This is the first in a series of articles encouraged by the Board of Certified Consulting Meteorologists and the National Council of Industrial Meteorologists to explore the ethical issues that can be encountered conducting business in the meteorological community. The purpose is to initiate a discussion within the broader membership about how the professional guidelines section of the AMS constitution comes to life in the conduct of everyday life of professional meteorologists. Comments are welcome and should be addressed to the authors. More formal responses can also be made to the editor of BAMS.

BUSINESS ETHICS FOR PROFESSIONAL METEOROLOGY

Expectations and Satisfied Customers

BY JERRY D. HILL, CCM, AND GERALD J. MULVEY, CCM

Many professional societies and boards have an ethics statement or code of conduct to which they expect their members to adhere. Our society has chosen not to have a separate ethics code, but has embedded clear guidelines for professional conduct into the organization's constitution. These guidelines pertain to all of us as members, but are particularly meaningful to meteorologists in private practice, who strive to meet the expectations of a variety of customers.

THE PRIVATE METEOROLOGY SECTOR. An article published in *BAMS* in 2007 estimated that private-sector meteorologists generally number about 4,000–5,000 persons, of whom about 1,600 were characterized as media meteorologists. The market value for the sector was estimated to be from $1.65 to $1.8 billion and possibly as much as $2 billion.

Private-sector meteorology involves traditional day-to-day work typical of most businesses, such as delivering products, billing, charging, and contract fulfillment. Some of these normal elements of conducting business are the very things that can become contentious between a company and their clients, leading to lawsuits and/or charges of unethical business practices.

AMERICAN BUSINESS ETHICS. In the United States, we can't fail to be aware of the news about ethics and questionable corporate practices that have plagued the business community during the past several years. Although not particularly notable in the private meteorology sector, allegations of fraud and misrepresentation, mostly in the finance community, have caused the U.S. Congress to pass new legislation and regulations. An example is the Sarbanes-Oxley Act of 2002 (available at www.gpo.gov/fdsys/pkg/PLAW-107publ204/content-detail.html), which was passed in the wake of a multitude of corporate scandals. One of the outgrowths of Sarbanes-Oxley was a requirement that a code of ethics be adopted for senior financial officers.

All of this has raised consciousness about ethics in business. Certain state licensing boards and authorities have started to require people in professions that involve the public trust to take annual ethics training courses as a condition of license renewal. Universities have developed ethics courses in their business and engineering departments; students can now actually earn an academic degree in the subject. Meanwhile, many professional organizations have updated or revised their codes of conduct.

Most U.S. companies and governmental entities promote ethical behavior as a standard business practice. This is sensible from both a business and legal perspective. To survive, our organizations must retain the trust of customers over a wide range of issues, from correct project charging to the quality of our products and services. Like any other business, those of us working in private meteorology have an ethical responsibility to provide diligent and competent work for our customers.

CONDUCTING BUSINESS AS A METEOROLOGIST. Any arrangement for meteorological services, whether for a long-term business relationship or a single, short-term task, involves the expectation of three fundamentals: price, schedule, and performance to a standard. The service agreement

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may be a detailed contract or a loose accord, but those three elements are still the same. Beyond those expectations are several basic things about the business arrangement that anyone anticipates when they engage a contractor or consultant.

Many consulting arrangements for meteorologists are made on a time and materials basis. Receipts confirm the cost of materials and other expenses, but the customer is seldom in a position to verify when and for how long the meteorologist works on a project. A customer is entitled to an honest accounting of this time. Misrepresenting that work, or falsely claiming services have been performed, can violate the deceptive practices statutes in a state Business and Commerce Code (e.g., California Business and Professional Code, Division 7, Part 2: Preservation and Regulation of Competition; and Part 4: Unfair Trade Practices, available at www.leginfo.ca.gov/.html/bpc_table_of_contents.html).

The expectation of schedule means that a business agreement not only calls for the service provider to meet an established deadline, but also to communicate about impending delays or late deliveries. Failure to do so can lead to significant business opportunity loss for that client. There is an ethical responsibility to maintain a current schedule for any deliverable and to make an honest accounting for any schedule delays.

Not every employee in an organization has the skills to accomplish every job. Each of us has certain core capabilities, but we must sometimes recuse ourselves from tasks for which we lack training or experience. In the regulated professions, such as professional engineering, it is actually a violation of the law to accept work outside the range of one's capabilities.

Clients expect that people we assign to their work will be competent in the relevant tasks. Meteorological consultants or contractors may be inclined to accept work with the belief that they can learn the necessary skills or substitute similar capabilities. Accepting work in an area outside one's competence can lead to a failure to perform the work on time or perform work that reflects current scientific standards. Not only can this ruin a business relationship, but it can also be the basis for litigation over nonperformance of a contract.

AVOIDING CONFLICTS OF INTEREST. Conflicts may arise between the competing private and professional interests of an individual or organization and their responsibilities to perform work for someone else. Potential conflicts of interest may be difficult to recognize and are easy to ignore. Some simple conflicts may appear to be insignificant, but the mere appearance of a conflict can lead to accusations of unethical conduct. We need to avoid conflicts of commitment, conflicts over proper use of institution/company resources, use of one's position, or conflicting relationships between company organizations.

Even when nothing improper happens, the appearance that a person can act for unmerited personal gain can cause doubt about the reliability of his or her performance. Any possibility of a conflict of interest must be examined closely before embarking on a business arrangement. The ramifications must be fully known by all parties. A third party can even be engaged to assess the situation prior to finalizing a business arrangement.

CONFIDENTIALITY. A company wise enough to recognize the influence of weather on their business will engage meteorologists to identify hidden business opportunities. This often involves the exchange of confidential business information. If confidential information is shared with, or even allowed to fall inadvertently into the hands of, competitors then the advantage of obtaining the meteorological services can be diluted or eliminated.

Some clients may require that a confidentiality agreement (such as a nondisclosure agreement, or NDA) be signed so that they have recourse if a breach of confidentiality occurs. In many cases, though, once the breach has occurred, no recourse can mitigate the business impact that may follow.

Confidentiality is disclosing information only to those who need to know, and protecting a client's proprietary data from outright theft. The computer age has led to a rapid growth in the collection of all manner of commercial information, such as sales trends and consumer behavior. Companies go to great effort and expense to create such databases, but this intellectual property is easily transported or transferred if not protected properly.

Consider the case where a company that makes household insect pest control products believed there was a correlation between the timing of their product's spring sales peak and the antecedent weather. They engaged a consulting meteorology firm to review their sales data for 10 major metropolitan markets in the United States and quantify a relationship if one could be found. Success would help them schedule advertising and product deliveries to stores so as to coincide with the year-to-year variations in the peak sales times. To facilitate the study,

the company provided the weather consultants with confidential multiyear sales data.

The consultants matched the historical sales data with concurrent weather data for the various locations and determined that there was a correlation with a particular degree-day function. (Appearance of pests in people's homes was driven by temperature.) The consultants developed a system for the company so it could use extended temperature forecasts and outlooks as input to a model that predicted when the spring sales volume would peak.

After the contract was complete, the owner of the consulting company thought the study could generate an informative technical paper. Without discussing his notion with the client, he wrote and subsequently published a paper in a biometeorology journal describing the apparent relationship between temperature and the development of the insect populations that had been studied. None of the client's sales data were tabled in the paper, and the precise prediction model was not given, but scatterplots showed the relationships. Was it ethical to publish the paper based on the client's sales data and without their knowledge, even though the exact data were not divulged? Clearly, it would have been more appropriate to consult with the client about publishing a technical paper before submitting a manuscript.

OTHER POTENTIAL PITFALLS. The private practice of meteorology produces some unique possibilities for exceeding the boundaries or capabilities of our science. Typical areas for concern are

- making of extravagant claims (statements beyond established scientific fact that are represented as fact) to enhance the probability of acquiring or fulfilling a contract;
- overstating professional forecasting capabilities and skills;
- exaggerating weather modification skill to give clients a false sense of the probability of success;
- procuring contracts for goods and services through bribes (involving money, gifts, or services to a client);
- misrepresenting qualifications to properly provide services or render scientific opinions;
- making unfounded attacks on the abilities or practices of peers and competitors in order to harm their reputation or influence customers;
- accepting work beyond the scope or depth of one's expertise;
- allowing attorneys or clients to influence or alter the scientifically supported results of investigations or opinions rendered;
- acquiring, storing, or using information about competitors that is obtained illegally or is confidential or a trade secret as defined by Restatement of Torts (1939) or the Uniform Trade Secrets Act.

MEETING THE CUSTOMER'S EXPECTATIONS. Whatever our customers expect of the services we provide, their satisfaction is essential if we want to retain a business relationship. Having a strong sense of professional behavior and ethical conduct with regard to both business practices and application of the science will help us meet our customer's requirements and expectations, which is the definition of quality.

FOR FURTHER READING

Kahaner, L., 1996: *Competitive Intelligence*. Simon & Schuster, 300 pages.

Spiegler, D., 2007: The private sector In meteorology: An update. *Bull. Amer. Meteor. Soc.*, **88**, 1272–1275.

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THE ETHICS OF DEFINING A PROFESSIONAL

Who Is a Meteorologist?

BY JERRY D. HILL, CCM, AND GERALD J. MULVEY, CCM

What is a "professional?" There are professional athletes, professional actors, and the term is even sometimes used by tradesmen to indicate the quality of their work, such as "professional plumbers." In the most basic sense, professionals are people who earn their living in a profession. More broadly, a professional has specialized skills and knowledge that required independent learning and effort on their part to attain. Before the AMS had its current categories of memberships, one of the categories was "professional member."

In any occupation, there is usually a sense of pride of profession. People in that occupation can resent others who attempt to portray themselves as a member of that profession without "paying their dues." This is particularly true in the atmospheric sciences profession, where the complexity of our science often warrants admiration from others.

To call oneself a professional in a certain occupation is intended to bring respect and inspire confidence. To protect the public, many professions, such as medicine, engineering, or public accounting, are regulated by state laws that establish the training, examination process, and experience required to qualify for a license. People using a title such as "medical doctor" or "certified public accountant" when not actually licensed in such a field are guilty of more than just a violation of ethical standards; they can land in jail or at least owe a hefty fine for the misrepresentation.

States have never licensed professional meteorologists, however, and some people have claimed publicly to be a meteorologist even with limited or no scientific training. Such representations might be considered a breach of personal ethics or professional conduct, even though no laws prohibit such actions.

We might define what, in a strict sense, the qualifications are for a person to be considered a meteorologist. In 1990, the AMS adopted a guideline (www.ametsoc.org/policy/whatisam.html) that describes a meteorologist as "an individual with specialized education who uses scientific principles to explain, understand, observe or forecast the earth's atmospheric phenomena and/or how the atmosphere affects the earth and life on the planet." This specialized education would involve a bachelor's or higher degree in meteorology, or atmospheric science, consistent with the requirements set forth in a separate AMS guideline on attributes of university programs for bachelor's degree programs in atmospheric science (www.ametsoc.org/policy/2010degree_atmosphericscience_amsstatement.html). The guideline says further: "There are some cases where an individual has not obtained a B.S. or higher degree in meteorology, but has met certain educational requirements and has at least three years professional experience in meteorology. Such an individual also can be referred to as a meteorologist."

The specialized education leading to a bachelor's degree referred to in the AMS guidelines should contain 24 hours of credit in atmospheric science plus supporting course work in mathemat-

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ics, physics, and computer science. The hours in atmospheric science must be specifically related to meteorology topics. The mathematics and physics coursework should be that required for other physical science and engineering majors. The physics coursework must be calculus-based and must include a lab.

A degree in a related science with a few course hours in meteorology does not qualify one as a meteorologist under these guidelines. An example might be someone with a degree in statistics who has taken a specialty statistics course in a meteorology department or online and is working in the area of climate data analysis. The person would still be considered professionally as a statistician and not a meteorologist, even though he or she is working with meteorological data.

In a different venue, the U.S. Federal Civil Service has established a standard for classifying government employees as "meteorologists" when they hold a degree from an accredited college or university and have earned at least 24 semester hours (36 quarter hours) of credits in meteorology/atmospheric science (see www.opm.gov/qualifications/standards/IORs/gs1300/1340.htm). An alternate federal standard has been established for persons who normally do important weather-related work such as performing calculations, operating specialized meteorological equipment, and making weather observations. These are people who have received technical or military training in meteorology but do not meet the academic standards to be classified as meteorologists. Under the Civil Service guidelines, they are classified as "meteorological aids" or "meteorological technicians," but not meteorologists.

Meeting the AMS or the relevant Federal Civil Service guidelines would be considered sufficient for persons to represent themselves as meteorologists. Otherwise, it would not be illegal, but would certainly be considered unethical, to use that label for oneself professionally.

One area where some people have historically taken liberties identifying themselves as meteorologists is in the broadcasting industry. In recent years, some broadcasters have taken meteorology courses available online to become self-appointed "meteorologists." To help deal with this trend, the AMS took steps in the public interest to create a standard for scientific training people must meet before they can be given a seal of recognition as a "Certified Broadcast Meteorologist" (CBM).

The CBM must possess a degree in atmospheric science/meteorology or have completed coursework considered equivalent to a degree in atmospheric science/meteorology. Some weathercasters who hold bachelor's degrees in communications or related subjects may have earned additional credits in meteorology to meet the academic requirements for equivalence to a degreed meteorologist. This additional training in meteorology should also be sufficient for them to be considered as professional meteorologists and referred to as such on the air.

People considering a career in broadcasting where they might use a university's distance learning coursework to supplement a nonmeteorology undergraduate degree in order to meet the AMS guidelines for becoming a meteorologist should examine the institution's curriculum closely. Distance learning programs do not normally offer the opportunity to meet the AMS requirement to complete physics coursework that is calculus-based and includes a lab. Also, to earn the Society's CBM seal requires coursework in atmospheric thermodynamics and dynamic meteorology that has calculus as a prerequisite.

In 2005, a bill was introduced in the Texas Legislature by a Dallas-area representative that would have made it a misdemeanor to call yourself a meteorologist unless you met specific academic requirements that were included in the bill. The standards used in the bill's language were tantamount to having a four-year bachelor of science degree in meteorology and were identical to the standards for National Weather Service meteorologists. The proposal would have established the only state-set standards for meteorologists in the country. The bill's sponsor claimed to have only one motive for the bill: the safety of the public. The sponsor said, "A very real possibility exists that some unqualified person, calling himself or herself a meteorologist, might someday misinterpret meteorological data in a weather emergency and lead the public into danger."

The bill did not pass the Texas legislature, but caused a storm among the state's weathercasters, some of whom did not meet the criteria set in the proposed bill but believed their experience gave them the equivalent skill of degreed meteorologists. There has been no effort to reintroduce the bill since 2005, and perhaps the establishment of the AMS's CBM seal, also in 2005, serves as an adequate substitute. However, the public still may not be making the connection between dis-

playing the seal and the weathercaster's academic qualifications.

Representing oneself to the public as a meteorologist requires very specific qualifications. These differ slightly between the AMS definition and the Federal Civil Service definition. However, the fundamental academic requirements are nearly identical. Ethical questions arise when someone who clearly does not meet any of the qualifications represents himself or herself as a meteorologist—for personal aggrandizement, to gain public trust, or for financial gain. At this time, there is no law in the United States that would make this a punishable offense, but it reflects adversely on the character of the person who does this or allows others to do so on their behalf.

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INTERNATIONAL BUSINESS AND METEOROLOGY

Special Ethical Dilemmas

BY GERALD J. MULVEY, CCM, AND JERRY D. HILL, CCM

Weather systems do not recognize political boundaries. Thus it follows that the business of meteorology transce1nds those same boundaries. However, when meteorologists conduct business in multiple countries or outside of their home country they can encounter special ethical dilemmas.

DILEMMAS AND GUIDANCE. Meteorologists working in the international business arena are subjected to a variety of local customs that can be in direct competition to maintaining the highest level of integrity. U.S. professionals' behavior and actions in this area must be guided by ethics associated with being a meteorologist and by specific U.S. federal legislation. For example:

- Foreign Corrupt Business Practices Act (FCPA)—prohibits U.S. corporations from offering or providing bribes to foreign government officials
- foreign trade restrictions and boycotts
- International Trade in Arms Regulations (ITAR)

Meteorologists involved in business in other countries have an overlapping responsibility for their ethical behavior. While respecting local customs, they must be responsive to the U.S. legal restrictions on their business practices and uphold the ethical principals of both the science of meteorology and the American Meteorological Society.

Bribes are a common business practice in some countries. While a gratuity may get your proposal a "quick or friendly" review and be a part of the business norms in a country, the gift can possibly bring an unpleasant consequence that will take years to undo. The gray area question is, "When does a gift become a bribe?" In many countries, gifts are part of the norm of business etiquette. But giving of a substantial gift, particularly to public officials, can be viewed as an attempt to influence their decisions. The key word in this gray area is "substantial," even if there is no expectation of return for favors or actions. A meteorological instrument vendor may see the gift of a sophisticated measurement station to a key official to monitor conditions near their home as an opportunity to provide a showcase for their products. The official may view it as a source of vital meteorological data that can be provided under "contract" to the local weather company or to a university for research under a government grant.

The U.S. government has recently increased enforcement of violations under the FCPA. In 2004, the federal government collected about $11 million in criminal fines and penalties and charged five individuals with violations related to FCPA. In 2010, more than $1 billion in fines was collected and about 35 people were indicted on charges.

A meteorologist working in other countries must be sensitive to a host of other ethical challenges, such as:

- business development—use of local consultants to advise on navigation of bureaucratic and cultural channels

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- contract performance—expectations of customers for work preformed/time charged
- technical challenges—access to local meteorological datasets that may incur substantial fees
- national security—some countries may view geophysical/meteorological information as sensitive
- cultural expectations—after-work hours social gatherings and activities

The use of "in-country" consultants is a practice that requires careful scrutiny. There are many valid uses for talented local experts to help design meteorological networks, obtain the facilities or personnel for data reduction and analysis or even introductions to key officials, as well as provide advice on local customs and professional rivalries. However, the selection of such consultants and their compensation, including expense accounts, is one of the "gray" areas of foreign business conduct. If the consultant has strong political or familiar connections with key decision makers, they are both desirable as a consultant and a potential source of suspicion for bribery allegations.

THE DILEMMA OF THE ROADWAY CONSTRUCTION PROJECT. The following example will illustrate some of the complexities of doing business in a foreign country:

You have been hired by an international engineering firm to provide the design team with localized climatological information on precipitation (type, rates, total storm amounts) and wind (speed and direction) along several potential road development corridors in a developing country. To get this consulting job, you took an aggressive stance with price and need to finish your in-country work as soon as possible. While the broad-scale climatological data is available (major cities and airports), the local climatological data and recent local meteorological measurement data along the potential road corridors is available only at selected universities and through the military. You approached the army major in charge of the military's data collection and processing program only to learn that the data you want, while it has been collected and processed, is considered sensitive due to the proximity of unnamed military facilities, and thus is not available to foreigners.

To explore other nonsensitive data sources, you approach the university professor in charge of collecting and processing similar data for civil uses. You are told that this local data is only stored in a "raw" format. The professor suggests that he and his graduate student can process the data into a suitable format for you. They are very willing to give you a "proposal" to perform this work. As a bonus, they imply that they have a special relationship with the army major in charge of the military data collection and can also access this information for processing to format the data at a modest cost. The professor assures you that the "military" data is not sensitive and he can easily send it to you back in the U.S. via e-mail when the processing that will take several weeks is completed. What do you do?

a. Give a grant to the university professor to "process" the civil data and extrapolate it to the full extent of the corridors.
b. Provide additional funding to the university professor to recover the "military" data.
c. Negotiate with the army major to acquire the military data so the full extent of the roadway corridor is covered.
d. Report to the engineering firm the data along the full extent of the corridors cannot be obtained but you will use best practices to extrapolate the required parameters.
e. Hire a local consultant to help clarify the legal status of the data and understand the army major's position.

WHAT IS THE QUESTION AND WHAT IS THE ANSWER? The question is trust. Can you really trust the university professor? Was the army major truthful or looking for a bribe? Is there any civilian and military data? Will any data you get be reliable or just extrapolations from major stations? Does the data collected and processed by the military have national security value?

The ethical response to these and related questions is best summarized to be above board with the engineering company and to believe, but verify. Ask the engineering firm if they have a local consultant who can validate your perception of what the army major said. If they do, double-check the understanding of the data's sensitivity. If it is confirmed sensitive, you as a "guest" in a foreign country must respect their national security concerns. As for the university professor's offer to process the civilian data, if that is the only way to get the data, a small grant may be appropriate, but not including the military data. As always, a sanity check on the

data acquired is appropriate. An analysis of openly available data to verify the general trends and establish correlations between acquired data (double mass analysis) and the openly available data would be advised.

SUMMARY. Meteorologists operating in foreign countries have additional ethical issues that must be addressed to account for U.S. law, local laws, local customs, and cultural differences in addition to the ethical standards of the meteorological profession.

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ETHICS FOR GOVERNMENT METEOROLOGISTS

BY BERNARD N. MEISNER, PH.D., CCM, JERRY D. HILL, CCM, AND GERALD J. MULVEY, PH.D., CCM

One might ask: "Why would the authors of this series of ethics articles include one about ethics for government meteorologists when there are already well-established standards for personal conduct in public service?" Clearly, meteorologists who work for state and federal agencies, as well as those who serve in the military, must adhere to standards that apply generically to their status as government employees.

However, by virtue of holding positions as professional meteorologists in government or military service, our colleagues in such employment are seen by the public as particularly knowledgeable experts in the science. They may be asked to serve as internal or external consultants or advisors. Often, they are asked to speak before public or professional societies and present their views about the capabilities of important elements of meteorology, such as extended forecasts, weather modification, climate change, or other topics. In expressing their opinions and responding to questions, meteorologists in the government service must use care to adhere to the ethics standards espoused by the AMS, such as keeping abreast of relevant scientific and technical developments, refraining from making exaggerated or unwarranted claims and statements, and referring requests for service that are beyond their professional capabilities to those who are properly qualified.

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BACKGROUND. The guiding principle behind all ethics rules and regulations is that public service is a public trust. In 1989, President George H. W. Bush issued Executive Order 12674 (www.doi.gov/ethics/docs/eo12674.html), setting forth 14 fundamental principles of ethical government service. The order directed the Office of Government Ethics (www.oge.gov/) to write 5 C.F.R. Part 2635 *Standards of Ethical Conduct for Employees of the Executive Branch*. The *Standards of Conduct*—which includes topics such as conflicting financial interests and impartiality, misuse of position and resources, and outside employment and activities—are designed to address not only actual conflicts of interest but also activities that give rise to the appearance of such conflicts.

The *Standards of Conduct* include a provision for individual agencies to issue supplemental regulations when necessary. It also directs agencies with jurisdiction over enlisted members of the uniformed services to separately issue regulations regarding their ethical conduct. A review of the standards and guidelines for a number of state government employees indicates strong similarities to those of the federal government. The various rules and regulations also address some activities of government meteorologists acting as private individuals in addition to when they are acting in their official positions. Thus, the ethical standards for government meteorologists can be quite complex and, sometimes, confusing.

FINANCIAL CONFLICTS OF INTEREST AND IMPARTIALITY. As with all government employees, government meteorologists should avoid an appearance of loss of impartiality in the performance of their official duties.

A government meteorologist may be asked to provide advice or make recommendations regarding the procurement of meteorological services, hardware,

or software. The meteorologist should exercise care to remain impartial. In certain situations, it may be necessary to either recuse oneself or obtain specific authorization before participating where impartiality is likely to be questioned, such as when the meteorologist or a family member has a current or former relationship with, or financial interests in, one of the companies seeking to provide the service or product.

In a classic case of conflict of interest[1], a now former Commerce Department employee's official duties included reviewing the performance of a certain company, which had contracted with the Commerce Department to update automated weather forecasting systems. At the same time that he was performing these oversight duties, the official began negotiating employment with the same company. A federal criminal statute, 18 U.S.C. 208, prohibits federal employees from officially working on particular matters that have a direct and predictable effect on an organization with which they are negotiating prospective employment. The employee's review of the company's performance on the Commerce Department contract violated this statute and resulted in a federal conviction. This is the same statute that bars federal employees from taking official action on matters that affect their own financial interests or those of their spouses or children.

In general, government meteorologists cannot serve as on-air meteorologists for commercial broadcast stations, since that might imply endorsement by the government of that particular station. Such employment might also create the appearance of the use of nonpublic information to which the meteorologist has access.

USE OF GOVERNMENT POSITION AND RESOURCES. Government meteorologists can only use government resources—including equipment, supplies, services, and duty time—for authorized purposes. Nonpublic information they learn through their government job cannot be used for personal purposes.

National Weather Service employees and certain other NOAA employees with responsibilities relating to forecasting are generally advised not to invest in weather futures, hurricane futures, or similar investments. Because NWS employees are presumed to have access to weather information either not available to the public, or before it is made available to the public, such investments would create the appearance of misuse of government information or their position.

A government meteorologist may write a letter of recommendation for a subordinate using official stationery and sign the letter using his official title. However, he may not use official stationery or sign using his official title if the recommendation is for a personal friend, unless the recommendation is for government employment.

OUTSIDE EMPLOYMENT AND ACTIVITIES. Analyzing outside employment and activities has been described as some of the most complex advice and counseling issues government ethics officials face. Some government agencies require their employees to obtain prior approval before engaging in specific types of activities, including outside employment.

Paid Activities. Some might question whether a government meteorologist might provide consulting services similar to what a private industrial meteorologist might do. A government meteorologist may engage in outside work or activities, but only if they do not conflict with their government duties. For example, a government meteorologist may be allowed to serve as an expert witness in a "slip and fall" legal case in which the weather may have been a contributing factor. Of course, the meteorologist may not use any government resources or data when working on the case. However, if one of the defendants in the case is the federal government (e.g., the fall occurred on government property), then a federal meteorologist may not serve as an expert witness against the government (18 USC 203 and 205). If, on the other hand, the government meteorologist is contacted by a federal attorney who is representing the government in that lawsuit, the meteorologist may serve as an expert witness for the government, provided the work is assigned to him/her by their supervisor and authorized by the agency's designated ethics official.

A government meteorologist, whose principal area of work is the meteorological applications of Geographic Information Systems (GIS), could not be paid for writing a book that focuses specifically on the work that relates to her official duties. However, she could accept compensation for writing or editing a textbook on GIS, provided the book conveys

[1] *Encyclopedia of Ethical Failure*, Department of Defense, Office of General Counsel, Standards of Conduct Office, July 2012. (www.dod.mil/dodgc/defense_ethics/dod_oge/eef_complete_2012.doc)

knowledge gleaned from the scientific community as a whole. The book might even include a chapter, among many other chapters, that discusses the meteorological applications of GIS (www.gpo.gov/fdsys/pkg/CFR-2009-title5-vol3/xml/CFR-2009-title5-vol3-sec2635-807.xml).

Volunteering and Other Unpaid Activities. Government meteorologists should be aware that volunteering and unpaid activities, such as acting as an officer, director, employee, agent, attorney, consultant, contractor, general partner, trustee, teacher, or speaker on their personal time, may be subject to certain rules and regulations.

In January 1996, the U.S. Department of Justice's Office of Legal Counsel issued a Memorandum Opinion for the General Counsel of the Office of Government Ethics (www.justice.gov/olc/11106nonprofitboards.pdf). The opinion was in response to two specific situations, one of which involved NOAA employees who were serving in their private capacities on the AMS Council. Concerns were expressed, because the AMS issues policy statements on issues in which NOAA has an interest, such as meteorological drought, atmospheric ozone, and hurricane research and forecasting, and the NOAA employees serving as AMS councilors would likely participate in the consideration of those issues on a policy level in the course of performing their official duties at NOAA. Since the matter did not involve the financial interests of the AMS, only policy issues, it was not considered a conflict of interest. Prior to the opinion, unless a specific waiver had been granted to the employees, the situation would have given rise to criminal conflicts of interest.

Teaching, Speaking, and Writing in Personal Capacity. Government meteorologists may accept compensation for teaching if the subject matter is unrelated to their official duties, but they cannot receive payments (other than for travel) for writing, speaking, or teaching about the programs and operations of their agency. For example, an NWS meteorologist might be asked by a local university to teach a course on hurricanes. He may accept compensation for teaching only if the course is offered as part of the regularly established curriculum of an institution of higher education (www.oge.gov/Topics/Outside-Employment-and-Activities/Teaching,-Speaking,---Writing/). In addition, the university may include the meteorologist's government title and position in course materials setting forth such information about all faculty members involved in the program. However, his title or position may not be used to promote the course, for example, by featuring the meteorologist's government title, "NWS Senior Meteorologist," in bold type under his name. In contrast, his title may be used in this manner when the meteorologist is authorized by the NWS to speak in his official capacity (www.oge.gov/Topics/Use-of-Government-Position-and-Resources/Use-of-Title-or-Agency's-Name/).

This raises the question of how a government meteorologist interacts with technical peers who are government contractors in the preparation of technical posters, papers, and presentations. A contractor may wish to position themselves favorably by including the names of government employees as authors even if they have not contributed significantly to the publication. Or government employees eager for recognition may "strongly hint" that they would like to be listed as an author on a paper for which they did not significantly contribute. In both cases, the answer should be "no." Acting otherwise could provide a leverage position to affect future program decisions. Government meteorologists are typically encouraged to participate in professional societies to maintain competence and expertise in their discipline. Some agencies, such as the NWS, may have policies requiring advance agency review, clearance, or approval of certain speeches, books, or articles to determine whether it discloses nonpublic information, or could reasonably be misconstrued as presenting a position of the NWS when it does not (www.nws.noaa.gov/directives/100/pd10001a.pdf).

Government meteorologists may use their official title when writing for a scientific or technical publication in their personal capacity, provided they include an appropriate disclaimer. However, they should refrain from using their official title when writing a newspaper article or blog about general meteorology.

CONCLUDING REMARKS. Government meteorologists are expected to observe the same ethical standards as all meteorologists, as mentioned in other articles in this series. In addition, their conduct may be governed by rules and regulations which can vary from one agency to another. Although the underlying principles of those rules are relatively simple—preventing conflicts of interest and encouraging ethical behavior—their specific provisions can be quite technical. Many government agencies provide ethics

training, either in person or online. Since, in some cases, failure to follow the prescribed standards of conduct might result in civil or, in some instances, criminal penalties, it behooves government meteorologists to consult an appropriate ethics officer prior to engaging in certain conduct.

The views expressed herein are those of the authors and do not necessarily reflect the position of the National Weather Service or the United States government.

The information in this article is not a substitute for individual advice. Agency ethics officials should be consulted about specific situations.

This is the fifth in a series of articles encouraged by the Board of Certified Consulting Meteorologists and the National Council of Industrial Meteorologists to explore the ethical issues that can be encountered conducting business in the meteorological community. The purpose is to initiate a discussion within the broader membership about how the professional guidelines section of the AMS constitution comes to life in the conduct of everyday life of professional meteorologists. Comments are welcome and should be addressed to the authors. More formal responses can also be made to the editor of BAMS.

RESOURCES AND GUIDANCE FOR ETHICS AND PERSONAL CONDUCT IN METEOROLOGY

BY JERRY D. HILL, CCM, AND GERALD J. MULVEY, CCM

Meteorology is one of the most data-driven sciences. The fundamental processes of taking weather observations, analyzing weather maps, and running numerical forecast models make this work about as objective as can be imagined. Why then, with this high degree of objectivity, would the AMS need a code of conduct for its membership?

The answer is probably because the science sustains many types of services where relationships between meteorologists or between meteorologists and their customers can invite compromises in personal behavior that might be considered unethical. Ethics guide us through areas where there are no laws but where there must be standards for personal conduct. A review of the AMS code and other guides for ethical behavior can illustrate the ways we should conduct ourselves in the normal course of performing our work and associating with our colleagues, customers, and the public.

AMS CODE OF CONDUCT. The AMS has taken an active interest in creating standards of performance for application of the atmospheric sciences. The society uses its constitution and various policy statements to set clear guidelines about ethical and professional conduct.

The AMS's Code of Conduct forms a portion of the Society's constitution (www.ametsoc.org/aboutams/organizationpdfs/constitution.pdf). They are in the Guidelines for Professional Conduct found in Article XII, as follows, and are also referenced in the membership application:

> To enhance the benefits of the meteorological and related professions to humanity, to uphold the dignity and honor of the profession, and to provide guidance for individual members, institutional members, or for members in association with other professionals, the American Meteorological Society has adopted the following Guidelines for Professional Conduct. Only individuals and organizations who intend to abide by these Guidelines should seek admission or continuing membership in the Society; therefore, these Guidelines will appear on the membership application form and will be published at least annually in the official organ of the Society.
>
> 1. Relationship of members to the profession as a whole.
>
> A. Members should conduct themselves in an ethical manner and reflect dignity and honor on their profession.
>
> B. Members who are professionally active should endeavor to keep abreast of relevant scientific and technical developments; they should continuously strive to improve their professional abilities.
>
> C. Members engaged in the development of new knowledge should make known to the scientific world their significant results through the media of technical or scientific publications or meetings.
>
> 2. Relationship of members to colleagues.
>
> Members should not take credit knowingly for work done by others; in publications or meetings, members should attempt to give credit where due.

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3. Relationship of members to clients and the general public.
   A. Members should base their practice on sound scientific principles applied in a scientific manner.
   B. Members should not direct their professional activities into practices generally recognized as being detrimental to, or incompatible with, the general public welfare.
   C. Members undertaking work for a client should fully advise him or her as to the likelihood of success.
   D. Members should refrain from making exaggerated or unwarranted claims and statements.
   E. Members should refer requests for service that are beyond their professional capabilities or their scope of service to those properly qualified.
   F. Members shall not use or display the official seal of the American Meteorological Society, the Radio Seal of Approval, the Television Seal of Approval, or the designation Certified Consulting Meteorologist or Certified Broadcast Meteorologist unless duly authorized by the Society.

To pointedly draw attention to ethics, item 1A of Article XII of the constitution was recently amended to include the reference that "members should conduct themselves in an ethical manner."

The guidelines help to establish a high level of confidence in the meteorological community's ability to execute its collective responsibility to the public. This confidence is developed by the daily demonstration of highly ethical professional conduct by AMS members and, in particular, by members who hold AMS certifications such as Certified Consulting Meteorologist (CCM) and Certified Broadcast Meteorologist (CBM).

AMS POLICY STATEMENTS. Beyond the statement on personal conduct in the AMS constitution, the Society has also sought over many years to promote ethical behavior guidelines through its policy statements. Those policy statements address the expected limits on specific capabilities of the science and practicing meteorologists.

Several of the policy statements have implicit standards for personal conduct that are particularly relevant to private-sector meteorologists offering services to industry or the general public. However, they relate mainly to the capability of the science and indicate where a claim of skill may be overexaggerated and could be considered to be unethical or an overrepresentation of competence. The AMS's statements are reviewed regularly and revised to reflect the present state of the science. Current and recent past statements may be found at www.ametsoc.org/policy/amsstatements_inforce.html.

Relevant sections of some current and archived past AMS policy statements include the following.

The Public/Private Partnership in the Provision of Weather and Climate Services [1999 (past)] The AMS offers the view that there is a clear division of responsibility between the governmnt and the private sector: "In the case of situations where life and property are threatened, the private sector relays public sector warnings and advisories to the public, ensuring that a consistent, unified voice is heard by those affected citizens." Members of the private sector may produce confidential forecast advice to their clients that is based on their own meteorological analysis. However, care must be taken to avoid dissemination of such advice to a threatened community when the forecast may be at variance with government warnings and advisories prepared for the public sector.

Weather Analysis and Forecasting [2007]. The AMS has outlined the expected skill in forecasting weather for periods ranging from 12 hours out to 8–14 days. Extended and seasonal outlooks are also discussed. The statement acknowledges the relative decreasing skill with increasing time in forecasting temperature and precipitation. This statement serves as a useful guideline to users of weather information. Meteorologists who might make assertions of skill beyond these guidelines without sufficiently addressing the accuracy degradations over time can be considered as making extravagant claims about their forecasting abilities. This would clearly be a violation of the personal conduct section in the AMS Constitution, which says, "Members should refrain from making exaggerated or unwarranted claims and statements."

Hurricane Forecasting in the United States [2007]. In the same manner as the statement on weather analysis and forecasting, the AMS has made a statement about the expected accuracy of hurricane track and intensity forecasting. The statement is meant to represent the state of the art in that specialty. The statement also includes a declaration about seasonal predictions that says, "Predictions of seasonal hurricane activity in the Atlantic basin have demonstrated forecast skill since the mid-1980s; however it is not yet possible

to confidently predict seasonal activity for smaller regions or landfalls." Making assertions about hurricane forecasting skill that conflict with this statement would be another instance of an extravagant claim.

Statement on Seasonal to Interannual Climate Prediction [2001 (past)]. The development of weather derivatives and the use of weather forecasts or outlooks as a guide to investing in financial markets have created a strong demand for seasonal outlooks in recent years. While there may be a demand for deterministic forecasts to use in this arena, claims of skill in this area can be considered to be an overstatement of forecasting capabilities. The AMS statement says, "Owing to the chaotic nature of day-to-day weather fluctuations, such forecasts will always remain probabilistic and be subject to considerable uncertainty, but they can nevertheless be of substantial value."

Planned Weather Modification through Cloud Seeding [2010]. Mitigation of drought has always been the hope of farmers, municipalities, and water districts. However, rain makers selling their services with misrepresented assurances of almost certain success have masked the true capability of the science to actually modify nature's weather.

The AMS policy statement on planned weather modification says that recent improvements in the composition and techniques for dispersion of seeding agents, observational technology, numerical cloud models, and in physical understanding of cloud processes permit ever more detailed design and targeting of planned weather modification effects, and more accurate specification of the range of anticipated responses. It cautions that, "There remain limits to the certainty with which desired changes in cloud behavior can be brought about using current cloud seeding techniques."

Responsible meteorologists who serve this public need still must adhere to a strong code not to promote the capability without substantial evidence about the probability and limitations of success. On this topic, the Weather Modification Association has adopted a statement on standards and ethics (www.weathermodification.org/standards_ethics.php) in order to further that association's purposes, which include but are not limited to

> Promoting research, development, understanding and application of weather modification for beneficial uses, and
>
> Encouraging and promoting the highest standards of conduct in all weather modification activities.

AMS CERTIFICATION PROGRAMS. Meteorologists who have qualified for and received the AMS accreditation as a Certified Consulting Meteorologist (CCM) find additional guidance from the Society about how they must conduct themselves. The qualifications for CCM certification stress that

> The character of the consultant must be of the finest and be manifest in devotion to the highest professional ideals. Relations with fellow meteorologists, and with clients or employers, should be conducted in a spirit conforming in full to the Society's Guidelines for Professional Conduct (Article XII of the Constitution).

Applicants for the CCM credential can expect to find questions about the AMS ethics guidelines on the written examination, and they will also be questioned about ethics situations during their oral exam. The AMS reserves the right to suspend or revoke the privilege of CCM certification if, in the conduct of his or her profession, the certification holder clearly exhibits conduct that fails to reflect the dignity and honor of the profession, or fails repeatedly to adhere to the criteria set out for the certification.

Similarly, the Certified Broadcast Meteorologists (CBM) program establishes standards for seal holders' conduct. The outline of the certification program says the AMS reserves the right to suspend or revoke the right to use the CBM seal if the holder, in the conduct of his or her profession, clearly fails to conduct himself or herself in a manner that reflects the dignity and honor of the profession or fails repeatedly to adhere to the criteria for the certification.

OTHER SOURCES OF GUIDELINES ON PROFESSIONAL CONDUCT. Looking beyond the AMS guidelines for personal conduct one can find much related material for scientists in general and see a variety of approaches to articulating standards of conduct. For practicing scientists, an overarching organization is the National Academy of Science (NAS), which has joined with its sister organizations, the National Academy of Engineering and the Institute of Medicine, to publish a rather definitive guide on professional standards of science. The title is *On Being a Scientist: A Guide to Responsible Conduct in Research* (3rd edition), published by

the National Academies Press (www.nap.edu/catalog.php?record_id=12192).

While the NAS publication is directed mainly toward scientists in the research area, it has useful guidelines for the practicing meteorologist on several topics, such as intellectual property, conflicts of interest, and credit for authorship. Case studies are included that inspire thought and illustrate the many gray areas that can exist when making judgments about professional ethics. It also includes a lengthy list of additional resources that the reader may seek out.

By itself, the National Academy of Engineering has established the Center for Engineering, Ethics, and Society, which includes an online Ethics Center (www.nae.edu/26187.aspx). The online center provides readily accessible literature and information, case studies and references, and discussion groups on ethics in engineering and science. It focuses on problems that arise in the work life of engineers and scientists.

The American Academy for Advancement of Science (AAAS), publisher of the journal *Science*, also is very involved in ethics related to science. The academy regularly publishes its *Professional Ethics Report* (PER; http://shr.aaas.org/newsletter/per/archives/newper70.shtml), which reports on news, events, activities, and resources related to professional ethics issues, with a particular focus on those professions whose members are engaged in scientific research and its applications.

Clearly, there is no shortage of ethics-related and science-oriented material available. Much can be found by searching the World Wide Web where material related to many types of businesses and professions illustrate how ethics issues arise. Whether a meteorologist is involved in research, teaching, industrial forecasting, or marketing weather services, there are many examples to be found of ethical dilemmas that can arise and where the boundaries of proper conduct may lie.