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Item 2.1

GRUAN Lead Centre progress report 02/2009 (covering the period 08/2008 to 01/2009)

(Submitted by GRUAN lead centre)

Summary and Purpose of Document

This documents contains the GRUAN Lead Centre progress report 02/2009, covering the period 08/2008 to 01/2009.

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Summary

The main item of progress for the past reporting period is the completion of the Lindenberg Upper Air Methods Intercomparison (LUAMI) campaign, which provided a number of lessons that will be included in the setup of GRUAN. This campaign brought together several radiosonde manufacturers (Vaisala, Graw, Meteolabor, Intermet South Africa) as well as a number of different research groups (ETH Zuerich, observatory Payerne, Central Aerological Observatory Moscow and and Lindenberg observatory, for the sounding portion and Lindenberg observatory, DLR, FZK Garmisch, and De Bilt for additional lidar observations) to intercompare a number of instruments either in situ or at different sites. In addition to the scientific and technological results, this campaign served as training ground for the lead centre staff and provided a first experience in handling an inhomogeneous data set from different stations and different instruments. These experiences contribute to the development of the data processing and data flow strategy that is being investigated at the lead centre.

The lead centre has set up a web site (www.gruan.org), which is hosted at the German Weather Service (www.dwd.de/gruan). This site will be used as tool for communication and exchange of information with the GRUAN community, the scientific community and the general public.

A focus on vertically resolved measurement uncertainties is expected to address some of the unresolved problems that impact the start up of the GRUAN network. (See details below)

Significant events in reporting period

Health of network

Progress against stated objectives

Objective and due date	Summary of progress
1. Evaluate the radiation correction for the temperature measurement of each radiosonde.	The radiation correction is the main source of uncertainty for temperature measurements. Experiments at the Lead Centre have measured the radiation effect on the RS-92 temperature sensor (as well as the humidity sensor). Model calculation of the radiation transfer indicates that the cloud albedo plays a crucial part in the radiation error. Based on these studies the uncertainty of the radiation correction can be established for this particular sensor. Stations, with the support by the lead centre, will need to address this issue, once their observation program is in place. A comparison of the different methods of radiation correction and the calculation of the corresponding uncertainty is in preparation and will be discussed in an upcoming LUAMI workshop.
3. Develop a strategy for detecting change in the measurement quality at GRUAN site, such as periodic intercomparison between instruments as often as possible at suitable intervals at each selected GRUAN sites	The lead centre promotes an advanced data analysis scheme, which will provide not only the measured quantity, but also the best estimate of the vertically resolved measurement uncertainty (quality quantification). This additional piece of information is expected to provide the key metric in instrument intercomparisons and should

	allow a quantification of changes to be expected through changes in instrumentation. A lot of additional work is required in establishing vertically resolved uncertainties, since this has not yet been done in disposable sounding equipment. Another important piece for insuring long term stability and high quality of the record is the documentation and publication of all processing steps. For this GRUAN will archive the most basic data produced by the instruments. All correction and evaluation procedures that apply to data in order to calculate the final product should be documented and published. This allows a homogenization of data at any time if inconsistencies are detected at a later stage.
4. Organize major intercomparison of operational and research radiosondes to choose which can qualify for use in the GRUAN network.	LUAMI served as test bed for a large major intercomparison for GRUAN. The experiences learned here will contribute to future intercomparisons.
5. First draft of manual / guidelines for GRUAN observations (assuring comparability, spreading best practices, sharing lessons, reporting)	A first draft of a manual for GRUAN observations and guidelines has been prepared by the GCOS secretariat. A revision of this draft based on the experiences of the routine operations at Lindenberg and those gathered during LUAMI is pending. Discussions at the workshop are expected to contribute strongly to the manual draft.
7. Develop a matrix / spreadsheet with criteria for initial and potential sites	No action yet taken. A solution of the instrument question is needed before a criteria matrix can be established. The experiences of the initial sites will be a key contribution to the development of future sites.
9. Establish data policy	Data policy has been agreed upon and is established.
10. Consider various options on data dissemination	The lead centre has developed a strategy for data dissemination, which will be discussed at the upcoming 1st Implementation-Coordination Meeting
11. Devise data dissemination practices (model, format, metadata, monitoring of usage)	See point 10
Other achievements Two flights of the DLR Falcon (coordinated by DLR) over the sites at Zugspitze, Payerne, De Bilt (Cabauw), and Lindenberg as part of LUAMI, showed that an airborne lidar system can be used as transfer standard for profiling observations of water vapour between different stations. Timing at all sites was nearly perfect. In addition the aircraft trajectory considered the balloon trajectory at Lindenberg to minimize spatial inhomogeneities. The analysis of these data is ongoing. In addition to the routine observations the Lindenberg observatory has started regular reference radiosoundings that will serve as the nucleus of GRUAN observations. Once a month, a payload that includes CFH, SnowWhite and RS90/92 FN sensors is launched. FLASH soundings may be launched in addition as they become available.	
Lead Centre operations Marion Fiedler will be on maternity leave beginning in June 2009 and the lead cen-	

tre staff will be temporarily reduced by one person. This will impact some of the support functions within the lead centre but it is not expected to cause any scientific impact. Funding and positions are secure.

Issues arising for WG discussion and feedback to the lead centre

The requirements of GCOS 121 about which sonde technology may be used for GRUAN require careful consideration. For UT/LS observations of water vapour, only two instruments are available (FLASH and CFH); however, neither is available at a larger scale. Other technology for stratospheric work is not in sight. The requirement of GCOS 121 to launch the best technology available at a site continues to create some confusion, since currently no metric exists to quantify what the "best technology available at a site" is (quality quantification). Thus the lead centre recommends that the major criterion of an observational method for GRUAN may be the complete analysis of its uncertainty budget. This will allow establishing vertically resolved error bars for all measurement parameters. The advantages of this approach are:

- A better insight into the quality of each sensor.
- A metric against which to evaluate sensor comparisons
- An indication for where critical weaknesses of sensors lie
- A metric to compare the performance of different sensors at different stations
- Information up to which altitude a quantity can be used (in particular water vapor), depending on application
- Documentation of known sources of uncertainty, which is currently not available

This task will take considerable work, which will be shared among the different stations and manufacturers involved in GRUAN.

Vaisala has announced an initiative to build a reference radiosonde. Towards this end, Vaisala tested a new humidity sensor (APS) during LUAMI. This move is appreciated and welcome, combined with the hope that other manufacturers start similar efforts. To enable a broader industrial support a common and open interface protocol for external instruments to be used on radiosondes should be promoted. This interface should allow sensor manufacturers to provide (possibly superior) sensors, which could be used on routine radiosondes used in GRUAN. This would be in the interest of GRUAN since sensors could be intercompared at different sites without the need to intercompare the entire radiosonde system at the sites involved. A common protocol shared between all manufacturers will also strengthen research in that field and provide a wider base for observational technologies. This would ultimately strengthen the manufacturers as well.

Risk register

Work plan for next six months

- 1st implementation coordination meeting
  March 2-4. Combined with additional work at Beltsville
- Establishing recommended ground measurements for sonde launches
- Start of observations at the different sites
  We expect that sites can start producing the first data under the GRUAN label. Additional work, such as added ground checks, theoretical studies and adaptation of software will be ongoing.
- Implementation of the data processing scheme
  Data processing will commence according to the agreements at the workshop
- Implementation of data dissemination scheme
  Data dissemination will commence according to the agreements at the workshop
- Implementation of uncertainty analysis scheme
- Preparation of LUAMI workshop