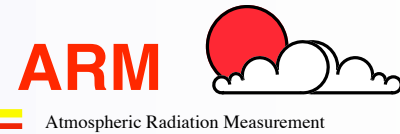


# **Atmospheric Radiation Measurement Program Value Added Products**

Jennifer Comstock

Pacific Northwest National Laboratory

# Value Added Products (VAPs)

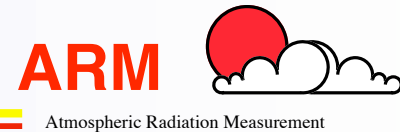


- Procedure or algorithm that adds critical value to existing ARM data
  - Calibration
  - Cloud boundaries from radar/lidar data
  - Assess instrument performance
  - “Best Estimate” of retrieved quantity

- ❖ Provide quality, calibrated measurements
- ❖ Supply users with derived geophysical properties not easily obtained

[http://www.arm.gov/data/vaps\\_all.php](http://www.arm.gov/data/vaps_all.php)

# VAP Categories

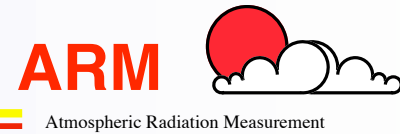


- **Geophysical quantities unavailable by direct means**
  - Cloud boundaries; microphysical properties; heating rates
  - Continuous thermodynamic profiles (MERGESONDE)
- **Apply corrections or calibrations to input data**
  - Lidar backscatter profiles (overlap, deadtime, after-pulse)
  - QC Rad – quality control on surface radiometer measurements
- **Perform comparisons of geophysical quantities**
  - Quality Measurement Experiment (QME)
  - Measurement – Model intercomparisons
- **Best Estimate of geophysical quantity**
  - Shortwave and Longwave Surface Flux
  - Aerosol Best Estimate (extinction profiles, optical depth)

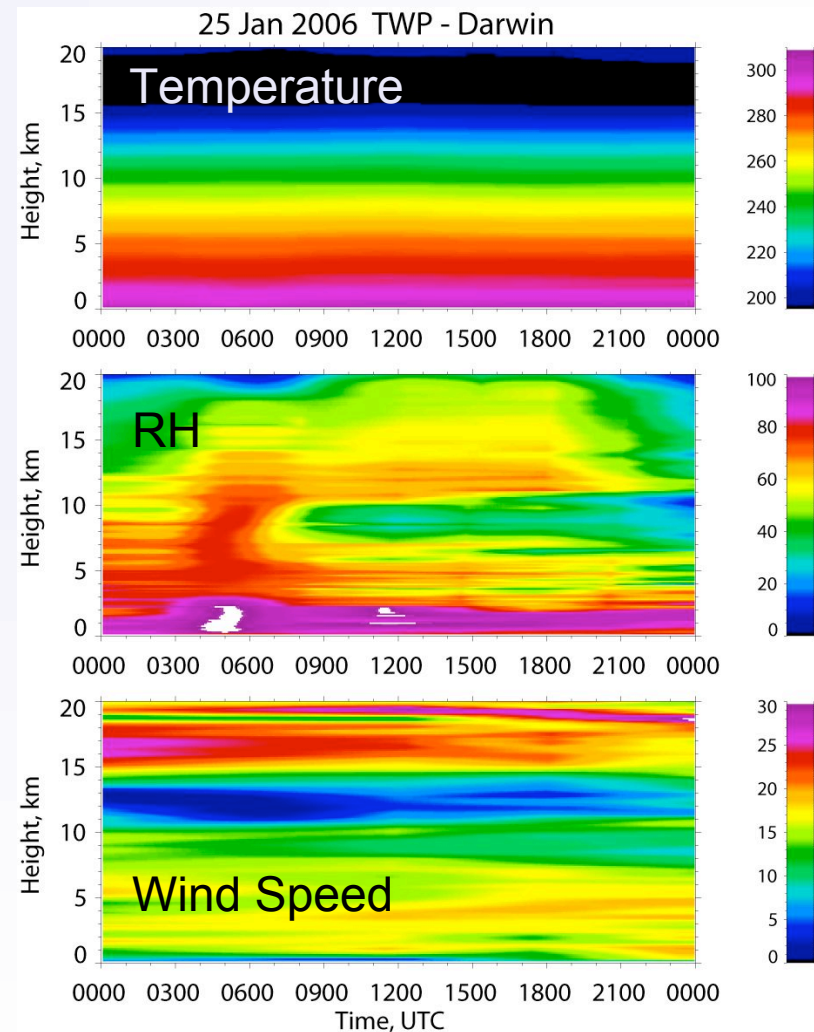
**Total VAPs in production or development: 47**

- 26 - "autonomous"
- 11 - manual operation
- 10 – both autonomous and manual aspects

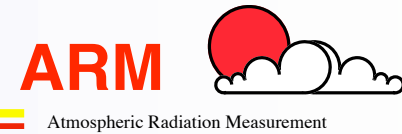
# Derive New Geophysical Quantity: Merged Sounding



- Purpose: To Derive Continuous Thermodynamic Profiles
- Observations: radiosonde profiles, MWR, surface met.
- ECMWF model output
- Applies a sophisticated scaling and interpolation scheme to produce profiles of T, P, RH, Winds
  - 1 minute resolution
  - 266 altitude levels



# Apply Corrections or Calibrations: Corrected Lidar Profiles



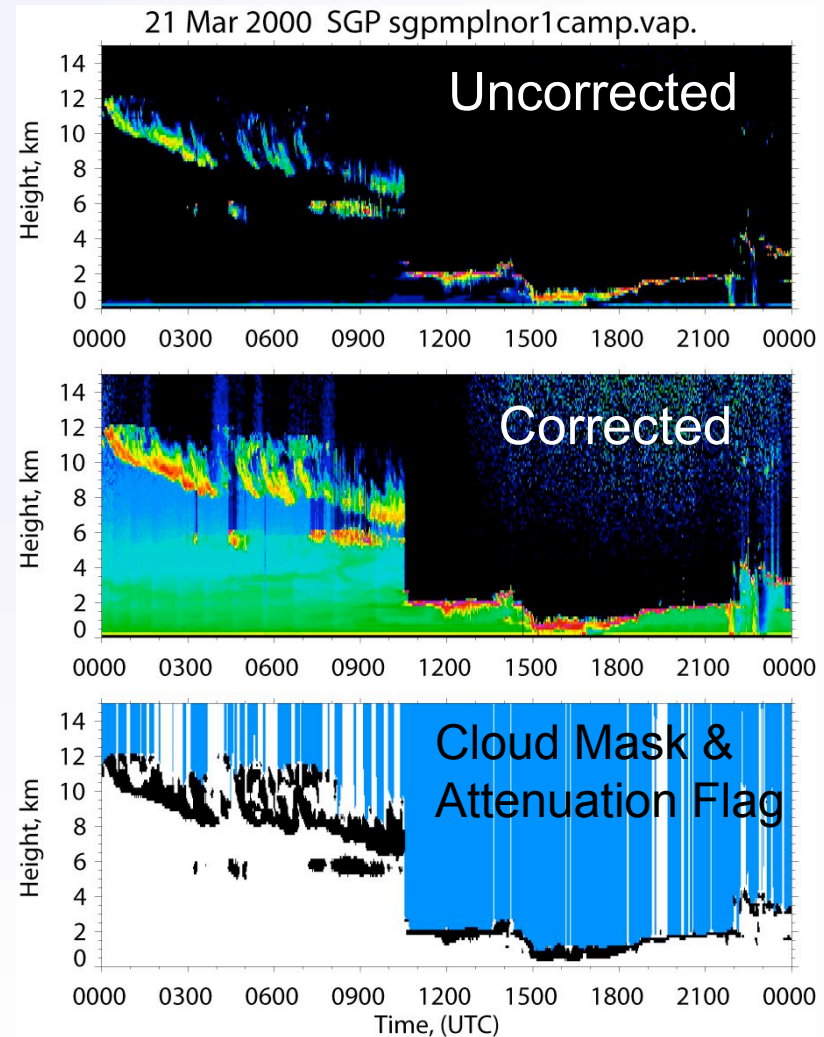
➤ Purpose: Derive lidar normalized backscatter coefficient from raw photon counts

➤ Apply Corrections

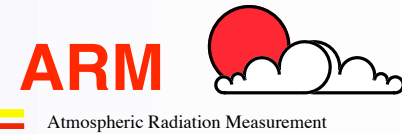
- Afterpulse
- Range-square
- Deadtime
- Overlap

➤ Detect cloud boundaries

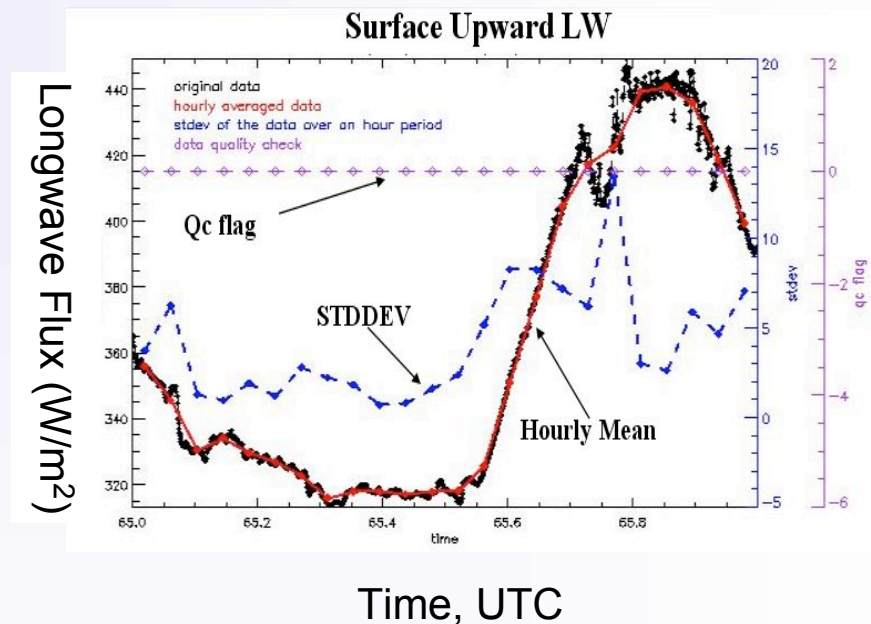
➤ Identify attenuated lidar beam



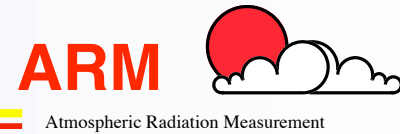
# Cloud Modeling Best Estimate



- Purpose: Provide a best estimate of 10 select ARM datastreams including:
  - Cloud fraction
  - Surface fluxes
  - Cloud cover derived from lidar/radar + TSI
  - LWP/PWV
- Compiles data from several VAPs
- Tailored for global climate model evaluation
- Averaged over 1 hour intervals at the 5 primary ARM sites

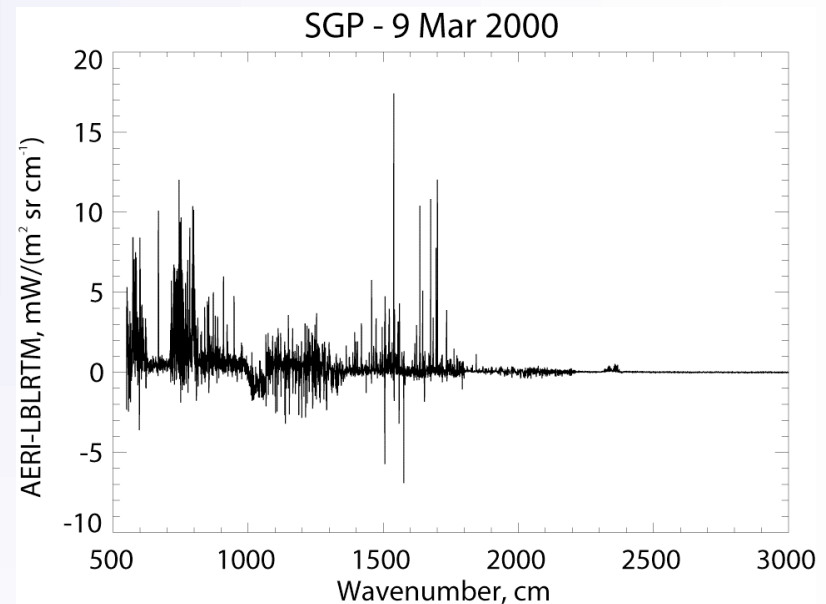


# Comparisons of Geophysical Quantities: QME AERI-LBL

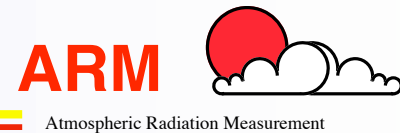


- Purpose: To compare observed and calculated longwave downwelling radiances
  - AERI (3.3 – 18  $\mu\text{m}$ )
  - Line-by-line radiative transfer model (LBLRTM)
- Originally performed for clear sky conditions
- Identified issues with spectral models used in radiative transfer

## Measurement – Model Difference

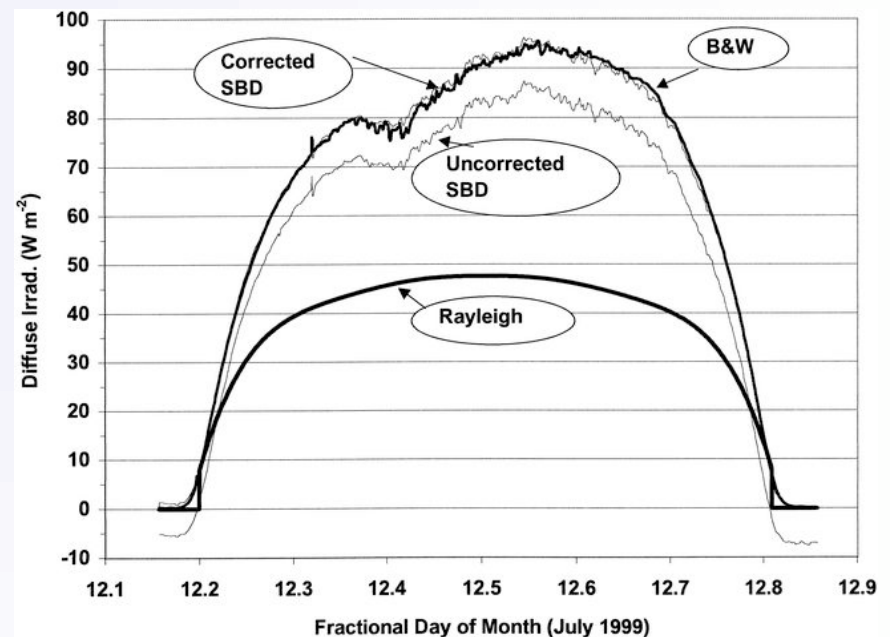


# VAPs Provide Consistency between Datastreams: Shortwave Pyranometers



- Energy loss due to IR emission identified in Standard Eppley Pyranometers caused a bias in SW diffuse measurement of 20-30%
- Eppley model 8-48 “Black and White” found resistant to IR loss
- ARM Replaced original pyranometers with “Black and White” version
- Developed SW Diffuse Correction VAP to correct archived data and provide consistency with new technology (Dutton et al. 2001)

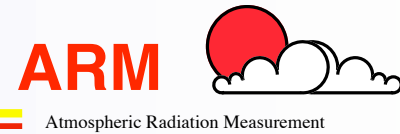
## Surface Diffuse Irradiance



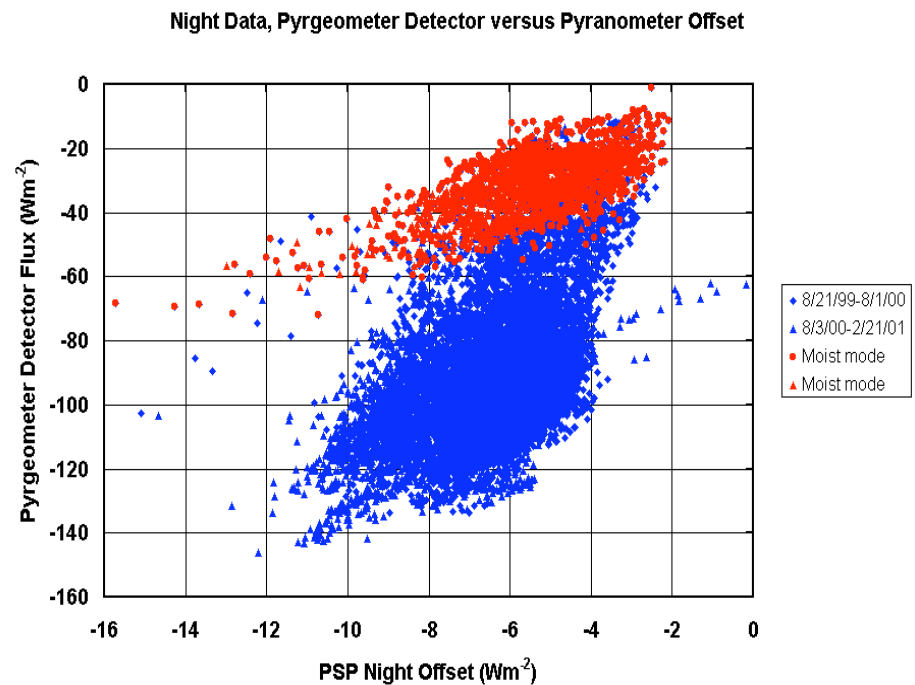
From Dutton et al. JTECH (2001)



# VAPs Provide Consistency between Datastreams: Shortwave Pyranometers



- During development of “Diff Corr” VAP, bimodal behavior of IR Loss discovered
- IR Loss occurs during both day and night
- Full corrections developed to compensate for bimodal behavior



# Extra Slides

# VAP Development Cycle

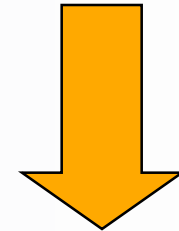
## 1. Discussion

VAP idea proposed to Working Group  
WG/Translator prioritize VAPS



## 2. Planning

Programmatic prioritization  
Allocation of resources

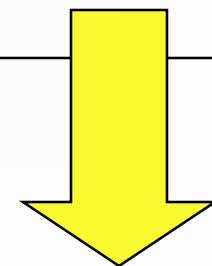
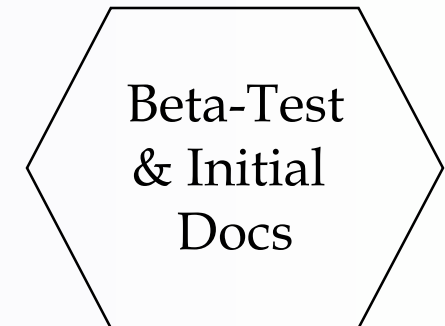


## 3. Development

PI Sponsor

Translator

Developer

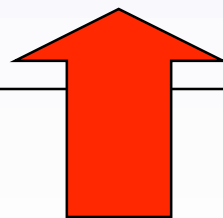


## 4. Evaluation Release

Science Team

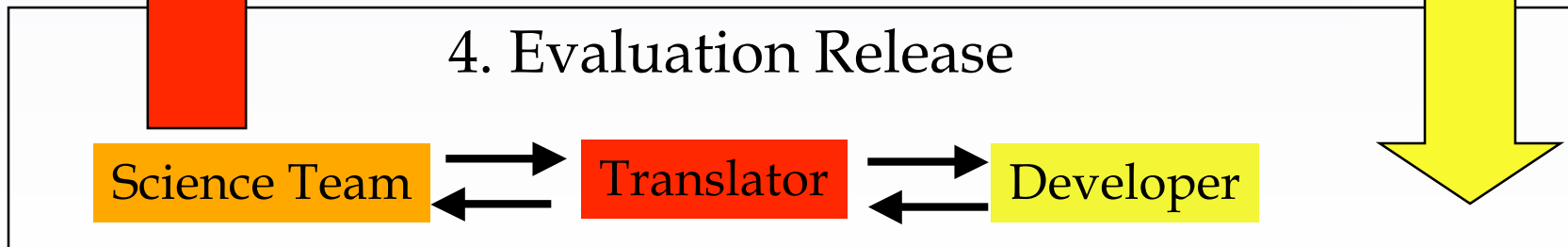
Translator

Developer



## 5. Production

Manual or Auto. Operations  
VAP output stored in the archive



# “Evaluation Release of VAPs”

