity of user groups as well as tailoring services to their needs.

Antarctic Observations and Infrastructure

WMO has adopted a new Unified Data Policy that is necessary for the global efforts to monitor, understand and then predict weather and climate, as well as the Global Basic Observing Network (GBON). GBON paves the way for a radical overhaul of the international exchange of observational data, which underpin all weather, climate and water services and products.

The increased frequency of extreme temperatures seen in Antarctica recently emphasises the need for systematic observations of demonstrated quality. There are significant challenges to obtaining continuous quality measurements over the ice sheet surface of the Antarctic, e.g., due to the impact of the snow albedo and of the extreme operating conditions. For that reason, WMO is committed to continue bringing together the international community of experts engaged in maintaining observing stations in Antarctica as part of its Global Cryosphere Watch[[8]](#footnote-8), to address specific observations, instrumentation, challenges, e.g., measurements of snow depth, air temperature, fast ice, etc.

Antarctic Climate Services

WMO, with partners, continued efforts to establish the Antarctic Polar Regional Climate Centre (AntRCC) Network, building on lessons learned from the establishment of the Arctic RCC Network. The AntRCC aims at producing coherent and harmonized climate products and services over the Antarctic domain and establishing a dialogue platform between stakeholders and users of climate information. WMO Member states (also signatories to the Antarctic Treaty) that earlier expressed interest in contributing to the AntRCC-Network are finalizing the AntRCC-Network structure, agreeing on technical and organizational arrangements, developing mechanisms for engaging with partners, and developing a roadmap towards the AntRCC-Network implementation, including the initiation of the demonstration phase. WMO will continue providing updates and engaging with Treaty Parties as relevant.

*Antarctic Maritime Safety Services*

Providing maritime safety services for vessels in the Antarctic is crucial. For this, WMO plays a key role in supporting the National Meteorological and Hydrological Services responsible for provision of meteorological maritime safety information as required under the International Convention for Safety of Life at Sea (SOLAS). Supporting these efforts, the International Ice Charting Working Group (IICWG), comprising the world’s national ice services, promotes maritime safety by coordinating all aspects of operational sea ice and iceberg information services. Task teams of the IICWG are presently focused on aligning key Southern Ocean sea ice and iceberg products with those of the North Atlantic, improving sea ice and iceberg detection using multi-spectral Synthetic Aperture Radar, developing new ice hazard risk products to augment traditional ice charts and support the IMO's Polar Code requirement for voyage-specific risk assessments, and working with maritime training institutes to provide better tools for teaching mariners about sea ice and icebergs.

Further to this, the WMO-IMO Worldwide Met-Ocean Information and Warning Service (WWMIWS) includes METAREAS coordinated by Argentina, South Africa, Australia, New Zealand and Chile, each of which covers a portion of the southern polar region, providing sea ice information including icebergs in the same way that the METAREAs coordinated by Canada, Norway and Russian Federation do for the northern polar region.

WMO is developing the updated Maritime Service description on Ice navigation service (MS 13). The MS 13 is to provide ice navigation information to maritime users in the vicinity of ice infested regions. WMO and IMO are also preparing for the 2nd WMO-IMO Symposium on Extreme Maritime Weather, expected in September 2024 at the IMO Headquarters in London, at which discussion topics will include polar themes for safe navigation.

High-level Publications of Interest

WMO produces several Antarctic and climate related science publications. Just to highlight three high-profile publications:

*WMO Statement on the State of the Global Climate*

Each year WMO produces a high-level “Statement on the State of the Global Climate” with key partners, including SCAR. These statements are presented at the Conference of Parties (COP) meetings and other fora and are available in English, Spanish, Russian, French, Chinese and Arabic. Copies of the 2022 provisional report can be downloaded from: https://library.wmo.int/doc\_num.php?explnum\_id=11359

*United in Science*

The United in Science report is a multi-organization high-level compilation that presents the very latest scientific data and findings related to climate change, to inform policy and decision-makers. See:

https://public.wmo.int/en/resources/united\_in\_science

*10 New Insights in Climate Science*

WCRP co-produces the “10 New Insights in Climate Science” with Future Earth and the Earth League. The 2022 edition was launched at COP27 and the 2023 version is currently being prepared. For further details see: https://10insightsclimate.science/.

WMO continues to look forward to a positive, mutually beneficial engagement with Treaty Parties in Antarctic weather and climate observations, services and research. For further queries please contact Mike Sparrow ([msparrow@wmo.int](mailto:msparrow@wmo.int)) in the first instance.

1. www.wmo.int [↑](#footnote-ref-1)
2. Co-sponsored by the International Science Council (ISC) and the Intergovernmental Oceanographic Commission (IOC) of UNESCO [↑](#footnote-ref-2)
3. https://climate-cryosphere.org/2021-clic-fellowships-grants-open-call/ [↑](#footnote-ref-3)
4. https://cordex.org/domains/region-10-antarctica/ [↑](#footnote-ref-4)
5. . https://www.wcrp-climate.org/wgcm-cmip [↑](#footnote-ref-5)
6. <https://climate-cryosphere.org/antarctic-cordex/> [↑](#footnote-ref-6)
7. <https://yoppfinalsummit.com/> [↑](#footnote-ref-7)
8. https://globalcryospherewatch.org/ [↑](#footnote-ref-8)