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Session 1

Task Team Progress Report for November 2020 – Radiosondes

(Submitted by Masatomo Fujiwara and Christoph von Rohden and the team members)

Summary and Purpose of this Document

Progress report from the task team on Radiosondes.

Summary

Some tasks had good progress.

This table shows the current members of the team.

Name	Affiliation	Status
Masatomo Fujiwara	Hokkaido University, Japan	Co-chair
Christoph von Rohden	GRUAN Lead Centre, DWD, Germany	Co-chair
Frank Schmidlin	NASA Retiree, USA	
Hannu Jauhiainen	The Association of Hydro-Meteorological Equipment Industry Vaisala, Finland	HMEI representative
Micheal Hicks	NOAA/NWS/OOS, USA	
Larry Miloshevich	MILO-Scientific, USA	
Rigel Kivi	Finnish Meteorological Institute, Finland	
Masami Iwabuchi	Japan Meteorological Agency, Japan	
Yang RongKang	China Meteorological Administration, China	
Martial Haeffelin	Institut Pierre Simon Laplace, France	
Sergey Kurnosenko	Scientific Software Consultant, USA	
Bruce Ingleby	ECMWF, UK	
David Edwards	Met Office, UK	

Progress on main tasks

Task: Assess the effects of the use of Automatic Radiosonde Launcher (ARL) compared to manual launches on measurement uncertainty estimates for radiosondes
Main Contact: Fabio Madonna, Masatomo Fujiwara, Rigel Kivi, and the auto-launcher task team
Due Date: (New deadline to be set at ICM-12)
Status: Done for the first part, but need a good strategy for the second part (see "Issues" below)
Milestone: Publication in the peer reviewed literature or a technical report
Progress & Issues: The following paper has been published:

- Madonna et al. (2020), Use of automatic radiosonde launchers to measure temperature and humidity profiles from the GRUAN perspective, Atmospheric Measurement Techniques, 13, 36213649, doi: 10.5194/amt-13-3621-2020.

The next step is to make a good coordination to answer the question "how to certify ARL GRUAN Data Product (GDP)" the key question is how to make manufacturer-independent Ground-Check (GC) (especially for Vaisala Autolauncher data). To this purpose, the following approaches will be tested at voluntary sites for a sufficiently long period:

- use of a Standard Humidity Chamber (SHC) (plus a reference thermometer, such as a PT100 sensor) immediately after the manufacturer GC and prior to loading the sondes;
- use of reference thermometer and hygrometer within the so-called ready-to-launch sondes storage area (see Madonna et al. (2020) for the description of this area in the ARL), as close as possible to the radiosonde sensors, with the optional use of a few additional thermometers and hygrometers within the storage area to monitor the uniformity of the temperature and relative humidity.

There are existing datasets which will be further investigated to check whether the implemented solution can guarantee the product traceability for the ARL products. These include data from four Japan Meteorological Agency (JMA) stations, not belonging to GRUAN, where Vaisala ARL is used adopting a modified setup of the Vaisala AS15 system including an additional GC based on reference instruments developed by Vaisala for temperature and humidity, i.e. Vaisala HMP155 with HMT333, lodged in a custom-made chamber. The corresponding measurement practice is briefly described in Madonna et al. (2020). It must be noted that this solution is not based on the use of a SI calibration standard.
All approaches have advantages and drawbacks, already discussed in the Madonna et al. (2020). The GRUAN Potenza site, after the upgrade of the ARL, is again operational and can be used to run specific experiments in 2021 (COVID-19 depending). Other solutions proposed from the sites will be considered, if any. In the first quarter of 2021, a telecon will be arranged to discuss and plan the work for 2021 involving representatives from all the sites equipped with an ARL and interested in this task.

Task: Standardizing cloud treatment (i.e., Develop a proposal on how and when cloud observations should be taken to support the radiosonde profiles including how that information should be included in the data files. Strategy to be cognizant of existing practices)
Main Contact: TT Radiosondes and TT AM (satellites)
Due Date: (New deadline to be set at ICM-12)
Status: Not yet started
Milestone: Publication in the peer reviewed literature or a technical report
Progress & Issues: We may also need to include TT Sites and LC on this task. (because operational sites & operational radiosonde softwares usually have been collecting this type of information for many years. In the radiosonde GRUAN Data Product, this is currently considered in the uncertainty estimation.) The Background: This arose from a discussion around the heterogeneity as to whether

and if so how and when cloud observations were being taken around the time of a radiosonde ascent by sites. Issues include not only how but "when" the cloud observation is taken, which is usually at the time of launch; however with drift and the up to 1 hour ascent (through troposphere) desired information on cloudiness at a given time/height of report is not available. Also, for radiosondes targeting a given satellite, a cloud observation at the time of overpass would be of value. There was a question whether the way cloud observations were taken should be standardized and transmitted with the RSlaunchclient and whether this would help to reduce uncertainty in GRUAN products in future potentially as these cloud observations may allow better assumptions around direct, diffuse and reflected solar radiation effects upon ascents. A clear sky ascent may take different assumptions from a cloudy ascent for e.g. This really matters in heterogeneous cloud environments where e.g. the sonde may by chance ascend through a clear column which is surrounded by several convective clouds of considerable depth.

Task: Use of descent data (i.e., Revisit the potential use and value of operational radiosonde descent data within GRUAN)
Main Contact: Bruce Ingleby and TT Radiosondes
Due Date: Presentation at ICM-12 by Bruce Ingleby (New deadline to be set at ICM-12)
Status: Ongoing (a paper is being prepared)
Milestone: Publication in the peer reviewed literature or a technical report
Progress & Issues: Emphasis is also on wind data. We need detailed information on manufacturers softwares and even on GDP processing how outliers, spikes, oscillations, and even biases are handled (e.g., evaluated and removed). Current discussion points: (1) The differences between ascent and descent winds, and (2) the need to have a standard or reference to compare them with. Regarding (2), ideas include having a second radiosonde very close to the balloon (to reduce pendulum motion) on some flights, and to have an ascent with two balloons which removes/reduces pendulum motion as the Payerne Team found.

Task: Justification for high ascent attainment (Criteria to include NWP impact, seasonal predictability, importance of monitoring LS winds, radiative transfer calculations, satellite validation, climatology, etc.)
Main Contact: TT Radiosondes, IPET-OSDE
Due Date: (New deadline to be set at ICM-12)
Status: Ongoing
Milestone: Publication in the peer reviewed literature or a technical report
Progress & Issues: An ad hoc team has been formed. Masatomo Fujiwara has started to gather related information/publications to draft outline. Some suggestions: Check presentations at WMO Impact Workshops. Try to make a statement that is as justified as possible to provide a basis. Needs

the modelling community to prove it. Background: The goal would be to extend GRUAN radiosondes another 10km from 20 hPa (25 km), typically 50% of the GRUAN radiosondes since 2016 reached this level, to 5 hPa (35 km), typically only 2% reached this for 2016-2020. Regarding benefits of consistently achieving 5 hPa in the context of satellite sensor validation, Tony Reale will kindly pursue a specific GSICS recommendation for the GRUAN meeting. A survey of balloon sizes used at each GRUAN site is also needed.

Task: Radiosonde wind uncertainty estimate (i.e., Evaluate and improve radiosonde wind uncertainty estimates)
Main Contact: Lead Centre, TT Radiosondes
Due Date: (New deadline to be set at ICM-12)
Status: Ongoing
Milestone: Publication in the peer reviewed literature or a technical report
Progress & Issues: Both RS92 GDP and Meisei RS-11G/iMS-100 GDP include wind uncertainty estimates. LC is to review wind uncertainty for RS41 GDP and RS92 v3 GDP. Lead Centre's progress: While developing the RS41-GDP, an analysis of the uncertainty of wind direction and wind speed in the GRUAN data processor has been implemented, based on the uncertainty of the GPS measurements themselves and on the software processing to smooth out pendulum and other components. The description is done in parallel in a corresponding section in the RS41 Technical Document.

List of OTHER TASKS

(The primary contact for most of these tasks is the Lead Centre or other body. The Task Team Radiosonde is to help and support their work.)
Task: GRUAN Radiosonde Fundamental Technical Document

Task: Community approach paper on the GRUAN change management

Task: RS92 GRUAN Data Product (GDP) version 3
Task: RS41 GDP
Task: Meisei iMS-100 GDP version 2
Task: Modem M10 GDP
Task: Ozonesonde GDP
Task: Frostpoint hygrometer GDP

Task: QC/QA flagging and presentation in data files, the "Quality Task Force"

Task: Multi-payload configurations (for the CIMO comparison; by DWD & MeteoSwiss)
Task: Updated analysis of dual launch holdings

Task: Survey of site approaches vis-á-vis variety of radiosonde issues

Task: Standard Humidity Chamber

Task: Metrological closure of GNSS-IWV and radiosondes