



STAR

**Center for Satellite
Applications and Research**

formerly ORA — Office of Research and Applications



Ancillary Measurements (TTAM)

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GRUAN ICM-8
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Boulder Colorado



Summary of progress TTAM 2015-2016

Task Team Membership:

- *No new member since 2014*

Lidar:

- *ISSI Team work on Uncertainties now published in AMTD (3 manuscripts)*
- *Data stream: No progress since ICM-7*
- *Technical document: ongoing, presentation by Thierry tomorrow*

Microwave:

- *Technical document: ongoing, presentation by Nico Cimini tomorrow*

FTIR:

- *Technical document: not started, presentation by Jim Hannigan tomorrow*



SASBE

Action: Create through appropriate data fusion approaches optimal estimates of the column ECV properties from multiple data streams building upon their respective strengths.

Who: Task Team on Ancillary Measurements, Science Coordinators, WG-GRUAN, Lead Centre

GIP A8

Time-frame: 2019 for first products, 2021 for more mature set of products

Performance indicator: Papers published and such estimators being produced and made available for data arising from GRUAN stations on a sustained basis.

Benefits: Better characterization than possible by any single instrument, better understanding of the instruments at GRUAN sites and their performance.

34	Demonstration study of Site Atmospheric State Best Estimate (SASBE) to include impacts of mixes of observations and spatial/temporal mismatch in context of climate monitoring and SAT cal/val; focus on temperature, H2O vapor profile and consistency between (among) respective platforms (AM, SAT, RAOB) to suport SASBE calculation.	TT ancillary measurements	April 2016
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.... Dykema, Borg, Jordis, Richard Q



The call for AM data streams ...

Action: Develop an average of at least one new data stream per year between 2016 and 2021

Who: Task Teams, Lead Centre, WG-GRUAN, sites, contributing / collaborating networks.

Time-frame: By 2021

Performance indicator: For each data product there exists:

- i) a Technical document describing how the measurements are to be taken;
- i) a paper describing the traceability and uncertainty quantification;
- i) a centrally processed data stream that is publically accessible.

GIP A2

Benefits: Improved ability to characterize atmospheric column properties at sites, complementary measurements allow independent verification of adequacy of uncertainty budgets calculated.

Action: Deploy data streams as they develop via the data portal and monitor indicators of usage such as publications that use the data.

Who: Lead Centre, Task Teams, sites

Time-frame: Continuous

Performance indicator: Data are publically accessible and there is demonstrable evidence of growing usage within the community.

Benefits: Long-term network utility and viability, return on investment

GIP A3

Action: Periodic review of data streams for usage and issues raised

Who: WG-GRUAN, Task Teams, invited experts (as deemed necessary)

Time-frame: Continuous, for any given stream at least once per four years.

Performance indicator: Brief report available on data stream and its usage with any actions required clearly stated.

Benefits: Ensuring that data streams remain cutting edge forcing oeriodic re-review and (as deemed necessary) reprocessing

GIP A4

Action: Undertake research to understand the effects of scheduling for different instruments and end-uses and provide quantitatively based advice on scheduling.

Who: Task Team on scheduling, Lead Centre, WG-GRUAN

Time-frame: Continuous

Performance indicator: Publications and evidence for progress in annual ICM reports, advice dispensed to sites and taken up.

Benefits: Optimal use of observational assets to meet stakeholder needs.

GIP A7

Action: Sustained engagement with the user community to ensure usage and exploitation of data arising from GRUAN activities.

Who: WG-GRUAN, Lead Centre, Task Teams

Time-frame: Continuous

Performance indicator: Papers published, presentations given, participation in international activities

Benefits: Ensures usage by expert community to drive value.

GIP A12

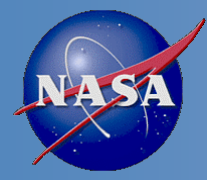


A Path Forward

Integrate AM data streams and SASBE

- Respective AM Atmospheric temperature/moisture profiles with uncertainties
- Routine input to NPROVS+ ... *from clients*
- Routine analysis of respective inter-platform (pair) consistency
- SIGMA estimation(s) for respective pairs
- SASBE based on consistent AM profiles including uncertainty (and SIGMA)
 - Climate monitoring
 - Sat Product cal-val
 - RT Model validation
- Scheduling routine AM / RAOB / SAT synchronized observations ...





GRUAN Uncertainty Measurement (GUM)



Given two measurement (m_1, m_2), their uncertainty (u_1, u_2) and variability (σ), then two observations are **consistent** if

“k” .ie. 2

$$|m_1 - m_2| < k \sqrt{\sigma^2 + u_1^2 + u_2^2}$$

... in following plots :

$$\mathbf{“k” = ABS(X - GRUAN) / u_2}$$

where u_2 is GRUAN uncertainty

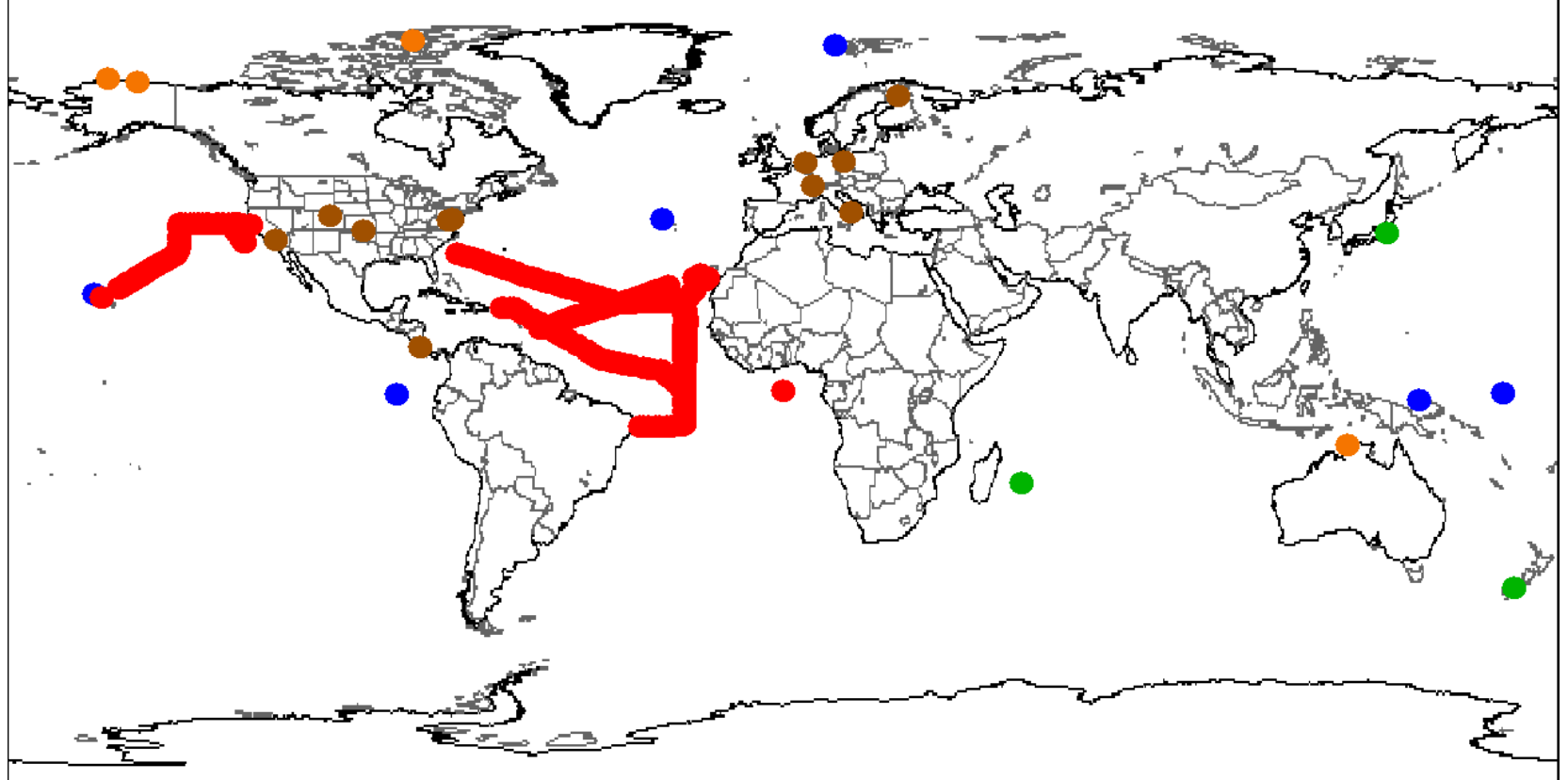
$$\sigma^2 + u_1^2 \sim ((“k”/2)^2 - 1) (u_2)^2 ; u_1 = a(u_2)$$

$$\sigma^2 \sim ((“k”/2)^2 - 1 - a^2) (u_2)^2$$



NOAA Products Validation System (NPROVS)

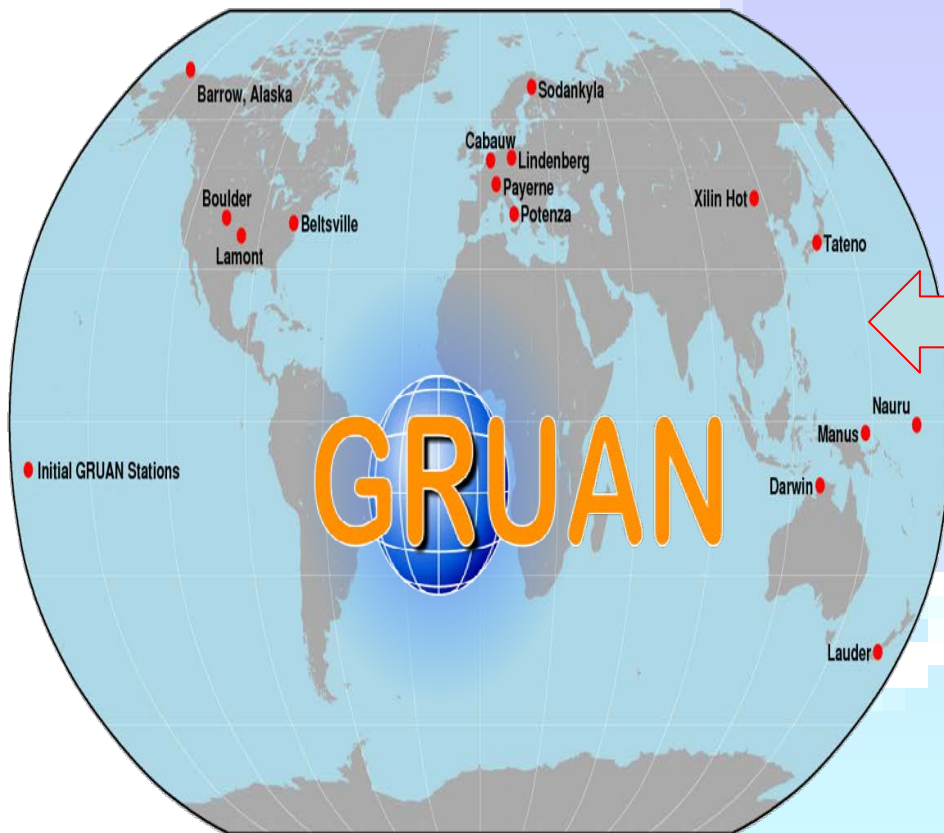
Coast Land Island (Coast) Island (Inland) Ship Dropsonde



Number of collocations: 20680 (32 unique locations)

2013 to 2016

GRUAN and JPSS funded Dedicated (S-NPP) RAOB Sites
Over 20,000 RAOBS (2000+ Dedicated) available since 2013



JPSS Funded Dedicated RAOB

- DOE ARM (SGP, NSA, ENA)
 - ✓ CIMSS
 - ✓ (2) per week
 - ✓ **GRUAN processed**
 - ✓ dual vs single, etc
- AEROSE
- CALWATER (El-Nino RR ...)
- Sterling Test Site ...

Global Climate Observing System (GCOS)
Reference Upper Air Network (GRUAN)

GAIA-CLIM Coordinations

EUMETSAT synchronized
(IASI-GRAS)

Synchronized GRUAN
RAOB and GPSRO
(COSMIC, GRAS)



SUMMARY

- Instrument Technical Documents
- Data Streams of AM Atmospheric profiles
- Scheduling routine AM / RAOB / SAT synchronized observations
- Integration into NPROVS+
- Consistency analysis, AM, , SASBE, SIGMA
- “3G” support





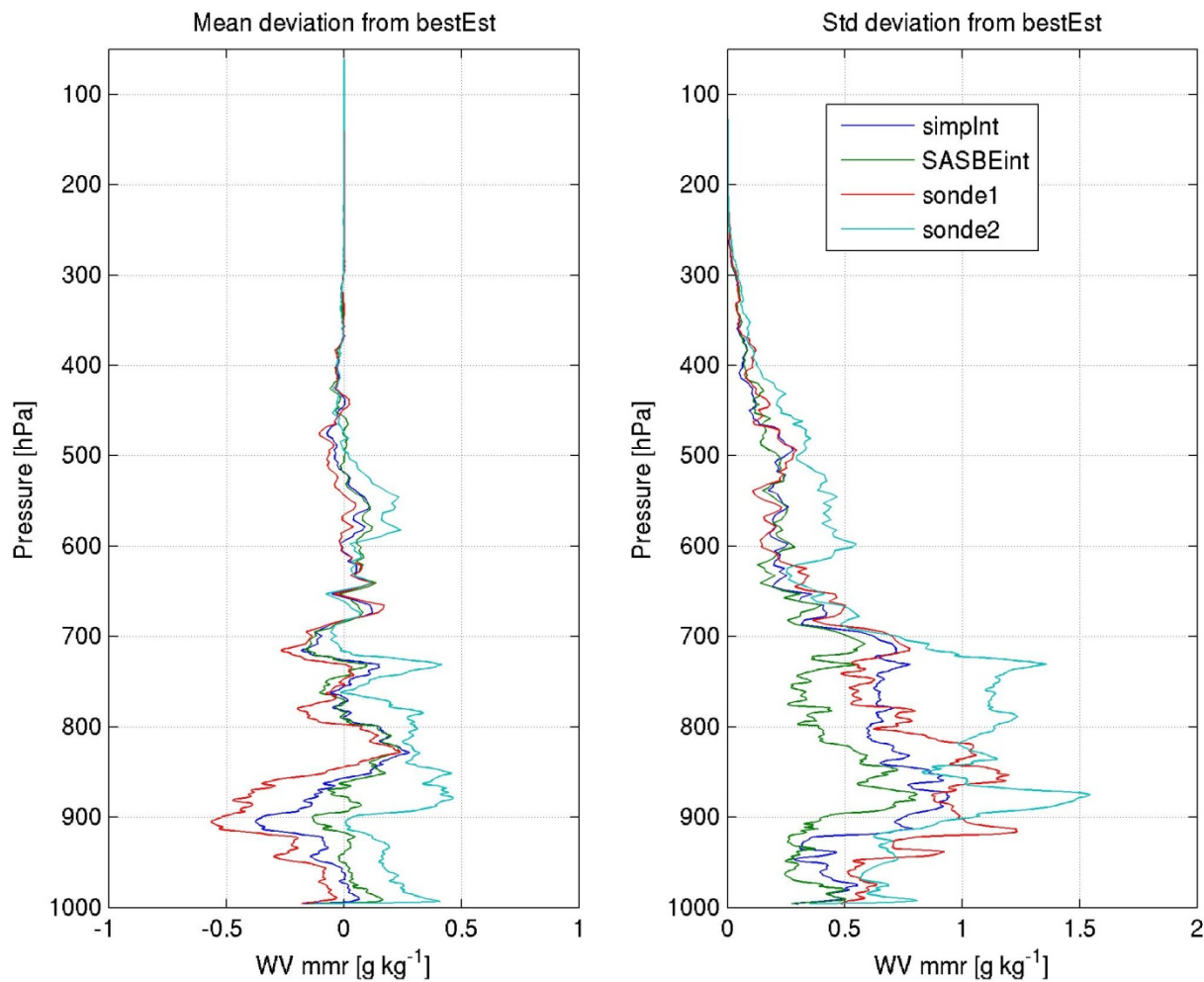
The GEWEX water vapor assessment (G-VAP)

- Marc Schröder, Maarit Lockhoff
- Special thanks goes to
- Ralf Bennartz, Frank Fell, John Forsythe, Antonia Gambacorta, Anthony Reale, Remy Roca, Noelle Scott, Lei Shi, Tim Trent, Andi Walther, June Wang, Qiong Yang





Using raman lidar for water vapor

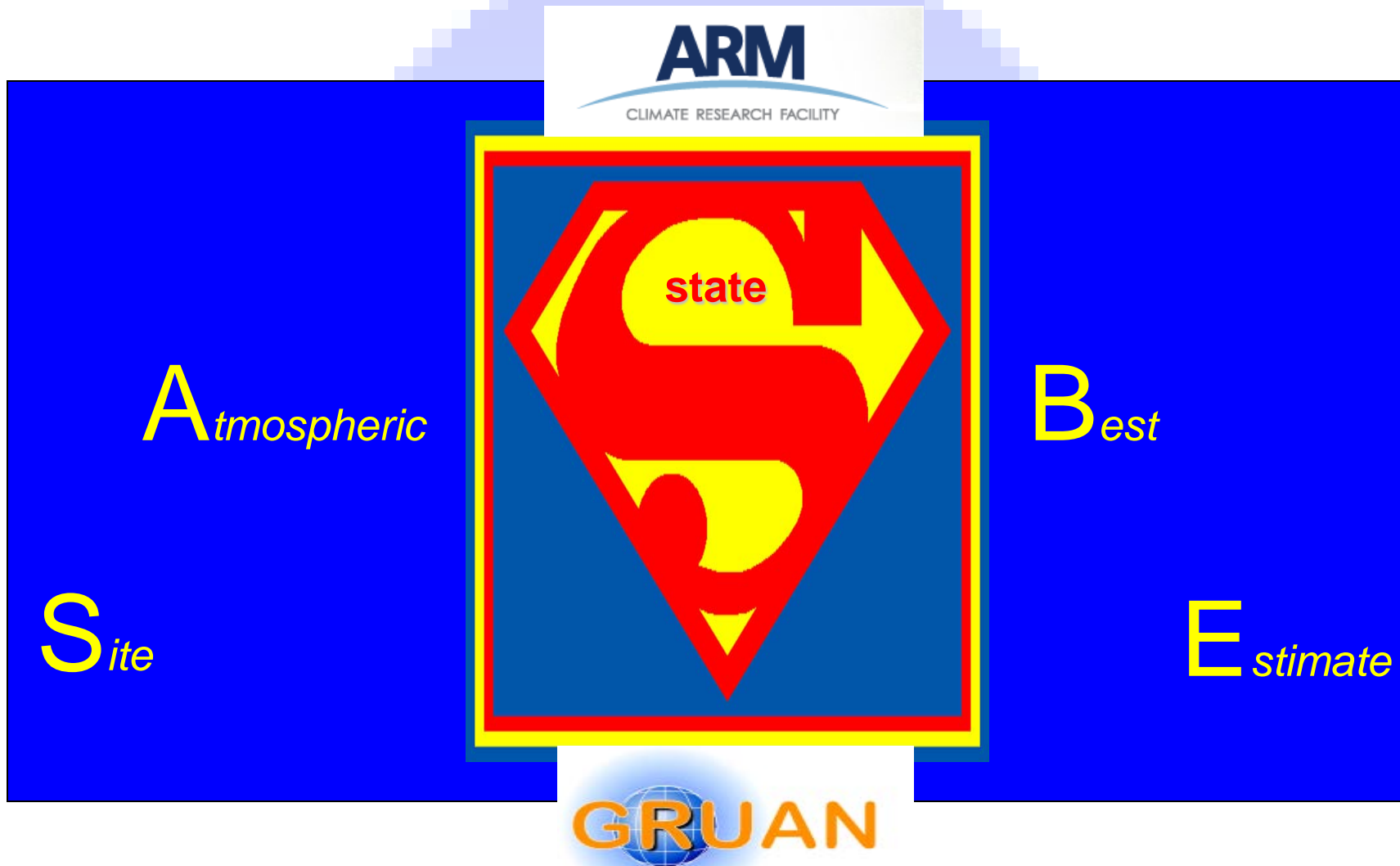




22	Technical documentation for GRUAN lidar stream (lidar Guide) submitted for review by WG-GRUAN	TT Ancillary Measurements	Dec 2015
26	Revise the RS-92 data stream based upon feedback received - revised version 3 release including qc flags vectors and data in different vectors (good, questionable, missing), including implementation of performance feedback. Validate new radiation correction using ancillary measures to build confidence (paper). Document v3 appropriately.	Lead Centre, TT radiosondes, TT ancillary measurements	March 2016
4	Define strategy and necessary steps to undertake transition from RS-92 to another sonde model. Produce GRUAN report on strategy and rationale including inter-alia: <ul style="list-style-type: none">– Sharing the burden– Role of ancillary measurements– Plans for parallel measurements– Ensuring competition in marketplace	Lead Centre, TT radiosondes, TT sites, WMO, GCOS	Oct 2015
28	Determine how best to work with NDACC and GAW to bring in measurements of aerosol properties into GRUAN. Produce short document outlining a proposed strategy.	WG Chairs, WG members, TT ancillary measures, Potenza, EARLINET	March 2016



Site Atmospheric State Best Estimate (SASBE)



SASBE as a metric for site assessment