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Station Scientists: Overcoming the Boundaries Between Meteorological and Societal Impacts Research

by Daniel Nietfeld*
Guest Editor**

Suppose an automobile manufacturer is focused on researching the development of a new car with the fastest, most efficient engine possible. The company knows it might have some success selling the car based solely on its technology. But the company understands that, while making a faster, more efficient car might be an important goal, it needs to work closely with drivers to ensure that the car meets their needs beyond just speed and efficiency. The driver must understand how to operate the car. This car manufacturer knows the importance of the human dimension. Similarly, if the weather industry has a goal of protecting life and property, the human dimension is a critical component.

Within the National Oceanic and Atmospheric Administration's (NOAA) National Weather Service (NWS), there are "station scientists" found at each of the Warning and Forecast Offices (WFOs), as well as at the River Forecast Centers (RFCs), and at national centers such as the Storm Prediction Center, the Aviation Weather Center, and the Tropical Prediction Center. Most of these dedicated scientists have the title of Science and Operations Officer (SOO), except in the river forecast centers, where they have the title of Development and Operations Hydrologist (DOH). Logic would argue that if there is research to be done that involves the human dimension of protecting lives and property, good science is paramount to solving problems. It would stand to reason then, that the station scientist would be the ideal person to lead any research activities that are aimed at solving these problems.

However, the logic just described often quickly runs into the cultural road block of tradition because of the imaginary walls that separate the notion of an atmospheric problem, such as understanding tornadogenesis, from the notion of a human decision problem such as understanding tornado warning response. Both are

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A double rainbow colors a hail shaft on the backside of a supercell in Fowler, Colo. (Photo by Scott Blair)

In This Issue

Can You See What I'm Saying? Some Thoughts on a Modified Basic SKYWARN Training Program for the Blind

by Tom Behler*

Prior to my recent move to Colorado, I served for many years as a county Amateur Radio SKYWARN Net Coordinator. I'm also incurably enthusiastic about all things meteorological. Combine these two elements, and you'll understand why I've been attending National Weather Service (NWS) Basic SKYWARN Spotter Training sessions for at least the last ten years. In the area of Michigan where I previously lived,, meteorologists from the Grand Rapids, Michigan, NWS office give these sessions. The sessions have been excellent and very well received. Jamie Bielinski, the warning coordination meteorologist for the Grand Rapids office, gave the most recent session. She gave an absolutely outstanding presentation to the class, complete with lots of visuals, many stormspotting "war stories," and even some small prizes for those who correctly answered quiz questions.

As I sat in the training class that evening, an idea suddenly occurred to me: "Could an enhanced basic SKYWARN training program be developed for the visually impaired?" I suspect that, to many readers of this article, the question may appear at first to be rather strange. Yet the question will seem much less odd when I tell you that I'm legally totally blind, constantly thirsting for meteorological knowledge, and frustrated by the highly visual nature of the tools used to communicate relevant weather-related information.

As Jamie presented the usual materials about how severe thunderstorms form, their stages of development, and the various types of clouds that need to be monitored closely for hail and tornadic activity, I began to wonder how the basic SKYWARN curriculum could be made to be more "blind friendly." I'm sure that the graphics in most SKYWARN classes are informative, easy to follow, and impressive. Those of us who are blind, however, miss all that interesting information.

Dozens of questions filled my mind as I gave this issue more serious thought. How could we get a blind person to "see" the various stages of a severe thunderstorm? How could we show a blind person what a tornado looks like? How could we describe the various types of clouds associated with severe thunderstorms? How might the importance of "tilt" as a condition that either feeds or starves a thunderstorm be communicated to a blind person? How could the structure, composition, and location of various segments of a thunderstorm cell be described? Also, how could the answers to these questions best be communicated? Would enhanced verbal descriptions be adequate? If so, what would the descriptions be like? Or might a physical model be a more fruitful path, and how might it be developed? I don't have definite answers to these questions, but they offer an enormous array of opportunities for future research and outreach efforts.

To illustrate what a helpful verbal description for the blind might look like, I'll start with my own description of a tornado. This description has grown from my knowledge of tornadoes and from bits and

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This ten-minute long tornado developed across the open countryside of west Texas. Damage was limited to a few snapped power poles. (Photo by Scott Blair)

Water and Society: Integrated Studies of Water Resource Challenges

by Wendy Pearson*

The National Weather Service (NWS) Central Region hosted the first ever Weather and Society Integrated Studies (WAS*IS) workshop focused on hydrology August 25-27, 2009, in Kansas City, Mo. Unlike past WAS*IS workshops, which have focused exclusively on weather, the Water and Society workshop focused on water resource challenges. The workshop brought together 32 social scientists, water resource professionals, and NWS hydrologists seeking to gain new insights into opportunities and solutions to water resource challenges, to align water resource outreach efforts, to strengthen emerging partnerships, and to inspire interdisciplinary collaborations.

A water resource decision makers' panel discussion led by a drought expert, a representative from a drinking water utility, and an emergency manager opened the conference. Panel members explained their job responsibilities, anticipated future water resources information needs for the next 10 years, and shared ideas on how water resources stakeholders can work together more effectively.

For a majority of the two and a half day workshop, participants worked in large and small group discussions, brainstorming solutions to challenges and identifying opportunities related to effective communication, social media, forecast uncertainty, interdisciplinary studies, and integrated water resources science and services. Workshop activities also included a tour of the Missouri Basin River Forecast Center in Pleasant Hill, Mo., and a tour of the Brush Creek Plaza Mitigation Project, provided by Brian Rast, U.S. Army Corps of Engineers.

Following are a few comments from workshop participants:

> "Having a good mix of partners at this meeting helped better demonstrate the value of using social science techniques."

> "Just learning of the potential resources available to move forward with this endeavor (interdisciplinary collaborations with social scientists) has been invaluable."

> "Definitely got me thinking in new ways!"

> "I had no experience with social science and societal impacts. I have many new ideas regarding new projects and collaborations with customers and partners."

> "Learned the comprehensiveness of water resources and the challenges each agency and partner faces."

> "This was definitely a huge learning experience for me. I learned so much about our partners and how my job ties into the 'whole group'! As a result, of better understanding my role, I can better contribute to the larger goals at hand."

Wendy Pearson, hydrologist for NWS Central Region Headquarters, Kevin Low, service coordination hydrologist for the Missouri Basin River Forecast Center, and Steve Buan, service coordination hydrologist for the North Central River Forecast Center, collaborated with Eve Gruntfest, director of the Social Science Woven into Meteorology (SWIMM) initiative at the National Weather Center, to organize the workshop. Seven of the NWS's 13 new service coordination hydrologists attended this workshop, as well as one hydrologist-in-charge, three service hydrologists, representatives from three NWS regional offices, two social scientists, a representative from the National Hydrologic Warning Council, NWS weather forecasters, and stakeholders.

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From the Director: What Are Social Sciences?

by Jeff Lazo*

A meteorologist colleague recently mentioned that it would be helpful if someone explained what the social sciences are. Here is my attempt to begin to do so. I will caveat this by pointing out that I am an economist by training and, although I have worked with experts from several different social sciences, I don't claim expertise in any of these disciplines. Thus I am happy to receive input, corrections, and/or additions on anything I say about other social sciences—and on economics as well.

I hope you've noted that for the last few issues of *Weather and Society Watch* we have been soliciting and publishing articles along disciplinary boundaries in an attempt to provide more understanding and perspective on the social sciences to our readers (e.g. Tom Behler on sociology in January 2009; Alan Stewart on psychology in April 2009; Gina Eosco on communication in July 2009). We want to develop these articles into a set of resources to help those from outside the social sciences develop a better understanding of the capabilities and constraints of the social sciences. We encourage contributions to this endeavor.

A few questions relate to this effort. The first is, "Why understand what social sciences are?" As we've discussed often in the pages of *Weather and Society Watch,* there is a strong movement in the weather community to better integrate with the social sciences. But underlying this recognition of the importance of developing an end-to-end-to-end weather enterprise is only a vague notion of what the social sciences are and what they can do. This is partly because many of those calling for this integration are physical scientists who, although passionate about doing a better job to benefit society, don't fully understand the opportunities an integrated weather enterprise presents—and the constraints associated with this desired integration.

The second question is, "What is the difference between doing social science and measuring societal impacts?" I would still like to clarify this better in my thinking, but there is a lot of societal impacts interest and concern in the weather community that doesn't really require or map one-to-one into social sciences. That is to say that there is a difference between undertaking social sciences and examining societal impacts. Counting dollar damages or people injured or killed may be societal impacts but it is not necessarily social science. I think this distinction is critical to the future of integration into the weather enterprise and suggest that others consider contributing thoughts on this.

Briefly I may say, very simplistically, that measuring societal impacts is largely driven by observation and generally produces data and information. I believe that undertaking social science should be driven by theory and, in addition to producing data and information, should produce "knowledge." I worry that many people may feel they are doing social science, when in reality they more generally are largely measuring impacts. While the process of measuring impacts is extremely important and often useful in context, it should not take the place of social science.

Finally, the third question is, "Given the desire for integrated and interdisciplinary, multidisciplinary, or even transdisciplinary work, why is it important to discuss specific disciplines, also known as stove pipes in some perspectives?" There are several fundamental reasons for maintaining something of a disciplinary perspective:

- Many of the people we should be connecting with still define themselves by disciplinary boundaries
- Most academic and even federal institutions are still structured this way and people are still hired along disciplinary lines
- There is incredible depth with each and every discipline, requiring experts and specialists in each discipline. We cannot and should not all be generalists.

Hiring a "social scientist" is rarely, if ever, the answer to the needs of an organization such as NWS or the weather enterprise. Understanding differences and commonalities is critical to getting the right input.

What is social science?
Social sciences are a group of academic disciplines that study human aspects of the world.

The social sciences include anthropology, communication, demography, economics, geography, history, political science, psychology, and sociology. Every social science has a rich history of theory, methods, and applications with outstanding experts in each field and a depth and diversity often unknown to those outside of the discipline.

Even with disciplinary boundaries seemingly well defined—at least while applying to a grad school—in reality many of these boundaries are blurred. For instance, there is an increasing overlap between psychology and economics as some areas in both disciplines study individual human behavior and decision making. So while I cannot adequately and fully explain "social sciences" in a single short article, I'll try to provide a few thoughts on the different disciplines.

For the (potentially incomplete) list of social sciences below, I've attempted to (1) provide a brief definition of the field (Okay, I stole most of these from the universal repository of knowledge called Wikipedia – actually from Simple Wikipedia!), (2) list a few Weather and Society * Integrated Studies (WAS*IS) colleagues or friends of WAS*IS with formal training in this discipline (I know I missed several people out of the nearly 200 WAS*ISers and ask you to help me fill out this list further if I missed you!), and (3) give examples of some of the questions / issues this field could address. I will preface by saying that some of this information has appeared elsewhere (e.g. the report of the NOAA Science Advisory Board Social Sciences Working Group, available online at **http://www.sab.noaa.gov/Reports/2009/SAB_SSWG_report_FINALtoNOAA_041609.pdf**.

Anthropology *(Heather Lazrus, Karen Pennesi, Jennifer Spinney)* is the study of how people live their lives now and how they may have lived them in the past. It is a holistic discipline dealing with the integration of different aspects of the social sciences, humanities, and human biology including anthropological linguistics, social and cultural anthropology, ethnology and ethnography.

- Understanding issues of vulnerable populations and weather and climate impacts
- Increasing effectiveness of resource management policies in various socio-cultural environments

Communication *(Gina Eosco, Jenifer Martin)* deals with processes of communication, commonly defined as the sharing of symbols over distances in space and time, encompassing a wide range of topics and contexts ranging from face-to-face conversation to speeches to mass media outlets, such as television broadcasting.

- Developing methods of communication of NOAA products and services to various stakeholders
- Understanding best practices in presenting and communicating uncertainty in scientific assessments related to weather variability and climate change.

Economics *(Jeff Lazo, David Letson, Dan Sutter, Rebecca Moore, Steven Stewart)* is the study of how people try to make use of limited resources to get what they want. Economists study "human behavior as a relation between scarce means having alternative uses."

- Establishing net benefits of programs for budgetary justification and program evaluation
- Understanding incentives of participants and stakeholders in organizational and economic processes relevant to NOAA missions

Geography *(Eve Gruntfest, Isabelle Ruin, Matt Biddle, Olga Wilhelmi, Burrell Montz)* is the study of the Earth and its features, its inhabitants, and its phenomena. Human geography focuses largely on the built environment and how space is created, viewed and managed by humans, as well as the influence humans have on the space they occupy

- Investigating behavioral responses to weather risks
- Developing strategies to improve hazards communication

History *(Roger Turner)* is the continuous, systematic narrative and research of past events as relating to the human species, as well as the study of all events in time in relation to humanity.

- How has the science of meteorology developed over time and what weather events have affected or been dealt with in history
- How has society responded to weather risks over time through

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Boundaries (continued from page 1)

very legitimate and highly important problems. Both take a lot of research. Both require good science using the scientific method and research techniques that ensure scientifically sound conclusions. But despite these similarities, the culture of traditional weather research has etched boundaries in the field that have kept meteorology in and human dimensional components out.

These cultural boundaries are a scientific shame because a station scientist should be in position to lead research efforts that need to be addressed, despite the nature of the equation that is being derived, or the survey results that are being interpreted. After all, if the station scientist isn't in a position to lead these efforts, the entire staff is crippled in doing that work.

For example, if a forecaster wants to do a study to determine how various outdoor warning siren policies are interpreted throughout a community, the project requires expertise in scientific techniques that will enable the forecaster to reach scientifically sound conclusions. The station scientist, then, is the critical person to assist the forecaster in that project, providing instruction, guidance, advice, and fostering collaboration with outside partners. Structurally, that project could have a similar outline to another forecaster's study designed to examine hundreds of winter storms for the purpose of learning the role of the jet stream in heavy snow production. In the later scenario, the role of the station scientist is clear, and he or she is the natural "research expert" who would be involved in that project.
Reality in most operational weather institutions is very different, however. Unfortunately, the invisible walls that separate meteorological research and societal impact research do exist, and they are sometimes dauntingly tall. Ironically, some research that is being done or has been done was intended and assumed to be pure meteorological research; however, the implications and conclusions appear to be more oriented toward societal impacts research. For example, some studies that have been done to show the use of ensemble forecast data concluded with results that at least indirectly explained human decision support. In other words, the invisible walls and boundaries are often crossed, without the researcher—or station scientist—realizing it. But the walls do need to come down, and they need to come down permanently. Otherwise, an egregious waste of societal impact research potential will continue.

Operational forecast offices have the unique advantages of being close to the people who are impacted by weather events, while also having extensive research resources available to them. The potential cross-discipline meteorological-social science studies that could be done, especially in cooperation with other research entities, are infinite. Therefore, it is quite critical that station scientists, in the near future, be prepared to help lead these societal impact research efforts, overcoming a culture that historically has not allowed them to develop such projects.

If tradition indeed created the culture that inhibits this mentality, the tradition itself needs to mature. And there is hope! For example, as of the fall of 2009, four NWS WFO SOOs have been through the Weather and Society * Integrated Studies (WAS*IS) program, which was created to comprehensively and sustainably integrate social science into meteorological research and practice. Like many instances of culture change, the earlier a paradigm shift occurs in the weather enterprise, the higher the likelihood that the resulting cultural changes will be successful and permanent.

One way to accomplish this early paradigm shift is to promote the entrance of people into the weather industry who have not inherited the culture of invisible walls. We need to strive for foundational education that incorporates societal impacts thinking into the curriculum. Students entering a college program who are pursuing a degree in weather should have the opportunity to be trained in assessing and understanding the societal impacts of weather. Students should be able to learn about the weather while simultaneously learning how society is impacted by the weather, as part of a holistic approach.

It isn't that hard to imagine the day when a student might earn a Bachelor of Science degree in the Societal Impacts of Weather. After all, there seems to be a natural demand. There seem to be as many people who are interested in the impacts of a winter storm as there are people who are interested in the winter storm itself. A few graduate programs are beginning to embrace the concept of this educational framework, and hopefully this trend will continue, eventually whittling down the debilitating walls.

For whatever reason, the paradigm of traditional disciplines has resulted in a detrimental gap that must be bridged. New forecast products continue to be designed by meteorologists without complimentary research on users' understanding of those forecast products, but they don't have to be (nor should they be). There have been some recent efforts in this direction that are evidence of improvement, such as the involvement of the Social Science Woven into Meteorology program at the National Weather Center and the University of Oklahoma in the development of the NWS Next Generation Warning Tool. But this type of work must continue.

The relationship between weather and society seems just as important as the relationship between a car and its driver. A station scientist needs to be prepared to look at all of the research problems that may result in the protection of life and property. Not being able to do this imposes a crippling limitation on the research capacity within the operational forecasting arena, and beyond. This editorial is a plea to the policy makers who can help continue the paradigm shift towards weather *and* society, for the benefit of all. And finally, it is a plea to existing station scientists to look beyond the equations of motion, and consider the components of emotion within the realm of research and science.

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**The views expressed in this editorial are those of the author and do not necessarily represent those of the National Weather Service.

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See an article you'd like to respond to? Want to share your views on a societal impacts topic and request feedback? Have program highlights or research updates to share? *Weather and Society Watch* is continually accepting a wide variety of articles, photographs, and book reviews. Not sure if you should contribute something? Have more questions? Please contact Emily Laidlaw at laidlaw@ucar.edu.

Conferences & Opportunities

Call for Papers: 2010 ACEEE Summer Study on Energy Efficiency in Buildings

Host: The American Council for an Energy Efficient Economy
Date: August 15–20, 2010
Location: Pacific Grove, California
Abstract Deadline: Nov. 6, 2009
For More Information: Please visit **http://www.aceee.org/conf/10ss/10ssindex.htm**.

Every other year, The American Council for an Energy Efficient Economy hosts the Summer Study on Energy Efficiency in Buildings in Pacific Grove, CA. For the 2010 conference, organizers are reaching out to social scientists from outside the energy field in order to learn from their insights about human behavior and decision-making. Conversely, this conference is also a terrific venue for social scientists to learn more about current thinking and efforts to influence energy behavior. For more information or to submit an abstract, please visit **http://www.aceee.org/conf/10ss/10ssindex.htm**.

Call for Papers: 2010 Lubbock Severe Weather Conference

Date: February 17–19, 2010
Location: Lubbock, Texas
Abstract Deadline: Dec. 4, 2009
For More Information: Please visit **http://lubsvrconf.org/**.

The 2010 Lubbock Severe Weather Conference will provide an opportunity for discussion and presentation of research on a broad spectrum of severe weather topics. An emphasis will be placed on the advances made in observation and analysis of severe hazardous weather. In addition, the conference will commemorate the 40th anniversary of the Lubbock tornado. For more information, please visit **http://lubsvrconf.org/**.

pieces of conversations with sighted individuals. I visualize a funnel cloud as something like a kitchen funnel hanging down from a thunderstorm, where the point of the funnel is reaching toward the ground, and the entire funnel is spinning like one of those toy tops we played with as kids. The spinning funnel proceeds in the direction the storm is traveling, and it gets lower and lower until it possibly touches the ground and becomes a tornado.

Here are some of my current thoughts, accurate or not, about various thunderstorm cloud formations: I envision a shelf cloud as extending outward from the main thunderstorm, like a shelf extends from a wall mounting. The outer edge of the shelf is where the gust front that precedes the main storm is located. I envision a roll cloud as similar to a shelf cloud, but, the outer edge of the shelf is curled under to make more of a rolled edge rather than the sharper edge you'd get on a wooden or metal shelf.

Ernie Ostuno, a forecaster in the Grand Rapids NWS office, wrote a book entitled *Paths of Destruction*, which recounts the 1956 F5 Hudsonville, Michigan, tornado. He includes some very helpful descriptions of mammatus clouds from area residents who witnessed them the day the tornado struck. In the words of Fred Schmidt, "I noticed the sky had a greenish color and the clouds looked like a bunch of glass marbles on a plate glass window being pushed across the sky as seen from below" (Ostuno, p. 66). Ruth Tidd described the mammatus clouds this way: "I walked outside and looked up at the sky. I had never seen anything like it! Giant puffballs that looked like tater tots were hanging down from the higher clouds, and they were an eerie yellow color" (Ostuno, p. 31).

As our next example, let's consider a detailed verbal description of the importance of tilt to the growth and maintenance of a severe thunderstorm cell. The description is from Jamie Bielinski, the WCM at the Grand Rapids, Mich. NWS Office.

> *A thunderstorm needs to eat just like a person. The storm eats from the warm, moist inflow into the thunderstorm base and rises up through the storm. If the food source is cut off from the thunderstorm, the storm will eventually dissipate. Try to envision tossing several basketballs into the air, one after another. First we will toss the basketballs out and up to the right, one after another. You could do this for as many balls as you would like and, chances are, the balls would not block the next basketball's path as they were falling to the ground. Now let's toss those basketballs straight up into the air. No matter how high you toss them, eventually they will collide at some point above you.. . . You have blocked the path of the basketball by tossing them straight up and down. This is similar to a thunderstorm. If the warm, moist inflow encounters cold rain falling through the storm, the warm, moist air can no longer rise. If you create a slight tilt to the thunderstorm, the warm, moist air does not have to encounter the rain-cooled air falling through the storm. The rain-cooled air will fall away from the storm's warm, moist updraft (the food source), and the storm can survive longer* (E-mail correspondence, February 2009).

For a blind person, descriptions such as these are a lifeline to valuable information about some of the basic features of severe thunderstorms and tornados. Even a sighted person who has seen the wonderful graphics in the NWS basic SKYWARN classes might benefit from such verbal descriptions.

Nevertheless, many of the visual aspects of severe thunderstorms and their development remain mysteries to me and, I suspect, to most other blind individuals. Some of the more noteworthy include wall clouds, scud clouds, and thunderstorm features, such as the rain foot and the rain-free base. The entire developmental cycle of various types of thunderstorms is also extremely difficult to visualize in a meaningful way.

David Salmon, author of a book on basic tornado concepts and terminology entitled *Tornado Watch*, describes a discrete Great Plains super cell thunderstorm:

> *The thunderstorm has an area of upward movement of air, where clouds are crisp, hard, well defined, or if you will, sculpted. The thunderstorm has an area of downward movement, usually associated with the precipitation that will fall. Some of the downward portion of the storm may be shrouded in less distinct clouds.*
>
> *Attendant cloud features include a broad flat top resting above the towers of rising air. This portion of the storm has been called the anvil top. The upper surface of the anvil is reasonably smooth, except for immediately over the most dynamically rising towers, where a bulge of convection may poke through. This bulge is called an over-shooting top. The broad flat anvil top will stretch downstream from the main body of the thunderstorm, swept there by the fastest winds.*
>
> *The front edge of the storm may have an attendant cloud feature known as a roll cloud... The overall cloud feature is fairly crisp, yet it may contain wisps and froths in the chaos there. These clouds at the leading edge of the storm may immediately precede the rain and hail that is to come, or there may also be a great vault between the lower leading clouds and the approaching rain. Strong winds may be associated with this leading, attendant cloud feature.*
>
> *Meanwhile, back in the updraft portion of the storm... beneath the rapidly rising towers is a flat-based feature called the rain-free base. Sometimes beneath the rain-free base is a downward extension of cloud called a wall cloud. And from the wall cloud, a funnel cloud or tornado may form. These cloud features are to be seen from outside of the storm.*
>
> *If the storm is coming straight over the observer, then the sequence of events would be: the roll cloud and its winds, rain, more wind, frequent lightning and thunder, a calming of the wind, a let up in the rain, the onset of hail near the interface of the down draft and updraft areas, then a sudden acceleration of wind again, and the tornado.*
>
> *In real life, the dimensions of all of this fall within an optimal range. The storm will be somewhat oblong perhaps no less than 10 miles, but not greater than 20 miles front to back. The width of the footprint of the storm will range from 6 miles to 15 miles. The long axis will be oriented close to the trajectory of the storm. The height of the severe storm will come within a range of 45,000 to 65,000 feet. The rain-free base will be 3,000 to 4,000 feet above the ground. The area spanned by the rain-free base may be roughly 1 mile to perhaps 4 miles square. The size of the wall cloud will be from perhaps ¼ mile up to 2 miles and it will extend downward perhaps 1,000 feet closer to the ground, or in extreme cases may be nearly touching the ground* (E-mail correspondence, April 2009).

This description, though quite good, still leaves much to the imagination of both the visually impaired reader and the less-experienced sighted observer. Therefore, it has occurred to me that perhaps physical models, along with detailed verbal descriptions, might produce the most helpful information. These models could be simple handmade crafts or more sophisticated structures.

As a start, David Salmon has taken on the daunting task of creating a physical model of the aforementioned Great Plains supercell thunderstorm. His initial efforts show how this can be done quite simply and inexpensively. Online (at http://www.sip.ucar.edu/news/focus1.jsp) are photos of David's model; below is his description of the model and his thought

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processes as he created it.

> *The storm is modeled after a discrete, Great Plains mesocyclone. The main body is composed of stacks of 2 inch thick styrofoam... partially covered with either stuffing (like you'd put in a stuffed toy), or with cotton balls. The stuffing is to simulate less distinct clouds. The cotton balls are to simulate the building parts of the storm. Near the right rear of the storm, I uncoiled a few of the cotton balls to simulate the process of rotation about the main updraft portion of the storm.*
>
> *The anvil is a larger piece of thin styrofoam. Near the rear portion of the storm, I made a combo of the stuffing with a few cotton balls, to simulate an over-shooting top. Beneath the front side of the anvil, I used some bubble-wrap to simulate mammatus clouds. Portions of the main body of the storm were left bare of clouds to simulate what I think is often just rain that is not shrouded in cloud.*
>
> *I attempted to make a wall cloud beneath the rain-free base at the right-rear quadrant. Most of the billowing cotton balls typically live just above that feature as an updraft tower.*
>
> *The bottom most portion of the storm model is another piece of the 2 inch styrofoam that is left bare of any distinct features. This is used to simulate the rain coming out of the bottom of the storm. There is a little "rain-wrap" going on at the back side of the storm, around the wall cloud feature.*
>
> *I would put the vertical exaggeration of the model storm at about 2 X 1. I wish I had leaned it forward a little more to better simulate the building towers at the rear. The anvil also could have been made a little more obtuse to the long axis of the storm, but one only thinks of these critical elements after the glue has dried* (E-mail correspondence, April 2009).

Ultimately, the skeptics among us might ask, "What is the value of this enhanced basic SKYWARN training for the blind? Why do the blind need to know what thunderstorm features look like, since they can't see them in real life anyway?" My answer is, Why not? Information of any kind is helpful in coming to terms with a severe weather situation. The blind stand to benefit from such knowledge, so why deny them that information?

Regarding benefits for the visually impaired, consider the following quotes from Kris Hickerson, a visually impaired amateur radio operator who, like me, is strongly dedicated to the NWS SKYWARN Program, and who regularly serves as a control operator for local SKYWARN nets in her area of southwestern Illinois.

> *I think this would be a great idea! I, like you, have sat through numerous weather spotter classes listening to the description of what was being drawn on the board. The last class I attended I came away feeling like I had a little better conception of what the storms and various cloud formations looked like, but this is still pure imagination on my part. I think some detailed descriptive explanations of the various cloud formations, types of clouds and so forth would be immensely helpful. If, somehow we could get some tactile images, that would be absolutely fabulous! …*
>
> *The other thing that blind people need to be aware of is that although we cannot go out as spotters, we need these classes just as much as our sighted peers, if we are going to understand the information that is given to us as net control operators. When working as net control, we need to be able to evaluate the information we are getting in order to determine where resources are most needed. If we don't have a good understanding of what is going on, we can't be as effective in assisting the people out in the field.… I suspect this might be an*

area that most blind people don't spend much time thinking about because it is beyond their direct realm of experience. However, if they don't, I think they should. What better way for us to keep apprised of what's going on around us, and to provide for the safety and security of our community, our family, and ourselves (E-mail correspondence, March 2009).

As this quotation suggests, the proposed enhanced SKYWARN training could have many potential benefits for the blind. Finally, let's conclude with a quote from Ernie Ostuno. It nicely summarizes the potential merits of such training, and the needs that such training could address, from the perspective of an NWS forecaster:

I'm wondering what you picture in your mind when a tornado is described. What do you imagine a "rotating column of air from the cloud base to the ground" to look like? What do you imagine a wall cloud to look like? This is an interesting topic because maybe there are better ways we can verbally describe what various cloud features look like to help blind and sighted people form a better picture in their mind. This picture would include not only what they look like, but also how they form (E-mail correspondence, February 2009).

This quotation highlights the need for the enhanced basic SKYWARN training curriculum. It also clearly demonstrates the willingness of at least some meteorologists to assist in its development. The main obstacle to creating this curriculum may well be the mechanics of designing and implementing it. I hope this article spurs some highly inventive minds in meteorological circles and in the visually impaired community to make it a reality.

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Jobs & Opportunities

Geospatial Project Manager and Hazard Researcher, Southern Illinois University

A post-doctoral scientist or staff scientist position in GIS-based hazard modeling and disaster planning is available at Southern Illinois University at Carbondale (SIUC). An active project manager and researcher is sought to join a team working with large geospatial databases and GIS-based hazard loss estimation software in order to assess natural and select technological hazards. Funding is from ongoing grants from FEMA to quantify hazard risk for the development of Pre-Disaster Mitigations Plans in Illinois. The successful candidate will have advanced GIS and database skills. The application deadline is December, 1, 2009. For more information or to apply, please visit **http://www.earthworks-jobs.com/rsgis/siu9101.html**.

Sea Level Rise and Climate Variability Postdoctoral Researcher, University of Maryland

This position investigates ocean warming and sea level rise and provides improved estimates of the uncertainty of historical sea level records. The researcher will use satellite altimeter observations and associated data sets, to explore the strengths and limitations of current coupled models in collaboration with the NOAA Geophysical Fluid Dynamics Laboratory. In addition this work is expected to provide improved estimates of uncertainty of the historical sea level record. A PhD in oceanography or remote sensing and a strong background in data analysis are required. The application deadline is November 10, 2009. For more information, please visit **http://www.clivar.org/about/maryland_1011.pdf**.

Sciences (continued from page 5)

changes in understanding of weather and weather forecasting and changes in institutions and behaviors.

Political Science deals with the theory and practice of politics and the description and analysis of political systems and political behavior.

- Analyzing political demand for programs and reactions to programs and regulations
- Understanding governance structures of vulnerable communities
- Understanding constraints and opportunities for interactions with private sector secondary users of NOAA products and services.

Psychology *(Alan Stewart)* is the study of human behavior, thought and feeling. It deals with all actions and reactions of people.

- Understanding how constituents perceive and use NOAA products and services
- Understanding risk perception, risk assessment, and risk communication
- Understanding how people make decisions with regard to weather, climate, ocean hazards and resource use, including intrinsic uncertainty.

Sociology *(Tom Behler)* is the study of societies and how humans act in groups. It concerns itself with the social rules and processes that bind and separate people not only as individuals, but as members of associations, groups, communities and institutions, and includes the examination of the organization and development of human social life.

- Understanding interactions within and between groups in response to watches and warnings
- Anticipating and examining societal adaptation to weather risks

Other disciplines sometimes classified as social sciences include:

- ***Linguistics*** investigates the cognitive and social aspects of human language.
- ***Education*** encompasses teaching and learning specific skills and the imparting of knowledge, positive judgment and well-developed wisdom.
- ***Law*** is the study of the rules that are capable of enforcement through institutions and in examining these rules, it crosses the boundaries between the social sciences and humanities, depending on one's view of research into its objectives and effects.
- ***Demography*** is the statistical study of populations encompassing their size, structure and distribution, and spatial and/or temporal changes in them in response to birth, migration, aging and death.
- ***Social Work*** is concerned with social problems, their causes, their solutions and their human impacts.

Given how little I have been able to explain here, I encourage readers with specific disciplinary expertise to provide input on their perspectives. We will continue to publish articles on specific disciplines, as well as on specific methods, so please consider contributing to help us build an accurate and complete set of resources on the social sciences.

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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 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.

Weather and Society Watch is available on the World Wide Web at: **http://www.sip.ucar.edu/news/**.

NCAR

Contact Us

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