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ICSU

International Council for Science



**Report of the Ninth
GCOS Reference Upper Air Network
Implementation and Coordination Meeting
(GRUAN ICM-9)**

**Helsinki, Finland
12 to 16 June 2017**

GCOS-211

World Meteorological Organization, 2017

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GRUAN ICM-9 Short-form Report

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1. Introduction

The 9th GRUAN Implementation and Coordination Meeting (ICM-9) was hosted by the Finnish Meteorological Institute (FMI) from 12 to 16 June 2017 in Helsinki, Finland. It benefitted from support by the local hosts, NOAA, and from the NOAA US GCOS office. The meeting included:

- A special session on Arctic research relevant to GRUAN.
- A special session dedicated to management of the change from RS92 radiosondes to alternative sondes.
- An optional visit to the Vaisala factory outside Helsinki.
- A break-out session on GAIA-CLIM outreach.
- An optional MeteoMet training course.
- An optional visit to the GRUAN site at Sodankylä during the weekend following ICM-9.

A GRUAN dinner, open to all attendees, was held on the evening of Thursday 15 June.

2. Attendees

The 57 attendees of ICM-9 are listed in [Table 1](#).

Table 1: ICM-9 attendee list

Name	Country	Affiliation
Seydi Ababcar Ndiaye	Senegal	Cheikh Anta Diop University, Dakar
Arnoud Apituley	The Netherlands	Royal Netherlands Meteorological Institute (KNMI)
Leif Backman	Finland	Finnish Meteorological Institute (FMI)
Greg Bodeker	New Zealand	Bodeker Scientific
Lori Borg	USA	University Wisconsin
Dan Brewer	USA	National Oceanic and Atmospheric Administration (NOAA)
Xavier Calbert	Spain	Agencia Estatal de Meteorología (AEMET)
Fabien Carminati	UK	Met Office
Belay Demoz	USA	Howard University
Howard Diamond	USA	National Oceanic and Atmospheric Administration (NOAA)
Galina Dick	Germany	GeoForschungsZentrum (GFZ)
Ruud Dirksen	The Netherlands	Deutscher Wetterdienst (DWD)
Hiram Escabi	USA	National Oceanic and Atmospheric Administration (NOAA)
Stephanie Evan	France	University of Reunion
John Eyre	UK	Met Office
Alessandro Fasso	Italy	Università degli studi di Bergamo
Jennifer Fowler	USA	University of Montana
Tom Gardiner	UK	National Physical Laboratory (NPL)
Pauli Heikkinen	Finland	Finnish Meteorological Institute (FMI)
Martti Heinonen	Finland	VTT Technical Research
Ben Ho	USA	University Corporation for Atmospheric Research (UCAR)
Peggy Hoch	USA	National Oceanic and Atmospheric Administration (NOAA)
Donna Holdridge	USA	Argonne National Laboratory
Stephen Hudson	Norway	Norwegian Polar Institute
Dale Hurst	USA	National Oceanic and Atmospheric Administration (NOAA)
Bruce Ingleby	UK	European Centre for Medium-Range Weather Forecasts (ECMWF)

Masami Iwabuchi	Japan	Japan Meteorological Agency (JMA)
Hannu Jauhiainen	Finland	Association of Hydro-Meteorological Equipment Industry (HMEI) and Vaisala
Jonathan Jones	UK	Met Office
Juha Karhu	Finland	Finnish Meteorological Institute (FMI)
Rigel Kivi	Finland	Finnish Meteorological Institute (FMI)
Rob Kursinski	USA	University of Arizona
Thierry Leblanc	USA	Jet Propulsion Laboratory (JPL)
Shwei Lin	Singapore	National Environment Agency (NEA)
Aleksey Lykov	Russia	Roshydromet
Fabio Madonna	Italy	Institute of Methodologies for Environmental Analysis (IMAA/CNR)
Juan Carlos Antuna Marrero	Cuba	Grupo de Óptica Atmosférica de Camagüey (INSMET)
Giovanni Martucci	Switzerland	MeteoSwiss
Marion Maturilli	Germany	Alfred-Wegener-Institut (AWI)
Andrea Merlone	Italy	Istituto Nazionale di Ricerca Metrologica (INRIM)
Johannes Nielsen	Denmark	Danish Meteorological Institute (DMI)
Tim Oakley	UK	Met Office
Roberta Pirazzini	Finland	Finnish Meteorological Institute (FMI)
Richard Querel	New Zealand	National Institute of Water and Atmospheric Research (NIWA)
Tony Reale	USA	National Oceanic and Atmospheric Administration (NOAA)
Christoph von Rohden	Germany	Deutscher Wetterdienst (DWD)
Marco Rosoldi	Italy	Institute of Methodologies for Environmental Analysis
Doug Sisterson	USA	Atmospheric Radiation Measurement programme
Herman Smit	The Netherlands	Forschungszentrum Jülich
Michael Sommer	Germany	Deutscher Wetterdienst (DWD)
Martin Stuefer	Austria	University of Alaska Fairbanks
Bomin Sun	USA	National Oceanic and Atmospheric Administration (NOAA)
Caterina Tassone	USA	GCOS Secretariat
Peter Thorne	Ireland	Maynooth University (NUIM)
Jordis Tradowsky	New Zealand	Bodeker Scientific
Rongkang Yang	China	China Meteorological Administration
Axel von Engeln	Germany	EUMETSAT

3. Review of ICM-8 actions

Actions agreed on during ICM-8 were reviewed at the start of ICM-9 by Peter Thorne. 36 actions had been agreed on at ICM-8. Of those:

- 12 were completed.
- 20 were still in progress.
- 4 remained unaddressed.

The status (St) of individual ICM-8 actions is shown in Table 2.

Table 2: ICM-8 actions

#	Action	Owner	Due	St
High priority actions				
1	Autosondes: An assessment of the advantages and disadvantages of manual vs. autsonde launches written up and submitted to the peer reviewed literature.	TT radiosondes (Rigel Kivi, Fabio Madonna)	June 2017	
2	Multi-payload launches: A document detailing the operational challenges related to multi-payload soundings submitted either to peer-reviewed literature (first choice) or to the WG for review as a GRUAN report. To be augmented by quantitative analysis of existing multi-payload flights.	TT radiosondes, NOAA NWS, Lead Centre, TT Sites, Science Coordinators	May 2017	
3	Radiosonde documentation: Develop first draft of GRUAN radiosonde generic technical document omnibus.	Lead Centre, TT Radiosondes, non-instrument experts, WMO Expert Team (to review).	November 2016	
4	RS92 product V3: Revise the RS92 data stream: revised version 3 including quality control flags + data in different vectors (good, questionable, missing), including implementation of performance feedback to the sites. Validate new radiation correction using ancillary measurements, including GAIA-CLIM NWP feedback, to build confidence. Document version 3 appropriately in peer-reviewed literature.	Lead Centre, TT Radiosondes, TT Ancillary measurements	March 2017	
RS92 transition actions				
5	ARM campaign proposal: Put in an intensive observations campaign proposal to ARM to run dual launch programmes at their sites of RS92 and RS41 to help quantify the effects for one year.	WG chairs, Ruud Dirksen, Doug Sister-son, Lori Borg, Tony Reale, TT sites	March 2017	
6	Interim analysis of initial RS92 results: Initial analysis of current dual launch data to be reported to GRUAN ICM-8 participants by email.	Alessandro Fasso, Lead Centre	June 2016	
7	Payload configurations (dual launches): Lead Centre to ascertain consistency or otherwise of payload configurations being undertaken by sites performing a dual sounding programme and, to the extent possible, make recommendations as to how to set the rigs to assure comparability.	Lead Centre and TT Sites	June 2016	
8	Darwin dual launches: Lead Centre to work with BoM to instigate an intercomparison campaign for RS92-RS41 transition at Darwin site.	Lead Centre, BoM, TT Radiosondes	July 2016	
9	Scheduling including golden match-ups: Lead Cen-	Lead Centre, TT radi-	December	

	tre to provide guidance on when and under what conditions to undertake flights if not to a regular schedule. Night/day/cloud/clear, informed by early lab results. Provide schedules for 'golden' launch times with polar orbiters/GNSS-RO.	osonde, Axel von Englen	2016	
10	Parallel soundings database: Lead Centre to instigate and populate a database of parallel soundings of RS92-RS41, including where possible satellite colocations, raw and black-box processed radiosonde profiles. Served through the Lead Centre and available to GRUAN community for analysis.	Lead Centre, TT Radiosondes, Tony Reale	August 2016	
11	Community approach paper: Paper describing the GRUAN change management replacement strategy submitted to a peer-reviewed journal (GI) to increase visibility of an effort and get broad community buy-in.	Lead Centre, TT Radiosondes, WG-GRUAN	September 2016	
12	Lead Centre-Sterling collaboration: Lead Centre and Sterling facility to undertake coordinated lab characterisation of the RS92 and RS41. Formal report at ICM-9.	Lead Centre, NWS sterling	June 2017	
13	First comprehensive analysis: Interim analysis of the radiosonde overlap observations completed and reported at ICM-9.	Lead Centre, TT Radiosondes, Science Coordinators, Alessandro Fasso	June 2017	
14	Satellite inferences: Interim analysis of the insights that can be bought by the use of satellite data to the characterisation of the change between RS92 and RS41 based upon the paired launches.	Lead Centre, TT Ancillary measurements	June 2017	
Remaining actions				
15	Reporting over the WIS: All sites with capability to report BUFR over GTS in NRT. Advice and technical support to be provided by Lead Centre/WMO/GCOS on a site-by-site basis to all certified and candidate sites not currently reporting BUFR to attempt to enable.	Lead Centre, GCOS, WMO, TT Sites	ICM-9	
16	Promotional video: Complete and disseminate promotional video for GRUAN.	Greg Bodeker and Lead Centre	May 2017	
17	Stratospheric water vapour trends: Extend trend sensitivity studies to stratospheric water vapour.	Task Team Scheduling	December 2016	
18	Site photos: Site photo surveys to be uploaded to new website. Lead Centre to instigate mechanism to remind sites to submit new photos. Several snapshot series available from each site on web at time of ICM-9.	Task Team Sites and Lead Centre	June 2017	
19	New modem product: Develop GRUAN data product and processing stream for Modem radiosondes. First	CNRS, Lead Centre, TT Radiosondes	March 2017	

	draft of technical document describing processing streams for all Modem radiosondes.			
20	Standard Humidity Chamber justification: Technical Note on the appropriate techniques for manufacturer independent ground checks using the Standard Humidity Chamber. Paper submitted to peer reviewed journal documenting scientific rationale.	Lead Centre, Science Coordinators	December 2016	
21	Lidar: Technical document for GRUAN lidar stream (lidar Guide) submitted for review by WG.	TT Ancillary measurements	December 2016	
22	GNSS-PW (I): Develop a GRUAN GNSS-PW product. Technical documentation completed for GNSS-PW measurements (GNSS-PW Guide)	TT, GNSS-PW	December 2016	
23	GNSS-PW (II): Define the GNSS-PW data collection client requirement, initiate data flow.	GFZ, Lead Centre, TT GNSS-PW, TT sites	April 2017	
24	Ozonesonde (I): Develop a GRUAN ozonesonde data product in consultation with NDACC and GAW. Completed technical documents.	Greg Bodeker, Jacquie Witte, Lead Centre	October 2016	
25	Ozonesonde (II): Define the ozonesonde data collection client requirement, identify the central data processing facility, and initiate data flow.	Greg Bodeker, Lead Centre	April 2017	
26	Aerosols: Determine how best to work with NDACC and GAW to bring measurements of aerosol properties into GRUAN. Produce short document outlining a proposed strategy.	WG Chairs, WG members, TT Ancillary measures, Potenza, EARLINET	June 2017	
27	GRUAN data transmission via BUFR: Complete proposal for transmitting GRUAN uncertainties over BUFR and required modification of BUFR tables and report to IPET-DRMM.	Sasha Kats, Kizu-San, TT Radiosondes, TT Sites, Lead Centre, CBS	November 2016	
28	Uncertainty structures in RS92 version 3 product: Version 3 release of RS-92 to include correlated uncertainty information and subsequent work to consider an emulator that can create N profiles consistent with the uncertainty information	Lead Centre, TT Radiosondes, Science Coordinators	March 2017	
29	Task Teams ToR: Task Teams to revise terms of reference to reflect current status and required work plans and submit to WG for approval.	TT Chairs and members	June 2016	
30	Certified site audits: Greg to draft and circulate guidelines for the certified site auditing to WG and TT site reps. Agreed version to become a GRUAN Technical Note.	Greg Bodeker	July 2016	
31	GRUAN Implementation Plan: Complete and publish new GRUAN Implementation Plan after publication of the GCOS Implementation Plan to ensure consistency with this 'parent' document.	Peter Thorne with input from WG-GRUAN, Lead Centre, chairs of all TTs.	December 2016	
32	Ecosystem of upper-air systems: Paper on the eco-	WG Chairs, principals	November	

	system of upper-air systems co-drafted with principals of NDACC, TCCON, etc. as submission to NDACC special issue	of remaining networks	2016	
33	Failsafe backup: Lead Centre and processing centres to evaluate options with regard to failsafe back-up to ensure data archival and processing software redundancy. Technical Note produced.	Lead Centre, Processing Centres	December 2016	
34	Website review: WG members to review the website, discuss, and provide feedback on any necessary structural innovations to Lead Centre. Then to provide feedback at ICM-9 based on use (WG-GRUAN to identify 2-3 volunteers to do this more in-depth review).	WG-GRUAN	June 2017	
35	CIMO TECO: GRUAN abstracts to be submitted to CIMO TECO and MMC2 in Madrid in late September.	WG co-chairs	September 2016	
36	SASBEs: Report on SASBE development activities at ICM-9.	TT Scheduling, TT Ancillary Measurements, Science Coordinators	June 2017	

4. Meeting agenda

Monday 12 June

Section 1 - Opening session and keynotes

8:00 - 8:40	Registration	
8:40 - 8:50	Welcome, local logistics, outline of events and adoption of agenda	Local hosts & WG chairs
8:50 - 8:55	Introductory talk from FMI	Professor Yrjö Viisanen
8:55 - 9:10	FMI air quality and climate studies	Dr. Iolanda Ialongo
9:10 - 9:25	GRUAN Fundamentals	Ruud Dirksen
9:25 - 9:40	Remarks from GCOS including relevant AOPC outcomes	Caterina Tassone
9:40 - 10:05	Lead Centre progress report	Ruud Dirksen
10:05 - 10:20	In memory of Sasha Kats	Ruud Dirksen

10:20 - 10:40 Coffee break

Section 2 - ICM-8 action items review

10:40 - 11:05	Assessment of progress against action items arising from ICM-8	Peter Thorne
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Section 3 - Discussion of topics raised by Task Team reports

11:05 - 11:15	Brief summary (2 slides) on discussion points arising from Radiosonde Task Team report	Hannu Jauhiainen
11:15 - 11:30	Discussion of Radiosonde TT topics	To be led by day chair

11:30 - 11:40	Brief summary (2 slides) on discussion points arising from Sites Task Team report	Belay Demoz and Dale Hurst
11:40 - 11:55	Discussion of Sites TT topics	To be led by day chair
11:55 - 12:05	Brief summary (2 slides) on discussion points arising from Scheduling Task Team report	Tom Gardiner and Fabio Madonna
12:05 - 12:20	Discussion of Scheduling TT topics	To be led by day chair
12:20 - 12:25	Poster summary: Temperature-SASBE version 2	Jordis Tradowsky
12:25 - 12:30	Poster summary: A multi-mission RO-GRUAN comparison	Johannes Nielsen

12:30 - 13:30 Lunch

13:30 - 13:40	Brief summary (2 slides) on discussion points arising from Ancillary Measurements Task Team report	Tony Reale and Thierry Leblanc
13:40 - 13:55	Discussion of Ancillary Measurements Task Team topics	To be led by day chair
13:55 - 14:05	Brief summary (2 slides) on discussion points arising from GNSS-PW Task Team report	Galina Dick
14:05 - 14:20	Discussion of GNSS-PW Task Team topics	To be led by day chair
14:20 - 14:45	Report from GRUAN science coordinators and subsequent discussion	Tom Gardiner and Richard Querel
14:45 - 15:00	General discussion of topics arising from task teams	To be led by day chair

15:00 - 15:30 Coffee break

Section 4 - Advances in the development of new GRUAN data products

15:30 - 15:50	Meisei	Masami Iwabuchi
15:50 - 16:10	Modem	Stephanie Evan
16:10 - 16:30	Ozonesonde	Richard Querel
16:30 - 17:05	The future of balloon-borne reference water vapor measurements in GRUAN: Motivation/GCOS IP-Thorne , P-CFH-Dirksen, Japanese FP-Fujiwara, FLASH B-Lykov, Air Labs CBH-Bodeker	Dale Hurst to coordinate
17:05 - 17:25	Lidar	Thierry Leblanc
17:25 - 18:00	Discussion on progress on GRUAN product development	Day chair
18:00 - Done	Discussion and resolution on the size, composition, and terms of reference for the Working Group (WG members only)	Greg Bodeker discussion lead

Tuesday 13 June

Section 5 - Special session on the Arctic

08:30 - 08:50	Research activities at Sodankylä	Rigel Kivi
08:50 - 09:15	INTAROS, integration of the existing Arctic observing systems into a common data frame	Roberta Pirazzini
09:15 - 09:45	ARM, ASR, and UAF Activities at the NSA	Martin Stuefer and Douglas Sisterson
09:45 - 10:05	Ny-Ålesund: Update & Atmosphere flagship programme	Marion Maturilli
10:05 - 10:20	Arctic Council	Johanna Ekman

10:20 - 10:45 Coffee break

Section 5 - Special session on the Arctic (continued)

10:45 - 11:05	Satellite-borne observations of GHGs in the Arctic	Hannakaisa Lindqvist
11:05 - 11:25	Atmospheric methane in the Arctic	Leif Backman
11:25 - 11:45	Arctic stratosphere dynamical response to global warming	Alexey Karpechko
11:45 - 12:05	The N-ICE campaign	Stephen Hudson
12:05 - 12:30	General Discussion	

12:30 - 13:30 Lunch break

Section 6 - GRUAN management of the RS92-other sondes transition

13:30 - 14:00	A summary of developments to date	Ruud Dirksen
14:00 - 14:20	The Met Office/British Antarctic Survey experience of managing a transition from RS92 to RS41.	Tim Oakley
14:20 - 15:00	Initial analysis results	Alessandro Fasso

15:00 - 15:30 Coffee break

Section 6 - GRUAN management of the RS92-other sondes transition (cont)

15:30 - 15:40	Testing radiosondes in the EDDIE tunnel at INRiM	Andrea Merlone
15:40 - 16:05	RS92-RS41 transition at Cabauw	Arnoud Apituley
16:00 - 16:20	Assessment of the radiation-induced temperature error for RS92-RS41 using NPROVS	Bomin Sun
16:20 - 16:40	Global correction of the radiosonde temperature biases in the upper troposphere and lower stratosphere using GPS RO data	Ben Ho
16:40 - 17:15	Discussion and development of agreed way forward for GRUAN transition from RS92 to other radiosondes	Ruud Dirksen to coordinate

17:15 - 18:00 Poster viewing

Jordis Tradowsky: An improved Site Atmospheric State Best Estimate for the temperature above Lauder, New Zealand

Johannes Nielsen: ROM SAF CDR v1 temperature profiles compared to GRUAN v2.0

Wednesday 14 June**Section 7 - GRUAN sites day**

8:30 - 9:00	GRUAN data flow	Michael Sommer
9:00 - 9:15	Lauder Site Update	Richard Querel
9:15 - 9:30	Developments at Singapore on the way to GRUAN implementation	Shwei Lin
9:30 - 9:45	Updates from Tateno and introducing the new candidate sites	Masami Iwabuchi
9:45 - 10:00	GRUAN activities at La Reunion	Stephanie Evan

10:00 - 10:30 Coffee break

10:30 - 10:45	ARM SGP CFH operations status	Martin Stuefer
10:45 - 11:00	ARM Sites report/instrument uncertainties update	Doug Sisterson
11:00 - 11:15	ARM Sites radiosonde operations status and upgrades	Doug Sisterson
11:15 - 11:30	CMA plans for the Xilinhoh site	Rongkang Yang
11:30 - 12:00	The GRUAN Mid-Atlantic Consortium: Vision, Composition, Activities, Plans	GMAC Team
12:00 - 12:30	Discussions of station reports	Lead Centre

12:30 - 13:30 Lunch break

13:30 - 13:50	A novel automatic calibration system for water vapour Raman lidar	Giovanni Martucci
13:50 - 14:15	The 2019 WMO radiosonde intercomparison campaign, GRUAN's scientific requests	Ruud Dirksen and Giovanni Martucci
14:15 - 14:30	Aspects of GPS-RO water vapour retrieval	Rob Kursinski
14:30 - 14:45	Partnering with operational met sites: Lauder's new Invercargill-based data stream	Richard Querel
14:45 - 15:00	GNSS data processing	Galina Dick

15:00 - 15:30 Coffee break

15:30 - 15:50	Consistency between GRUAN sondes, LBLRTM and IASI	Xavier Calbet
15:50 - 16:10	GRAS Occultation Forecasting Prediction: A new EUMETSAT Product?	Axel von Engeln
16:10 - 16:30	The use of AIRCORE in GRUAN	Rigel Kivi

16:30 - 16:50	The status of the Fluorescence Lyman- α Stratospheric Hygrometer (FLASH-B) instrument	Aleksey Lykov
16:50 - 17:05	Links between GRUAN and the global radiosonde network	Bruce Ingleby

17:05 - 17:25	Update on where we are at with bringing new sites into GRUAN.	Greg Bodeker lead
17:25 - 18:00	An open discussion for sites	Dale Hurst and Belay Demoz to moderate

Thursday 15 June

Section 8 - Optional sessions

Option 1: Visit to Vaisala

Option 2: Breakout session on GAIA-CLIM outreach

8:30 - 10:00	Discussion of GAIA-CLIM gap analysis and prioritisation activity	Peter Thorne
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10:00 – 10:30 Coffee break

10:30 - 12:30	Hands on session on the GAIA-CLIM Virtual Observatory	Fabio Madonna and Peter Thorne
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Option 3: Review of GRUAN web pages

8:30 - 10:00	A team review of the GRUAN web pages	Greg Bodeker and whoever else is interested.
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10:00 – 10:30 Coffee break

10:30 - 12:30	Continuation of web review	Greg Bodeker
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12:30 – 13:30 Lunch break

MeteoMet Training Course

13:30 - 13:50	Metrology for GRUAN: MeteoMet activities of interest	Andrea Merlone
13:50 - 14:10	Towards SI traceable humidity measurements with radiosondes	Martti Heinonen
14:10 - 14:30	Basic metrology, terminology, procedures	Tom Gardiner
14:30 - 15:00	MeteoMet training course Q&A	

15:00 to 15:30 Coffee break

Section 9 - GRUAN Operations

15:30 - 15:40	Status of the GRUAN radiosonde generic technical document omnibus	Christoph von Rohden
15:40 - 16:00	Analysis of radiation temperature experiments	Christoph von Rohden

16:00 - 16:15	Discussion of radiation temperature results	Lead by day chair
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Friday 16 June

Section 10 - Underpinning science for GRUAN

8:30 - 8:50	Geophysical profile data from GRUAN radiosonde data products to a top of the atmosphere radiance and uncertainty	Fabien Carminati
8:50 - 9:10	Integration and Assessment of GRUAN v2 uncertainties using NPROVS+	Tony Reale
9:10 - 9:30	Manual vs. autosonde launches	Rigel Kivi
9:30 - 9:50	GRUAN and RO intercomparison as done in the ROM SAF VS31 project	Jordis Tradowsky
9:50 - 10:10	Frost point hygrometers and satellite sensors for stratospheric water vapour	Dale Hurst

10:10 - 10:30 Coffee break

Section 11 - GRUAN connection to partner communities and activities

10:30 - 10:50	Reporting from the IROWG meeting in Austria	Jordis Tradowsky
10:50 - 11:10	Discussion of results from GAIA-CLIM maturity assessment for GRUAN and what we can learn from this.	Peter Thorne
11:10 - 11:30	The new AOPC task team on GUAN	Tim Oakley
11:30 - 11:50	The new C3S BARON activity	Fabio Madonna
11:50 - 12:20	GAIA-CLIM gap analysis and prioritisation activity	Peter Thorne
12:20 - 12:30	General discussion	Day chair

12:30 - 13:30 Lunch

Section 11 - GRUAN connection to partner communities and activities (cont)

13:30 - 13:50	Discussion of the GRUAN Science Coordinator role	Greg Bodeker
13:50 - 14:10	Update of the IAGOS-H2O ongoing aircraft measurements and QA-efforts	Herman Smit
14:10 - 14:40	GRUAN web page and other tools to coordinate Working Group communication	Michael Sommer
14:40 - 15:00	Ozonesondes in GAW and future collaboration between GAW-WCCOS and GRUAN on ozonesonde QA	Herman Smit

15:00 - 15:30 Coffee break

Session 12 - Wrap-up

15:30 - 16:30	The GRUAN work plan for 2017/2018	Peter Thorne
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16:30 - 17:00	Close	Local hosts and co-chairs
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5. Agreed on actions for the coming year

Recognizing that ICM-10 is expected to follow ICM-9 by only 10 months, four high priority items (including closure of two from ICM-8), eight actions related to the transition from RS92 to RS41 radiosondes (including closure of three actions from ICM-8), and thirteen other actions (including closure of five actions from ICM-8) were agreed on. These are listed in [Table 3](#). Following discussion, it was decided to finalise an RS92 version 3 product after the RS41 version 1 product has been completed. A number of business as usual items were not recorded as actions including:

- Review and updates of the GRUAN website.
- Backfilling membership and co-chair vacancies on task teams.
- Revision of WG terms of reference following WG meeting outcomes in consultation with AOPC and GCOS Secretariat.
- Reflect on science coordinator discussion outcomes.
- Data management and serving issues.

Table 3: ICM-9 actions

#	Action	Owner	Due
High priority actions			
1	First draft version of RS41: Lead Centre to provide a first cut of the RS41 GDP by no later than ICM-10 and provide this data set to GRUAN community for analysis. Use the GAIA-CLIM traceability chain approach developed by NPL and applied to the RS92 version 2 product to guide the RS41 product creation and consideration of correlated, structured random and random components. Session on RS41 GDP preparation at ICM-10.	Lead Centre, TT Radiosondes	April 2018
2	Qualify new data streams: Qualify currently available candidate data streams available via the Lead Centre (Mesei 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, Lead Centre, TT sites, TT radiosonde	April 2018
3	Autosondes: An assessment of the advantages and disadvantages of manual vs. auto-sonde 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 auto-launched sondes?; iii) Does the random uncertainty change?; iv) impact of lifetime in launcher (quality, SHC repeatability, and height attained).	TT Radiosondes and Lead Centre	August 2017 to define small set of well posed questions to be addressed. December 2017 to submit manuscript
4	Radiosonde documentation: Develop first	Lead Centre, TT radio-	January 2018

	draft of GRUAN radiosonde generic technical document omnibus. Available for review.	sondes, non-instrument experts, WMO ET (to review)	
RS92 to RS41 transition actions			
5	Community approach paper: 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.	Lead Centre, TT Radiosondes, WG-GRUAN	July 2017
6	Parallel soundings database augmentation with satellite/ancillary: 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).	Lead Centre, TT Ancillary measurements, TT Sites.	Oct 2017 (satellites plus Lindenberg) Apr 2018 (all sites)
7	Darwin dual launches: 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.	Lead Centre, BoM, Greg Bodeker	December 2017
8	UKMO/BAS ascents inclusion: Arrange for the inclusion of Met Office and BAS parallel soundings data in the RS92-RS41 transition. Particular interest in St. Helena given paucity of tropical locations.	Lead Centre, Tim Oakley	April 2018
9	GUAN/GRUAN coordination: WG-GRUAN, 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.	WG Chairs, GCOS secretariat, Lead Centre	July 2017
10	Scheduling by conditions: Lead Centre, based upon results to date to advise sites on 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.	Lead Centre, TT Radiosonde, TT Sites, Alessandro Fasso's ad hoc group	October 2017
11	Updated analysis of dual launch holdings: 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-	Science Coordinators (or TT on RS92/41 transition analysis), Lead Centre, TT Radiosondes, TT Ancillary measurements	April 2018

	page written summaries a month in advance and talks in transition session).		
12	Capability to create RS92v2 GDP from MW41: Given agreed priority of RS41 GDP over RS92 version 3 product generation, develop short-term 'fix' to enable version 2 processing to be applied to RS92 soundings lodged using the MW41 ground equipment.	Lead Centre	October 2017
Remaining actions			
13	Sites photos: Technical note on guidance on site survey photos and upload instructions. Current site photo surveys to be uploaded to appropriate area of website. Lead Centre to instigate mechanism to remind sites to submit new photos.	Lead Centre, TT Sites	April 2018
14	New modem product: 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	April 2018
15	Lidar: Take necessary steps to be in a position to qualify the Lidar GDP starting after ICM-10. Remaining steps are finalisation and review of Technical Document and provision of a beta test data stream to Lead Centre.	TT Ancillary measurements	April 2018
16	GNSS-PW: Take necessary steps to be in a position to qualify the GNSS-PW GDP starting after ICM-10. Remaining steps are finalisation and review of Technical Document and provision of a beta test data stream to Lead Centre.	TT GNSS-PW	April 2018
17	Ozonesondes: 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 Lead Centre.	Greg Bodeker, Jacquie Witte, Lead Centre	April 2018
18	Failsafe back-up: Lead Centre and Bodeker Scientific to instigate failsafe backup of the raw data that is offsite of Lindenberg.	Lead Centre and Greg Bodeker	October 2017
19	Golden overpass: 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.	Lead Centre and TT Sites	August 2017
20	CFH roadmap: Prepare a strategy document (2-sides max) to address the remaining steps required for instigation of a frostpoint hygrometers GDP for presentation and discus-	Lead Centre, TT Radiosondes, TT Sites	April 2018

	sion at ICM-10.		
21	Certification and auditing: WG-GRUAN and Lead Centre to ensure certification and auditing of sites on the agreed upon timetables and verify against these targets at ICM-10.	Greg Bodeker, Lead Centre	April 2018
22	Annually based reporting: Lead Centre to provide automated reports on 2017 performance no later than 20 January of each year. Sites to append site report no later than 15 February to inform ICM-10. WG-GRUAN members to read site reports prior to ICM-10.	TT Sites, Lead Centre, WG-GRUAN	February 2018
23	Australian sites composition and certification: Greg Bodeker to respond to suggestion to move Alice Springs to Brisbane and to advocate for certification.	Greg Bodeker	August 2017
24	Letters on behalf of sites: WG-GRUAN chairs to review site reports and initiate letters from appropriate parties accordingly. TT Sites to be tasked with raising such requests intersessionally rather than solely at ICMs.	WG Chairs, TT Sites	August 2017
25	Update on radiation chamber results: 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	April 2018