Public Weather (continued from page 2)

this issue, especially by implementing the decisions of the Madrid Conference.

The mechanism would focus on bringing providers and users of information together, with an initial goal of establishing dialogues aimed at understanding the gap and seeing how it could be narrowed.

Establishing a Task Force to Help With this objective in mind, the Task Force on Socio-Economic Applications of Public Weather Services was established in 2005. The first meeting of the task force, held in Geneva in 2008, engaged participants from a number of user sectors such as agriculture, energy, water resources, health, and media. Social scientists, economists, and development bankers, along with representatives of a number of NMHS, also attended.

The task force addressed questions such as:

- What kind of weather, water, and climate information is required in each sector and what is the appropriate form for this information (text, maps, graphs)?
- How is the information used in both developed and developing countries in the sector represented? If this information is not used, why not?
- How is weather, water, and climate information used to make decisions?
- To what degree has the sector been involved in developing informational products for their sectors? How has user feedback occurred during product revision or improvement?
- How has the information use changed over the last two or three decades?
- What have been the most important sectors?
- Have providers of information on weather, water, and climate kept up with changing needs?
- Have information providers conducted training sessions on the appropriate use or application of their products in decision making?

- What is the level of communication with the information providers? How is communication informed or delivered to each user sector? Is this delivery efficient?
- What types of information are missing that users need to reduce the risk associated with weather-related events?
- How will the sector (both public and private) be affected in the absence of the information on weather, water, and climate (including high-impact and severe weather, as well as day-to-day weather forecasts)?
- What is the level of input from the users as the information is prepared?
- Are the requirements of users well understood and respected in product and service preparation and delivery?
- What kind of information do the providers need from the user sectors to help them improve products and services?

Based on the results of its first meeting, participants agreed that the task force should continue its work, taking a phased approach to identify mechanisms for addressing critical “provider-user” issues. A particular focus was on identifying and taking inventory of existing decision support tools. The task force also played an essential role in preparing the Madrid Conference, providing substantive papers that served as the basis for discussions and were published as part of the conference proceedings.

The Task Force Moves Forward With a New Name

After the Madrid Conference, the task force was considered the main group mandated with guiding the process of the implementation of the Madrid Action Plan (MAP), advising WMO on service delivery and on other issues in connection with the conference. At its second meeting in July 2007, the task force was asked to serve as an overall expert and advisor to WMO in the follow-up to the Madrid Conference. In doing so, the task force would integrate its terms of reference with the MAP.

To better reflect the outcomes of the Madrid Conference and the activities associated with the implementation of the MAP, the task force name was changed to “WMO Forum: Social and Economic Applications and Benefits of Weather, Climate and Water Services.”

The task force also discussed serving as the primary WMO steering mechanism for follow-up to the MAP on the time scale up to the proposed follow-on “Madrid + 5” Conference recommended in the Plan. There was general agreement that the WMO Forum should

-Subsume the follow-up to its earlier work on applications of public weather services into its broader responsibility;
- Cover both social and economic applications and benefits of weather, climate, and water information and services;
- Focus its efforts primarily on strategic level advice on service-wide issues and encourage, recognize, and respect the existing and new activities in support of the MAP;
- Give particular priority to education, training, and capacity-building aspects of the overall WMO plan for implementation of the congressional decisions on the MAP;
- Strengthen the user sector input to its work;
- Integrate the consideration and actions arising from the July 2006 Espoo Conference on Living with Climatic Variability and Change: Understanding the Uncertainties and Managing the Risks into the follow-up action on the MAP;
- Chancel coordinated advice on MAP implementation matters to the Secretary-General and, as appropriate, to the Executive Council through its Working Group on Strategic and Operational Planning; and
- Offer to develop preliminary plans by July 2008 for a proposed Madrid + 5 Conference.

Communicating Uncertainty in Weather Forecasts to Benefit Users

by Julie Demuth*, Rebecca Morris**, and Jeff Lazo***

During a recent winter weather event along the Colorado’s Front Range, the short-range forecast for Boulder read as follows:


We can’t help but wonder how people interpret and use this forecast. The forecast gives a probability of precipitation of 90%, which reeks uncertainty about whether or not it will snow, but this same forecast also includes phrases such as “periods of snow” and “total daytime snow accumulation of 3 to 5 inches possible.”

How do people integrate these different pieces of information? How does this influence their interpretation of the precipitation forecast? Uncertainty is communicated about some elements (i.e., chance of snow, amount of snow, wind speeds) but not others (i.e., high temperatures). What do people think about these different pieces of information communicated in these ways?

More generally, do people even notice these details? Do the details affect how people use the information and, if so, how do they feel about the preferences for how this information is conveyed? Would people like different information and, if so, what? And—perhaps the most important question—how can we translate what we learn by asking these questions to develop products that more effectively communicate weather forecast uncertainty to the benefit of users?

Without well-designed products that explicitly convey uncertainty information, forecasts can easily be misinterpreted and misused in decision making. Addressing how to effectively communicate weather forecast uncertainty requires interdisciplinary research that integrates physical and social science.

To begin exploring some fundamental knowledge gaps pertaining to this issue, we conducted a controlled-access, Internet-based survey of the U.S. public in November 2005. We received more than 1500 completed responses from around the country. The survey included eight uncertainty-related questions to begin investigating people’s perceptions of weather forecast uncertainty and their interpretations of and preferences for uncertainty information.

One of the fundamental questions the survey began to explore is whether people infer uncertainty into deterministic forecasts and, if so, to what extent. The question read, “According to the forecast high temperature for tomorrow for your area is 75°F. What do you think the actual high temperature will be?” Respondents were offered several response options, including the deterministic (single-value) option of 75°F and several options with temperature ranges symmetric about 75°F.

The majority of respondents inferred uncertainty into the deterministic forecast (See Figure 1). This indicates that most people are aware that weather forecasts are uncertain, even when uncertainty information is not explicitly provided. These responses also show that how much uncertainty people infer varies greatly, from as little as ±1 degree to 10 degrees or more. Although these results may not be surprising to the weather community, this type of information has rarely, if ever, been assessed empirically in this way.

Two other research questions were:

- To what extent do people prefer to receive forecasts that are deterministic versus forecasts that explicitly provide uncertainty information?

Figure 1. Respondents’ expectations of tomorrow’s actual high temperature, given a forecast high temperature of 75°F (N=1465). (Source: AMS)

(continued on page 13)
One Step Closer to Integrating Social Science and Meteorology

NWS WAS1’S Alumni Meet for the First Time

by Andrea Bleistein

National Weather Service (NWS) alumni of the Weather and Society*Integrated Studies (WAS1’S) program gathered in Kansas City, Mo., on October 24 and 25, 2007. Our general objectives for this meeting were to gather all the NWS alumni in the same room, discuss our experiences since we went through the WAS1’S program, and crystallize how each of us can work to improve the integration of social science at the NWS.

This meeting was meant to strengthen the NWS voice to better support ongoing initiatives that span the entire weather enterprise. As Societal Impacts Program (SIP) Director Jeff Lazo noted, this was the first specialized WAS1’S meeting to be held as a result of the ongoing grassroots WAS1’S movement.

We spent a good deal of time sharing information on individual WAS1’S projects. We also covered the SIP, the National Oceanic and Atmospheric Administration’s (NOAA) Social Science Working Group (SSWG), and NOAA’s Science Advisory Board (SAB). Our open discussion topics ranged from operations to strategic planning.

The SAB has stated recommendations for integrating social science to support NOAA’s mission goals. Although these programmatic topics are centered at NOAA, they do have implications for gaining support in the budget process. Through our discussions, we realized that we must plan strategically if we are to garner the necessary support for funding WAS1’S initiatives and research. In breakout groups, we developed an initial NWS WAS1’S vision and mission (see http://www.sip.ucar.edu/news/NWS), a business case, and a concept paper. We also discussed general communications planning.

We took away some actions for propelling the informal NWS WAS1’S movement forward, including developing training for all NWS staff and incorporating WAS1’S projects into the NOAA budget process. We talked about the need for our group to communicate constantly—both within the NWS and throughout the larger enterprise—to continue and expand our grassroots effort.

Future workshops could also educate social scientists on meteorology or focus on the needs of emergency managers.

Pulling off such a unique meeting on a limited budget and in short order was quite a challenge. We think we did a decent job in helping to facilitate the advancement of WAS1’S in the NWS (and therefore across the enterprise). The problem will come as time passes and as we build on our successes. We hope that in a future meeting, all WAS1’S alumni can come together in a national workshop setting! Future workshops could also, for example, educate social scientists on meteorology or focus on the needs of emergency managers.

Perhaps most importantly, this workshop is just one example of how of those who have gone through the WAS1’S program are really trying to embrace culture change in their organizations and institutions.

It is our hope that all who work in the related atmospheric sciences will begin to apply an integrated sense of understanding and application, generating improvements in products and services that go beyond the verification numbers. As we move toward this goal, it will become increasingly clear that our work is enhancing our way of living by increasing public preparedness and, ultimately, by saving lives.

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What do you think about the state of Cuban meteorology?
Excellant radars, excellent scientists and forecasters.

What is needed for improvement?
More computing power to run the Cuban forecast and research models.

Was the U.S. embargo part of the problem for Cuba not having access to adequate computing?
I am a scientist, not a politician, so I should not really answer this. But there are excellent computers built in other countries.

Will the U.S. ever sign the Kyoto protocol?
Not until the next President, at the earliest.

It was clear that the younger people especially had a keen interest in what was going on scientifically and politically in the United States.

After this opening morning session, the conference participants boarded buses for a short drive to a nice outdoor restaurant in the western suburbs of Havana. This began an experience that yielded insight into the other two societys’ (combat-case and non-scientist meteorological). After a lunch of chicken, pork, rice, and beans on the outdoor patio under the trees, the participants, joined by the young musicians of the morning, spent the afternoon dancing to a variety of songs and discussing a variety of scientific and other topics in a very informal, festive setting. It was clear that the younger people especially had a keen interest in what was going on scientifically and politically in the United States.

I enjoyed meeting a group of students from the recently established Meteorology Program at the University of Havana. They were surprisingly well informed, with their information coming mostly from the Internet. They were very interested in the upcoming U.S. presidential election and how it might affect relations with Cuba. They clearly hungered for better relations.

Uncertainty (continued from page 3) and How do people interpret probability of precipitation forecasts, which are already commonly available and familiar?

Results from these questions suggest that many people are receptive to more forecast uncertainty information, and nearly half of respondents reported a clear preference for receiving uncertainty versus deterministic information.

Results also suggest that when communicating forecast uncertainty, whether people understand the forecast precisely from a meteorological perspective is less important than whether they can translate that information for their own personal use and decision making. A recently submitted paper discusses our findings in greater detail (Morsos forthcoming; manuscript available from the authors).

Future research could employ other social science methodologies, such as interaction and focus groups. Such methods can be especially useful for exploring people’s thought processes about their interpretations of, uses of, and preferences for forecast information. Robust interdisciplinary research in these areas can improve how we communicate weather forecast uncertainty information, ultimately better serving members of the public and other user groups.

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Reference