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Aware Today. Alive Tomorrow.

by Sheldon Drobot*, Michael Chapman, Paul Pisano***, William Mahoney III****, and Benjamin McKeever*******

Adverse weather conditions continue to plague the transportation network, but ongoing research and development promise a new system to improve driver safety and mobility.

On a snowy morning this past winter, a driver lost control of his vehicle and collided with a tractor-trailer traveling the opposite direction, resulting in his untimely death. This particular crash occurred on Highway 287 in Colorado, but the script is repeated again and again across our nation. Every year, there are 1.5 million weather-related vehicle crashes in the United States, leading to 673,000 injuries and nearly 7,400 fatalities (Pisano et al., 2008). Adverse weather and the associated poor roadway conditions are responsible for 554 million vehicle-hours of delay per year in the country, with associated economic costs reaching into the billions of dollars (FHWA, 2010).

Can these weather-related crashes be prevented? We believe they can, at least some of them, and a revolutionary new initiative called IntelliDrive℠ — spearheaded by the U.S. Department of Transportation's (USDOT) Research and Innovative Technology Administration (RITA) — will lead the way. IntelliDrive℠ (www.intellidriveusa.org) is a multimodal initiative to enable wireless communications among vehicles, infrastructure, and personal communication devices. It offers the promise of enhancing our safety, mobility, and quality of life, while also helping to reduce the environmental impact of surface transportation.

In the past few years, several studies described weather-related data elements that are already, or will soon be, available from vehicles. Table 1 (see p. 11) lists the most common elements, categorized as either "input" or "observed". The "observed" category includes direct observations of specific atmospheric variables (e.g., barometric pressure, temperature) that should benefit the weather community as input for weather models and as data at high spatial and temporal resolution data for improved situational awareness. The "input" category includes both logistical information (e.g., date, time, location) and vehicle system status observations (e.g., windshield wiper state, traction control, stability control), which can be used in conjunction with other data sets to infer weather and road conditions.

The challenge for the weather community is to harness

(continued on page 10)

A tornado near Hasty, Colo. on April 22. (Photo by Scott Blair)

In This Issue

Geospatial Visualization	2
StormReady in the Classroom	3
Forecasting Impacts	4
Data Rescue Saving Lives	6
Jobs & Opportunities	7
Conferences & Opportunities	9
About WSW & Contact Us	11

Using Geospatial Visualization to Facilitate Weather and Water Communication

by Greg Dobson*

In today's modern world, massive weather and hydro data collections exist within many federal, regional, and state agencies. This data is used daily for critical decision making across many sectors and at many different levels of scale. However, much of this data is not easily accessed or in formats that are clearly interpreted by the non-scientific community (e.g. local and regional decision makers, the general public). Decision makers require more than just raw data to make accurately informed decisions; they need complete integrated data solutions. By integrating trusted sources of weather and hydro information with other geographic datasets (e.g. economic, environmental, cadastral, infrastructure, terrestrial), Geospatial Visualization tools can be created to enhance and facilitate science and risk communication. The use of Geospatial Visualization techniques is well-suited to consider diversity of stakeholder values, trusted sources of information, data uncertainty, geographic scale, and for displaying a range of predicted outcomes through scenario planning, all leading to decisions based on a combination of factors and not single drivers.

To help address this issue, scientists at the University of North Carolina at Asheville's (UNCA) National Environmental Modeling and Analysis Center (NEMAC) and the Renaissance Computing Institute (RENCI) at UNC Asheville Engagement Center have been collaborating with many organizations, including the National Climatic Data Center, the National Weather Service, the U.S. Forest Service, state and regional climate centers, and other local groups to develop a process for converting weather, hydro, climate, and other data into useful information through effective Geospatial Visualization. By working with local and regional decision makers including city and county planners, emergency and first responders, council members, and others, NEMAC seeks to facilitate decision making processes between this non-scientific community, weather forecasters, hydrologists, and climate scientists concerning topics such as floodplain management, weather-related hazard mitigation, climate change, future build-out scenarios, societal impacts, and economic development.

To aid in this effort, NEMAC has created a four-step process to guide this transfer of data into useful knowledge. The process includes 1) integration of data and information, 2) creating visualizations, 3) telling the story, and 4) group decision making. The focus is to ingest weather and hydro data from multiple sources and integrate it with a variety of other datasets. Data integration occurs at county and regional scales in order to facilitate local decision making among the aforementioned groups. Specific tools created to help guide this transfer of knowledge and better interpret weather

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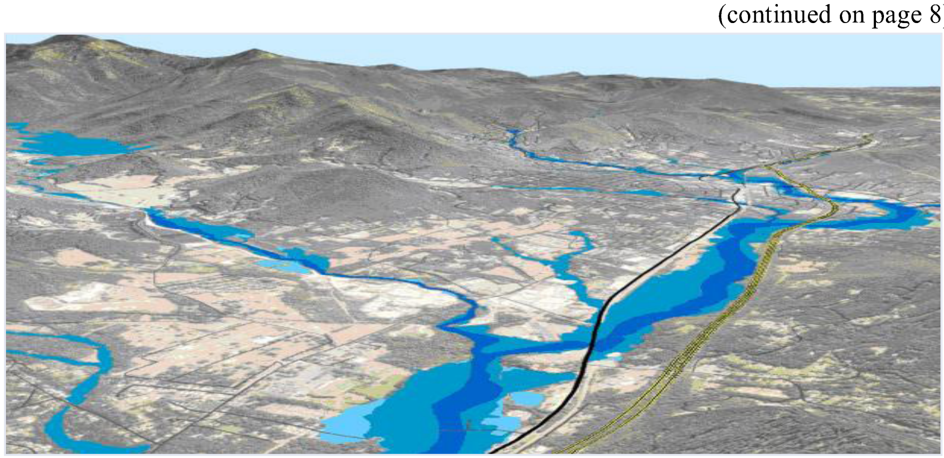

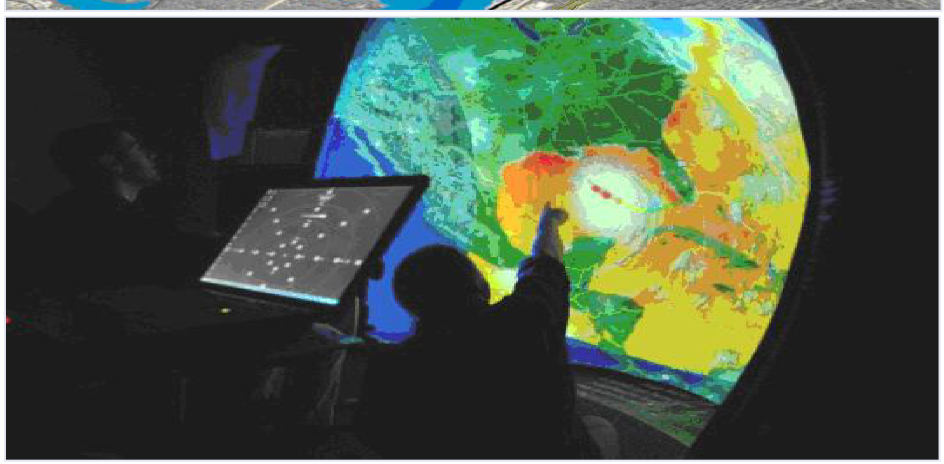

Figure 1. (top) 3D display of floodplains overlaid with high resolution terrain data and aerial photography.

Figure 2. (bottom) Hurricane data displayed in an immersive GeoDome.

StormReady Comes to the Classroom

by Megan Bolter* and Tom Behler**

The initiative to acquire National Weather Service (NWS) "StormReady" certification for Ferris State University (FSU) had its roots in an upper-level sociology class at the university entitled "The Sociology of Disasters and Emergency Preparedness". The class was taught by Dr. Tom Behler in the spring 2009 semester. In the class, an effort was made to take a sociological approach to a variety of emergency and disaster situations, and to examine patterns of both public and private response to those situations. Disaster or emergency situations that were studied included terrorism (both domestic and international), school/campus violence, natural/geological hazards (e.g. earthquakes, avalanches, volcanoes and tsunamis), and, of course, weather-related disasters.

Dr. Behler first learned of the NWS StormReady initiative from his attendance at the Weather And Society * Integrated Studies (WAS*IS) summer workshop in Boulder, Colo., in August 2008. After further investigating the details of StormReady certification, Dr. Behler felt that pursuing this recognition for Ferris State University would be beneficial on several levels. In the short term, pursuing this distinction would serve as an interesting project for a willing group of students who needed to complete a required group project for a significant part of their course grade. But pursuing the StormReady certification also had additional broader benefits. It would provide Ferris State University with an important badge of honor, by making it one of only four universities in the state of Michigan—and one of only 51 universities nationwide—to achieve this recognition (Franklin, *Communities*). It would be an important step toward further protecting life and property on the university campus, and would further solidify an already productive working relationship between Ferris and the Grand Rapids, Mich., Weather Forecast Office (WFO) staff. Finally, it would enhance meaningful linkages between Grand Rapids NWS staff and emergency management officials in both the city of Big Rapids and Mecosta county (where Ferris is located).

The stage was set for the StormReady certification class project when Dr. Behler first shared the details of the assignment with the students and indicated that he'd like to see one of the groups take on his "pet project" aimed at assessing Ferris State's eligibility for becoming a StormReady university. A group of four students, led by the lead author, quickly rose to the challenge. With Dr. Behler's assistance, several organizational meetings were held with relevant individuals who could assist with the project. These individuals included three key Ferris State University staff members: the assistant director of emergency management, the university's safety coordinator, and a geography professor who teaches the "Weather and Climate" course). The meetings also included the warning coordination ,meteorologist (WCM) from the Grand Rapids NWS office.

The group's first task was to determine how many of the StormReady certification guidelines the University already had fulfilled and what additional guidelines Ferris might have to meet in order to satisfy all of the certification requirements. Based on an initial examination, the group was pleasantly surprised to discover that FSU already had met all of the certification guidelines in at least one of the suggested ways and had even exceeded those guidelines in a number of instances. More specifically, the StormReady application listed six major guidelines, each of which contained associated criteria that had to be met according to population size. In light of Ferris State's population size of approximately 13,500 during the typical academic year, the group made the following determinations regarding how the University was meeting the various guidelines and their associated criteria:

1. *Communication—Must have a twenty-four hour warning point and an emergency operations center (EOC).* Ferris State was found to have both, in that it has a twenty-four hour warning point at its dispatch center, and its own Emergency Operations Center (EOC), located in the University's public safety building. Ferris also has an agreement with the city of Big Rapids to use the city EOC if its EOC

(continued on page 12

From the Director: Forecasting Impacts
by Jeff Lazo*

Figure 1 is part of a Wind Advisory issued May 5, 2010 by the Los Angeles/Oxnard, CA National Weather Service (NWS) Weather Forecast Office (WFO). It is not at all unusual for an advisory issued by an NWS WFO. It seems obvious and reasonable to advise or warn that strong gusty winds may cause driving problems. It seems responsible to provide information about the potential impacts from severe weather events.

URGENT - WEATHER MESSAGE - NATIONAL WEATHER SERVICE LOS ANGELES/OXNARD CA - 351 AM PDT WED MAY 5 2010

* IMPACTS: GUSTY WINDS WILL CREATE DANGEROUS AND ERRATIC CROSS WINDS AND COULD CREATE AREAS OF BLOWING DUST AND SAND IMPACTING TRAVELING ON AREA ROADWAYS AND HIGHWAYS. HIGHWAYS 14 AND 138 WILL LIKELY BE IMPACTED BY THE STRONG WINDS. PRECAUTIONARY/PREPAREDNESS ACTIONS ... A WIND ADVISORY MEANS THAT WINDS ARE OR WILL SOON BE IN EXCESS OF 35 MPH WITH GUSTS GREATER THAN 45 MPH. MOTORISTS... ESPECIALLY OPERATORS OF HIGH PROFILE VEHICLES...ARE URGED TO USE CAUTION WHILE TRAVELING ACROSS DESERT. VISIBILITY MAY BE REDUCED IN SOME AREAS DUE TO BLOWING DUST AND SAND. BE PREPARED FOR SUDDEN GUSTY CROSS WINDS WHICH CAN CAUSE VEHICLE LOSS OF CONTROL.

Figure 1. Example of National Weather Service Wind Advisory

But then . . . why not advise that blowing dust and strong winds are related to soil erosion and farmers should take necessary precautions? Why not tell people with respiratory sensitivities that blowing dust may irritate their bronchial passages? Why not advise the folks at the Antelope Valley California Poppy Reserve that high winds may wipe out the remaining poppy blooms and that they should thus update their website (http://www.parks.ca.gov/?page_id=627 in case you are wondering).

In keeping with its mission of "… protection of life and property and the enhancement of the national economy," the NWS provides weather forecasts to assist organizations and the public to make better decisions. It seems reasonable that providing information about weather impacts will lead to even better decisions to protect life and property. This is consistent with what I've heard at recent meetings I've attended where National Weather Service folks have talked of moving from a paradigm of forecasting the weather to forecasting impacts.

But what impacts should the NWS warn the public about? And, how qualified is the National Weather Service to determine the impacts of weather events? It seems obvious that gusting winds may cause "vehicle loss of control." But is this the most important or immediate impact of concern? Maybe for gusting winds in the desert it is. In many areas the folks in the WFO may have a good sense of what the primary impacts are of different weather events. Perhaps impacts can be forecast based on this local knowledge. Perhaps …

But what about something like forecasting impacts of an extreme cold event on the 18 million plus people in the New York City urban area? What impacts should the NWS warn about? About potential frost-bite, freezing water pipes, slippery roads, increased mortality and morbidity, increased energy demand, decreased consumer expenditures on ice cream cones, death of trees and plants, increased stress on diesel engines due to gelling of the fuel, psychological impacts on shut-ins, and a multitude of other impacts on 18 million people? And then what about tornado warnings, hurricane warnings, severe thunderstorm warnings, flash flood warnings, flood warnings, winter storm warnings, special marine warnings, non-precipitation warnings, tsunami warnings, and even space weather warnings? And what about all the different conditions in the 122 WFOs around the country serving multitude concerns and needs of the 309,205,896 people of the U.S. (as of 15:19 UTC on May 05, 2010. http://www.census.gov/main/www/popclock.html)

I do not know what the context and plans are within the National Weather Service for moving from forecasting weather to forecasting impacts, but the potential does raise a number of issues. The NWS does an amazing job forecasting the weather, but I wonder what it means by "impacts." If purely

URGENT - WEATHER MESSAGE - NATIONAL WEATHER SERVICE IMAGINARY WFO SOMEPLACE IN THE US - 351 AM PDT WED MAY 5 2021

* IMPACTS: GUSTY WINDS MAY INDUCE SUBSENSORY VIBRATIONS IN HYBRID VEHICLE DRIVING MECHANISMS THAT MAY IRRITATE A SMALL PERCENT OF MALE DRIVERS UNDER THE AGE OF 27 AND COULD LEAD TO SLIGHT ELEVATION OF SYSTOLIC BLOOD PRESSURE AND INCREASED HEART ATTACK POTENTIALS WHEN THESE INDIVIDUALS REACH THEIR LATE 80S.

Figure 2. Ficticious NWS Impacts Advisory

focusing on purely physical impacts (reduced visibility, high river flow, increased avalanche potential) that may not be a far reach from current NWS physical science-based capabilities. If moving from forecasting physical impacts to forecasting societal impacts (e.g., reduced driving speeds, increased health problems, changes in energy demand) the NWS is moving from its core competency to a whole new paradigm – one that (1) requires a significant investment to develop a social science competency, and (2) may well start to test the private-public divide.

It will be interesting to see if a move from forecasting weather to forecasting impacts is really planned in the NWS, what it means to the people advocating the change and also to those making it happen, and whether or not it is well thought out or is it perhaps just "buzz words"? (see Figure 2). How far can the science-based NWS go down the societal path?

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StormReady (continued from page 12)

devote the time to documenting and submitting the application materials. Thank you and congratulations for helping to make Ferris State University a StormReady University. (E-mail Correspondence, October 2009)

Finally, assisting Ferris State University to become StormReady certified was personally beneficial to the participants in the group project, as they actually saw the certification process unfold. To quote Megan Bolter, the lead author of this article: "In less than a month we discovered that Ferris already had met all of the requirements, and that fact just had to be documented. Our group project actually had turned into sending in an application to the NWS for StormReady. I even had the fortune to attend the site visit by the NWS officials as well as the certification ceremony. It was amazing to see the different members of the Ferris community working together to better the community.... I am truly proud to say I am a student here at Ferris State University, and that I was allowed to follow this project through to the very end. I am thrilled to have worked with such committed Ferris faculty, Ferris staff members, and NWS officials who exemplified a commitment to answering the plea made by Ferris State's founder, Woodbridge Ferris". "My plea in Michigan- and it will be my plea to the last breath I draw, and the last word I speak- is education for all children, all men, and all women of Michigan, all the people in all our states all the time." (Woodbridge Nathan Ferris Resource Site). In short, Ferris State University provided an excellent example of faculty and staff working with the students to further their education. The NWS and their StormReady program also answered this Woodbridge Ferris's plea by furthering the surrounding community's education regarding ways to protect itself from weather related disasters. Is this not the sort of thing that we all want to see happen within the University setting, and its surrounding environment?

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Data Rescue Saves Lives

by Toni Rosati*

It seems there are very few true win-win situations these days. Politics are never easy, the war on terror doesn't seem to have a clear answer, and even climate change, so obviously happening in the minds of most scientists, is a source of skepticism in the media and public eye. In fact, the Pew Research Center, a non-partisan public opinion research organization, conducted two recent polls on the public perceptions of climate change. The April 2009 data showed a "sharp decline over the past year in the percentage of Americans who say there is solid evidence that global temperatures are rising" while the October 2009 survey dropped this finding another 14%, from 71% in April to just 57% believing there is solid evidence by October (people-press.org/report/556/global-warming). The polls were conducted *before* "Climategate".

Most scientists want to move forward on the climate debate by gathering more data. In that sense, we and the skeptics can actually agree on something – more data *will* give us better information. However, without spending millions of dollars, what can we actually do to meet these data needs? New satellites provide excellent data but are expensive and can only create current weather observations. Studying ice cores and tree rings yields important observations about historical environmental conditions, but these techniques are best suited for paleoclimate records, or pre-1500s, respectively. To get weather information for interim years, some researchers have turned to historic journals to interpret the casual descriptions of weather and sea conditions. But there is another way…

Retired National Oceanic Atmospheric Administration (NOAA) scientist Richard Crouthamel founded the International Environmental Data Rescue Organization (IEDRO) in 2005 to provide a creative and relatively inexpensive solution to this problem. Recording information about weather has fascinated humans for centuries, and even developing countries have scores of records on daily temperatures, precipitation, pressure—and even glacial photographs dating as far back as the 1600s.

Regarding African data for example, much of the older African data (i.e. prior to the 1940s) are of excellent quality since, during that time, most African countries were colonies of European nations (i.e. Kenya, of Britain; Mozambique and Angola of Portugal; Niger, Mauritania, Senegal, and Chad of France), and the Europeans ran the various African national meteorological services with the same care that was used in their own mother countries. It is true that since the "independence" of many African countries, the funding for collecting data dropped, as did the meteorological services' attention to accuracy and care of their weather observations. However, the quality many times depends on the staff rather than the wealth of the country. Malawi, the fourth poorest country in Africa, has a first class meteorological service (considering their finances) with a dedicated staff, whereas Senegal, a wealthy Africa country, has difficulty. However, it can be said generally that the poorer the country, the greater the likelihood that a country's historical data is at risk; when people are starving, a government just cannot justify spending limited resources on rescuing and digitizing old data. Handwritten data and strip charts alike are often poorly stored. Depending on the economic situation of the area, the paper that holds this irreplaceable information may be stored in huts, basements or other below-ground structures that can be flooded at any time. Sometimes the data is discarded or burned to create more storage space.

With a recent grant from NOAA, IEDRO is moving forward with its mission to "rescue weather data from developing countries…" by building partnerships with each country's weather service. IEDRO provides computers and basic photography equipment to local teams who organize and photographically capture the data. Most importantly, IEDRO trains the meteorological office staff according to its stringent quality standards. Once all photos pass this standard, IEDRO sends the data to NOAA for input into an internationally open weather data database.

Dr. Ed Root, one of IEDRO's talented volunteers, has created an automated digitizing method for the often-found strip charts. Hydro-meteorological strip charts look like pen traces on a grid. The charts are mounted on cylinders that rotate at a constant speed. A pen attached to a mechanical device records the changes in parameter values over time. Depending on the speed at which the cylinder turns, the charts may represent parameter changes over a 24-hour period or a 7-day week.

Dr. Root's computer program analyzes the digital photographs of weather strip charts and extracts the data into useful tables or comma delimited files. While digitizing this information by hand can take 15-20 minutes per chart, the time required for the software to digitize a one-day weather strip chart is less than 5 seconds! Rescued data, once analyzed, can save lives across the globe. The six primary paths that data rescue can take to save lives are through climate change, disease prevention, flood forecasting, safer infrastructure, preventing famine, and understanding history. (www.iedro.org). Dr. Crouthamel relayed a painful story about a family of farmers in Pakistan. Given what they knew at the time, the family reserved the proper amount of food and seed to survive a 3-year stretch of difficult climate. But once the historic data for the area was analyzed, it showed that reserves for nearly 7 years were necessary to ensure survival. With extreme sadness Dr. Crouthamel said, "I know that family didn't survive much longer than a year from when I met them." Even with its recent grant, IEDRO is still in need of donations, sponsorships, and volunteers. Anyone interested or with suggestions is encouraged to contact Richard Crouthamel at r.crouthamel@iedro.org or make a donation by visiting www.iedro.org.

Data rescue is by far the most inexpensive method to quench the thirst for more data. Rather than spending millions of dollars establishing new climate observation sites throughout the world, which will produce an accurate and complete climate record over the next 100 years, organizations like IEDRO can use a fraction of those millions to go to developing countries to rescue, validate, and digitize the billions of weather records which exist from the past 250 years.

Primary historical data brings depth to trend analyses and model accuracy. The use of this data can lead to better policy, better education, better agricultural and architectural decisions, and ultimately, save thousands of lives.

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Jobs & Opportunities

Associate Director for Association of State Floodplain Managers
Madison, Wis.

The Association of State Floodplain Managers (ASFPM) is seeking qualified candidates for the position of Associate Director. ASFPM is a national non-profit, professional membership association with 14,000 members and 29 chapters throughout the United States.

The Associate Director will assist the Executive Director with overall leadership and management of the organization's activities and finances, and will help develop Association positions on national policy, represent the Association in national policy dialogue, and build relationships with Congress, the Administration, other agencies/partners and organizations.

Application deadline is June 1, 2010. References will be requested from top 2-5 candidates. For more information, please visit: http://www.floods.org/n-jobpost/index.asp#337.

Emergency Management Coordinator for Florida Emergency Preparedness Association
Lake Buena Vista, Fla.

Coordinator will be responsible for planning, coordinating and managing activities in emergency management to mitigate, prepare, respond to and recover from natural and man-made disasters. The ideal candidate will have a Bachelor's degree in communications, business administration, public administration, or related field and at least 3 years of experience in emergency management and preparedness programs. Position will remain open until filled. For more information, please visit: http://www.fepa.org/jobs.aspx.

Geospatial (continued from page 2)

and hydro data have included the use of geographic information systems (GIS), web-based interactive technologies, and other Geospatial Visualization techniques. In addition, these Geospatial Visualization techniques have also been used to create integrated data products, such as 2D and 3D posters, movie animations, and gaming engines, all of which can simulate virtual environments. These integrated data products can be displayed on a variety of high-tech and interactive platforms, including large-format touch screens, an oversized Visualization Wall, and an immersive GeoDome.

As previously mentioned, the non-scientific community, which can include many local and regional decision makers, often has a difficult time interpreting 2D maps and ascertaining much useful information from them. However, by presenting the same information using alternative Geospatial Visualization techniques, including the use of 3D data displays, this same information can become much more meaningful and useful to the decision makers who rely on such data to make important decisions about our communities and beyond. It is one thing to show floodplain maps and other associated tabular information, but by providing this same information in a 3D perspective, key elements such as the depth of water over roadways and on buildings, can be realistically and virtually displayed in such a manner that any decision maker or member of the general public can quickly garner much needed knowledge.

Much of NEMAC and RENCI at UNCA's applied research has been focused on a major flood event in the mountains of western North Carolina and how that event specifically affected the local Swannanoa River watershed. In September 2004, remnants of two hurricane systems, occurring less than two weeks apart, produced torrential and record rainfall, which led to devastating flood events along the main river channel. Problems with the first system were further compounded by an unexpected and emergency release of water from a large reservoir, which greatly contributed to the local flooding. Societal impacts were severe from both systems, destroying many roads, bridges, houses, and businesses, and causing 200 million in damages (NCDC 2004). Part of the issue was a lack of communication and knowledge concerning the disconnect between what was occurring in the city of Asheville, N.C., at an elevation of 2200ft, and the headwaters of the watershed adjacent to the eastern continental divide, at elevations reaching 6000ft. These two locations, while only located 15 miles apart, experienced a 15 inch rainfall differential, with 5 inches occurring in Asheville, and 20 inches occurring in the upper watershed. Issues such as orographic enhancement and mountain watershed hydrology were not fully taken into account, nor clearly understood by local decision makers.

As a result of the flood events, a Flood Damage Reduction Task Force (FDRTF) was created at the request of the mayor of Asheville. The FDRTF consisted of a mix of people from the local region representing a broad range of expertise, and included city and county planners/council members, engineers, university researchers, business leaders, and local non-profit groups. This eclectic group sought to provide an assessment and make recommendations on how to lessen the damage from future flood events in the Swannanoa River watershed. However, it became immediately clear that they needed access to varied datasets, in non-traditional formats, in order to make better informed decisions, as many individuals in this group did not have a scientific background. NEMAC was able to listen and collaborate with the FDRTF and help address their needs by providing many different forms of Geospatial Visualization tools and technologies. Much of this was accomplished through rapid prototyping, where needs were heard, and tools and products were designed and created and then provided back to the group for use and feedback. Though informal, this proved to be an excellent approach for quickly creating a suite of integrated data products through Geospatial Visualization that were invaluable to the FDRTF and the conclusions that were eventually reached.

Some of the Geospatial Visualization tools that were created included detailed 3D panoramas of the watershed from multiple vantage points,

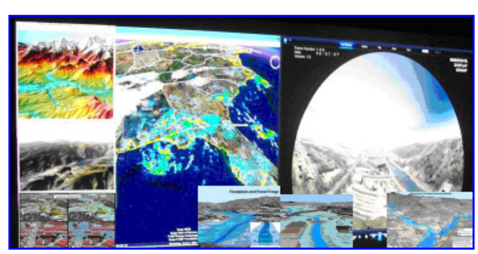

Figure 3. The Viz Wall can display many datasets simultaneously with its 16'x8' screen. This can be an effective tool for facilitating group decision making.

online GIS viewers for remote access to basic geographic data, floodplain and flood model datasets displayed on highly detailed terrain data, 3D building models adjacent to the river and beyond overlaid with flood information, 3D movie animations highlighting virtual "fly-through" tours, and displays of proposed mitigation plans and what affects they might have on the local hydrology. Technologies such as the Viz Wall housed at the RENCI at UNC Asheville Engagement Center were critical in facilitating group discussions on the proper uses of these Geospatial Visualization products. With the Viz Wall, all of these products could be displayed on its 16x8 foot screen simultaneously, allowing the decision makers to see all of the data before them at once. These tools and products were also imported into a GeoDome, which provides a 180 degree immersive and virtual environment. All of this work eventually led to the creation of "Water in Western North Carolina", a 5 minute, GIS-based, education and outreach movie that highlights flooding and impervious surface concepts in mountain watersheds. In addition, a complete Flood Tour booklet was created to guide decision makers and the general public on a tour of the watershed, while highlighting important points and locations of flooding, the floods of 2004, and local hydrology. Current initiatives include additional education and outreach efforts through community meetings and presentations, websites, and a large display on flooding in the new Swannanoa Valley Museum.

While the focus of this Center's work on Geospatial Visualization has been applied to flooding, specifically in the Swannanoa River Watershed, these techniques lend themselves well to be transferred to many other environments and for many other issues. For instance, RENCI at UNC Asheville has worked with a local county Emergency Management office to create a Multi-Hazard Risk Assessment tool. The goal was to integrate all GIS data related to natural and manmade hazards into a single Geospatial viewer, and to allow for basic analysis and visualization of the data. The tool gives users a better understanding of the connections between, for example, extreme rainfall, landslides, and dam failures, and provides for visualization of this in a Geospatial context. It also provides additional functionality in that it can assess potential societal impacts by determining what the amount of damage might be for a specific hazard from a potential event. The use of Geospatial Visualization as a communication tool could be applied to many other areas as well, including the effects of sea-level rise due to climate change, basic climate science, the risk of rock and landslides due to transportation projects, enhanced precipitation patterns in mountainous environments, and the list goes on.

Geospatial Visualization as a facilitation and communication tool for weather and water issues has proven to be very effective by researchers at UNCA. By working directly with other scientists and decision makers across multiple and varied sectors, better solutions for dealing with issues such as flooding, for example, have been created through the use of Geospatial Visualization techniques. The bottom-line is that by combining data with stakeholder and user values, better decisions will often result. By incorporation Geospatial Visualization, decision makers and the general public can better understand weather, hydro and other information and how it ties to their local communities, and thus into their community values. This is what transforms our process from one of simple education and outreach, which is one-way communication, to a two-way communication process that facilitates good decision making. Geospatial Visualization helps take the uncertainty out of the equation and allows people to connect to the real data and facts.

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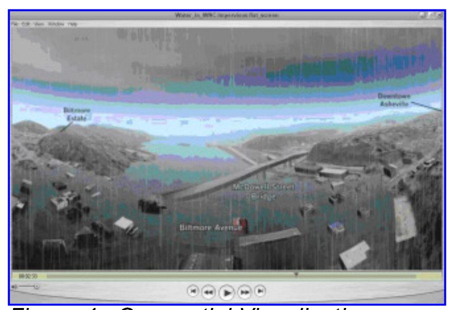

Figure 4. Geospatial Visualization can lead to the creation of "virtual tours" shown in animated movies.

Conferences & Opportunities

To see our complete list of conferences and opportunities, please visit the Weather and Society Watch Web site at http://www.sip.ucar.edu/news/conferences.jsp.

Alive (continued from page 1)
the promise of these mobile observations and provide useful applications to the driving public. To meet this challenge, RITA, the Federal Highway Administration (FHWA) Road Weather Management Program, and the National Center for Atmospheric Research (NCAR) are collaborating on a multi-year study. The main foci of this project are to (1) assess the accuracy and bias of mobile sensors; (2) develop algorithms and capabilities to translate mobile data into useable weather and road hazard products; and (3) incorporate these observations into effective weather–responsive roadway management systems and advanced decision support tools.

Early results (e.g., Chapman et al. 2010) suggest that vehicle-based measurements of air temperature are reasonably accurate (mean absolute errors around 1°C). More importantly, there is little evidence to suggest that variations in environmental conditions, such as wind speed, the occurrence of precipitation, or ambient air temperature affect the accuracy or bias of vehicle measurements.

With respect to developing algorithms, preliminary research confirms that vehicle data can be combined with traditional meteorological observations in intelligent ways to produce road and atmospheric hazards. However, two key data challenges remain. With 230 million vehicles on the nation's roads logging 3 trillion miles driven annually, the sheer volume of data could be overwhelming if even a fraction of them are transmitting data. Additionally, a foundational component of the IntelliDrive[SM] program is ensuring anonymity for drivers, which could present a challenge for data integrity. Both of these issues must be addressed before these data will be broadly usable and acceptable. One solution for these issues is to statistically process and generate derived observations, which are valid along a given length of roadway. In prototype work performed by our team (Drobot et al. 2009), these derived observations consist of all observations of one parameter (e.g., temperature, atmospheric pressure) aggregated on a road segment over a designated period. In other words, the derived observations provide synthesized atmospheric and road conditions for a specific area and time. The default setting for the road segment length is one mile and the default setting for the period is five minutes, but these settings are configurable.

As previously noted in this journal, our science is only as good as society's ability to use it (Hooke, 2007). Even after developing ways to use vehicle data, we must ensure that the applications are useable for society. It is not enough to think our job ends when the information is released; rather, we need to understand what happens next. Actualizing the integration of vehicle-based road and atmospheric hazard applications for the public will not be an easy task. Only as a unified enterprise, consisting of all creators and users of data, can we develop the necessary tools that can be transferred to the public and utilized in ways that will lead to increased safety and mobility. This is particularly true when focusing on ways to introduce information to the driver without also adding a dangerous distraction. Fortunately, the weather enterprise has considerable experience in this regard.

Even with the existing caveats and concerns, we anticipate that vehicle data will be valuable in positively contributing to the generation of improved weather and road condition products because of the uniqueness of this potentially large volume of data, the wide-ranging distribution of observations, and the frequency with which the observations occur. The weather community is encouraged to participate in this exciting endeavor.

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Contribute to WSW

See an article you'd like to respond to? Want to share your views on a societal impacts topic? Have program highlights or research updates to share? *Weather and Society Watch* is continually accepting submissions. Please contact Emily Laidlaw at laidlaw@ucar.edu.

Observed Data Elements	
Barometric Pressure	Rain (Rain Sensor)
Ambient Air Temperature	Sun (Sun Sensor)
Relative Humidity	Pavement Temperature
Input Data Elements	
Date (Year, Month, Day)	Brake Status
Time (Hour, Minute, Second)	Brake Boost
Location (Lat/Lon)	Accelerometer (lateral, longitudinal)
Elevation	Yaw Rate
Vehicle Heading	Headlight Status
Vehicle Velocity	Traction Control
Hours of Operation	Stability Control
Wiper Status	Rate of Change of Steering
Anti-lock Braking System Status	Impact Sensor
Adaptive cruise control radar	Ambient Noise Level
Short-range wide beam radar	Camera imagery

Table 1. Weather-Related Vehicle Data Observations.

About Weather and Society Watch

Weather and Society Watch is published quarterly, in January, April, July and October, 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. The newsletter is intended to serve as a vehicle for building a stronger, more informed societal impacts community.

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/.

For additional information or to submit ideas for a news item, please contact:
SIP Director: Managing Editor: Emily Laidlaw (laidlaw@ucar.edu) or Jeff Lazo (lazo@ucar.edu)

StormReady (continued from page 3)

is disabled in some way.

2. *NWS information reception—Must have four different ways to receive NWS weather warnings*. Ferris State was found to have five: NOAA weather radios at various campus locations, amateur radio capability in its EOC, televisions throughout campus to receive important weather information, radios to receive weather bulletins from local commercial broadcast stations, and both hard-wired and wireless internet throughout campus.

3. *Hydrometeorological Monitoring—Must have two ways of monitoring local weather conditions.* Ferris had five: anemometer, rain gauge, a functioning weather station linked to the internet, access to radar via the internet, and a television radar source.

4. *Local warning dissemination—Must have two ways to do this, in addition to NOAA Weather Radio (NWR) Specific Area Message Encoding (SAME) radio receivers in public facilities.* In addition to NWR receivers, Ferris was found to have an outdoor warning siren system, a local alert broadcast system, a cable television override, an established and tested automated telephone calling tree involving all critical facilities, a coordinated area-wide public safety radio network, and the ability to broadcast selected messages to targeted areas of campus.

5. *Community preparedness—Must train spotters and dispatchers biannually, and must conduct at least two annual weather safety talks for anyone interested.* Ferris conducts an average of five different safety talks each year, and has hosted or co-hosted Skywarn training for their dispatchers and weather spotters for at least the last three years.

6. *Administrative—Must have a formal Hazardous Weather Operation Plan; make biannual visits by the emergency manager or his/her designee to the nearest NWS office; and must arrange for an annual visit by an NWS official.* Ferris was found to comply with all three of these requirements. (Franklin, *How To*)

Once the student group determined that Ferris State had met and/or exceeded the six certification guidelines, their next task was to arrange an NWS site visit, in order to verify that the guidelines actually had been fulfilled via the means described. This site visit was arranged and conducted in September of 2009 by Jamie Bielinski (WCM of the Grand Rapids WFO), and Nathan Jeruzal, (forecaster from that same office). The visit went extremely well, and the capabilities noted above were readily verified. The University's capabilities were then re-evaluated by a panel of National Weather Service professionals and local emergency managers, and ultimately were approved for the StormReady certification. On Wednesday, November 18th, 2009, Ferris State was honored in a formal recognition ceremony proclaiming the StormReady certification achievement.

The importance of being "storm ready", and the significance of this certification have been well documented. For example, one can point to Van Wert County, Ohio. In order to receive its StormReady certification the county had to install a system of warning alerts in public places including the local movie theater. Later that same year, during a tornado outbreak the theater manager and employees, when warned of the impending tornado, were able to get the 50 customers in attendance to safer locations within the theater, such as interior hallways and bathrooms. "Minutes later a tornado tore off the building's roof and tossed cars into the screen and front seats where minutes earlier kids and parents had been watching ' The Santa Clause 2' movie. Amazingly, there were no fatalities in the theater, despite the fact that 35 fatalities had been documented from the same tornado outbreak elsewhere." (Franklin, 2009). StormReady entities benefit from the StormReady certification in still other ways. Organizations, cities, or towns that are StormReady certified are more likely to receive federal grants and monies for other related projects. They are better able to show that the community's safety is at the forefront of community management's efforts. "Storm Ready communities are better prepared to save lives from the onslaught of severe weather through advanced planning, education and awareness. No community is storm proof, but StormReady can help communities save lives." (Franklin, *StormReady*).

The acquisition of the StormReady Certification clearly benefitted Ferris State University itself. To quote Michael McKay, Ferris's Safety Coordinator in an e-mail to Dr. Behler: "I really think the congratulations goes to you and your students. The project developed and documented by the students in your Sociology of Disasters course here at Ferris was the key to obtaining this recognition. This is a great example of how academic programs can contribute to the overall safety of the University by becoming involved and engaged. Likely, without your students pursuing this certification, I would not have been able to

(continued on page 5)