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Coordination Meeting (ICM-14)**

Session 7

La Réunion

28 November – 2 December 2022

Task Team Progress Report for November 2022 – Satellites

(Submitted by Lori Borg, Axel von Engel, and task team members)

Summary and Purpose of this Document

Progress report from the task team on Satellite-based remote sensing measurements.

Task Team Structure

The current members of the task team are listed on the GRUAN TT-SAT page <https://www.gruan.org/network/task-teams/tt-satellite>. One new member was invited, working in metrology at NIST, and the person will attend a TT-SAT telecon before making a final decision.

Name	Affiliation
Lori Borg (co-chair)	SSEC, University of Wisconsin-Madison, USA
Axel von Engel (co-chair)	EUMETSAT, DE
Stephen Leroy	AER
Tony Reale	NOAA / NESDIS / STAR
Benjamin Ruston	UCAR
Chi Ao	Jet Propulsion Laboratory, California Institute of Technology
Johannes Nielsen	Danish Meteorological Institute
Florian Ladstder	Wegener Center, University of Graz, Austria
Fabien Carminati	Met Office
Jordis Tradowsky	Bodeker Scientific
Bomin Sun	NOAA
Thomas August	EUMETSAT

Progress

TT-SAT Telecon, 12 July 2022

The 2nd TT-SAT telecon occurred on 12 July 2022. In total, 10 people attended. Main points from this telecon are:

- Action T01-01 from 1st telecon (identify member of NIST satellite group that could present and/or join TT-SAT): closed, Contact was provided, co-chairs invited person to join the TT, person though will decide after attending the next TT telecon.
- Action T01-02 from 1st telecon (improve expertise on spectroscopy in TT-SAT): open, though some potential candidates were identified.
- General discussion on options to support EUMETSAT Cal/Val activities for EPS-SG with radio sondes (will be further discussed at ICM-14).
- Discussed inputs to the GRUAN implementation plan (agreeing on action tailored to TT-SAT), and the group concurred with the presented proposal (notified also GRUAN co-chairs that group agreed).

- ICM-14 was briefly discussed, encouraged task team members to participate / provide a science talk (clarified also afterwards that this is a physical meeting).
- ICM-9 action on Satellite data collocations with RS92/41 pairs (A2) was presented and discussed (see also separate entry below).
- Justification for high ascent attainment was discussed (see also separate entry below).
- The WMO 2022 Upper-Air Instrument Inter-comparison Campaign at Lindenberg was briefly discussed. An action was raised to provide satellite overpass information for NOAA20 & Metop-C (Excel sheet was then prepared, and provided to LC).
- Next TT-SAT Meeting Date was discussed, either prior to ICM-14, if need arises, or afterwards to inform TT.

Progress with provision of satellite based ancillary measurements to RS92/RS41 collocation database (A2, initially raised at ICM-9)

The satellite task team (TT-SAT) was tasked to provide the Lead Centre (LC) collocated satellite measurements with the historical RS92/41 database. When this action was raised, it was considered to be a rather clearly formulated task. Discussions since, at several ICMs and telecons, have shown that various factors do make fulfilling this action complex. It was most recently discussed at the 12th of July telecon (see above) and also at the last WG GRUAN telecon on 16th September 2022.

The discussions at the TT-SAT telecon focused (again) on the not well defined scope of the action, e.g. it could potentially be very time consuming, require significant storage at GRUAN for the satellite data, it is also unclear which satellite data is best suited (infrared, microwave, radio occultation, etc), or which processing level (level 1, 2, 3) to store, which collocation criteria to use (e.g. 1h, 100 km). It was also determined that flexibility would need to be built into this system such that reprocessed satellite data could be provided at a later date to update the satellite data as the reprocessed satellite data are much more suitable for climate applications. The NOAA group gave an update on options in regards to leveraging NPROVS to provide LC with satellite data. LC already provided a spreadsheet with information on sonde pairs (RS41 & RS92). NPROVS is being updated to include GRUAN processed radiosondes and currently includes Vaisala processed versions of the radiosondes. These NPROVS files will then become publicly available.

It was however also suggested that efforts should be focused on enhancing the capabilities to query the GRUAN database for sondes that are coincident with satellite observations. For example, a user would be able to determine for a given radiosonde, including dual RS41/RS92 launches and sequential sondes (ie two sondes within 3/4 of an hour collocated with an overpass), which satellite observations are available that are within approximately 2-hours (at the surface for polar and at 100 hPa for GP-SRO). These queries would include information for the NOAA-20, SNPP, Metop-A,B,C, GRAS, and

COSMIC platforms. A user would then use this information to identify cases to assess and then either get the data directly from the satellite data archives or go through NPROVS, which could also provide access to observations (temperature, radiance, model) and provide some analysis support (see Reale/Sun talks at ICM-14) as needed. Once cases of interest are identified (the tough part), users will be well equipped to access the data on their own. The format/extent of the querying/database capabilities should be discussed at ICM-14. We envision that this functionality would reside at the LC. This would make the GRUAN radiosonde archive more relevant/usable to the satellite community.

Radio Occultation

Commercial RO data is purchased by several organizations in the US, as well as by EUMETSAT in Europe. Primarily, this is targeting Near-Real-Time (NRT) for weather forecasting. The International RO Working Group had its 7th meeting near Graz, Austria. The need to deal with commercial data in the climate context was raised there, e.g. is access to that data free, is level 0 data including readers available, are several RO centers able to process that data.

At IROWG, several other actors were also presenting plans to launch a commercial RO constellation too. In addition, state agencies are encouraged to make use of future satellite platforms to include RO observations, as well as to enhance capabilities of existing RO instruments (e.g. to add Galileo observations to COSMIC-2 and Sentinel-6).

The next EUMETSAT/ROM SAF reprocessing is tentatively planned to start within Q4/2022 (covering all GRAS, as well as CHAMP, Grace, COSMIC, Sentinel-6 (maybe COSMIC-2)), the ROM SAF is expected to complete their level 2 and 3 data processing within 2023.

Justification for high ascent attainment (C7)

This was discussed at 12th of July 2022 TT-SAT telecon. A need to assess the impact on RT modeling was identified, and an action on the TT has been raised. Furthermore, it was discussed whether NWP models could show the benefit of assimilating sonde data up to 10 hPa, albeit it was unclear whether they assimilate that high altitude data. The TT was further actioned to obtain that information from ECMWF and MetOffice (both NWP centers answered in the meantime, and this data is assimilated, though RH measurements are screened out below a certain temperature threshold. ECMWF is preparing a manuscript to get further insights into the impact of this data on the forecast quality). Note also that another manuscript is in preparation, based on an ICM-13 talk, thus further discussions at ICM-14 should include all relevant actors.

RS92/RS41 Sonde Assessments: RIVAL

The Radiosonde Inter-comparison & VALidation (RIVAL) field campaign, which began in 2018, to assess RS92/RS41 sonde differences at the Eastern North Atlantic (ENA), North Slope Alaska (NSA),

and Southern Great Plains (SGP) ARM sites is complete. This field campaign was initially approved for 1-year of weekly RIVAL launches (RS92 and RS41 on the same balloon) at each of the ARM field sites, but was extended at the SGP site to make use of the remaining RS92 sondes. Launches at ENA and NSA sites ended in October 2019 with a total of 54 and 19 launches completed at each site respectively. Conditions at the NSA site including; staffing, instrumentation, and weather prevented routine RIVAL launches at this site. RIVAL launches continued at the SGP site through January 2022 and a total of 110 RIVAL launches were completed. Details on the field campaign dates and launches are provided in Table 1. This effort was in collaboration with GCOS Reference Upper Air Network (GRUAN) and partially funded by the JPSS Radiosonde field campaign. All RIVAL launches targeted NOAA20 satellite overpasses at each of the field sites making these launches not only benefit to the scientific radiosonde user community, but also the satellite retrieval community.

RIVAL Radiosonde Launches			
Site	ENA	NSA	SGP
StartDate	26 Apr 2018	20 Jun 2018	13 Feb 2018
EndDate	18 Oct 2019	20 Oct 2019	12 Jan 2022
Launches Completed Total (Single/Twin)	54 (54/0)	19 (12/7)	110 (38/72)

Table 1: RIVAL Sonde launch summary. NOAA20 overpasses were targeted with either a Single RIVAL balloon (RS92 & RS41 radiosondes on the same balloon) 15-minutes prior to overpass or Twin balloons consisting of the RIVAL balloon followed by a second balloon with a single RS41 radiosonde. The twin balloons were launched 45- and 5- minutes prior to overpass.

RIVAL launches have been ingested into NPROVS and collocated with satellite retrievals. A sample RIVAL launch from the SGP site and satellite collocations are shown below. TT-SAT (L. Borg, T. Reale, B. Sun) will follow up with the LC to determine if all RIVAL launches were ingested into the GRUAN dual soundings database and to collaborate with the analysis of the dual-launch holdings and having these measurements included in a final publication on the RS92-RS41 radiosonde transition.

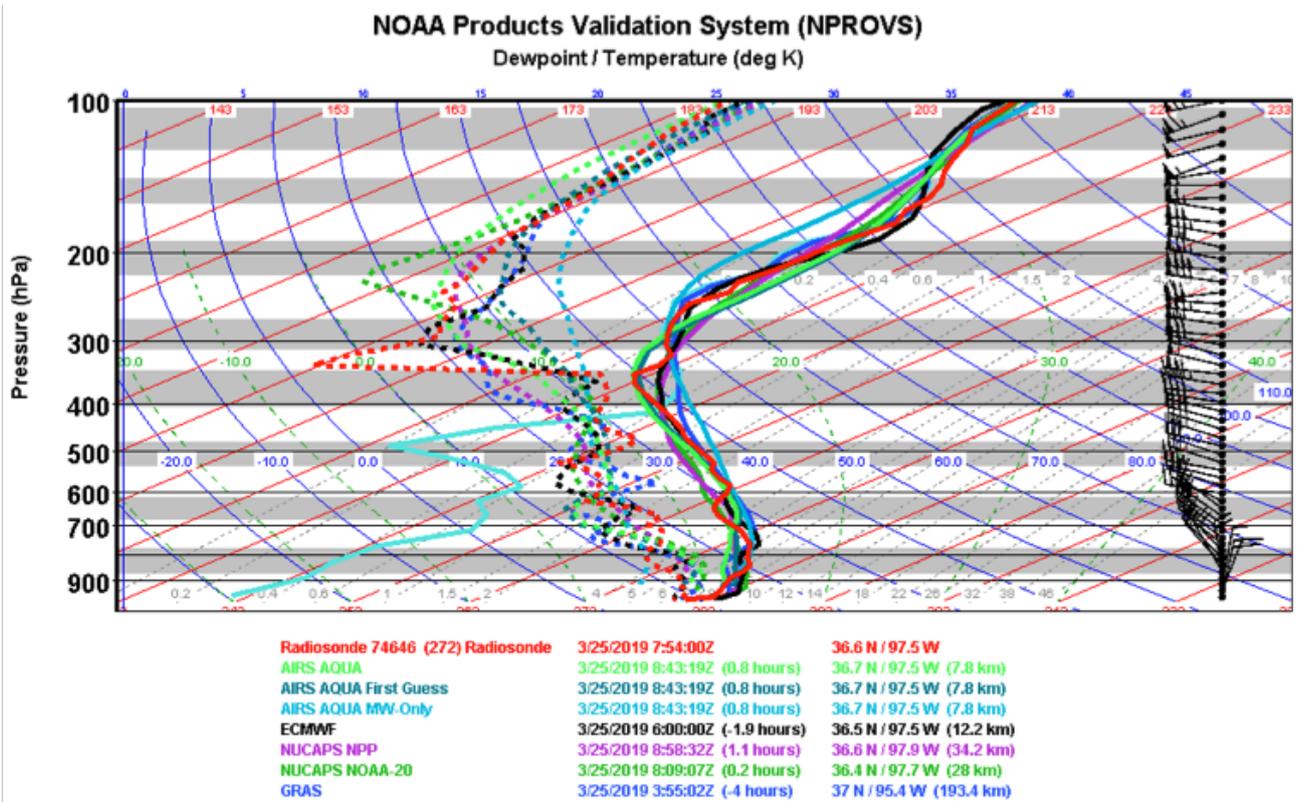
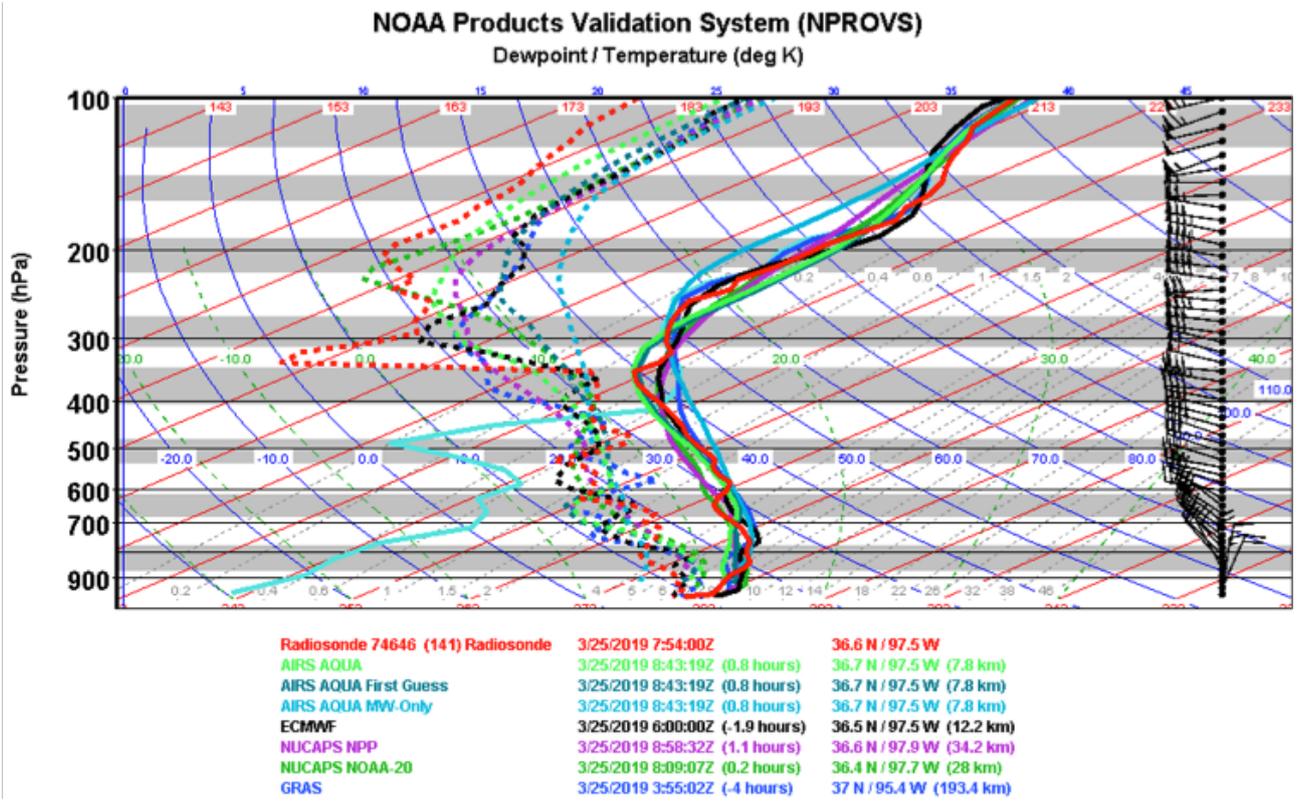


Figure 1: RS41(top) & RS92 (bottom) RIVAL sounding and satellite collocations, 25 March 2019. Radiosonde (red), satellite retrievals (various colors), and GRAS RO (royal blue) with collocation information. Images courtesy Tony Reale.