

# WORLD METEOROLOGICAL ORGANIZATION GLOBAL CRYOSPHERE WATCH

REPORT No. 15

## FINAL REPORT OF THE BEST PRACTICES TEAM MEETING, FIRST SESSION

Graz, Austria  
23-24 September 2016



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## EXECUTIVE SUMMARY

The first meeting of the Best Practices Team took place on Sept 23 and 24, 2016, at the University of Graz, Austria.

The updated roadmap for developing the GCW Best Practices Guide and Manual is available in [Annex 5](#), of this document. It was acknowledged that the development must be completed prior to the end of 2017, to allow for their approval at the Executive Council session in 2018 (EC-69).

It was agreed that the Manual will be focused on identifying the variable and associated data requirements, by cryosphere component, while the Guide will reflect the procedures and standard practices that will enable the availability of defined data (“how to”).

The participants noted that Dr Schöner has led the development of the GCW Primer, consolidating the available background information on the cryosphere, and agreed that the Primer will remain outside the formal approval process of the WMO.

The participants agreed that their first priority is to develop the GCW Best Practices Guide by compiling the currently available methodologies, standards, practices applied for the measurement and observation of the specific variables. The GCW Manual will be developed as the information on the GCW Guide becomes more mature and has been reviewed by the larger community.

The participants agreed that once completed, the Manual and Best Practices Guide must include sections on (i) Observations for all cryosphere components, (ii) Integrated Products and (iii) the Data Portal. It was agreed that the highest priority for the Best Practices Team is the development of the Observations section. The sections on the Integrated Products and Data Portal will be included at a later date, with the exception of the Snow Watch which is the most mature.

The work on developing best practices will be organized in four groups dealing with (i) snow and solid precipitation, (ii) sea ice; lake and river ice, (iii) glaciers, ice caps, ice sheets and ice shelves, (iv) permafrost and seasonally frozen ground. The participants agreed that for each cryosphere component the Guide will include best practices for the measurement of each variable agreed upon during the CryoNet-5 meeting. If the contributors identify additional variables, these will be considered in the next version of these documents. At this stage, the scope of work is limited to the observation techniques and instruments.

The participants agreed that when referencing other available sources on national or international practices, the GCW Guide and Manual should include a summary of the relevant information and the links to the original document. Efforts must be made to maintain these links up to date. Additionally, ongoing coordination with the Terminology Team is critical, to ensure the consistent use of terms. Recognizing the complexity of defining consistent procedures addressing multiple stakeholders, the participants agreed to commence the development process by focusing on the measurement of snow on the ground, glaciers, ice. It was recommended that Mr Craig Smith of Environment and Climate Change Canada is invited to contribute to this activity, as soon as feasible.

It was agreed that for the development of the Guide, it is critical to engage experts from other organizations, e.g. Joint Technical Commission for Oceanography and Marine Meteorology (JCOMM), Commission for Instruments and methods of Observations (CIMO), Commission for Hydrology (CHy), World Glaciers Monitoring Services (WGMS), etc. Each team member agreed to approach the community of experts there are already linked to, and request their contribution. Additional guidance on the content to be developed will be provided by the Team Co-Chairs.

Given the tight deadlines, it was agreed that the team will collaborate via teleconferences, frequently (e.g. weekly or by-weekly) and will use the opportunity of the GCW Steering Group meeting in Cambridge, UK, in Jan 2017, to advance the development of the Guide. A potential face

to face meeting was proposed for April 2017, based on the progress made until then, in developing the content for all cryosphere components.

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## **MEETING REPORT**

### **1. ORGANIZATION OF THE MEETING**

#### **1.1 Welcome and Opening of the meeting**

The first session of the Best Practices Team opened at 09:00 hours on Friday, 23 September 2016 at the premises of the University of Graz, Department of Geography and Regional Science (Austria).

The Team Co-Chairs, Dr Charles Fierz (Switzerland) and Dr Þorsteinn Þorsteinsson (Iceland) welcomed the participants and wished for a successful meeting.

The list of participants is provided in [Annex 2](#).

Dr Petra Heil was unable to attend in person and joined the session via WebEx for parts of both days.

#### **1.2 Adoption of the Agenda**

The Provisional Agenda, as contained in [Annex 1](#) was adopted by the meeting.

#### **1.3 Working Arrangements**

The work of the meeting was conducted as a committee of the whole. The session and documentation was in English only.

The Team agreed on its working hours and adopted a tentative time table for consideration of the various agenda items. A WebEx link was organized to accommodate Dr Heil's participation.

The Secretariat introduced the documentation plan of the meeting, available at <http://www.wmo.int/pages/prog/www/OSY/Meetings/GCW-BPT-1/GCW-BPT-1.html>. The Chair thanked all those who have contributed to the documentation plan.

#### **1.4 Introductions of participants**

The chair of the Best Practices Team invited the participants to introduce themselves.

### **2. DEVELOPMENT OF BEST PRACTICES**

#### **2.1 Review of WMO regulatory framework relevant to the development of GCW Best Practices**

**2.1.1** Dr Charles Fierz provided an overview of the expected outcomes, noting that this was the first plenary session of the Best Practices Team of the GCW Observations Working Group, and that its work is directly linked to the results of the CryoNet Team, which had held its 5<sup>th</sup> meeting prior to this meeting.

**2.1.2** Mr Etienne Charpentier provided a short overview of the process for adopting regulatory and guidance material in WMO. A summary is included in [Annex 3](#). He noted that the approval process for any GCW regulatory material must be approved by the GSG, first and then by EC PHORS. Appropriate resolutions, as endorsed by the EC PHORS, will be submitted to CBS and EC or the CG for approval.

Mr Charpentier noted that the 19<sup>th</sup> General Congress (2019) is expected to approve the GCW as fully operational; this means that the operation of the GCW is regulated, and that defined procedures on the operation of the network are approved, i.e. the GCW Best Practices Manual and Guide need to be formally approved by WMO Congress, and be issued as technical reports.

In this context, the GCW Manual would include what the Members shall or should do and will need to be approved by Congress. Manuals are, generally, short. One option is to include the GCW Manual in the WIGOS manual; however, as a standalone manual it would be more visible.

By contrast, the GCW Guide needs to include the information of substance (“the how”) that would guide a practitioner to deliver data of expected attributes. The approval could be delegated to the Executive Council. [Annex 3](#) also lists the existing WMO Publications relevant to the GCW.

**2.1.3** Mr Charpentier also provided an overview of the draft recommendations relevant to GCW, that have been submitted for approval to CBS-16 (Nov 2016), as resulting from the Decision 7(1)/1 of the EC-68, on the development of the Global Cryosphere Watch. These are available in [Annex 3](#), and cover the minimum requirements for CryoNet, the requirement for international exchange of snow data, and the increase in the engagement of members relative to the development of the GCW.

**Action:** The Secretariat will keep the GCW Best Practices team informed on the CBS decisions.

**2.1.4** It was also noted that there is a section on GCW in the WIGOS manual. In the development of the GCW Best Practices, the Best Practices Team in conjunction with the CryoNet Team will identify the additional information for inclusion in the GCW Manual and Guide, while ensuring consistency of information and avoiding duplication.

**Action:** The Secretariat to review the current provisions in the WIGOS manual relevant to GCW and provide a summary to the Best Practices team members, in support of the development of the GCW Guide and Manual.

**2.1.5** It was agreed to ensure that all relevant variables of the cryosphere components are available in OSCAR. Additional variables can be added but the established process needs to be followed, i.e. by identifying the application areas requiring the proposed variables.

**Action:** Each cryosphere component lead to verify the OSCAR variables available and compare with the proposed variables and identify application based arguments, if proposing new variables for OSCAR.

**2.1.6** The participants agreed that their first priority is to develop the GCW Best Practices Guide by compiling the currently available methodologies, standards, practices applied for the measurement and observation of the specific variables. The GCW Manual will be developed as the information on the GCW Guide becomes more mature and has been reviewed by the larger community.

**2.1.7** The participants noted that Dr Schöner has led the development of the GCW Primer, consolidating the available background information on the cryosphere. It was agreed that the Primer will remain outside the formal approval process of the WMO.

## **2.2 Assessment of the scope of work developing the GCW Best Practices Manual and Guide**

**2.2.1** Dr Þorsteinsson provided an overview of the GCW data requirements, prepared in support of the development of the GCW Data Policy ([Annex 4](#)). The best practices must be aligned with the data requirements as they must enable the availability of the data and metadata from the CryoNet and contributing stations.

**2.2.2** The participants discussed the proposed structure of the Manual and Best Practices Guide. It was agreed that once completed, both documents must include sections on (i) Observations for all cryosphere components, (ii) Integrated Products and (iii) the Data Portal.

It was agreed that the highest priority for the Best Practices Team is the development of the Observations section. The sections on the Integrated Products and Data Portal will be included at a later date, with the exception of the Snow Watch which is the most mature.

**Action:** The Secretariat will communicate with the GCW Steering Group (GSG) and Snow Watch team on the development of the GCW Manual and Guide.

**Action:** The Secretariat will communicate with the GCW Steering Group (GSG) and Data Portal team on the input for the proposed Data Portal section of the GCW Manual and Guide.

**2.2.3** To the extent possible, a consistent structure should be used for all components. The Global Atmosphere Watch (GAW) manuals and guides could be used as reference, although they don't appear to maintain the same structure for all observed components.

Additionally, it was noted that the Sea Ice chapter in the currently proposed outline for the GCW Manual and Guide is structured differently than the other components. It was proposed to assess aligning it to the generic structure, to the extent possible.

**Action:** Secretariat to review and provide summary of the GAW Guides, as an example.

**2.2.4** The participants noted the need to increase the profile and visibility of the GCW and recommended the development of a Wikipedia entry for GCW. The engagement of experts beyond those already active could be facilitated by communicating the mandate and opportunities of the GCW more broadly.

**Action:** To increase the visibility of the GCW mandate and documentation the participants have asked Dr Jeff Key to create a Wikipedia entry for the GCW, with support from the other GCW Experts.

**2.2.5** As a global effort, the GCW Best Practices must reflect specific conditions in different regions, and be relevant to a broad range of applications requiring cryosphere data. The agreed roadmap towards achieving fully documented and accepted GCW Best Practices (Guide and Manual) is reflected in [Annex 5](#).

### **2.3 Development of the GCW Guide of Best Practices**

**2.3.1** Based on the information provided by Mr Charpentier ([Annex 3](#)), the Team agreed on the differences, in principle, between the GCW Manual and GCW Guide. Specifically, the Manual will be focused on identifying the variable and associated data requirements, by cryosphere component, while the Guide will reflect the procedures and standard practices that will enable the availability of defined data.

**Action:** Best practices team to recommend to the GSG the approval of the scope of the GCW Manual and Guide and the associated road map, as resulting from this meeting.

The participants agreed that the GCW Guide needs to reference practices addressing all aspects of the measurement (parameters, resolution, accuracy, units, representativeness, coverage), while recognizing that different applications would require observations taken using different methodologies.

Dr Vasily Smolyanitsky recommended to include in the general structure of each chapter, subsections on terminology, observing techniques, data codes, and data exchange.

**2.3.2** The Team agreed that the work on developing best practices could be organized in four groups dealing with (i) snow and solid precipitation, (ii) sea ice; lake and river ice, (iii) glaciers, ice caps, ice sheets and ice shelves, (iv) permafrost and seasonally frozen ground.

The participants agreed that for each cryosphere component the Guide will include best practices for the measurement of each variable as defined by the CryoNet Team and documented in the CryoNet-5 meeting report. If contributors identify additional variables, there will be considered in the next version of the documents. At this stage,

the scope of the work is limited to the observation techniques and instruments applicable for the identified variables.

**Action:** The Team co-chairs together with the Secretariat will amend the currently available outline, by reflecting the updated list of variables for each component from the CryoNet-5 meeting report before sharing it with the experts identified for contributing to the development of the Guide content.

**2.3.3** The meeting noted that the differences in terminology used in the broader community of experts create a major challenge. It is critical to the successful implementation of the GCW to have consistent terminology and information, to enable users with a full understanding of the measurements, observations, data, and products (e.g. snow depth vs snow height, snow mass balance).

**Action:** The Best Practices Team must collaborate with the Terminology Team to ensure the consistency of the terminology used in developing the GCW Manual and Guide.

2.3.4 The participants agreed that when referencing other available sources on national or international practices, the GCW Guide and Manual should include a summary of the information relevant to the GCW objectives and the links to the original document. It was recognized that links could become inactive or documents could be updated. Therefore, to maintain the currency of the information, a process is needed to regularly update links. If required, permission from the proponent organization needs to be obtained prior to the publication in the GCW documents and the sources must be referenced.

**Action:** The Secretariat and the Team will periodically review and update the links included in the GCW Guide and Manual.

**2.3.5** The participants agreed that with the increased use of automatic instruments and of emerging technologies, the Guide needs to include references to the newer methodologies for measuring the cryosphere variables (e.g. lidar for snow).

**2.3.6** The participants agreed that, in parallel with the development of the GCW Manual and Guide, the GCW website needs to be updated with links of the applicable documents, including for automatic measurements, as they become available. Currently the documents available on the GCW site are mostly for manual measurements.

**Action:** The contributors to the GCW Manual and Guide are requested to provide to Dr Key and the Secretariat information and links of the available relevant materials.

**2.3.7** The meeting agreed to develop the GCW Guide and Manual, the English version, followed by translation only once approved, to avoid additional cross language confusion and limit the effort of managing multiple versions.

## **2.4 GCW Guide of Best Practices Work Plan**

**2.4.1** Recognizing the complexity of defining consistent procedures addressing multiple stakeholders, the participants agreed to commence the development of the Guide by focusing on the measurement of snow on the ground, glaciers, ice. As recommended for the CryoNet variable list, the best practices for the measurement of solid precipitation will be addressed together with the measurement of snow (on ground and on ice). It was recommended that the following aspects are taken into account:

- i. Glacier mass balance: the community has come together and produced a document that represents the practices.
- ii. Include measurement aspects relevant to all communities, ensuring the capture of specific practices required by certain applications.
- iii. Decide whether ablation needs to be represented in the snow measurement guide/manual.

- iv. The measurement of snow in Antarctica will be addressed based on the experience and practice of the experts working there.

**2.4.2** As an example of the complexity of developing best practices, the participants noted the challenge of measuring snow on the ground, e.g. defining the “no snow” conditions, and the challenge of measuring snow depth through snow and ice layers.

**2.4.3** It was agreed that the GCW Best Practices Team needs to cooperate with JCOMM in the development of the material for sea ice observations. The participants discussed the opportunity of moving the relevant content on measurements from the JCOMM documentation into the GCW Manual and Guide. Alternatively, if maintained by JCOMM, GCW experts will contribute and support the development of content in JCOMM documents, and the GCW documents will reference it in its manuals and guide.

**2.4.4** For the sea ice variables, Dr Smolyanitsky proposed to develop the content for the GCW Best Practices Guide and Manual based on integrated components; (1) sea ice mass balance: thermodynamic integrator (ice thickness, snow depth, snow-sea ice temp profile); (2) sea ice conditions (concentration, stages of development, forms, motion); (3) sea ice and snow profiles.

The representation of the integrated variables with more than one variable for sea ice has been discussed extensively and how this impacts the acceptance of stations as CryoNet stations. Not all aspects related to this topic were clarified during the meeting and more focus is needed on this as specific guidance is developed, to document the practices consistently.

**Action:** During the development of the Sea Ice chapter, the contributing experts need to review and agree on the most appropriate structure of the information, to align it with the requirements for CryoNet stations and that for contributing stations.

**2.4.5** Dr Petra Heil proposed to develop the guidelines for Sea Ice observations to include requirements for primary variables (those routinely observed), secondary variables, and derived variables (derived from measurements).

**Action:** Dr Heil to discuss with Oystein Godoy on how to connect GCW Data Portal with the sea ice applications to enable the data exchange.

**Action:** Dr Key and Dr Heil to provide a summary of the known snow buoy data available in the Arctic and Antarctic regions.

**2.4.6** Dr Smolyanitsky noted that the sea ice parameters are published in the JCOMM regulatory documents and electronic chart systems as classes with attributes (classes as variables), including how to measure and report them. However, there appear to be inconsistencies with the OSCAR database. The JCOMM approach could be useful in defining the reporting component for the Data Portal component of the Guide.

**2.4.7** It was agreed to include in the GCW Manual and Guide the derived variables in the outline and to document the methodology of deriving variables from individual measurements.

**2.4.8** The Team identified the scope of individual sections of the GCW Guide. Dr Fierz proposed that the team members approach the communities of experts to identify lead authors for each component, as well as other contributions. The team members will be responsible for coordinating the consolidation of the input. Once identified, the Team Co-Chairs will provide guidance to the lead authors on the development of each chapter.

**2.4.9** Overall, the development process will consist in several steps: (1) experts will develop content (version 1); (2) this will be submitted for review to the Best Practices Team who will provide feedback to the contributing experts; (3) contributing experts will adjust content, as required.

### **3. FUTURE WORK**

#### **3.1 Engagements of experts for the development of content for the GCW Best Practices Guide**

**3.1.1** It was agreed that the Best Practices team members will actively seek the engagement of the experts from national and international organizations who are interested in contributing to the development of the GCW Best Practices guide as a consolidated single and authoritative source of information. All experts must be identified and their contribution confirmed prior to the end of 2016.

**Action:** The Secretariat will draft a template for the message that the Team Members will use to contact the potential contributors, soliciting their engagement in the development of the GCW Guide.

**3.1.2** For the development of the Snow and Solid Precipitation chapter, as proposed in paragraph 2.4, the Best Practices Team recommended the engagement of Mr Craig Smith of Environment and Climate Change Canada. He would develop the initial version of the Snow and Solid Precipitation Chapter of the Guide by consolidating the information from available references, and reflecting snow variables identified by the CryoNet Team. The specifics of the measurement of snow on ice, glaciers, Antarctica will require additional consultations with experts working there.

**Action:** Secretariat and Team Co-Chairs to coordinate with CIMO and the Commission for Hydrology (CHy) on engagement for the development of the snow and solid precipitation measurement guidelines, including reflecting WMO SPICE recommendations. The Secretariat will work to facilitate the engagement of Mr Craig Smith (Canada).

**3.1.3** The Best Practices team members have committed to actively reach out to other organizations and expertize for contributions to the guide. The following actions reflect the planned engagements, and the respective component leads.

**Action:** For the Chapter on Glaciers variable measurements, Dr M Citterio and Dr Þorsteinsson will seek to engage experts from the World Glacier Monitoring Service, and agree on the contribution to the GCW Best Practices Guide.

**Action:** Dr Michele Citterio and Dr Christophe Genthon will assess the addition of requirements to the content developed for glaciers and how to address the balance of requirements, and agree on the contribution to the GCW Best Practices Guide.

**Action:** For the chapter on Permafrost, Dr Charles Fierz will contact Dr. Julia Boike for recommendations on appropriate experts that could contribute to the development of the best practices guide, and agree on the contribution to the GCW Best Practices Guide.

**Action:** For the chapter on frozen ground Dr Fierz will contact Dr Annett Barstch, Dr Kari Luojus, and Dr Jannette Nötzli for recommendations on appropriate experts that could contribute to the development of best practices, including addressing the similarities/differences between permafrost and frozen ground, and agree on the contribution to the GCW Best Practices Guide.

**Action:** For the chapter on floating ice (Sea Ice, Lake and River Ice, Icebergs, ...), Dr Heil will contact Dr Hajo Eicken (International Arctic Research Center, University of Alaska-Fairbanks) and Dr Smolyanitsky will connect with the International Ice Charting Working group for recommendations on experts that could contribute to the development of the best practices. Dr Key, Dr Heil, and Dr Smolyanitsky will coordinate their respective contacts and content development, and agree on the contribution to the GCW Best Practices Guide.

The participants decided that the chapter on ice sheets will be addressed as a separate component. For the chapter on ice shelves the plan for the development of the best practices for measurement will be developed at a later date.

### **3.2 Next meetings (C. Fierz & Þ. Þorsteinsson/GCW-PO)**

**3.2.1** The Best Practices Team acknowledged the criticality and the time sensitivity of their tasks and decided to collaborate actively via teleconferences (e.g. WebEx).

**Action:** Monthly WebEx teleconferences of the Best Practices Team will be organized to assess status of contributions to developing the Guide components. The first is proposed for the week of 7 November 2016. The Secretariat will organize the WebEx call, at the recommendation of the Team's co-chairs.

**Action:** Organize during the GSG meeting in January, 2017, a session on Best Practices, given the presence at the meeting of most team members. At that time, progress will be assessed, including reviewing the timing and scope of the GCW Best Practices Manual.

**3.2.2** Based on the progress made over the next six months, a potential face-to-face meeting is planned for April 2017 (3-4 April), for reviewing the draft of the Guide, if necessary. This would replace the originally planned meeting, in Iceland, in March 2017.

### **3.2 Action Sheets from this meeting (Ch. Fierz & Þ. Þorsteinsson/GCW-PO)**

The Team also agreed on the list of actions arising from this meeting. The list is provided in [Annex 6](#).

## **4. REPORT TO GCW STEERING GROUP**

The Team agreed on a report to be submitted to the GCW Steering Group that would eventually be submitted to EC-PHORS session for consideration. The agreed report is provided in [Annex 7](#).

## **5. ANY OTHER BUSINESS**

Under this agenda item, the Team discussed the following relevant issues:

It was proposed that the GSG-4 meeting refines the mandate and activities of the Integrated Products WG, to help in developing the work plan and engagements.

This is needed to enable the development of the contribution to the GCW Best Practices Guide and Manual, as well as for preparing the application-based supporting arguments for any additional variables to be proposed for inclusion in OSCAR.

## **6. CLOSURE OF MEETING (18h00)**

The Chair thanked the participants and the Secretariat for contributing to the successful outcome of the meeting. The participants agreed that this has been a very productive meeting.

The meeting closed at 18.00 hours on Thursday, 24 September 2016.

## **AGENDA**

*(GCW Best Practices Team meeting, Graz, Austria, 23-24 September 2016)*

**VENUE:** University of Graz, Department of Geography and Regional Science, Heinrichstrasse 36

**DATE/TIME:** 23 September 2016 09.00 to 24 September 2016 18.00

### **1. ORGANIZATION OF THE MEETING** (Co-chairs Ch. Fierz & Þ. Þorsteinsson)

- 1.1 Welcome and Opening of the meeting (W. Schöner, Ch. Fierz & Þ. Þorsteinsson, and C/OSD)
- 1.2 Adoption of the Agenda (Ch. Fierz & Þ. Þorsteinsson)
- 1.3 Working Arrangements (W. Schöner, Ch. Fierz & Þ. Þorsteinsson)
- 1.4 Introductions of participants (participants)

### **2. DEVELOPMENT OF BEST PRACTICES**

- 2.1 Review of Actions, relevant to GCW best practices, from previous meetings (GCW-PO)
- 2.2 Report on the progress to date on compiling guidelines, best practices and standards (Ch. Fierz & Þ. Þorsteinsson)
- 2.3 Review of the Best Practices Team Work Plan (Ch. Fierz & Þ. Þorsteinsson)
- 2.4 Development of the GCW Guide of Best Practices
  - 2.4.1 Table of Content (ToC) of the GCW Guide, including experts responsible for drafting individual sections (Ch. Fierz & Þ. Þorsteinsson)
  - 2.4.2 Expanded ToC identifying scope of individual sections (in-session, Ch. Fierz & Þ. Þorsteinsson)
  - 2.4.3 Road map to GCW Guide approval (Ch. Fierz & Þ. Þorsteinsson)
- 2.5 Development of the GCW Manual of Best Practices
  - 2.5.1 Table of content of the GCW Manual, including experts responsible for drafting individual sections (Ch. Fierz & Þ. Þorsteinsson)
  - 2.5.2 Expanded ToC identifying scope of individual sections (in-session, Ch. Fierz & Þ. Þorsteinsson)
  - 2.5.3 Road map to GCW Manual approval (Ch. Fierz & Þ. Þorsteinsson)

### **3. FUTURE ACTIVITIES**

- 3.1 Next meetings (Ch. Fierz & Þ. Þorsteinsson/GCW-PO)
- 3.2 Action Sheets from this meeting (Ch. Fierz & Þ. Þorsteinsson/GCW-PO)

### **4. REPORT TO GCW STEERING GROUP**

- 4.1 Draft report to GSG (Ch. Fierz & Þ. Þorsteinsson/GCW-PO)

### **5. ANY OTHER BUSINESS** (Ch. Fierz & Þ. Þorsteinsson)

### **6. CLOSURE OF MEETING (18h00)** (W. Schöner/ Ch. Fierz & Þ. Þorsteinsson/WMO Secretariat)

**LIST OF PARTICIPANTS***(GCW Best Practices Team meeting, Graz, Austria, 23-24 September 2016)*

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## **Summary on governance for adopting regulatory and guidance materials**

Prepared by Etienne Charpentier

### **Governance for adopting Regulatory and Guidance materials**

- Technical Regulations (WMO Manual)
  - Standard practices and procedures
  - What (Members shall / should)
  - Approved by Congress
  - Developed by Technical Commissions
- Guidance Materials (WMO Guide)
  - Recommended practices and procedures
  - How, can include standard practices
  - Delegated to Executive Council
  - Developed by Technical Commissions
- GCW materials approval process
  - GCW BP Team => GSC > EC-PHORS => CBS => EC or Cg

### **Publications relevant to GCW:**

- WMO No. 49, Technical Regulations
- WMO No. 1160 Manual on WIGOS (new): Includes GCW section
- Guide to WIGOS (being developed): Will include GCW section referring to GCW Guide
- WMO No. 544, Manual on the GOS
- WMO No. 488, Guide to the GOS
- WMO No. 8, Guide to Meteorological Instruments and Methods of Observation (CIMO Guide)

### **EC-68 Decisions (Polar & High Mountain Activities – 1/3): Decision 7(1)/1 (Development of the Global Cryosphere Watch**

- Endorses CryoNet concept
- Endorses need to speed up GCW Data Portal
- Embark in development of snow trackers to support PRCCs
- EC-PHORS to draft Res. For EC-69

### **CBS-16, Guangzhou, China, 23 to 29 November 2016**

#### **Draft Recommendations:**

- Updated version of the Manual on WIGOS; Includes minimum requirements for CryoNet
- Initial version of the Guide to WIGOS
- Revised Manual on the GOS and Guide to the GOS
- International Exchange of Snow Data
  
- **Development of the Global Cryosphere Watch (GCW)**
  - Members, through a partnership among national research institutes, universities and academia, contribute their respective stations to CryoNet, according to a concept endorsed by Decision 7(1)/1 (EC-68)
  - Regional Associations to consider relevant CryoNet stations for the Regional Basic Observing Networks (RBON)
  - Members, that did not nominate Focal Point(s), to do it with a view of taking part in the development of the GCW surface observing network; several focal points may represent national GCW partners

## DATA POLICY FOR GCW (DRAFT)

Prepared by:  
Þorsteinn Þorsteinsson and Tómas Jóhannesson  
Icelandic Meteorological Office

The data policy supports the objectives of the GCW to provide:  
**Authoritative, clear, and useable data, information, and analyses on the past, current and future state of the cryosphere.**

**GCW data** are data collected and archived by the stations/sites accepted by Cryonet

- **Question to be addressed:** What about ancillary data provided by others?

### Suggestions based on:

- IPY data policy (IPY = International Polar Year)
- SVALI data policy (SVALI = Stability and Variations of Arctic Land Ice, Nordic Project)

### What is GCW data?

In order to be considered officially part of GCW, the operators of each station/site must comply with the GCW Data Policy, including submission of metadata and availability of data according to an agreed timetable.

To meet the GCW objectives, GCW implementation and data treatment encompasses:

- Regular and active reviewing and updating of cryospheric observation requirements.
- Integration of data to assess the state of the cryosphere and its interactions with the Earth system.
- Enhancement of the quality of observational data through standardization and application and improvement of best practices in measurements.
- Improving access to data and products from WMO observation systems and partners
- Fostering coordination between research projects and observing systems.

### Data availability and exchange

GCW data, including operational data delivered in real time, are made available fully, freely, openly, and on the shortest feasible timescale.

- Any exceptions?
- Should a grace period be defined?

For reference, the SVALI data policy document mentioned these exceptions:  
*"The only exceptions to this policy of full, free, and open access are where legitimate obligations, for example related to contracts of earlier projects or national laws and regulations restrict data access."*

### Need to reference resolutions made by WMO and other bodies.

- The IPY data policy document referred to the following international resolutions:
- the Twelfth WMO Congress, Resolution 40 (Cg-XII, 1995)
- the Thirteenth WMO Congress, Resolution 25 (Cg XIII, 1999)
- the ICSU 1996 General Assembly Resolution
- the ICSU Assessment on Scientific Data and Information (ICSU 2004b)
- Article III-1c from the Antarctic Treaty
- the Intergovernmental Oceanographic Commission Data Exchange Policy

**ICSU (2004b): states that** "Full and open access" is equitable, non-discriminatory access to all data preferably free of cost, but some reasonable cost-recovery is acceptable.

**WMO Resolution 40:**

Uses the terms "Free and unrestricted" and defines them as nondiscriminatory and without charge. Free and unrestricted" and defines them as nondiscriminatory and s an than the cost of reproduction and delivery without charge for the data and products themselves.

**Data Preservation**

The **GCW Data Portal** will ensure long-term preservation and sustained access to GCW data. Data should be archived in their simplest, useful form and be accompanied by a complete metadata description.

It is necessary to decide how the responsibility will be shared between the WMO/GCW Data Portal **and** station/site operators.

**Data Acknowledgment**

- Users of GCW data must formally acknowledge data contributors and sources.
- Where possible, acknowledgment should take the form of a formal citation (journal article, book or book chapter, published report).
- Websites where data are available in real time should also be cited.

## **ROADMAP TO GCW GUIDE/MANUAL APPROVAL**

As a global effort GCW must produce a Guide and a Manual that will reflect specific conditions characterizing the cryosphere in different regions, and be relevant to a broad range of applications requiring cryosphere data.

### **GCW Guide**

1. The approval of CryoNet network is expected to be done by EC-69 (May 2017).
2. As the CryoNet is a core GCW network that applies GCW agreed practices, it is required that the GCW Guide is endorsed by EC-PHORS and EC-69 informed of that fact.
3. Therefore, the critical stages of the Road map to GCW Guide are:
  - a. The first outline and assignment of work must be available for GSG-4 (16-20 January 2017)
  - b. The final outline must be available for EC-PHORS-7 (end of March 2017)
  - c. The GCW Guide must be published end of 2017

### **GCW Manual**

4. GCW/CryoNet is one of the four components of WIGOS and all mandatory practices relevant to GCW/CryoNet must be documented in the WIGOS Manual.
5. The approval of the major revision of the WIGOS Manual will be done by Cg-18 (May/June 2019). This revision must contain appropriate provisions specified in the GCW Manual.
6. Note: The 2019 List of CryoNet stations will be submitted to Cg-18 for approval and reference should be made from the Resolution on CryoNet to the GCW Manual, which need to be approved prior to the CG-18.
7. Therefore, the critical stages of the Road map to GCW Manual are:
  - a. Final draft ready for ICG-WIGOS (1 Q. 2018)
  - b. Final draft ready for CBS-Ext.(2018) (3 Q. 2018)
  - c. GCW Manual published by the end of 2018

### **Task for the Best Practices Team**

8. The 3<sup>rd</sup> session of the GCW Steering Group prepared a draft work plan/timeline for the development of the GCW Guide and Manual, that guided the work of the team prior to their first face to face meeting.
9. A new roadmap and work plan is outlined below.

### **Draft Work Plan/Timeline**

#### **Q4, 2016 to Q1, 2017**

- Identify experts who can contribute to the development of the Guide content by cryosphere component and variables
- Continued survey of existing manuals and reports.
- Contact the GCW Focal Points and ask for access to national reports/manuals.
- Decide what can be extracted from older reports/manuals (with permission), and what new developments in measurement techniques/data reduction need to be emphasized in a new guide/manual.

#### **Jan 2017:**

- Version 2 of the outline and assignment of work to experts, are identified, by cryosphere component;
- document and new draft work plan distributed to entire CryoNet group and GCW Steering Group.

**March 2017:**

- Outline of the new GCW Guide to cryosphere practices ready (formal writing will start when the structure has been decided).
- Inform EC-PHORS; seek additional commitment of expertise to contribute to the development of the content, as needed.
- Use the Guide structure to develop the GCW Manual simultaneously.
- Collaboration with other groups and organizations (formal and informal), e.g. COST group on snow-related best practices, established.
- Engage CIMO, where possible, building on the existing work plans.
- Seek Input/feedback from WMO expert groups.

**June 2017:**

- First complete version of the Guide ready by June 2017.

**Dec 2017:**

- *GCW Guide to the Cryosphere* published
- Plans for *GCW Manual on Best Cryosphere Practices* fully developed

**Mid-year 2017 – Congress 2019:**

- Work on Manual: Compilation, discussion, writing, editing, publishing.
- **2020:** GCW in operational phase

**LIST OF ACTION ITEMS ARISING FROM THE MEETING**

<i>No.</i>	<i>Ref.</i>	<i>Action item</i>	<i>By whom</i>	<i>Deadline</i>
1	2.1.3	The Secretariat will keep the GCW Best Practices team informed on the CBS decisions.	GCW-PO	On-going
2	2.1.4	The Secretariat to review the current provisions in the WIGOS manual, relevant to the WIGOS and provide a summary to the Best Practices team members, in support of the development of the GCW Guide and Manual.	GCW-PO	Nov 2016
3	2.1.5	Each cryosphere component lead to verify the OSCAR variables available and compare with the proposed variables and identify application based arguments, if proposing new variables for OSCAR.	Component Lead	Dec 2016
4	2.2.2	The Secretariat will communicate with the Snow Watch team on the development of the GCW Manual and Guide.	GCW-PO	Nov 2016
5	2.2.2	The Secretariat will communicate with the Data Portal team on the input for the proposed Data Portal section of the GCW Manual and Guide.	GCW-PO	Nov 2016
6	2.2.3	Secretariat to review and provide summary of the GAW Guides, as an example.	GCW-PO	Nov 2016
7	2.2.4	To increase the visibility of the GCW mandate and documentation the participants have asked Dr. Jeff Key to create a Wikipedia entry for the GCW, with support from the other GCW Experts.	All, J Key	Nov 2016
8	2.3.1	Best practices team to recommend to the GSG the approval of the scope of the GCW Manual and Guide and the associated road map, as resulting from this meeting.	Co-chairs	Jan 2017
9	2.3.2	The Team co-chairs together with the Secretariat will amend the currently available ToC, by reflecting the updated list of variables for each component, from the CryoNet-5 meeting report, before sharing it with the experts identified for	Co-chairs	Oct 2016

No.	Ref.	Action item	By whom	Deadline
		contributing to the development of the Guide content.		
10	2.3.3	The Best Practices Team must collaborate with the Terminology Team to ensure the consistency of the terminology used in developing the GCW Manual and Guide.	Best Practices and terminology Team Chairs	On-going
11	2.3.4	The Secretariat will periodically review and update the links included in the GCW Guide and Manual.	GCW-PO	On-going
12	2.3.6	The contributors to the development of the GCW Manual and Guide are requested to provide to Dr Key and the Secretariat information and links of the available relevant materials.	All	On-going
13	2.4.4	During the development of the Sea Ice chapter, the contributing experts need to review and agree on the most appropriate structure of the information to align well with the requirements for CryoNet stations and that for contributing stations.	Sea Ice Component Leads	Dec 2016
14	2.4.5	Petra Heil to discuss with Øystein Godøy on how to connect GCW Data Portal with the sea ice applications to enable the data exchange.	Petra Heil	Nov 2016
15	2.4.5	Dr. Jeff Key and Dr. Petra Heil to provide a summary of the known snow buoy data available in the Arctic and Antarctic regions.	Jeff Key Petra Heil	Dec 2016
16	3.1.1	The Secretariat will draft a template for the message that the Team Members will use to contact the potential contributors, soliciting their engagement in the development of the GCW Guide.	GCW-PO	Oct 2016
17	3.1.2	Secretariat and Team Co-Chairs to coordinate with CIMO and CHy on engagement for the development of the snow and solid precipitation measurement guidelines, including reflecting WMO SPICE recommendations. The Secretariat will work to facilitate the engagement of Mr Craig Smith (Canada).	GCW-PO and Co-Chairs	Oct 2016
18	3.1.3	For the Chapter on Glaciers variable measurements, Dr M Citterio and Dr Þorsteinsson will seek to engage experts from the World Glacier Monitoring Service, and agree on the contribution to	M Citterio Þ. Þorsteinsson	Nov 2016 (engagement) Dec 2017

No.	Ref.	Action item	By whom	Deadline
		the GCW Best Practices Guide, as per road map.		(development)
19	3.1.3	Dr Michele Citterio and Dr Christophe Genthon will assess requirements addition to the content developed for glaciers and how to address the balance of requirements, and agree on the contribution to the GCW Best Practices Guide, as per road map.	M Citterio and C Genthon	Nov 2016 (engagement) Dec 2017 (development)
20	3.1.3	For the Chapter on Permafrost, Dr Charles Fierz will contact Julia Boike for recommendations on appropriate experts that could contribute to the development of the best practices guide, and agree on the contribution to the GCW Best Practices Guide, as per road map.	C Fierz	Nov 2016 (engagement) Dec 2017 (development)
21	3.1.3	For the chapter on frozen ground Dr Charles Fierz will contact Dr Annett Barstch, Dr. Kari Luojus, and Dr Jannette Nötzli for recommendations on appropriate experts that could contribute to the development of best practices, including addressing the similarities/differences between permafrost and frozen ground, and agree on the contribution to the GCW Best Practices Guide, as per road map.	C Fierz	Nov 2016 (engagement) Dec 2017 (development)
22	3.1.3	For the chapter on floating ice (Sea Ice, Fresh Water Ice, Icebergs, ...), Dr Petra Heil will contact to contact Hajo Eicken (International Arctic Research Center, Univ of Alaska) and Dr Vasily Smolyanitsky will connect with the International Ice Charting Working group for recommendations on experts that could contribute to the development of the best practices. Dr Jeff Key, Dr Petra Heil, and Dr. Vasily Smolyanitsky will coordinate their respective contacts and content development, and agree on the contribution to the GCW Best Practices Guide, as per road map.	P Heil V Smolianitsky J Key	Nov 2016 (engagement) Dec 2017 (development)
23	3.2.1	Monthly WebEx teleconferences of the Best Practices Team will be organized to assess status of contributions to developing the Guide components. Proposed week of November 7 <sup>th</sup> . The Secretariat will organize the WebEx call, at the recommendation of the Team's co-	GCW-PO and Co-Chairs	On-going

<i>No.</i>	<i>Ref.</i>	<i>Action item</i>	<i>By whom</i>	<i>Deadline</i>
		chairs.		
24	3.2.1	Organize during the GSG meeting a session on Best Practices, taking opportunity of the presence of members at the meeting. At that time an assessment of progress will be conducted, including reviewing the timing and scope of the GCW Best Practices Manual.	Co-Chairs	Jan 2017

## **BEST PRACTICES TEAM REPORT TO THE GCW STEERING GROUP**

### **1. Recommendations on the structure of the GCW Manual and Guide on Best Practices**

The Best Practices Team recommends that the Manual will be focused on identifying the variable and associated data requirements, by cryosphere component, while the Guide will reflect the procedures and standard practices that will enable the availability of defined data.

The CryoNet Manual and Best Practices Guide must include sections on

- (i) Observations for all cryosphere components,
- (ii) Integrated Products and
- (iii) Data Portal,

to document all activities required to provide reliable data to any data user.

The work on developing best practices should be organized by cryosphere component and by the respective variables, organized in four groups dealing with

- (i) snow and solid precipitation,
- (ii) sea ice; lake and river ice,
- (iii) glaciers, ice caps, ice sheets and ice shelves,
- (iv) permafrost and seasonally frozen ground.

For each cryosphere component the best practices will provide information on the measurement of each variable recommended during the CryoNet-5 meeting (see meeting report).

The road map for the development of the GCW Guide and Manual and their approval process is available in [Annex 5](#) of this report.

### **2. Inter Team collaboration:**

- A close collaboration with the GCW Terminology Team is critical towards ensuring consistency in the use of terminology relative to the intended application.
- A close collaboration with the CryoNet Team is needed to ensure that the Guide and Manual address the recommended variables.
- The engagement of the Data Portal and Integrated Products WG and Teams are needed to document all aspect of the cryosphere data and products.

A review of the overall governing structure may be warranted to ensure that the above mentioned goals are achieved without overhead.

### **3. Additional Resources**

Recognizing the complexity of defining consistent procedures addressing multiple stakeholders, the participants agreed to commence the development process by focusing on the measurement of snow on the ground, glaciers, ice.

The Best Practices Team co-chairs recommend the engagement of Mr Craig Smith of Environment and Climate Change Canada to contribute to the development of the snow and solid precipitation chapter based on the outcome of the Solid Precipitation Intercomparison Experiment (SPICE) of WMO CIMO. Additionally the collaboration with CIMO in documenting the best practices and the use of instrumentation is highly recommended.

Engagements of experts from other organizations is critical to the success of the development of the GCW Best Practices. The GCW Steering Group is requested to

facilitate their engagement and contribution. The final documents will provide the appropriate recognition for their contribution.

At the same time, where possible the GCW Best Practices should be developed as joint documents with other organizations specialized in the respective field. This will ensure the broader reach and acceptance of the developed documents.

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