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Item 7.2.2

Site report: Boulder, Colorado, USA

(Submitted by Dale Hurst)

Summary and Purpose of Document

This document contains an overview of the measurement programme at the Boulder site with respect to GRUAN requirements, and addresses the questions to be discussed in this session.

Site: Boulder, Colorado, USA

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Questions

1. Which of your existing radiosonde launches already meet the mandatory requirements (GCOS-121: once weekly best production quality radiosonde, once monthly stratospheric water vapour; recommended twice daily), and which additional launches need to be instigated or augmented?

We currently launch InterMet RS-1 radiosondes on a weekly basis. These provide transmitted data from:

- EnSci ECC ozonesondes (weekly) for full (surface to 28 km) vertical profiles of ozone
- NOAA frost point hygrometer (twice-monthly) for full vertical profiles of water vapor

We await the fabrication of the NCAR GAUS system for receiving transmitted data from Vaisala RS-92 radiosondes and the funding to purchase 50+ such radiosondes per year for weekly launches on board our current InterMet + ECC + FPH payloads.

2. Which ground based measurements can you provide in addition to the mandatory GPS total water vapour column (microwave, FTIR, lidar, …) and how can you use these additional observations to make sure that measurement uncertainty estimates will be consistent?

We are investigating a cooperative agreement with Radiometrics Corporation for use of one of their MP-3000 microwave profilers that provide measurements of water vapor, temperature, and liquid water at a vertical resolution of several hundred meters. Depending on operational and personnel costs this instrument would be located at our balloon launch site (higher cost) or at the Radiometrics facility in Boulder, about 10 km NNW of the Marshall launch site.
We may also be able to coordinate our balloon launches with a ground-based solar FTIR spectrometer operated by NCAR for column water vapor retrievals. This instrument is located about 10 km NNW of the Marshall launch site.
These ground-based measurements will permit quality checks of the radiosonde measurements (T and RH) and the NOAA FPH measurements (water vapor mixing ratio), and perhaps be useful to gauge if our measurement uncertainty estimates are realistic. It is currently unknown how these measurements can make sure that measurement uncertainty estimates will be consistent, but our plan is to utilize these ground-based measurements over the long term for verification and quality control checks of the balloon-borne measurements.

3. Do you have any limitations regarding the development of GRUAN launch protocols for routine and reference sonde launches (e.g. the use of autosonde launchers)?

No, all of our sonde launches are performed manually.

4. Do you have any limitations regarding the development of uniform GRUAN data processing schemes for remote sensing observations?

Unknown until we reach a cooperative agreement with the owners/operators of the ground-based remote sensors.

5. What local analysis can you provide to assure that measurements uncertainties will be consistent across the network (analysis of redundant observations either dual sonde launches or sonde + remote sensing observations)?

Comparisons between InterMet radiosonde and NOAA FPH water vapor measurements are already performed on a regular basis. Adding RS-92 radiosondes to our payloads would provide another layer of comparison to ensure that we understand the measurement uncertainties. We also have the capability of dual-launching the CFH with our NOAA FPH for comparison purposes. Ground-based measurements over the long term will provide verification and quality control checks of the balloon-borne measurements.

6. For sonde observations: Can you provide all raw data for central archiving?

We can provide all raw data from the InterMet + FPH + ECC system (currently in place) for central archiving. With the addition of the GAUS system for receiving RS-92 data we can provide whatever data are output from the GAUS, whether these are considered “raw” or “meta” data.

7. For remote sensing observations: Will you be able to archive all raw data for possible future reanalysis and reprocessing?

Unknown until we reach a cooperative agreement with the owners/operators of the ground-based remote sensors.

8. What help do you need from the Lead Centre / WGARO / GCOS Secretariat in moving forwards?

Our greatest obstacle in adding RS-92 radiosondes to our payloads and in making cooperative agreements with the owners/operators of ground-based remote sensors is funding. Our participation in GRUAN cannot come at the expense of our own long-term monitoring program.

9. Will you be able so host local intercomparison campaigns (yet to be scheduled)?

Yes. In fact, we are in the process of organizing two water vapor intercomparison campaigns at our Marshall balloon launch site. The first one will occur during March and April of 2010. We anticipate carrying Vaisala RS92 and RR01 radiosondes, the CFH, and potentially a small TDL-based water vapor sensor along with our current balloon-borne instrumentation (FPH). The RR01 (reference radiosonde) is equipped with an advanced polymer sensor capable of measuring humidity in UT/LS region. Possible ground-based instruments/techniques for the campaigns would include GPS (UCAR/COSMIC and NOAA), a microwave profiler (Radiometrics), and a solar FTIR spectrometer (NCAR). The second campaign is still being planned but will most likely occur during January-March of 2011. In addition to the instrumentation utilized in the first campaign, the NCAR HIAPER (High-performance Instrumented Airborne Platform for Environmental Research) will make spiral ascending and descending to obtain water vapor profile data.

10. Are there any special infrastructure needs that should be addressed?

None have surfaced thus far.