

WeatherZine

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Inside this issue:

Editor's Introduction	1
Women in the Atmospheric Sciences	1
<i>Astounding Progress since WWII: Personal Viewpoint of Joanne Simpson in 2002</i>	
<i>By Joanne Simpson</i>	
Into Focus:	3
<i>Thoughts on a Developing Career as a Woman in Science</i>	
<i>By Tracey Holloway</i>	
Follow Up From Last Month's Guest Editorial	4
Response to April 2002 WeatherZine Editorial	4
<i>By James L. Franklin</i>	
Reply of Powell and Aberson to Franklin	5
<i>By Mark Powell and Sim Aberson</i>	
Student Editorial	6
<i>Better Communication with Decision Makers: Focus on Forecasts</i>	
<i>By Holly C. Hartmann</i>	
Correspondence	7
WeatherZine News	
• <i>WeatherZine To Call It Quits</i>	8
• <i>Materials Available for the Convective Season and Flood Forecasting</i>	9
Research Highlight	9
Education Highlight	9
Jobs	10

Editor's Introduction: *Women in the Atmospheric Sciences*

In 2000 I had the opportunity to serve on a "Diversity Task Force" at the University Corporation for Atmospheric Research

(<http://www.ucar.edu/communications/staffnotes/0004/women.html>).

The UCAR Task Force was motivated by an earlier study conducted at the Massachusetts Institute of Technology (MIT). The MIT study found that:

The Committee discovered that junior women faculty feel well supported within their departments and most do not believe that gender bias will impact their careers. Junior women faculty believe, however, that family-work conflicts may impact their careers differently from those of their male colleagues. In contrast to junior women, many tenured women faculty feel marginalized and excluded from a significant role in their departments. Marginalization increases as women progress through their careers at MIT. Examination of data revealed that marginalization was often accompanied by differences in salary, space, awards, resources, and response to outside offers between men and women faculty with women receiving less despite professional

accomplishments equal to those of their male colleagues. An important finding was that this pattern repeats itself in successive generations of women faculty.

In response to such concerns in science and engineering generally, the National Science Foundation adopted as one of its strategic goals to "strive for a diverse, globally oriented workforce of scientists and engineers ... a diverse science and engineering workforce that is representative of the American public and able to respond effectively to a global economy is vitally important to America's future." (<http://www.nsf.gov/sbe/srs/nsf00327/fra mes.htm>).

With this issue of the WeatherZine we are pleased to offer 2 perspectives on Women in the Atmospheric Sciences. The first is from Joanne Simpson, whose distinguished and successful career makes her one of the leading atmospheric scientists in the nation. The second is from Tracey Holloway, a recently minted Ph.D. (Princeton) who is now at Columbia University. We hope that these essays, and the contrast between them, serve to stimulate discussion on the status of under-represented groups in science and engineering.

Women in the Atmospheric Sciences *Astounding Progress since World War II Personal Viewpoint of Joanne Simpson in 2002*

Prior to World War II the handful of women working in atmospheric sciences were primarily two or three physicists involved in such problems as upper atmosphere radiation. Their positions were as assistants to men.

During World War II approximately 50 women got nine months of training in the so-called "A" Course, given at three U.S. universities to train Aviation Cadets to become military Weather Officers. I was one of the 20 or so that received this training at

Women in Atmospheric Sciences Continued

the University of Chicago, in the "Fourth War Course", which graduated in May 1943. This training enabled me to get a B.S. in Meteorology and have a start at a Masters degree. There were seven women in my class of 210 and we all finished in the top half. We were trained to teach Aviation Cadets, which I did both at N.Y.U. and the University of Chicago, assisting men in teaching dynamics and synoptic laboratory, mainly plotting and analyzing weather maps by hand, which were used to teach forecasting.

After the war we women were supposed to go back home, get behind the mop, and have babies, which nearly all the women did. A handful of us had become very interested in meteorology and wanted to continue to become professionals. Every possible obstacle was put in our way, ranging from refusal of scholarships to downright hostility from the wives as well as the men. When I talked to the famous Carl Rossby, the head of the Chicago Department, he said "No woman has ever obtained a Ph.D. in Meteorology, none ever will, and even if you did manage to get one, no one will give you a job." I became even more determined. I taught Physics to War Veterans at Illinois Tech, and took most of my graduate courses there free as a faculty member. Rossby went back to Sweden. In 1947, Herb Riehl, intrigued by my interest in his work in tropical meteorology, took me on as a Ph.D. student, and I finally got my Ph.D. in 1949, when my son David was three years old. Being a full-time student, teacher, and housewife, too, was quite a rat race and day care for David always a worry.

But the last of Rossby's imprecations was right—no one would give me a job in meteorology. I got my first foot in by means of a summer job. Even that was purely a matter of luck. My mother was dating a famous meteorologist, Dr. Bernhard Haurwitz, then a professor at MIT. He ran a project at Woods Hole, which involved analysis of the same tropical cloud observations that so fascinated me when Riehl taught about tropical clouds in his graduate course at Chicago. The aircraft measurements made inside and outside trade-wind cumulus enabled the famous oceanographer Henry Stommel to derive the first recognition and theory of cumulus entrainment. I took part of the data set back to Illinois Tech, where I had been promoted to Assistant Professor and had my first graduate student. He and I did some exciting work on clouds over heated islands and in 1951 I was finally offered a full-time job at Woods Hole. My then husband, who had a Ph.D. in physics, graciously accepted a job there building oceanographic instruments and working on the side on turbulence.

This story illustrates the problems faced by women trying to do meteorology at the time—nepotism rules at most organizations, difficulties in finding child care, and almost uniform male lack of confidence that women could or would stick to the job and produce anything, whether research or good forecasts. I heard the story nauseatingly often from men "Well, I hired a woman once and she left to have a baby, couldn't come up to scratch." Four female

meteorologist friends of my generation showed real ability, published good research, and tried to make their way. Two got Ph.Ds, one of those couldn't find a job and became a traffic analyst. Two gave up, one with lifetime bitterness, the other apparently graciously accepted being a part-time research assistant all her life, where she was smarter than most of those she assisted. The second Ph.D. never married. Her career was restricted by not being allowed to go on field programs, but she published good research and was eventually a section head and served on the American Meteorological Society (AMS) Council.

I broke the barrier against women on field programs by dint of a wonderful man named Captain Max Eaton in the Office of Naval Research, who funded nearly all the research at Woods Hole. I had applied for a WWII amphibious aircraft to carry on the work of modeling and understanding tropical clouds. The Navy lent the aircraft to Woods Hole and it was being instrumented when I was told I could not go on the field program I had planned because Woods Hole never allowed women on its oceanographic vessels. When informed of this, Captain Max called the Director of Woods Hole and said "No Joanne, no airplane" and the fat was in the fire. We carried out three productive tropical programs in five years, learning more about entrainment, the tropical boundary layer, and building the first cumulus models. At Woods Hole, they had to start letting women oceanographers go on the ships, and so did most other institutions.

By the late 1960's and early 70s a few more women began to earn Ph.D.s. The Department of Meteorology at the University of Washington, in the person of Joost Businger, led the way by educating the two female superstars of the next generation, Peggy LeMone and Kristina Katsaros. In the mid-70s Peggy and I did a survey of women in professional positions in meteorology. There were 150 survivors who had Ph.D.s or equivalent. All, married or single, reported discrimination, difficulties in getting good jobs, and hurtful criticism, some severely wounding. The married women nearly all had to put their husbands' jobs first. Many survived by a mother or other relative providing childcare. We also found numerous women who had tried and given up, more than half because of child care problems, nearly all carrying hurts from hostility and criticism.

Peggy LeMone persuaded the AMS to start a Board on Women and Minorities, which she caringly chaired for many years. In addition to her brilliant boundary layer publications from serving as aircraft scientist on more than 20 important field programs, she acted as a one-woman crusader to encourage and comfort other women and to show them how wonderful a career in meteorology could be, if you could be tough and persistent enough to stand the difficulties.

From the 1970s onward the situation for women meteorologists has improved so much nearly everywhere that I am personally convinced they have as good opportunities as men do. Most nepotism rules have fallen. Many universities make a position for a qualified spouse,

Women in Atmospheric Sciences Continued

male or female. Many honor societies are trying so hard for diversity that women and minorities have a slight advantage.

When I came to NASA in 1979, for the first time I was working in such an enlightened environment that we had enough women to talk science in the ladies room. Since then it has only improved. When the Tropical Rainfall Measuring Mission (TRMM) satellite was launched in Japan in 1997, on the U. S. team, the lead scientist and lead engineer were both women (myself and Abby Harper) and on the Japanese team, a leader in their data system was a woman (Rico Oki)!

Next year more than half the employees of NASA's Goddard Space Flight Center will be women and minorities. The rosters of most graduate Atmospheric Science departments now are between 25 and 60 per cent female. I only hope that our economy will have jobs for them. But in any case, we can be assured that the women will have at least an equal chance to get what jobs there are.

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Into Focus:

Thoughts on a Developing Career as a Woman in Science

I never really think of my status as a woman when I'm acting as a scientist. Just like I don't think about air pollution while shoe shopping. It is difficult to extract which aspects of my life are unique to my status as a woman, as a scientist, as any of the other categories I fit. Or, unique just to me. I am 28, female, unmarried. I just finished my Ph.D. in atmospheric and oceanic sciences. I have a good post-doc in New York City, and a pending offer for a faculty position. I travel a lot, work with people I like, and study exactly what interests me. Science has been good to me; in most respects independent of gender.

Not all of my experiences have been entirely unisex. I have seen my communication methods adapt to a professional culture shaped by men. On a number of occasions early in grad school, I refrained from jumping into heated debates among my male peers. But over time, I found a balance between strength and geniality that fits. Still, this balance is not appropriate for most social interactions. The same force that aids in persuasive professional communication can seem rather unfeminine when applied in the personal sphere. One friend even labeled the two voices. "Watch out," he would say "now Serious Tracey is talking."

While I seek advice and feedback from a range of trusted confidantes, there are certain topics reserved for my women-in-science friends. These conversations often pertain to personalities affecting research, or professional demands straining personal interactions. For example, it is not uncommon for us to strategize about how to build better working relationships with colleagues, or discuss the importance of positive feedback in effective advising.

These concerns are not unique to women nor to scientists,

but I cannot recall once when a male friend has said that he wished his advisor gave more "positive feedback." Nor, for that matter, do I hear many guys talking about their "relationship" with their advisors at all. A guy may find his advisor likeable, annoying, overbearing, or invisible, but rarely does he solicit advice on how to improve communication, or how to reach out for support.

Reflecting back on my as-yet brief career, these communication challenges have been minor. The real difficulty was simply deciding what I wanted to do. I have always had many interests, and have envisioned myself in many careers: mayor of Chicago, artist, attorney, teacher. I could see myself campaigning in the Windy City. I could see myself painting on the streets of Paris. But it took a while to develop a clear picture of life as a scientist—and how I would fit into that picture.

For an undergraduate deciding whether to pursue science, the picture of life as a scientist may be determined by just a few key professors or graduate students. Are these people like me? For women, this "like me" feeling can be harder to find.

In my case, the picture of life as a scientist developed between my junior and senior year in college. I had decided to major in applied math, but I still had no plans to pursue an advanced degree or research career. Then in one pivotal year, I met a few people "like me" who were happy scientists. Maybe I could be happy in science, too?

The most influential person was my undergraduate advisor. He was friendly and funny and would drum-roll his fingers on the desk as he helped hunt for bugs in my code. When he found the error, he would lean back with a smile and a few

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weatherzine-admin@sciencepolicy.colorado.edu

and include your name, organization, and email address.

Into Focus: Thoughts on a Developing Career as a Woman in Science Continued

conclusive beats. "Ah ha!" he would exclaim, "Isn't this fun?" He got me excited about my research. And, I could think of lots of ways he was "like me," but right now all I remember is that we were both from the Midwest.

While gender is one obvious characteristic of "like me," it is not a requirement by any means. It is, however, one more trait, along with national background, race, or even a common sense of humor, that can make the difference between students identifying with a career in science or not. Diversity within the scientific community may create broader appeal to the next generation of scientists. A wider array of potential role models will be available for students

considering this career path.

I feel lucky to fall in a group that is often "encouraged to apply" for jobs and funding. But, I am just an individual pursuing my interests. Hopefully in time, there will be no need for "women in science" to be a cause. We can just be scientists who dress well.

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Follow Up From Last Month's Guest Editorial

The National Hurricane Center (NHC), represented by James Franklin, sent us a response to last month's guest editorial by Mark Powell and Sim Aberson.

Powell and Aberson have prepared a short rejoinder, which follows the NHC response.

Response to April 2002 WeatherZine Editorial "Tropical Cyclone Landfall Forecasting: Making Research Relevant"

Powell and Aberson recently considered National Hurricane Center (NHC) forecasts in which the forecast track of the center of a tropical storm or hurricane intersected the coastline of the United States during the period 1976-2000. Their study, and their recent guest editorial on this topic (see Tropical Cyclone Landfall Forecasting: Making Research Relevant, April 2002 WeatherZine, http://sciencepolicy.colorado.edu/zine/archives/33/guest_editorial.html), may lead some readers to conclude that the accuracy of NHC forecasts close to the United States has not improved over time. In fact such forecasts have improved.

It had been previously shown that official NHC track forecasts over the period 1970-1998 improved at an annual average rate of 1.0%, 1.7%, and 1.9% for the 24-h, 48-h, and 72-h forecast periods, respectively, for the Atlantic basin as a whole. Powell and Aberson noted that "although these trends [were] promising, neither forecast landfall position nor time error trends [had] been quantified." Investigating these specific parameters (by interpolation from NHC forecasts) at time periods roughly 12, 24, 36, 48, and 60 h prior to landfall, they showed that none of the landfall location error trends, and only the 24 h landfall timing error trend, showed a statistically significant improvement. In the AMS Bulletin article describing their research, they attributed the overall lack of improvement in landfall forecasts to a "conservative least-regret" forecast philosophy for storms threatening to make landfall, or to deficiencies in numerical models or the observing network in the Caribbean and Central America.

One might conclude from their discussion that this apparent

lack of improvement in landfall forecasts would also characterize the trend of actual official NHC forecasts for storms near or threatening the coastline, since their suggested explanations should apply equally well to the 12, 24, 36 h, etc., official forecast positions from which the coastline intersections were inferred. Two questions that naturally arise are: (1) what are the long-term trends of NHC forecast errors for storms near the coastline, and (2) are these forecast trends detectably different from basin-wide trends?

Powell and Aberson restricted their analysis to forecast tracks making landfall or passing within 75 km of the coastline. However, this strategy omits cases of keen interest for which a storm is forecast to remain offshore but come close enough to the coast to require the issuance of a tropical cyclone watch or a warning, such as 2001's Hurricane Michelle. Interest on the part of emergency managers and the general public was extremely high for this event, and evacuations were ordered, even though no (United States) landfall was ever forecast.

Our interest, then, is in forecasts issued for storms threatening land, whether or not a landfall is specifically forecast. A simple way to identify such threats is to consider those forecasts issued when watches or warnings (either hurricane or tropical storm) were in effect. Three statistical regressions were performed for the period 1970-2001, one for those forecasts issued when U.S. mainland watches or warnings were in effect, one for those forecasts issued when watches and warnings were not in effect, and one for the entire sample of forecasts. The trend lines at each forecast period indicate that NHC forecasts for storms that threaten

Response to April 2002 WeatherZine Editorial Continued

land have been improving, with annual average percentage improvements of 0.8%, 1.7%, and 1.9% at 24, 48, and 72 h, respectively. The 24 and 48 h trend lines were significant at or above the 95% level, while the 72 h trend line exceeded the 90% significance level. The improvement trends at 48 and 72 h were about 75%-80% as large as those for the non-threats, while the 24 h trend was about half as large.

Statistical tests confirmed that forecasts for non-land-threatening storms improved more rapidly than those for storms threatening land, at least at 24 and 48 h. Examination of the trend lines showed that forecast accuracy is currently comparable for the threat and non-threat samples, whereas early in the period, non-land-threatening forecasts lagged in accuracy. In our view, changes in observing systems over time, in particular the increasing use of satellite observations in numerical models over data-sparse oceanic regions, could account for the trend more plausibly than a "conservative" forecast philosophy on the part of the NHC.

In terms of forecaster philosophy, data availability, or model performance, there is not likely to be much difference between the sample of forecasts that contain a landfall and those issued when watches and warnings are in effect. Given that NHC forecasts near the coast are improving, what explains Powell and Aberson's assessment that there has been a lack of improvement in landfall forecasts? One possibility is the very small sample that occurs when only the landfall point is considered. For the roughly 24 h forecast period, they verify 129 landfalls during the interval 1976-2000, or an average of just 5 verifications per year. At 48 h, there are fewer than 3 forecasts per year being verified. These numbers represent only about 3% of the total number

of forecasts issued, and form an extremely small data set from which to extract long-term trends.

Finally, we disagree with Powell and Aberson's assertion that landfall is the most important part of the forecast, and are troubled that emergency managers are "really paying attention to the landfall forecast." If this is true, then we are failing in our efforts to focus attention away from the precise forecast track of the center. Coastal residents under a hurricane warning are risking their property and lives if they fail to respond adequately because they see an official forecast indicating landfall in some community other than their own. While the timing and location of landfall of the center are important, particularly to the news media, it is not clear that these "forecast" parameters are of any more practical importance than, say, the 24-36 h forecast positions, which help determine the coastal warning zones.

While the most severe hazards generally occur fairly close to the center, dangerous conditions associated with tropical cyclones cover a large area and may last for a day or more. This distribution of hazards is difficult to assess from the official forecast track alone. The mean landfall position error 24 h in advance is about 120 km. This current level of uncertainty in tropical cyclone track forecasts, and the distribution of hazards, dictate that actions to protect life and property should be more closely tied to the threats defined by the tropical storm or hurricane watches and warnings.

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Reply of Powell and Aberson to Franklin

We appreciate the interest that Franklin has shown in our work and appreciate his efforts to add to the studies of tropical cyclone track forecast accuracy near the United States.

Powell and Aberson concluded that forecasts of the time and location of tropical storm and hurricane landfalls in the mainland United States, Puerto Rico, and the U.S. Virgin Islands have not improved statistically (except the 24 h time of landfall forecasts) between 1976 and 2000. This result does not reflect on the accuracy of forecast tracks in general and should not be taken to mean that such forecasts for storms near or threatening the coastline have not improved during the same period of time.

Franklin attempts to quantify the accuracy and improvement trends of these forecasts. Though we do not necessarily disagree with his conclusions, we believe that there are a number of concerns with his methods and that his results do not conflict with those of the Powell and Aberson study.

Franklin looked at the subset of forecasts issued when hurricane or tropical storm watches or warnings were in effect for the mainland United States. However, some of these storms did not make landfall, and many of the forecasts verified either well inland or far from land areas. For example, for Hurricane Gabrielle (2001), the forecasts issued 24 h before landfall near Venice, FL, and earlier, are not included because warnings were not issued 21 h before landfall; however, 72 h forecasts that verified near the Grand Banks off Newfoundland are included.

Franklin specifically mentions Hurricane Michelle (2001) as being of "keen interest" because it was forecast to come close enough to Florida without making landfall to prompt the issuance of hurricane warnings. In this case, the 48 h forecast of the closest approach to Florida is not included in the Franklin subset, though the quick transition to an extratropical cyclone prevented the inclusion of forecasts verifying in the central Atlantic Ocean from his sample. We believe that the forecasts issued 24 to 48 before landfall

Reply of Powell and Aberson to Franklin Continued

should be included in, and that the forecasts that verify far away from the coastline should be excluded from, such a study. Further, Franklin excludes all forecasts of storms near Puerto Rico and the Virgin Islands that were included in the Powell and Aberson study.

Even so, Franklin shows that the forecasts in his chosen subset improved at an annual rate of 0.8%, 1.7%, and 1.9% at 24, 48, and 72 h respectively. We have calculated the improvement rate in the Powell and Aberson sample. Landfall location forecasts have improved at an annual rate of 0.0%, 1.6%, and 1.6%, and the timing forecasts have improved at an annual rate of 2.2%, 0.3%, and -0.7%, at the same lead times. Since both the timing and location errors contribute to the total error, the improvement rates found in both studies are comparable, at least at 24 and 48 h; the very small 72 h sample in the Powell and Aberson study may be the cause of the degradation shown at 72 h. Franklin found that improvements in the 24 and 48 h forecasts in his sample were statistically significant at the 95% level, and the 72 h forecasts at the 90% level. Aberson and Powell showed that the 24 h forecasts of the landfall time had significantly improved at the 99% level, and the 48 h forecasts of landfall location had significantly improved at the 90% level. The 72 h forecasts did not show significance, probably due to the

very small sample.

Finally, Franklin states that the public should "focus attention away from the precise forecast track of the center," though his study quantifies the errors of that exact metric. We agree with this statement, but we do not believe that this precludes evaluation of errors, either of the landfall time and location or of forecast tracks threatening land, after the event, and informing the hurricane preparedness community and the public of how well tropical cyclone impacts are forecast. As long as forecasts of the precise track of the center are issued by the National Hurricane Center, the precise track will continue to be a focus of the hurricane preparedness community and the public. Public education to the fact that dangerous conditions associated with tropical cyclones cover a large area away from the storm center must continue. This education will remain a difficult task as long as public is presented with such forecasts.

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Student Editorial

Better Communication with Decision Makers: Focus on Forecasts

In the April 2002 WeatherZine student editorial (http://sciencepolicy.colorado.edu/zine/archives/33/student_editorial.html), Tom Pagano questioned the sustainability of being an interdisciplinary scientist involved in both the physical and social sciences. As Tom pointed out, developing relationships with decision makers and understanding their world requires a lot of time that could otherwise be devoted to traditionally more respected and rewarded physical science research. Realistically, not all of us can, or will, devote collective months and years to understand how individual decision makers process information or manage risk.

What can we do, in a practical sense, to more effectively interact with decision makers without shifting from our careers in physical science? Roger Pielke Jr., in the August 2000 WeatherZine (<http://sciencepolicy.colorado.edu/zine/archives/1-29/23/editorial.html>), suggested we develop expertise that extends across a broad range of policy topics. I strongly agree with his identification of forecasts as one important cross-cutting area. Practically all resource management decisions make use of forecasts, even if only as implicit assumptions that the future will be much like the past.

So every time a forecast is issued or every time decisions

must be made, we have an opportunity to influence how science is perceived and ultimately used. Our involvement can be as extensive as Tom's or as cursory as responding to a question at a meeting or over the telephone. Unfortunately, in my experience, even individuals with scientific training are contributing to confusion about forecasts. The following are areas where we particularly need improvement.

Interpret forecasts correctly. If misinterpreted, even perfect forecasts can be perceived as worthless - or worse. The uncertain nature of forecast products is not the problem. Instead, decision makers are often confused about the subject the forecasts refer to, as are too many scientists. For the seasonal climate outlooks issued by the National Weather Service's (NWS) Climate Prediction Center (CPC), the probabilities refer to the likelihood of conditions falling within each of three categories defined by the historic distribution of temperatures and precipitation occurring over 1971-2000. Too often, the forecasts are misinterpreted as indicating how extreme conditions will be, or simply as the chance of conditions being above or below "average" or "normal." In addition, probability anomalies are difficult for laypersons to understand. It is more effective to simply state the probabilities associated with each possible condition.

Jargon creates confusion. The terms "normal," "average," and "climatology" are used too casually. They seem too basic to require explanation, but their meaning differs

Student Editorial Continued

according to a user's background and is often misconstrued. Are you, for example, referring to the expected value of seasonal total precipitation or the historical distribution (i.e., normal or climatological probabilities) of precipitation? Not only are the meanings statistically different, they provide different kinds of information to decision makers that will not be used in the same way.

Context is critical. Often, decision makers lack a good sense of the historical range of meteorological conditions for their region, especially concerning extremes. Simply providing a sense of historical conditions can be a great help to decision makers. Things get more confusing when dealing with specific forecast products. Are you aware that the seasonal climate outlooks issued by the CPC, the International Research Institute for Climate Prediction, and Canadian Meteorological Center each reference different historical periods? Statistically, the differences are small but it complicates communication with potential users.

Sometimes we simply don't know. While we are all aware of the limitations of our individual expertise, some scientists find it difficult to admit that meaningful forecasts are not always possible. CPC seasonal climate outlooks use "CL" to indicate that forecast techniques have insufficient skill on which to base a prediction. Decision makers appreciate acknowledgement of scientific uncertainty and can respond to it. In a broader sense, overselling scientific capabilities or future advancements can be detrimental in the long run, as decision makers are disappointed when performance doesn't live up to prior billing.

Don't confuse the role of researchers, forecasters, and decision makers. Scientists have the responsibility to conduct quality research, possibly targeted for specific applications and always communicated effectively. Forecasting agencies are responsible for issuing the best product possible. Experimental forecast products should be, but often aren't, clearly differentiated from official products that are based on techniques that have passed performance

tests. It seems elementary to point out that decision makers are responsible for making decisions, but I know of cases where forecasters were pressed, and acquiesced, to advise what actions to take in response to potential threats.

Learn about "bad" products and science. Many decision makers express that they have difficulty differentiating between "good" and "bad" information. I have seen climate forecasts marketed by a private firm that were visually stunning, but incorrectly interpreted outlooks made by the National Weather Service's Climate Prediction Center (CPC). And decision makers have consistently asked whether Farmer's Almanac forecasts are better than NWS products. In a broader sense, many decision makers feel they are unable to distinguish between "good" and "bad" science. Because forecasts are perceived as not promoting any governmental agenda, they provide neutral ground for discussing other scientific topics. When I give talks to local-level decision makers, questions often come up about whether information and conclusions about other topics are correct or not, especially concerning climate change, ozone depletion, and air pollution. It pays to be well aware of these issues.

The bottom line is that forecasts provide each of us an opportunity to interact with decision makers. Effective interaction doesn't require that we each become interdisciplinary experts. By improving our involvement in a few areas, we can facilitate the informed use of advanced science.

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Holly Hartmann recently received her Ph.D. in Hydrology and Water Resources from the University of Arizona, where she is now an Associate Research Scientist.

Correspondence

Dear WeatherZine,

In response to Thomas Pagano's editorial in the April 2002 edition of WeatherZine, "Life as an Interdisciplinary Scientist: Am I being set up?" (http://sciencepolicy.colorado.edu/zine/archives/33/student_editorial.html), I would like to share the following experience.

When I was two years out of college (1989) and working at an environmental consulting firm in Boston, I had the opportunity to attend an Aquatic Biology and Toxicology conference in Montreal, sponsored by two professional scientific societies in Canada having similar missions related to the conference topic. The closing plenary session's

premise was to discuss how the two societies could work together more effectively to address problems of aquatic toxicology. At some point during the session, I stood up to say that while it was admirable that the two societies were discussing what they could do to work together more effectively, I wondered how and when "we" (the scientists and engineers) would broaden the discussion to include better cooperation with and among the urban planners, lawyers and others who "we" as scientists and engineers love to hate...?

As all heads immediately turned in my direction, my question was initially met by wondrous murmurs in the audience and stunned silence by the professors on the discussion panel.

Correspondence Continued

After proceeding on to a few other questions, the panel moderator indicated that he wanted to come back to my question. His response, essentially, was that it is my generation that is going to work out the answers. He noted that for most of his long career as a professor, almost all students applying for graduate studies in toxicology had traditional scientific backgrounds in fields such as chemistry or biology. However, it was in recent years that he was starting to see more and more applications from budding interdisciplinarians with undergraduate degrees in fields such as planning, humanities, and the like. He saw this as a positive sign for the future, but felt that working out the issues that such approaches provoke was a little beyond him - and was a task waiting for us.

Because "real" science was essentially invented by astronomers, physicists and chemists, the hard rules (such as reproducible experimental results) for what constitutes scientific endeavor were established by disciplines that had little room for shades of gray. When the next science - biology - came along, it was viciously attacked by the scientific establishment as fluff. As biology began to be accepted as a real science, ecology, the next science, came along. It, too, went through its period of non-acceptance by the more hard sciences, and is still fighting some residual battles over these issues today. Now, the next science - anthropology - has come along, and is in the midst of the same kinds of struggles, with hot debates in the present day as to whether it is science at all. As each new science becomes accepted, I think our overall concept of what constitutes "science" can and must change. And hopefully the anthropologists you have worked with have shown you that all fields of study have their culture, and that culture

changes through the actions of individuals, among other means.

I am glad to see from your article that you are still enthusiastic about interdisciplinary work. I, too, am a staunch supporter and practitioner of such approaches. I hope that your enthusiasm will continue to grow rather than being thwarted by the difficulties involved, especially now that you are about to receive your Ph.D. You will be one of those to whom the toxicology professor referred when he said that it is up to my - our? - generation to create the answers to questions like the ones you've raised. It will be an exhausting struggle, but one well worth it. I even believe that our planet's physical and political future may depend on it.

I think the issues raised by Thomas Pagano's articles may also be central to some of the questions currently posted on MIT's Civil and Environmental Engineering Department on-line newsletter Web site - such as "why don't American undergrads want to major in CEE? How can the status of the profession be elevated?" On the one hand, interdisciplinary study and work is surely the vanguard of the future for environmental studies and much of academia more generally, yet it is ironically undervalued by the current establishment - thus creating a cycle of undermining its future....

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WeatherZine News

WeatherZine To Call It Quits

Almost six years ago—on December 15, 1996, to be exact—the WeatherZine was born. What started as an internship project for Quindi Franco, a UCAR SOARS student, the WeatherZine was supported by the U.S. Weather Research Project (USWRP) up to the present time, growing to 750 subscribers in academia, government, the private sector, and NGOs in the U.S. and beyond. In the early days of the Internet, the WeatherZine was originally conceived to provide a simple summary of recent changes to the Social Aspects of Weather website (along with links to relevant sections), and news, events, and announcements of interest to the weather research community. But the WeatherZine expanded, largely based on feedback from its readers, to include:

- A regular column by the editor on policy issues related to the atmospheric sciences community such as "The Data Quality Act and the Atmospheric Sciences" and "Kaching!! Dealing with Financial Conflicts of Interest."

- In April 1999, a regular guest editorial from a prominent member of the weather research community was added featuring articles such as "How much 'skill' is there in forecasting El Nino?" by Chris Landsea and John Knaff, and "The Future of the 'Public-Private Partnership' Toward a More Synergistic Relationship in the 21st Century," by Michael R. Smith, WeatherData, Incorporated.
- A student editorial, as well as Education and Research Highlights, were added after the WeatherZine relocated to the University of Colorado in August 2001.

The look of the WeatherZine has evolved as well over the years from simple email text to what we believe is a much more sophisticated and stylish appearance. The WeatherZine was distributed in pdf format and was also available online. The subscription list grew solely by word of mouth from 0 in 1996 to over 750 in June 2002. The WeatherZine has been cited in the reports of the

WeatherZine News Continued

Intergovernmental Panel on Climate Change and in Science magazine.

With the August 2002 issue the WeatherZine will be saying farewell, though the archives will remain online. The

WeatherZine staff has greatly enjoyed producing this bimonthly publication and appreciates the support that its 750+ subscribers and other readers have provided over the years.

WeatherZine News

Materials Available for the Convective Season and Flood Forecasting

The following materials are available on the MetEd web site at <http://meted.ucar.edu/modules.htm> :

- Mesoscale convective systems: squall lines and bow echoes
- Anticipating convective storm structure and evolution CD-ROM
- Predicting supercell motion using hodograph techniques
- A convective storm matrix CD-ROM
- An MCS matrix CD-ROM
- How models produce precipitation and clouds
- Hydrology for the meteorologist: the headwater forecast process
- Hydrology for the meteorologist: basic hydrology for headwater forecasting CD-ROM
- Rain gauges: are they really ground truth?
- A social science perspective on flood events
- Urban flooding: it can happen in a flash!
- Quantitative precipitation forecasting overview

Research Highlight

The June 2002 edition of Weather and Forecasting, vol. 17, n.3 (<http://ams.allenpress.com/amsonline/?request=get-toc&issn=1520-0434&volume=017&issue=03>) is devoted to a review of the 3 May 1999 Oklahoma-Kansas tornado and its impacts. Articles that may be of particular interest to WeatherZine readers include:

- Tornado-Related Deaths and Injuries in Oklahoma due to the 3 May 1999 Tornadoes.
- Deaths in the 3 May 1999 Oklahoma City Tornado from a Historical Perspective.
- Storm Prediction Center Forecasting Issues Related to the 3 May 1999 Tornado Outbreak.
- Warning Decision Making: The Relative Roles of Conceptual Models, Technology, Strategy, and Forecaster Expertise on 3 May 1999.
- OK-FIRST: An Example of Successful Collaboration between the Meteorological and Emergency Response Communities on 3 May 1999.
- Response to Warnings during the 3 May 1999 Oklahoma City Tornado: Reasons and Relative Injury Rates.
- Tornado Damage Survey at Moore, Oklahoma.
- Engineering Observations of 3 May 1999 Oklahoma Tornado Damage.
- Lessons Learned from the Damage Produced by the Tornadoes of 3 May 1999.
- Taking Shelter: Estimating the Safety Benefits of Tornado Safe Rooms.
- After the Storm: Building a Safe Shelter for the School Children of Mulhall, Oklahoma.

Education Highlight

Initiated in 1997, the Integrative Graduate Education and Research Traineeship (IGERT) program was developed to meet the challenges of educating Ph.D. scientists and engineers with the multidisciplinary backgrounds and the technical, professional, and personal skills needed for the career demands of the future. The program is intended to catalyze a cultural change in graduate education, for students, faculty, and universities, by establishing new, innovative models for graduate education in a fertile environment for collaborative research that transcends traditional disciplinary boundaries. It is also intended to facilitate greater diversity in student participation and

preparation and to contribute to the development of a diverse, globally-aware, science and engineering workforce.

IGERT is an NSF-wide endeavor involving the Directorates for Biological Sciences; Computer and Information Science and Engineering; Education and Human Resources; Engineering; Geosciences; Mathematical and Physical Sciences; Social, Behavioral, and Economic Sciences; and the Office of Polar Programs.

The deadline for IGERT preproposals will be sometime in the September/October 2002 time frame. Specific dates will be established shortly and posted at

<http://www.nsf.gov/home/crssprgm/igert/start.htm>.

Jobs

AAAS Science and Technology Policy Fellowships, 2003-04

Scientists and engineers are invited to apply for one-year science and technology policy fellowships in Washington, DC, beginning September 2003. Fellows serve in the Congress and several executive branch agencies including the U.S. Environmental Protection Agency, the U.S. Food and Drug Administration, the U.S. Department of Agriculture, the U.S. Department of Agriculture, the U.S. Agency for International Development and the U.S. Department of State.

These programs are designed to provide each Fellow with a unique public policy learning experience and to bring technical backgrounds and external perspectives to decision-making in the U.S. government.

Applicants must be U.S. citizens and must have a Ph.D. or an

equivalent doctoral degree by the application deadline (January 10, 2003) from any physical, biological or social science, any field of engineering or any relevant interdisciplinary field. Individuals with a master's degree in engineering and at least three years of post-degree professional experience also may apply. Federal employees are ineligible. Stipends begin at \$56,000.

For application instructions and further information about the AAAS Science and Technology Policy Fellowship Programs, contact: 1200 New York Avenue, NW, Washington, DC 20005. Phone: 202/326-6700. E-mail: science_policy@aaas.org. Web: <http://fellowships.aaas.org>.

Underrepresented minorities and persons with disabilities are encouraged to apply.

Interesting Weather Factoid

True or False?

Half of all forest fires are caused by lightning.

FALSE. Four out of five forest fires are caused by people, through negligent behavior such as smoking in forested areas or improperly extinguished campfires. Lightning is the most common natural cause of forest fires.

From The Institute for Business and Home Safety Website, <http://www.ibhs.org/>

About Us

WeatherZine is a bimonthly newsletter on the societal aspects of weather. It contains opinion pieces, news, and a brief summary of developments at the *Societal Aspects of Weather* web site.

Primary support for the *WeatherZine* comes from the U.S. Weather Research Program.

On-Line version

(<http://sciencepolicy.colorado.edu/zine/>)

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