GRUAN Lead Centre progress report 01/2018

Covering the period 05/2017 to 04/2018

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Summary

Tateno has been certified.

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

The GRUAN Lead Centre participated in StratoClim campaign in Nepal.

Co-organization of ICM-10.

Development of GRUAN data processor for GNSS-WV (cooperation with GFZ).

Development of GRUAN data processing for RS41 and RS92.

Coordination of RS92-RS41 transition.

Health of network

The network comprises 26 sites.
Dakar was invited by WMO to become candidate site.
Certification of Tateno has been completed. In total 10 sites have been certified.
Certification process ongoing for Lamont (SGP).

Lead Centre operations

- Operationally running GRUAN data management server - GDMS (24/7).
- Operationally running GRUAN meta-data data base - GMDB (24/7).
- Operationally working GRUAN file archive - GFA (24/7).
- Ongoing development and optimization of all GRUAN server software components, GDMS, GMDB, GFA.
- Ongoing development on several software tools for use at sites, e.g. RsLaunchClient, LidarRunClient, gt92, gtRsl, gm41.
- Regularly update of data flow statistic plots (available at website).
- Configuring radiosonde data flow for new GRUAN sites: Tenerife, Dolgoprudny, Minamitorishima, Syowa.
- The Lead Centre was actively involved in co-organizing ICM-10 together with AWI.

- Configuring data flow for sites switching to RS41.
- Continued testing and characterization of Vaisala RS41.
- Coordination RS92-RS41 transition.
- Ongoing development GRUAN data processor.

Visitors to LC

- Thierry Leblanc, June 2017, LidarRunClient.
- Tom Gardiner & David Medland (NPL) July 2017, GRUAN-GAIA/CLIM.
- Korea Research Institute of Standards and Science (KRISS) CoreTemp2017 Campaign, September 2017.
- GUAN task team meeting, December 2017.
- Vaisala, discussion/coordination, March 2018.

Instrument research

The following activities were undertaken in testing and/or characterizing research instruments and radiosondes

- FLASH-B.
- RS41, RS92 (lab & intercomparison).

Site Visits

Visit to INRIM, Turin, November 2017.

Conferences

- ICAWS, Offenbach, October 2017.
- StratoClim meeting, Rome, November 2017.
- SPARC UTLS workshop, Mainz, February 2018.

GRUAN-related publications

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

- Borger, C., M. Schneider, B. Ertl, F. Hase, O. E. García, M. Sommer, M. Höpfner, S. A. Tjemkes, and X. Calbet, Evaluation of MUSICA MetOp/IASI tropospheric water vapour profiles by theoretical error assessments and comparisons to GRUAN Vaisala RS92 measurements, Atmos. Meas. Tech. Discuss., 2017, 1–37, doi:10.5194/amt-2017-374, 2017, https://www.atmos-meas-tech-discuss.net/amt-2017-374/.
- Brunamonti, S., T. Jorge, P. Oelsner, S. Hanumanthu, B. B. Singh, K. R. Kumar, S. Sonbawne, S. Meier, D. Singh, F. G. Wienhold, B. P. Luo, M. Böttcher, Y. Poltera, H. Jauhiainen, R. Kayastha, R. Dirksen, M. Naja, M. Rex, S. Fadnavis, and T. Peter, Balloon-borne measurements of temperature, water vapor, ozone and aerosol backscatter at the southern slopes of the Himalayas during StratoClim 2016-2017, Atmos. Chem. Phys. Discuss., 2018, 1–38, doi:10.5194/acp-2018-222, 2018, https://www.atmos-chem-phys-discuss. net/acp-2018-222/.

- Calbet, X., N. Peinado-Galan, P. Ripodas, T. Trent, R. Dirksen, and M. Sommer, Consistency between GRUAN sondes, LBLRTM and IASI, Atmos. Meas. Tech., 10(6), 2323–2335, doi:10.5194/amt-10-2323-2017, 2017, https://www.atmos-meas-tech.net/10/2323/2017/.
- Kremser, S., J. S. Tradowsky, H. W. Rust, and G. E. Bodeker, Is it feasible to estimate radiosonde biases from interlaced measurements?, Atmos. Meas. Tech. Discuss., 2018, 1–13, doi:10.5194/amt-2018-6, 2018, https://www.atmos-meas-tech-discuss.net/amt-2018-6/.
- M. de Podesta, S. Bell, and R. Underwood, Air temperature sensors: dependence of radiative errors on sensor diameter in precision metrology and meteorology, Metrologia, 55(2), 229, doi:10.1088/1681-7575/aaaa52, 2018, http://stacks.iop.org/0026-1394/55/i=2/a=229.
- von Rohden, C., T. Naebert, M. Sommer, and R. Dirksen, Temperaturmessung in der atmospähre mit radiosonden, Technisches Messen, 84(12), 804–813, doi:10.1515/teme-2017-0074, 2017, ISSN 2196-7113.
- Tradowsky, J. S., G. E. Bodeker, R. R. Querel, P. J. H. Builtjes, and J. Fischer, Combining Data from the Distributed GRUAN Site Lauder-Invercargill, New Zealand, to Provide a Site Atmospheric State Best Estimate of Temperature, Earth System Science Data Discussions, 2018, 1–23, doi:10.5194/essd-2018-20, 2018, https://www.earth-syst-sci-data-discuss.net/essd-2018-20/.
- Vérèmes, H., G. Payen, P. Keckhut, V. Duflot, J.-L. Baray, J.-P. Cammas, J. Leclair De Bellevue, S. Evan, F. Posny, F. Gabarrot, J.-M. Metzger, N. Marquestaut, S. Meier, H. Vömel, and R. Dirksen, A Raman lidar at Maïdo Observatory (Reunion Island) to measure water vapor in the troposphere and lower stratosphere: calibration and validation, Atmos. Meas. Tech. Discuss., 2017, 1–38, doi:10.5194/amt-2017-32, 2017, http://www.atmos-meas-tech-discuss.net/amt-2017-32/.
- Weatherhead, E. C., G. E. Bodeker, A. Fassò, K.-L. Chang, J. K. Lazo, C. T. M. Clack, D. F. Hurst, B. Hassler, J. M. English, and S. Yorgun, Spatial Coverage of Monitoring Networks: A Climate Observing System Simulation Experiment, J. Appl. Meteor. Climatol., 56(12), 3211–3228, doi:10.1175/JAMC-D-17-0040.1, 2017, https: //doi.org/10.1175/JAMC-D-17-0040.1.
- Weaver, D., K. Strong, M. Schneider, P. M. Rowe, C. Sioris, K. A. Walker, Z. Mariani, T. Uttal, C. T. McElroy, H. Vömel, A. Spassiani, and J. R. Drummond, Intercomparison of atmospheric water vapour measurements at a Canadian High Arctic site, Atmos. Meas. Tech., 10(8), 2851–2880, doi:10.5194/amt-10-2851-2017, 2017, https://www.atmos-meas-tech.net/10/2851/2017/.

Progress against stated objectives		
Nr	**Action**	**Summary of progress**
1	Lead Centre to provide a first cut at the RS41 GDP by no later than ICM-10 and provide to GRUAN community for analysis (alpha / beta). Use the GAIA-CLIM traceability chain approach developed by NPL and applied for RS92v2 product to guide product creation and consideration of correlated, structured random and random components. Session on RS41 GDP preparation at ICM-10. **Lead Centre, TT radiosondes**	Further development of RS41 data product pending on proper interpretation of results from radiation experiments. See presentation at ICM-10
2	Qualify currently available candidate data streams available via the LC (Meisei and SRS) according to the guidance in GRUAN-TN4. Requires the steps denoted in TN4 to be satisfied. Either data served via NOAA NCEI or action plan for each stream of required further steps available by ICM-10 **WG-GRUAN, LC, TT sites, TT radiosonde**	Technical Document for Meisei data products was reviewed and published (GRUAN-TD-5)
3	An assessment of the advantages and disadvantages of manual vs. autosonde launches written up and submitted to the peer reviewed literature. First define the critical questions to answer which would appear to be at least: i) Can we create a GDP?; ii) Is there a bias between manual and autolaunched?; iii) Does the random uncertainty change?; iv) impact of lifetime in launcher (quality, SHC repeatability, and height attained);. Could compare manual / autosonde dual against LC arisen database of manual/manual dual launch to get at iii) **TT radiosondes and LC**	Preliminary analysis was performed on data available at LC. Data from other sources will be included and combined with analyses already performed in the past.
4	Develop first draft of GRUAN radiosonde generic technical document omnibus. Available for review. **LC, TT radiosondes, non-instrument experts, WMO ET (to review)**	In progress. Awaiting input from co-authors. Current draft version (>90 pages) has been circulated for pre-review.

5	Paper describing the GRUAN change management replacement strategy submitted to peer-reviewed journal (GI) to increase visibility of effort and get broad community buy-in. **LC, TT radiosondes, WG-GRUAN**	Manuscript almost ready for submission
6	Lead Centre to augment parallel soundings of RS92-RS41 with satellite co-locations and 'ancillary' measurements (CFH, FPH, lidar, MWR, satellites, cloud observations (incl. BSRN) within +/-2 hours). **LC, TT ancillary measurements, TT sites, TT GNSS-PW**	RS92, RS41 & CFH/FPH data are available. Discussion with NPROVS team on how to merge with satellite data
7	Lead Centre and Greg Bodeker to continue to work with BoM to instigate an intercomparison campaign for RS92-RS41 transition at the tropical Darwin site recognising current lack of a sustained tropical characterisation assessment. **LC, BoM, Greg Bodeker**	Discussion with BoM (Matt Tully) ongoing
8	Arrange for the inclusion of MO and BAS parallel soundings data in the RS92-RS41 transition. Report at ICM-10. Particular interest in St. Helena given paucity of tropical locations. **LC, Tim Oakley**	In progress
9	GRUAN WG, Lead Centre and GCOS secretariat to draft letter to send to countries hosting GUAN sites that run / ran RS92 to survey plans and advocate to undertake some degree of parallel measurements and submit to GRUAN Lead Centre collection. Letter to go from Tim as GCOS network manager to GCOS focal points. **WG Chairs, GCOS secretariat, LC**	Letter has been drafted

10	Lead Centre, based upon results to date to advise sites of whether particular conditions are most uncertain and therefore when (under what conditions) launches of dual configurations may derive most value. The parallel soundings as a whole should represent a wide variety of conditions across the network and at each site. **LC, TT radiosonde, TT sites, Alessandro Fasso's ad hoc group**	Overview of conditions during RS92-RS41 twinsoundings will be presented at ICM-10
11	Several techniques to be pursued (including use of satellites, NWP, ancillary) to analyse the effects of the transition both on manufacturer processed and GRUAN processed (when available for RS41) data products arising from dual flights. Updates available for ICM-10 (2-page written summaries a month in advance and talks in transition session) **Science Coordinators (or TT on RS92/41 transition analysis), LC, TT radiosondes, TT ancillary measurements**	No progress to report
12	Given agreed priority of RS41 GDP over RS92v3 product generation develop short-term 'fix' to enable v2 processing to be applied to RS92 soundings lodged using the MW41 ground equipment. **Lead Centre**	Completed. All RS92 soundings performed with MW41 (mwx files) have been (re)processed
13	Technical note on guidance on site survey photos and upload instructions. Current site photo surveys to be uploaded to appropriate area of website. LC to instigate mechanism to remind sites to submit new photos. **Lead centre, TT Sites**	Pending
14	Develop GRUAN data product and processing stream for Modem radiosondes. First draft of technical document describing processing streams for all Modem radiosondes. Initial data stream available for evaluation by Lead Centre. **CNRS, Lead Centre, TT Radiosondes**	Beta version of product has been developed. Presentation at ICM-10 to report on current status

17	Take necessary steps to be in a position to qualify the Ozonesonde GDP starting after ICM-10. Remaining steps are review of Technical Document, peer reviewed description of product and provision of a beta test data stream to LC. **Greg Bodeker, Jacquie Witte, Lead Centre**	Ozone TD under review
18	LC and Bodeker scientific to instigate failsafe backup of the raw data that is offsite of Lindenberg **LC / Greg Bodeker**	Due to discontinued involvement of Bodeker Scientific in GRUAN, alternative backup location will be offered by CNR-IMAA (Fabio)
19	Lead Centre to create a filter that spits out to each site a list of the likely overpass coincident times within a defined radius based upon the EUMETSAT occultation forecast product. Emailed weekly. **LC, TT Sites**	Completed
20	Prepare a strategy document (2-sides max) to address the remaining steps required for instigation of a frostpoint hygrometers GDP for presentation and discussion at ICM-10 **Lead Centre, TT Radiosondes, TT sites**	No progress
21	WG-GRUAN and LC to ensure certification and auditing of sites on the agreed upon timetables and verify against these targets at ICM-10 **Greg Bodeker, Lead Centre**	Site certification of Tateno completed, ARM/SGP in progress.
22	Lead Centre to provide automated reports on 2017 performance no later than Jan 20th. Sites to append site report no later than Feb 15th to inform ICM-10. WG-GRUAN members to read site reports prior to ICM-10 **TT Sites, Lead Centre, WG-GRUAN**	Completed
25	Lead Centre staff to consider the various feedback and suggestions received on the issues raised at ICM-9 on the radiation chamber results. To the extent resources, technical and practical considerations permit perform further experimentation and report a substantive update at ICM-10. **Lead Centre**	New radiation chamber has been designed and constructed. On display during site visit.

Achievements

- Contribution to ARM proposal RIVAL (RS92-RS41 comparison).
- Development of GRUAN data processor for GNSS-WV (cooperation with GFZ).
- Data processing for RS92 mwx files.

Technical documentation published:

- GRUAN-TD-5 - *Technical characteristics and GRUAN data processing for the Meisei RS-11G and iMS-100 radiosondes.*

Training by Lead Centre

- On-site training and assisting staff in Kathmandu (Nepal) in preparation and launch of CFH during StratoClim campaign.
- Training of staff from Forschungs Zentrum Jülich (FZJ) in preparation and operation of CFH/Ozonesonde.

Issues

- Staffing: despite staffing being at nominal level, the LC is understaffed to perform and/or support all tasks, research activities and campaigns that need to be done.

Work plan for next 12 months

- Complete the development of a new GRUAN data processor.
- Develop GRUAN data product for RS41 (RS41-GDP.1).
- Develop GRUAN new version of data product for RS92 (RS92-GDP.3).
- Complete the GRUAN radiosonde omnibus.
- Prepare WMO-CIMO Radiosonde intercomparison campaign.
- Recertify sites (Lindenberg and Ny-Alesund).
- Further coordinate RS92-RS41 transition within GRUAN.
- Further develop the GRUAN website.
- Operationalize processing of CFH data.