Progress on standardisation of cloud observations and their reporting

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Task: Standardizing cloud treatment (at balloon launches at GRUAN sites)

- Proposed at ICM-11
- Main Contact: TT Radiosondes, TT AM (satellites) [We propose to add TT Sites and LC]
- Milestone: Publication in the peer reviewed literature or a technical report

- 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 GDP data files.
- Strategy to be cognizant (aware) of existing practices, and the results of the survey into site issues identified (Note: the survey results were presented at ICM-12)

1. Motivations of this task

- This task arose from a discussion at ICM-11 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.

1. Motivations of this task

- [Rslaunchclient & GDP uncertainty]
- 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.
- “For a GDP, we should document all the relevant meteorological conditions (cloudiness at the launch is one of them)”

- [Difficulty in cloud obs]
- A clear sky ascent may take different assumptions from a cloudy ascent because, 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.

- [Request from TT AM (Satellite)]
- The cloud info would help identify cloud-free cases required for satellite sensor monitoring (hyperspectral IR, etc) using (overpass) GRUAN radiosondes (along their tracks).

2. Challenges

- “Cloud observation/detection is always a fascinating but challenging topic in remote sensing and climate.”

- Historically, cloudiness (amount, type and base height) has been VISUALLY observed by human at weather stations.
- These man-made observations have gradually been replaced by those made by laser ceilometers (since the mid-1990s over the USA) and other instruments at some research sites.
- [See e.g., WMO CIMO Guide, 2018, Vol 1, Chap. 15]

- Again, we note that radiosondes are drifting while flying for >1.5 hours – thus, ideally, cloud observations should be made for the whole flight period and for the whole relevant regional domain. . . [Geostationary satellites images, in addition to various on-site measurements, may be also useful?]

3. The survey results (TT-Site, ICM-12)

- A quick survey summary:
  - Some sites have automated 24h-instrumentation available (ceilometers, radars, sky imagers, etc.)
  - Some sites do manual observations (but with different levels of reporting in place)
  - Some sites do not have cloud observations

- One suggestion from outside TT-Site:
  - “These in situ cloud observations are very valuable, particularly when they are bundled together with GRUAN radiosonde temperature and RH profiles. It appears to be challenging to unify different types of obs. into the same format, but the effort is worthwhile.”

4. Discussion

- The current strong need (for sat. val.): “To provide baseline "manual" cloud observations at each launch, but in particular for launches targeting a satellite overpass (targeting relatively clear cases).”

- Do we need to show some demonstrations how the surface cloud information is important (and what magnitude of uncertainty it may give), for satellite validation, for GDP uncertainty, etc. ?
- Or, because the impacts are obvious, we should start discussion on archiving some available cloud data (in particular, the manual obs.), to see if it is feasible? [Note that currently available cloud data vary a lot among GRUAN sites.]
- After that, we start to consider “recommendations” for cloud observations at GRUAN sites and their reporting/archiving?

- What are useful for satellite validation purposes?
- What are useful for GDP uncertainty reduction?

- We start with trying “to develop a set of manual observation techniques/storage at GRUAN sites” ? (i.e., starting from manual obs. and then thinking about automated obs.)

If you have any comments/suggestions, please email me (Masatomo Fujiwara) at fuji@ees.hokudai.ac.jp

5. Proposal as the next steps

- We ask LC whether Rslaunchclient (and the radiosonde GDPs) have capability to report/archive/disseminate the manual cloudiness observations at the launch.
- We ask the sites that have manual cloudiness observations to consider to send that info together with each radiosonde flight.

- We ask the sites and LC to consider the possibility to report/archive/disseminate (the already available) automated cloud measuremet data – This should be covered by TT-AM?

- After these trials by some sites, we write up a TD/paper on our then agreed recommendations.

- Also, perhaps as a separate task, various “cloud instruments” (including sky cameras with various algorithms, balloon-borne sensors) are reviewed and considered for the potential use in GRUAN (led by TT-AM?)