WMO OMM
World Meteorological Organization
Organisation météorologique mondiale
Organización Meteorológica Mundial
Всемирная метеорологическая организация
المنظمة العالمية للأرصاد الجوية
世界气象组织

WEATHER CLIMATE WATER
TEMPS CLIMAT EAU

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Ref.: 14634/2023-1.4 /ESM

Our ref.: 14634/2023/I/ESM/GCW/TPRCC-NS23 18 July 2023

Annex: 1

Subject: WMO Survey on RA II Members' status and plans regarding terrestrial cryosphere observations and data (in-situ and remote sensing)

Action required: To complete the WMO Survey **by 31 August 2023**

Dear Sir/Madam,

I wish to refer to the following resolutions of the seventeenth session of the Regional Association II (Asia) (RA II-17): Resolution 9 (RA II-17) – Observations and Data exchange in support of polar and high mountain activities, and Resolution 10 (RA II-17) - the RA II Operating Plan 2021–2024 (see *Abridged final report with resolutions and decisions of the Seventeenth Session* (WMO-No. 1279)). Specifically, RA II-17 decided that a focused approach is required to accelerate the development and provision of climate information in the framework of the Third Pole Regional Climate Centre – Network (TPRCC-Network) by concerned Members, as defined in the Implementation Plan (IP), as a living document (RA II-17(II)/INF. 6.3), to be included in the RA II Operating Plan (2021–2024).

Furthermore, the Members recognized the need to take stock of their requirements and potential for sharing their cryosphere[1] observations and their support to regional cooperation in support of enhancing the capacity to provide services tailored to polar and high mountain areas of RA II. In this sense, RA II-17 endorsed an increased engagement of Members and partners for enabling the access to cryosphere data, in support of meeting their information needs. As part of the implementation of these resolutions, a questionnaire has been prepared by WMO Secretariat to survey Members in RA II on the status of their observing programmes for all components of the cryosphere, the data sharing mechanisms (in-situ and remote sensing) through WMO Information System (WIS), and the utilization of those data to derive integrated products to be disseminated in support of necessary weather and hydro-climate services.

Members in RA II are kindly requested to complete the online survey (https://forms.office.com/e/arpkUaUJJr) no later than **31 August 2023**.

[1] Cryosphere components consist of snow, sea and freshwater ice, permafrost, glaciers, ice caps, ice sheets, and solid precipitation.

To: Permanent Representatives of Members with WMO in RA II

cc: Hydrological Advisers in RA II
Cryosphere experts

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To facilitate the broad engagement at the national level, in responding to this survey, we are making it available, in two formats, an online form and as a Word document. Please note that we strongly encourage that only one completed online questionnaire per Member/partner is submitted.

Should you have any questions concerning the survey, or should you experience problems accessing it, please do not hesitate to contact the WMO Secretariat by email at cryosphere@wmo.int with the subject "WMO RA II Cryosphere Survey".

I wish to highlight the importance of answering the questionnaire to support the capacity development in terms of cryosphere observations and data in high mountain regions.

I thank you and the Government of your country for your continued support to the activities of WMO.

Yours faithfully,

Wenjian Zhang
for the Secretary-General

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QUESTIONNAIRE ON MEMBERS' STATUS AND PLANS REGARDING TERRESTRIAL CRYOSPHERE OBSERVATIONS AND DATA

(in-situ and remote sensing)

Part I: Basic information on institutions/organizations

I.1 Please provide the following information:

I.1.1 Name of your Country/Territory (Selectable)

I.1.2 Name of your Institution/Organization_____

I.1.3 Name of the submitter_____

I.1.4 Email address of the submitter_____

I.2 Does your institution/organization have the mandate to carry out the following activities of cryosphere at the national level?

I.2.1 Cryosphere observations:

☐ Glacier

☐ Permafrost or Seasonally frozen ground

☐ Snow

☐ Lake ice

☐ River ice

☐ None

I.2.2 Cryosphere data collection and archive

☐ Glacier

☐ Permafrost or Seasonally frozen ground

☐ Snow

☐ Lake ice

☐ River ice

☐ None

I.3 If any, please list other institution(s)/organization(s) within your country or territory that is(are) responsible for terrestrial cryosphere related activities.

I.3.1 Name(s) of institution(s)/organization(s) and its(their) cryosphere components monitored (No more than 500 characters)

_____
_____
_____

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_____
_____

I.3.2 The website(s) of the institution(s)/organization(s) (If applicable, separated by comma, no more than 500 characters)

_____
_____
_____
_____
_____

Part II: Existing capacity on cryosphere in-situ observation

Glacier

II.1 Are glaciers in your country/territory observed in-situ?

☐ Yes

☐ No

II.1.1 If yes, please indicate the details (start year, end year (or current), no more than 500 characters).

_____
_____
_____
_____
_____

II.2 Which glacier variable(s) is/are monitored? (Please tick all that apply)

☐ Glacier mass balance (at a point and/or glacier wide)

☐ Glacier thickness

☐ Glacier volume

☐ Glacier runoff

☐ Glacier area

☐ Surface ablation at a point

☐ Surface accumulation at a point

☐ Other (Please specify, with short description, separated by comma, no more than 250 characters):

_____
_____
_____

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II.3 Are there any glaciers in your country/territory that are not being monitored?

☐ Yes

☐ No

II.3.1 If yes, please indicate how many.

_____

II.4 What are the current challenges your institution/organization faces in relation to glacier observations?

☐ Professional equipment and its maintenance

☐ Observing methods and techniques

☐ Data transmission

☐ Resources

☐ Other (Please specify, separated by comma, no more than 250 characters):

_____
_____
_____

Permafrost or Seasonally frozen ground

II.5 Are there any stations or projects within your country or territory for in-situ observation of permafrost or seasonally frozen ground?

☐ Yes

☐ No

II.5.1 If yes, please indicate how many stations.

_____

II.6 Which permafrost or seasonally frozen ground variable(s) is(are) measured? (Please tick all that apply)

☐ Permafrost temperature

☐ Active layer thickness

☐ Rock glacier velocity

☐ Soil moisture

☐ Other (Please specify, with short description, separated by comma, no more than 250 characters):

_____
_____
_____

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II.7 What are the current challenges your institution/organization faces in relation to permafrost or seasonally frozen ground observations?

☐ Professional equipment and its maintenance

☐ Observing methods and techniques

☐ Data transmission

☐ Resources

☐ Other (Please specify, separated by comma, no more than 250 characters):

_____
_____
_____

Snow

II.8 Are there any stations within your country or territory that perform in-situ snow observations?

☐ Yes

☐ No

II.8.1 If yes, please indicate how many.

_____

II.9 Which snow variable(s) is/are measured? (Please tick all that apply)

☐ Snow depth

☐ Water equivalent of snow cover

☐ Amount of solid precipitation

☐ Snow density

☐ Grain shape & size of snow

☐ Depth of snowfall

☐ Presence of snow

☐ Snow surface temperature

☐ Snow cover extent

☐ Other (Please specify, with short description, separated by comma, no more than 250 characters):

_____
_____
_____

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II.10 Are your snow observations according to the WMO guidance on the Best Practices of Snow (*Guide to Instruments and Methods of Observation, Volume II – Measurement of Cryospheric Variables* (WMO-No. 8))

☐ Yes

☐ No

II.10.1 If no, please indicate why. (No more than 500 characters).

_____
_____
_____
_____
_____

II.11 What are the current challenges your institution/organization faces in relation to snow observations?

☐ Professional equipment and its maintenance

☐ Observing methods and techniques

☐ Data transmission

☐ Resources

☐ Other (Please specify, separated by comma, no more than 250 characters):

_____
_____
_____

Lake ice

II.12 Is lake ice in your country observed in-situ?

☐ Yes

☐ No

II.13 Which lake ice variable(s) is/are measured? (Please tick all that apply)

☐ Ice thickness

☐ Ice concentration

☐ Ice class (pack, fast ice)

☐ Stage of ice development

☐ Ice phenomena (dates of freeze-up, fast ice formation/breakout, melt onset, break-up)

☐ Ice stage of melting

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☐ Other (Please specify, with short description, separated by comma, no more than 250 characters):

_____
_____
_____

II.14 What are the current challenges your institution/organization faces in relation to lake ice observations?

☐ Professional equipment and its maintenance

☐ Observing methods and techniques

☐ Data transmission

☐ Resources

☐ Other (Please specify, separated by comma, no more than 250 characters):

_____
_____
_____

River ice

II.15 Is river ice in your country observed in-situ?

☐ Yes

☐ No

II.16 Which river ice variable(s) is/are measured? (Please tick all that apply)

☐ Ice thickness

☐ Ice concentration

☐ Ice class (pack, fast ice)

☐ Stage of ice development

☐ Ice phenomena (dates of freeze-up, fast ice formation/breakout, melt onset, break-up)

☐ Ice stage of melting

☐ Other (Please specify, with short description, separated by comma, no more than 250 characters):

_____
_____
_____

II.17 What are the current challenges your institution/organization faces in relation to river ice observations?

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☐ Professional equipment and its maintenance

☐ Observing methods and techniques

☐ Data transmission

☐ Resources

☐ Other (Please specify, separated by comma, no more than 250 characters):

_____
_____
_____

Part III: Metadata in OSCAR/Surface

III.1 Is(are) the station(s) mentioned in Part II (Existing capacity on cryosphere in-situ observation) registered to the GCW surface observing network (GCW CryoNet/GCW Contributing/GCW affiliated) in OSCAR/Surface?

	Yes (please indicate the number)	No
Glacier		
Permafrost or Seasonally frozen ground		
Snow		
Lake ice		
River ice		

III.2 What are the challenges to registering cryosphere observations in OSCAR/Surface?

☐ The variables observed are not in OSCAR/Surface

☐ Lack of resources

☐ Other (Please specify, separated by comma, no more than 250 characters):

_____
_____
_____

III.2.1 If “The variables observed are not in OSCAR/Surface” is selected for the previous question, please list those variables, together with short definition (Separated by comma, no more than 500 characters).

_____
_____
_____
_____
_____

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Part IV: Cryosphere data exchange and archival

Glacier

IV.1 Where do you collect glacier data?

☐ No observation

☐ WGMS

☐ NSIDC

☐ GLIMS

☐ GTN-G

☐ RGI

☐ FoG

☐ Other (Please specify, separated by comma, no more than 250 characters):

_____
_____
_____

IV.1.1 How is the in-situ glacier data available?

☐ Via publications/reports

☐ Digitally via email

☐ Through website display or download service

☐ Via standardized web-services

☐ Not available anywhere

☐ Other (Please specify, separated by comma, no more than 250 characters):

IV.1.1.1 Please provide the applicable link(s). (Separated by comma, no more than 500 characters)

_____
_____
_____
_____
_____

IV.1.2 In which format does your institution/organization make the glacier data available to users?

☐ NetCDF (nc)

☐ ASCII (txt, csv, etc.)

☐ GIS (shapefile, etc.)

☐ BUFR

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☐ Other (Please specify, separated by comma, no more than 250 characters):

_____
_____
_____

IV.2 Does your institution/organization retrieve satellite products for glacier monitoring?

☐ Yes

☐ No

IV.2.1 If yes, please indicate the details of the products, including the name of the satellite-related and retrieval method(s) used. (Separated by comma, no more than 500 characters)

_____
_____
_____
_____
_____

IV.3 Does your institution/organization develop glacier reanalysis datasets based on in-situ observation and satellite data?

☐ Yes

☐ No

IV.3.1 If yes, please list relevant datasets. (Separated by comma, no more than 500 characters)

_____
_____
_____
_____
_____

Permafrost or seasonally frozen ground

IV.4 Where do you collect permafrost or seasonal frozen ground data?

☐ No observation

☐ GTN-P

☐ NSIDC

☐ Other (Please specify, with short description, separated by comma, no more than 250 characters):

_____
_____
_____

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IV.4.1 How is the in-situ permafrost or seasonally frozen ground data available?

☐ Via publications/reports

☐ Digitally via email

☐ Through website display or download service

☐ Via standardized web-services

☐ Not available anywhere

☐ Other (Please specify, separated by comma, no more than 250 characters):

_____
_____
_____

IV.4.1.1 Please provide the applicable link(s). (Separated by comma, no more than 500 characters)

_____
_____
_____
_____
_____

IV.4.2 In which format does your institution/organization make the permafrost or seasonally frozen ground data available to users?

☐ NetCDF (nc)

☐ ASCII (txt, csv, etc.)

☐ GIS (shapefile, etc.)

☐ BUFR

☐ Other (Please specify, separated by comma, no more than 250 characters):

_____
_____
_____

IV.5 Does your institution/organization retrieve satellite products for permafrost or seasonally frozen ground monitoring?

☐ Yes

☐ No

IV.5.1 If yes, please indicate the details of the products, including the name of the satellite-related and retrieval method(s) used. (Separated by comma, no more than 500 characters)

_____
_____
_____

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_____
_____

IV.6 Does your institution/organization develop permafrost or seasonally frozen ground reanalysis datasets based on in-situ observation and satellite data?

☐ Yes

☐ No

IV.6.1 If yes, please list the relevant datasets. (Separated by comma, no more than 500 characters)

_____
_____
_____
_____
_____

Snow

IV.7 Where is the in-situ snow observation data stored?

☐ No observation

☐ Government organizations

☐ Scientific research institutions

☐ Other (Please specify, separated by comma, no more than 250 characters):

_____
_____
_____

IV.7.1 How is the in-situ snow data available?

☐ Via publications/reports

☐ Digitally via email

☐ Through website display or download service

☐ Via standardized web-services

☐ Real time (GTS)

☐ Not available anywhere

☐ Other (Please specify, separated by comma, no more than 250 characters):

_____
_____
_____

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IV.7.1.1 Please provide the applicable link(s). (Separated by comma, no more than 500 characters)

_____
_____
_____
_____
_____

IV.7.2 In which format does your institution/organization make the snow data available to users?

☐ NetCDF (nc)

☐ ASCII (txt, csv, etc.)

☐ GIS (shapefile, etc.)

☐ BUFR

☐ Other (Please specify, separated by comma, no more than 250 characters):

_____
_____
_____

IV.8 Does your institution/organization retrieve satellite products for snow monitoring?

☐ Yes

☐ No

IV.8.1 If yes, please indicate the details of the products, including the name of the satellite-related and retrieval method(s) used. (Separated by comma, no more than 500 characters)

_____
_____
_____
_____
_____

IV.9 Does your institution/organization develop snow reanalysis datasets based on in-situ observation and satellite data?

☐ Yes

☐ No

IV.9.1 If yes, please list relevant datasets. (Separated by comma, no more than 500 characters)

_____
_____
_____

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_____
_____

Lake ice

IV.10 Where is the in-situ lake ice observation data stored?

☐ No observation

☐ Government organizations

☐ Scientific research institutions

☐ Other (Please specify, separated by comma, no more than 250 characters):

_____
_____
_____

IV.10.1 How is the in-situ lake ice observation data available?

☐ Via publications/reports

☐ Digitally via email

☐ Through website display or download service

☐ Via standardized web-services

☐ Not available anywhere

☐ Other (Please specify, separated by comma, no more than 250 characters):

_____
_____
_____

IV.10.1.1 Please provide the applicable link(s). (Separated by comma, no more than 500 characters)

_____
_____
_____

IV.10.2 In which format does your institution/organization make the lake ice data available to users?

☐ NetCDF (nc)

☐ ASCII (txt, csv, etc.)

☐ GIS (shapefile, etc.)

☐ BUFR

☐ Other (Please specify, separated by comma, no more than 250 characters):

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_____
_____
_____

IV.11 Does your institution/organization retrieve satellite products for lake ice monitoring?

☐ Yes

☐ No

IV.11.1 If yes, please indicate the details of the products, including the name of the satellite-related and retrieval method(s) used. (Separated by comma, no more than 500 characters)

_____
_____
_____
_____
_____

IV.12 Does your institution/organization develop lake ice reanalysis datasets based on in-situ observation and satellite data?

☐ Yes

☐ No

IV.12.1 If yes, please list relevant datasets. (Separated by comma, no more than 500 characters)

_____
_____
_____
_____
_____

River ice

IV.13 Where is the in-situ river ice observation data stored?

☐ No observation

☐ Government organizations

☐ Scientific research institutions

☐ Other (Please specify, separated by comma, no more than 250 characters):

_____
_____
_____

IV.13.1 How is the in-situ river ice observation data available?

☐ Via publications/reports

Ref.: 14629/2023-L1 VESM

☐ Digitally via email

☐ Through website display or download service

☐ Via standardized web-services

☐ Not available anywhere

☐ Other (Please specify, separated by comma, no more than 250 characters):

_____
_____
_____

IV.13.1.1 Please provide the applicable link(s). (Separated by comma, no more than 500 characters)

_____
_____
_____
_____
_____

IV.13.2 In which format does your institution/organization make the river ice data available to users?

☐ NetCDF (nc)

☐ ASCII (txt, csv, etc.)

☐ GIS (shapefile, etc.)

☐ BUFR

☐ Other (Please specify, separated by comma, no more than 250 characters):

_____
_____
_____

IV.14 Does your institution/organization retrieve satellite products for river ice monitoring?

☐ Yes

☐ No

IV.14.1 If yes, please indicate the details of the products, including the name of the satellite-related and retrieval method(s) used. (Separated by comma, no more than 500 characters)

_____
_____
_____
_____
_____

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IV.15 Does your institution/organization develop river ice reanalysis datasets based on in-situ observation and satellite data?

☐ Yes

☐ No

IV.15.1 If yes, please list relevant datasets. (Separated by comma, no more than 500 characters)

_____
_____
_____
_____
_____

Part V: Cryosphere data processing and utilization

V.1 Do you generate cryosphere monitoring products?

☐ Yes

☐ No

V.1.1 If yes, please list all that apply. (Separated by comma, no more than 500 characters)

_____
_____
_____
_____
_____

V.1.2 If no, do you have needs for such products? List all of your interests or in need. (Separated by comma, no more than 500 characters)

_____
_____
_____
_____
_____

V.2 Are there any additional aspects of cryosphere monitoring in your country that are relevant to your activities and you want to share/note/highlight? (No more than 500 characters)

_____
_____
_____
_____
_____

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V.3 Does your institution/organization generate any cryosphere forecasting/prediction products?

☐ Yes

☐ No

V.3.1 If yes, please specify. (Separated by comma, no more than 500 characters)

_____
_____
_____
_____
_____

V.4 Which cryosphere forecasting/prediction products are necessary in the area of responsibility of your institution/organization but are not available today? (For example, snow depth, snow water equivalent, snow cover extent, sea ice extent, sea ice concentration, etc.) (Please specify, applicable link(s) if any, separated by comma, no more than 500 characters)

V.5 Does your institution/organization provide early warning services for cryosphere hazards?

☐ Yes

☐ No

V.5.1 If yes, which cryosphere hazards do you provide services to?

☐ GLOF (Glacial Lake Outburst Flood)

☐ Snow avalanche

☐ Ice avalanche

☐ Other (Please specify, separated by comma, no more than 250 characters):

_____
_____
_____

V.6 What cryosphere services are in need in your country/territory, as you're aware of? (No more than 500 characters)

_____
_____
_____
_____
_____

_____