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Summary of March 2016 ARM User Executive Committee Meeting

January 2017

ARM

CLIMATE RESEARCH FACILITY

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Executive Summary

The Atmospheric Radiation Measurement (ARM) Climate Research Facility User Executive Committee (UEC) met face to face for the first time since the committee was formed in December 2014 at the National Center for Atmospheric Research (NCAR) Mesa laboratory in Boulder. Prior to this point, all UEC meetings were done via telephone, usually with the aid of collaboration software (e.g., Lync, GoToMeeting) allowing the entire committee to see a common presentation. These conference calls covered a wide range of topics, many of them on a recurrent basis; however, since the calls were limited to less than 90 minutes it was felt that a more dedicated meeting would allow us to delve more deeply into some of these topics.

Three topics for this meeting came from previous conference call discussions: (1) data quality, (2) uncertainty quantification, and (3) improved communications. Two other topics were discussed during this meeting: (4) an overview of the LES (large-eddy simulation) ARM Symbiotic Simulation and Observation (LASSO) project and (5) the process for electing new UEC members.

Summaries of each of these topics are provided below, *along with recommendations that the UEC feels should be considered by the ARM Facility* (which will be highlighted using italics).

Acronyms and Abbreviations

AERI	Atmospheric Emitted Radiance Interferometer
AMF	ARM Mobile Facility
AOD	aerosol optical depth
ARM	Atmospheric Radiation Measurement Climate Research Facility
ARSCL	Active Remotely Sensed Cloud Locations
ASR	Atmospheric System Research
DOE	U.S. Department of Energy
DQ	data quality
LASSO	LES ARM Symbiotic Simulation and Observation
LES	large-eddy simulation
LWP	liquid water path
MFRSR	multifilter rotating shadowband radiometer
MWR	microwave radiometer
MWRRET	microwave radiometer retrieval
NCAR	National Center for Atmospheric Research
NWP	Numerical Weather Prediction
OME	Online Metadata Editor
PI	principle investigator
PILS	particle-into-liquid sampler
PWV	precipitable water vapor
QME	quality measurement experiments
SGP	Southern Great Plains
UEC	User Executive Committee
UQ	uncertainty quantification
VAP	value-added product

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1.0 Introduction

This meeting was held at the National Center for Atmospheric Research (NCAR) Mesa laboratory, Boulder, Colorado. Atmospheric Radiation Measurement (ARM) Climate Research Facility User Executive Committee (UEC) members present were:

Chuck Long, Ernie Lewis, Larry Berg, Hailong Wang, Matt Shupe, Andrew Gettelman, and Dave Turner. Rob Wood joined the discussion at several points via conference call, as he was unable to attend in person. Gannet Hallar and Pavlos Kollias were unable to attend.

ARM Infrastructure members present were:

Jim Mather, Jennifer Comstock, Jimmy Voyles, Ken Kehoe, Doug Sisterson, Hanna Goss, and Giri Prakash.

The ARM UEC met face to face for the first time since the committee was formed in December 2014 at the NCAR Mesa laboratory in Boulder. Prior to this point, all UEC meetings were done via telephone, usually with the aid of collaboration software (e.g., Lync, GoToMeeting) allowing the entire committee to see a common presentation. These conference calls covered a wide range of topics, many of them on a recurrent basis; however, since the calls were limited to less than 90 minutes it was felt that a more dedicated meeting would allow us to delve more deeply into some of these topics.

Three topics for this meeting came from previous conference call discussions: (1) data quality, (2) uncertainty quantification, and (3) improved communications. Two other topics were discussed during this meeting: (4) an overview of the LES (large-eddy simulation) ARM Symbiotic Simulation and Observation (LASSO) project and (5) the process for electing new UEC members.

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2.0 Data Quality Discussion

This topic has been discussed relatively frequently on past UEC conference calls. The UEC (and others) have noted that the Data Quality (DQ) has been less than optimum for some datastreams, that some instruments need to become more robust (e.g., from the ARM radars), that field campaigns (especially ARM Mobile Facility [AMF]) need more support from mentors and translators (in addition to better communication between the campaign principle investigator [PI] and the Facility), and that many of the instrument mentors (as well as other people in the infrastructure) are overextended. It was recognized that tension exists between “trying to do everything” and “do a few things very well”.

The UEC agreed that the infrastructure staff is spread too thinly, and thus much of the discussion focused on how to prioritize infrastructure activities. Input comes from a range of sources: Atmospheric System Research (ASR) working groups, U.S. Department of Energy (DOE)-hosted workshops, area-specific advisory panels (e.g., aerosol science group), ARM’s Decadal Vision document, annual priorities from DOE headquarters, and large programmatic efforts like the LASSO project. Ultimately choices will have

to be made; for example, perhaps we need to reduce emphasis on more complex processes to focus more effort on ensuring high-quality measurements of fundamental (or uniquely DOE) quantities.

One suggestion is that the Facility considers classifying data sets into one of two categories: "short-term" and "long-term". Data sets in the "long-term" category would have the appropriate DQ applied (by the Data Quality Office [DQO] and mentors) so that long-term (e.g., multi-year) analyses could be performed. Example data sets might include LW and SW broadband radiation, Atmospheric Emitted Radiance Interferometer (AERI) spectral radiance, precipitable water vapor (PWV) and liquid water path (LWP) from the microwave radiometer (MWR), and aerosol optical depth (AOD) from the multifilter rotating shadowband radiometer (MFRSR). Data sets that fall into this category should already be relatively independent of too much manual processing, and also would be useful for the development of climatologies (or climate data records). Any datastream in this category would require significant attention to minimize or eliminate any "epochs", wherein a datastream has a temporal discontinuity due to instrument change-out, sharp calibration change, rapid reduction in instrument sensitivity, etc. Metadata for these long-term data sets was deemed absolutely critical for their success. Data sets in the "short-term" category would likely include the more complex instruments and value-added products (VAPs), ones that are difficult and/or expensive to provide as longer (more than multi-month) data sets. Examples might be the X-band radar network at the Southern Great Plains (SGP) site, particle-into-liquid sampler (PILS) observations, or the cloud droplet number concentration VAP. Thus, VAP development/operation effort would be more focused on processing the long-term data sets, whereas higher-order data products from short-term data sets would be primarily provided by PIs. *One action item is for ARM Facility management to consider the subset of measurements that might be classified as "long-term" by this definition*.

There was a discussion on PI-produced higher-order data produces versus ARM-produced VAPs. *There was basic agreement that PIs need more encouragement to provide their higher-order data products to the ARM Data Archive*. The Online Metadata Editor (OME) process was noted as being a very good development in making these PI-submitted data sets more accessible to the larger community. There was a general sense that *the facility should focus its energies on a smaller number of VAPs that have large customer bases*; a smaller number of VAPs should hopefully improve the ability of the translators/DQO staff to better characterize the DQ of these products. Examples of VAPs with large customer bases include the Active Remotely Sensed Cloud Locations (ARSCL) cloud boundary and radar reflectivity data set, and the microwave radiometer retrieval (MWRRET)-retrieved PWV and LWP.

The Facility recently updated its scheduling process for AMF deployments, and formalized it into a document available from the ARM web site. There is now significantly more time built into the early state of the deployment to allow mentors the opportunity to find/fix any DQ issues before the official start of the deployment. *This was considered a very positive development by the UEC*.

The reprocessing of historical data was discussed, and in particular how should the Facility prioritize reprocessing relative to ongoing real-time DQ activities (since it often involves the same people)? The particularly difficult topic of datastream epochs was brought up and how can/should reprocessing be used to correct reduce the transitions between epochs. Questions also included: how do reprocessing tasks get into the queue, how are the reprocessed data quality determined, how is the version of the data documented and communicated, how is the downstream processing (e.g., through the VAP chain) prioritized/done? *It was decided that a future UEC phone call would be dedicated to discussing this topic in more detail*.

3.0 Uncertainty Quantification Discussion

The uncertainty quantification (UQ) discussion is another topic that has come up frequently in past UEC conference calls. This meeting started with a discussion of the one possible way to specify different levels of UQ that was outlined in the ARM technical report by Compos and Sisterson. It was noted that the "field calibration" method outlined in this report was considered the highest level, but that only ~3% of the ARM observations have this level of UQ performed. It was also noted that quality measurement experiments (QMEs), which were considered a critical part of the VAP process in the late 1990s, would be useful for performing this field calibration. However, it was also noted that understanding the results from historical QMEs required a fair amount of input from ARM scientists, and thus has a relatively large manual component that may be too much for the DQO to undertake.

The discussion then transitioned to a different way to consider uncertainties: as random, systematic, or representative. *The UEC recommended that the Facility ask its mentors and translators to provide an estimate of the random and systematic errors in each of the observations under their purview*. As it was recognized that providing a quantified measure of systematic error can be difficult, we suggested that the mentor also indicate how the random and systematic error values were determined: expert guess with a lot of uncertainty, expert guess with some uncertainty, or fairly certain based upon other observations or model calculations.

The recommendation was made to put these mentor-provided values into a database, have the instrument and VAP handbooks point to this table, and have the archive distribute these uncertainty values with their associated datastreams as the data are ordered. By using a database, reprocessing efforts can easily update these values (if indeed they change). It was suggested that this be done with a single instrument first; the microwave radiometer was considered a good choice.

The UEC also recommended that the instrument handbooks be updated to include discussions on the random, systematic, and representativeness errors. If possible, sources of systematic error should be identified in the report. The committee recognized that representativeness error is particularly challenging, but needs to be included in the handbooks. We recognize that the representativeness error might differ instrument to instrument, but we still believe that this should be discussed in the handbook (again, metadata was deemed key and the handbook was considered the best place to capture this).

There was a discussion on the automatic computation of UQ for some ARM datastreams (i.e., including 1-sigma error bars directly in the data product netCDF files). ARM management is already moving in this direction by doing this for the boundary-layer profiling sites at the SGP for the LASSO project. This was deemed to be a good starting point, as lessons learned from this would be useful before trying to compute uncertainties for all ARM observations.

4.0 Improving Communication Discussion and the New ARM Web Page

The UEC had noted that communication between the Facility and the user community could be greatly improved. This has been a topic of discussion during several previous calls. The Facility management has recognized this for some time, and has been redesigning the ARM web page. An overview of the issues of concern with the current ARM website was provided, and the proposed high-level navigation of the new website. One of the priorities is a close coupling of the new ARM website and the data discovery tool; *this was endorsed by the UEC*.

5.0 Overview of LASSO Project

The LASSO project is a major effort underway in the ARM Facility, and an overview of this project was presented remotely by LASSO PIs, Bill Gustafson and Andy Vogelmann. The LASSO project is already almost a year old. There is a separate LASSO advisory committee that communicates with the PIs approximately quarterly. The PIs explained the LASSO workflow, who is involved, the project's timeline, and deliverables. There were many questions for clarification and some suggestions. Perhaps the main question regarded what model output was being stored; *there was a suggestion that state and cloud variables, as well as their tendencies, should be stored*. However, the question of which tendencies and at what resolution was not determined as this is a data volume issue for the Archive, and will require more discussion.

6.0 Election of New Committee Members

The entire UEC was elected in December 2014. The charter indicates that the terms are for four years, but the intent is to have half of the UEC up for reelection every two years. The intent of this "staggered" election process is so that there is some continuity within the UEC across election cycles. Thus, we needed to discuss the process on how we would determine which subset of the members would come up for reelection in November 2016. It is clear that the current vice-chair should not be up for reelection as he will become the chair in January 2017 and the current chair should be up for reelection. *We discussed selecting the other members who would be up for reelection by lottery, but the decision was not finalized*. Note that it was acknowledged that a person could be reelected back to the UEC for an additional term. There was a suggestion that it might be good for the UEC to have an early career member, and also representation from an operational (Numerical Weather Prediction; NWP) group.


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