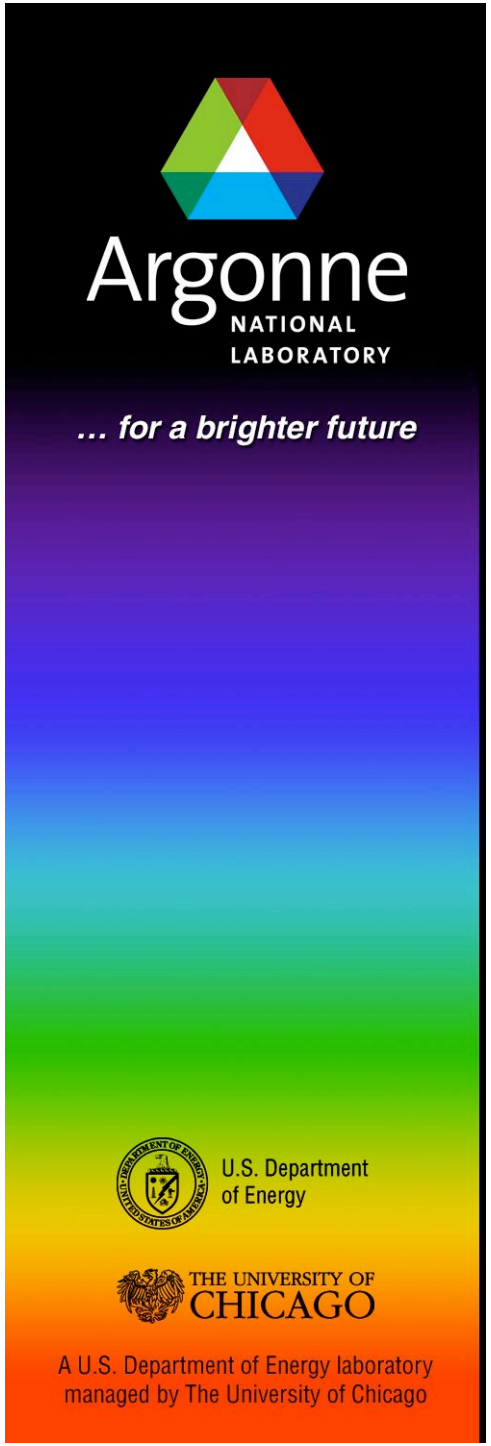


ARM Climate Research Facility

# Radiosonde Operations and Quality Control Procedures at the ARM Climate Research Facility

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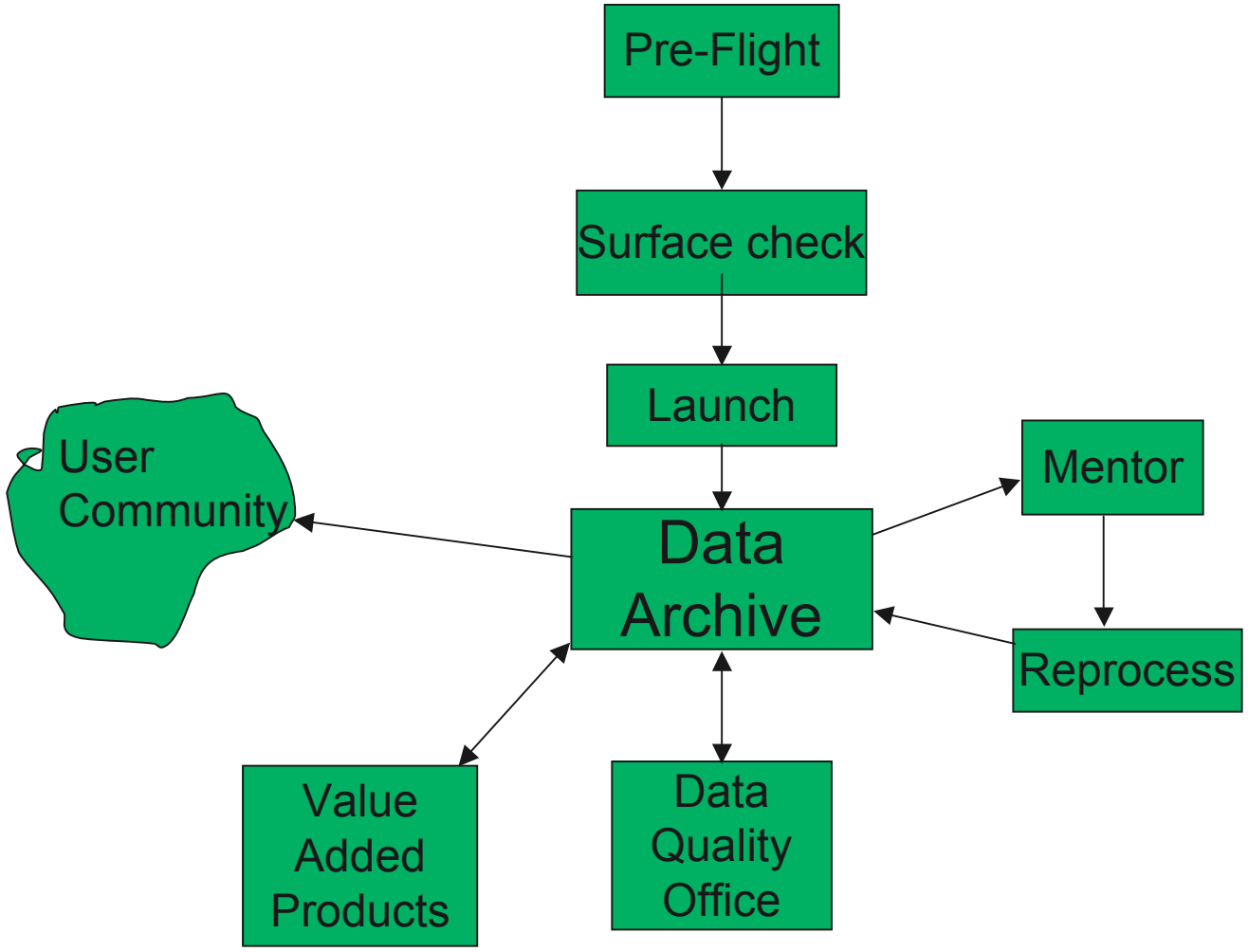
*Meeting on the Implementation of the GCOS Reference Upper Air Network (GRUAN)*

# ACRF Radiosonde Operations

- Daily launches from the Central Facility (Lamont, OK, USA)
  - 0530 GMT
  - 1130 GMT
  - 1730 GMT
  - 2330 GMT


- Additional Lauches within SGP site as required for IOPs
- Vaisala RS92 Sondes with LORAN C wind determination
- ARM also makes launches from:
  - North Slope of Alaska (Barrow) (2 X/day: GPS winds)
  - Manus Island (Tropical Western Pacific) (2 X/day: GPS winds)
  - Nauru Island (Tropical Western Pacific) (2 X/day: GPS winds)
  - Mobile facility (California [2005]; Africa [2006]; Germany [2007]) (4 X/day GPS winds)


Pre-Flight
Surface check
Launch
User Community
Data Archive
Mentor
Reprocess
Value Added Products
Data Quality Office

# *Prelaunch Procedures*

- Primary Instrument verification: Ground Check Station
  - Reconditioning (burn off packaging impurities from RH sensor)
  - Obtain corrections to Temperature (25 $^{o}$C) and RH (0%)

- Ambient Surface verification:  Surface Temperature Humidity Reference System
  - Aspirated compartment for ground reference values
  - Compare with 6 different T, RH sensors

# Post-Launch Procedures


- Near-surface T, RH Values
  - Data Quality Office provides near surface values to mentor daily
  - Inspection of initial values sometimes indicates unreasonable T or RH differences between surface and first reported height. When this occurs, the entire launch is reprocessed with appropriate surface values
- Daily inspection of profiles by instrument mentor may trigger Data Quality Report
  - Broken Temperature sensor
  - Failure of heating circuit for RH sensor
- Weekly Data Quality Office reports
  - Used by mentors for equipment maintenance and data quality issues
  - Used by scientists for data quality and usefulness (height of sounding for example)

# *Ongoing Quality Control*

- Value Added Products
  - Lssonde: Moisture profiles from each radiosonde are scaled such that its total precipitable water vapor matches that retrieved from the microwave radiometer (MWR)
  - Merged sounding: A combination of observations from radiosonde soundings, the microwave radiometer, surface meteorological instruments, and ECMWF model output to define profiles of the atmospheric thermodynamic state at 1 minute intervals.
- Intensive Operating Periods
  - Water Vapor IOPs: Detailed comparison of sonde, MWR, Raman lidar, radiometer profiles at the ACRF (1996, 1997, 2000) and dry, winter time studies at NSA (2004)
  - RS92 - NASA ATM radiosonde temperature intercomparison: Investigate upper air T and RH measurement biases

# *Feed back into Improved Sonde Performance*

- Relative Humidity
  - Dry bias of RS80 sonde RH measurements
  - Dependence on “batch number” of sonde manufacture/calibration
  - Correction for assumed time lag of sonde sensors
  - Radiative corrections for Temperature
  - Radiative corrections for Relative Humidity
- Changing components
  - Comparison of RS80 and RS90 sonde performance - carried out during Water Vapor IOP 2000.
  - Comparison of LORAN C and GPS wind sensing

# Changing Operating Components

- Certain circumstances warrant changes in operation, equipment or software
  - Vendor no longer supports/provides component or software
  - ACRF is dissatisfied with performance
    - *Dry bias of RS80 sondes*
    - *Poor calibration and quality control of vendor ("batch" dependence of RH sensors)*
    - *ACRF may be able to "convince" vendor to modify components*
- Formal Procedures
    - *Baseline and Engineering Change Request System: Debate among ACRF engineers and scientists to evaluate rationale, necessity, and means of implementation*
    - *IOP: Field study to compare performance before and after modifications (WVIOP-2000, e g)*

# *Changing Operating Components (cont)*


- Informal Procedures
  - Instrument mentors have immediate access to new data for continuing comparison and will likely comment on changes in their monthly reports.
  - Users have full knowledge of changes through metadata and data quality reports. Because the sonde data is often critical to their results, they often undertake their own comparisons and provide feedback.

# Summary


- ACRF is vitally involved in maintaining and improving radiosonde performance
- Pre-flight and surface comparisons are critical
- Attention to detail by mentors, DQ office, and users is critical to maintaining reliability