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| WEATHER CLIMATE WATER | **World Meteorological Organization****EXECUTIVE COUNCIL****Seventy-Sixth Session**27 February to 3 March 2023, Geneva | **EC-76/Doc. 3.1(18)** |
| Submitted by: Co-Chairs of EC-PHORS4.I.2023**DRAFT 1** |

**AGENDA ITEM 3: IMPLEMENTATION OF CONGRESS DECISIONS: TECHNICAL MATTERS**

**AGENDA ITEM 3.1: Long-term goal 1: Services for societal needs**

# RECOMMENDATIONS OF EC-PHORS

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| **Summary****Document presented by:** Co-Chairs of EC-PHORS**Strategic objective 2020–2023:** LTG 1, 2, 3 and 4**Financial and administrative implications:** will be reflected in the Strategic and Operational Plans 2024–2027.**Key implementers:** SERCOM, INFCOM, RB, EC-PHORS and RAs**Time frame:**. 2024–2027**Action expected:** Review the proposed draft recommendation and the draft resolution to be submitted to Cg-19 |

# GENERAL CONSIDERATIONS

### Introduction

Priorities to Address Global and Regional Impacts of Changes in the Cryosphere

1. Draft Recommendation 3.1(18)/1 (EC-76) summarizes the key priorities for action by WMO structures and in collaboration with partners, proposed for the 2024-2027 period. These priorities align [A Johnson] with Strategic Objective 1.5, and the actions will improve [A Johnson] access to information to[A Johnson] address the risks and impacts from the accelerated and, largely, irreversible changes in the cryosphere, at global and regional levels.
2. These priorities reflect the full value cycle and are aimed at addressing the information needs of [D Campbell] regions, where the [D Campbell] cryosphere is present, as well as downstream and lowlands regions, and the ocean. For example, these actions are relevant to small island countries (SIDS) [D Campbell] affected by the melting glaciers and ice sheets (e.g. via [D Campbell] sea level rise), countries with seasonal snow cover impacted [D Campbell] by the increased variability of snow cover [D Campbell] and its impact on water resources (floods, flash floods, coastal inundation, droughts, etc.) and the increased risk of cryosphere related hazards (landslides, increased carbon release from permafrost, etc.), [D Campbell]
3. With draft Recommendation 3.1(18)/1, EC will recommend to the nineteenth session of the World Meteorological Congress (Cg-19), the draft Resolution ##/1 (Cg-19) – Priorities to Address Global and Regional Impacts of Changes in the Cryosphere, as provided in the [annex](#_Annex_to_draft_1) to this draft Recommendation.

The [annex](#Annex_to_Resolution) to the Cg-19 draft resolution outlines five key priorities and their respective priority actions to complement and enhance existing work plans of the WMO structures.

**Expected action**

1. Based on the above, EC-76 will recommend submission to Cg-19 of the [annex](#Annex_to_draft_Recommendation) to draft Recommendation 3.1(18)/1 (EC-76), as a stand-alone draft resolution.

# DRAFT RECOMMENDATION

## Draft Recommendation 3.1(18)/1 (EC-76)

### Priorities to Address Global and Regional Impacts of Changes in the Cryosphere

THE EXECUTIVE COUNCIL,

**Recalling:**

1. [Resolution 48 (Cg-18)](https://library.wmo.int/doc_num.php?explnum_id=9827#page=162) – Key Directions of the Polar and High Mountain Agenda for the next WMO Financial Period (2020–2023),
2. [Resolution 18 (EC-73](https://library.wmo.int/doc_num.php?explnum_id=11008#page=338)) – Transition and Pre-operational Plan of the Global Cryosphere Watch,
3. [Resolution 30 (EC-73)](https://library.wmo.int/doc_num.php?explnum_id=11008#page=495) - Executive Council Panel on Polar and High mountain Observations, Research and Services
4. [Resolution 3 (EC-75)](https://library.wmo.int/doc_num.php?explnum_id=11331#page=19) – United Nations Global Early Warning/Adaptation Initiative,
5. [Resolution 6.6/1 (INFCOM-2)](https://meetings.wmo.int/INFCOM-2/_layouts/15/WopiFrame.aspx?sourcedoc=/INFCOM-2/English/2.%20PROVISIONAL%20REPORT%20(Approved%20documents)/INFCOM-2-d06-6-RECOMMENDATION-SG-CRYO-INTEGRATION-CRYOSPHERE-EARTH-SYSTEM-approved_en.docx&action=default) - Closing the gap on the integration of cryosphere in the Earth system approach of WMO
6. [Resolution 4(3) (EC-76)](https://meetings.wmo.int/EC-76/_layouts/15/WopiFrame.aspx?sourcedoc=/EC-76/English/1.%20DRAFTS%20FOR%20DISCUSSION/EC-76-d04(3)-GHG-MONITORING-INFRASTRUCTURE-draft1_en.docx&action=default) - WMO- coordinated global greenhouse gas monitoring infrastructure [D Campbell]

**Recognizing:**

1. The increasing risks posed by the melting and shrinking of the cryosphere to people and ecosystems including in mid-latitudes [D Campbell] polar and high mountain regions and extending to lowlands and small islands, and the associated outstanding gaps in meeting their societal needs for related weather, climate, water and other environmental services,
2. That impacts of changes in the cryosphere are felt well beyond the countries where they occur, being transmitted to vast human populations and the ocean via impacts on atmospheric circulation and [D Campbell]hydrological systems, with [D Campbell] cascading impacts on weather and climate,
3. That Executive Council Panel on Polar and High mountain Observations, Research and Services (EC-PHORS) has operated under the general terms of reference of RAs with regard to the WMO activities in Antarctica, as in Annex II of [*Basic document No. 1*](https://library.wmo.int/index.php?lvl=notice_display&id=14206#.Y5xydHbMI2w) (WMO-No. 15), since first established by [Resolution 9 (EC-LX)](https://library.wmo.int/doc_num.php?explnum_id=5031#page=115) as Executive Council Panel of Experts on Polar Observations, Research and Services (EC-PORS), as an evolution from the EC Panel of Experts on Antarctic Meteorology,
4. The value of enhanced coordination and planning of WMO and of Member’ engagements in Antarctica (South of 60˚S) and the opportunity this presents for delivery of observations, services and research outcomes to improve our understanding of the global and regional impacts of Antarctic and Southern Ocean environment, especially in relation to future changes of Antarctica Ice Sheets,

**Recognizing further** the achievements of EC-PHORS in coordinating with relevant international organizations active in polar and high mountain regions and in engaging WMO technical commissions, the Research Board and regional associations in the work of the Panel,

**Mindful of** the evidence presented in the [Sixth Assessment Report](https://www.ipcc.ch/assessment-report/ar6/) (AR6) of the Intergovernmental Panel on Climate Change (IPCC) on impacts attributed to the irreversible changes in the cryosphere, as are the increased uncertainty of freshwater resources, the contribution to sea level rise, the increased exposure to cryosphere related and coastal hazards,

**Having examined** the report of the twelfth [A Johnson] the Executive Council Panel on Polar and High-mountains Observations, Research and Services (2022) ([EC-76/INF. 3.1(18)](https://meetings.wmo.int/EC-76/InformationDocuments/Forms/AllItems.aspx))

**Having considered:**

1. The High-Level Action plan presented by the UN Secretary-General at the twenty-seventh Conference of the Parties to the United Nations Framework Convention on Climate Change (COP27),
2. The recommendation of the Policy Advisory Committee contained in document [EC‑76/INF. 2.5(1–2)](https://meetings.wmo.int/EC-76/InformationDocuments/Forms/AllItems.aspx),
3. That WMO is an Observer to the Arctic Council and an invited expert to the Antarctic Treaty Consultative Meeting,

**Welcomes** the completion of the Year of Polar Prediction (YOPP) project of the WMO’s World Weather Research Programme (WWRP) and a new project Polar Coupled Analysis and Prediction for Services proposed in the WWRP Implementation Plan for 2024–2027;

**Acknowledging** that implementation of outputs associated with changes in the cryosphere and downstream impacts on water resources and sea-level rise are subject to the outcome of budgetary decisions or the Secretary-General being able to identify efficiencies; *[P Endersby]*

**Recommends** to Congress the adoption of Priorities to Address Global and Regional Impacts of Changes in the Cryosphere, through draft Resolution ##/1 (Cg-19, as provided in the [annex](#Annex_to_draft_Recommendation) to the present recommendation;

**Requests** the EC-PHORS to keep the list of proposed activities under review and to make a final proposal to Congress (i.e. a revision of the annex to the present recommendation), in consultation with the other bodies of WMO.

See [EC-76/INF. 3.1(18)](https://meetings.wmo.int/EC-76/InformationDocuments/Forms/AllItems.aspx) for more information

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## Annex to draft Recommendation 3.1(18)/1 (EC-76)

**Draft Resolution ##/1 (Cg-19)**

### Priorities to Address Global and Regional Impacts of Changes in the Cryosphere

THE WORLD METEOROLOGICAL CONGRESS,

**Recalling:**

1. [Resolution 1 (Cg-Ext)](https://library.wmo.int/doc_num.php?explnum_id=11113#page=9) - WMO Unified Policy for the International Exchange of Earth System Data,
2. [Resolution 48 (Cg-18)](https://library.wmo.int/doc_num.php?explnum_id=9827#page=162) – Key Directions of the Polar and High Mountain Agenda for the next WMO Financial Period (2020–2023),
3. Resolution ##/1 (Cg-19) – WMO Strategic Priorities 2024–2027,
4. Resolution ##/1 (Cg-19) – Early Warning System for all action plan,
5. [Resolution 6.6/1 (INFCOM-2)](https://meetings.wmo.int/INFCOM-2/_layouts/15/WopiFrame.aspx?sourcedoc=/INFCOM-2/English/2.%20PROVISIONAL%20REPORT%20(Approved%20documents)/INFCOM-2-d06-6-RECOMMENDATION-SG-CRYO-INTEGRATION-CRYOSPHERE-EARTH-SYSTEM-approved_en.docx&action=default) - Closing the gap on the integration of cryosphere in the Earth system approach of WMO,
6. [Recommendation 3.1(18)/1 (EC-76)](https://meetings.wmo.int/EC-76/English/Forms/AllItems.aspx?RootFolder=%2FEC%2D76%2FEnglish%2F1%2E%20DRAFTS%20FOR%20DISCUSSION&FolderCTID=0x0120002E248E5BDF8F774FB72A5FDD5565F016&View=%7BBF176166%2DEC65%2D44AF%2DAED2%2D269501CD0FA0%7D) - Priorities to Address Global and Regional Impacts of Changes in the Cryosphere,

**Having considered:**

1. The evidence presented in the [Sixth Assessment Report](https://www.ipcc.ch/assessment-report/ar6/) (AR6) of the Intergovernmental Panel on Climate Change (IPCC) on the accelerated impacts at global and regional level attributed to the irreversible changes in the cryosphere, as are the increased uncertainty of freshwater resources, the contribution to sea level rise, the increased exposure to cryosphere related and coastal hazards,
2. The value of enhanced coordination and planning of WMO and of Members’ engagements in Antarctica (South of 60˚S) and the opportunity this presents for delivery of observations, services and research outcomes to improve our understanding of the Antarctic and Southern Ocean environment, especially in relation to future changes of Antarctica Ice Sheets,

**Takes note** of the UN General Assembly (UNGA) *proclamation of* the period 2023–2027 as “Five Years of Action for the Development of Mountain Regions” UNGA Resolution 77/172 (<https://www.undocs.org/A/77/443/Add.11>) and of the UNGA Resolution 77/443 ([https://www.undocs.org/A/77/443](https://www.undocs.org/Home/Mobile?FinalSymbol=A%2F77%2F443&Language=E&DeviceType=Desktop&LangRequested=False)) proclaiming 2025 as the UN International Year of Glaciers’ Preservation;

**Noting**  the significant gap in monitoring the state of the permafrost, a high-carbon ecosystem, and our limited understanding of the climate change driven release of greenhouse gases from the thawing permafrost, as reported in the [Sixth Assessment Report](https://www.ipcc.ch/assessment-report/ar6/) (AR6) of the Intergovernmental Panel on Climate Change (IPCC), [D Campbell]

**Noting further** the preparatory work that has started for a fifth International Polar Year (IPY) in 2032–2033, under the coordination of the International Arctic Science Committee (IASC) and Scientific Committee on Antarctic Research (SCAR), and the opportunity that this presents for the active engagement of WMO,

**Welcomes:**

1. The successful integration, post-reform, of the many technical activities related to the cryosphere into the work programmes of WMO constituent bodies, i.e. INFCOM, SERCOM and the Research Board;
2. The roadmap set forth by the [Call to Action](https://highmountainsummit.wmo.int/en/call-action) arising from the 2019 WMO-led High Mountain Summit, with the active engagement of many WMO partners;

**Decides to endorse** the five high-level priorities identified in the [annex](#Annex_to_Resolution) to this Resolution as a roadmap for accelerating the integration of cryosphere information into the work of the WMO bodies, in order to sustainably and equitably support Members in addressing the global and regional impacts of the irreversible changes in the cryosphere and their downstream impacts on freshwater resources, sea level rise, and increased disaster risks;

**Requests** the Executive Council to:

1. Ensure that the five priorities identified in the [annex](#Annex_to_Resolution) to this resolution are reflected in the implementation of the WMO Strategic Plan 2024–27 as they align with the WMO Long-term Goals, and in the WMO Operating Plan;
2. Consider updating the terms of reference of EC-PHORS, to serve as a mechanism for engagement and advocacy in the execution of this resolution and as an interface with key partners and stakeholders;

**Requests** INFCOM, SERCOM, the Research Board, and the regional associations, in collaboration with EC-PHORS and other relevant WMO bodies, to reflect the priorities identified in the [annex](#Annex_to_Resolution) to this resolution, in their work programmes;

**Urges** Members, particularly those that have operational activities on cryosphere and in polar and high mountain regions, to:

(1) Mobilize national institutions with relevant programmes to make available their data that contribute to meeting the priorities in the [annex](#Annex_to_Resolution) to this resolution, to the operational community in near real time and on a free and unrestricted basis to support publicly funded research;

(2) Enhance their observing and monitoring programmes and services to enable the delivery of the priorities identified in the [annex](#Annex_to_Resolution) to this resolution;

(3) Maintain efforts for national coordination of agencies and authorities with responsibilities in polar and high mountain regions;

(4) Support the implementation of this resolution with in-kind and financial contributions;

**Recognizing** that implementation of outputs associated with changes in the cryosphere and downstream impacts on water resources and sea-level rise are subject to the outcome of budgetary decisions or the Secretary-General being able to identify efficiencies; [*P Endersby*]

**Requests** the Secretary-General:

(1) To make the necessary resources available to support WMO’s coordination, planning and implementation of Polar and High Mountain activities, to the extent possible [P Endersby];

(2) To bring the present resolution to the attention of all concerned.

[Annex: 1](#_Annex_to_draft_3)

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## Annex to draft Resolution ##/1 (Cg-19)

### Priorities to Address Global and Regional Impacts of Changes in the Cryosphere

The WMO goals of an Earth system approach to observations, modelling and prediction require additional actions on the integration and use of cryosphere information to close the gaps to a fully coupled cryosphere in the Earth system, and to enable effective services responding to emerging needs, e.g. development of early warning systems.

Coordination through WMO as an intergovernmental organization, is essential and most beneficial to Members, by extending the well-established practices for weather and climate to the integration of the cryosphere, reflective of its critical role in the Earth system.

Under the leadership of WMO and guided by the scientific knowledge available, the five high-level priorities will provide a clear framework to accelerate the integration of cryosphere information in the work of all WMO bodies, and to foster tangible improvements to the transfer of research to services, in particular for vulnerable communities where the impacts of the melting and the shrinking cryosphere in polar regions, the high mountain regions, as well as downstream, in coastal areas, and by small island countries (e.g. glaciers and ice sheet melt driving the sea level rise).

These priorities and their links to the WMO Long-term Goals (LTG), are as follows:

1. The urgency of global and regional emerging risks from the changing cryosphere in a changing climate, are understood and reflected in the workplans of WMO bodies and in global frameworks (LTGs 1, 2, 3, and 4),
2. Collaborative and coordinated technical mechanisms are optimized to support advancing service delivery by Members to address relevant gaps in polar and high mountain regions, at all scales (LTGs 1, 2, 3, and 4),
3. Earth system predictions are enhanced through closing gaps in polar and high mountain observations; improving data sharing; and improved numerical models integrating mature research related to cryospheric processes (LTGs 1, 2, 3 and 4)
4. Partnerships and collaboration with research and external stakeholders, advance knowledge sharing, and amplify the existing capacity to deliver services, in a regional relevant manner (LTGs 1, 2, 3, 4 and 5),
5. Antarctica: Members’ collaboration in collecting and sharing observations, conducting research, and developing and providing services, is enhanced (LTGs 1, 2, 3, and 5)

The delivery of these priorities will be supported by several flagship actions, as outlined below.

1. **The urgency of global and regional emerging risks from the changing cryosphere in a changing climate, are understood and reflected in the workplans of WMO bodies and in global frameworks**(aligned with LTGs 1, 2, 3, and 4)

The following key activities will contribute to addressing this priority:

* 1. Develop and promote high-level, long-term ambitions communicating the urgent need for global actions in addressing changes in polar and high mountain regions and their impacts downstream, including on coastal areas and SIDS;
	2. Improve the understanding of societal risks and opportunities in polar, high mountain, and lowlands, where cryosphere related impacts are felt, and advocate for their representation in the WMO strategies;
	3. Reflect cryosphere related services requirements within the WMO Strategy for Service Delivery across the range of time and spatial scales applicable to polar and high mountain regions and across impact-based services;
	4. Advocate for a focused approach in the work plans of WMO bodies, which [A Johnson] contribute to enhancing the resilience of vulnerable communities and regions facing impacts of irreversible changes in the world’s cryosphere, through coordination, knowledge and capacity-sharing, rapid technology adoption, and enhanced services;
	5. Coordinate and align service needs with advocacy for action through global campaigns to give new impetus to the international community’s efforts to address the information needs while balancing technical, scientific, operational, funding mechanisms, and policy aspects. Such campaigns include but not limited to the UN International Year of Glaciers’ Preservation and the UNGA proclamation of the period 2023–2027 as “Five Years of Action for the Development of Mountain Regions”.
1. **Collaborative and coordinated technical mechanisms are optimized to promote and support advancing service delivery by Members to address gaps in polar and high mountain regions, at all scales** (LTGs 1, 2, 3, and 4)

The following key actions will contribute to addressing this priority:

1. Develop requirements and plan pilot projects for regional mountain monitoring and warning centres, to address the intertwined hydrological, climate, ecosystem and social issues and policies that would support economies in areas surrounding high-mountains and their communities (e.g. the Call for Action of the WMO High Mountain Summit);
2. Within the framework of the WMO Integrated Processing and Prediction System (WIPPS), explore the potential to include new types of Regional Specialized Meteorological Centres to deliver region- and domain-specific products across all timescales, e.g. mountain monitoring and warning centres;
3. Continue the implementation of Polar Regional Climate Centre Networks and Outlook Forums (Arctic, Antarctic, the Third Pole), [Decision 47 (EC-70),](https://library.wmo.int/doc_num.php?explnum_id=4981#page=216) with relevant partners, with a focus on addressing evolving requirements, the capacity development needs, and a focus on addressing the gaps on cryospheric products;
4. Integrate cryospheric and related environmental hazards in the Multi-Hazard Early Warning System (MHEWS) and the catalogue of hazardous events, which to enable the development of necessary early warning systems, and with the engagement of relevant partners;
5. Develop consistent indicators for monitoring and reporting on cryosphere changes and their impacts, which to enable the provision of sustainable and timely weather and hydroclimate information services, e.g. the implementation of early warning systems as applicable to polar, high-mountains, coastal areas, and the monitoring of the release in the atmosphere of greenhouse gases from the thawing permafrost and glaciers, [D Campbell]etc.;
6. Use the opportunity of the completion of internationally coordinated research projects, e.g. the Year of Polar Prediction (YOPP) to develop approaches and pilot projects for translating mature research results into sustainable services, through appropriate mechanisms.
7. **Earth system predictions are enhanced through closing gaps in polar and high mountain observations, improving data sharing, and improved numerical models integrating mature research related to cryospheric processes** (aligned with LTGs 1, 2, 3 and 4)

The following key actions will contribute to addressing this priority:

* 1. Initiate the development of global high mountain Earth system forecasting and prediction capabilities, including Numerical Weather Prediction (NWP) verification and validation over high mountain areas, [A Johnson] to inform and manage risks from mountain-based extreme events and climate change, both in the mountain headwaters and downstream;
	2. Foster the organization of demonstration projects to advance the effectiveness of forecasts and warning services and the development and the sustainability of the necessary capacity for vulnerable regions affected by the rapid changes in the cryosphere;
	3. Establish a framework for multinational fully integrated observatories (supersites) hosting projects on addressing critical knowledge gaps on the atmosphere-ocean-cryosphere-land interactions, for example (1) testing new technologies and methods; (2) data assimilation, ground truthing and validation of models, and (3) pilot projects to assess EWS solutions;
	4. Enhance the free and open exchange of data related to the cryosphere (as defined in the WMO Unified Data Policy), across all relevant stakeholders and ensure their effective integration through the WMO Integrated Global Observing System (WIGOS), the WMO Information System (WIS), and WIPPS;
	5. Foster the integration of cryosphere data into Earth system models to drive improved predictability and better understanding of the climate impacts of rapid changes in the cryosphere;
	6. Sustain advocacy for critical satellite observations and data over polar and high mountain regions to support risk monitoring and assessments and the development of necessary services.
1. **Partnerships and collaboration with research and external stakeholders, advance knowledge sharing and amplify the existing capacity to deliver services, in a regional relevant manner** (aligned with LTGs 1, 2, 3, 4 and 5)

The following key actions will contribute to addressing this priority:

1. Take stock of and report on current and past research activities and results on changes in the cryosphere and their societal impacts to identify opportunities for transfer of research to operations and outstanding gaps in meeting emerging needs for information services, e.g. forecasts, warnings, hydrology, water resources, link between cryosphere melt and carbon release in the atmosphere [D Campbell] etc.;
2. Advocate for the representation of cryosphere related policy priorities of vulnerable regions in the work plans of WMO bodies;
3. Advocate for the co-production of knowledge through coordinated integrated research projects in High mountain regions and Antarctica, modelled on the Polar Prediction Project and Year of Polar Prediction campaign, to improve access to critical data and knowledge on representing the rapid changes in polar and high mountain regions, to support future operational services;
4. Pursue mutually beneficial engagements and partnerships with key partners, broader international research and, academia, across the full value cycle, in addressing key concerns and needs related to cryospheric changes in a regionally relevant manner [A Johnson];
5. Actively engage early career scientists and foster capacity development activities for local experts and communities, as a means [A Johnson] to sustain the development and delivery of services addressing urgent challenges related to drastic changes in the global cryosphere.
6. **Antarctica**: **Members’ collaboration in collecting and sharing observations; conducting research; and developing and providing services, is enhanced** (aligned with LTGs 1, 2, 3, and 5)

The following key actions will contribute to addressing this priority:

* 1. Conduct/organize high-level consultations and provide recommendations on the role of WMO on the coordination of activities of Members with an interest in Antarctica and its Southern Ocean environment (South of 60˚S), consistent with the Earth system approach and the WMO strategic plan, and taking into account the particularities of programmes on Antarctica;
	2. Engage Members with interests on Antarctica to evolve the necessary structure in WIPPS and WIGOS to meet effectively the information needs in support of activities of Members on Antarctica (South of 60˚S), integrating mature research results and considering the concepts of Regional WIGOS Centres, Regional Specialized Meteorological Centres and that for the Antarctic RCC-Network;
	3. Develop an integrated service delivery model for Antarctic weather and marine services, including a coordinating role of WMO, in consultation with Members’ Antarctic operators and parties to the Antarctic Treaty Consultative Meeting (ATCM);
	4. Maintain active engagements between WMO structures and other groups or bodies, such as the SCAR, the Council of Managers of National Antarctic Programmes, and with regard to aspects of Antarctic meteorology of relevance to their functions.

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