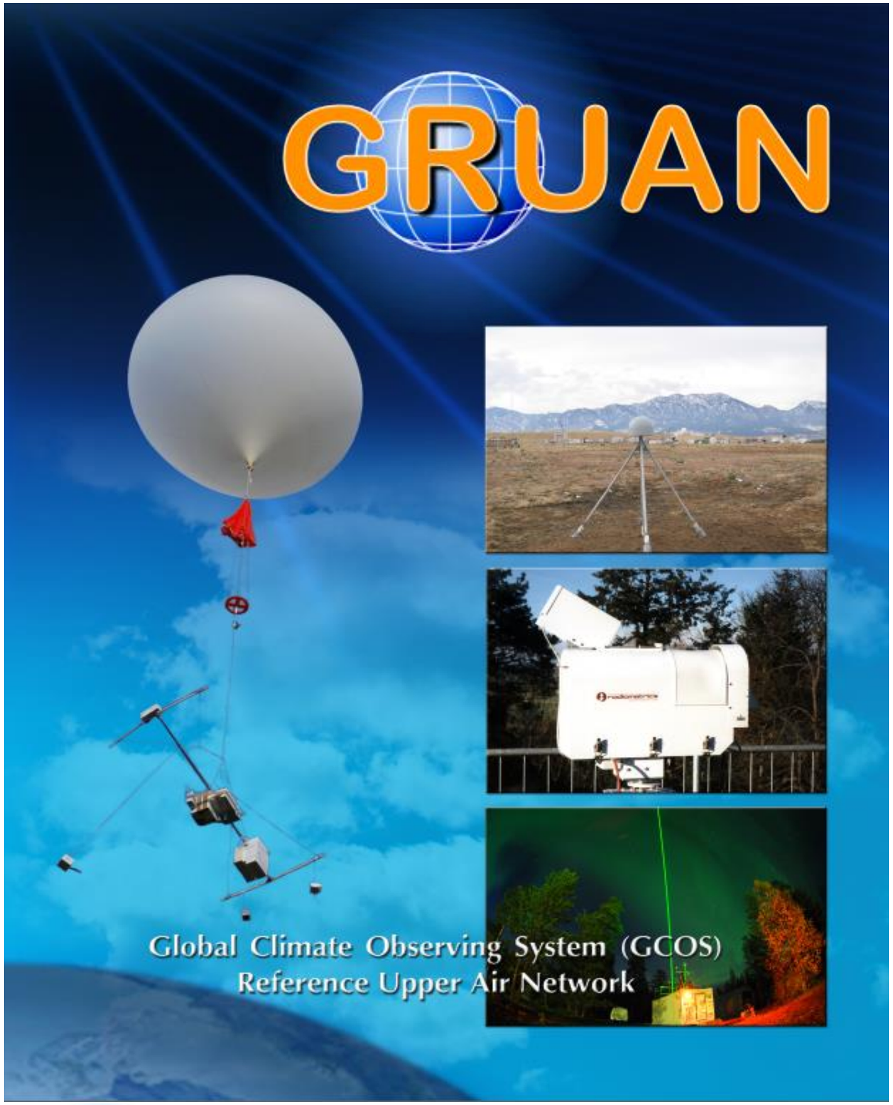

Review of progress against GRUAN IP

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GRUAN IP

Action 1:	
Action:	Ensure day-to-day operation of the GRUAN network including addressing the high-priority actions from the latest ICM, regular reports to the AOPC on progress, issues and updates on GRUAN IP, and undertaking regular Implementation and Coordination meetings.
Who:	Lead Centre, WG-GRUAN and GCOS Secretariat
Time-Frame:	Continuous
Performance indicator:	Delivery of the strategic goals of GRUAN; number of high-priority actions addressed; reports to AOPC; ICM meetings.
Benefits:	The operational delivery of GRUAN; GDP available to the user community.

- The most quantifiable indicator is the number of HP actions addressed: 2 out of 6. This suggests difficulties in implementing priority actions.
- In addition, the WG GRUAN must ensure that actions are clearly defined and achievable.
- If an item is identified as a priority, it must be handled by the person (entity) responsible so that it can be completed at least by the following ICM.
- Moreover, support should be requested (from the CC) to define a new strategy and overcome the existing challenges.

Action 2:	
Action:	Continue the development of the measurement techniques in Table 1, and any identified additional candidate measurement techniques, to enable GDP certification.
Who:	Task Teams, data processing centers, Lead Centre, WG-GRUAN, sites, contributing / collaborating networks.
Time-Frame:	By 2030
Performance indicator:	Number of systems which have certified GDPs (based on Table 1 which could have systems added during the period of this IP).
Benefits:	Increased availability of reference data.

- No new systems have been certified in the last 18 months (for the second time!), we must have at least 2-3 new GDPs before ICM-17.
- GNSS, M10, and what else? Skydew? Graw? GTH3? Modem M20?

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Action 3:	
Action:	Deploy GDPs as they develop via the data portal and monitor indicators of usage such as publications that use the data and availability in third-party repositories.
Who:	Lead Centre, Task Teams, sites.
Time-Frame:	Continuous
Performance indicator:	Data are publicly accessible and there is demonstrable evidence of growing usage within the community.
Benefits:	Long-term network utility and viability, return on investment.

- The availability of data through PANGEA is key for GRUAN data provision. Currently the LC website and the GRUAN data in the CDS are the only options for the users. Copernicus Climate Data Store (CDS) will be soon updated (beginning of 2026) and able to manage monthly updates, but data are reformatted (preserving all metadata), according to the CDS Common Data Model.

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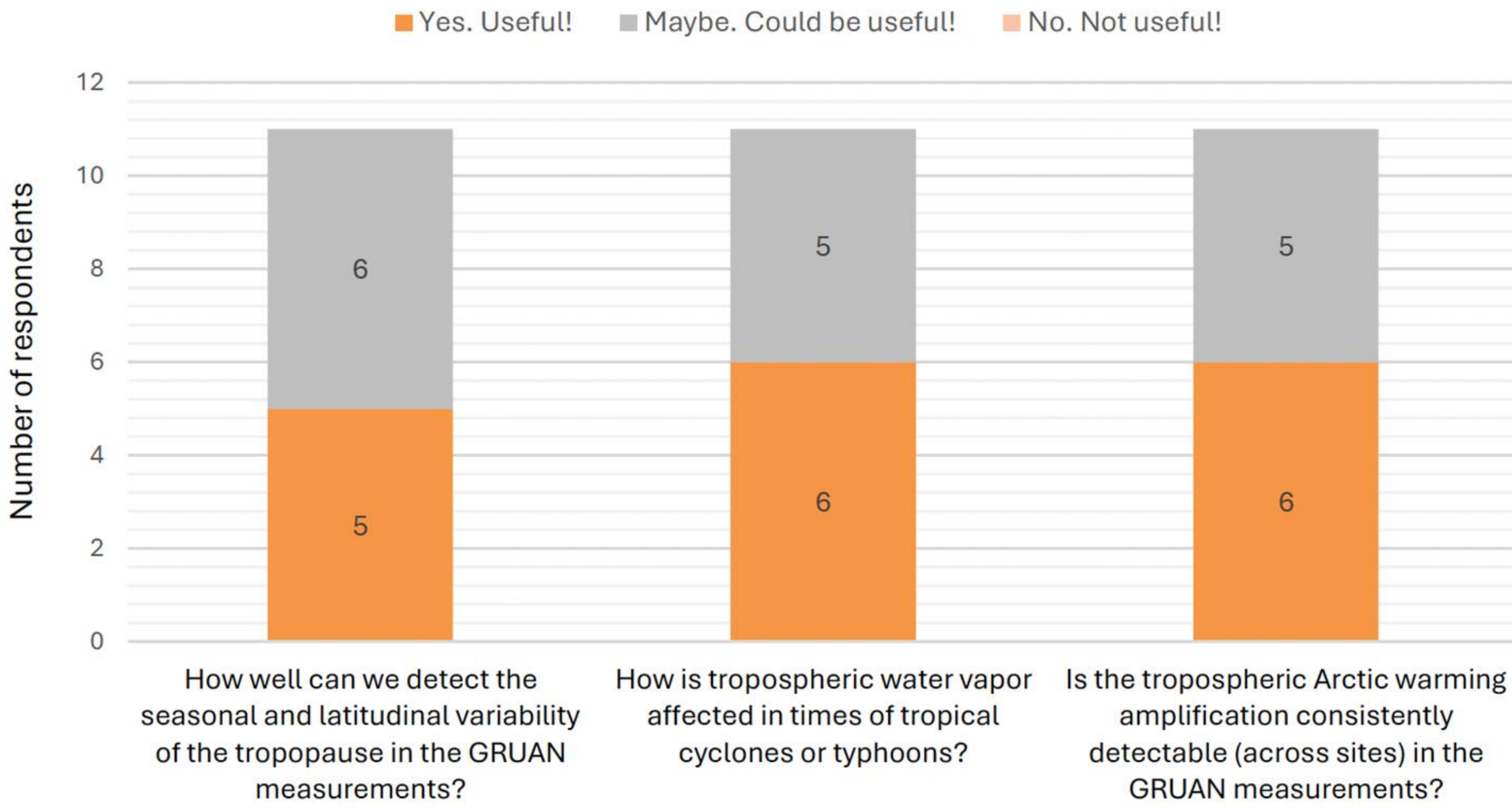
Action 4:	
Action:	Implement a process for the periodic review of GDPs, to assess their usage, document issues and check consistency between GDPs. Review should include external peer review.
Who:	WG-GRUAN, Task Teams
Time-Frame:	Develop process (2025); Implement (2026)
Performance indicator:	Implemented process by end of 2026.
Benefits:	Ensuring that GRUAN data streams/products remain cutting edge, consistent and are regularly reviewed both internally and externally. Updated GDPs where required.

- Can we close the triggering process document (LC to finalize)? Implementation of QA/QC CC4 action.
- UNISA&CNR have launched a survey to evaluate GRUAN data, sent to approximately 100 CDS users (led by Dr. Monica Proto at CNR-IMAA). The respondents come from various countries and application domains, with about 70% belonging to the academic sector. Results will be discussed in the next WG GRUAN meetings.
- CRIM EU Cost Action may provide support through STMs, involving specific experts to assist in the assessment of GRUAN.

Assessment from CDS EQC program

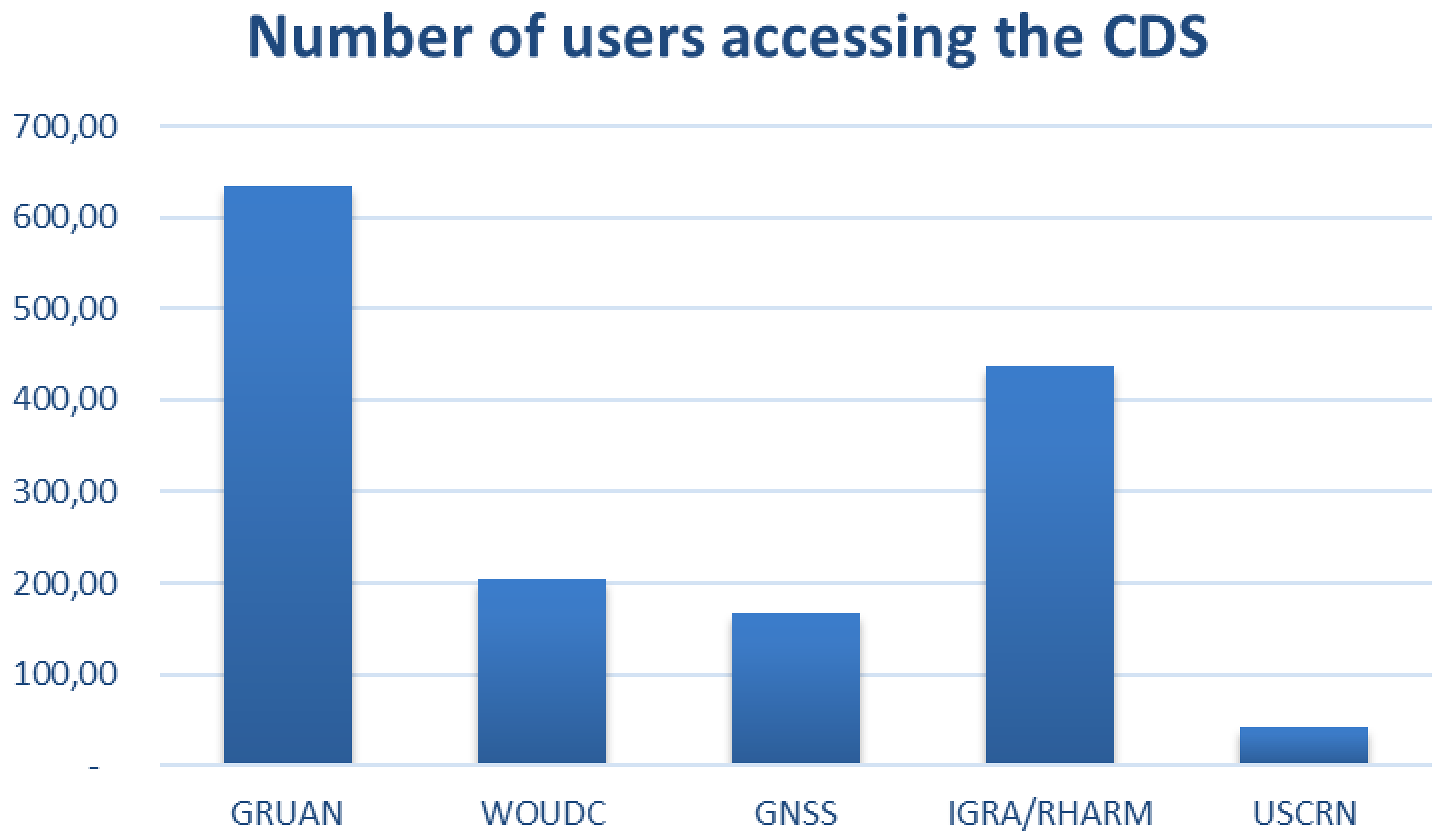
CDS EQC program collected feedback (11 respondents) to specific questions



Action 5:	
Action:	Instigate and improve GRUAN data hosting system, including DOIs and usage tracking options.
Who:	Lead Centre, GCOS Secretariat, TT sites.
Time-Frame:	2024-2025
Performance indicator:	New system implemented
Benefits:	Improved accessibility, citation and data usage tracking.

- See Madonna/Fujiwara talk on Monday for the analysis of publication and web search.
- Statistics from the access through the CDS reveal a continuously growing number of data users.
- Deploy of GRUAN data in PANGEA with a doi can facilitate the tracking of data usage.

CDS data users



Despite being less comprehensive, GRUAN has the largest number of users in the CDS, and this number has been growing over time.

The CDS access statistics from 2020-04-27 show more than 600 users

Action 6:	
Action:	Recruit and retain more sites with a priority in South America, Africa and Eurasian regions.
Who:	WG-GRUAN, Lead Centre
Time-Frame:	Continuous
Performance indicator:	At least 35 active sites present on map at the end of the IP period.
Benefits:	Improved global network coverage, reference quality measurements in new regions important to stakeholders.

Action 7:	
Action:	Review and re-review sites as detailed in the GRUAN manual so that at least 80% of the active sites are certified over the last year of the IP period.
Who:	WG-GRUAN, Lead Centre
Time-Frame:	Continuous, for any given site at least once per four years.
Performance indicator:	Number of certified sites; number of sites delivering data streams via the relevant GRUAN data portal(s).
Benefits:	Certification ensures a minimum quality to end users and a degree of compatibility/comparability of their data streams and quality to the contributing sites.

2 new sites certified (Tenerife, Xilinhot), recertification proceeds regularly, contacts with three new sites (Helwan, Punta Arenas, Concordia), other sites have been proposed (e.g. Palau). See discussion in presentation 1_4.

Action 8:	
Action:	Develop and implement a proposal to review and revive silent sites.
Who:	WG-GRUAN, Lead Centre, GCOS sites
Time-Frame:	2024
Performance indicator:	Silent site removal process is implemented and working; number of silent sites.
Benefits:	The proposal would revive the silent sites or decommission them from GRUAN. It would ensure a high quality and active network.

The silent data policy was approved by the WG, and the site in Dolgoprudny (Moscow) is currently under review, following the escalation steps defined in the policy.

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Action 9:	
Action:	Develop, test and implement new UTLS water vapor sensors and new cooling agent for R23 replacement.
Who:	Task Team on radiosonde, WG-GRUAN, Lead Centre
Time-Frame:	2024-2026
Performance indicator:	New sensors and non-R23 cooling methods for frostpoint techniques are tested (by end of 2024); implemented at all relevant GRUAN sites (2026).
Benefits:	Continuity of the UTLS water vapor measurements.

Action 10:	
Action:	Justify the use of the Standard Humidity Chamber (SHC) and document the necessary procedures.
Who:	Task Team on sites, Lead Centre
Time-Frame:	2024
Performance indicator:	Peer reviewed paper and technical note published. Increase use of SHC at GRUAN sites.
Benefits:	Improved uncertainty calculation for radiosondes measurements; potential for SHC to become more widely used at non-GRUAN sites.

Action 11:	
Action:	Strengthen the use of satellite and GRUAN products for validation and calibration activities of both data sets, leading to improved uncertainty estimates.
Who:	Task Team on Satellite, Lead Centre, WG-GRUAN
Time-Frame:	Continuous
Performance indicator:	Publications and evidence for progress in annual ICM reports.
Benefits:	Better characterization of measurement uncertainties, optimal use of observational assets to meet stakeholder needs.

- Prioritize development of a GDP of the most mature products for UTLS. Skydew and then CFH/FPH

- Still not finished! CC have been involved and did comments/proposal to share efforts. LC to move on.
- Do we have now the SHC at all GRUAN sites (manual launches)?
- TT4 action on autolaunchers (talk by G. Romanens).

- Results from VICIRS project (talk by N.Cimini)

- EUMETRAVES, validation campaign starting in 2026Q2

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Action 12:	
Action:	Ensure sustained interactions with other networks interested in upper-air measurements of ECVs to realize synergies through cross-cutting governance activities, collaborative projects, joint peer-reviewed publications etc.
Who:	WG-GRUAN, Lead Centre, Task Teams
Time-Frame:	Continuous
Performance indicator:	Memoranda of understanding enacted, appropriate cross-representation, joint participation in research project.
Benefits:	Scientific insights, mitigation of capability redundancies, better governance in the framework of WIGOS.

Action 13:	
Action:	Periodically review WG-GRUAN membership and terms of reference and whether task teams are still relevant/additional task teams needed.
Who:	WG-GRUAN, Lead Centre, Task Teams, AOPC
Time-Frame:	Review internally at GRUAN ICMs as a standing item. Reported annually to AOPC including relevant decisions and issues.
Performance indicator:	Regular review at ICMs and reporting to AOPC.
Benefits:	Ensure continuous relevance of activities and relevant expertise is recruited and retained to address the present challenges.

- Regular meetings will be organized with BSRN and GSRN representatives (Action for GCOS Sec.) BSRN developed uncertainty estimation for SW radiation products (two different groups, to intercompare).

- WG-GRUAN, TTs membership and ToR have been reviewed and published on the GRUAN website.

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Action 14:	
Action:	Sustained engagement with the user community to ensure usage and exploitation of data arising from GRUAN activities.
Who:	WG-GRUAN, Lead Centre, Task Teams, AOPC
Time-Frame:	Continuous
Performance indicator:	Papers published, presentations given, participation in international activities and occasional special sessions on GRUAN in international conferences.
Benefits:	Ensures usage by user community to drive value.

- Scientific paper published in 2024 citing GRUAN or using GRUAN data: 11 paper (12 papers in 2023)
- Presentations/posters given at Reanalysis conference, Japanese Met Society, EGU 2025, C3S GA
- Tracking of data usage in the CDS to collect feedback and C3S work on the GRUAN data assessment and usage
- Short Course "Reference measurements for climate studies and applications", 29 April, 10:45-12:30 (CEST) at the General Assembly 2025 of the European Geosciences Union (EGU) in Vienna (supported by C3S).

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Action 15:	
Action:	In collaboration with partner networks, assess the relevance and tractability of the full suite of remaining GRUAN target variables defined in GCOS-112 (updated with new ECV definitions in the 2022 GCOS IP) in the context of measurement capabilities and measurement programmes underway in partner networks.
Who:	WG-GRUAN, Lead Centre, Task Teams
Time-Frame:	2026
Performance indicator:	Report available and some data streams for new ECVs not yet considered, at a minimum, under demonstrable development (stretch target: at least one additional ECV now has a GRUAN product).
Benefits:	After network expansion the next benefit would be in starting to observe all important facets of the column at the sites which requires expanding the ECV set.

- Discussion initiated with BSRN and GSRN on radiation products.
- Interaction established with SHADOZ regarding ozone soundings.
- In the next WG meetings, we should address the other GRUAN priority 2 products and, with introductory presentations from experts, discuss the feasibility of implementing GDPs for the remaining ECVs.

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Action 16:	
Action:	Review and update GRUAN Manual and Guide (GCOS-170 and GCOS-171).
Who:	WG-GRUAN, Lead Centre, AOPC and GCOS Secretariat, WMO SC-ON
Time-Frame:	2024-2026
Performance indicator:	Updated GRUAN Manual and Guide.
Benefits:	Recognition by NMHSs who provide sites and/or analysis capabilities. Visibility with stakeholders such as the satellite cal/val community.

- Completed, GRUAN operations manual reviewed by LC and WG GRUAN. Final additions needed to update the Organizational diagram for GRUAN management and oversight (giving more visibility to Processing centers) and the references.
- Any final feedback from the WG GRUAN?
- Then, we shall engage with WIGOS to publish it within the WIGOS manual.

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Action 17:	
Action:	Contribute to the WMO-GCOS activity on the implementation on the tiered networks. Show how GRUAN has benefits for broader measurement networks.
Who:	WG-GRUAN, Lead Centre, AOPC and GCOS Secretariat, WMO SC-ON
Time-Frame:	2024-2030
Performance indicator:	Progress on the implementation of tiered networks within WIGOS. Peer reviewed publications highlighting the benefits of GRUAN to broader observing network.
Benefits:	Strengthening of GRUAN's position within the global observing system. Benefits of GRUAN programmes to other end users.

- C3S work using GRUAN algorithms to improve upper-air (Madonna et al., 2022) and GNSS (Rannat et al., 2023) global data continues.
- Additional assessments need to be developed under the SCG.
- GRUAN papers: a new general paper is being drafted; another for a scientific data journal should be prepared (LC and CC?).

Action 18:	
Action:	Periodically review aspects around sustainability and environmental impacts of GRUAN operations
Who:	WG-GRUAN, Lead Centre, AOPC and GCOS Secretariat, WMO SC-ON
Time-Frame:	2024-2030
Performance indicator:	Reporting of sustainability and environmental impacts. Testing and deployment of new more sustainable practices.
Benefits:	As a leading network it is important that GRUAN leads by example in regard to environmental sustainability concerns minimizing the environmental footprint where and when possible.

- We may report the outcome of the discussion had at ICM-16 although «numbers» from an assessment are expected.

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