VAP Update for *Warm Boundary Processes Working Group*

Shaocheng Xie*
Lawrence Livermore National Laboratory

*Translator (Interim) for WBP Working Group

Science product development led by team of scientists

ARM CLIMATE RESEARCH FACILITY

Translator Group

Shaocheng Xie
Lead Translator
Warm BL POC
Modeling POC

John Shilling
Aerosol POC

Scott Collis
Convective POC
CACTI POC

Krista Gaustad
Software
Development

Scott Giangrande
High-latitude POC
ACE ENA POC
MARCUS POC
COMBLE POC
MOSAiC POC

Topics:

ARM
CLIMATE RESEARCH FACILITY

- WBP Working Group data needs
- Current ARM data status
- Efforts to address data issues
- General discussion/feedback

WBP Working Group Data Survey

(from Yunyan and Rob)

- **What are the top 3 (or more) ARM data streams that you use most in your warm boundary layer research? (8 responses)**
  - ARSCL/KAZRARSCL
  - Sounding
  - Continuous Forcing
  - LASSO,
  - MWRRET
  - Surface aerosols
  - QCRAD
  - ARMBE-CLDRAD
  - AERI
  - Doppler lidar
  - ECOR, EBBR

WBP Working Group Data Survey

(from Yunyan and Rob)

- **Data needs and issues**
  - Surface site data and vertical profiles of cloud and aerosol properties, as well as simultaneous thermodynamics and large-scale environments; LASSO
  - The ARM data currently is not calibrated or quality controlled.
  - Improved documentation of how to best use quality control fields. Improved overviews of the data stream variables in the technical reports.

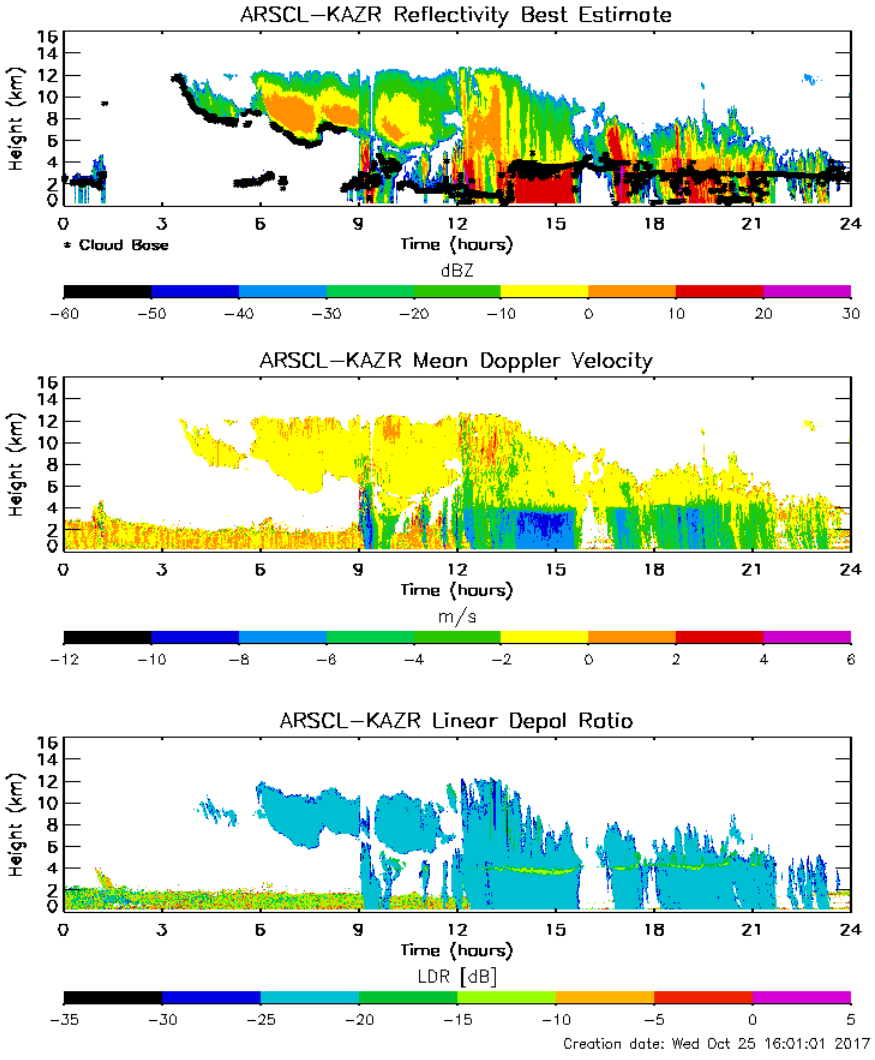
Warm Boundary Layer Clouds – VAP Update

- Core VAPs for Mobile Facility deployments
  - AWARE: QCRAD (45%),RADFLUX(0%) Complete: AERINF, DLPROF, PBLHT, MPLCMASK
  - LASIC: Complete: QCRAD, DLPROF, PBLHT, MPLCMASK, MWRRET1, AERIINF (ready to ship) RADFLUX(0%)
  - MARCUS: MPLCMASK, PBLHT, AERIINF (ready to ship)
- New VAP Development
  - Photogrammetry Products: COGS (evaluation), PCCP (development; end FY19)
  - QCAOD – reviewing data for release this summer
  - MWRRET2: end FY19
  - AERIOE– Running and shipping data to archive, meta data issue preventing discoverability
- MFRSR Related VAPs
  - On hold due to filter upgrades to include the 1625 nm channel
  - Affects AOD, CLDOD, SURFSPECALB
- Available: Cloud Type (SGP, TWP) and Shallow Cumulus (SGP)
- QCRAD annual processing through 2018 at SGP C1, E13, brsC1; NSA, and OLI; ENA In Progress
- ARSCL available for all fixed and AMF sites (< 1 month delay).
- ARMBE, Forcing are also available for SGP, NSA, ENA, and some selected AMF sites

ARSCL Improvement

Translator contact: Giangrande, sgrande@bnl.gov

- "Instant" ARSCL:
  - New process chain brings faster product availability ('c0').
- Now Up-To-Date (!!):
  - Available for all AMF, fixed site deployments to within 1 month.
- More Accurate:
  - For FY20: Incorporating Doppler spectra processing, new streams to better remove artifacts, designate clouds.



Microwave Radiometer – 3 channel (LWP/PWV) MWRRET2TURN Automated Bias Calculation

- Ongoing issues with biases. Developed automated bias calculation within MWRRETv2
  - Daily bias values calculated by taking running mean of difference between calculated and clearsky tbsky during clearsky periods.
- Site dependent settings (currently available for OLI, ENA)
- Validated against manual monthly bias corrections
  - Maximillian Maahn at Oliktok
  - Carolyn Brauer at ENA
- Current status
  - Wrapping up VAP logic and finalizing DOD

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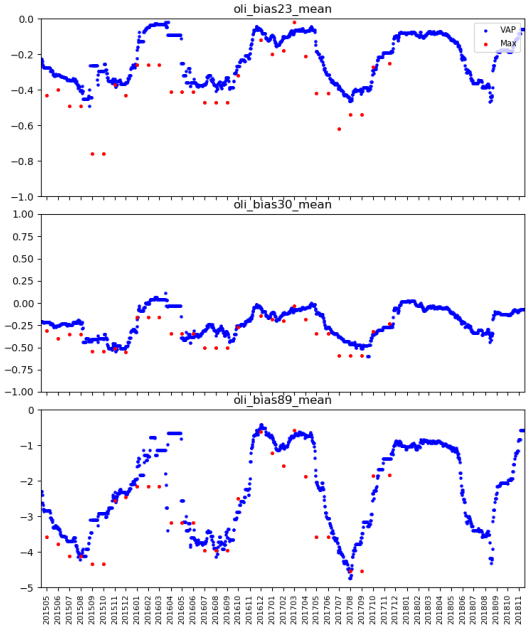
Gaustad, Krista L <Krista.Gaustad@pnnl.gov>

MWR3C - Auto-bias Correction Results

Comparison of OLI daily auto-bias to manually calculated monthly bias

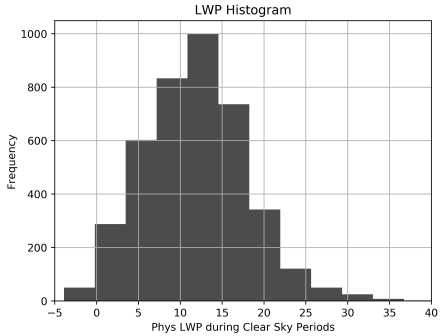
VAP Auto-bias

Manual

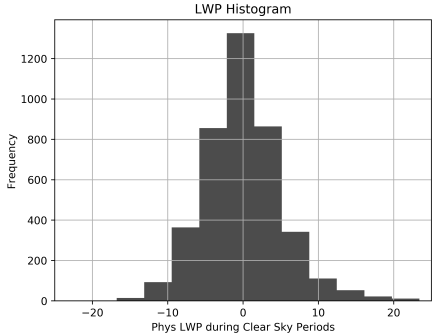


Histogram of retrieved LWP during clear sky periods in 2015

No bias Correction



Auto-bias



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MPLCMASK Updates

- **Issues identified**: incorrect corrections to lidar profiles (i.e. deadtime corrections) – caused errors in depolarization ratios and cloud mask
- MPLCMASK code updated to apply improved/correct corrections
- Minor Improvements to the order of instrument corrections in MPLCMASK
- Extrapolate existing deadtime to higher returns (deadtime comes from manufacturer, we extrapolate to higher value)

Impact: Improves cloud boundary detection, depolarization ratio. Feeds into other VAPs (i.e. MPL PBLHT)

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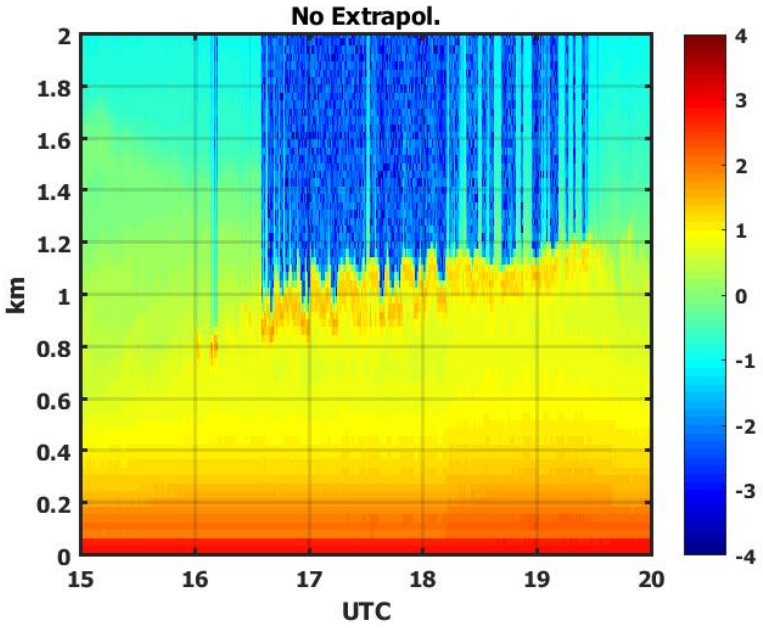
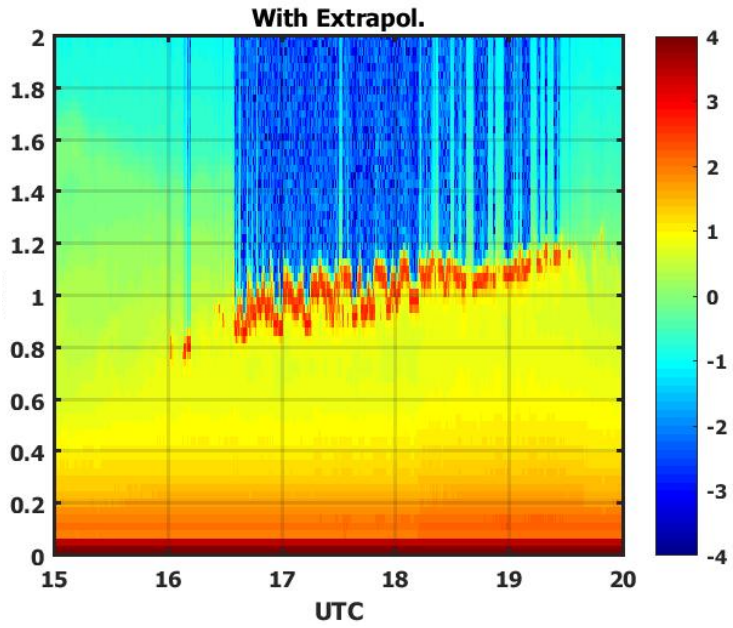
Improved Deadtime Correction - Impact on Backscatter

Old Deadtime (No extrapolation)



New Deadtime (With extrapolation)



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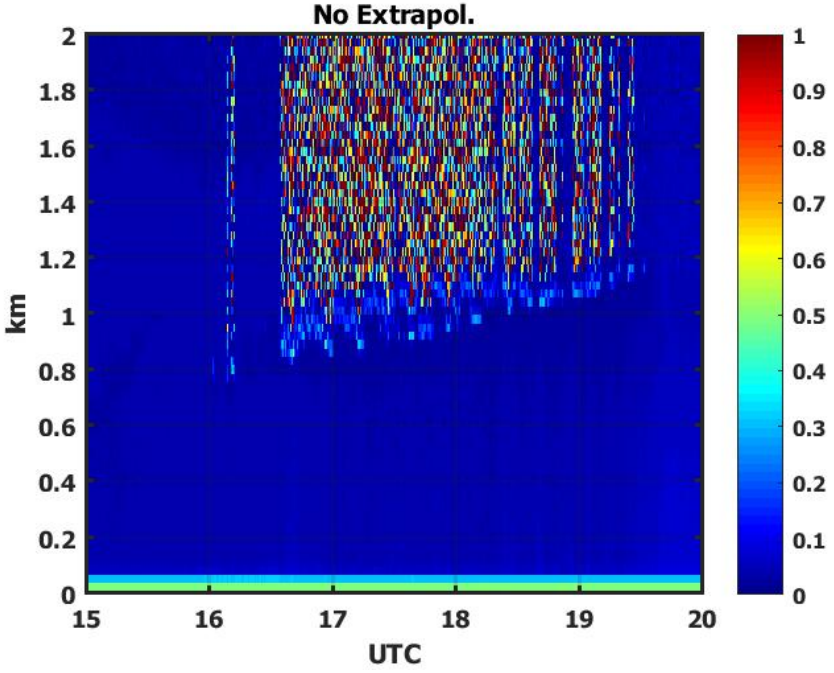
Improved Deadtime Correction
Impact on Linear Depolarization Ratio

Old Deadtime (No extrapolation)



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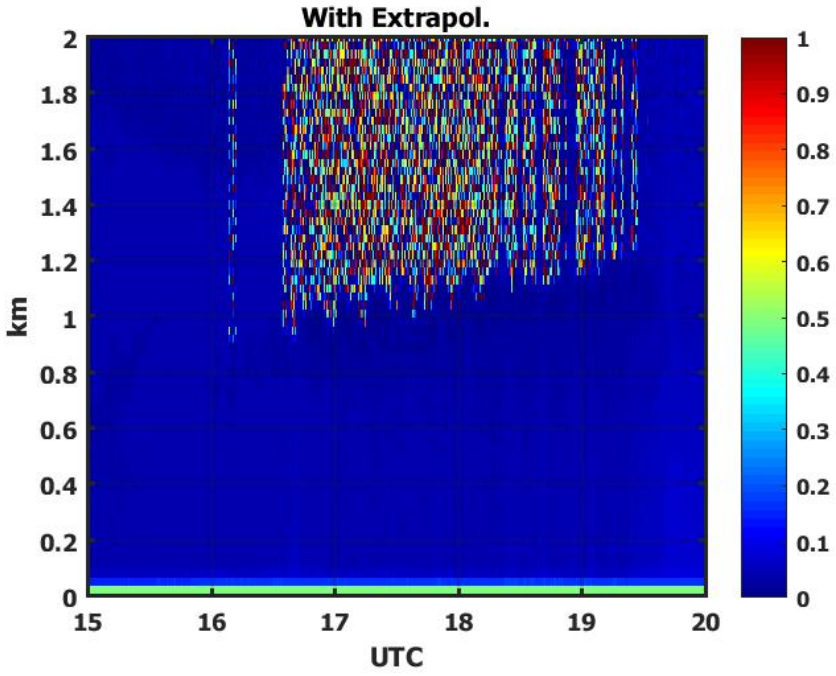

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Initial list of high priority variables for data quality and quantifying uncertainties

Measurement	Instrument	Translator Contacts
Radar reflectivity	KAZR	Scott Giangrande
Liquid water path (Microwave Brightness Temperatures)	MWR, MWR3C	Laura Riihimaki, Shaocheng Xie
Surface Turbulent Fluxes (SH, LH)	EBBR, ECOR	Shaocheng Xie
Aerosol Optical Depth	MFRSR, CIMEL	Connor Flynn Laura Riihimaki
Cloud base height	MPL, CEIL, DL, other lidars	Laura Riihimaki Connor Flynn
Precipitation (rain rates)	Gauges, disdrometers, CSAPR, XSAPR	Scott Giangrande, Scott Collis

Feedback desired:

- How do you plan to use uncertainty in your research?
- What measurements do you need uncertainty for?

General Discussion/Feedback

EXTRA SLIDES

WBP Working Group Data Survey

(from Yunyan and Rob)

ARM CLIMATE RESEARCH FACILITY

- **What are the top 3 (or more) priorities of ARM data for studies on warm boundary layer turbulence and coupling with the underlying surface? (7 responses)**

  Surface measurements

  profiles of aerosols, cloud droplet number concentration, cloud boundaries and liquid water path

  simultaneous retrievals of thermodynamics.

  AERIoe at all ARM sites

  LASSO

  Doppler lidar standard for AMF campaigns and fixed sites; figure out if stereo-photogrammetry would help in other sites besides SGP

  Spatial coverage of cloud observations at the SGP is limiting.

  Routine UAVs?

WBP Working Group Data Survey

(from Yunyan and Rob)

ARM CLIMATE RESEARCH FACILITY

- **What are the top 3 (or more) priorities of ARM data for studies on warm boundary layer clouds and precipitation? (3 responses)**

  Remote sensors, Surface budget measurement system, LASSO

  Retrievals of in-cloud drizzle properties and integrated liquid water path.

  multi-wavelength radar

WBP Working Group Data Survey

(from Yunyan and Rob)

ARM CLIMATE RESEARCH FACILITY

- **What are the top 3 (or more) priorities of ARM data for studies on warm boundary layer aerosol-cloud interaction? 4 responses**

  Remote sensors, Surface budget measurement system, LASSO

  Profiles of aerosol number concentration, and cloud droplet number concentration during both precipitating and non-precipitating conditions.

  improved aerosol information from lidar and UAS that are more relevant to aerosol in or near cloud

  Default ancillary aircraft campaigns would be ideal.

WBP Working Group Data Survey

(from Yunyan and Rob)

ARM CLIMATE RESEARCH FACILITY

- **What are the top 3 (or more) ARM data streams that need significant improvements in data quality, temporal or spatial resolution (8 responses)**
  - Calibration and stability issues for cloud radar, MWR, …
  - Insect
  - Consistency between ARSCL and KAZRARSCL – reprocess historical ARSCL?
  - Raman lidar retrieval (rlprof) too much noise, not correct
  - LASSO (more advanced physics)
  - Cloud optical depth in broken clouds isn't available and critical
  - Better lidars at all sites with aerosols would be great
    - Almost none of the ARM data are quality controlled and calibrated.
    - Consistent, long-records of ARMBE from all valuable AMF and fixed sites
    - The MWR data (especially the 89/90 GHz channel) is very challenging to use because of calibration. This greatly hinders the ability to use these data to get good LWP values.
    - Historical ARSCL data needs to be reprocessed with new MPL mask and radar cloud top height retrievals consistent with KAZRARSCL