

## Weather and Water: Summary of a Special Session from the 1993 IMAC Meeting

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A special session of the 1993 IMAC meeting, held at the Illinois State Water Survey in Champaign, focused on two integral parts of Illinois's natural resources puzzle—weather and water. Together, these parts of the hydrologic cycle significantly contribute to the economic welfare of the state. The summer of 1993 will long be remembered by midwesterners as heavy rains and record floods devastated large areas and cost billions of dollars. To address issues related to weather and water, six Illinois scientists were asked to present information describing their recent findings.

The first two speakers focused on weather and forecasting. Michael Fortune (Northern Illinois University) described how newer computer technology was letting students and forecasters make better real-time weather predictions of storm development and movement. He showed how the atmosphere and its weather systems could be examined over time in a computer-aided, three-dimensional process. James Carter (Illinois State University) described the technological changes that have

occurred in television weather forecasting over the last 40 years. Again, computers have allowed for significant advances in the way weather information is spatially presented.

The presentations of the four remaining speakers (Illinois State Weather Survey) dealt with climate and its relationship to water resources in Illinois and surrounding midwestern states. Wayne Wendland provided insight into Illinois's historical climate record. He described temporal changes in Illinois precipitation and temperature measurements and discussed how tree coring could be used to extend the climate record back into the mid-1800s. Kenneth Kunkel's presentation examined the variability in Illinois's climate during the last 100 years. He indicated that summer precipitation, important for Illinois corn and soybean production, had gone from near normal amounts each summer during the 1960s and 1970s to extremes (both very wet and very dry) during the 1980s and 1990s. Stanley Changnon discussed how important the relationship is between climate and water resources, describing how fluctuations in climate (warm/dry and cool/wet) generally parallel significant changes in surface water supplies (drought and flooding). The final speaker, Steven Vermette, described how Illinois and its government and private sector officials deal with global climate change issues, particularly how the state would mitigate the impacts of potential changes in both seasonal temperature and precipitation.

## The Use of Maps and Satellite Imagery in the Weather Presentations on Television

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For Americans it is common to see weather presented on television, but the rest of the world does not have comparable coverage of weather and climate. To document the wealth of weather and climate coverage in the United States, I presented a paper on this subject at the recent International Cartographic Conference in Cologne, Germany. The presentation to the large audience was quite different from the paper published in the *Proceedings* (Carter, 1993). The presentation consisted of 15 text slides and 65 maps or satellite images captured from television weather programs. Our television weather environment is so rich that it was great work to reduce the total number of images to only 65.

From the perspective of both a climatologist and a cartographer, I have been observing television weather presentations for many years. Such presentations are but one part of a complex system of data collection, data evaluation, data transmission, mapping, analysis, forecasting, dissemination, and presentation. Because the subject matter is geographical and data are integrated from many sources covering many areas at different scales, this weather presentation and forecasting system can be

thought of as an example of a geographic information system (Carter, 1988a). It is interesting to speculate how other geographic information systems would look if they were as formally developed as the weather information system and they included the systematic presentation of the information to the public.

Weather maps on television have received some attention in the mapping literature. Lindgren (1991) looked at the use of television news maps in Desert Storm and included a section on the use of weather maps. This was built on her earlier work on weather maps on television (Caldwell, 1981). Monmonier (1989) has looked at many aspects of weather maps, and he gives considerable focus to their role in television in his book on maps with the news. The popular weather literature has recently featured articles on the presentation of weather on television, but the use of maps is somewhat incidental in these articles (AWO, 1992; Teel, 1992; Wright, 1990). A similar article exists for the pilots and aircraft owners (Horne, 1992).

#### **Common Elements of TV Weather Presentations**

Weather presentations on television usually contain a synoptic chart with highs, lows, and fronts, showing what is predicted for a few hours hence. A map of predicted high temperatures and low temperatures is also common. There is often a map of radar echoes, and most of these are dynamic presentations showing the movement of the precipitation over the

past few hours. It is also quite common to have a loop of cloud imagery as captured from a satellite, usually the GOES satellite. The other thing common in all of the presentations is the weather presenter, sometimes called the weathercaster, who mediates the presentations. The presenter is as integral to the weather program as the maps and loops of images.

In many ways the presentation of weather and climate data on television represents what many of us in cartography aspire to do. Weather is represented by combinations of thematic maps and satellite imagery. In many cases the symbology on the maps is raster-based satellite or radar imagery. Color is used in these maps, in many cases effectively. The weathercasters employ dynamic presentations, showing change over time. The maps are quite current and in terms of radar echoes may be real-time. The focus of these presentations is the current and forecast weather, but the longer-term perspective of climate is frequently brought into the presentation. Local shows usually reference the mean or average temperatures as well as precipitation. It is common to report how far above or below the mean precipitation the local area is for the month or up to this point in the year. Some presenters will talk of temperature departures in terms of heating degree days or cooling degree days. The weather channel frequently shows maps of temperature departures. These colorful maps dramatically illustrate the presence of masses of warm and cold air.

#### **Categories of TV Weather Presentations**

In general, there are four types of weather presentations.

1. Local stations with a weather segment lasting less than five minutes and usually presented two or more times per day. The focus is the local weather but usually a national picture is included.
2. National network presentations, which usually are short segments injected into other programs. The focus is the 48-state conterminous United States.
3. *A.M. Weather*, a 15-minute weather program carried on public broadcasting stations on weekday mornings. Coverage is for the 48-state conterminous United States and southern Canada.
4. The Weather Channel, an all weather channel broadcasting 24 hours a day, seven days a week. Coverage is of the United States at national, regional, and local levels.

There are great variations in the nature of local weather presentations. In many cases the people doing the presentations are neither trained weathercasters nor meteorologists. In fact, there is good reason to suspect that doing the weather segment is where many people break into television. Where this occurs, the maps for the presentation are prepared elsewhere and given to the presenter. It is not uncommon to see the same maps employed in local weather presentations on different channels, indicating that the channels contract for their maps from

the same source. In other cases the local presenter may do his or her own maps and the nature of the presentation reflects the skill of the presenter.

Interestingly, the best displays of maps and imagery in the presentation of weather are done on selected local stations. Illinois readers are probably familiar with Tom Skilling of WGN in Chicago. I have been told of similar local presentations in other major markets. Skilling's presentations are quite complex and demanding of the viewer. He is likely to show 18 maps in a three-minute segment. Many of these maps are dynamic presentations incorporating loops of satellite imagery or the continuous projection of the evolution of a weather system over two to five days. Many of the features portrayed by Skilling are done to illustrate a concept. He sometimes employs a 3D net laid over the midwest—its apparent height reflecting the pressure at the surface or aloft. He puts this net into motion so that it rises or falls as the pressure system is forecast to strengthen or weaken.

The weather segments of ABC, CBS, NBC, and CNN all belong in the second category—national weather presentations. These presentations are concerned only with the national patterns, unless there is a unique and severe weather event in one part of the country. On the three national networks the weather segment is integrated into the morning host programs and the weather personality is often treated as a regular on the show. The maps are very generalized. In some cases, the national network provides time for the weather per-

son on the local station to give a brief look at local weather. CNN frequently has a brief segment on the national weather, similar to those on the national networks. But, at other times CNN will have a more extended segment on the weather across the country. Also, CNN may show one or more international maps, which I have never seen on any of the three national networks.

*A.M. Weather* cannot be put into a category with any other program I have seen. However, a colleague has told me about a comparable program in Anchorage. *A.M. Weather* is produced early in the morning every weekday and put out for presentation by local public television stations. In central Illinois, the program is carried by WILL-TV in Urbana at 6:15 A.M. and by WCBU-TV in Peoria at 7:15 A.M. The central program guide for *A.M. Weather* (Maryland Public Television, 1991) lists four other Illinois stations as carrying the program: WSIU, WTTW, WQPT, and WUSI. Not all public television stations will carry the program, and some stations show the program more than once a day (Carter, 1992).

On any given morning two of the three meteorologists who work for the National Atmospheric and Oceanic Administration will make the presentation. Although viewers see the meteorologists as they introduce each segment, they see only the maps during the presentation of the weather information. As the meteorologists talk through the weather they move a wooden pointer over the maps pointing out significant items. The program begins with a northern hemisphere

satellite view of the Americas with the track of the jet streams overlaid on the cloud pattern. The jets are removed and the cloud loop is put into motion. As the meteorologists move through the current weather segment, they focus on different parts of the country. They may spend more than a minute moving over the cloud image map and the synoptic map detailing the weather in different parts of the country.

Next, the program provides a forecast, developed with many maps showing the predicted conditions of fronts, temperature extremes, and precipitation amounts for two to five days out. This forecast is followed by a segment on weather conditions of interest to pilots. This segment includes maps of winds aloft at three different levels, areas of visual and instrumental flying restrictions, maps showing projected patterns of turbulence, with patterns of freezing levels overlaid. The symbols on some of these maps are specific to pilots and are not meaningful to most viewers. The final segment shows weather advisories and warnings in the United States and the southern regions of Canada. Once last spring, a loop of the Index of Greenery for the conterminous United States for the previous few weeks was included in a program.

The fourth category of weather presentation, the Weather Channel, is a mainstay of most cable television systems. This channel is now 10 years old and has become a commercial success. Teel (1992, p. 10) reported that as of late 1991 there were "... 50 million subscribers—the fifth largest weekly

audience of all cable networks. The channel's meteorologists were being seen in 85 percent of American homes with cable TV and in 54.7 percent of all households with television." The substance of the program is the continuous presentation of weather conditions. Viewers can tune in at any time and be within 15 minutes of coverage of the local or national weather. The heart of these presentations is the maps and loops of satellite or radar imagery. As the program has developed an audience it has taken on a component to instruct viewers on the workings of the atmosphere, including a segment called "The Weather Classroom" (Moore, 1992).

The maps and images on the Weather Channel are not as detailed as those presented by Tom Skilling nor those on *A.M. Weather*. The maps remain in use as long as they are relevant. Although there are more than 20 weathercasters on the Weather Channel, the maps reflect the image of the channel. Each person making the presentation adds a personal touch, but the graphics remain common to all presenters. Many of the maps carry advertising along their top border. Many of the products advertised on maps are related to weather conditions or are seasonal. Cold medicines are likely to be advertised on the maps showing a pain index or the incidence of influenza. Tire advertisements are likely on a map showing predicted travel conditions.

The weather presentations are interspersed with the usual commercial interruptions and automated segments showing local

weather, as many as 10 each hour. These segments are individualized for each of more than 800 National Weather Service zones (Moore, 1992) and consist of either a recorded voice-over or music. The items included in each local weather segment vary and may include any of the following:

- text describing the National Weather Service forecast for the next 36 hours for the local area,
- statistical weather data for the local city,
- regional sunrise, sunset, and moon phase data,
- regional forecast map with weather icons and temperatures for major cities,
- current local radar loop showing movement of precipitation, if any, in the area during the past 90 minutes,
- the extended forecast being weather icons, highs and lows for the local city for the next three days,
- forecast for cities nationwide, being a scroll of data about 23 cities.

The Weather Channel features international weather at regular intervals, but in most cases only Europe is presented. The likely presentation will last 50 seconds and will include a satellite loop of cloud cover, a forecast map of the weather for the next day with isobars, and a map of predicted precipitation or a map of predicted highs. Sometimes the international segment will include a synoptic map of the western coasts of the northern Pacific Ocean showing

lows, fronts, isobars, and significant areas of precipitation. This map will be followed by a map of Hawaii showing temperatures and weather descriptions for selected cities. Then a similar map of Alaska is shown, followed by a map of wind chills for the same Alaskan cities. This Pacific sequence may consume 40 seconds. Sometimes the Pacific sequence is preceded by a presentation of the GOES satellite loop showing the west coast of the U.S., Canada, and Alaska.

Recently the Weather Channel has begun to do fairly simple maps to illustrate the cause and effect of specific meteorological events, for example, the drought in the west. For awhile the channel had a series of maps comparing the tracks of storms in 1991-92 with the different pattern in 1992-93. The effect of Mount Pinatubo has been considered. The heavy blizzard of March 1993 in the eastern United States was the subject of another series of maps. These series are more climatological than meteorological.

This four-fold categorization of weather presentation was based on the weather programs I could view conveniently in late 1992 and early 1993. However, after I made the presentation I received information about other television weather shows. If I included information about these shows, it might be desirable to revise the categorization. Also, the presentations have changed somewhat since my period of intense viewing. The biggest change has been in CNN's weather presentation, which now includes maps of the weather in Eurasia and in south and east Asia.

Obviously, the presence of these maps separates the CNN weather presentations from those of the other national networks.

### The Television Viewing Environment

Maps on television are seen in a totally unique viewing environment. Normally, we think of maps printed on large sheets of paper or in atlases. With these analog products, the user has the freedom to view the map as he or she wants. The user can linger over the map, can use reading aids, change light levels, make measurements, and more. By contrast, the user has no control over the presentation of maps shown on television. Viewers see the map appear on the screen only to disappear when the presenter moves on (Carter, 1988b). Although the viewer lacks control over any map shown on television, weather maps are different in that the types of maps and times of presentation are consistent from day to day or even hour to hour. The viewer knows when to tune in and what to expect about the nature and format of the maps that will be shown. New information will be imposed on redundant base data, and the mediator will interpret the patterns shown on the maps and the images. Based on the number of

maps and images produced for presentation on television weather programs, this form of presentation is successful.

The use of maps on television as part of the many weather presentations exposes the public to maps of many types. It is my contention that the largest map viewing audience is the audience of the television weather map. It is equally likely that the largest number of maps made day to day are maps made for presentation of weather on television across the country. It is a big business with a large audience. Besides being a business, it is a means for agencies and individuals to disseminate warnings and give guidelines, a means to transmit helpful advice, and an aid for planning activities. In the process many people learn some geography and much about the atmospheric sciences.

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