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Session 1

Task Team Progress Report for October 2020 – Scheduling

(Submitted by Tom Gardiner and Fabio Madonna)

Summary and Purpose of this Document

Progress report from the task team on Measurement Schedules and Associated Instrument-type Requirements.

Following the 2016 review by the Science Coordinators of areas of common research interest across the network it was decided to extend the scope of the scheduling task team to cover the issues surrounding measurement combination. The aim of the revised task team is to develop methodologies to optimally combine measurements of ECVs from multiple instruments to meet all GRUAN objectives including climate trend detection, satellite calibration/validation, and studies of local mesoscale processes and events.
Task team membership: Tom Gardiner (co-chair), Fabio Madonna (co-chair), Dave Whiteman, Rigel Kivi, Lori Berg, Xavier Calbet Alvarez, Jordis Tradowsky, John Dykema, Alessandro Fassó, Tony Reale, Alexander Haefele, Richard Querel, Doug Sisterson and Rob Kursinski.
The long-term objective for the Task Team is to develop tools to characterise the atmospheric column above each site through the combination of measurements from multiple instruments, taking into account relevant collocation effects, with a view to:

- providing the best available estimate of the vertically resolved atmospheric column above the site;
- ensuring continuous measurements of ECVs without temporal gaps;
- understanding and improving the quantification of the total uncertainty budget;
- optimising the operational costs.

In terms of scientific outputs from the task team, while the activity of the team remains a voluntary one without specific funding, the outputs mainly relate to relevant work within other projects and the main information sources are from peer-reviewed literature, GRUAN documentation, and currently unpublished studies of which the group is aware. Some limited new analyses are being undertaken by team members using existing data sets to start to address areas where critical gaps exist that prohibit scientifically defensible choices.
Although there has not been a great deal of coordinated task team activity since the last ICM, there have been a number of relevant activities by members of the task team which are described below.
Ongoing work on Copernicus Climate Change Service development for reference and baseline network data covering a range of GRUAN-relevant ECVs. This has included:

- Publication of a peer-reviewed paper by CNR-IMAA (Sy et al., 2020) providing a quantitative estimation of the uncertainty introduced by the spatial and temporal subsampling effects on decadal trends using a novel approach, which may be considered useful for the design of a measurements network (i.e. to identify the minimum number of sites needed to estimate a trend), as well as for several climate applications.
- Development of a radiosonde data harmonization approach, named RHARM (Radiosounding HARMonization), which provides a homogenized dataset of temperature, humidity and wind

profiles along with an estimation of the measurement uncertainties for 691 radiosounding stations globally peer-reviewed paper in ESSD journal (Madonna et al., 2020, under review).

- Application of the Product Traceability and Uncertainty assessment procedure, developed during GAIA-CLIM, to the uncertainty assessment of the GRUAN RS92 data record including reporting of uncertainties over different timescales.

- Ongoing development of co-location uncertainty assessment tools, following from GAIA-CLIM project, utilising ECMWF ERA-5 reanalysis data paper in preparation.

Involvement in the preparation for the forthcoming CIMO WMO Upper-Air Instruments Intercomparison (UAII2021), including description of the Data Visualization and Analysis Software (DVAS) that aims to ensure a transparent, unbiased and traceable processing and analysis of the radiosounding data that will be collected during UAII2021 as summarised at the 2020 European Geophysical Union conference (EGU2020-17779).
Contribution to the work of managing the change within GRUAN from RS92 to RS41 radiosondes, described in the paper by Dirksen et al., 2020.
In addition, over the next three years, there are additional resources through a PhD student who will investigate "Study of temperature, water vapor and ozone trends with measurements from in situ sounding, GNSS radio-occultation and atmospheric reanalysis". The PhD topic is largely of interest for GRUAN and synergy with other partners will be established also to maximize the benefit for the network.

- Sy, S., F. Madonna, M. Rosoldi, E. Tramutola, M. Proto, G. Pappalardo: Sensitivity of trends to estimation methods and quantification of subsampling effects in global radiosounding temperature and humidity time series, Int. J. Climatol.,123, 2020, https://doi.org/10.1002/joc.6827.

- Dirksen, R. J., Bodeker, G. E., Thorne, P. W., Merlone, A., Reale, T., Wang, J., Hurst, D. F., Demoz, B. B., Gardiner, T. D., Ingleby, B., Sommer, M., von Rohden, C., and Leblanc, T.: Managing the transition from Vaisala RS92 to RS41 radiosondes within the Global Climate Observing System Reference Upper-Air Network (GRUAN): a progress report, Geosci. Instrum. Method. Data Syst., 9, 337355,2020 https://doi.org/10.5194/gi-9-337-2020

- Madonna, F., Tramutola, E., Sy, S., Serva, F., Proto, M., Rosoldi, M., Gagliardi, S., Amato, F., Marra, F., Fass, A., Gardiner, T., and Thorne, P. W.: Radiosounding HARMonization (RHARM): a new homogenized dataset of radiosounding temperature, humidity and wind profiles with uncertainty, Earth Syst. Sci. Data Discuss., https://doi.org/10.5194/essd-2020-183, in review, 2020.