

**WMO Workshop 'Climate Data Stewardship needs and applications in support of the
State of the Climate reporting',
23-26 June 2025, Astana, Kazakhstan**

Introduction

The basic aim of the workshop was to ensure that the process for producing WMO State of the Climate (SoC) reports is based on well-managed, robust and reliable national, regional and global information and datasets. Members of SERCOM's ET DDS (Expert Team on Climate Data Development and Stewardship) and ET MCCVC (Expert Team on Monitoring and Communicating Climate Variability and Change) joined forces to identify complementary activities to further strengthen the WMO SoC reporting process in terms of scientific robustness and transparency.

ET MCCVC oversees the WMO SoC reporting (national, regional and global scales), thereby acknowledging the outstanding importance of high quality, well managed and scientifically robust information and data. The Team can identify climate monitoring-related stewardship requirements for climate data and information.

ET DDS develops and promotes standards and good practices in generating and managing robust and user-friendly climate datasets and information. The Team can assess climate monitoring-related requirements for climate data and information and support the development of relevant solutions.

The workshop provided an opportunity for separate meetings of ET DDS and ET MCCVC to discuss workshop implications and internal matters for each team.

The occasion of the workshop was used to connect to KAZHYDROMET to discuss climate data and monitoring capacities and requirements, thereby strengthening their role in related WMO activities.

International Organising Committee

An international Organising Committee was established through informal consultations and consisted of the following representatives:

Mr John Kennedy	ET MCCVC	Ms Ge Peng	INFCOM (ET IM)
Mr Denis Stuber	ET DDS	Mr Douglas Rao	WCRP (ESMO)
Mr Reinaldo Silveira	ET DDS	Mr Chris Hewitt	WMO
Ms Gulshan Tulebayeva	KAZHYDROMET	Ms Claire Ransom	WMO
Ms Tursyn Tillakarim	KAZHYDROMET	Mr Peer Hechler	WMO

The Committee held two online meetings with the below discussion foci:

2 April, 14:00 – 15:30 Geneva time (12:00-13:30 UTC): Workshop concept and agenda
7 May, 13:00 – 14:30 Geneva time (11:00-12:30 UTC): Workshop logistics

Workshop flow

Dr. Serik Sairov, First Deputy Director-General of KAZHYDROMET, warmly welcomed the participants to Astana and highlighted KAZHYDROMET's role in the national and international arenas.

Mr Peer Hechler, on behalf of the Secretary-General of WMO, expressed his gratitude to the Government of Kazakhstan and KAZHYDROMET to host this WMO workshop and highlighted the potentials of international collaboration in times of global and regional challenges.

The workshop agenda is provided in **Annex 1**. Meeting participants introduced themselves during a *tour de table* (List of participants see **Annex 2**).

Several experts from KAZHYDROMET presented an overview of KAZHYDROMET's activities with more specific insights into the NMHS's observing network, data management practices, data portal and climate services – the latter implemented in close collaboration with relevant national authorities.

Mr John Kennedy presented the work of ET MCCVC, Messrs. Denis Stuber and Reinaldo Silveira introduced key ET DDS activities and Mr Douglas Rao gave an overview of current research around Machine Learning potentials for data set development including quality control and modelling.

Key data sets underpinning the SoC reporting as well as WMO Regional Climate Centres' (RCC) climate monitoring activities were presented by Mr Kennedy and Mr Sensoy, respectively.

Workshop participants discussed extensively a list of key requirements for data sets underpinning the SoC reporting as well as RCC climate monitoring (**Annex 3**). These requirements will be considered by the two ETs for inclusion into their work plans during the current intersessional period.

A visit to KAZHYDROMET's meteorological observing station Nur-Sultan was organized, thereby providing excellent insights into national observational practices.

Workshop participants discussed also capacity building needs for consideration by the two ETs (**Annex 4**).

Mr William Wright provided an overview of the current status of the revision of WMO-N° 1238, Manual on the High-Quality Global Data Management Framework for Climate. He pointed out the significance of WMO Manuals as WMO regulatory material that contains statements on mandatory and recommended practices for WMO Members, noting that WMO-No 1238 is currently the only such regulatory material in the climate domain.

Mr Stuber presented the status of recent discussions about vocabulary around the DAYCLI message to allow for an exact understanding of the time of observation including the time period covered by the observation and the day to which the observation is assigned.

ET DDS members present in Astana and ET MCCVC members participating in the workshop discussed workshop outcomes and summarized inputs for ET DDS and ET MCCVC workplans', respectively (**Annex 5**). A full ET DDS meeting with participation from ET MCCVC members was held in the afternoon of the last workshop day (meeting report cf. **Annex 6**).

In the concluding session, KAZHYDROMET colleagues and WMO ET members expressed their sincere appreciation for the engaging and productive workshop discussions and the extraordinary hospitality and collaboration.

Key workshop outcomes are summarized in **Annex 7**.

Agenda

Note: The workshop agenda was complemented by

- i) A social programme, which included the visit of KAZHYDROMET's long-term meteorological observing station Nur-Sultan,*
- ii) An additional time slot for discussion regarding the current review of WMO-No. 1238 (Manual on the High-Quality Global Climate Management Framework for Climate) as well as the current discussion about vocabulary attached to the DAYCLI message (international exchange of daily climate data), and*
- iii) Two separate meetings of ET DDS and ET MCCVC, respectively, as well as one joint meeting.*

1) Opening including welcome addresses

Dr. Serik Sairov, First Deputy Director-General, KAZHYDROMET
Mr. Peer Hechler, WMO Representative

2) Introduction on Kazhydromet (with a focus on climate data and climate monitoring)

3) Setting the scene

Overview of the process of the WMO State of the Climate reporting including underpinning basic climate monitoring activities (including RCCs, NMHSs), relevant datasets and dashboards, and requirements for robust data and information sources (ET MCCVC)

Overview of SERCOM climate data-related activities in support of climate monitoring (Reference Climatological Stations, Centennial Observing Stations, DAYCLI, Stewardship Maturity Matrix for Climate Data (SMM-CD), Homogenisation, Data Rescue etc.) (ET DDS)

Machine learning and Artificial Intelligence in the climate data field (WCRP/ESMO)

4) Strengthen the data and information basis of WMO's SoC reporting

(i): Brainstorming on general data and information requirements and solutions for SoC reporting,

(ii) Use cases: How can ET DDS Data Rescue, DAYCLI and Homogenisation activities help improving the SoC database

(iii) Stewardship Maturity requirements for SoC datasets (incl. mandatory WMO RCC datasets)

5) Capacity development needs (Members and RCCs)

6) Workshop outcome

7) Closure

List of Participants:

Mr Urip Haryoko, ET DDS
Mr Serhat Sensoy, ET MCCVC
Mr Reinaldo Silveira, ET DDS (co-chair)
Mr Denis Stuber, ET DDS (co-chair)
Ms Tursyn Tillakarim, ET DDS
Mr Blair Trewin, ET MCCVC
Mr Markus Ziese, ET DDS, ET MCCVC

Ms Ainur Abenova, KAZHYDROMET
Ms Yerkhan Ashimgali, KAZHYDROMET
Ms Marzhan Bakbergen, KAZHYDROMET
Ms Nuraily Kuzhageldina, KAZHYDROMET
Ms Aliya Mamytova, KAZHYDROMET
Mr Almas Shabdanov, KAZHYDROMET
Ms Aigerim Smagulova, KAZHYDROMET
Ms Gulzhan Tulebayeva, KAZHYDROMET
Ms Altynai Zhapbasbayeva, KAZHYDROMET
Ms Bakhyt Zhezdebayeva, KAZHYDROMET

Mr Peer Hechler, WMO Secretariat

Online participation

Mr Axel Andersson, ET DDS
Mr Robert Dunn, ET DDS
Mr Ali Eddenjal, ET DDS
Mr Jose Guijarro, ET DDS
Mr John Kennedy, ET MCCVC (co-chair)
Ms Ge Peng, INFCOM representative
Ms Claire Ransom, WMO Secretariat
Mr Douglas Rao, WCRP representative (ESMO WGORC)
Mr Rachid Sebbari, ET DDS
Mr Alesandro Spinuso, ET DDS
Ms Freja Vamborg, ET MCCVC
Mr William Wright, ET DDS

Astana workshop discussion outcomes for consideration by ET DDS and ET MCCVC

DARE priorities from a SoC reporting perspective

- Extension of (Centennial stations') timeseries backwards to 1850 to support Members' requests for regional long-term assessments relative to the pre-industrial period
- Completion of the timeseries 1991 to present for anomaly monitoring and assessment
- Special focus on Central African and South American regions
- DARE efforts to always include marine (incl. ship) and hydrological observations
- Consider attaching a process to (WMO) DARE activities, which ensures that the (information about) rescued data is shared pro-actively with international data centres, thereby promoting data use and avoiding future data loss through data duplication.
- Further promote the establishment of WMO WIPPS centres for historical climate data

Side items:

- *Consider discussing the restoration of Syrian data (recent 15 years of observations missing) with WCRP (Douglas Rao) as a potential show case for Machine Learning application*
- *Consider sending letters of acknowledgement to INDARE, MEDARE and WACA-DARE contributors and explore ways to integrate project outcomes into the WMO-C3S DARE portal.*

Homogenisation priorities from a SoC reporting perspective

- All datasets used for long-term climate assessment should undergo homogeneity and uncertainty assessments

Side item: Consider revisiting and re-vitalising WMO's National Climate Monitoring Products (NCMP) approach

DAYCLI priorities from a SoC reporting perspective

- Requirement to collect, store, maintain and make accessible DAYCLI daily climate data globally (incl. back-up)
- Requirement to provide RCCs and NMHSs with DAYCLI encoding and decoding software to enable them capturing and using daily climate data
- Requirement to operationally monitor and continuously improve the availability and quality of the DAYCLI message
- Develop a convincing DAYCLI communication plan to attract the interest and collaboration of international data centres in processing and using daily climate data
- Explore ways to make sure that historical daily climate data are available for all stations reporting DAYCLI, so that useful daily data sets are available for SoC reporting (rather than collecting DAYCLI messages over the next 30 years to have a meaningful data set available)

Roadmap elements for the further implementation of the WMO Stewardship Maturity Matrix (SMM)

- Revisit the aspects and categories of the SMM for global data sets to better serve the needs of the SoC reporting
- Further promote stewardship maturity assessments under ET DDS guidance and review for global data sets used for SoC reporting
- Consider reflecting SMM assessment results appropriately on the SoC dashboard(s)
- Consider creating a (rather static) WMO Website with access to the SMM templates and guideline
- Consider an alternative solution for the current WMO Climate Data Catalogue
- Continue promoting the use of the WMO SMM on regional (WMO RCCs and partners) and national (NMHSs and partners) levels including through the provision of training
- Encourage data set providers to engage in stewardship maturity assessments

**Capacity development needs
identified by workshop participants in relation to the workshop theme**

Note: The below topics were identified for capacity development. They are listed for consideration by ET DDS and ET MCCVC for inclusion in their respective intersessional workplans and/or forwarding to the appropriate WMO Expert Teams or communities

Parallel observations and data analysis regarding the transition from manual to automated observations

Managing data from Automatic Weather Stations

CLIMAT and DAYCLI messages

Climate Data Management Systems (CDMS)

CDMS specifications (WMO-No. 1131)

Data provenance and lineage

CDMS and OSCAR

CDMS and WIS2

CDMS and Regional Climate Centers

Data Security (Service continuity, backup, archive, etc.)

Data Rescue

Quality control of climate data

Data completeness (from observations to final data sets in CDMSs)

Handling data gaps

Managing datasets

Climate dataset development and stewardship maturity matrix

Basic climate statistics including return periods and statistics in a changing climate

Homogenisation

National Climate Monitoring Products (NCMP)

The use of gridded data (analysis, reanalysis, prediction, projection)

Where to find climate data and the tools to use it

Reanalysis

WMO Policy and Open Data

Suggested ET DDS and ET MCCVC workshop conclusions and workplan elementsRegarding the further implementation of the WMO Stewardship Maturity Matrix (SMM)

Revisit the SMM aspects and categories to better underpin the SoC reporting

Increase the engagement of data set providers in assessing stewardship maturity

Identify ways to properly reflect SMM assessment results on the SoC dashboard/future Hub

Revisit the content of the current WMO Climate Data Catalogue and transfer the appropriate content to a website created under WMO IT infrastructure

Continue the assessments of relevant datasets for WMO reports

Focus on capacity development activities (including training) to promote SMM assessments on the national and regional levels

Identify an appropriate storage facility for SMM assessment files

Regarding data rescue

Help motivating Members to pay appropriate attention to data rescue (e.g. through online consultations)

Explore ways to attach a process to (WMO) DARE activities, which ensures that the (information about) rescued data is shared pro-actively with international data centres

Regarding homogenization

The ET DDS plans for training on homogenization were re-confirmed and ET MCCVC collaboration suggested

Regarding Capacity Development

Assess the capacity development needs expressed during the workshop

Regarding climate monitoring

ET MCCVC experts to consider revisiting ETCCDI and NCMP approaches in support of the SoC reporting

Mr. Serhat ŞENSOY proposed expanding the boundaries of the Eastern Mediterranean Climate Center (www.emcc.mgm.gov.tr) to include the territory of Kazakhstan.

WORLD METEOROLOGICAL ORGANIZATION

Expert Team on Climate Data Development and
Stewardship,
26 June 2025, 16:00 – 17:00 Astana time

Original: English

ReferencesGithub: <https://github.com/ET-DRC>Wiki general: <https://github.com/ET-DRC/Home/wiki>Wiki DAYCLI: <https://github.com/ET-DRC/DAYCLI-message/wiki>

Shared drive, see at:

<https://community.wmo.int/en/governance/commission-membership/sercom-management-group/standing-committee-climate-services/expert-team-climate-data-development-and-stewardship>
Agenda

1. Opening
2. ET DDS-relevant Astana workshop outcome
3. Update ET IM
4. Update TT on Infrastructure
5. Update WMO 1131 (CDMS Specifications)
6. Forum on data management in South America
7. Consultations on homogenization
8. Status DAYCLI
9. AoB
10. Closure, next ET DDS meeting, coming events

Participants:

Mr Alessandro Spinuso	Mr Jose Guijarro	Mr Tursyn Tillakarim,
Mr Ali Eddenjal	Mr Markus ZIESE	Mr Urip Haryoko
Mr Axel Andersson	Mr Rachid Sebbari	Mr William Wright
Mr Denis Stuber	Mr Reinaldo Silveira	Mr Peer Hechler
Ms Ge Peng	Mr Robert Dunn	
Mr John Kennedy, Mr Serhat Sensoy and Mr Blair Trewin of ET MCCVC		

Notes (actions and agreements highlighted in **bold)**

Mr Peer Hechler presented the ET DDS-relevant outcome of the Astana workshop (cf. ANNEX 5 above). Mr Axel Andersson stressed the opportunity to report findings of the Astana workshop to the Task Team on Climate Infrastructure (TT CI; next meeting on 3 September 2025, 13:00 – 15:00 Geneva time, focus: Data rescue and climate observations: Centennial stations, Reference Climatological Stations etc.).

Ms Ge Peng and Mr William Wright summarised one of the current key activities of INFCOM ET IM: A high-level review of WMO 1238. The Team is checking for duplications and any inconsistencies against other regulatory material and proposing harmonisation revisions. The entire review of climate-relevant material in WMO Technical Regulations in relation to WMO 1238 is planned to be finished prior to INFCOM-4 in 2026, pending priority guidance from the TT-CI.

Mr Denis Stuber informed the Team of the publication of the 2025 edition of the WMO-No. 1131 Climate Data Management System (CDMS) Specifications and provided a brief summary of the INFCOM activity to assess the functional requirements for CDMSs specified in WMO 1131.

Mr Reinaldo Silveira reflected on his participation in the very informative Forum on data management in South America under the [Enandes+](#) project (Enandes+: Enhancing Adaptive Capacity of Andean Communities through Climate Services).

Mr Stuber highlighted the opportunity to collaborate with ET MCCVC on the consultations on homogenization. He mentioned the approach to discuss and prepare the consultation with the whole community in advance, and schedule the consultation at the end of the process (Consultation on homogenization scheduled not before September 2025). Mr Stuber informed the Team of 17 submissions from NMHSs in response to a short questionnaire about products and services using homogenized data (See the list of responses and the Mind Map on the current status of the preparation of the consultation:

<https://github.com/ET-DRC/Home/tree/main/consultation/homogenization>).

The planned overview presentation of Mr Jose Guijarro can be accessed here:

https://github.com/ET-DRC/Home/blob/main/consultation/homogenization/homogenization_of_climate_series.pdf).

Mr Stuber informed the Team of joint collaboration with INFCOM's ET Data Standards to design a new BUFR sequence for the DAYCLI message (access to the proposed DAYCLI format, questions/answers, meeting summary at <https://github.com/wmo-im/BUFR4/issues/238>; previous discussion (2020-2022) cf. <https://github.com/wmo-im/BUFR4/issues/51>).

The Team agreed on its **next meeting date and hour: 20 August 2025, 13:00-15:00 Geneva time.**

Upcoming events

- ✓ 3 September 2025: Task Team on Infrastructure, Geneva, Switzerland
- ✓ 20-24 October 2025: Cg-Ext, Geneva, Switzerland
- ✓ 4-6 November 2025: 15th EUMETNET Data Management Workshop, Oslo, Norway
- ✓ 10-21 November, 2025, COP 30, Belem, Brazil
- ✓ April 2026 (double-check!!), INFCOM-4
- ✓ May 2026, 12th Seminar for Homogenization and Quality Control in Climatological Databases and the 7th Interpolation Conference in Budapest, Hungary
- ✓ October 2026, SERCOM-4

Summary of workshop actions and requirements

Note: The tables below list specific actions and requirements that emerged from workshop discussions. They include the action to convert the workshop conclusions (cf. Annex 5 above) into actionable ET DDS and ET MCCVC workplan elements.

Actions

Action	Responsibility
Update ET DDS and ET MCCVC intersessional workplans w.r.t. Astana workshop outcomes	ET DDS and ET MCCVC Co-Chairs
Explore Machine Learning potentials to close data gaps in Syrian climate records	Peer Hechler (WMO) to approach Douglas Rao (WCRP/ESMO)
Explore incorporation of Caspian Sea monitoring information into SoC Asia 2025+ reports	Peer Hechler (WMO) and Tursyn Tillakarim (KAZHYDROMET)
KAZHYDROMET requests exploration of WMO funding opportunities for WIS training	WIS Division
Check status of Centennial stations candidate Nur-Sultan	Peer Hechler (WMO)
ET DDS and ET MCCVC experts to review draft DAYCLI vocabulary *	Denis Stuber (ET DDS)
Consider sending letters of acknowledgement to INDARE, MEDARE and WACA-DARE contributors and explore ways to integrate project outcomes into the WMO - C3S DARE portal	Peer Hechler (WMO)

***Draft proposed vocabulary:** Attribution Day: Is the day to which the values of parameters are assigned. Should reflect the day used by NMHSs to compile their long-term data series. Climatological Day: This represents the 24-hour period over which the various daily parameters are measured or calculated, whether for extremes, averages or accumulations.

Requirements

Note: The below listed requirements will be formally submitted to INFCOM by ET DDS and ET MCCVC through SC-CLI and the SERCOM Management Group (tbc). The requirements will also be brought to the attention of the current Task Team on Climate Infrastructure.

Requirement
Broaden the scope of WMO-No. 1238 to include climate monitoring
Maintain and further increase the current number of CLIMAT reporting observing stations (> 3000 globally: GSN and exRBCN) and make them identifiable through OSCAR
Promote the submission of DAYCLI messages from at least all (> 3000 globally; see above) CLIMAT- reporting observing stations and make DAYCLI-reporting stations identifiable through OSCAR
Establishment of global WMO centres for historical data under WIPPS
Global collection, management, storage, back-up and accessibility of daily climate data exchanged through the DAYCLI message
Provision of WMO RCCs and NMHSs with DAYCLI encoding and decoding software to enable capture and use of DAYCLI daily climate data
Operationally monitoring and improving the availability and quality of the DAYCLI message