The American Meteorological Society

Certified Consulting Meteorologists

Newsletter

Volume 7, Issue 4 Winter 2016–2017

This newsletter is intended to enhance communications between CCMs, the BCCM, and the AMS. It is published quarterly to provide information about the on–going activities of the CCM program. Please remember to use the **CCM LinkedIn page** for your communication and exchanges between CCMs.

Alicia Wasula
CCM Newsletter Editor
Kelly Savoie and **Sangjun Lee**
CCM Newsletter Managing Editors

Highlights Inside this Issue

The Chair's Column

Dear CCM Colleagues,

It has been my privilege to serve as Chair of the board this year. It has been a rewarding, yet challenging experience. Thanks to the hard work and dedication of the 11 exceptional board members this year, we were able to accomplish the following towards our goals:

- Collaborated with the Board for Early Career Professionals on an article for an upcoming issue of BAMS;
- Selected a recipient for the Harrison Award from a field of highly deserving nominations;
- Conducted two regional exams with the help of several CCM volunteers, both of which were recommended for certification;
- Continued working with the 4 holdover candidates from 2015; processed 9 new applications in 2016; anticipate conducting 8 oral exams at the Annual Meeting in Seattle, WA, leaving a few holdover candidates for 2017 still in the application / written exam process;
- Updated the oral examination material for use with the next round of exams in January 2017;
- Laid the groundwork for CCM activities at the 2018 Annual Meeting in Austin, TX with additional planning meetings / discussions taking place at the 2017 Annual Meeting in Seattle, WA;
- Conducted other activities related to normal board business.

As you can see, it has been a busy year, with a particularly demanding grading schedule this last quarter. Many thanks to the candidates submitting applications this year, the board members who worked tirelessly on grading exam material, and to Kelly Savoie for putting in many hours to keep this program running very smoothly year after year.

As we look forward to the new year, the board is looking toward its annual membership and leadership change. Mark Wenclawiak and I will be completing our appointments to the board at the conclusion of the 2017 Annual Meeting. Mark has been an outstanding board member to work with and we thank him for his dedication and service over the years. Dr. Anthony (Tony) Lupo, who served as Chair-elect this year, will be assuming the Chair position at the conclusion of the 2017 Annual Meeting. There are a couple extra changes this year in addition to the routine ones. Tim Hall agreed to serve an extra year on the board and was selected as the Chair-elect for 2017. Regretfully Larry Peabody recently offered his resignation to the board; Mitch Baer agreed to serve an extra year on the board allowing ample time to fill the vacancy. The 2017 BCCM membership is as follows:

Terms Expiring 2018	**Terms Expiring 2019**
Tony Lupo, *Chair 2017*	Tim Hall, *Chair-elect 2017*
Mitch Baer	Steve Hanna
Ron Baskett	Gale Hoffnagle
Terms Expiring 2020	**Terms Expiring in 2021**
David Legates	Lou Cantrell
Lance Steele	Pam Knox
Alicia Wasula	Rick Shema

Last, but certainly not least, I invite each of you that plan to be in attendance at the 2017 Annual Meeting in Seattle, WA to the CCM Breakfast being held on Wednesday, January 25 from 7:00-8:15am local time in the Washington State Convention Center, Skagit 1. You will hear from several speakers including:

- Matt Parker, AMS President;
- Keith Seitter, AMS Executive Director;
- Maureen McCann, AMS Commissioner on Professional Affairs;
- Tim Spangler, the Chair of the Board of Best Practices;
- As well as a recap of the previous year, a look at the year ahead & news from headquarters from Tony, Kelly & I.

We plan to begin with welcome and introductions promptly at 7:00am, so come hungry for good food and information! At the conclusion of the CCM portion of the breakfast, NCIM plans to meet in the same location from 8:15-9:30am.

I wish each of you a safe and happy holiday season, and a blessed new year.

Jennifer M. Call, CCM #674
Chair, Board of Certified Consulting Meteorologists
American Meteorological Society ■

The Professional Development Tracking System is Back Online

Thank you to everyone for your patience during this lengthy process. The professional development tracking system is finally back online. Please use your AMS online account credentials to log into the system at apps.ametsoc.org/pdts. If this will be your first portfolio submission, instructions on the process are available through the Professional Development page on the AMS Web site.

If you have previously bookmarked the page for the tracking system, please make note of the new url address apps.ametsoc.org/pdts. Please forward this on to any of your colleagues who may not be on our distribution list and feel free to email Kelly Savoie if you have questions. ■

Meteorological Uncertainty and the Expert Witness

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A common dilemma for the expert witness is that he or she is asked to provide a "yes-or-no" answer. However, all environmental problems, including those involving meteorology and air pollution, have varying degrees of uncertainty. For example, if we know that the 95 % confidence range is ± 2 m/s on, say, a wind speed estimate of 5 m/s, how do we explain the uncertainty to a lawyer, judge, and/or jury?

A Supreme Court ruling in 1993 (Daubert v. Merrell Dow Pharmaceuticals) determined that, to be admissible, expert scientific testimony that is derived from research done for the purpose of litigation must show that the conclusions were reached after following recognized scientific methods of research. In the Spring 2013 CCM newsletter, Gale Hoffnagle wrote an article on the effects of Daubert on expert witness testimony. He pointed out that an expert who cannot state the margin of error of his calculations can be disqualified by the judge. It is the judge's duty to keep out of the court experts who cannot properly qualify their opinions. Independent of litigation requirements, today's scientific journals require that confidence ranges be included for observed data, and our daily meteorological model forecasts are couched in terms of probabilities.

This article draws on my experiences in interpreting meteorological uncertainties as an expert witness. Here is a question asked during a preliminary meeting with a lawyer who was overseeing my work – "How accurate can I say your dispersion model is? Within 5 %?" I respond "More like plus and minus a factor of two or three". He says "Can we say 10 or 20 %?" I respond "Maybe 60 or 70 %". We then proceeded to negotiate to a compromise number where I was comfortable and he was not too displeased.

A few examples of typical scenarios where uncertainty arises are described below. These include:

- Analysis of whether two meteorological observations are similar (representative)
- Assessing confidence whether there was freezing rain (or other weather phenomena) at a specific time and place
- Interpretation of model-predicted concentration contours
- Magnitude of variability of winds in urban street canyons
- Wind speed and direction variability on mountaintops

The first scenario concerns whether two sets of meteorological observations for a given time period and/or a given location are similar. For example, in power plant permitting exercises (nuclear or fossil), there is a requirement to use 1 to 5 years of meteorological data from an on-site tower or from nearby official weather stations. If ten meteorological sites are available within 10 or 20 km, is one site more representative of the region than the others? Or if 10 years of meteorological

data are available from the on-site tower, is one year representative of the others? There is always variability in time and space, even during so-called "steady" weather conditions over flat uniform terrain. To analyze the representativeness of a data set, we can use detailed formal statistical methods or a simpler approach shown next. The specific question concerns whether the annual wind direction rose from 2000 at the meteorological tower at the Pilgrim Nuclear Station is representative of the three-year period from 1999 through 2001.

Table 1 contains standard annual wind rose information, indicating the fractions of the time the wind was from the 16 wind direction sectors for each year. It is seen that the wind rose has a similar general distribution from year to year, but the specific fractions in any given sector can vary by as much as 0.01 or 0.02. My simple approach was to determine whether the 2000 wind rose fractions were within the range of expected variability. To do this, I counted the times that the listed annual number was the highest, middle, or lowest for that sector for the three-year period. In this way, the variability in 2000 is seen to be similar to that of the other two years. I have found this level of variability in similar analyses of annual wind roses at other nuclear power plants.

The second scenario involves assessing whether there was freezing rain (or whatever) at a given time and place. This is a common job for a CCM. Somebody is suing someone else, for example, for contributing to a fall at a gas station by not spreading salt on ice that was allegedly a result of freezing rain just before the incident. The CCM looks up weather records from the nearest weather stations, looks at radar maps, local reports, etc. and then is asked to give his opinion. But are we ever 100 % sure that a weather event was occurring at a specific time and place? There hardly ever is a suitable measurement with adequate QA/QC at the time and location in question. How do we phrase our conclusions in the face of uncertainty? Our client would not be happy if we said "there is a 50 % chance that there was freezing rain". The solution that we often use is a "weight of evidence" argument, based also on available witnesses, personal weather stations, camera footage, etc.

Direction	Pilgrim 33 ft wind rose 2001 towards	Pilgrim 33 ft wind rose 2000 towards	Pilgrim 33 ft wind rose 1999 towards	Range of three years
N	0.089	0.072	0.099	0.027
NNE	0.163	0.140	0.138	0.025
NE	0.119	0.111	0.110	0.009
ENE	0.100	0.099	0.096	0.004
E	0.092	0.096	0.091	0.006
ESE	0.057	0.068	0.060	0.011
SE	0.045	0.057	0.054	0.012
SSE	0.031	0.033	0.032	0.002
S	0.036	0.044	0.021	0.023
SSW	0.046	0.056	0.041	0.015
SW	0.039	0.048	0.038	0.010
WSW	0.037	0.043	0.049	0.012
W	0.038	0.045	0.041	0.007
WNW	0.029	0.031	0.039	0.010
NW	0.037	0.025	0.040	0.015
NNW	0.028	0.027	0.040	0.013
Sum of	0.986	0.995	0.989	0.201
	Times highest 3	8	5	Avg =
	Times middle 7	5	4	0.013
	Times lowest 6	3	7	

Table 1. Pilgrim annual wind rose fractions for 3 years. Salmon is "highest", green is "middle", orange is "lowest".

The third scenario is interpretation of model-predicted pollution concentration contours. Modelers agree that, when model predictions are compared to observations in field research studies, there is an approximate factor of two root-mean-square disagreement between predicted and modeled concentrations. However, the charts and tables given to the client are usually deterministic (single numbers or contours), which may lead them to interpret the contours of concentration as absolute limits. This can cause difficulties when we are consulting in cases where there is a group of people at specified locations suing for damages due to a pollutant release. Who is likely to be under the plume and who is well away from the plume?

How does a CCM convey the uncertainty in plume location modeling to a lawyer or a judge and jury? Figure 1 contains a SCICHEM prediction of deterministic concentrations for a specific toxic gas release. It is easy to see that, if the contours were expanded or contracted, there can be a shift in the size of the affected population. My analyses of plumes during several field experiments suggest that the uncertainty in the direction of the plume centerline averages about ± 30 degrees (larger

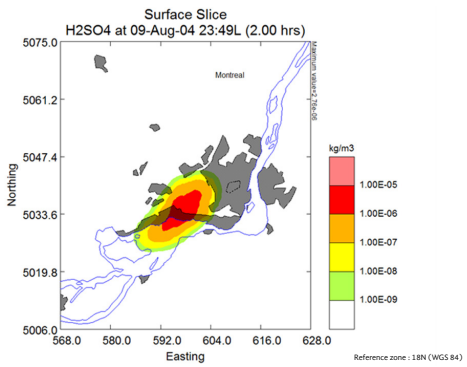


Figure 1. SCICHEM model predictions of concentrations 2 hrs after a toxic gas release

for small wind speeds). Uncertainty in plume width averages about ± 30 %. However, for any given scenario, this uncertainty estimate can vary considerably, depending on the source (ground-level or stack; buoyant or not; line, area, or volume; time dependent; knowledge of emissions rate), terrain, representativeness of meteorological observations, averaging time, and many other factors. Some dispersion models (e.g., SCICHEM) provide uncertainty outputs (variances) in addition to the deterministic mean, but few clients fully understand their meaning. As stated in the previous scenario, other types of information such as videos, emergency responder reports, and public complaints can add to the weight of evidence in these cases.

The fourth scenario involves a person who attempted (but was stopped by authorities) to base jump off the Empire State Building (Figure 2 is a photo taken from the top looking north). The City of New York claimed that he was endangering the public. The base jumper claimed that, based on his long experience, he knew what winds are expected around buildings and in street canyons and would be able to avoid the public. I was hired by the City on the basis that I had recently led a field experiment (MSG05) in the area and had published papers on the measured wind variability. I testified that flow is very uncertain in street canyons and justified the statement using observations from the field experiment. The base jumper lost the case but was pleased about the publicity that had been generated.

The fifth scenario concerns wind direction at the top of a mountain at the time that a forest fire started in a remote area with no witnesses nearby. One expert says that his analysis shows that the wind at a top of the mountain at a certain time is known within 10 % (speed) and 10° (direction).

Figure 2. Looking north from top of Empire State Building

Another expert says that it is impossible to know the wind speed and direction at a given time and location in complex terrain within a factor of two or 30°, respectively. Averaging time is a factor, too, since a fire can be ignited during a 5 second period with a high wind gust. What is the answer?

For the above scenarios, it is possible to carry out a detailed formal statistical analysis that would include estimating and interpreting error bounds (e.g., 95% confidence limits) on observations or model predictions of meteorological or air pollution variables. Standard statistical methods can be applied to any observation and/or model output or performance measure (e.g., mean bias). Usually the analyst must assume a distribution shape (e.g., normal, log-normal, exponential). Methods such as bootstrapping are based on resampling the observations and do not need to assume a distribution shape. However, once this is done, we often find that the uncertainty concept is difficult to explain to non-scientists such as most lawyers, judges, and juries. I have succeeded in doing this in some special research studies not directly related to regulatory actions. It is helpful to work with lawyers and judges with a background in science and statistics.

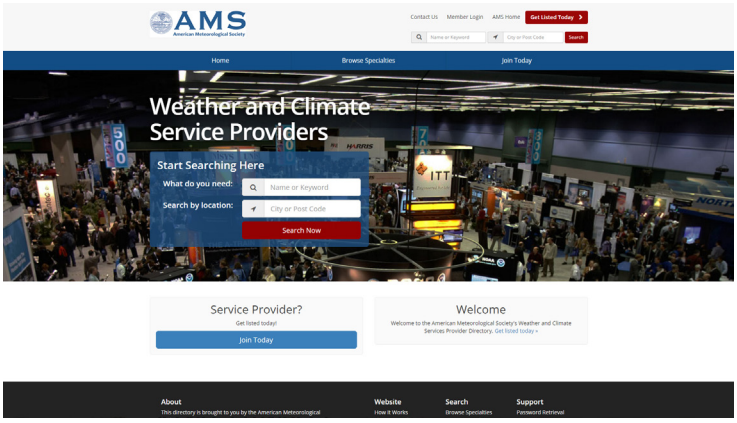
The concept of uncertainty or variability is seldom used in the bulk of the dispersion modeling work carried out by most CCMs. This work is concerned with running EPA dispersion models such as AERMOD for permitting projects involving National Ambient Air Quality Standards (NAAQS) for criteria pollutants (e.g., SO2, ozone, NO2 and PM2.5). The NAAQS are single numbers and do not make explicit use of statistical confidence limits or other uncertainty estimates. The goal is to make the permitting process consistent so that any person running the dispersion model will get the same answer. The process reduces to the question of whether the modeling results show compliance or not with a single number. If 95 % confidence limits were allowed to be considered, then industries would usually argue for the lower concentration number and environmental groups and agencies would usually argue for the higher limits.

Acknowledgements – I appreciate review comments received from fellow CCMs Bob Paine, Gale Hoffnagle, and Bruce Egan. ■

Weather and Climate Service Providers Directory

We want to remind you that AMS launched a new online Weather and Climate Service Providers Directory last February and CCMs may add a listing free of charge. Some of the great features of this new directory include the ability to add:

- company logo
- profile photo
- social media links
- Website URL
- CV
- photo albums
- videos
- text articles
- up to ten specialties



To enter your free listing, go to the following sign up page created exclusively for CCMs and follow the prompts; have your AMS Member Account Number and CCM Number available. If you have questions, feel free to email us. ■

AMS Election Results

Congratulations to CCM Elizabeth Austin who was recently elected to the AMS Council for 2017! View the full election results on the AMS Web site. ■

AMS Online Awards and Fellows Nominations are now open

The Council of the American Meteorological Society invites members and friends of the AMS to submit nominations for consideration for the Society Awards, Lecturers, Named Symposia, Fellows, Honorary Members, and nominees for elective Officers and Councilors of the Society. Of particular interest to CCMs, are the following awards:

- The Henry T. Harrison Award for Outstanding Contributions by a Consulting Meteorologist
- The Award for Outstanding Contribution to the Advance of Applied Meteorology
- Fellows

For a description of the awards and details on the nomination process, please see the AMS Awards site.
Nomination Deadlines.

– Online Awards and Fellows: 1 May 2017
– Honorary members: 1 July 2017
– Lecturers: 1 May 2017 ■

2017 AMS Annual Meeting Activities

The AMS Annual Meeting will be held 22-26 January 2017 in Seattle, WA. The theme of the 2017 meeting is "Observations Lead the Way". There will be eight short courses offered the weekend prior to the start of the meeting. CCMs receive up to eight professional development points for attending the meeting and completing a short course (four points for the meeting, four points for a full day short course, two points for a ½ day short course). For details on the meeting and registration information, please visit the AMS Web site. ■

CCM Breakfast

The CCM Breakfast at the Annual Meeting will take place at the Convention Center on Wednesday, January 25th from 7-8:15am in room Skagit 1. ■

Quarterly Announcement from COMET

Please look below for highlights of COMET's newest publications on MetEd. This update includes continuing education training in four main topic areas: Climate, Forecasting, Satellite Meteorology, and Datums. There is also a new course based on COMET's Tropical Textbook.

New Lessons:

Climate:

- Climate and Water Resources Management, Part 2: General Principles in Integrating Climate Change
- Interpreting Climate Outlooks: An Australian Example
- Communicating Climate Change Scenarios With Decision Makers: Lecture by Dr. Holly Hartmann, Research Hydrologist
- Sea Level Change: Basics
- Sea Level Change: Datums and Terminology

Forecasting:

- Predicting Convective Cessation for Aviation Forecasters
- Forecasting Clear Air Turbulence for Aviation
- Forecasters' Overview of the Mediterranean and Europe

Satellite Meteorology:

- SatFC-G: IR Bands, Excluding Water Vapor
- SatFC-G: Near-IR Bands
- SatFC-G: Impact of Satellite Observations on NWP
- SatFC-G: Visible and Near-IR Bands

Datums:

- NOAA's VDatum: Transforming Heights between Vertical Datums
- The Importance of Accurate Coastal Elevation and Shoreline Data

New Course:

- Introduction to Tropical Meteorology

New Spanish Course:

- Introducción a la meteorología tropical

French Lessons:

- Utilisation des vents d'ASCAT et d'autres données pour les prévisions maritimes
- Utilisation des estimations de vent par diffusiomètre et de hauteur de vague par altimètre dans les prévisions maritimes
- Communiquer l'incertitude de la prévision
- Prévision des conditions météorologiques à partir de l'imagerie de vapeur d'eau
- Phénomènes extrêmes de forte houle sur les côtes atlantiques marocaines
- Ondes de montagne et vents de subsidence

Currently, these materials are freely available to everyone, courtesy of COMET's primary sponsors. They are NOAA's NWS, NESDIS and NOS programs, EUMETSAT, the Naval Meteorology and Oceanography Command, the Meteorological Service of Canada, Bureau of Meteorology, and the USACE and DOI/ Reclamation. ■

Connect on Social Media

LinkedIn

The LinkedIn page is becoming more active. If you have not joined, please do! The LinkedIn page is accessible and open only to CCMs. You must join LinkedIn (it is free) first before requesting to join the CCM page. Once you join LinkedIn (or if you are already a member), then just simply type "Certified Consulting Meteorologist" in the search box on the top right to search for our group. We anticipate the LinkedIn site to be an easy way for CCMs to communicate with each other and keep us all abreast of news, developments, and items of interest to CCMs.

Facebook

For all CCMs, colleagues, and the general public, we have a CCM Facebook page. It can be found by searching in Facebook for "Certified Consulting Meteorologist (CCM)." This page needs much more interest to be generated, beginning with every CM "liking" the page.

Twitter

For all CCMs, colleagues and the general public, we have a new Twitter account. Leading up to the Annual Meeting, this year we intend to market the CCM booths at the Student & Career Fairs and AMS Resource Center via Twitter. If you are on Twitter, please follow the handle @AMS_BCCM ■

Upcoming AMS Meetings

97th AMS Annual Meeting
22–26 January 2017
Seattle, Washington

2017 AMS Washington Forum
2–4 May 2017
Washington, DC

45th Conference on Broadcast Meteorology/Fourth Conference on Weather Warnings and Communication
21–23 June 2017
Kansas City, MO

21st Conference on Atmospheric and Oceanic Fluid Dynamics 19th Conference on Middle Atmosphere
26 – 30 June 2017
Portland, OR

17th Conference on Mesoscale Processes
24–28 July 2017
San Diego, CA

2017 Summer Community Meeting
2–3 August 2017
Madison, WI

38th Conference on Radar Meteorology
28 August – 1 September 2017
Chicago, IL

Thanks to all of our contributers for this issue.

We encourage you to share your experiences, views, findings, or studies for the next newsletter.

E-mail your articles to:
Alicia Wasula

Spring 2017 Newsletter submission deadline is March 10