



WMO/IOC/UNEP/ICSU  
GLOBAL CLIMATE OBSERVING  
SYSTEM (GCOS)

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**8th GRUAN Implementation-  
Coordination Meeting (ICM-8)**

Session 1

Boulder, USA

25 April – 29 April 2016

**Lead Centre progress report 01/2016**  
*(Submitted by GRUAN Lead Centre)*

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**Summary and Purpose of Document**

Progress report from the GRUAN Lead Centre covering the period 03/2015 to 03/2016.

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## **GRUAN Lead Centre progress report 01/2016**

covering the period 03/2015 to 03/2016

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### **Summary**

Cabauw, Payerne, Potenza, and Sodankyla are official GRUAN certified sites. Beltsville is currently going through the process of certification.

Several candidate sites joined GRUAN

Presentation of GRUAN at dedicated side event during WMO congress

LC staffing back at full strength

The GRUAN Lead Centre has participated in several conferences and workshops.

The GRUAN Lead Centre participated in campaign at La Reunion.

Preparation of ICM-8.

Development of GRUAN data processing for RS92 v3.

### **Health of network**

Several candidate sites have joined GRUAN:

- BOM-sites Darwin, Melbourne, Alice Springs, Macquarie Island, Davis (Antarctica)
- Singapore
- Dolgoprudny (Moscow)

Certification process for various sites initiated and/or concluded (see achievements & work plan)

### **Lead Centre operations**

- The Lead Centre participated in the preparation of ICM-8.
- Setting up dataflow from Tateno (RS-11G)
- Testing and characterization of Vaisala RS41.
- Ongoing development of RsLaunchClient.

### Site Visits

The Lead Centre visited the following sites:

- Sodankyla; assist with setting up datastream for RS92 autosonde and CFH
- Cabauw; officially hand-over the GRUAN certificate

### GRUAN-related publications

The following GRUAN-related publications appeared in peer-reviewed literature:

- Bodeker, G. E., et al., Reference upper-air observations for climate: From concept to reality, *Bull. Amer. Meteor. Soc.*, 97, 123–135, [doi:10.1175/bams-d-14-00072.1](https://doi.org/10.1175/bams-d-14-00072.1), 2016.
- Kräuchi, A., et al., Controlled weather balloon ascents and descents for atmospheric research and climate monitoring, *Atmos. Meas. Tech.*, 9(3), 929–938, doi:[10.5194/amt-9-929-2016](https://doi.org/10.5194/amt-9-929-2016), 2016.
- Ning, T., et al., The uncertainty of the atmospheric integrated water vapour estimated from GNSS observations, *Atmos. Meas. Tech.*, 9(1), 79–92, doi:[10.5194/amt-9-79-2016](https://doi.org/10.5194/amt-9-79-2016), 2016.
- Trickl, T., et al., How stratospheric are deep stratospheric intrusions? LUAMI 2008, *Atmos. Chem. Phys. Discuss.*, 2016, 1–44, doi:[10.5194/acp-2016-264](https://doi.org/10.5194/acp-2016-264), 2016.
- Vömel, H., et al., An update on the uncertainties of water vapor measurements using Cryogenic Frostpoint Hygrometers, *Atmos. Meas. Tech. Discuss.*, 2016, 1–26, doi:[10.5194/amt-2016-44](https://doi.org/10.5194/amt-2016-44), 2016.
- Antón, M., et al., Validation of GOME-2/MetOp-A total water vapour column using reference radiosonde data from GRUAN network, *Atmos. Meas. Tech.*, 8(3), 1135–1145, doi:[10.5194/amt-8-1135-2015](https://doi.org/10.5194/amt-8-1135-2015), 2015.
- Bodeker, G. E. et al., Techniques for analyses of trends in GRUAN data, *Atmos. Meas. Tech.*, 8(4), 1673–1684, doi:[10.5194/amt-8-1673-2015](https://doi.org/10.5194/amt-8-1673-2015), 2015.
- Butterfield, D. et al., Determining the temporal variability in atmospheric temperature profiles measured using radiosondes and assessment of correction factors for different launch schedules, *Atmos. Meas. Tech.*, 8(1), 463–470, doi:[10.5194/amt-8-463-2015](https://doi.org/10.5194/amt-8-463-2015), 2015.
- Ignaccolo, R., et al., Modelling collocation uncertainty of 3d atmospheric profiles, *Stochastic Environmental Research and Risk Assessment*, 29(2), 417–429, doi:[10.1007/s00477-014-0890-7](https://doi.org/10.1007/s00477-014-0890-7), 2015, ISSN 1436-3240.
- Jensen, M. P., et al., Comparison of Vaisala radiosondes RS41 and RS92 at the ARM Southern Great Plains Site, *Atmos. Meas. Tech. Discuss.*, 8(11), 11,323–11,368, doi:[10.5194/amtd-8-11323-2015](https://doi.org/10.5194/amtd-8-11323-2015), 2015.
- Kreher, K., et al., An objective determination of optimal site locations for detecting expected trends in upper-air temperature and total column ozone, *Atmos. Chem. Phys.*, 15(13), 7653–7665, doi:[10.5194/acp-15-7653-2015](https://doi.org/10.5194/acp-15-7653-2015), 2015.
- Ladstädter, F., et al., Climate intercomparison of GPS radio occultation, RS90/92 radiosondes and GRUAN over 2002 to 2013, *Atmos. Meas. Tech.*, 8(4), 1819–1834, doi:[10.5194/amt-8-1819-2015](https://doi.org/10.5194/amt-8-1819-2015), 2015.
- Musacchio, C., et al., Arctic metrology: calibration of radiosondes groundcheck sensors in Ny-Ålesund, *Meteorological Applications*, 22, 854–860,

doi:[10.1002/met.1506](https://doi.org/10.1002/met.1506), 2015, ISSN 1469-8080.

- Sairanen, H., et al., Validation of a calibration set-up for radiosondes to fulfil GRUAN requirements, Measurement Science and Technology, 26(10), 105,901, 2015.
- Yu, H., et al., Evaluation of humidity correction methods for Vaisala RS92 tropical sounding data, J. Atmos. Ocean. Technol., 32(3), 397–411, doi:[10.1175/jtech-d-14-00166.1](https://doi.org/10.1175/jtech-d-14-00166.1), 2015.

**Progress against stated objectives**

Nr	Open items	Summary of progress
1	Technical note outlining the process that will be undertaken to certify a new program at a site with an existing certified measurement program	Document has been prepared
2	Produce a Technical Note highlighting the steps that must be achieved for a GRUAN product to be accepted ('certified') and released. WG to review criteria for acceptance	Document has been prepared
3	All sites with capability to report BUFR over GTS in NRT. Advice and tech. support to be provided by LC / WMO / GCOS on a site by site basis to all certified and candidate sites not currently reporting BUFR to attempt to enable. In first instance LC to ascertain status for each site as to why not reporting BUFR to GTS and advise Tim Oakley and Roger Atkinson.	In progress
4	Define strategy and necessary steps to undertake transition from RS92 to another sonde model. Produce GRUAN report on strategy and rationale including inter-alia: <ul style="list-style-type: none"> <li>• Sharing the burden</li> <li>• Role of ancillary measurements</li> <li>• Plans for parallel measurements</li> <li>• Ensuring competition in marketplace</li> </ul>	Document drafted, to be discussed at ICM8
6	Lead Centre to work with sites not attaining regularly 10 hPa to understand why and help improve situation. Short report from each affected site at ICM-8	Affected sites have taken steps to improve performance; mainly change of balloon type/size.

12	GRUAN information event at WMO congress to include presentations from PRs and handing of certificates.	Done. Successful event with good turn out.
13	Prepare and disseminate promotional video for GRUAN. Site reps to send segments to Greg.	Video is in final production phase
17	Each site to produce first version of photos to document seasonal and long term site changes (regular e.g. semi-annually from stated locations / daily webcam shots etc. as appropriate to their specific case, and 'on change'). Uploaded to GRUAN website. LC to instigate mechanism to remind sites.	Several sites have submitted photo material. Further implementation pending development of new GRUAN website.
18	Develop first draft of GRUAN radiosonde generic technical document omnibus	Delayed by staffing issues at LC.
19	Develop GRUAN data product and processing stream for Modem radiosondes. First draft of technical document describing processing streams for all Modem radiosondes	Document and processing software under development by Meteomodem.
20	Lead Centre and US National Weather Service Sterling facility to meet in person to discuss collaboration and advise Working Group	Pending.
21	Technical Note on the appropriate techniques for manufacturer independent ground checks using the SHC. Paper submitted to peer review documenting scientific rationale	Additional experiments have been performed on non-RS92 radiosondes to supply
25	Develop a GRUAN ozonesonde data product in consultation with NDACC and GAW. Completed technical documents	In progress, task is lead by G. Bodeker and J. Witte
26	Revise the RS92 data stream based upon feedback received - revised version 3 release including qc flags vectors and data in different vectors (good, questionable, missing), including implementation of performance feedback. Validate new radiation correction using ancillary measures to build confidence (paper). Document v3 appropriately.	In progress. Version 3 of GRUAN data processor is still under development
29	Define the GNSSPW data collection client requirement, initiate data flow	

### **Achievements**

- Well-received presentation of GRUAN at dedicated side event during WMO congress
- Cabauw, Payerne, Potenza, and Sodankyla have become GRUAN-certified sites.
- Ongoing development of RsLaunchClient (current version: 0.5.12)
- LC-funded cooperation with GFZ resulted in development of GNSS data product, paper published in AMT (DOI: [10.5194/amt-9-79-2016](https://doi.org/10.5194/amt-9-79-2016))
- Presentation (poster) at GCOS science conference

### **Training by Lead Centre**

- Training of AWI staff going to Ny Alesund
- Training of Geomar staff going on cruise in the Arctic
- Instruction of GRUAN principles and procedures for GRUAN-PhD student
- Training of ETH staff in preparation and launch of CFH and RS41 for StratoClim campaign
- Training and assisting staff at La Reunion in preparation and launch of CFH during MORGANE-2 campaign.

### **Issues**

- Staffing: as a consequence of the appointment of new Lead Centre head one of the GRUAN-scientist positions was vacant until November 2015.

### **Work plan for next six months**

- Participate in StratoClim campaign
- Completion of Beltsville and Tateno site certification application.
- Work on the GRUAN radiosonde omnibus.
- Redesign the GRUAN website and its communication tools to facilitate more flexibility regarding content management, e.g. shared editing permissions for certain parts of the website.
- Complete the development of a new GRUAN data processor, and version 3 of the RS92-GDP. This version will digest DC3DB and MWX file formats, and it will be easily customized for processing data of other radiosonde types.
- Coordinate RS92-RS41 transition within GRUAN
- Continue testing and characterization of the RS41