# Disaster Weather Communication, Education, and Training for First Responders
## A WAS*IS Initiative

Joshua J. Jans and Cecil S. Keen
*Minnesota State University, Mankato, MN 56001*

## 1. INTRODUCTION

A recent 'in the field' experience working directly with First Responders (Fire Fighters, Law Enforcement, Paramedics, and Dispatchers) in a 'Disaster Weather' situation provided another insight into the actions and decisions made under such circumstances. (Figure 1) When combined with field and survey research from similar situations in Minnesota, Kansas, and Texas, there appears to be a consistent lack of understanding of weather processes that tends to distort their evaluative reactions in such circumstances. If one includes the changes in modern technology and advances in forecasting capabilities, it becomes increasingly important to ensure that First Responders are conversant with all these factors. In an attempt to bridge the gap between societal response (First Responders) and forecast science, this WAS*IS inspired project has led to the development of a multi-level, online, and in-class curriculum. The courses cover basic weather processes, data tools and interpretation, and decision-making strategies focused towards these emergency responders. The courses' structure has been underpinned by the National Fire Protection Agency (NFPA) standards that are designed to safeguard responders in chemical, biological, and other emergencies. The NFPA essentially serves as the leading authoritative source in the US on public safety. First Response teams thereby adhere to these standards. Currently, there is no focused training aimed toward 'weather specific disasters'.


**Figure 1:** Field experiences and survey research has led to the development of weather courses for the First Responder Community including fire fighters, dispatchers, paramedics, and law enforcement.

Corresponding author address: Joshua Jans
Atmospheric Sciences, Minnesota State University
Mankato, MN 56001
E-mail: joshua.jans@mnsu.edu

This paper introduces such a training course in an attempt to bridge the public and science barrier that is apparent in weather specific emergencies. A recent such weather disaster took place in Greensburg, KS from which behaviors and decisions were observed.

### 1.1 *Greensburg, KS EF-5 First Hand Experience*

On May 4th, 2007, an EF-5 tornado disaster took place in Greensburg, KS. (Figure 2) The research team (comprised of professional fire fighters and certified atmospheric scientists) was on the northwestern outskirts of the town when the tornado struck around 9.45 PM CDT. Over the following 5 hours, they were participants, observers, and rescuers until local responders were able to become fully operational. Around 90% of Greensburg (population 1,574) was destroyed with the remaining ~10% severely damaged by the nocturnal tornado. It was estimated to have a width of 2.7 KM (1.7 Miles), traveled about 35 KM (22 Miles), and resulted in 11 fatalities and over 60 injuries. (Figure 3) Additional tornadoes from the same supercell were responsible for two more fatalities northeast of Greensburg. One of those fatalities happened to be a First Responder from the Macksville Police / Stafford County Sheriff's Department, who was hit by the tornado while in his patrol vehicle. It should be noted that many lives in Greensburg were saved due to the timely warnings given by the National Weather Service (NWS) in Dodge City, KS. Forecasters were able to issue a Tornado Warning 39 minutes before the tornado hit the town. This was updated with a 'Tornado Emergency' message 10 to 12 minutes before impact - strongly encouraging Greensburg residents to get to shelter immediately.


**Figure 2:** Researchers received first hand experience of the EF-5 Greensburg, KS Tornado event on the night of May 4, 2007.

Our field research team was able to provide valuable assistance to residents and local responders who arrived from adjacent counties. (Figure 4) The team provided weather briefings to Kansas State Troopers and Incident Command Leaders. These enabled them to proceed to impacted areas and alerted them for areas where the supercell continued to spawn additional tornadoes - northeast of the town. By 3:00 AM CDT, Regional and Federal resources began an organized response in the

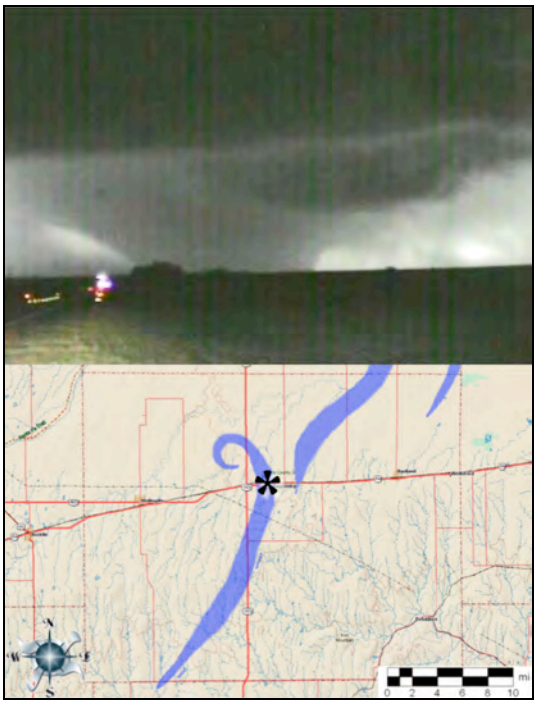

**Figure 3:** Marty Logan of KOTV & KWCH News captured this large backlit EF-5 Tornado hitting the town Greensburg, KS on night of May 4, 2007. **(Top)** Shaded in blue is the damage path taken by the Greensburg Tornado with the star representing the town of Greensburg. **(Bottom)**

**Figure 4:** Professional fire fighters on the research team helped setup a unified command system in Greensburg shortly after the tornado hit. **(Top)** An aerial photo was taken by FEMA of downtown Greensburg during the clean up effort. **(Bottom)**

community with the basic necessary equipment and manpower to fully deal with the disaster. From a meteorological and societal insight, this weather event again confirmed the unequivocal need for First Responders to have a proper knowledge, training, and tools with which to anticipate, stage, and respond to such weather events.

What appeared to be lacking in their actions and behaviors were (1) a fundamental understanding of *what to expect of the weather*; (2) with 39 minutes elapsing before being hit, one would have thought they could have been somewhat proactive in their resource staging, but were blatantly not; and (3) even after the event there appeared to be a stunned incapability to comprehend what rescue actions needed to be accomplished by those in command. Clearly the human and personal shock is understandable, but after all, this town is in Tornado Alley and some anticipation of such disasters is not unknown. What became apparent from our field observations was the need of realistic and up-to-date training on the basics of weather and more so on the new technologies available for forecasting, predicting and observing weather. Some basic, practical understanding of weather processes would go a long way towards a more coherent and organized response.

## 2. THREE TIERED SOLUTION

Resulting in part from this, an association was developed between Public, Private, and Academic partners under the title of *Disaster Weather Research Center* at Minnesota State University, Mankato (MSUM). The central mission is to develop a weather curriculum to be available as an online training course specifically geared towards First Responder needs. The courses would offer an overall introduction to weather, followed by a data collection and interpretation course, to be supplemented by a 'decision-making' course for team leaders. The courses would focus on heavy weather situations – thunderstorms, winter storms, and everything in-between. These courses are a bare-bones weather curriculum dealing with only the things that have practical implications for responders. This clearly becomes a matter of evaluation and the content open to various interpretations. We see this as a course evolving over time – specifically, to satisfy the needs of a select audience. The introductory course is designed as an online course. The two following levels would have both online and classroom components. Considering the audience, the course needs to have a strong visual appeal, but also requires a practical, hands-on learning environment to make it work. (Figure 5)

### 2.1 *Awareness Level*

The Awareness Course entitled, "An Introduction to Disaster Weather" focuses upon weather events that have the potential for causing disasters. We have attempted to demystify the 'science and vocabulary' of weather and present the participant with simplified processes as much by way of diagrams, animations, and videos as possible. We need responders to understand

the processes by which weather occurs and be able to relate these to their real-time environments. Wherever possible, we have used examples that are relevant to persons who are on active duty and would be seeing weather 'in the field'. Furthermore, specific focus sections are included within each module that would have implications towards First Responders.

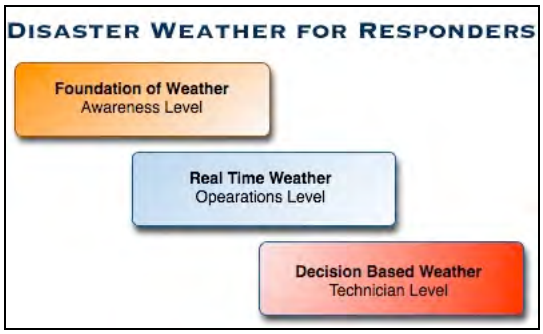


**Figure 5**: Disaster Weather for Responder Curriculum follows the NFPA Curriculum structure with Awareness, Operations, and Technician Level Courses.

### 2.2 *Operations Level*

The Operations Level Course, "Disaster Weather – Employing Digital Techniques" will offer participants a more in-depth look at weather processes and introduces a higher level of understanding of the sequential development of weather phenomena. It is at this level that participants will understand meteorological coding and language related to warnings, watches, forecasts, and other hazard information offered by NOAA Agencies. An overview of online and offline data sources will be incorporated and how to evaluate and apply the various products they will meet. Participants will be able to distinguish between days of nuisance weather episodes versus days of potentially deadly weather. Forecasting and now-casting timelines will be identified so that in-field mobile and stationary technologies can be utilized – if available. The structure of this course will require some classroom demonstrations and hands-on experiences for the participants. The objective is to enable the participants to make informed decisions before, during, and after a disaster weather incident.

### *2.3 Technician Level*

The final level is a Technician Course, "Disaster Weather – Decision Making." This is envisioned as one for those in positions of incident command. It will rely heavily on real-world examples. Furthermore, it will feature a combination of classroom and practical experiences. The course will task participants to become discretional in reading and interpreting different forecast and now-casting products. Participants will evaluate past weather events and be given scenarios of decisions that were and should have been made. While it is recognized that no 'past' will duplicate into a 'future', by giving participants examples where mistakes have been made may enable them to make more informed decisions than before. Participants would be expected to demonstrate a practical knowledge of weather-data resource management during field exercises. Through such scenario learning, decision makers will emerge with better confidence in their calls and presumably better outcomes.

## 3. DEVELOPMENTAL ISSUES

The development of this "Disaster Weather for Responders" curriculum did not come without a variety of challenges - in two areas specifically: Cultural Acceptance and Course Development & Tools. To overcome the cultural barrier, we initially had to concede to the fact that the First Responder Community has its own subculture (like any field of trade) and operates by a '*within'* philosophy. Simply put, there is a tendency to listen to those "within the service," over those outside it. This immediately halted the advancement of the project until we could find allies from within the different responder agencies to support the validity of the project. This took several visits to demonstrate and win-over the leadership in order to gain creditability. This was accomplished by attending responder meetings, participating in training seminars, and partaking in onsite tours. (Figure 6) All were useful since it also gave us a level of understanding of their particular needs and training formats.

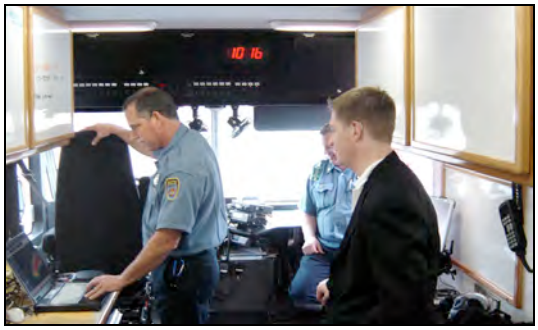

**Figure 6.** Researcher Joshua Jans was given a tour of the communication and onboard weather technology of the Austin Fire Department Regional Strike Team mobile command center.

### 3.1 *Online Development Challenge*

The modern day classroom knows no limits in a world of online learning where students can attend courses from around the globe 24/7. Unlike any classroom course development, challenges for an online course occurred at almost every turn! How to register, who to register, what will they be viewing the materials on, what is their resolution capabilities etc. An enormous amount of time was spent just sorting out these issues. However, when we came to the 'easy' part, the meteorological content, we were thrown back again. Here it was to design a template simple yet truthful for an audience with little atmospheric science background and hardly any 'weather' jargon.

The surveys and in person interviews we conducted in researching the Responder issues suggested that we needed to simplify the weather language we would use. Actually doing so was in fact quite difficult. Furthermore, most courses offered to Responder communities were

quite different to anything we could design for weather content. Thus we were faced with not only the technical side of building an online course and the interface tools that need to go along, but the real challenge came in the deconstruction of complicated weather processes that still needed to hold scientific merit.


**Figure 7.** Two screenshots of the Awareness Level online learning environment First Responders will use to take "Awareness Level - An Introduction to Disaster Weather. "

### *3.2 Beta Users*

The Awareness Level Course was beta-tested on 20 selected users. These 'testers' were fire fighters, meteorologists, emergency management, and educational personnel. Their evaluations were invaluable and also frustrating! An online feedback tool was used to track their ratings and comments. On the whole, the course structure and visual content were given very high marks with an average of 4.5 out of 5. Somewhat lower ratings were received from the fire fighters in regard to the technical concepts, the responder applicability, and the quiz questions – saying they were too difficult! While we were initially stunned by these comments, we managed to use this opportunity to extract more specific details of those misunderstood concepts. It appears that those concepts covered that had a direct bearing on the Responders actual job, were understood best. Those that were 'background and/or basic knowledge' were found difficult to grasp! We tried to capitalize on this and produced a section entitled "Implications for Responders" where we addressed specific concepts as punch lines for Responders to understand. (Figure 8) Finally, the quiz questions were revamped to include both learned concepts and action-based questions (relating to hypothetical situations). Overall, we believe we have been successful in covering the best for both sides – a practical training for Responders within a scientifically truthful depiction of the discipline.

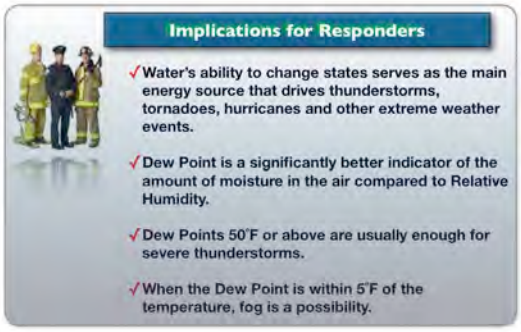


**Figure 8.** An example of an "Implications for Responders" that serve as punch lines for Responders to remember the most important concepts within a module.

## 4. CONCLUSIONS:

While this has been an experience beyond our initial concepts, it has been seen and received as a useful tool by an enthusiastic Responder community. As with all teaching, perhaps particularly in the sciences, there is little or no support for this type of curriculum development – despite the need. We have a model and a plan for levels 2 and 3 - the more applied of the courses envisioned. We are hoping that funding will condense from the vapor we have had to run on so far and that some liquid assets will rain upon us! Perhaps, this is the new science challenge in America – running on nothing, with funding being post-active, rather than proactive toward need!

## 5. ACKNOWLEDGMENTS

Photography and Images courtesy of:

Shane Motley, Randy Denzer, Greg Henshall / FEMA, WHDH 7 News – Boston, MA , Marty Logan with KOTV & KWCH, National Weather Service - Dodge City, KS Forecast Office

This project is aided by:

Minnesota State University, Mankato
Weather Analysis Laboratory for Teaching and Educational Resources
Austin Fire Department, Texas
Texas Forrest Service
Texas Task Force One - Urban Search & Rescue