

Task Team GCOS Surface Reference Network



29th AOPC Session

Sarah Gallagher, Met Éireann
Tilman Holfelder, DWD



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A GCOS Surface Reference Network (GSRN)

Improved long-term accuracy, stability and comparability of observations.

- To achieve simultaneous high-quality observations of ECVs
- Recognized reference network (surface observations) within WMO tiered system (like GRUAN for upper air)
- Provide reference data; full traceability; defined & quantified uncertainties
- All measurements documented with complete metadata description
- Could/should be subset of stations in existing networks (e.g. GSN, GBON), but open to include new stations (e.g. scientific stations)
- The PILOT Phase will focus on **surface air temperature** and **precipitation**





Key Meetings of GSRN

- GSRN-TT-1 (Dublin June 2022): Agreed on 10-year goal; GSRN governance, draft station and measurement requirements; draft terms of reference for GSRN-LC.
- INFCOM-2 (WMO, Oct 2022): Document on pilot network requirements and station nomination for approval.
- GSRN-TT-2 (Torino Sept 2023): In-person meeting with GSRN-LC staff to discuss progress & plans; GSRN(Pilot) stations assessment and recommended list; draft metadata and station level data; measurement uncertainty; draft GSRN(Pilot) implementation plan.
- GSRN(Pilot) station contacts: On-line meeting on; Introduction (1-Feb 2024); metadata (2-April 2024); station level data and GSRN processing (3-June 2024) ; Uncertainty (18 June 2024)

Pilot GSRN
(Test Phase, some stations in different climate regions)

Initial GSRN
(first operational products, certified stations)

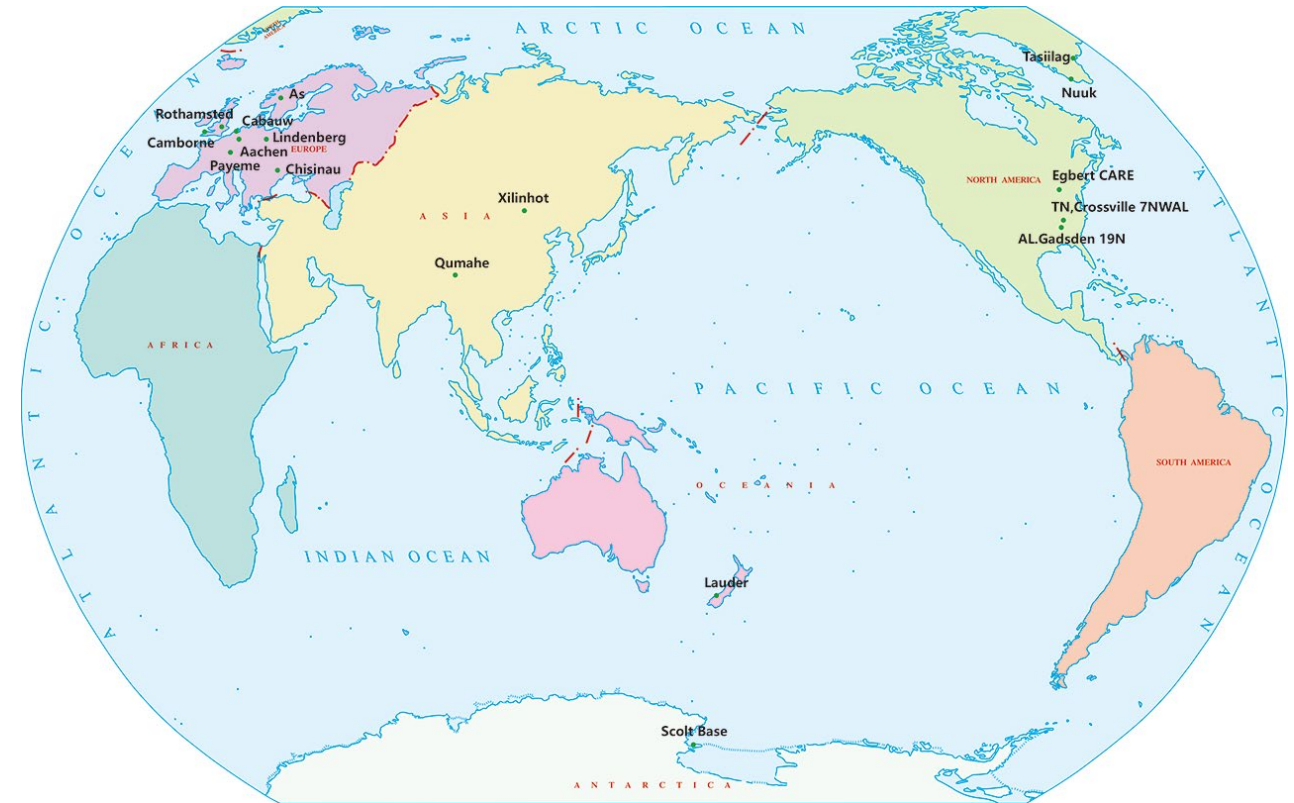
(Final) GSRN
(global network with operational products)

- Proof of concept of GSRN
- Pilot GSRN phase can be used to bring a station towards reference quality
- GSRN LC and TT-GSRN development and oversight

- Generate first GSRN products (e.g. daily mean air temperature near surface) considering all uncertainty components (using measurements of AQI)
- Gather experience dealing with different instrumentation at stations and climate regions
- Implement procedures on how to manage, process and archive data
- Implement data quality assessment methods (QA / QC)
- Generate certification process for stations
- Report to INFCOM 4 (2026):
 - **Report on the development of the GSRN, the Pilot phase and recommendations for an operational GSRN**

Pilot GSRN – status update

- 17 pilot GSRN stations across 11 countries:
 - Canada
 - China
 - Denmark
 - Germany
 - Moldova
 - Netherlands
 - New Zealand
 - Norway
 - Switzerland
 - UK
 - USA
- LC/TT-GSRN working with station contacts to ensure initial:
 - Station Level Metadata
 - Measurement Level Metadata
 - Data transfer (CSV, BUFR, WIS2.0)



Website for GSRN: <https://www.gsrn.pub/>



GSRN(Pilot) Implementation Plan

- GSRN(Pilot) Stations – data transfer, metadata, online meetings
- Metadata database for GSRN Stations (GSRN-LC) – including stations nominated to OSCAR Surface
- Website/forum to support implementation
- GSRN ‘portal’ for data/metadata to be uploaded, and its operational implementation
- Processing software to manage, process and archive data, including the generation of GSRN data products, and its operational implementation
- GSRN ‘facility’ to display network/station monitoring, measurement time-series and allow access to data
- Implement a GSRN monitoring and incident management system, reporting to relevant bodies

- Regular on-line meetings (monthly) between GSRN-LC, TT-GSRN co-chairs and GCOS Secretariat to discuss:
 - progress of GSRN-LC workplan
 - GSRN(Pilot) implementation
 - issues/risks
- Operational management system dev. Engagement with Pilot stations (data transfer tools, metadata, ...)
- Operational phase of the pilot GSRN (LC)

Station Name	GSRN station ID	Country / territory	WIGOS Station Identifier(s)	WMO Region	Longitude	Latitude
Egbert GSRN	001	Canada	0-124-0-73190	IV - North America, Central America and the Caribbean	79.78W	44.23N
TN, Crossville 7NW	002	United States (the)	N/A	IV - North America, Central America and the Caribbean	85.1345W	36.0138N
AL, Gadsden 19N	003	United States (the)	N/A	IV - North America, Central America and the Caribbean	85.9621W	34.2851N
Cabauw	004	Netherlands	0-20008-0-CES	VI - Europe	4.9270E	51.9710N
Chisinau	005	Moldova	0-20000-0-33815	VI - Europe	28.8484E	46.9715N
As	006	Norway	0-20000-0-01463	VI - Europe	10.7819E	59.6602N
Aachen	007	Germany	0-20000-0-10505	VI - Europe	6.02439E	50.7983N
Lindenberg	008	Germany	0-20000-0-10393	VI - Europe	14.1180E	52.2085N
Camborne	009	United Kingdom (the)	0-825-0-48	VI - Europe	5.3167W	50.2167N
Rothamsted	010	United Kingdom (the)	0-20000-0-03680	VI - Europe	0.3583W	51.8061N
Qumathe	011	China	0-156-0-56915	II - Asia	94.7281E	34.9319N
Xilinhot National C.	012	China	0-20000-0-04102	II - Asia	116.1167E	43.9500N
Playene	013	Switzerland	0-20000-0-06610	VI - Europe	6.9425E	46.8116N
Scott Base	014	New Zealand	0-554-0-89665	Antarctica	166.7562E	77.8485S
Lauder	015	New Zealand	0-20000-0-93817	V - South-West Pacific	169.6843E	45.0385S
Nuuk	016	Denmark	0-208-0-04250	VI - Europe	51.7308W	64.1833N
Tasilaq	017	Denmark	0-208-0-04360	VI - Europe	37.6367W	65.6111N

Number of abnormal events per day: 11

Number of abnormal events per month: 19

events classification

Category	Count
Metadata	4
Operation Monitoring	7
Other	0

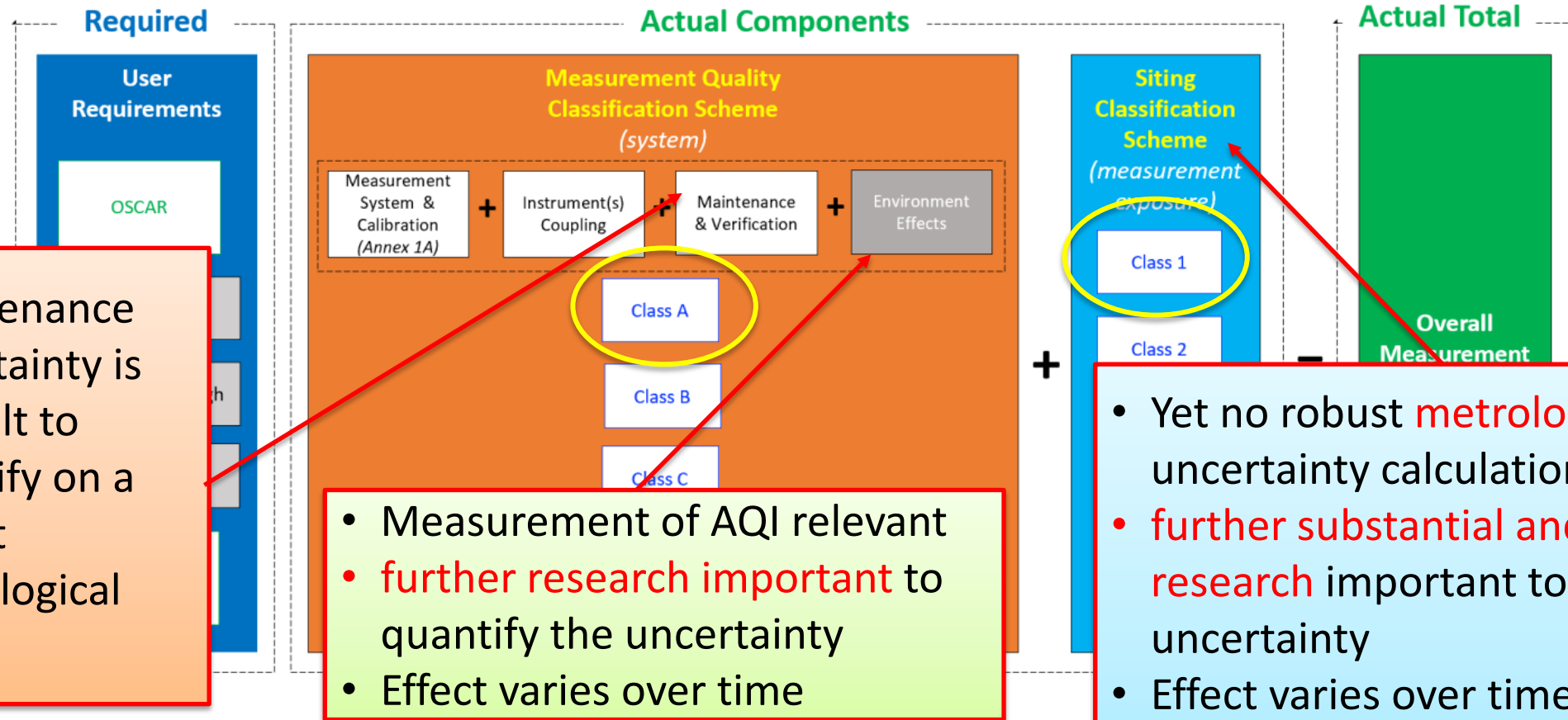
New daily abnormal events

Daily event statistics of stations

Unresolved abnormal events

Overall Measurement Uncertainty

Following the WMO Measurement Quality Classification (MQC) the overall measurement uncertainty has the following contributions:



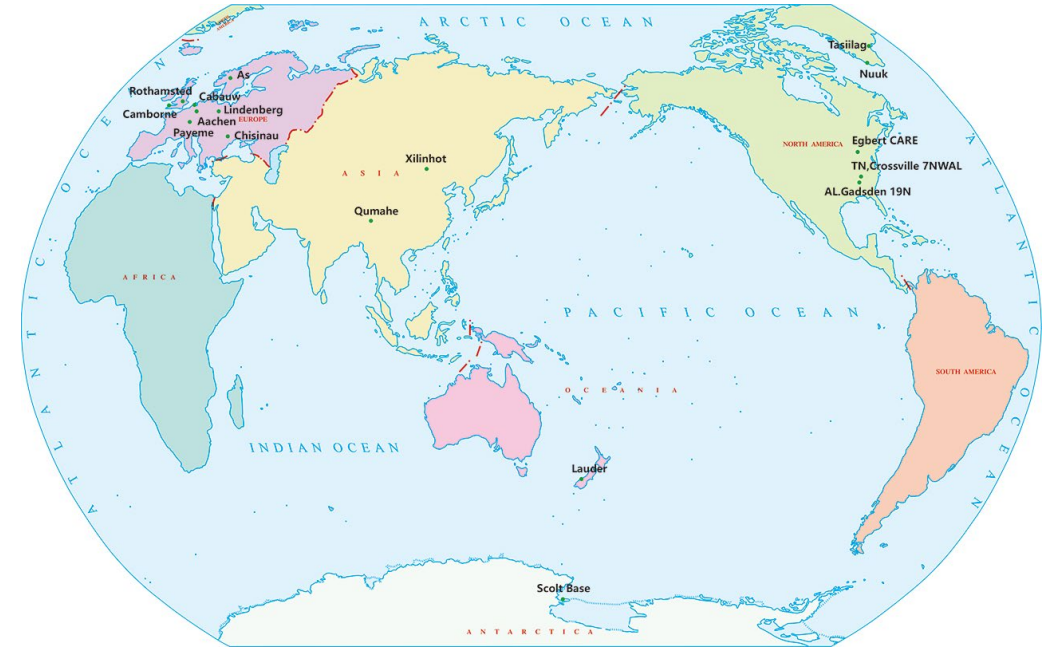
- Maintenance uncertainty is difficult to quantify on a robust metrological basis

- Measurement of AQI relevant
- further research important to quantify the uncertainty
- Effect varies over time

- Yet no robust **metrological** basis for uncertainty calculation
- further **substantial and in-depth research** important to quantify the uncertainty
- Effect varies over time/season
- Some effects can be taken into account with AQI (e.g. shading)

Plenary in-person meeting China

- 3rd Plenary 14-18 October in Xi'an, China
- Additional trip by TT-GSRN co-chairs, secretariat and GRUAN LC to Xilinhote reference station 11-12 Oct
- Director of INFCOM/GCOS will open along with CMA
- Focus on Pilot phase implementation:
 - Metadata
 - Operational Practices (pilot station experts)
 - Progress of the LC & LC workplan
 - Developments on uncertainty calculations & latest experiments
 - SC-MINT collaboration
 - GSRN data products and users' needs
 - Research & outreach



- 3rd in-person Meeting in October 2024 in Xi'an (China) will be essential
 - Station and measurement metadata and dataflow from 17 Pilot stations
 - To define first GSRN products (for temperature and after precipitation)
 - To examine uncertainty and how this can be defined in a data product – research gaps and collaboration with SC-MINT (long-term research)
 - (some) Pilot station contacts attending in-person to discuss status, successes and issues
 - Pilot phase is now well underway and making good initial progress!

Thank you



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