NCAR

Weather and Society Watch

A Publication of NCAR's Societal Impacts Program (SIP) **Volume 2, Number 2, January 18, 2008**

Weather, Climate, and Four Societies

by Rick Anthes*

In the Spring 2007 *UCAR Quarterly* (www.ucar.edu/communications/quarterly/spring07/president.jsp), I wrote about my visit to Cuba in March as part of a delegation from the American Meteorological Society (AMS) to the Cuban Meteorological Society (SOMET). I was proud to be part of an effort, led by my good friend Oswaldo (Os) Garcia—a native Cuban who is now head of the geosciences department at San Francisco State University— to establish a relationship between the two meteorological societies.

Official relationships between Cuban and U.S. scientists have been virtually impossible because of the huge political differences between the countries and the strangling effect of the U.S. embargo of Cuba. With some preparation, however, it is possible for U.S. professionals to visit Cuba for research purposes. At the invitation of SOMET, we were able to visit Cuba for four days and discuss scientific and educational items of mutual interest. Out of this trip came an invitation for me to return to Cuba in December 2007 to continue discussions of research collaborations. One of my main goals in these meetings was to establish ongoing scientific collaborations and professional relationships that would benefit both countries.

We had good discussions at the SOMET headquarters in Havana and at the Institute for Meteorology (INSMET). We talked primarily about hurricanes, climate, and mesoscale research and forecast models. Despite the tight restrictions on U.S.–Cuba interactions, meteorologists in both countries already benefit from each others' work. The INSMET scientists have access to desktop computers that are powerful enough to run modern limited-area weather prediction models; the one they are using is a nested-grid version of MM5. Currently they make one operational run a day using a three-domain nested-grid version of MM5, the Penn State/NCAR mesoscale model. This version allows weather features to be analyzed with a resolution of 81 km, narrowing to 27 and 9 km for progressively smaller portions of the forecast area.

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The INSMET scientists are aware of the newer Weather Research and Forecast (WRF) model and plan to use it more in the future. They receive their initial and boundary conditions necessary to run the model operationally from open Web portals of the U.S. National Centers for Environmental Prediction, which makes its forecasts freely available to any users around the world. They also have direct interactions with NOAA's Tropical Prediction Center in Miami, and they share data, forecasts, and information as necessary during hurricanes and other extreme weather events. Forecasts of hurricanes and

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The INSMET Radar in Cuba
(Photo by Rick Anthes)

In This Issue

Social and Economic Applications and Benefits of Public Weather Services

by Haleh Kootval* and Donald Wilhite**

It has been recognized for some time that most national meteorological and hydrological services (NMHS) focus their attention and resources on improving the accuracy and precision of forecasts, paying less attention to the users of these products, their understanding of the atmospheric phenomena, and the potential impacts of such phenomena on their lives.

Specialized users of weather information—traditionally people involved in agriculture, fisheries, maritime commerce, and air transport—have grown to include those concerned with energy and water resource management, banking and insurance, construction, and urban design. All of these users can derive significant benefit from weather services, whether they obtain them through the NMHS or through the private sector.

Because weather information contributes to the public's safety and welfare, it is of immense social and economic benefit to society. Thus, it is no longer sufficient for NMHS to just employ good science and deliver accurate forecasts. Today NMHS must also educate and inform the public and more specialized users about how to make best use of the fruits of the scientific endeavor. They must also engage their diverse stakeholders from the earliest stage of product or tool development through the time when a product becomes operational. There must also be ample opportunities for continuous user feedback as the product evolves in response to changing user needs or new technologies.

The World Meteorological Organization (WMO) spearheaded some work on the economic and social benefits of meteorological and hydrological services in the early 1990s, with two international conferences in 1990 and 1994. In between these conferences, though, not much was achieved. In 2005, planning began for another international conference on the same subject. That conference, entitled "Secure and Sustainable Living: Social and Economic Benefits of Weather, Climate and Water Services," was held March 19-22, 2007, and has become commonly known as the Madrid Conference. The purpose of the conference was to contribute to secure and sustainable living for all peoples of the world by evaluating and demonstrating, and thus ultimately enhancing, the social and economic benefits of weather, water, and climate services.

Task force members at the July 2007 meeting (Photo credit: WMO)

Demonstrating the Value of NMHS

Information garnered through surveys and consultations by the Public Weather Services Programme (PWSP) of WMO had shown that, because of political and economic changes taking place in many of the WMO member countries, NMHS were increasingly required to provide concrete evidence of the benefits of their products and services to society. They were also required to justify budgetary requirements from their governments, again in terms of the tangible returns to society from investments in these services. Many NMHS sought guidance and assistance from WMO on how to accomplish this task. The PWSP recognized that the first step was an urgent need for NMHS to develop effective relationships with the users of their services and products.

Furthermore, the gap between the providers and users, which was evident in societal responses to environmental information disseminated by the meteorological community, did not allow users of the information to make effective decisions. Effective decision making associated with, for example, natural hazards, depends on the ability of the decision maker to assess the consequences of the weather, water, or climate risk to society and the economy and to take the appropriate action. In the area of natural disasters, the societal response to recent events indicates that there is a significant gap between the provision of an adequate forecast and the ability to comprehend fully and respond effectively to the associated risks.

In an attempt to bridge this gap, a mechanism was proposed through the PWSP that would provide continuity in assisting NMHS with

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Communicating Uncertainty in Weather Forecasts to Benefit Users

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

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

Today: *Periods of snow. High near 23. North northeast wind between 11 and 13 mph. Chance of precipitation is 90%. Total daytime snow accumulation of 3 to 5 inches possible.*

We can't help but wonder how people interpret and use this forecast. The forecast gives a probability of precipitation of 90%, which conveys 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."

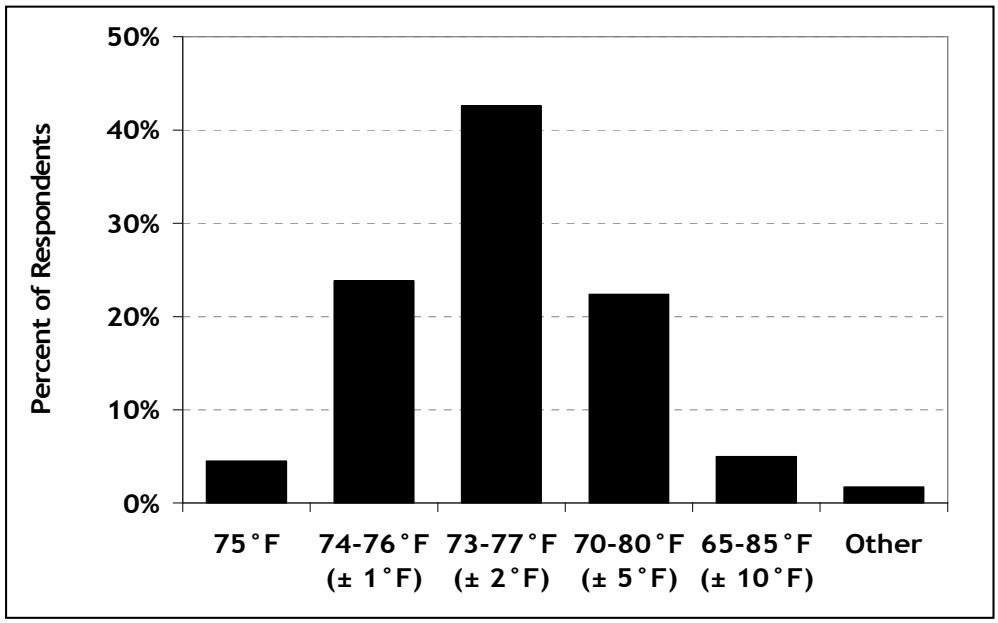

Figure 1. Respondents' expectations of tomorrow's actual high temperature, given a forecast high temperature of 75°F (N=1465). (Source: AMS)

How do people integrate these different pieces of information? How does this influence their interpretation of the uncertainty about 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 temperature). 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 people have 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 2006. 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, "Suppose the forecast high temperature for tomorrow for your area is 75ºF. What do you think the actual high temperature will be?" Respondents were offered several response options, including the deterministic (single-value) option of 75ºF and several options with temperature ranges symmetric about 75ºF.

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?*

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One Step Closer to Integrating Social Science and Meteorology

NWS WAS*IS Alumni Meet for the First Time

by Andrea Bleistein*

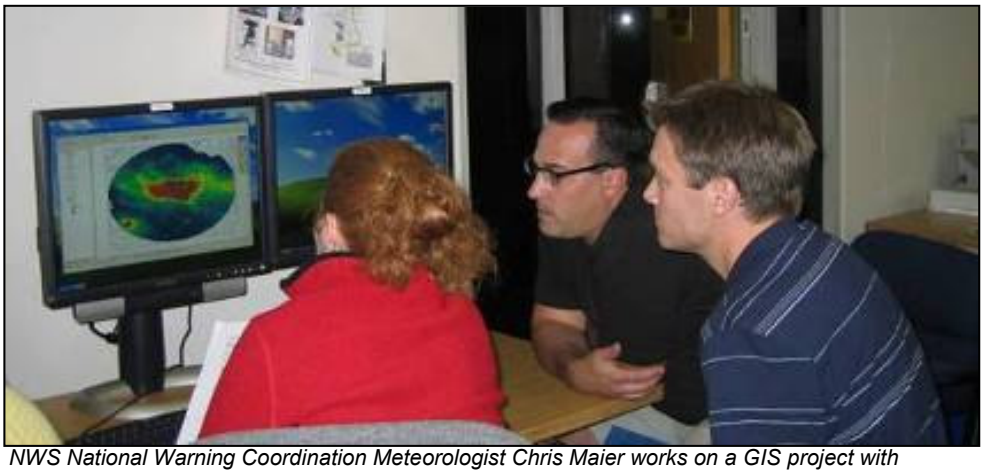
National Weather Service (NWS) alumni of the Weather and Society*Integrated Studies (WAS*IS) program gathered in Kansas City, Mo., on October 24 and 25, 2007. Our general objectives for this meeting were to gather all the NWS alumni in the same room, discuss our experiences since we went through the WAS*IS program, share information on our WAS*IS projects, 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 WAS*IS meeting to be held as a result of the ongoing grassroots WAS*IS movement.

We spent a good deal of time sharing information on individual WAS*IS 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 WAS*IS initiatives and research. In breakout groups, we developed an initial NWS WAS*IS 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 WAS*IS movement forward, including developing training for all NWS staffers and incorporating WAS*IS 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.



*NWS National Warning Coordination Meteorologist Chris Maier works on a GIS project with other WAS*ISers during the 2007 summer workshop in Boulder, Colo. (Photo by Eve Gruntfest)*

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 WAS*IS in the NWS (and therefore across the enterprise). The proof will come as time passes and as we build on our successes. We hope that in a future meeting, *all* WAS*IS 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 how those who have gone through the WAS*IS 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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*NWS Lead Meteorologist Chad Omitt participates in the summer WAS*IS workshop. (Photo by Eve Gruntfest)*

Health and Climate, Weather Scientists Now Working Together

by David Rogers*

Many factors influence disease outbreaks and each must be understood to create an effective public health response. In particular, there is growing recognition that public health strategies must take into account climate variations and change. Greater cooperation between the health, weather and climate communities is leading to new international activities, such as the Meningitis Environmental Risk Information Technologies (MERIT) project.

MERIT is a collaborative effort of the World Health Organization (WHO) and members of the environmental, public health, and epidemiological communities. The project, which aims to combine environmental information with knowledge of epidemic meningitis to increase the effectiveness of prevention and response control strategies, is a compelling example of cooperation among researchers and practitioners in different disciplines.

Meningococcal meningitis is one of the most feared epidemic diseases because of its rapid onset, high fatality rates, and the long-term disabilities, such as brain damage and deafness, that affect many survivors. The risk of meningitis epidemics is ever present in the dry, dusty climate of sub-Saharan Africa. Current meningitis control strategies in Africa, based on reactive vaccination campaigns in districts that have passed a predetermined epidemic threshold, have not been fully satisfactory in reducing the burden of the disease. In 2008, a ten-year vaccination program will begin in this so-called “Meningitis Belt” to protect the 350 million people at risk from epidemics.

With approximately 50 to 60 million doses of a new vaccine being produced each year, order-of-priority decisions will necessarily continue over the next decade. MERIT is developing a more proactive approach that will put *Open Health,* WHO’s new public health information system, at the heart of the decision-making process.

Mitigating or eliminating epidemics depends on timely assessments of changing risks to a community. This is now possible with software tools, such as *Open Health*, which enable real-time disease tracking and monitoring, as well as real-time assessment of control strategies based on the integration and analysis of epidemiological, biological, social, economic, demographic, and environmental risk factors (See Table 1).

The meningitis early-warning system will combine weather forecasts and assessments of dust, humidity, and other environmental parameters with health information from regional and local surveillance systems and social, economic, and demographic data already available within *Open Health*.

Timed to coincide with the implementation of a new meningitis vaccine, a comprehensive surveillance system will reinforce the immunization program by helping to prioritize the deployment of the vaccine.

Better knowledge of these risk factors empowers medical officials, enabling them to monitor the current public health situation, provide early warning of future risks, and determine the consequences of particular intervention strategies. They can also assess the operational risks that may affect effective treatment of the disease, such as access to health care facilities. This approach rationally determines the populations most at risk and identifies those that can be treated.

Open Health can also be used to assess the impact of climate change on health risk. Anticipating changes

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Categories	Factors
Demographic	Migration of populations increases the risk of disease spreading over large distances.
Economic	Poor economic conditions can delay or prevent distribution of vaccines to at-risk populations, prevent access to early treatment, and create barriers to education and awareness of disease.
Environmental	Because climate creates environments and habitats for endemic and epidemic disease, climate change alters and often increases the risk of epidemics. Analyses and forecasts of weather and climate are therefore of particular interest in the development of early warning and assessment systems.
Epidemiological	The vulnerability of a population to epidemics is influenced by their immune status, the arrival of new strains of the bacteria, and carriage rates, among other factors.
Social	Crowded living conditions, such as in households and at markets, tend to increase the rate of transmission of infection.

Table 1. The factors that influence disease outbreaks can be assessed through Open Health, allowing for design and implementation of effective control strategies.

Disappearing Sea Ice and Weather-Related Consequences

by Sheldon Drobot*, Mark Anderson, and Robert Oglesby*****

Thousands of miles away, a shrinking Arctic sea-ice cover threatens to alter weather patterns and influence human activities around the world. Over the modern satellite record (1979 to the present), the extent of the Arctic sea ice has been declining significantly in all months (Stroeve et al., 2007).

By mid-July 2007, it was clear that a new record low in summer ice extent was in the making (See http://ccar.colorado.edu/arifs). But few could have imagined that the 2007 ice cover would decline to the levels observed. The final September ice extent was 4.28 x 106 km2, 23% lower than the previous record, set in 2005.

This additional loss corresponds to an area roughly the size of Texas and California combined! Based on an extended sea ice record, it appears that the ice extent in September 2007 represents a 50% reduction compared to that recorded between the 1950s and the 1970s (See Figure 1). Computer models indicate and scientists agree that the ice will likely continue to decline in the future until the Arctic is ice free during the summer.

We can surmise that the loss of sea ice will have mixed effects. Potential benefits might include the opening of new shipping lanes, such as the fabled Northwest Passage, which would reduce transit distances. However, there are also some clear problems associated with the loss of ice.

A recent study indicated that sea ice loss would lead to less precipitation in the western United States, an area that is already struggling with water availability issues (Sewall and Sloan, 2004). Another recent study suggested that the loss of sea ice would lead to increased precipitation over portions of Europe (Singarayer et al., 2006).

The decline in Arctic sea ice also could affect specific western U.S. states like Colorado by, for example, reducing the severity of Arctic cold fronts that drop

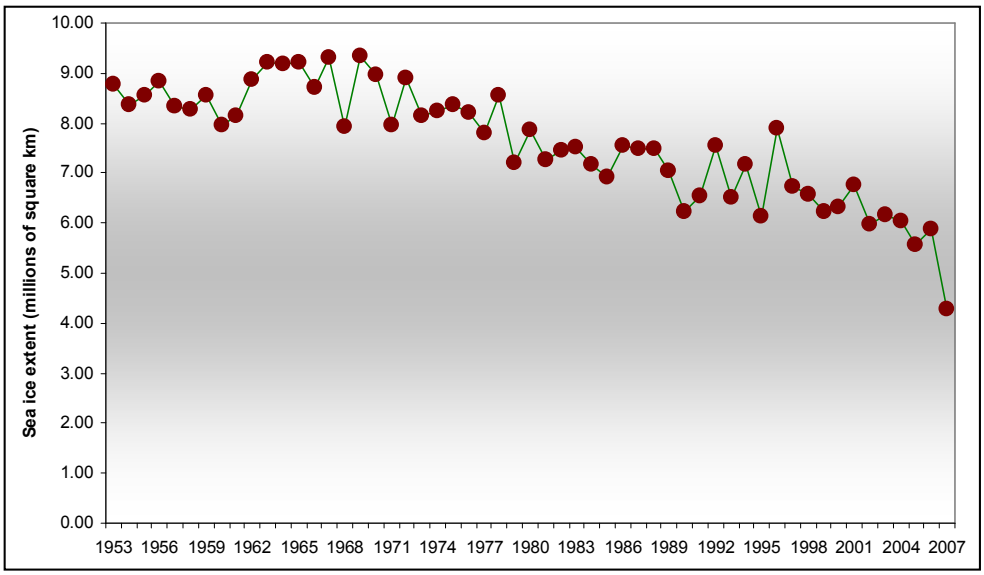

Figure 1. Each dot shows the minimum sea ice extent observed in a given year. This year's sea ice extent stands out as a record low. Figure generated by S. Drobot based on data from NASA and the British Atmospheric Data Centre.

into the West, in turn altering snowfall amounts. This would have a significant impact on the ski industry and on agriculture, among other sectors.

A recent study indicated that sea ice loss would lead to less precipitation in the western United States.

Finally, some potential consequences are largely unknown. Many of these revolve around the impacts of sea ice loss on weather patterns. How will the reduction in sea ice cover vary the formation of very cold air masses that currently migrate to the mid-latitudes? Will these air masses continue to develop? During what seasons will they form? Are milder winters and warmer summers consequently on hand for the mid-latitudes? Will severe weather continue to take place in the same regions?

The El Niño effect offers a relevant analogy; whenever we experience a strong El Niño, some parts of the United States experience drought conditions and others see more rain. We think that the loss of sea ice may cause similar changes, but we don't yet know what those changes might be.

More research is needed on how the atmosphere will change because of reduced Arctic sea ice, and soon.

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References

Sewall, J., and L. Sloan, 2004: Disappearing Arctic sea ice reduces available water in the American west, Geophys. Res. Lett., 31, L06209, doi:10.1029/2003GL019133.

Singarayer, J., J. Bamber, and P. Valdes, 2006: Twenty-First-Century Climate Impacts from a Declining Arctic Sea Ice Cover. J. Climate, 19, 1109–1125.

Stroeve, J., M. M. Holland, W. Meier, T. Scambos and M. Serreze, (2007), Arctic sea ice decline: Faster than Forecast, Geophys. Res. Lett, 34, doi: 10.1029/2007GL029703.

After WAS*IS Ecstasy, the Laundry: One Atmospheric Scientist's Experience

by Andrea Schumacher*

In July 2007, I attended the Weather and Society*Integrated Studies (WAS*IS) workshop in Boulder, Colo. Being an atmospheric scientist by training and trade, WAS*IS provided me with the exciting opportunity to learn about interdisciplinary research being done in the areas of weather, climate, societal impacts, and emergency response. WAS*IS also introduced me to a community of researchers and practitioners from various disciplines, opening the door for future collaborations.

As I returned to my job as an atmospheric researcher, though, I realized that incorporating the WAS*IS ideology into my current research on the prediction of hurricane formation and intensity change would be a slow and daunting task. I feel as though I have a dual professional life, and from my understanding, this is not an uncommon experience after WAS*IS.

Many atmospheric graduate programs and research facilities are not set up to accommodate interdisciplinary research, and those interested in incorporating societal impacts research must forge their own paths. So, in collaboration with two fellow WAS*IS participants, I began to work on a "side" project related to the human dimensions of hurricanes.

We generated a set of research questions related to the resource utilization and response of professional pet care providers during natural disasters. We then developed a research project proposal to address these questions that has since been approved by the Natural Hazards Center Quick Response program at the University of Colorado.

While drafting our Quick Response proposal, I encountered numerous obstacles related to working within a system not set up for interdisciplinary research. I will now share some of the lessons I've learned from this process with the hope that they will help other atmospheric scientists navigate the realm of social science research.

Identify and recruit champions

Identifying individuals who supported our interdisciplinary research idea was a crucial step. I found champions within my home institution, in my parent university's sociology department, and through connections with the WAS*IS community. By first identifying the colleagues most likely to support my research topic and gaining their insight and approval, I was better prepared to gain support from more reluctant colleagues and supervisors.

Know your institution's Institutional Review Board (IRB) process, inside and out

If your project will involve human subjects in any way, you may need formal approval from your IRB office. This may, as in my case, require IRB training through an online course or onsite class before your application can be considered.

My IRB office had never worked with an atmospheric scientist. This required more diligence on my part in properly explaining my needs and understanding the requirements I had to fulfill. This lack of an established relationship, which may exist at many institutions, makes the IRB approval process more time consuming. However, it also provides an opportunity for establishing a good relationship that will help you and others in your field in the future.

Understand your institution's grants and awards policies

Funding types and sources available for social science research may differ from those your grants and awards office is used to dealing with. For example, the Quick Response grant we applied for does not compensate salary or overhead, which limited the amount of administrative support I could receive for preparing the grant proposal. As with any new project, it is especially important to work closely with your grants office to avoid possible delays.

Do not give up

Working on projects outside your area of expertise can be overwhelming at times. Procedural obstacles are discouraging, and seemingly simple matters such as finding background literature and funding from unfamiliar sources can be daunting tasks. From my own experience, those in the atmospheric research field may find it particularly difficult to get involved in societal impacts and hazards research. This difficulty stems from the obstacles I've outlined above as well as a general inexperience with social science research methodology. This is a shame, since many atmospheric researchers got into the field with the goal of helping society and have a great deal to contribute to this interdisciplinary research area.

It is my hope that more atmospheric scientists with the desire to contribute to societal impacts research will get involved with the ever-growing community of scientists, practitioners and stakeholders interested in interdisciplinary weather and climate research and take the initiative to develop and act on their own research ideas.

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*Review of Storm World: Hurricanes, Politics, and the Battle Over Global Warming**

by Ken Lerner**

The U.S. suffered devastating hurricane seasons in 2004 and 2005. In 2004, storms criss-crossed Florida, highlighting its vulnerability and threatening to affect the presidential election as the government's disaster response resources were tested. The following year was incomparably worse in terms of lives and property lost as Hurricanes Dennis, Emily, Katrina, Rita, and Wilma left a trail of destruction.

It was a freakishly bumper year for Atlantic storms in general—the National Hurricane Center ran through the entire alphabet of storm names and was forced to use Greek letter identifiers for the last several storms. In the wake of these events, Chris Mooney poses the question: Is global warming making hurricane activity a bigger threat?

In *Storm World*, Mooney addresses the issue through interviews and portraits of some of the leading voices in climate and tropical storm research. He talks with Bill Gray of Colorado State University, the “Grand Old Man of hurricane forecasting,” who has made a name for himself with his annual hurricane-season forecasts. Gray is a vehement critic of any link between global warming and tropical storms and a global warming skeptic in general.

On the other side, he talks to prominent global-warming theorists such as Kerry Emanuel of MIT, Judith Curry of Georgia Tech, and Greg Holland, Director of the Mesoscale and Microscale Meteorology (MMM) Division at the National Center for Atmospheric Research (NCAR). Mooney also relates the hurricane-global warming issue to the debates over global warming, federal science funding, and censorship of scientists by the current administration (the latter is not surprising in light of Mooney's previous book, *The Republican War on Science*). Despite these dimensions, or perhaps because of them, Mooney takes great pains to provide a balanced argument.

Mooney begins with a brief history of the science of tropical storms and introduces enough technical concepts and terms to provide a basis for intelligent discussion. Mooney also presents background on how storms originate and what drives them, and describes the effects of sea-surface temperatures, wind shear, and steering winds.

Climate may affect storms, and storms may, in turn, affect climate by transporting heat from the tropics to the mid-latitudes. Mooney notes that storms in the Atlantic basin naturally attract widespread press coverage in the United States but are only part of the global tropical storm picture. Indian Ocean storms are the source of the most casualties worldwide since they make landfall in densely-populated and impoverished areas, while the Pacific Ocean produces the greatest number of storms with the most intense strengths.

As readers, we benefit from meeting some of the scientists and getting to know them, but we are also dragged through sometimes wearying accounts of each camp's criticism of the other.

The book is not really an attempt to answer the question of whether global warming is driving an increase in storm frequency or intensity. Instead, it is a journalistic treatment of the controversy, the competing theories, and the debates that have taken place at academic meetings and in the press.

As readers, we benefit from meeting some of the scientists and getting to know them, but we are also dragged through sometimes wearying accounts of each camp's criticism of the other and debates over who will and won't sign this or that public statement. The book describes storms, but is largely devoted to the human s*turm und drang* surrounding the issue.

Taken as a whole, the book is a balanced, well-written treatment of a controversial issue at the boundary of science and politics. Mooney's thoroughness is evidenced by 290 endnotes, a long list of interviews, and the five pages of bibliography and recommended reading that accompany the text.

Mooney defers to the experts on the key question. As he comments in Chapter 14, "We watch scientists battle, and no matter how much of their debates we think we understand, if we're honest we know they're always a little bit ahead of us, knowing a little bit (or a lot) more." He makes a sensible plea for enlightened, fair, and accessible discussion. He also calls for a focus on preparedness, since it is clear that destructive storms will continue to occur, whether or not we think we know why.

*Mooney, Chris, 2007. *Storm World.* Orlando: Harcourt.

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Write Your Own Review!

If you would like to write a review on a similar book for a future issue, please send your ideas to Emily Laidlaw at laidlaw@ucar.edu.

*Review of Storm World: Hurricanes, Politics, and the Battle Over Global Warming**

by Kate Eschelbach**

Chris Mooney does an incredible job portraying the current debate over whether global warming is causing an increase in hurricane intensity, as well as providing a comprehensive history behind that debate. *Storm World*, like the full title promises, covers every aspect of the science behind how hurricanes form, details on predicting their scope, frequency, and intensity, the politics that scientists encounter, and the battles that have ensued between scientists.

Mooney makes it clear that the book is not about whether or not global warming exists. The book, rather, is about whether or not hurricanes are increasing in number and intensity due to global warming and understanding why there is not a solid consensus on that issue.

Overall, this is a wonderfully detailed book that takes the reader though a history of hurricane prediction research and its intersection with the field of climate modeling. It also connects the reader to the researchers themselves, presenting all sides of the story as it unfolds while giving the reader the opportunity to see the research and political timeline develop through the scientists' eyes. This approach enables the reader to truly understand why there is still a debate and why, despite that indecision, decision makers still need to act.

After telling the story from all sides, Mooney asks: Why does it matter whether or not hurricanes are getting stronger or more frequent? Then he asks a question that is of utmost relevance: Even if it is not resolved that hurricane intensities are driven by global warming, shouldn't we still put more attention towards protecting ourselves against them?

An underlying theme throughout the book points to the fact that there are a number of large, vulnerable coastal cities, including but not limited to New Orleans, that have been spared the full attack of a hurricane. Mooney says that one of the things the leading scientists actually agree on is that the outlook for these cities isn't good.

He asks a question that is of utmost relevance: Even if it is not resolved that hurricane intensities are driven by global warming, shouldn't we still put more attention towards protecting ourselves against them?

We are very vulnerable to hurricanes along our coastlines, and that vulnerability is not going away. We need to use the science that we know now about hurricanes to determine ways to protect these vulnerable areas through more intense risk assessments, building codes and other hazard mitigation strategies such as habitat restoration. Mooney also argues that we need more scientists to help bring the most current scientific relevance to the public, whether it is to policy makers or the media or to anyone trying to understand how the most current findings relate to their lives.

Ultimately, I think this book, especially the last chapter which includes Mooney's powerful conclusions about the debate and its relevance to our communities, should be read by anyone who not only has an interest in the hurricane debate, but also has an interest in the effects hurricanes might have on society.

*Mooney, Chris, 2007. *Storm World.* Orlando: Harcourt.

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As sea ice continues to melt, scientists contemplate how many more years we may be able to see icebergs in the summer.
(Photo by Rear Admiral Harley D. Nygren, NOAA Corps, ret.)

From the Director

Is There a Future for Public Weather Services?

by Jeff Lazo*

Fifteen years ago I was a brand new assistant professor at Penn State when some grad students asked me what I knew about this thing called the "World Wide Web." Some of the things it could do sounded pretty cool, so we arranged for Computing Services to demonstrate the new technology for us.

At the time I never imagined that today I could be sitting in Heathrow airport outside London after checking in online the day before, reading e-mails from work over a wireless Internet connection, listening to John Mayer on an iPod, and using the cell phone in my pocket to call home. And even then I'm nowhere near as technically or cognitively proficient as those of the "Millennial Generation"—those born from around 1977 to 1995—who seem able to IM, talk on a cell phone, surf the Web, and carry on a conversation at the same time.

So when we were asked at a recent World Meteorological Organization (WMO) symposium to present a vision of what public weather services (PWS) will look like in 20 years, I realized I had no idea what would happen by 2028 . . . except that things will likely be very different in ways that I cannot imagine.

As I tried to predict future challenges for public sector meteorology, it occurred to me that this could be a moot question. Why, in 20 years, couldn't a private-sector for-profit company provide all the services, products, and activities of PWS for all countries in the world? But when I tried to present this as a possibility, others at the symposium dismissed it saying, "It's never going to happen because public weather services do things that are impossible for the private sector to do."

So I asked what makes PWS stand for *public*—instead of *private*—weather services, and whether anything could change if a competitive private-sector firm wanted to enter the market. I came up with three elements that currently provide justification for "public" services:

1. *The high fixed costs of observing and forecasting systems*
2. *The role of public entities in generating and disseminating watches and warnings to the public*
3. *The difficulty of charging prices for or obtaining revenues from the provision of weather information*

First, do weather observing and forecasting systems cost too much for a private company to develop on their own? About 42% of all current satellites are primarily for commercial use and are likely privately owned and operated (UCS Satellite Database 2007), so it wouldn't seem that satellites are the main obstacle.

And technological advances are likely to become much cheaper over the next 20 years. Private-sector ground-based observation systems seem feasible as well (think WeatherBug). Supercomputers are no longer a barrier either, given the exponentially increasing power of computer hardware.

Second, it is well understood that it is the duty of governments to provide watches and warnings to protect the physical and economic well-being of their citizens. This doesn't mean that the public sector is necessarily better at this than the private sector. It seems possible that in the future a government may find it more cost-efficient to contract these activities to a private-sector firm—perhaps especially in smaller countries where economies of scale could allow a private-sector firm to provide hydromet services across a number of small countries for less money than the countries would spend individually.

Heavy snow blankets a roof near downtown Aspen, Colo. after a January snowstorm produced over 2 feet of snow in 48 hours. (Photo by Emily Laidlaw)

Isn't it also conceivable that in the next 20 years or so watches and warnings could be generated efficiently, automatically, and directly to individuals in a way that would deliver these messages through advanced technologies that will supersede or combine cell phones, PDAs, and GPS devices?

Third, the types of information provided by PWS are considered to be public goods and, based on the characteristics of public goods, it is not possible to charge a price for such information. If firms can't charge for their services, they won't be in business long. But as technology changes, so do the characteristics of goods and what was once a nonexcludable public good may one day be an excludable private good. The Office of the Federal Coordinator for Meteorology estimates that U.S. government spending on meteorological operations

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Readers Share Thoughts through Satisfaction Survey

by Emily Laidlaw*

It's hard to believe that it's been nearly a year and a half since we first published *Weather and Society Watch*! We started the newsletter to foster discussion, encourage debate and expand perspective about societal impacts of weather and weather forecasting. We've wondered how we've been doing in achieving that mission, so in November we asked our regular subscribers to tell us through an online survey.

Now, we would like to thank the 84 generous readers who responded and report on some of our key findings, as well as some of the changes we plan to implement in response to your input. To see complete results of the survey, please visit http://www.sip.ucar.edu/news/readersurvey.

With respect to our mission,
- 84% of respondents strongly agreed or agreed that the newsletter offers new perspectives on the societal impacts of weather and weather forecasts
- 74% of respondents strongly agreed or agreed that the newsletter helps them stay updated on weather-related societal impacts research, conferences, and other opportunities
- 74% of respondents strongly agreed or agreed that the newsletter contains relevant content about weather's general impact on society
- 52% of respondents strongly agreed or agreed that the newsletter helps them stay updated on colleagues' work
- 44% of respondents strongly agreed or agreed that the newsletter enables them to stay updated on NCAR publications and activities.

In response, we plan to increase efforts to provide information about what you and your colleagues are working on or interested in by including short summaries in each issue from readers on their interests and research.

With respect to the quality of the newsletter,
- 70% of respondents said the expertise of our contributors is of very high or high quality
- 62% of respondents said the variety of our content is of very high or high quality
- 57% of respondents said the diversity of our authors is of very high or high quality
- 54% of respondents said the depth of our content is of very high or high quality.

In response, we will include a greater diversity of contributors and work to further incorporate our international audience in each newsletter, as we have done in this issue. We also plan to increase interdisciplinary knowledge and depth by including more in-depth research articles that provide readers with an understanding of research methods from various fields of the social sciences.

With respect to overall satisfaction with the newsletter,
- 71% of respondents reported being very or somewhat satisfied with *Weather and Society Watch*
- 6% of respondents said they are neither satisfied nor dissatisfied
- 1% of respondents reported being somewhat dissatisfied.

In response we believe that while these results are encouraging, we are still focused on serving our readers even better! And we hope that we will be able to show an even greater level of reader satisfaction in future surveys!

Many of you also took the time to write in comments on topics ranging from how often you think the newsletter should be published to how we could improve *Weather and Society Watch* to your thoughts on SIP's other information resources. We appreciate your taking the extra time to provide this helpful feedback, and we promise that your thoughts have been heard!

For those of you who may not have had time to complete the reader satisfaction survey, it is never too late to let us know what you think. You can always send your thoughts to laidlaw@ucar.edu or visit our online feedback page at http://www.sip.ucar.edu/news/submit.jsp.

As always we thank you for reading *Weather and Society Watch*, and we look forward to continuing to bring you pertinent and timely information about the societal impacts of weather and weather forecasting!

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A January snowstorm covered residential streets near downtown Aspen, Colo. with more than 2 feet of snow in 48 hours.
(Photo by Emily Laidlaw)

flooding rains are a high priority in Cuba. To meet these challenges and to improve agriculture and marine meteorology in general, the Cubans could benefit greatly from increased computer power, improved communication networks, and a larger community of scientists and technicians educated in modeling and data assimilation.

At the same time, Cuba may have lessons for the United States and other countries in hurricane awareness and preparation. Cuba has a history of extensive hurricane planning at national through local levels, and widespread evacuations are standard practice. Hurricane Ivan killed at least 25 Americans and at least 65 others across Venezuela and six Caribbean islands, but no storm-related deaths were reported in Cuba, despite estimated property damage of more than $1 billion USD.

Rick Anthes poses with students during his trip to Cuba (Photo courtesy of Rick Anthes)

Coincidentally, my research visit overlapped with the IV Congreso Cubano de Meteorología, and I was asked by my Cuban colleagues to use this opportunity to talk informally to a larger audience about meteorological trends in the United States. The Congress was held at the Capitolio, a stunningly beautiful building (modeled after the U.S. Capitol) that used to house the Cuban legislature before the revolution, located in Havana's historic downtown. This venue for the congress of more than 200 professionals from Cuba, Mexico, and many countries in Central and South America could not have been more impressive.

Thus I got to see the opening ceremonies of the Congress on Tuesday morning, which started with the annual SOMET Awards, given this year to two Cubans, Raimundo Vega and Roger Rivero. Vega, from the Climate Center at INSMET, was presented a lifetime achievement award for his contributions in climate. Rivero's award was based on his development of an early-warning agricultural alert system for droughts. Rivero currently works at the Provincial Meteorological Center in Camagüey.

Following the awards ceremony, an orchestra of young people ranging in age from about 8 to 15 played a short program of lovely chamber music. The concert ended with an inspiring song about the environment, written by one of the women who works at INSMET.

I then gave a presentation, using my own slides which Os had translated into Spanish for me. The translations were extremely helpful because few people in Cuba speak or read English. My talk, which was also translated as I gave it by a colleague, Dr. Israel Borrajero, consisted of two themes, weather and climate change. I linked these topics through hurricanes.

I showed progress in hurricane forecasts in the United States, founded on improving observations and models. Then I summarized the 2007 assessment of the Intergovernmental Panel on Climate Change (IPCC), which declared global warming "unequivocal," and ended by speculating on how global warming would affect hurricanes in the future.

These topics were obviously of keen interest to the audience, which followed my 25-minute talk carefully, and when it was over I received many questions. One global warming skeptic claimed that I and the IPCC had it all wrong, that the warming over the past century was just natural and the result of solar variability. He also pointed out that Hurricane Katrina did not prove anything about global warming (I never said it did). His long "question" was more of a speech, and reminded me of many such rebuttals from skeptics in the United States.

After the session adjourned, a Cuban reporter interviewed me and asked some pointed questions, to which I gave short, obviously simplified answers:

What do you think about the state of Cuban meteorology?
Excellent 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 societies (lower-case and non-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, friendships, and exchanges of ideas, science, and technologies.

They could not understand why the United States continues its policy of a tight embargo, and I could come up with no good explanations. Far from encouraging change in Cuba, the embargo serves to entrench hostile positions on both sides. This was brought home by the prominent anti-American government billboards and posters displayed throughout the city.

It seems to me that we should eliminate or at least start relaxing the embargo and establishing contacts between people in Cuba and the United States, preparing for a time when the leadership of both countries realize that we all have more to gain by cooperating, trading, communicating, and sharing ideas than maintaining this ancient embargo. We have made peace with Japan, Vietnam, China, and other previous enemies of the United States. Isn't it time to do so with neighbors and friends who live less than 100 miles from our shores?

* Dr. Richard A. Anthes (anthes@ucar.edu) is president of the University Cooperation for Atmospheric Research (UCAR) and president of the American Meteorological Society (AMS).

Inside El Capitolio, in Havana, home to the Cuban legislature until 1959 (Photo by Rick Anthes)

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 than is currently available to them. A vast majority of respondents indicated a willingness to receive 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 (Morss forthcoming; manuscript available from the authors).

Future research could employ other social science methodologies, such as interviews 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

Morss, R. E., J. L. Demuth, and J. K. Lazo. Forthcoming. Communicating uncertainty in weather forecasts: A Survey of the U.S. public. Submitted to *Weather and Forecasting.*

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 2006, 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 developing and developed 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 influencing factors?*
- *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 information communicated or delivered to each user sector? Is this delivery method appropriate?*
- *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 preparations for 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 agreed to serve as the 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 Climate Variability and Change: Understanding the Uncertainties and Managing the Risks into the follow-up action on the MAP;*
- *Channel 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 2010 for the proposed Madrid + 5 Conference.*

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Director *(continued from page 10)*

and supporting research in fiscal year 2007 was about $3.4 billion (OFCM 2007). Spiegler estimates U.S. private-sector activities at about $1.7 billion.[1] This indicates total U.S. meteorological spending on the order of $5–$6 billion a year, or about $53 a year per U.S. household, or around $1 a week. With the inevitable changes in information delivery technology over the next 20 years, it seems that a private-sector firm could find an efficient means of extracting a couple bucks a week per household for weather forecasts.

I'm not saying with any certainty that PWS will be defunct in the future. Here I've taken a very simplistic view of potential barriers to a private firm entering the weather information provision market in a way that would make it redundant for the public sector to continue what it is doing now. I would say, though, that because the future is very uncertain and given that technology is evolving rapidly, PWS will likely need to think outside the box in order to continue serving the public of the future.

*Jeff (lazo@ucar.edu) is the director of NCAR's SIP.

References

Office of the Federal Coordinator for Meteorology, 2006. *The Federal Plan for Meteorological Services and Supporting Research: Fiscal Year 2007*. Silver Spring, MD: U.S. Department of Commerce/NOAA

Spiegler, D.B.2007. *The Private Sector in Meteorology- An Update. 2007.* http://www.ametsoc.org/boardpges/cwce/docs/DocLib/2007-07-02_PrivateSectorInMeteorologyUpdate.pdf/

Union of Concerned Scientists Satellite Database. http://www.ucsusa.org/global_security/space_weapons/satellite_database.html.

Footnote

[1] "The total current Private Sector Meteorology market exceeds $1.5 Billion. Based on all the information accessed and analyzed, the margin of error in this estimate may be conservative by 10-20% or more, resulting in a total market size between $1.65 and $1.8 Billion, and perhaps as high as $2 Billion." (Spiegler 2007, p.20-21)

Health *(continued from page 5)*

in the geographical distribution and intensity of disease risk up to five years ahead would allow sufficient time to increase national and district level awareness; adjust immunization programs; and, raise funding to produce and deploy additional vaccines and other preventive measures.

The *Open Health* system works at every level. In districts, surveillance improves by virtue of filling the gaps and reducing the overlaps between existing systems, providing health information managers with a single decision support system. Critical data on real-time evolution of disease is entered quickly and easily, allowing rapid identification of health risks when combined with national and global routine health information and environmental and demographic data.

Open Health eases the inclusion of these external data, improving risk analysis and identification and increasing the effectiveness of subsequent health interventions. The factors responsible for specific disease risks can be calculated within modules embedded in *Open Health* using its own internal data archive and data acquisition portal. This data acquisition portal is able to access facilities such as the International Research Institute for Climate and Society (IRI)'s *Maproom* and its extensive data library, which synthesizes and compiles disease-relevant weather and climate information. Examples of such information, which can be included in various disease transmission models, include rainfall totals, vegetation indices, and temperature data.

MERIT is a guiding example of the cooperation that is possible among health, environment, and social science researchers and practitioners. Establishing such linkages can be an important step in developing and delivering the tools needed to combat climate-sensitive diseases.

*Dr. David Rogers (drogers@bluewin.ch) is president of the Health and Climate Foundation in Marchissy, Switzerland.

Conferences & Announcements

WAS*IS Summer 2008 Workshop

Are you passionate about the societal aspects of meteorology? The NCAR Societal Impacts Program (SIP) is happy to announce that it will hold a 2008 Summer WAS*IS workshop, contingent upon funding. WAS*IS is a grassroots effort to fully integrate social science into meteorological research and practice. WAS*IS is doing this by building an inter-disciplinary community of practitioners, researchers, and stakeholders who are dedicated to this vision, and by providing this community with ways to explore related ideas, methods, and examples. See the Bulletin of the American Meteorological Society (BAMS) article for more information (http://ams.allenpress.com/archive/1520-0477/88/11/pdf/i1520-0477-88-11-1729.pdf).

More information about the workshop and how to apply will be posted on the WAS*IS Web page (http://www.sip.ucar.edu/wasis) by February 15, 2008.

Joint WAS*IS and AMS Summer Policy Colloquium Reception at AMS Annual Meeting!

Who: Everyone! Bring your friends!
Why: To meet others who are interested in science policy and societal aspects of meteorology, including WAS*IS alumni and the AMS Summer Policy Colloquium
When: Tuesday, Jan. 22, 8-10 p.m.
Where: Windsor Room, Hilton New Orleans Riverside Hotel
How: Sponsored by the NCAR Societal Impacts Program

To see more announcements and opportunities, including job opportunities, please visit *Weather and Society Watch* on the Web at http://www.sip.ucar.edu/news.

About *Weather and Society Watch*

Weather and Society Watch is published quarterly by the Societal Impacts Program (SIP) at the National Center for Atmospheric Research (NCAR). The University Corporation for Atmospheric Research (UCAR) operates NCAR with support from the National Science Foundation (NSF) and other sponsors.

The purpose of *Weather and Society Watch* is to provide a forum for those interested in the societal impacts of weather and weather forecasting to discuss and debate relevant issues, ask questions, and stimulate perspective. The newsletter is intended to serve as a vehicle for building a stronger, more informed societal impacts community.

Any opinions, findings, and conclusions or recommendations expressed in this publication are those of the author(s) and do not necessarily reflect the views of NSF or other sponsors. Contributions to *Weather and Society Watch* are subject to technical editing and copy editing at the discretion of SIP staff.

Weather and Society Watch is available on the World Wide Web at: http://www.sip.ucar.edu/news/. Archives of *WeatherZine*, a previous weather impacts newsletter upon which *Weather and Society Watch* was modeled, are available on the Web at http://sciencepolicy.colorado.edu/zine/archives/.

Contact Us

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About SIP

All aspects of the U.S. public sector, along with the nation's economy, are directly and indirectly affected by weather. Although the economic impacts of weather and weather information on U.S. economic agents have been loosely documented over the years, no definitive assessments have been performed, and information generated from the previous studies is difficult to locate and synthesize.

SIP, initiated in 2004 and funded by NOAA's U.S. Weather Research Program (USWRP) and NCAR, aims to improve the societal gains from weather forecasting. SIP researchers work to infuse social science and economic research, methods and capabilities into the planning, execution and analysis of weather information, applications, and research directions. SIP serves as a focal point for developing and supporting a closer relationship between researchers, operational forecasters, relevant end users, and social scientists concerned with the impacts of weather and weather information on society. Program activities include primary research, outreach and education, and development and support for the weather impacts community.

For more general information on SIP, contact Jeff Lazo at lazo@ucar.edu or http://www.sip.ucar.edu.