

Weather maps on television in the USA

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On all television stations in the U.S. that present a general news program, there will be a weather forecast segment. In almost all of these weather presentations the weathercaster points to features on a variety of maps and comments on the patterns of the weather. The number of TV weather maps produced and the number of viewers of these maps may exceed all other forms of map production and viewing. On any given day many millions of viewers will see one or more weather forecast programs with varieties of maps. The purpose of this paper is to look at how maps are used and presented in this environment. No attempt has been made to evaluate the design of the individual graphics, nor is consideration given to how the maps are made.

There are some common elements in all of these presentations. In all cases observed there is a person controlling the sequencing of the maps and talking about the weather elements portrayed on the maps. All of the presentations are in color. There is usually a synoptic weather map with fronts and areas of precipitation. Likewise there will be a forecast map showing weather for the next day. Maps of forecast high and low temperatures are common to all presentations.

There are two dynamic image maps that are common to most presentations. Each consists of a loop of image data over a period of a few hours. One is a loop showing cloud cover over the past 12-24 hours moving over a base map with political boundaries and hydrography for reference. In most cases the cloud cover is from the GOES satellite centered at about 110° West and covers all of the Western Hemisphere. Presenters may show the entire hemisphere or only a local portion of the image. Colors may be employed to enhance features in the cloud images. The presenter may cycle through this loop a number of times and many times will freeze the loop to look at a particular situation. The U.S. government has a radar network and the images from this network are integrated into a dynamic loop. This imagery covers only the lower 48 states of the U.S.A.

The persons making these weather presentations vary greatly in the skills they bring to the task. In some cases the person making the weather presentation is selected based on appearances in front of the camera and knowledge of weather, maps, and geography is of little concern. In other cases these presenters are formally trained meteorologists. Many of the more formally trained persons make their own forecasts and add interpretations. The American Meteorological Society certifies 'weathercasters'--the name they use for persons making these presentations. The more than 500 Weathercasters so certified can display the AMS seal, which is a matter of pride for many stations.

In many ways the presentations of weather maps on television do what we in cartography aspire to do. Remote sensing imagery and vector data are combined.

These presentations visualize abstract concepts in map form. Many of the presentations are dynamic, showing change of one or more variables over time. Some of these dynamic presentations represent the past, but others are simulations of projected data.

These television presentations represent a unique map viewing environment. In most news stories on television where maps are used the viewer has little anticipation of what map will be presented, when it is coming or how long it will be shown. By contrast, these weather maps are presented in a consistent fashion on the same base by the same personalities at the same time of day, day after day. Viewers become comfortable with a preferred format of presentation and tune in to see new information imposed on a familiar series of map bases.¹

The author identifies four types of weather presentations on television. 1 - Local stations will have a weather segment lasting less than five minutes two or more times a day. The focus is the regional weather but most include an overview of the national pattern. Many of the maps used in these presentations are unique to the local station and vary greatly in quality. 2 - National networks have short weather segments with national maps showing the synoptic pattern and temperatures. These presentations are normally quite brief. In many cases the national network provides an opportunity for the local station to inject a local weather update. 3 - AM Weather is a 15-minute weather program carried on many Public Broadcasting Stations on weekday mornings. A portion of this presentation includes information for pilots. 4 - The Weather Channel represents the ultimate presentation environment. This channel is available 24 hours/day, 7 days/week, and features an almost continuous display of maps interspersed with commercial advertisements.

A discussion of each of these environments follows. The Weather Channel and AM Weather are one of a kind, so that the only question of what to observe and sample was choosing programs. For the national networks and the local stations the choice of what to report on was a matter of what was available for viewing and personal tastes.

Local Stations

Each commercial local station is likely to do three or four news presentations per day: early in the morning, in the early evening, and one at the end of regular programming before most people go to bed. Most of these news programs will be 30 minutes long. Many stations also do a news segment at noon and may have short segments interspersed between other scheduled programs. The news will be presented by a news team, consisting of one or two general news reporters, a sports reporter, and a weather person. For weekends and periods of vacations, there will be replacement persons for each of these individuals. The weekend replacements are likely to be the least trained of all of the weather presenters.

Because most stations purchase the forecast information from one of the firms who provide the data and the graphics, at a minimum the person needs to select some graphics and text and put it together into a segment. Many of the better and more experienced weather persons add their own flourishes to the graphics, create some of

their own maps and charts, and revise the national forecasts according to their own studies. At the other extreme the local team may produce almost all of their own weather information.² It is very difficult to generalize about local weather presentations. In a 30 minute news program 2-4 minutes may be given to the weather segment. Most involve data on local conditions and a look at conditions nationally. All will involve the use of maps. Almost all use a loop showing cloud movements over the area in the last 12 to 24 hours. Likewise, many will use a loop of radar echoes. Some will show the image of the local radar with the beam extending out of the center. In some areas the weather person will name the 'weather spotters' who contributed local observations used in the presentation.

A Unique Local Presentation

Tom Skilling is an AMS Certified Weathercaster who does the weather segment in the 9:00PM news on WGN out of Chicago. As such, this presentation may be thought of as a local presentation but it is not a typical local presentation. Although WGN calls itself a 'SuperStation' and may be seen in many parts of the country, the program has a Chicago bias. I have chosen to detail his presentations because I have watched him for many years and have been fascinated with the details he incorporates into his presentations. It would be impossible to sample all weathercasts from across the country, so I offer this as but one sample of what can be done in a local presentation. There may be more dramatic and more animated weather presentations, but I have not seen them.

The details of one presentation are given to illustrate the use of maps. The length of time the image is displayed is given. This was the presentation of November 18, 1992. In 3 minutes 7 seconds Skilling presented 19 maps, in the following sequence. Many of these maps were dynamic presentations so that there were far more than 19 images shown in this program.

- Loop of the satellite view of clouds over the Midwest in and around Chicago; the clouds are gray to white depending on temperature; 12 seconds
- Color enhanced version of the same loop of clouds; 8 seconds
- Loop of radar echoes as they move over the Midwest; 11 seconds
- 3D satellite representation of clouds in the Midwest; 7 seconds
- Map of the forecast weather for the next 48 hours in the Midwest; bright patches of colors identify various bodies of air and the fronts; many air bodies are labeled; 15 seconds
- Map above put into motion showing how the pattern is expected to move over the next 48 hours; 11 seconds
- Shaded relief map of the U.S. extending from Mexico to Hudson Bay with loop of cloud coverage over the past few hours; 13 seconds
- Loop of radar echoes imposed over the same base map; 11 seconds
- Loop of enhanced satellite image showing Florida and a large storm to the east; 15 seconds
- Map of the synoptic weather pattern extending on the same base from Mexico to Canada; air bodies and fronts symbolized in the bright patches of colors as above; map is put into motion in 3 steps; 15 seconds

- Map of upper air pattern with the jets on the same base; again using comparable color schemes and put into motion in steps; 10 seconds
- Satellite image loop of entire hemisphere from North to South Pole showing the Americas and the Pacific Ocean; 6 seconds
- Same loop focused on the western U.S.A.; 9 seconds
- Dynamic map of a storm system that was predicted to affect the Chicago area; presented in steps; 10 seconds

Skilling then presents statistics on the recent weather in the area before returning to more maps; 15 seconds

- Map of forecast of precipitation in next 24 hours in the USA and Canada; isohyets are employed in a simulated 3D effect; 7 seconds
- Dynamic map of projected storm tracks; product of numerical models; on the same base as former map; 7 seconds
- Same map with areas of cloud cover added and the projected positions of the major center of Low Pressure for the next four days; 7 seconds
- Supercomputer forecast map for 5 days out with fronts and isobars; 9 seconds
- Same forecast map with projected areas of cloud cover and precipitation; 4 seconds

The weathercaster then provides his forecast in terms of statistics as he completes his part of the news show.

Skilling often employs some other devices to help explain the behavior of the weather. One common technique is to use a 3D grid suspended over the map surface to give visual form to a large dome of high pressure. This grid is viewed from a perspective position. With a dynamic presentation he then shows how the pressure surface will change with time. Another interesting map presentation is his attempt to show a spatial interpretation of the probability of precipitation. He has done this with a grid of square cells imposed over an urban map.

National Networks

In the United States each of the three networks ABC, CBS, and NBC, have weekday morning news programs. These programs are built around a host and hostess and a weather person. The regular weather person on each of the networks is quite well known and will have a personal following. At regular intervals the weather person will do his weather presentation. It is appropriate to say 'his' in this case for as far as I know only men have served as the weather persons on the three networks. In all of the other weather presentation environments, women are well represented as weather presenters.

All of the three networks have associations with local stations. In many cases the national broadcast of weather will consist of two or three national maps presented by the weather personality and then a cut-away to the local weather person for a brief segment on the local situation. When the local station chooses to not take the opportunity to cover the local weather, a filler such as a listing of the weather in the major cities around the nation is shown.

Of the three national maps likely to be shown, the first map will feature the weather for the day with areas of precipitation and cloudiness highlighted. Fronts may be represented, as well as areas with extreme weather. In most cases these maps are quite generalized. The second map will be similar to the first but will be the forecast for the next day. A third map is likely to portray the predicted high temperatures for this day. The total time for such national presentations is likely to be 30 seconds to 2 minutes. The local weather segment will be about 30 seconds long. This may be as simple as a map of high temperatures for the day with a voice-over of the local forecast. In other cases the presenter may show a map of the counties in and around the viewing area. Icons will be used over selected cities to indicate the type of weather and high temperatures will be written beside the icons. A radar image may be shown if precipitation is present. If weather is a problem with driving on this day then a map may be used to indicate problem areas. The local segment will probably include some statistics.

The Cable News Network, or CNN, is still another type of national channel. This television network is available only to cable subscribers and in many cases cable subscribers have to pay an extra charge to get access to CNN. With regularity, weather and other news items are provided. As on the other networks the weathercasters on CNN have become well known personalities and interact with the other news broadcasters on the show.

Unlike the other national networks, CNN does not have local affiliates. Therefore, there is no local weather, only the national picture of the weather. There appear to be two types of weather presentations made on CNN. One is a quick overview of perhaps 40 seconds duration. This may consist of a map with fronts, clouds, and types of precipitation for the U.S.A. and Canada following by a similar map showing the prediction for a day later. The other type of weather presentation will be much longer and will have the weathercaster standing in front of the maps and making interpretations. The base map used by CNN shows most of the Gulf of Mexico on the south to much of Hudson Bay in Canada on the north, the same as employed in most weather presentations focusing on the U.S.A. The weathercasters on this channel often show an integration of the radar loop over the cloud loop to give a dynamic image of the recent history of precipitation and cloud cover over the country.

AM Weather on Public TV

This 15-minute program is produced early in the morning Monday through Friday and is made available to Public Television stations. Public Television is non-commercial. The individual stations can show it when they want to and more than 300 stations carry the program. In central Illinois one public station shows it at 6:15AM and another shows the same program at 7:15AM. Not all public television stations chose to show the program while some show the program more than once.³

From day to day all programs look alike, although there might be a special segment where interesting data are available or where an unusual weather event dominates the news. There are three meteorologists associated with the program and two of them

are seen in each broadcast. The meteorologists use a wooden pointer to point out specific items or areas of interest as they talk through the maps. The persons are not visible when the maps are viewed, unlike most other television weather presentations. The basic map used to show the U.S.A. extends north to include southern Canada and extends south to include much of the Gulf of Mexico. This map does not extend east to include all of the Maritimes of Canada, nor is there any attempt to include Alaska or Hawaii. The producers of the show are aware of the extent of their ability to forecast in areas where data are limited and therefore they do not try to forecast where they cannot give reliable forecasts.

The synoptic charts used on television employ a subset of the traditional weather symbols used on standard National Weather Service synoptic charts. To help the reader use these charts the producers distribute a guide to the symbols to anyone who sends a self-addressed stamped envelope. The symbols used on the TV synoptic charts are bolder than the standard symbols and are in color to aid in recognition. For example, haze and fog are in yellow and black and are the only two symbols employing yellow.

The following sequence of maps illustrates the nature of the program flow and the use of maps in one of these presentations. This particular presentation was December 30, 1992. The program begins with the title lead-in, followed by credits and sponsoring organizations. The meteorologists then introduce themselves and make brief comments about the nation's weather. Then the following set of maps were shown. In most cases the shift from one map to the next is instantaneous.

- Satellite view of North America extending from northern South America to the Arctic Ocean, showing cloud patterns over the eastern Pacific Ocean; starts with a static pattern of clouds; low clouds are dark gray and higher clouds are white; the focus is the jet streams which are shown as ribbons using a symbol that implies movement; 15 seconds
 - The jets are removed and the clouds are set in motion; the cloud loop covers 23 hours up to about 2 hours before the program is produced; 14 seconds
 - Same satellite image map but the coverage is limited to the conterminous 48 state and southern Canada; the clouds are put in motion and then turned off and on as the meteorologist reviews specific events; 50 seconds
 - Same cloud map focused on the west coast where there have been heavy rains: 30 seconds
 - Radar imagery showing precipitation for the 48 states; shown as a loop which is then frozen; where high tops of clouds prevail the elevations of those tops are shown; 32 seconds
 - Current synoptic map of the U.S.A. and southern Canada; 77 seconds
- Then one meteorologist comes on and introduces the forecast segment; 8 seconds
- Projected fronts and areas of projected precipitation by type for the coming evening, about 12-24 hours away; 32 seconds
 - Same map for the next evening; 27 seconds
 - Same map for two evenings hence; 29 seconds
 - Projected high temperatures for this day; 22 seconds
 - Projected high temperatures for tomorrow; 18 seconds
 - Projected low temperatures for this coming evening; 17 seconds

- Projected low temperatures for tomorrow evening; 14 seconds
- Projected quantities of precipitation over the next 24 hours; 22 seconds
- Projected five day forecast of temperatures showing areas predicted to be above and below normal; 12 seconds
- Projected five day forecast of precipitation showing areas predicted to be above and below normal; 15 seconds

Then one meteorologist introduces the section on flying conditions; 10 seconds

- Map of current flying conditions showing areas where instrument flight rules and marginal visual flight rules exist; 18 seconds
- Same map with contours of freezing level heights imposed; 17 seconds
- Same map with areas of turbulence indicated; 15 seconds
- Comparable map of flying conditions that afternoon; 11 seconds
- Same map with projected areas of turbulence indicated; 12 seconds
- Map of winds aloft, at 2,000 feet above the ground surface; broad arrows are employed to show general trends; colors are used to show areas where speeds range between 25-50 knots; 6 seconds
- Winds aloft map at 10,000 feet mean sea level; 11 seconds
- Winds aloft map at 18,000 feet msl; colors show areas where winds are 25-50 kts and 50-100 kts; 13 seconds

Then one meteorologist introduces weather advisories and warnings in a section called 'weather watch'; 3 seconds

- Northeastern U.S. and Canadian Maritimes; 12 seconds
- Northeastern U.S. to Great Lakes area in U.S. and Canada; 10 seconds
- Southeastern U.S.; 6 seconds
- Eastern 1/2 of the U.S. showing areas with gale warnings; 10 seconds
- Upper Midwest/Plains States of U.S.; 16 seconds
- Northwestern U.S.; 17 seconds
- Southwestern U.S.; 23 seconds
- The Pacific Coast of the U.S.A.; 19 seconds

The producers extended the coverage of the forecasts to southern Canada in response to requests from Canadians who could pick up the program. Because of a lack of data they will not extend the forecasts to include Mexico. Based on the correspondence received the producers estimate a viewing audience of about one million persons for these broadcasts.⁴ When unique items become available they may be included in a program. One day last summer they included a loop of three months of the AVHRR vegetation index for North America, showing when the vegetation greened up from winter into summer.

The Weather Channel

This channel is included in the basic cable TV package in most areas. Its sole programming consists of reports on current weather, forecasts of weather, and weather related activities 24 hours/day, 7 days/week. The programming is fairly predictable but is flexible enough that in the event of interesting features or natural disasters the weathercasters will give greater emphasis to such events.

At the top of the hour there will be a segment showing the current and forecasted weather for the nation. This segment is likely to last for at least six minutes without interruption. The presentation will include satellite image maps of the country in which the clouds are put into motion and stopped as the presenter points out particular events. In most cases this presentation will include close-ups of areas with particular problems. Viewers will also see a national map showing the loop of radar echoes as they have evolved over the past 90 minutes. There will be forecast maps for the coming three to five days. There is likely to be a map of departures from normal for temperatures or for precipitation, depending on which is more dramatic at the time. Included in this section may be discussions of why the weather is as it is. For instance, when freezing rain was covering a large portion of the Midwest, the meteorologists created a map showing how a large trough of cold air was penetrating into the center of the country while a layer of warm air was moving north and overriding the cold air mass. This presentation was dynamic as the warmer, moist air was seen to slide northward overriding the colder air.

Many of the maps in this current weather presentation will be shown again and again during the day. However, the weathercasters are sensitive to the data they are showing and maps are revised as needed. For example, the author observed a presentation on wintery travel conditions in which the weathercaster made a point of indicating that he and his colleagues had extended the zone of freezing rain to the east of the area shown on the map and that colleague were updating the map as he spoke. He even commented that this is one of the advantages of working in live television.

Interspersed throughout the presentations by the weathercasters will be segments on local weather and commercial advertisements. There may be 10 of these local weather segments in an hour, each lasting for a little more than a minute. A major function of TWC is broadcasting the National Weather Service local forecasts for each of the over 800 NWS zones.⁵ In total, the local weather segment may account for one-fifth of the total programming. This segment is automated and contains either a recorded voice-over or music. The items included in each local weather segment vary and may include any of the following:

- text description of 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 3 days
- forecast for cities nationwide, being a scroll of data about 23 cities

Advertisements may account for one-fifth of the total programming. Many of the advertisements are related to weather. Having built an interest in weather, viewers want more which has created other business. TWC advertises its own books, videos and services. Being able to telephone for detailed weather information for any of about 300 cities around the world is one of these services. They now have a segment

Concluding Comments

called the 'Weather Classroom' which is repeated many times late at night. They suggest that viewers record the segment and play it later at their convenience. They sell a workbook in support of the Weather Classroom.⁶ This book includes instructions on reading weather maps.

The Weather Channel features 'international weather' at regular intervals. In most cases the only thing presented is Europe. 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 northern Pacific Ocean showing lows, fronts, isobars and significant areas of precipitation. This map shows the countries that border the Pacific on the west. 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 Alaska 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.

The Weather Channel employs a great diversity of maps of many types. Some maps are used as tools to help the weathercasters explain a particular weather situation. Other maps are interpretations of weather information, such as the map of 'clothes to wear to school', or the 'discomfort index for persons subject to allergies.' Even choropleth maps are employed to show incidences of outbreaks of disease related to weather conditions. Other maps will address beach and boating conditions, the status of fall colors, the potential for fires, and ski conditions. During the ski season they report of the weather conditions in the areas of the ski resorts and will show maps of regional snowfall with the locations of the ski resorts on the map. Because the Weather Channel is commercial some maps carry the name of the sponsor above the map. It is not uncommon to see the name of the maker of a cold relief medicine attached to a map of 'air stagnation'.

The Weather Channel is unique in that the graphics and maps created by the staff are able to be shown over and over again. The maps that are shown in the sequence at the beginning of the hour may be shown many times over during the hour. In any given hour, three or four weathercasters will alternately make presentations. Each weathercaster prepares his/her own presentation so that each presentation will reflect the individuality of the preparer even though they use the same maps.

Last year the Weather Channel celebrated its Tenth Anniversary. While in the early years many questioned that a 24 hour television weather program would survive, today this channel is available to more than 50 million subscribers.⁷ The substance of this television channel is a continuous display of weather information portrayed on maps. The cartographic community should take satisfaction that the population of television viewers will support a program that is essentially map presentations.

In total, the use of maps for the presentation of weather on television in the USA represents a major industry that is viewed by a very large population. Tens of millions of viewers in North America rely on the availability of systematic weather presentations at predictable times. These presentations serve to disseminate warnings and guidelines, give helpful advice, aid in planning activities and travel, as well as giving peace of mind. In the process millions of persons are exposed to maps that contribute to knowledge of geography and the atmospheric sciences. And, these maps are seen in a way few other maps are viewed in that day after day a similar collection of maps are presented in a systematic way by the same people.

These weathercasters and weather programs are but one step near the end of a large and complex process. The industry is that of weather observation and forecasting. Collecting the data to common standards, bringing the data together at central facilities, incorporating the data into complex models, analyzing the data and generating forecasts, distributing the processed data back out on the networks, and putting the data into graphical form are all done by people not seen on television.⁸ And, all of this is done in near real time. The weathercaster takes this packaged information, adds some refinements and enhancements, designs a program around the maps, and integrates herself/himself into the presentation. The results vary, but obviously there is a market for these presentations.

Weather is something that everyone can identify with. Monmonier cited a study noting "70 percent of the TV news audience is highly interested in the weather."⁹ Wright reported on a study that found 95 percent of the audience watched a local station in Florida for the weather.¹⁰ Obviously, people tune in to look at weather maps. Lindgren¹¹ detailed the use of maps on television during the Gulf War showing that that media event was another situation where viewers wanted to see maps. It is appropriate to ask if there are other 'mappable' subjects that would draw a supportive audience? This question should be examined in terms of the map use environment, which integrates the subject matter with the personalities making the presentations and the medium.

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