Updating the ARM Decadal Vision

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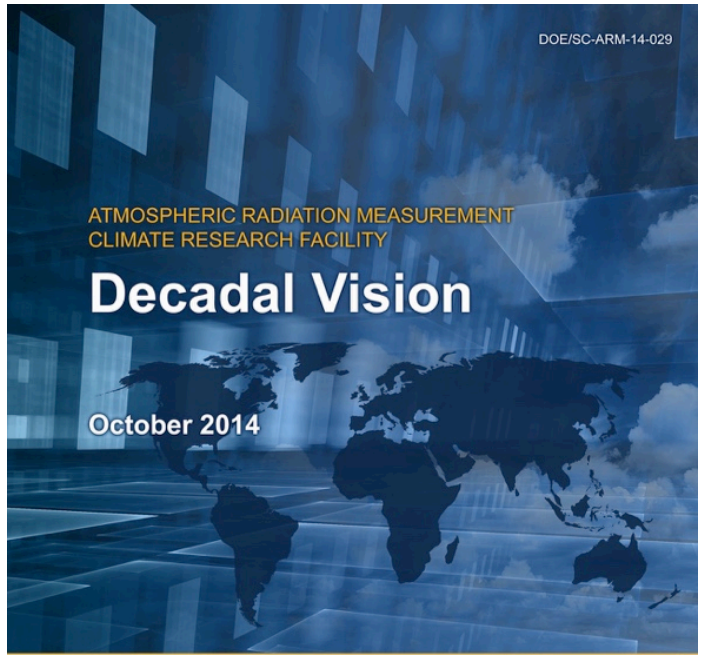
June 23, 2020

Agenda

- Background for initiating the updated vision document
- Outcomes from two workshops
  - Cloud and Precipitation Measurement and Science Group: Ann Fridlind
  - Aerosol Measurements and Science Group: Allison McComiskey
- Overview of the draft decadal vision

Decadal Vision: 2014

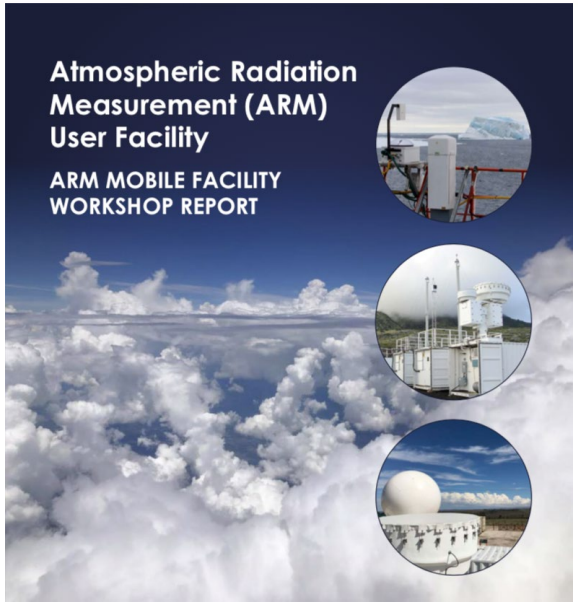


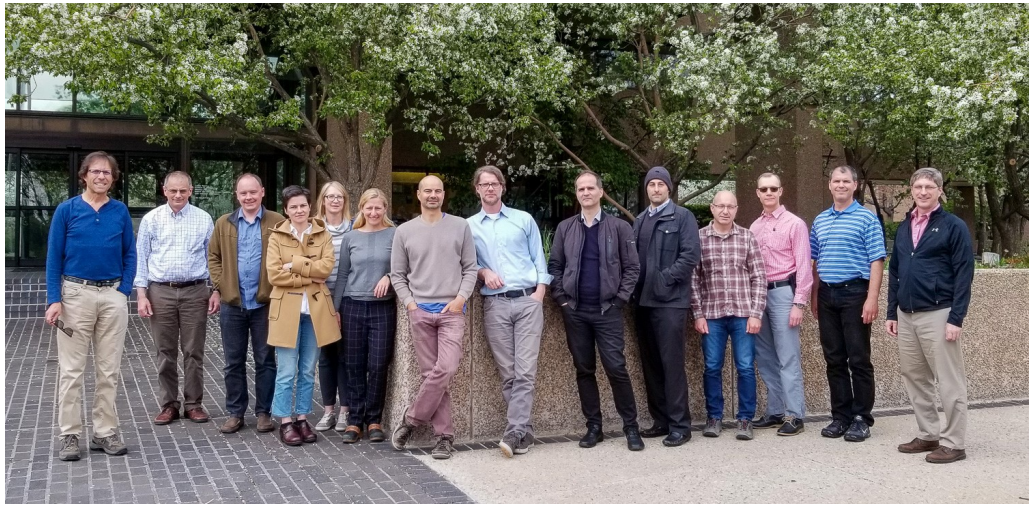
Decadal Vision strategic plan identified five focus areas:

- Establish observation modeling “megasites” at the SGP and in the arctic
- Produce routine high-resolution simulations over ARM sites
- Continued focus on measurement excellence
  - Specifically called out aerosol instruments, scanning radars, and frozen precip
  - Develop UAS/TBS capabilities and review possible G-1 replacement
- Enhance data products and processes
  - Continue to improve the discoverability of ARM data
  - Improve the characterization and communication of data quality
  - Use DOIs to better link data to background information
  - Integrate ARM data with other BER measurements and simulations
- Strengthen interactions with the user community

Collecting Input for an Updated Vision Document

- ARM Mobile Facility (August 2018)
  - DOE-sponsored; led to selection of southeast United States as new home of 3rd mobile facility
- User Executive Committee (November 2018)
- LASSO Next Steps (May 2019)
  - Argentina deep convection field campaign selected from four options based on project readiness
- Aerosol Measurements (November 2019)
  - Reviewed strategies for increasing impact
- Aerial Measurements (March 2020)
  - Broad array of new and upcoming capabilities reviewed
- Cloud and Precipitation Measurements (March 2020)
  - Reviewed strategies for increasing impact

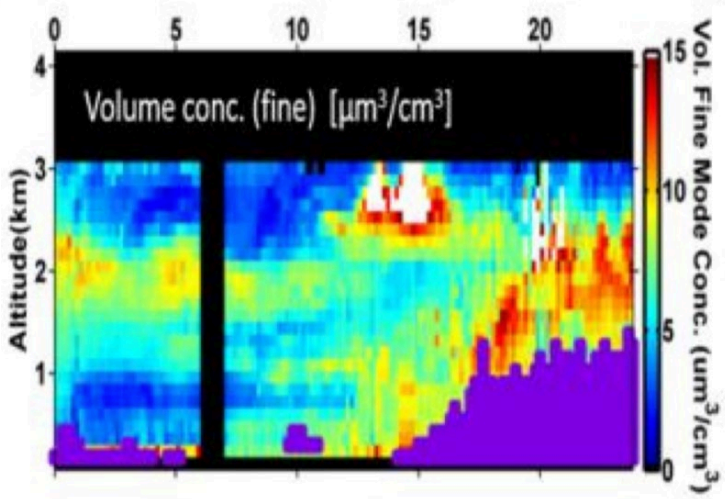




Aerosol Measurement and Science Group (AMSG)

The AMSG has been meeting since 2015 (and informally for several years prior to that).

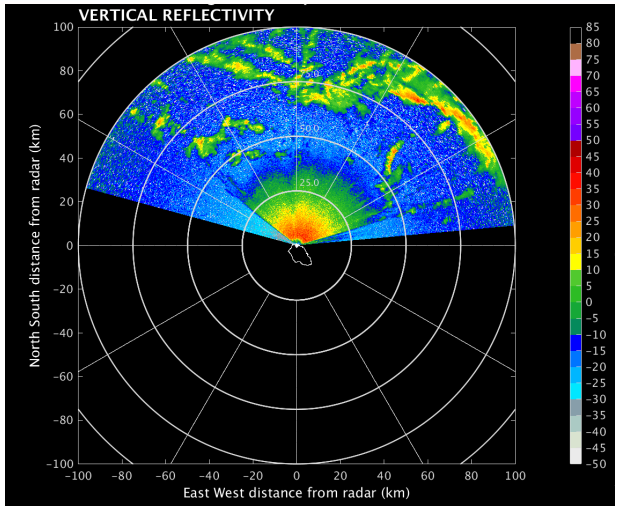
- AMSG chair is Allison McComiskey
- The group has focused on improving ARM aerosol measurements and identifying strategies to enhance the impact of these measurements
- Implementing recommendations from 2017 AMSG workshop
- Worked with ASR co-chairs to survey community needs
- Held a follow-on workshop in November 2019. Some outcomes:
  - Gaps include vertical profiles, complete size distributions
  - Need more accessible data products for modelers
  - Focus on field campaigns with comprehensive measurements
  - Pay attention to (and document) local sources
  - Implement more instrument intercomparisons



Cloud and Precipitation Measurements and Science Group

Formed in 2019 to address broad issues related to cloud and precipitation Measurements

- CPMSG chair is Ann Fridlind
- First engagement with community was at the 2019 ARM/ASR Principle Investigator meeting
- Identifying barriers to advancing science priorities (with input from larger community) and ”enabling” activities. The latter include:
  - Identifying short-term measurement designation
  - Review instruments on a rotating basis to assess impact
  - Develop strategy to reduce large-volume datasets
  - Develop regime classifications
  - Support open source development for data products, tools, simulators
  - Coordinate joint modeling-observation projects



The Mission of the ARM Facility

To provide the climate research community with strategically located in situ and remote-sensing observatories designed to improve the understanding and representation, in climate and earth system models, of clouds and aerosols as well as their interactions and coupling with the Earth's surface.

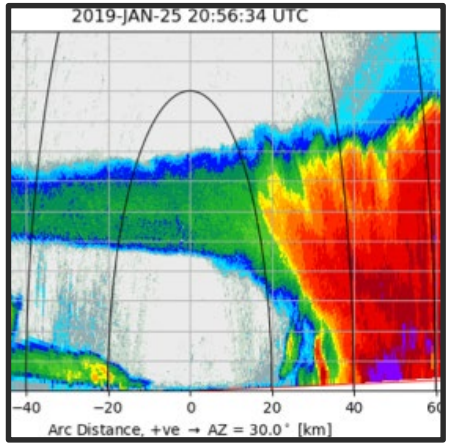
https://www.arm.gov/wp-content/uploads/ARM_Decadal_Vision_2020_Draft.pdf

Decadal Vision: 2020

- Measurements
  - Deploy long-term mobile facility in the southeast US
  - Implement new research aircraft
  - Coordinated operations including intensive periods and expanded spatial sampling
  - Pursue new measurement capabilities
- Data Analytics
  - Development of analytic techniques toward automated quality assessment and measurement uncertainties
  - Increased emphasis on data analysis by mentors and translators

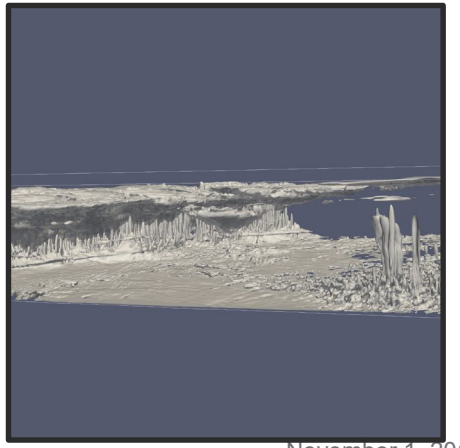
Measurements

Data Analytics



Data Services

Observations to Models

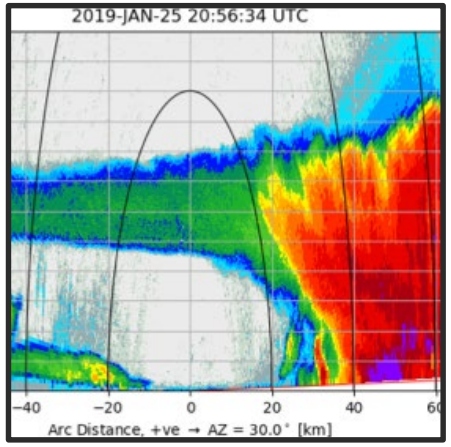


Decadal Vision: 2020

- Data Services
  - Develop flexible computing environment
  - Develop software tools to enable improved data access and analysis
  - Enable open-source software practices
- Observations to Models
  - Apply LASSO to deep convection and other meteorological regimes
  - Organize ARM data around virtual field campaigns
  - Develop joint observation-modeling projects
  - Exploit model configurations such as single column models and regionally refined grids
  - Use model simulations to inform instrument deployment and operation

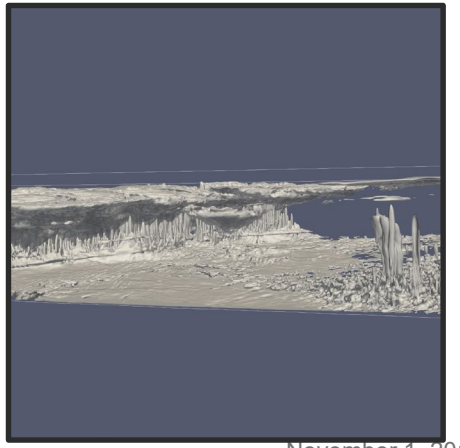
Measurements

Data Analytics



Data Services

Observations to Models



Capability Needs

- Some needs explicitly called out in vision document
- Actual priorities to be determined through engagement with community as now
- Transparent mechanism to track requests through working groups and other community science teams

Capability Needs Template

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/ Recommendation	Roadmap to modelling
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. **(Medium)**	Focus on fewer, high quality radar platforms. **(3 months)** Calibration needed for quantitative data and products. **(6 months)**	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. **(Medium)**	Prioritize VAPS and follow-on analysis of existing retrieval algorithms. **(6 months)** Data assimilation approaches, e.g. through LASSO may be required. Doppler lidars can play a role for sub-cloud motions. **(6 months)**	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.

Review of New Capability Requests

Requests submitted by working groups and other science groups through group leads.

Assessment based on maturity, readiness, and expected impact.

Display plans and on-hold requests under "Future Directions" on www.arm.gov.

Addition of significant new capabilities may need to be offset by reduction in scope. Such reductions will be based on usage and expected impact.

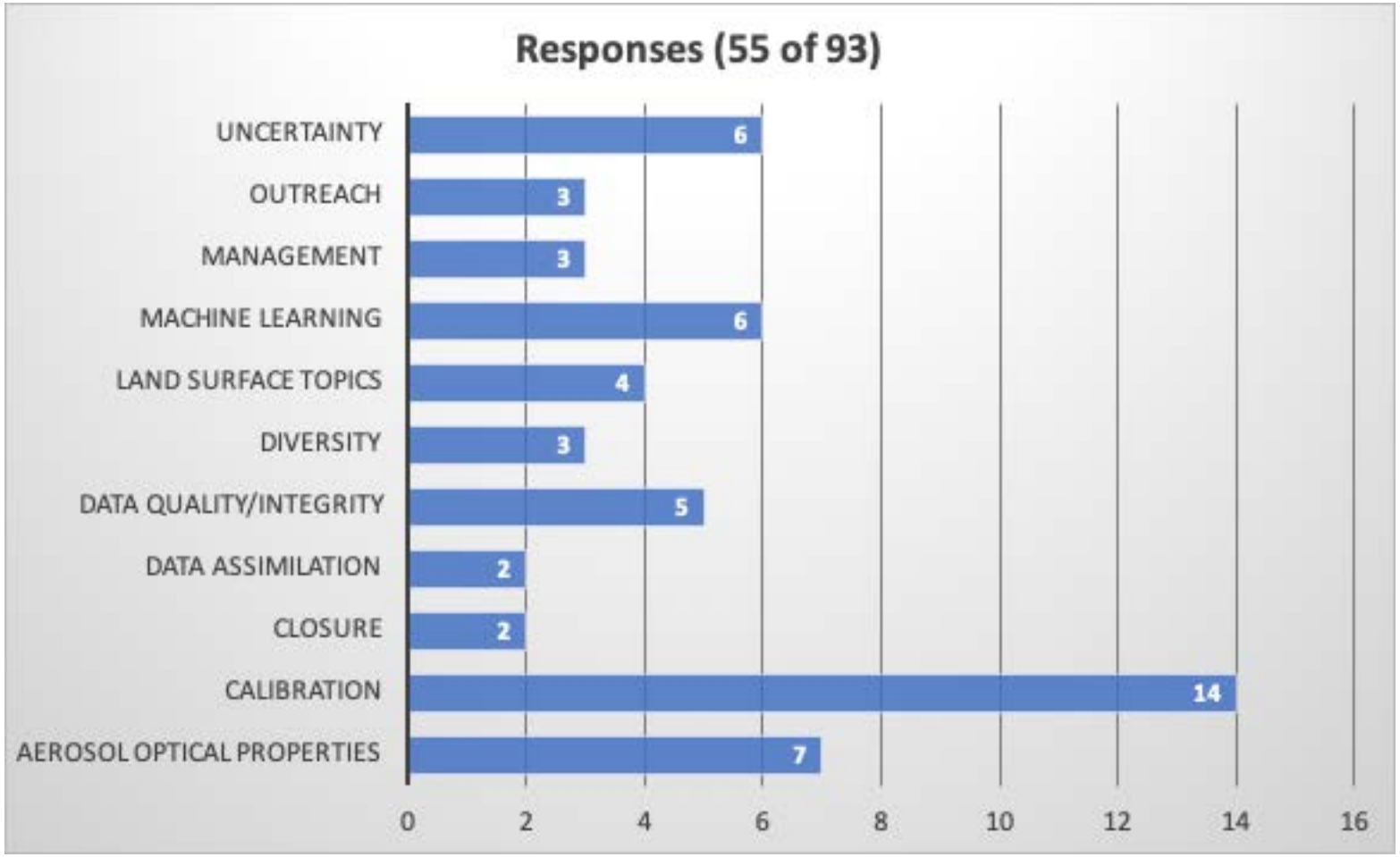
Responses to ARM Decadal Vision Questions from ARM/ASR Meeting

June 2020

Responses to Like, Neutral, Concern Questions

Question	Like	Neutral	Concern
Coordinated use of intensive periods	80	13	4
Increased emphasis on spatial sampling	90	17	0
Increased emphasis on data characterization	77	29	4
Develop more flexible computing environment	36	69	4
Develop ADC software tools	43	59	6
Facilitate open-source software practices	79	18	14
Apply LASSO to additional meteorological regimes	50	49	3
Develop metadata-based virtual field campaigns	77	24	3

Open Poll: Topics with Two or More Responses



Other Open Poll Responses

1. Benchmarking
2. Big science question
3. Aerosols
4. Aerosol profiling
5. Contingency Plan
6. Cross-valid. Air & Gnd obs
7. Heterogeneity
8. How should ARM integrate w/models
9. Influence of weather on obs
10. Influence of complex terrain
11. Ice
12. Integration cloud & aerosol
13. Interoperability (of data?)
14. Lab observations of ice & cloud
15. Lightning
16. Local environments
17. Long-term obs
18. Metrics
19. Metadata enhancements
20. Passive radiometers
21. Process & QC historical data
22. Profiling
23. Radiative closure
24. Scale
25. Soundings
26. Spatial coverage
27. Spectral radiometry
28. Spectroscopy
29. Statistical Representativeness
30. Thermodynamic profiles
31. Validation