

**2nd GRUAN Implementation-Coordination Meeting (ICM-2)**

Payerne, Switzerland  
2-4 March 2010

Item 1.2

**(Lead Centre report on progress)**

*(Submitted by Holger Vömel, Head GRUAN Lead Centre)*

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**Summary and Purpose of Document**

This document contains the GRUAN Lead Centre progress report 01/2010, covering the period 08/2009 to 01/2010.

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**GRUAN Lead Centre progress report 04/2010**

covering the period 08/2009 to 01/2010

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**Summary**

The Lead Center, NOAA/NCDC, and DOE/ARM held a meeting to discuss the data flow and data dissemination of data generated within GRUAN as well as to establish a unified QA/QC for Vaisala RS92 observations within GRUAN. An understanding was reached between the Lead Center, NOAA/NCDC and DOE/ARM about their respective roles in the distributed processing and data archiving of GRUAN data.

The definition of measurement uncertainty, traceability and the requirements for an operational network in metadata collection has been completed in cooperation with the Working Group on Atmospheric Reference Observations. This document will be the key for the uniform treatment of uncertainties across the network and serve to improve the data quality of the existing observing systems.

A workshop discussing the results of the Lindenberg Upper Air Methods Intercomparisons (LUAMI) was held at Lindenberg in September 2009.

The Lead Center participated in the preparation of the upcoming CIMO radiosonde intercomparison at Yangjiang, China. Holger Vömel represented the Lead Center in the expert team that conducted a site visit in Yangjiang and will be coordinating the scientific sounding instrument payloads, which will be part of this intercomparison campaign.

In January 2010 a campaign comparing the Vaisala RR01 reference radiosonde with other scientific in situ instruments (CFH and FLASH) was conducted at the GRUAN station Sodankylä in cooperation with Vaisala, the Lead Center and the GRUAN station at Lindenberg. This campaign was an intensive test of the prototype reference radiosonde under development at Vaisala.

**Health of network**

The network is not yet operational	
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**Progress against stated objectives****Objective and due date****Summary of progress**

Objective and due date	Summary of progress
2. develop definition for optimal GRUAN site to decide on future sites (optimal location/climate zone, institution etc.)	not yet started. The experiences and lessons learned at the different GRUAN sites will be key to the definition of an optimal GRUAN site. The site certification process, which has yet to be established, needs to be considered. This task will commence with the operational start of the

	network and the definition of the site certification and evaluation process within GRUAN.
3. write a GRUAN implementation plan, reaching out until at least 2013	Completed. The GRUAN implementation plan has been published as document <a href="#">GCOS 134 (WMO/TD No. 1506)</a> .
4. develop a common GRUAN definition and terminology for measurement uncertainty and stability. A guide that ensures the quality of all GRUAN measurements (including a common definition of terminology: accuracy, stability, uncertainty etc.)	A manuscript describing the definition and methods of establishing measurement uncertainties has been completed and has been submitted to the peer reviewed journal <a href="#">Atmospheric Measurement Techniques</a> . After acceptance of this publication a working document will be prepared that will serve as operational reference for GRUAN.
5. develop a case study for such a guide focusing on in-situ observations	Temperature measurements using Vaisala RS92 radiosondes will be used as case study. Many parameters of the Vaisala RS92 have been tested and documented, thus information to perform this case study is available. A ground check independent of the manufacturers ground check is in place at Lindenberg to test temperature (additionally also humidity, and pressure) measurements under controlled conditions before launch. This case study will establish and validate the measurement uncertainty using Vaisala radiosondes. Different sources of measurement uncertainty are being discussed, as well as how they have been established and how they have been validated. These results will be presented at ICM2.
6. prepare a position paper on a process to manage change and optimize intercomparisons at GRUAN sites	A post related to this issue was published at the <a href="#">GRUAN blog</a> and remains open to discussion.
7. establish and maintain an inventory of GRUAN sites using a common template	Ongoing. Currently 50% of sites have contributed to this inventory; however, the information from ARM not yet complete constitutes nearly all of the open sites.
8. address immediate questions by sites	Completed. Questions by sites have been addressed and are open to discussion at the GRUAN blog: <a href="http://gruan.wordpress.com/category/faq">http://gruan.wordpress.com/category/faq</a> .
9. develop a communication platform for the GRUAN community (blog, wiki, FAQ, other?)	Completed. The Lead Center has implemented a section of Frequently Asked Questions, which may be updated regularly and which is currently available both at the GRUAN web site ( <a href="http://www.gruan.org">www.gruan.org</a> ) and at the GRUAN blog ( <a href="http://gruan.wordpress.com">http://gruan.wordpress.com</a> ). The pages at the GRUAN web site are static pages that are maintained by the GRUAN Lead Center, whereas the pages at the blog can receive contributions by the GRUAN community. These pages are

	administered by the GRUAN Lead Center, and contributions require a one time approval to avoid illegitimate abuse of the site.
11. formalize links between Lead Centre and NCDC, ARM program regarding data dissemination, investigate value of NDACC / BADC involvement for high-res in-situ	<p>On 28 and 29 September 2009 a meeting between Lead Center staff and NOAA/NCDC took place in Asheville, NC, reaching a mutual understanding about the cooperation between the Lead Center and NOAA/NCDC.</p> <p>On 30 September 2009 a meeting of Lead Center staff and ARM staff took place at the ARM Data Archive at Oak Ridge National Laboratories, Oak Ridge, TN. This meeting addressed remaining issues of the cooperation between ARM and the Lead Center.</p> <p>Details of both meetings are described below.</p>
12. develop proposal to define data dissemination among all GRUAN partners	Completed (see details below).
13. provide a list of technically competent potential participants (2-3) in 2010 CIMO intercomparison campaign in China to CIMO Secretariat; Head of LC to be formally involved in the organization of the campaign	GRUAN will participate in the 2010 CIMO intercomparison campaign in China, represented by Holger Vömel as part of the organizing committee and by Junhong Wang and Masatomo Fujiwara of the working group as technical experts.
14. foster participation of research radiosondes in CIMO intercomparison campaign	The CIMO intercomparison campaign will include payloads carrying scientific sounding instruments in addition to those carrying approved routine operational radiosondes. The scientific sounding instruments payload will include instruments that provide observations of atmospheric parameters in altitude regions where routine operational sensors show their limitations. The Lead Center in cooperation with Dr. Fujiwara is actively pursuing the participation of Cryogenic Frostpoint Hygrometer (CFH) sondes and a discussion between Howard University and Dr. Wang is currently ongoing to contribute multithermistor sondes to this campaign. This payload is also scheduled to carry the reference radiosonde RR01 manufactured by Vaisala. Since this instrument is not yet an operational product, this reference radiosonde would participate under the scientific sounding instruments payloads and not follow the strict evaluation criteria for operational instruments.
15. nominate members on expert team analyzing results from CIMO intercomparison campaign	see 13.

16. perform gap analysis on existing documentation (manuals) vis-a-vis the adopted skeletal GRUAN manual of operation, and provide a summary document of where these gaps are.	not yet started.
17. submit proposal for WIGOS-PP in conjunction with development of GRUAN IP	Completed. The <a href="#">WIGOS pilot project proposal</a> has been submitted to the WIGOS expert group.

### Achievements

- On 28 and 29 September a meeting between Lead Center staff and NOAA/NCDC took place at the NOAA/NCDC office in Asheville, NC, reaching a mutual understanding about the cooperation between the Lead Center and NOAA/NCDC. The detailed report of this meeting can be found at <http://www.gruan.org> or at <http://gosis.org/whatsnew.htm>. Participants attending this meeting were associated with NOAA, DOE/ARM, UCAR, and the Lead Center at DWD/MOL. The GRUAN Lead Center was represented at this meeting by Holger Vömel and Michael Sommer.

According to the agreement reached at the Implementation and Coordination Meeting at Norman, Oklahoma, the goal of this meeting was to formalize the links between the Lead Center, NOAA/NCDC, and DOE/ARM and to establish a formal path of data processing and data dissemination. The scheme underlying the data flow within GRUAN is based on a distributed data archive, in which different functions of the data processing chain and data archive are being hosted by different agencies, utilizing the strength of each partner. The discussions included the following topics: 1) Data archiving capabilities at NCDC and ARM; 2) Capabilities of the meta-database, which will be located at the Lead Center; 3) Development of a data dissemination portal that links the meta-database and the GRUAN archive with the data users; 4) The role of NCDC and ARM in radiosonde QA/QC; 5) Organizing data flows from the GRUAN sites, through a QA/QC institution to the GRUAN data archive. It was agreed that the Lead Center will work with NCDC on the GRUAN data flow with respect to NCDC data dissemination capabilities. Key personnel involved in this activity established a first contact. It was further agreed that all RS92 observations within GRUAN sites will first be collected in Lindenberg, where they will be formatted into the ARM Climate Research Facility (ACRF) NetCDF format and sent to ACRF for standard processing. This step will ensure that all Vaisala RS92 observations pass through the same processing and QA/QC steps. The processing at Lindenberg will then add uncertainty estimates to all Vaisala RS92 observations before distributing the data through NCDC. The Lead Center will work with NCDC on establishing metadata definitions and will work with ACRF on defining the proper NetCDF file format. The data management plan that summarizes this meeting will be presented at ICM2. A follow-up meeting took place at the ARM Data Archive at the Oak Ridge National Laboratory. This meeting served to provide a background on the experiences and lessons learnt by ARM and focused on the details of the collaboration between the Lead Center and ARM.

- The Lindenberg Upper Air Methods Intercomparison ([LUAMI](#)) campaign workshop was held in Lindenberg on 21 - 23 September 2009. One of the key achievements of this campaign was the use of the Water Vapour LIDAR Experiment in Space (WALES) onboard the research aircraft Falcon of DLR as transfer instrument to compare Raman LIDAR and sonde launches at 4 different locations (Payerne, Cabauw, Lindenberg and Zugspitze). While the comparisons at Payerne, Cabauw, and Lindenberg showed excellent agreement within these systems, issues were identified at the Zugspitze LIDAR, which were subsequently addressed and corrected. Temperature measurements by the radiosondes participating in this comparison agreed for tropospheric measurements on average to within 0.2 K. Larger discrepancies occurred when the balloon exited clouds, temporarily exceeding more than 1 K. In the stratosphere night-time differences were generally less than 0.2 K, whereas day-time differences were generally lower than about 0.5K. For relative humidity measurements a larger spread of observations was found. In the lower troposphere the different instruments agreed largely to within 5% RH; larger

differences mainly occurred do to cloud water contamination. In the upper troposphere agreement between different instruments was poorer and occasionally large discrepancies of 30% RH or more were observed. One reason for these larger differences is again the radiation error. However, since even at night time substantial differences were observed other factors contribute to the overall poor agreement.

In the stratosphere excellent agreement was found between FLASH and CFH, repeating results from previous studies. Current commercial radiosonde sensors did not deliver useable data in the stratosphere. Data from the VFS100 (formerly APS) were well correlated to the measurements from the CFH and FLASH, but with a consistent bias, which is still under investigation. The good correlation with CFH and the good upper tropospheric performance indicate potential of this sensor.

The Lindenberg Raman LIDAR Ramses participated in LUAMI and provided good data on a few clear nights that occurred during LUAMI. Most importantly the system provided excellent data during the aircraft, balloon, and LIDAR intercomparison night involving WALES. Overall in 2008 Ramses performed measurements during 130 nights with acceptable data quality. The LIDAR is calibrated using radiosonde data at low altitude (1-3 km) which are launched in Lindenberg every 6 hours. The Calibration is performed whenever co-incident LIDAR and Radiosonde data are available.

Several other remote sensing instruments participated in LUAMI; however, it remains difficult to bring these inhomogeneous systems together, allowing a consistent cross-evaluation of their data products in particular under consideration of the respective measurement uncertainties. The discussions concerning measurement uncertainties were especially fruitful and the strengths and limitations of some observing systems regarding uncertainty estimates became apparent.

- In January 2010 further tests of the Vaisala reference radiosonde have been conducted at the GRUAN station at Sodankylä in cooperation with Vaisala, the Lead Center and the GRUAN station at Lindenberg. These tests were conducted as part of the Lapbiat 2 campaign organized by the Finnish Meteorological Institute (FMI). Over twelve soundings of multiple instrument payloads have been launched including early test models of the Vaisala RR01 reference radiosonde, the Cryogenic Frostpoint Hygrometer (CFH), the FLuorescent Advanced Stratospheric Hygrometer for Balloon (FLASH-B), the Cobald backscatter sonde, the Internet RSB1 radiosonde and the routine Vaisala RS92 radiosonde in various combinations. FLASH and CFH again showed good agreement in stratospheric measurements, whereas previously unidentified issues of the Internet RSB1 radiosonde were found. The use of the backscatter sonde allowed the identification whether observations took place inside clouds or in clear air. Further comparisons are planned both at Sodankylä as well as at Lindenberg. This campaign served as preparation for the upcoming CIMO intercomparison at Yangjiang, China.

- In response to requests by the Lead Center, Vaisala published details about the history of changes made to the Vaisala RS92 radiosonde (<http://www.vaisala.com/>). This data continuity document is an important source of information detailing the consistency of the Vaisala RS92 radiosonde production and is essential for evaluating the impact of changes in the manufacturing of radiosondes, which will be used within GRUAN. It is hoped that other instrument manufacturers can provide similar documentation.

- The participation of research radiosondes in the upcoming CIMO intercomparison campaign at Yangjiang, China is actively supported through the involvement of the Lead Center and two GRUAN experts in this campaign. Holger Vömel was member of the WMO expert team that conducted a site visit at Yangjiang between 29 August and 6 September 2009 and he is currently in charge of coordinating the scientific sounding instruments component of this comparison. The site visit report can be found at <http://www.wmo.int>

### **Lead Centre operations**

The Lead Center is still understaffed; however, Marion Fiedler is expected to return from maternity leave in summer 2010. Michael Sommer participated in a 6 week intensive English

training course.

**Work plan for next six months**

- Implementation and Coordination Meeting (ICM2) at Payerne in March 2010
- Establishing recommended ground measurements for sonde launches
- Start of observations at the different site.
- Implementation of the data processing scheme
- Additional work, such as added ground checks, theoretical studies and adaptation of software will be ongoing.