

OFFICE OF THE
FEDERAL COORDINATOR
FOR
METEOROLOGICAL SERVICES AND SUPPORTING RESEARCH

OFCM Special Session:

**Atmospheric Transport and Dispersion Modeling
Support for Homeland Security**

Eighth Annual George Mason University Conference
on
Transport and Dispersion Modeling

July 14, 2004

Office Of The
Federal Coordinator
For
Meteorological Services And Supporting Research
8455 Colesville Road, Suite 1500
Silver Spring, Maryland 20910

AGENDA

Wednesday, July 14, 2004

Special OFCM Session

Supporting Homeland Security Requirements for Atmospheric Transport and Diffusion Modeling

Session Chair: Mr. Bob Dumont, Office of the Federal Coordinator for Meteorology (OFCM)

1:30 p.m. – 1:45 p.m. Welcoming Remarks/Set the Stage
Mr. Samuel P. Williamson, Federal Coordinator for Meteorology

1:45 p.m. – 2:00 p.m. Invited Talk: *Interagency Modeling and Atmospheric Assessment Center (IMAAC)*
Ms. Nancy Suski, Director, Emergency Preparedness and Response Portfolio, Science and Technology Directorate, Department of Homeland Security

2:00 – 3:15 Panel Discussion: The Evolving Roles and Responsibilities of Federal Agencies in Providing Transport and Dispersion Support

Moderator: Mr. Rickey Petty, Office of Science, Department of Energy

Panelists:

NOAA/National Weather Service
..... *Dr. Paula Davidson, Environmental Hazards Planning Lead, Office of Science and Technology, NOAA's National Weather Service*

NOAA/Air Resources Laboratory
..... *Mr. Bruce Hicks, Director, Air Resources Laboratory, NOAA's Office of Oceanic and Atmospheric Research*

NOAA/National Ocean Service.....
.....*Ms. Debbie Payton, Hazardous
Materials Program Manager for Fate and Transport Modeling, Office of
Response and Restoration, NOAA’s National Ocean Service)/Office of
Response and Restoration*

DOD/Defense Threat Reduction Agency.....
.....*CDR Stephanie Hamilton, USN,
Meteorology & Oceanography Program Manager, Consequence
Assessment Branch (TDOC), Defense Threat Reduction Agency*

DOE/DHS/National Atmospheric Release Advisory Center (NARAC)..
.....*Dr. Gayle Sugiyama, National Atmospheric
Release Advisory Center, Lawrence Livermore National Laboratory*

Nuclear Regulatory Commission

.....*Dr. Stephen McGuire, Nuclear
Regulatory Commission*

Environmental Protection Agency

.....*Ms. Kathryn Snead, Center for
Radiation Site Cleanup, Office of Air and Radiation, Environmental
Protection Agency*

3:15 – 3:45..... Coffee Break

3:45 – 5:15 Presentation and Discussion: *Federal Research
Needs and Priorities for ATD Modeling—A Report of the OFCM-sponsored Joint Action
Group for Atmospheric Transport and Diffusion Modeling Research and Development
Plan*

Dr. Walter Bach, Jr., Cochair JAG/ATD(R&DP)
Program Manager, Environmental Sciences
Division, Engineering Sciences Directorate, Army
Research Office, Department of the Army/Army
Research Office

5:15 Wrap-up

5:30 Adjourn

INTRODUCTION

Special OFCM Session – Supporting Homeland Security Requirements for Atmospheric Transport and Diffusion Modeling

Session Chair: Mr. Robert Dumont, OFCM

Welcoming Remarks/Set the Stage: Mr. Samuel P. Williamson, OFCM

INVITED SPEAKER

Invited Talk: *Interagency Modeling and Atmospheric Assessment Center (IMAAC)*

Invited Speaker: Ms. Nancy Suski, Director, Emergency Preparedness and Response Portfolio, Science and Technology Directorate, Department of Homeland Security and Cochair of the Joint Action Group for Atmospheric Transport and Diffusion Modeling Research and Development Plan

Summary of Talk:

Ms. Nancy Suski described the Interagency Modeling and Atmospheric Assessment Center (IMAAC) vision and concept. It is a work in progress – barely off of the drawing board. The vision is that the IMAAC will be both the center of a collaborative research program and a 24/7 Federal response capability that will produce and distribute the Federal hazard prediction in the case of an atmospheric release that results in (or is expected to result in) a domestic incident of National significance. The concept is that the IMAAC will coordinate with Federal ATD modeling centers to develop a single hazards prediction for a domestic incident of National significance. The IMAAC resides within the Science and Technology Directorate of the Department of Homeland Security.

The IMAAC has a diverse customer base ranging from incident commanders on the front lines to government officials needing to inform and calm the public and plan for long term recovery operations. DHS adopted the “train as you fight” philosophy of DOD and plans to provide support to planning and exercises as well as 24/7 operations and technical reachback capability for incidents of National significance.

Ms. Suski described why DHS is implementing the IMAAC concept now. Although the Federal agencies developed a wide range of atmospheric hazard prediction capabilities two relatively recent events changed the landscape. First, with the formulation of DHS, a

new steward of domestic response capability was created and a cabinet-level official assumed the responsibility for coordination of domestic response assets. Secondly, an exercise involving top officials held shortly after the formation of DHS shone the spotlight on the long acknowledged, but seldom addressed, need for a coordinated Federal response to atmospheric hazards. DHS and the Homeland Security Council (HSC) tasked an interagency group of experts who were already working on consequence management for radiological event to also address this need. This group then established a subgroup which quickly stepped up to the challenge posed by Secretary Ridge and the HSC. Ms. Suski described the subgroup decision to respond with the answer that there was not just one model, but rather a suite of tools residing in several Federal agencies and the private sector, as well resources not yet used by DHS, like NASA's remote sensing capability. The subgroup developed the IMAAC concept to leverage all these capabilities to provide not a single model, but rather a single hazard prediction.

There are many challenges ahead, including the urgent need for an urban meteorological and dispersion modeling capability that does not yet exist. A more detailed understanding of urban meteorology is required. There is also a need for methods to incorporate concentration values that are sensed in near real-time with model-derived data for incident characterization and event reconstruction. DHS is a member of the OFCM group that is writing the Federal ATD R&D Plan. Ms. Suski deferred discussion of additional R&D needs to the presentation by Dr. Walter Bach who is the other Cochair of the Joint Action Group for Atmospheric Transport and Diffusion Modeling Research and Development Plan (JAG/ATD(R&DP)).

The IMAAC is operational at the NARAC. The IMAAC is connected to the DHS Homeland Security Operations center (HSOC) and the DHS FEMA National Emergency Operations Center (NEOC). IMAAC products are distributed through a variety of network capabilities (both classified and unclassified). The IMAAC Working Group is developing the concept of operations and a Memorandum of Agreement for long term implementation. Although the IMAAC operational mission has absorbed most of the attention so far this year, the DHS Science and Technology Directorate plans to establish a Scientific Advisory Group to help develop long-term R&D priorities.

Ms. Suski noted that the formation of the IMAAC is an important accomplishment that would not have been possible without many of the people in attending this session. The benefactors of the IMAAC are the men and women who risk their lives daily in public service: the police officers, fire fighters, EMTs, and other responders who the public relies on, day in and day out, in times of catastrophic disaster and during smaller scale emergencies. They deserve the best our country has to offer. Our ability to quickly and effectively respond will result in saved lives and faster recovery efforts. To achieve the IMAAC vision will require a national team. Everyone has a part to play and everyone must play their part.

Summary of Discussion Period:

Question: What plume models are being considered?

Answer: So far only the Federal ATD modeling systems have been considered, including HPAC, HYSPLIT, ALOHA, and NARAC. The IMAAC hasn't looked at academic and private sector models yet but there are plans to do that. One of the key objectives is to develop the R&D criteria of the models.

Question: The IMAAC's emphasis on atmosphere is OK, but there are other media, e.g., waterborne, and other pathways, such as the food supply. Does DHS plan to implement an approach similar to the IMAAC for other media and pathways?

Answer: The Homeland Security Council asked DHS to look at water pathways. The Department of Health and Human Services (DHHS) is looking at spread of diseases from animals. IMAAC considered other names to take into account the other aspects, but we needed to start with atmospheric transport and diffusion.

Question: Is there a concept on how to bring the models together?

Answer: DHS is looking at tools existing tools and methods that exist in the Federal community and there is a need to look at ensembles, but some of these methods are not yet developed for hazards predictions and research is required.

Question: Is there an independent group designated to help DHS develop and implement new products?

Answer: The actual structure of the final IMAAC will include a strong scientific basis for its programs, including independent verification and validation of products that are otherwise ready move into operations. Other aspects of research still need to be looked at.

Question: Does DHS's concept of the IMAAC have aspects of interagency coordination/cooperation.

Answer: – Yes, it has from the beginning and will continue to do so.

Question: Is DHHS going to be included?

Answer: Yes, DHS is just beginning to coordinate with DHHS to ensure that organizations within the DHHS Centers for Disease Control (CDC) are aware of the IMAAC.

Question: Does DHS have enough funds available for the IMAAC to do the job?

Answer: No, there is never enough money and time. We must strive to do as much as possible as a scientific community to work collaboratively on a good overall R&D program, to gain as much as we can out of all of the individual R&D programs.

PANEL SESSION

Panel Discussion Topic: *The Evolving Roles and Responsibilities of Federal Agencies in Providing Transport and Dispersion Support.*

Moderator: Mr. Rickey Petty, Program Manager for the Environmental Meteorology Component of the Atmospheric Science Program

NOAA NWS Presentation. Dr. Paula Davidson, NOAA's NWS. Dr. Davidson reviewed aspects of NOAA's NWS support to Homeland Security, including NOAA's posting of staff members at the DHS Homeland Security Operations Center (HSOC). She described the use of HYSPLIT to provide dispersion predictions for public safety. Information on product dissemination and support to users, including emergency managers and first responders was presented. Dr. Davidson emphasized the role of NOAA's All-hazards Radio; the "All Hazards" warning system for natural and technological hazards. She described the current research programs to improve dispersion modeling and provided an overview of the NOAA's NWS support to the IMAAC.

Question: Can you say how NOAA will coordinate with the transportation sector, e.g. evacuation issues on highways, including information transfer from the NWS to the local and state agencies handling the incident?

Answer: On a real-time basis, state and local authorities can (and do) call the local NWS Forecast Office for more information. Also, authorities can call the Senior Duty Meteorologist (SDM) at the National Centers for Environmental Prediction (NCEP) at Camp Springs, MD. DHS routinely uses information from a NWS. The information is available at the IMAAC and the IMAAC personnel can contact the NWS.

Question: In terms of products provided to the agencies, you provide products in a meteorological format, not an ATD format.

Answer: NWS has to provide in WMO format, GRIB or GRIB2, but also GIS format for some dispersion products.

Follow-up: If there is a standardized format for ATD models then shouldn't the NWS provide its ATD products in that format?

Answer: IMAAC should play the role of providing ATD products in the format required by specific users.

Question: Is there any way for the international community to standardize these data/products?

Answer: Not aware of any initiative to do that.

NOAA ARL Presentation. Mr. Bruce Hicks, NOAA's OAR/ARL. Mr. Hicks Presented NOAA's ARL perspective of transport and diffusion support to homeland security. Organizations within NOAA's ARL are responsible for developing the various elements that comprise a National end-to-end dispersion forecast capability that spans spatial scales from urban to global scale. Mr. Hicks described the "READY" website, an open web portal to various NOAA dispersion products. He then reviewed the current emphases on applying urban meteorological and dispersion data, including the development of the DCNet capability which is the first Urban Atmospheric Transport and Diffusion (ATD) Test Bed in the Washington, DC, area. ARL Scientists have identified the need to establish ATD Test Beds in complex environments across the country and to make use of sources of opportunity, such as power substations that continuously release detectable amounts of sulfur hexafluoride (SF₆) gas.

Question: Can you comment on other sources of meteorological data, e.g., highway data, and do you plan to use data from those sources?

Answer: Don't know how to do it yet, but we do need to make use of the data.

Question: With the Internet and all of the weather enthusiasts there is the potential for linking lots of local automated weather stations. Suggest using that data in some way. Also, NOAA's NOS has automated tidal observation stations that have meteorological towers with sensors and data that are available in near real-time.

Answer: NOAA would want to see the data first, prior to deciding how best to use it.

NOAA's NOS Presentation. Ms. Debbie Payton, NOAA's NOS/OR&R. Ms. Payton presented the support plans under NOAA's NOS Office of Response and Restoration. NOS ORR provides scientific and technical services for the support of oil and HAZMAT spills and provides forecasts for restoration, per the EPCRA and CAA-RMP authorities as implemented by the EPA and USCG. NOAA's NOS Office of Response and Restoration develops tools for the end users while emphasizing the importance of communicating the science back to the coastal environment user community. She stated that it is not clear how NOS will fit into IMAAC. One point that must be worked with IMAAC is the role of the CAMEO/ALOHA programs and how the programs will interact with other ATD modeling systems. Ms. Payton then reviewed the CAMEO (large database of chemicals, toxics, health, fire, etc.) and ALOHA (first responder, 10 min and 60 mi) capabilities. She also reviewed the gaps of ALOHA. She noted that training is an issue to users and concluded the talk by describing why probabilistic forecasts should be developed.

Question: Can you reconsider NOAA's position on modeling gasoline fires and associated releases? Also, suggest that NOS include the capability to run CAMEO/ALOHA directly from the field (e.g., a first responder, such as a HAZMAT technician using a Blackberry or cell phone) and not rely on long distance telephone calls to an ATD modeling center.

Answer: We have been trying to address the Internet access issues and are working the issues. The gasoline issue is more complex, there is still a lack of understanding of the mixture.

Question: What happens with the events that are over in 30 minutes, e.g., chlorine/train derailment? How are ATD modelers going to handle these fast ones?

Answer: Beyond my scope. Users sometimes have not been able to run ALOHA until after the fact, since these are very short time scale events. People want to know where the impacts are for post-analysis.

Question: It is difficult to use ALOHA to get detailed source information for use with another dispersion model. It would be helpful to get the source values specifically instead of just the whole package.

Answer: ALOHA has the capability for other data, but you need to contact the program office on how to get it.

DOD DTRA Presentation. CDR Stephanie Hamilton, DTRA. CDR Hamilton reviewed the Defense Threat Reduction Agency's mission statement and capabilities for T&D modeling and hazards predictions. DTRA provides 24/7 weapons of mass destruction (WMD) response support to DOD, including use of tools as HPAC. HPAC includes a meteorology program. CDR Hamilton reviewed DTRA's ATD R&D needs and its partnerships with other agencies. DTRA uses weather data from a variety of users including NATO countries.

DOE/DHS NARAC Presentation. Dr. Gayle Sugiyama, NARAC LLNL. Dr. Sugiyama reviewed the capabilities of the National Atmospheric Release Advisory Center (NARAC), from data, to modeling and consequence management information (value-added data). Data and products are shared with outside users via the internet. Validation is a key component of their products through various experiments with other agencies and universities. Main problem for reconstruction tools is the source term. This is a key datum necessary for improvements. ATD models are a key component of a larger response system, including detection, warning, and incident characterization.

NRC Presentation. Dr. Stephen McGuire, NRC. Dr. McGuire's presentation focused on the NRC response to nuclear incidents, reviewing the process followed after an incident. Protective Action Plans have already been developed for nuclear plants, which provide decision-makers with the action to take dependent on what is occurring at the time of the incident. This includes evacuation and monitoring procedures. He described the collaboration of dispersion output with NARAC was described and subsequent actions and decisions by both groups. Data is also shared with IMAAC, and limited information is disseminated to the public.

Question: These recommendations of action are typically time dependent, but they can change with time based on local changes. How do you expect to provide a change of action when conditions change?

Answer: We will try to predict the entire time that is needed (e.g. 24 hrs) and look at the actions which will need to be taken during that time period. If things change, we will re-look at the recommendations and discuss any changes.

Comment: I want to commend NRC for conducting these test exercises. NRC is good at conducting joint drills with state and local governments. Great job.

Question: Many nuclear power plants are in complex environments, but dispersion models are simple, and local met data is hardly elaborate, the concern is that NRC is not having industry keep up with evolving technology with met data and technological tools.

Answer: Many licensees are way behind, but RASCAL model is also constrained in that it uses coarse topographic data. RASCAL modelers try to use multiple weather stations (w/in 70 miles of the plant). We are trying to take the complex environments into account and compare RASCAL results with results from NARAC in situations where NARAC has higher fidelity inputs.

Question: In times of nuclear attack, if NRC not mandated, which agency is mandated to decide?

Answer: The state or local agency makes the decisions. NRC provides the technical advice.

Question: What if it's a national attack, who then makes the decision?

Answer: Others should address this question, I'm only addressing a local nuclear site. If terrorism on a plant we would respond the same way.

EPA Presentation. Ms. Kathryn Snead, EPA ORIA. Ms. Snead presented an overview of EPA's ATD modeling support to Homeland Security. She reviewed the offices and centers who are available on a 24/7 basis. EPA can best support by time scale: CAMEO/ALOHA (short-term); monitoring data input (intermediate; no modeling); reconstructive modeling in support of remediation activities (long-term).

Question: You stated there was no intermediate modeling capability, but you provide monitoring. We've heard at this conference that decisions on where to put the monitors require modeling. Are you suggesting IMAAC help to place the monitors in the best place?

Answer: It would be best if agencies worked together to use the established framework and resources to get to the best end solution.

***** **Break** *****

PRESENTATION

Presentation: *Federal Research Needs and Priorities for ATD Modeling—A Report of the OFCM-sponsored Joint Action Group for Atmospheric Transport and Diffusion Modeling Research and Development Plan*

Presenter: Dr. Walter Bach, Jr., Cochair JAG/ATD(R&DP), Program Manager, Environmental Sciences Division, Engineering Sciences Directorate, Army Research Office, Department of the Army/Army Research Office

Summary of Presentation:

Dr. Walter Bach is Cochair of the OFCM Joint Action Group for Atmospheric Transport and Diffusion Modeling Research and Development Plan. He described the purpose of the Federal ATD Research and Development Plan: To present a research and development (R&D) plan for providing the ATD modeling capabilities needed to meet established needs of the user communities, with special emphasis on enabling the National strategy for responding to domestic CBRN incidents. The Plan is directed to the Federal Committee for Meteorological Services and Supporting Research (FCMSSR). The following are key points of Dr. Bach's presentation:

1. The objective of the Federal ATD modeling effort is to meet the established needs of the user communities. The JAG/ATD(R&DP) looked at the end-user's perspective and kept that perspective in mind throughout its deliberations. The end-users are involved in a variety of activities, including planning, response and recovery. Users want the following: accurate and timely predictions of hazards to human health and safety and the environment, actionable information in their terms, and answers to the questions: How bad is it (or could it have been) and where? Users need to know implications of uncertainty for their actions. Users also need a technical reachback capability. Although the focus of the R&D Plan is on emergency response applications there are other relevant applications such as air quality and military applications.
2. The science community can use these needs to justify key research and development needs that are required to develop capabilities to support the end-users. These needed capabilities and improvements include: synoptic to intra-urban scales, simple to complex environments, and analysis and prediction capabilities for atmospheric fields. Key challenges include: quantify uncertainty in model inputs and predictions; close the knowledge gap between the mesoscale and microscale modeling capabilities; and represent transport and diffusion in complex flows, including urban and coastal environments.

3. The JAG/ATD(R&DP) observed the following challenges:
 - Timely and accurate hazard predictions in urban areas are required to assess vulnerabilities and threats to public safety.
 - Acceptance of local-scale meteorological and concentration data into consequence assessment systems.
 - Examine the role of regional meteorological monitoring networks.
 - Diverse requirements and capabilities argue for diverse models.
 - Conduct field experiments and sustained analysis of data to understand ATD, especially in urban environments
 - Develop meteorological and tracer measurement capabilities.
4. The JAG/ATD(R&DP) developed the following two Keystone Recommendations. The list of implementation actions is included in the PowerPoint presentation:
 - a. *Quantify Uncertainty*. Applies to meteorological and concentration data.
 - b. *Interpret Uncertainty*. Modelers working with users to provide a constant feedback. Education and outreach is a key part of this as users will require training.
5. Supporting Recommendations: The keystone recommendations will not be able to be successful without certain support, including: capturing and using diverse existing data sets for ATD experiments; establishing ATD test beds, on a 24/7 basis; development of model evaluation standards; develop/improve atmospheric sensors to support ATD; develop local/regional measurement siting criteria for agency instrumentation systems; bridge the modeling gap for various model scales to interact.
6. The Next Steps include publishing the R&D Plan, presenting the R&D Plan to the ICMSSR and at the Urban Meteorology Forum in September 2004, and finally presentation to the FCMSSR for agency implementation.

{Note: The OFCM-sponsored Joint Action Group for Atmospheric Transport and Diffusion Modeling (Research and Development Plan) report, titled *Federal Research and Development Needs and Priorities for Atmospheric Transport and Diffusion Modeling* and dated September 2004 is available from OFCM and can be downloaded from the OFCM Web site at:
<http://www.ofcm.gov/homeland/homelandsecurity.htm>

Discussion Period:

Comment: Dr. Paula Davidson, NOAA NWS/OS&T clarified the points made about meteorological data assimilation and mesoscale model verification. She stated that the NWS does assimilate meteorological observational data in its meteorological models at

global and regional scales. Parameterization of boundary layer processes is an on-going effort. The NWS is working on methods to verify the performance of its models in the boundary layer. Also, there is a continuing need for more local information.

Question: From a private sector perspective the companies that provide mesoscale wind forecasts have to get it right or they will not be in business for long. Customers are quick to provide feedback if the wind forecasts are not representative of the conditions they observe. The customers are good verifiers. The private sector can bring to market, and the consumer can help provide the feedback. This is a resource we should try to tap for verification of products such as mesoscale wind forecasts.

Comment: For the meteorological data, models are being run and we can validate the results. With ATD models, you very seldom have events that we can verify (e.g., events/incidents where concentrations are measured and tracer studies).

Question: In bridging the scales, it is important to be careful with statistical methods. The statistical to instantaneous comparison is a very difficult area.

Answer: The direction is more of a probabilistic approach instead of deterministic.

Follow-up: That's on the statistical side, but this bridging of scales is a bigger problem.

Comment: I agree, how do bridge the gap in scales is a big problem....we've only done statistical to statistical. Research is required.

Answer: We have not determined the course the research should go, but the course should be that which the agencies provide. The community of the science can come and address these things. This is not a 1-2 year, but a 10-year+ implementation. An important part of the test bed concept is the user/modeler-forecaster interaction.

Follow-up: The report should include a distinction between these two (statistical to instantaneous).

Follow-up: How to do it is not clear, but research needs to try to make this distinction.

Question: you mentioned remotely sensed data tracer sets, if those sets are available (and they are), would the agencies make this available for validating models?

Answer: Can't speak for the agencies, but this should be explored further. We need to use the resources we have.

Question: Can we invite the modelers for comment? Is there a benefit added to the model verification to use this sort of data?

Answer: We should be open to use such data, and folk should discuss further.

Comment: Many field experiments have used this time/space data, but its easier to use fixed point data averaged over time. A Research need is how to use this data so as not to take forever to use the data.

Comment: Need for better weather observations. FAA uses radar and observation sited...working on sensor integration. Has the JAG looked at what the FAA has done?

Answer: We have not addressed by agency, but by need in the report. There is a lot of data out there which can be used, e.g., weather radar. Test beds need to be looked at on finer scales and compared to the larger ones.

Follow-up: FAA (MIT Lincoln Labs) developed a gridded wind analysis, 35 major terminals, (ITWS) 2km gridded wind analysis, it might of interest to the community. Could be incorporated into the test beds.

Comment: More remote sensing activities are needed. There are a lot of things NASA is doing that can be used in ATD modeling.

Comment: in New York, SJSU meet with FAA to use the data from them.

Follow-up: BL parameterization verification, Lidars are good, but NY air quality profiles could be used for verification. (northeast study)

Answer: Special intensive operating periods (IOP) are good, but there should be other options.

Comment: Suggest you supplement general observations with quantified metrics. Also, the point that the tools need to meet needs of the users is a good one. Finally, the concepts of “learning while doing”, “training while fighting”, you can do a lot now, like 18 hours forecasting after a chemical spill in Georgia, you have data that is as effective as the forecasts. It is possible to include specific projects in your plans to validate them, and to incorporate any lessons that can be learned.

Comment: We heard about the use of ATD models in sensor fusion and data integration – it is evidently one of the big funding sources for ATD modeling. What recommendations are being made that will use ATD models in that context?

Answer: That approach has its own research need, but we are trying to tell the Federal agency decision-makers what they need. That type of use of this report is not what we are getting at. But, sensor fusion is important.

Comment: The problem is defending the ATD modeling approach in Homeland Security efforts.

Question: I can think of many ways to view the fusion problem – use data for the modeling of the winds, take observations of concentrations and release it and simulate it. Do you want to integrate available observations and concentrations or use a best-estimate of both?

Answer: Yes. Someone needs to know when they are or are not affected.

Question: Archiving data is expensive. Someone would have to look at all the data, combine into it in one system, and say this is what we want and show what we are lacking. (e.g., night time releases).

Answer: We so need to get the data into a common database for the user. If many users use the data then we can learn more about the problem that is being studied. One recommendation that was not mentioned is to re-do the more classic experiments with modern technology. This provides us with a check against current capabilities.

Question: NASA is an active participant in the IMAAC. In IMAAC, we plan to use data from satellite-borne sensors

Comment: We need to remind people that there is a battle of balancing the wind field using mesonet data. Many times you want high resolution profile data, but if you put a surface wind in and it is not consistent then your model will blow up. In terms of data needs, we need vertical profile data as well as surface data.

Comment: One of the most difficult cases is night time boundary layer (BL). During an experiment, we found turbulence to be a problem in the urban environment. Are there any programs to address this?

Answer: Not aware of any, but the Oklahoma City experiment in July 2003 tried to address some of this. There was an urban heat island there.

Follow-up: The Oklahoma City Lidar data set shows the urban heat island effect. And yes, there is some morning transition. We have not looked at the night time data.

Follow-up: But no one has the finer scale turbulence data.

Question: When it comes to funding, we need to show that appropriated funds are wisely spent, how do we get this across to the Congress, i.e., that appropriated funds are wisely spent?

Answer: We tried to address things in the short-term which could be done. But the problem is very large. This is not only a program with short objectives, but a long-term program as well.

Question: How do we convince people that this is worthwhile? This idea of a test-bed for the Army, the urgency has forced people to think about it, for research and for operations. Just like the weather radar, think about the test beds as an operational issue.

Answer: Like DC Net. I agree. Test beds should be supporting all types of operations.

Question: there may be ways to improve things, but look more into peacetime versus wartime. Maybe this would help funding.

Answer: It would be nice, but the military implications are expansive.

END