

# An Update from the ARM Cloud and Precipitation Measurements and Science Group

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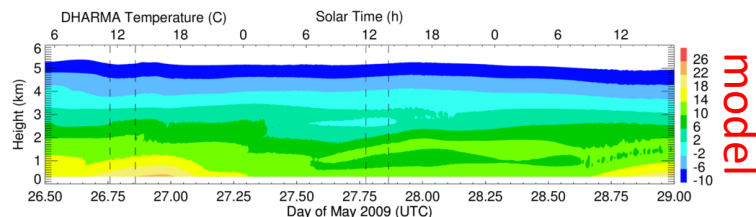
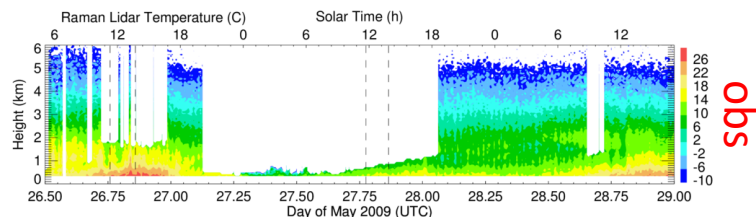
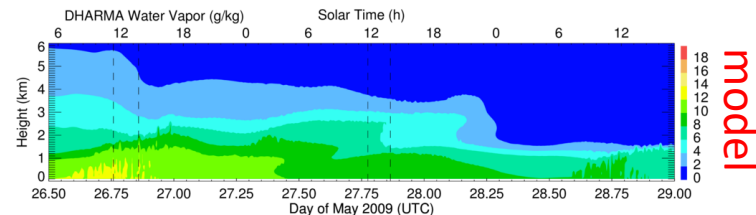
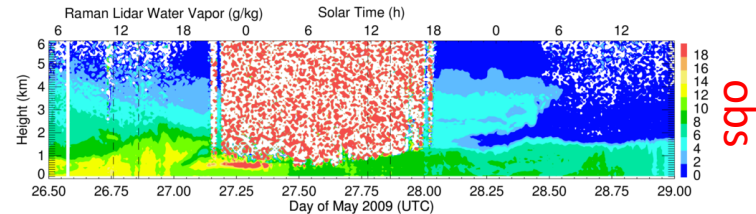
- convened in February 2019
- presented preliminary findings to PI Meeting in June 2019 ('listening tour')
- drafted six general recommendations
- virtual workshop to review and flesh out in March 2020 (thanks to attendees!)
- report due circa October 2020

# What is the CPMSG?

- ARM Cloud and Precipitation Measurements and Science Group
  - The CPMSG ... is charged with working together to provide **constructive recommendations regarding the operation, characterization, and development of instruments providing cloud and precipitation measurements along with the development of data products** derived from these instruments and the identification of measurement gaps
  - A driving consideration for the group should be **how resources can best be applied** to measurements of cloud and precipitation properties and the development of associated data products **to increase the scientific impact of these measurements**
- Starting point
  - Given scientific focus areas that are important to DOE objectives and relevant to ARM measurements, for various **pare there subtopics where ARM has strong potential to contribute but is not reaching that potential** for various possible reasons?

# Boundary layer structure and near-cloud dynamics

- strong potential to contribute
  - long-term data sets with high spatial and temporal near-surface resolution (Doppler lidar, ceilometer, Raman lidar retrievals of WVMR and T, polarimetric radar)
  - extensive ancillary data sets (soundings, surface met network, sfc fluxes, soil moisture, LASSO simulations, ...)
- specific barriers to progress?
  - PBL properties difficult to robustly define
  - data sets difficult to harmonize
  - coastal and island locations not ideal
  - Oklahoma not as flat as Wangara



DHARMA LES at SGP (Vogelmann et al., 2015)  
versus Raman lidar retrievals

# Processing PI Meeting Feedback

- Questions to the 2019 PI meeting
  - are there specific barriers to progress over a five-year time frame that key investments could feasibly address?
  - are *you* encountering any specific barriers to progress?
  - do you see areas where you could be engaged in lowering barriers?
- Diverse input systematically tabulated
  - town hall breakout, visits to working group breakouts, breakfast table meetings, hallway and poster session discussions
  - six subtopic areas: PBL, shallow warm clouds, mixed-phase clouds, ice properties and processes, deep convection, cirrus
  - variety of other input re VAP process, infrastructure challenges, instruments, funding model, etc.

# Prioritizing new investments

- Develop and maintain a **public list of measurement or analysis gaps** that require either specific additional investments or integration of PI or external data sets or codes, as well as a method for gauging community support

Science Question	How do coupled dynamical and microphysical processes drive convective lifecycle, and radiative and precipitation properties?				
Problems & Roadblocks	Impact	Research Elements	Maturity/ Readiness	Solution/ Recommend	Roadmap to Modeling
Uncertainties in retrievals of velocity and microphysical properties.	Accurate observational estimates of convective velocity and microphysics are needed to improve understanding of underlying convective processes, model validation and parameterization development. This is a significant shortcoming for interpreting convective simulations.	Multi-wavelength radar observations (VPT, scanning, polarimetric, spectral).	Research platforms are mature, but continuous operation remains a challenge. <b>(Medium)</b>	Focus on fewer, high quality radar platforms. <b>(3 months)</b> Calibration needed for quantitative data and products. <b>(6 months)</b>	High-quality, quantitative retrievals are necessary for process study analysis and model evaluation.
		Retrievals of vertical velocity	Historical methods are mature but may have uncertainties that are too large for target process studies. Validation difficult. <b>(Medium)</b>	Prioritize VAPS and follow-on analysis of existing retrieval algorithms. <b>(6 months)</b>  Data assimilation approaches, e.g. through LASSO may be required. Doppler lidars can play a role for sub-cloud motions. <b>(6 months)</b>	Long-term datasets (statistics) of convective vertical velocity is an important target for large-scale models. Accurate retrievals are needed for evaluation of high-resolution models. Need regime-based evaluation.

# Enabling Program Capacity

- Create a “short-term measurement” designation and strategy for instrument and data product streams that are too resource-intensive to bring into ARM’s legacy, long-term measurement paradigm with sufficient consistency
  - establish a class of instruments that will not be expected to achieve continuous operation
  - pursue more flexible operations on a case-by-case basis (e.g., targeted radar operations)
- Develop and maintain a public list of measurements or value-added products (VAPs) that are getting insufficient use to warrant further investment
  - where marginal value of extending data sets is low, slate for cessation
  - make way for higher-use products
- Develop and implement a plan to reduce particularly high-volume data streams while maintaining scientific value
  - rich data sets expensive to store
  - develop strategies to avoid storing least-valuable data

# Enabling Usage of Existing Data Stream

- Develop and support **an open source and community code paradigm** for existing and future data products and tools
  - value-added products, PI data products, forward-simulator codes
  - e.g., user-integrated multivariate PBL data set? (“best estimate+”)
- Develop and maintain **a system of regime classification** for long-term data sets and deployments of ARM mobile facilities
  - low-overhead and especially valuable for large data sets
  - engage working groups in suggesting/approving
- Seek and support **frameworks that bring individuals and groups together** for limited joint exercises
  - LES/CRM/SCM intercomparisons historically engaged large international groups
  - “best estimate+” data sets
  - instrument performance
  - product development

# Going forward

- Preparing public report to Jim Mather circa October 2020
- Got feedback?
  - type in your comments and questions right now
  - join **working group discussions re matrix approach to prioritizing new investments** this week (feedback will reach us)
  - join breakout **discussion of observation-guided model development group activity** on Thursday at 11ET
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