

# DOE ARM Aerosol Working Group, Agenda, Nov 30 - Dec 2, 2005, Boulder, CO

## Wednesday, Nov. 30

14:00 Ogren Remarks from Meeting Host, Logistics

14:05 Schmid Welcome, Introduction, Agenda, Meeting Goals, Make-up of AWG, etc.

New Chief Scientist Team: associates of CST will join each WG, Yangang Liu is CST for AWG, brings ideas to reshape and/or refocus the AWG.

AWG proposals: historically between 1-7 proposals have "aerosol" in their abstract

Goals of this meeting:

max. exch of info (who does what, what have I signed up for)

Plan IOPs

Discuss AWG refocus

Recommendations to STEC

## May 2003 Aerosol IOP (AIOP)

### Presentations of JGR Special Issue Papers

Most publications of any ARM IOP

14:20 Hallar **2005jd006250 ARM Aerosol Intensive Operating Period: Comparison of aerosol scattering during coordinated flights**

Twin Otter comparisons very good

Paper (level flight legs – each leg 4-10 min in duration) 2 planes flights coordinated, looking for wave length dependence

Cumulative scattering coefficient across entire size distribution

Fine mode fract (compare Cessna and twin otter)

No correlation between two planes for fine mode fract

14:35 Andrews 2004jd005734-Comparison of methods for deriving aerosol asymmetry parameter

**Betsy Andrews** (NOAA) Deriving aerosol asymmetry parameter methods

Many methods, many instruments during AIOP (2003), listed instruments, methods, PI

Generally all methods compare fairly well, paper also gives guidelines for Low RH, high RH

Climatologies have been derived from several locations by Fiebig (NOAA) and described in a paper

BBHRP uses  $g=0.7$ , but Betsy seems to show that  $0.55 < g < 0.63$  (low RH, I think)

Ogren: Still no way to measure  $g$  directly at ambient conditions

14:40 Strawa **2005jd006056- In-Situ Measurement of Aerosol Optical Properties Made During the DOE Aerosol IOP: 1. Comparison of Extinction and Scattering Coefficients (Strawa)**

14:45 Collins **2004jd005448- Application of aerosol hygroscopicity measured at the ARM Southern Great Plains site to examine composition and evolution**

Aerosol hygroscopicity (size dependence correlates to hygrosc growth) max RH = 85% Lot of variability, but in general large particles show more hyg. Growth. Mode-resolved hygroscopicity (measure hygro at specific particle sizes)

Some examination of growth processes (how aerosols behaved hygroscopically throughout day)

14:50 Collins **2005jd006092- Coupling aerosol size distributions and size-resolved hygroscopicity to predict humidity-dependent optical properties and CCN spectra (Collins)**

Couple aerosol size distributions and size-resolved hygroscopicity to predict (couple DMA and TDMA data)

Analyze what made up the aerosol (ammonium sulfate, OC/EC, Dust) F(RH) comparison

Now have TDMA at SGP permanently

Discussion: what analyses will be done with TDMA data? Most of them, except mode-resolved hygroscopicity.

Plan is to provide analyses like those shown showed to the Archive.

Measurement of chemical composition would help understand (aerosol mass spectrometer)

14:55 Michalsky **2005jd006341- Radiative Closure Studies for Clear Skies During the ARM 2003 Aerosol Intensive**

Closure problem (broadband sw measurements, and model output)

Models employed: Sbdart, raprad, smarts, sbmod, modtran, rrtm\_sw

Used MWR data from archive which is off by 3% which will increase the direct biases by 1, 1.5 W

Comparing RSS total data vs sbdart

Discussion: calibration questions

15:00 Schmid for Ricchiuzzi **2004jd005863- A comparison of aerosol optical properties obtained from in-situ measurements and retrieved from Sun and sky radiance observations during the May 2003 ARM aerosol intensive observation period**

Aerosol optical properties (in-situ, sun and sky radiance observations)

Compare remote sensing aerosol single scattering albedo, back scatter fraction, radiation closure

Used OD from nasa instrument, IAP, PSAPs and Nephys

Surface albedo from CIMEL, tower MFR,

Uses a monte carlo model, CSPHOT data, mie scattering theory, iterates

Compares Cessna, in-situ (twin otter), CIMEL (single scattering albedo), same thing for backscatter fraction, Used retrieved data, and compared to MFR (from tower)  
Different way to look at closure

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A comment: MFRSR data are not particularly well calibrated (from archive)  
Also: MWR bias problem not well communicated

**Important issue:** A common problem with data retrieved from the Archive (known problem with data, not communicated to users, paper gets published, then someone pipes up about the known data issue) Trying to link DQRs, come with data which is delivered by Archive.

Forcing folks who use ARM data to read associated DQRs is an issue.

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15:05 Schmid **2004jd005837- How well can we measure the vertical profile of tropospheric aerosol extinction?**

MPL (2), Raman Lidar, airborne (Neph + PSAP, sunphotometry, cavity ring down) AATS-14, compared to other instruments.

Discussion: Should put new Cessna optics rack on ground to compare to existing measurements first.

15:10 Ferrare Brief synopsis of all other JGR Special Issue Papers and Overall Status

11 papers sent to production, 7 papers still being reviewed. Deadline 1/11/2006, articles that miss this deadline, will still be linked online to the issue (published in early March, 2006)

Several papers summarized...

Discussion: Can these AIOp papers be made available to members of the AWG?

**New Aerosol IOP effort**

15:50 Kassianov **"Aerosol single-scattering albedo and asymmetry parameter retrieved from MFRSR observations during the May 2003 Aerosol IOP"**

Aerosol single-scattering albedo, asymmetry parameter retrieved from MFRSR observations

In situ asymmetry parameter (retrieved) is 0.55 to 0.65, but commonly reported values are 0.7 to 0.77. This might be because of particle sizes measured ground based aren't representative of the column. This technique can describe aerosol load, and variability of aerosol properties, consistent with independent retrievals. Need to consider more cases (more data).

Discussion: questions about assumptions (modes?), how technique works

**MASRAD (Summer 2005)**

**Marine Stratus Experiment (DOE ASP MASE, July 2005)**

16:05 Andrews Results from MASRAD and the 6-month AOS deployment at Pt Reyes.

**Betsy Andrews:** 6-month AOS deployment at Pt. Reyes

Super foggy location

How does aerosol interact with clouds, and how do clouds (precipitation) affect aerosols?

Bond correction to PSAP data may need to be modified for sea salt aerosols.

Discussion: would well mixed aerosols preclude what was observed?

16:20 Strawa Cavity Ring-Down Measurements with Cadenza

**Tony Strawa:** Cavity Ring-Down Measurements with Cadenza

1 um and 5um impactors,

Cadenza and neph, psap measurements are very similar

Data to be archived Jan. 2006

UAV Cadenza (10% wt. of current) will be flown March, 2007

Discussion: RH data available (from NOAA), noise in absorption partly due to correction issues. Look at foggy periods

16:35 Dubey Insights from In-situ Measurements of Black Carbon during the Marine Stratus Experiment.

<http://aerosols.lanl.gov>

aircraft measurements, cloud, black carbon centric.

Intercepted pollution plume in cloud, July 6, 2005 (18:30 )

Discussion: how many plumes have been observed (not many)

**Aerosol Lidar Validation Experiment (ALIVE, September 2005)**

16:50 Schmid Overview

17:05 Schmid AATS-14

17:10 Flynn/Ferrare AOD comparisons

CSPOT (CIMEL sun photometer), MFRSR, NIMFR, UV\_MFRSR (NREL), AATS-14, Raman Lidar data used in comparison. Issues with calibration, etc.

Cloud screened MFRSR AOD: <http://engineering.arm.gov/~sbeus/> (Not official sources of data)

9/16/2005 Wide discrepancy in reported AOT, so which do you use?

Conclusion: MFRSR E13, Cimel, RSS now show reasonable AOT agreement, though still not final.

Should there be more routine inter-comparison between AOT (i.e. C1 and E13): YES!

NIMFR sent back to PNNL (delron melted)

UV-MFRSR (USDA instrument, get data via XDC?)

Flynn, Turner results will be presented during instrument talks

Ran over schedule, end of first day:

**Thursday, Dec. 1**

## Presentations of ARM Science Team Funded Efforts Related to Aerosols

### FY2005

8:30 Chuang

Examine Aerosol Indirect Effects with a 3-D Cloud Resolving Model and ARM Data: Develop and Validate Aerosol/Cloud Parameterization for GCMs

Discussion: no IAP data shown in comparisons (available for 2001 comparisons)

8:55 Ferrare Characterizing the Vertical Distribution of Aerosols Over the ARM SGP Site

Aerosol type, vertical variability,  $f(RH)$

Future: use CAMS, GEOS3, etc., higher temporal resolution expand to global (CALYPSO)

Discussion: where are we with respect to aerosols (monitoring)? Just getting started. Use AERONET measurements, for example, ARM data,

9:20 Lacis Cloud/Aerosol Radiative Forcings and Feedbacks in a Climate GCM

Retrieving AOT over land from satellite data is difficult

**Lacis: GISS GCM aerosol at SGP**

GISS model E (?), using AQUA and TERRA data, no tuning of the model, seems to get reasonable results for some things, not so good on others (550 nm), grid cell size (4 deg x 5 deg) Comparisons to satellite data averaged over several years over land and over ocean. MISR data shows bias over water, Ferrare thinks newer MISR data might show better comparison. GCM aerosol particle sizes are too big, model needs to be revised to use smaller particles Adding parameterizations to the model to better characterize aerosol constituents Comparison of MFRSR (E13 and C1) OD, angstrom exponent with model data, some mention that MFRSR calibration issues, with model results.

Discussions: cloudy sky aerosol OD issue (model E can handle this better ?- Ghan)

9:45 Lewis (for Schwartz) Parameterization of aerosol properties on relative humidity

Goal: simple, accurate parameterization of radius, refractive index and density based on RH, tradeoffs between simplicity and accuracy, Accuracy goals 2-3% radius, index of refraction approx. 0.01, density approx. 5%

Considered several substances in this parameterization

10:10 refreshment break

### FY2006

10:30 Liu (for Miller) Parameterizations of Cloud Microphysics and Indirect Aerosol Effects

10:45 Frisch (for Feingold) Investigation of the aerosol indirect effect at SGP and AMF using ground-based remote sensors

Suggestion to turn investigations like this over to the infrastructure

Turner: MWR data not very useful for thin clouds (uncertainties)

10:55 Schmid Vertically resolved radiative properties of aerosols and clouds

11:05 Ghan Cloud Modeling for Indirect Effects of Aerosols

### Presentations of ARM Infrastructure Funded Efforts Related to Aerosols

11:20 Liljegren Overview of instrument acquisition/deployment status and plans (including the capital and expense equipment budgets).

CIMEL issue with regard to ALIVE IOP (XDC will monitor GOES transmissions logs, email alerts will contact ARM person(s), Jim L. will make sure this email list is correct and current. In short, efforts are being made to prevent a recurrence of the problem.

11:35 Collins Mentor: SGP TDMA

TDMA (tandem differential mobility analyzer) data available from 10/1/2005.

Will be delivering data to Archive soon, measures hygroscopicity, volatility, ambient hydration state, aerosol size distributions

11:50 Ogren or Sheridan Mentor: AOS (SGP + AMF)

NSA: PSAP3W, CCN counter coming soon (ARM could help NOAA \$ wise and humidified measurements could happen)

AMF: ccn concentrations, supersaturation measurements quite reproducible, stable. SSA often > 1.0, which points to Bond et al corrections, which will be (perhaps) incorporated into NOAA's qc checks. (Connor/Annette: Check with NOAA about this with regard to aoscorr)

PSAP3W corrections for blue/red unknown, so far, they are assuming same correction as previously used for green (i.e. for PSAP1W)

IAP: 3 humidities soon

Issues: ozone measurements, OPC hard to keep running, want to add CCN counter to SGP

All: consider adding sampling for EC, OC, and dust.

12:05 Lunch Break

13:10 Andrews for Quinn Aerosol Chemistry PMEL

13:25 Flynn Micro Pulse Lidar

Environmental control needs improvement (might fix some problems Connor is seeing in the data)

Discussion: Why not get vendor to fix the nearfield saturation problem, A: we're trying that.

13:40 Turner Mentor: Raman Lidar

Proposed new VAPS liq water content profile, temperature profile, ice water content, cirrus extinction profiles, liquid water cloud droplet number density (WG needs to specify priority)

Comparison to IAP profiles (discussion) pristine region (low altitude)

13:55 Ogren or Sheridan In-situ Aerosol Profiling (Cessna) IAP

2x a week, flights over SGP

f(RH) added in 2003 -- Connor: we are not ingesting f(RH) data for cmdliap

IAP data near surface, matches ground based measurements, when averaged appropriately.

IAP flights daylight only, randomized, so not biased to specific times of day, etc.

Upgrades: new plane, new inlet design to allow supermicron particles, improved f(RH)

14:10 Hodges Mentor: MFRSR, NIMFR

Discussion: should we cannibalize an MFRSR to create a NIMFR at SGP C1. Seems like this is approved.

14:25 Kiedron Mentor: RSS radiometric stability issues in retrievals of aerosols OD

14:40 Liljegren Status report: Cimel

14:55 Turner Aerosol from AERI

15:10 refreshment break

#### **Future Focus of AWG**

15:30 Liu Message from Chief Scientist team

15:40 All Discussion

Get ideas, feedback for STEC

Redirect AWG to focus on indirect aerosol effects and microphysical parameterizations

Why: ARM focus area, and DOE ASP has been reconfigured to focus on aerosol effects on climate.

Models need to be revised to better handle aerosols.

Use Raman Lidar as "signature instrument"

Infrastructure support to operate and produce VAPs (per Yangang Liu)

Need financial support to develop new VAPs.

Deliverables: reduced uncertainty/discrepancy regarding indirect aerosol effects

Multi-moment schemes (predict liquid water content, droplet concentration, and/or relative dispersion, for example)

Signature instrument and related VAPs (Raman Lidar)

Join ARM ASP meetings, IOPs, GCM community that evaluate indirect aerosol effects. DOE ASP has working group meetings.

Proposed new name for AWG: Just a suggestion

Group has been doing excellent work, and ideally, this new focus on indirect aerosol effects would be an addition to existing work, but given the current fiscal environment, we have to face facts, and we may need to go off in a new direction.

Discussion: We have been doing indirect aerosol effect work, but now from a political (and ARM Science plan) we have to emphasize this work.

**Ghan:** delighted in new focus, uncertainty in climate modeling is in the clouds, cloud interactions, less uncertainty about aerosol indirect effects. We have to work with cloud param efforts to make this work correctly.

Indirect aerosol effects is not major focus, but it is a focus.

**Turner:** Raman Lidar can't measure liquid water during daylight. Don't know what the vertical velocity really is.

**Ogren/Ghan:** We need a lot more than RL instrument (focus on one instrument seems to fly in the face of ARM

successes – multiple instruments, scientists,

**Flynn:** Conflict: current science call prohibited DOE labs to submit new retrievals, which seems contradictory with desire for new VAP development

**Schmid:** Seemed to have input from higher up to focus on the RL, and indirect aerosol effects.

Aerosol, aerosol indirect effects will be lost by focusing on the RL ?

**Schmid:** Hope that this refocus is not just a political move.

**Schwartz:** Regret that this is a surprise to him, no chance to talk to Warren Wiscombe about this. Political?

Aerosol science needs to be done, ARM has been making major advances, It would be a shame to stop making this sort of progress. Focus on AOT is really on chemistry and physical processes as they influence atmos. Radiation

ARM/ASP need to work together to make sure the main factors are covered by at least one of the groups (i.e. don't want to have a major "underlap" (no work done by either ASP or ARM in a particular area relating to aerosols). ASP is mainly a campaign-type operation, which is a 24-7 operation, and we (ARM) should continue working in this way. Schwartz and Wiscombe need to talk in depth before this indirect aerosol effects stuff gets set in concrete.

**Ogren:** focus on indirect effects is important, but wonder about the abrupt change, and questions about the RL as a "signature instrument". Could do science projects to see if RL is the appropriate instrument, but a "right turn" is not necessarily a good idea.

**Liu:** RL as signature instrument does not mean that we would stop work on all other instruments. But RL does have new instrumentation to get LW, IW, etc. which might help measure indirect aerosol effects.

**Ferrare:** Shouldn't cloud properties group focus on RL, rather than AWG? Cloud retrievals from the RL should be funded by cloud WGs.

**Liu:** RL has new mentor.

**Turner:** Mentor's job is to keep the instrument running, not to develop new VAPs.

**Ferrare:** RL-related VAP development is important, but losing aerosol resources to do cloud-related (?) VAPs seems wrong.

**Liu:** indirect aerosol effects is a new focus by the science plan. So, we have to make some change to keep aligned to the new plan (not political).

**Schwartz:** Who did made this decision? 2004 science plan had this included.

**Ferrare:** direct and indirect effects mentioned in 2004 science plan,

**Liu:** refocus for indirect aerosols does not mean we drop other work. But it does mean that we have to do work in that direction.

**Schmid:** limited funds means that something's got to give!

**Liu:** List priorities, and then make decisions.

**Schmid:** group is questioning the RL "signature instrument"

**Ghan:** SGP is a "lousy place" to find indirect effects

**Ogren:** this group is not pure aerosol research. AWG is doing work in aerosols to understand climate interactions.

**Liu:** pure aerosol research does not mean that we're not doing aerosol forcing.

**Schwartz:** group is already doing indirect aerosol effects.

**Liu:** One idea is to create a new "subgroup" (?) within AWG focused on indirect aerosol effect. Another idea is to create a new subgroup focused on "pure aerosol research". To do this right we have to involve folks actively involved in modeling (cloud param folks, etc.) Make a new group focused on aerosol/cloud modeling, etc. CLOWD is an example of a cross-cutting group. CLOWD pulls folks from IRF, etc. Making these new groups involves extra travel, etc. and getting folks to sign on, is difficult, simply because of the travel requirements.

Nobody seems to have a problem doing the indirect aerosol effects, but the RL "signature instrument" seems to be generating a lot of resistance among AWG members. There is already a recognized problem with lack of funding for new retrieval development. What are the real measurement needs to improve the microphysical parameters? New instrumentation means that something we're currently doing will have to be dropped due to funding issues. Let the newly funded aerosol science projects suggest new measurements are needed to better resolve the aerosol indirect effects as a result of their work. Completely focusing on aerosol indirect effects will mean that we stop work on aerosol absorption? We can't do that, and Dr. Liu emphasized that he's not advocating that.

Will group endorse apply infrastructure resources to develop "VAP" new retrievals for various RL retrievals many of which seem more related to the other WGs? What will have to be given up to do this.

**Schwartz:** Look at pg 38 of 2004 science plan (regarding aerosols).

### **Aerosol Value Added Products (VAPs)**

16:30 Flynn: Aerosol Best Estimate (ABE)

16:40 Delamere Broadband Heating Rate Profile (BBHRP)

16:55 All Discussion BBHRP+ABE

NSA aerosol properties during daylight, can do fixed "g", MFRs, Jennifer does not think the extinction profile is used yet. John Ogren says that aerosols might not be too important, and put a range of humidification factors on the aerosols, and you might be OK. Ogren wonders about the aerosol above the clouds, which would probably be significant for BBHRP, and there's no information available.

Peter Kiedron: single scattering albedo from MFRSR DDR, but there are apparent discrepancies so BBHRP inputs may not have been as correct as they could be, so BBHRP runs should be done.

17:00 Kehoe ARM Data Quality Office

## **Ran long again, end of day 2.**

### **Friday, Dec. 2**

#### **Other ARM Infrastructure Presentations**

17:40 Schmid for Miller CLASIC Overview

17:55 Schmid CIRPAS Twin Otter Payload

**CLASIC:** serious budget issues. Is there some other program that can help with this IOP? Mark Miller has approached folks in D.C., and Wanda is approaching folks. ASP might be doing another field campaign in 2007, so maybe they would be interested. ASP program considering (St. Louis, Oklahoma City, others)

8:40 Jiang Aerosol-cloud-radiation-surface flux interactions

8:55 McComiskey Direct Aerosol Forcing: Calculation from Observables and Sensitivities to Inputs.

9:10 Dubay Opposite Indirect Aerosol Effect on Water and Ice Cloud Microphysics

9:25 Grabowski Shallow convection, cloud microphysics, and the indirect impact of atmospheric aerosols

9:40 Penner Indirect effects intercomparison

9:50 Turner **Indirect and Semi-Direct Aerosol Campaign (ISDAC proposed for April- May 2008, NSA)**

Discussion: Dave proposed several hypotheses, some discussion about these, expensive IOP, aircraft flights (need twin otter type, very expensive flights), need lot more sonde launches, etc. As a group, should this be pursued? (no strong argument to this). Might be something NSF would be interested in. Dave needs help fleshing out the proposal. Seems like there is OK to proceed. Send Dave email if interested in IOP proposal. (Connor, Joyce Penner, Steve Ghan will help).

10:00 Discussion

10:15 refreshment break

#### **Discussions**

General discussions:

ARM data problems: problems@arm.gov, and/or email to DQ office when investigators find problems in the data.

Mentor job is a "thankless" job. How to get mentors more involved: co-authorship. ARM has no explicit policy to doing this, but no specific prohibition either. Can this be a recommendation? Encourage this, where it makes sense. Authors might want to contact instrument mentor for input on papers. This should be a policy ARM wide.

More mentors/resources: is there flexibility to move \$ around to provide more \$ to mentors? (Jim L: Not easily done, but might be possible. Usually for a limited duration when some big instrument job is going to happen. If we keep adding instruments, and don't increase the mentor budget, then pretty soon there will be no good data.)

AOD QME: This should be a straight AOD intercomparison. Joe M suggests use of model if there is no co-located instrument, like at EFs. This would be a translator/mentor product, a new VAP. ABE v1 is done (or close to it), AOS datastreams are nearly done, so infrastructure resources could be devoted to new task.

RSS product: calibrations, AOD generation, QME like MFRSRs need mentor help  
Get Peter's algorithm for RSS AOD (should come naturally)

Convert existing MFRSR to NIMFR at SGP E13 if sensor delivery is delayed.

AWG refocus: Beat: 1) should indirect effect be a new focus? Are already doing this. Should this be the "only" focus? The answer appears to be "no", puts all your eggs in one basket, and is a recipe for disaster. Warren W. wants AWG to work more closely with the cloud breakout session at STM. Make a decision on path forward during that breakout session.  
2) Is there interest in a focus group "Cloud Microphysics Parameterization"? Suggestion: reach out to other groups, perhaps at STM, indirect effect session at STM (plenary, and a WG session) Invite cloud properties and modeling folks to WG meetings?

Other model inputs: Feingold's,

RL needs additional manpower (Dave's products). Warren wants them. (processing of RL data to get these new things). Resources: Can it be done, and how soon? Dave says progress will be very slow. Diana to take mentor role, not to do VAP development. Diana: overlap correction (these are hanging progress up, currently) and for the "old RL things", Diana just needs time to come up to speed. New stuff: algorithm development, which is a science task, not mentor work. New VAPs for RL, would require Diana to be full time on this. We have to get additional RL support to continue to make progress on new algorithm development. Would a second mentor help? Dave/Rich suggests "yes"

**Recommendation:** Temporarily, increase RL mentor to fulltime job.

**Second recommendation:** New products need to be proposed as an unsolicited research project

**CLASIC recommendation:** descope to address aerosol ind. effects only

Absorption IOP: cavity ring down, photoacoustic instruments to SGP (optical property measurements) funding not available? Does AWG think this is still worthwhile (budget \$60K approx.). Costs are for instrument transport, and staff time, some travel to site. Maybe ASP folks would be interested. Absorption workshop is planned (Sheridan). Location at SGP for this IOP is not crucial (Reno or Boulder are possible locations)

**Recommendation: endorsed**

Aerosol chemistry measurements needed?

PILS, mass spec (campaign basis? ASP might support this), sounds like guest IOP proposal idea.

Why measure aerosol chemistry? (Wanda wants to know if we need chemistry data to support ARM efforts)

Should these sort of measurements be put on IAP plane? (NOAA plane will have PILS? Requires bigger plane. No inexpensive way to add chemistry measurements to ARM dataset.

CIMEL for AMF?

Can Brent be persuaded? Can ARM purchase a CIMEL so that we have a spare? Calibs take some time, and we end up with a data gap. Might want data transmission method in addition to GOES. There are existing CIMELs that work this way. CIMEL data can be expanded to provide additional data. Get AERONET's software? Science team proposal (what to do, who will do it, etc.).

Humidograph Nephelometer for Barrow? If ARM buys it, NOAA will operate it, but Ogren suggests a TDMA instead: \$90K