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GRAPHICAL WEATHER PRODUCTS AT THE NEWPORT/MOREHEAD CITY NC NATIONAL WEATHER SERVICE (NWS) FORECAST OFFICE

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1. INTRODUCTION

Weather forecasts issued by the National Weather Service provide customers with predictions of meteorological parameters significant to day-to-day living. In an effort to support the NWS's strategic plan (1), and its goal of providing graphical forecast products, the NWS Forecast Office in Newport/Morehead City, NC, has been creating graphical representations of several different forecasts. Details of the NWS Strategic Plan can be found at

http://www.nws.noaa.gov/sp/strplan.htm

Graphical weather forecasts of 3-hourly weather, marine weather, and local weather threats of the day, along with graphics of other weather products, are available on our Internet Homepage.

http://www.nws.noaa.gov/er/mhx

Although these products are graphical in nature, they are also Section 508 (2) compliant. Section 508 of the Rehabilitation Act, amended 1998, requires that Federal agencies' electronic and information technology is accessible to people with disabilities.

The programs that create these graphics were developed locally. They also run locally, and are available to all National Weather Service field offices.

This paper will show the graphical products that are available at the current time and explain how a National Weather Service office can generate them locally. It will also discuss other products that can be formatted as graphics, and present future plans for more graphical products.

Graphical weather products are a very important development in the NWS Strategic Plan. The graphics that are being created at the NWS Newport/Morehead City, NC, have been received very favorably by the public and other government agencies. They are easier to interpret than their textual counterparts. The graphical weather products developed at the National Weather Service office in Newport/Morehead City, NC, have been lauded as a major accomplishment, and represent no small change in how the public gets their weather information.

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2. OLD FORMAT

For nearly 30 years, the Zone Forecast Product (Fig. 1) was a major public product a forecaster would issue after each forecast cycle.

```
936 AM EDT THU SEP 20 2001

NCZ029-044-079-090-091-202100-
UPDATED
DUPLIN-GREENE-LENOIR-MARTIN-PITT-
INCLUDING THE CITIES OF...GREENVILLE...KENANSVILLE...KINSTON...
SNOW HILL...WILLIAMSTON
936 AM EDT THU SEP 20 2001

.TODAY...SHOWERS LIKELY WITH A FEW THUNDERSTORMS POSSIBLE...MAINLY
THIS AFTERNOON. HIGH IN THE LOWER 80S. SOUTH WIND 5 TO 10 MPH.
CHANCE OF RAIN 70 PERCENT.
.TONIGHT...MOSTLY CLOUDY WITH A 30 PERCENT CHANCE OF SHOWERS AND
THUNDERSTORMS. LOW IN THE MID 60S. SOUTHWEST WIND 5 TO 10 MPH.
.FRIDAY...PARTLY SUNNY WITH A 20 PERCENT CHANCE OF SHOWERS OR A
THUNDERSTORM. HIGH IN THE MID 80S. SOUTH WIND 5 TO 10 MPH.
.FRIDAY NIGHT...PARTLY CLOUDY WITH A SLIGHT CHANCE OF SHOWERS. LOW IN
THE MID 60S.
.SATURDAY...PARTLY CLOUDY AND A LITTLE WARMER WITH A SLIGHT CHANCE OF
AFTERNOON SHOWERS OR A THUNDERSTORM. HIGH 85 TO 88.
.SATURDAY NIGHT...PARTLY CLOUDY WITH A SLIGHT CHANCE OF SHOWERS. LOW
IN THE MID 60S.
.SUNDAY...PARTLY CLOUDY WITH A SLIGHT CHANCE OF SHOWERS AND
THUNDERSTORMS. HIGH IN THE MID 80S.
.MONDAY...MOSTLY CLOUDY WITH A CHANCE OF SHOWERS AND THUNDERSTORMS.
LOW IN THE MID 60S. HIGH IN THE LOWER 80S.
.TUESDAY AND WEDNESDAY...MOSTLY CLEAR SKIES. LOWS IN THE LOWER 60S.
HIGHS 81 TO 84.
```

Figure 1: Example of a Zone Forecast Product group.

The Coastal Waters Forecast (Fig. 2) is another product that has been issued in the same format for many years.

```
AMZ150-152-202100-
S OF CURRITUCK BEACH LIGHT TO OREGON INLET NC OUT 20NM-
S OF OREGON INLET TO CAPE HATTERAS NC OUT 20NM-
945 AM EDT THU SEP 20 2001

...SMALL CRAFT ADVISORY THIS AFTERNOON...

.THIS AFTERNOON...SE WIND 20 KT BECOMING S 25 KT. SEAS 6 FEET.
SHOWERS LIKELY WITH A TSTM POSSIBLE.
.TONIGHT...S WIND 15 KT BECOMING SW 10 KT. SEAS 3 FEET. SCATTERED
SHOWERS AND TSTMS.
.FRI...VARIABLE WIND 10 KT BECOMING S. SEAS 3 FEET. WIDELY
SCATTERED SHOWERS.
```

Figure 2: Example of a Coastal Waters Forecast group.

The Coded Cities Forecast (Fig. 3) is a more concise version of the Zone Forecast Product; however, it is difficult for the general public to decipher.

```
FPUS42 KMHX 200716
CCFMHX

MHX TE 081/065 083/067 087 15532
EWN TE 082/065 085/066 087 15532
HSE TE 081/070 081/070 085 15542
PGV TE 081/065 084/064 087 15532
```

Figure 3: Example of Coded Cities Forecast.

The State Weather Roundup (Fig 4.) is a product that is issued once an hour, and displays the weather observations at various locations across the state. It, too, is in a tabular product; however, the main problem with this product is that if the reader is not familiar with the area, it is hard to interpret what is going on across the state.

```
NCZ078-087-090-091-093-098-101-201500-
SOUTHEASTERN NORTH CAROLINA
CITY            SKY/WX     TMP DP  RH WIND       PRES
LUMBERTON       PTSUNNY    73  67  81 CALM       30.07R
GOLDSBORO       CLOUDY     73  63  68 SW6        30.08R
KINSTON         PTSUNNY    73  70  88 CALM        N/A
KENANSVILLE     CLOUDY     68  68 100 CALM       30.07R
NEW BERN        CLOUDY     70  68  93 CALM       30.09R
CHERRY POINT    SHOWER     70  68  93 SW9        30.08R
BEAUFORT        CLOUDY     75  70  84 S12G20     30.08R
WILMINGTON      PTSUNNY    76  69  79 CALM       30.06R
```

Figure 4: Example of State Weather Roundup.

3. NEW FORMAT

While the formats of the Zone Forecast Product, the Coastal Water Forecast, and the State Weather Roundup has not changed with the advent of the Advanced Weather Interactive Processing System (AWIPS) (an automated weather information communication, processing, and display system of the National Weather Service) and the Interactive Forecast Preparation System (IFPS), which is a way for the forecaster to interact with raw model data, and represents a better way to make a weather forecast, the Coded Cities Forecast has been expanded from 2 1/2 days out to 7 days (Fig. 5).

```
FPUS42 KMHX 200716
CCFMHX

MHX TE 081/065 083/067 087 15532
    BBBAA 066/084 066/082 063/082 062/082 064 02233220000
EWN TE 082/065 085/066 087 15532
    BBEAA 065/084 066/082 061/082 061/082 064 22233220000
HSE TE 081/070 081/070 085 15542
    BBBAA 068/081 070/080 065/080 066/080 068 22233200000
PGV TE 081/065 084/064 087 15532
    BBBAA 065/085 064/082 061/078 060/081 064 02233220000=
```

Figure 5: Example of new Coded Cities Forecast format.

The implementation of IFPS has enabled NWS Forecast Offices to create the Revised Digital Forecast (Fig. 6), a detailed, tabular forecast product. Weather elements are presented in 3-hourly forecast increments for the first 3 days, and 12-hourly increments for the next 4 days.

```
DUPLIN-GREENE-LENOIR-MARTIN-PITT-
INCLUDING THE CITIES OF...GREENVILLE...KENANSVILLE...KINSTON...
SNOW HILL...WILLIAMSTON
308 AM EDT THU SEP 20 2001

             THU  09/20/01     \     FRI  09/21/01     \     SAT  09/22/01
EDT        03 06 09 12 15 18 21 24 03 06 09 12 15 18 21 24 03 06 09 12 15 18

POP 12HR                50          30          20           0          20
QPF 12HR                 0           0           0           0           0
MAX QPF                  0           0           0           0
MX/MN                   81          65          84          64          87
TEMP          70 76 80 79 74 70 69 68 69 76 79 78 74 72 68 66
DEWPT         66 67 66 66 67 67 66 66 67 68 66 66 66 65 65 65
RH            87 74 62 64 79 90 90 93 93 76 64 67 76 79 90 97
WIND DIR       S  S  S  S  S  S  S SW SW  S  S  S  S  S  S  S
WIND SPD       5 10 10 10 10 10 10  5  5  5  5 10 10 10 10 10  5  5 10 10
CLOUDS        MC MC MC MC MC MC MC MC MC MC PC PC PC PC PC PC PC PC PC PC
RAIN SHWRS     C  C  C  C  C  C  C  C  C  S  S  S  S  S  S  S  S  S  S  S
TSTMS          C  C  C  C  C  S  S  S  S  S  S  S                S  S  S  S

           \SUN 09/23/01\MON 09/24/01\TUE 09/25/01\WED 09/26/01\
EDT        21 03 09 15 21  03 09 15 21  03 09 15 21  03 09 15 21

POP 12HR     20    30    30    20    20     0     0     0
MX/MN        65    85    64    82    61    78    60    81
CLOUDS       PC    PC    PC    MC    MC    SC    SC    SC
RAIN SHWRS    S     C     C     C     C
TSTMS               S     S     S     S
```

Figure 6: Example of Revised Digital Forecast.

4. GRAPHICAL FORECASTS

Many weather products can be presented in a graphical format. Presented in this section are several products that are reformatted by programs written at the NWS office in Newport/Morehead City NC, and displayed on Internet.

a. Revised Digital Forecast

The Revised Digital Forecast (RDF) is a very detailed forecast product issued by National Weather Service offices. However, for the general public, it is difficult to read and interpret. Therefore, the National Weather Service office in Newport/Morehead City has developed an AWIPS-based program that converts this tabular product into a graphical one for display on Internet homepages (Fig. 7).

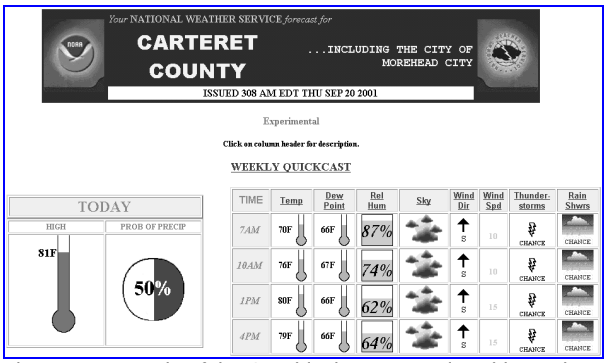

Figure 7: Example of the Graphical RDF. To view this product in color, go to http://www.nws.noaa.gov/er/mhx/digital/095.htm

This graphical zone forecast product offers the general public an easy-to-interpret forecast for maximum and minimum temperatures, and daytime and nighttime probability of precipitation. It also presents 3-hourly forecasts of temperature, dewpoint, relative humidity, sky condition, wind speed, and wind direction, and if forecast, obstruction to visibility, precipitation, heat index and wind chill. These elements are forecast out to 60 hours.

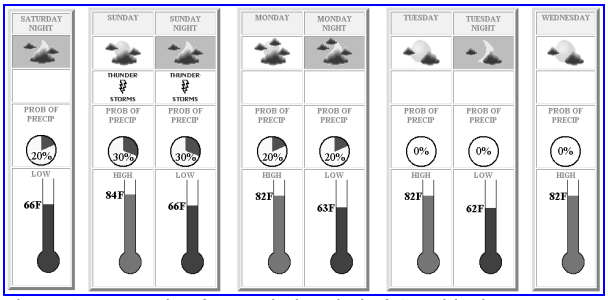

Figure 8: Example of extended period of Graphical RDF.

From 60 hours out to 7 days, forecasts for maximum and minimum temperatures, probability of precipitation, precipitation type if available, and sky condition are presented on a 12-hour temporal resolution (Fig. 8).

In addition, each 12-hour forecast within the ensuing 60-hour time period, and the entire extended forecast period out to 7 days, are available in printable format for those who want to print and display just one period.

A "Weekly Quickcast" (Fig. 9) is also available from the Graphical RDF page. This product gives the user a "one-stop shopping" page for the weather expected for the next 7days. It includes maximum and minimum temperature, daytime and nighttime probability of precipitation, midday and midnight sky condition, predominant weather of the day, wind speed range, predominant wind direction, and maximum and minimum relative humidity.

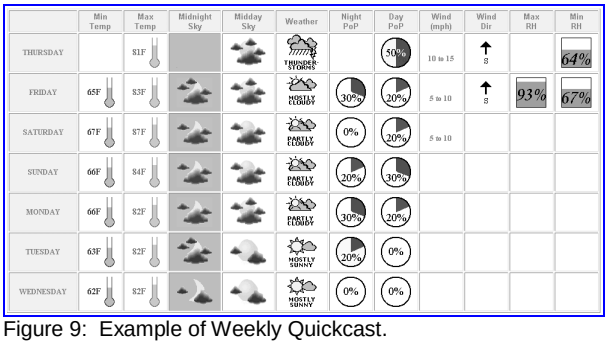

Figure 9: Example of Weekly Quickcast.

Each of these pages is available for each county in the County Warning Area. The Eastern Region of the National Weather Service has adopted this format for each NWS Forecast Office homepage. This product is very easily read and interpreted, and provides a standard way for NWS offices to present weather forecasts graphically. Feedback from the public, and from emergency managers and other officials, has shown enthusiastic approval, and wide use of this graphical product. In fact, this product was used to brief New York City officials during the rescue efforts after the World Trade Center attacks on September 11, 2001.

b. Coastal Waters Forecast

The text version of the Coastal Waters Forecast (CWF) is an easy product to read. Often, however, mariners simply want to know if there are any flags, e.g. threats to boating (high winds, rough seas) forecast for their area of concern. Therefore, a graphical product (Fig. 10) is being produced by the NWS office in Newport/Morehead City NC, to give mariners a quick look at any hazardous weather they may expect during the next 12 hours.

A current example of the Graphical CWF is located at:

http://www.nws.noaa.gov/er/mhx/marine/cwf.htm

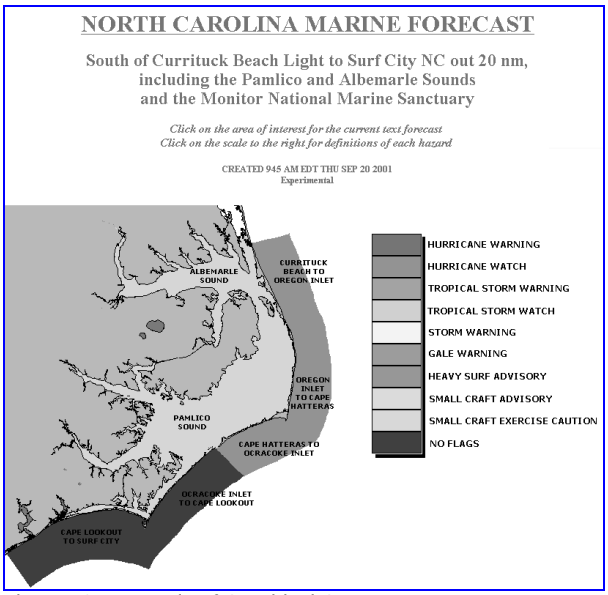

Figure 10: Example of Graphical CWF.

c. Eastern Regional Coastal Waters Forecast

A graphic of all of the marine flags forecast for the coastal waters off the coastline of the NWS Eastern Region is available at:

http://www.nws.noaa.gov/er/mhx/ermarine/ercwf.htm

This page presents a graphical forecast of hazards that may be encountered by mariners navigating the near-shore waters along the East Coast (Fig. 11). It covers the coastal waters from Maine southward to northern Georgia.

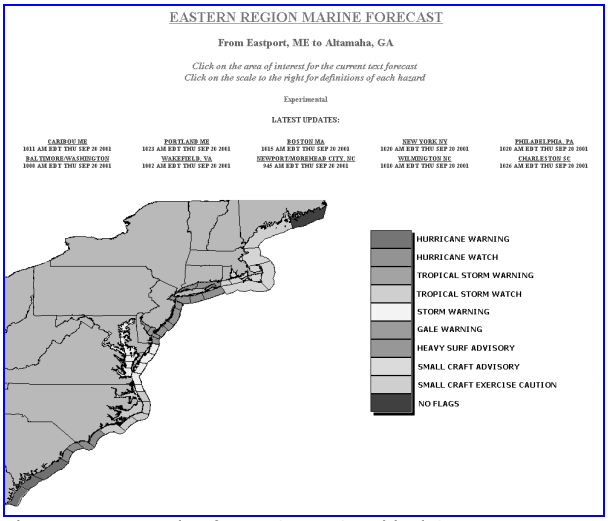

Figure 11: Example of East Coast Graphical CWF.

d. Coded Cities Forecast

The Coded Cities Forecast is another tabular product that is somewhat difficult for the general public to interpret. The program to produce the graphical representation of this product was written at the

Wilmington NC weather office. The Newport NC office has adapted this graphic for local use (Fig. 12).

An example of this product can be seen at http://www.nws.noaa.gov/er/mhx/mhx.html

A separate product is produced for each station in the Coded Cities Forecast product. To access each of the cities, links are available from the main Internet page.

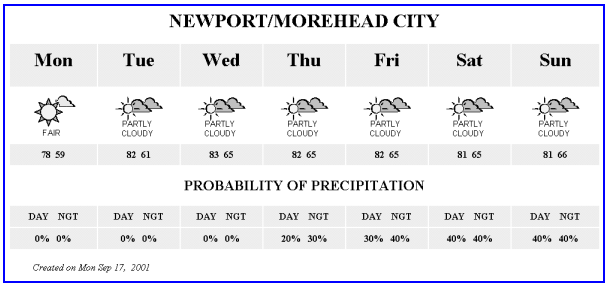

Figure 12: Example of Graphical CCF.

e. State Weather Roundup

The State Weather Roundup (SWR) is a tabular product that is easy to interpret. However, if the user is not familiar with the area, the product is of no use. Therefore, a graphical version of this product (Fig. 13) is produced every hour.

This product is available at http://www.nws.noaa.gov/er/mhx/swr/swr.htm

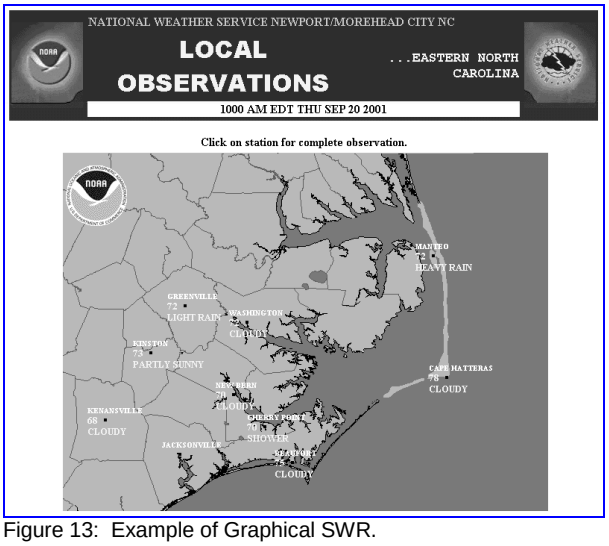

Figure 13: Example of Graphical SWR.

f. Regional Temperature/Precipitation

Similar to the State Weather Roundup is the Regional Temperature and Precipitation (RTP) product (Fig. 14), produced two times a day. This product lists the observed maximum and minimum temperatures and observed precipitation for the day.

The RTP is also presented in graphical form at http://www.nws.noaa.gov/er/mhx/swr/rtp.htm

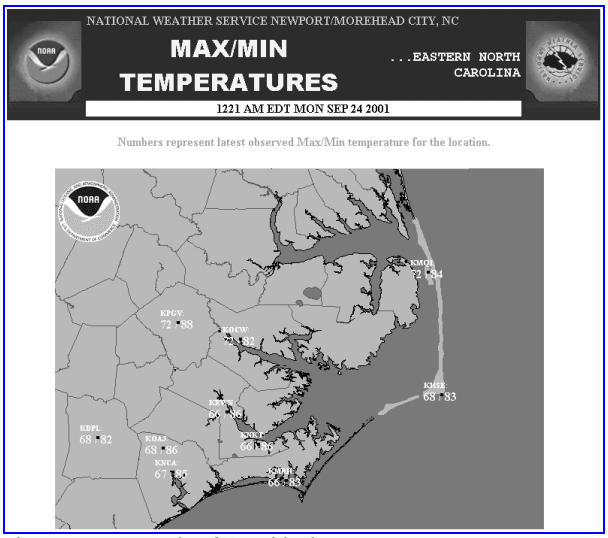

Figure 14: Example of Graphical RTP.

g. IFPS Produced Graphics

The IFPS produces, on demand, various graphical forecasts (Fig. 15), which can be uploaded automatically to Internet. While these products are produced by the IFPS, a program was written locally to make displaying these graphics on Internet easy for the general public. The Graphical User Interface for these products is at

http://www.nws.noaa.gov/er/mhx/gfe/getgraf.htm

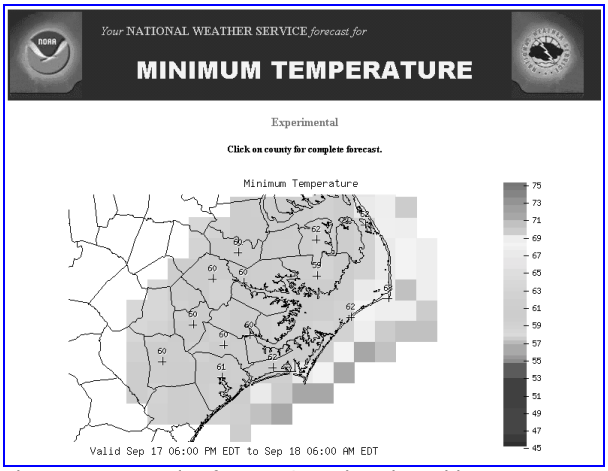

Figure 15: Example of an IFPS produced graphic.

5. CREATING THE GRAPHICS LOCALLY

All of these products are produced by the AWIPS automatically. When the text product is issued, it triggers the appropriate program to run. The program will read the product, interpret it, put the data into html format, then send the html files to the Internet web server. Once the programs are installed they are completely hands-off, ie, the forecaster doesn't have to do anything to generate the products.

Local National Weather Service offices can get the software from the National Weather Service Local Applications Database at

http://isl715.nws.noaa.gov/LAD/site.php3

6. FUTURE PLANS

Several other National Weather Service products will be formatted as graphical products in the future.

a. Regional Coastal Waters Forecast

The regional Coastal Waters Forecasts are one example of this. Southern Region, Western Region, and Central Region (Great Lakes area) all have coastal areas. The base graphics are already completed for these regions. This product will be similar to the Eastern Regional Coastal Waters Forecast (section 4c).

b. Fire Weather Forecast

The Fire Weather Forecast is another product that lends itself to graphical representation (Fig. 16). It is currently a tabular product.

```
NCZ095-098-202205-
CARTERET-ONSLOW-
412 AM EDT THU SEP 20 2001

                          TODAY       TONIGHT          FRI

CLOUD AMOUNT            MO CLDY      MO CLDY      PT CLDY
PRECIP CHC (%)               50           30           20
PRECIP TYPE               TSTMS      SHOWERS      SHOWERS
MAX/MIN TEMP                 81           65           83
WIND                       S 15          S 5         S 10
PRECIP AMOUNT            .25-.50            0            0
PRECIP DURATION              3            --           --
HUMIDITY (%)                58           100          55
HAINES                       3            3            3
LAL                          3            2            2
MIXING HGT/DISP           4600         FAIR         5500
TRANSPORT WIND           SW 20            --        SW 15
VENTILATION RATE         92000            --        82500
INVERSION BURNOFF TEMP   NO INV           --        NO INV
REMARKS...NONE
$$
```

Figure 16: Example of tabular Fire Weather Forecast

Local Forestry personnel like the layout and information presented on the Graphical Revised Digital Forecast. The Graphical Fire Weather Forecast will combine the information in the text product with some information from the Revised Digital Forecast.

c. Rip Current Forecasts

The last graphical product in the planning stages is the Rip Current Forecast (Fig. 17), issued during the summer months. The Rip Current Forecast is an experimental product, and was issued during the summer of 2001. It was utilized by local beach officials to warn the public of dangerous swimming conditions.

```
NCZ096-098-202200-
CARTERET-ONSLOW-
1132 AM EDT THU SEP 20 2001

.RECREATIONAL FORECAST...

THE FORECAST FOR THE CRYSTAL COAST INCLUDING NORTH TOPSAIL BEACH...
EMERALD ISLE...PINE KNOLL SHORES...AND ATLANTIC BEACH.

...INCREASED RIP CURRENT THREAT TODAY ALONG THE CRYSTAL COAST...

ALONG THE AREA BEACHES THIS AFTERNOON...SHOWERS ARE LIKELY WITH A
FEW THUNDERSTORMS POSSIBLE. HIGHS WILL BE IN THE LOWER 80S WITH
SOUTH WINDS AROUND 15 MPH.

RIP CURRENT THREAT...
THERE IS AN INCREASED RIP CURRENT THREAT TODAY ALONG CRYSTAL
COAST BEACHES. THIS MEANS THAT WIND...WAVES AND TIDES ARE
CREATING STRONG RIP CURRENTS ALONG THE COAST.

WATER TEMPERATURES ALONG THE CRYSTAL COAST.
BEAUFORT HAD 75 DEGREES, AND HAMMOCKS BEACH REPORTED 74.

TIDE INFORMATION FOR ATLANTIC BEACH.

LOW TIDE 429 PM THIS AFTERNOON.
HIGH TIDE 1028 PM THIS EVENING.
LOW TIDE 432 AM FRIDAY.
HIGH TIDE 1057 AM FRIDAY.
```

Figure 17: Example of Rip Current Forecast.

The graphical representation of this forecast (Fig. 18) was created manually on a PC during the summer of 2001. However, by the summer of 2002, it will be an automated AWIPS program.

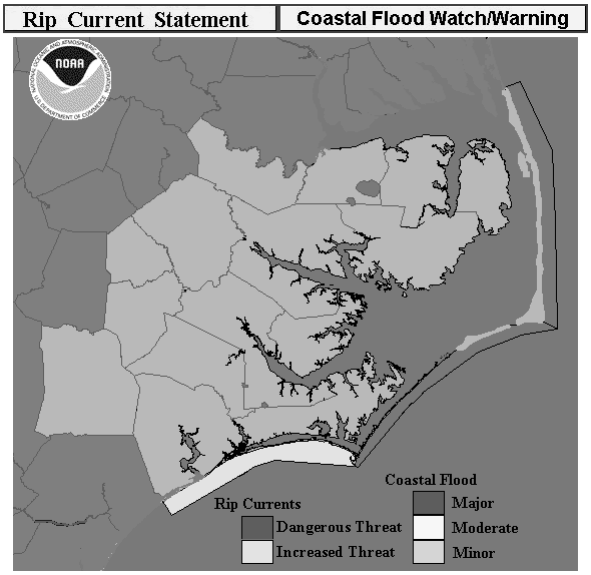

Figure 18: Example of Graphical Rip Current Forecast.

To view this product, see

http://www.nws.noaa.gov/er/mhx/threats/othermar.htm

d. Other Products

Other products that are being planned for reformatting as graphical products using AWIPS are the manually produced Local Hazards graphics (Fig. 19). The Local Hazards graphics include, among others, forecasts of severe thunderstorm types, river flooding, and winter weather types. To view these products, which are currently being created manually on a PC, see

http://www.nws.noaa.gov/er/mhx/threats/HWOpage.htm

Figure 19. Example of Local Hazardous Weather product.

7. National Products and Section 508

At a recent Eastern Region Webmaster conference, there was a discussion about how to make other graphical products Section 508 compliant, for example, local radar depictions, satellite images, upper air charts, etc. While I have no suggestions on some of these, I would like to offer an option for IFPS produced graphics and radar charts.

At the current time, the IFPS graphics that are published on the Newport/Morehead City NC web page are image-mapped by county, and linked to the appropriate Graphical Revised Digital Forecast page. In the future a separate file will contain only the maximum temperature, minimum temperature, probability of precipitation, etc., generated from the Revised Digital Forecast, and linked to from the IFPS generated graphics.

This same method could be used for radar charts. Image maps of the County Warning Area can be linked from the radar graphic to the appropriate NOWCAST (short term forecasts produced by NWS Forecast Offices).

8. ACKNOWLEDGEMENTS

The author would like to acknowledge Warning Coordination Meteorologist Jeff Orrock for his work in developing the local threats page and graphics, forecaster Chris Collins for his work in setting up IFPS, the Newport/Morehead City, NC, internet web page, and for his work on the application that creates the Graphical RTP. The author would also like to thank Meteorologist-in-Charge Tom Kriehn, Data Acquisition and Program Manager Central Wills, Rose Miller of Eastern Region Scientific Services, and meteorological intern Nick Petro for their review of this paper.

REFERENCES

(1) National Weather Service, 1999: "National Weather Service Strategic Plan for Weather, Water, and Climate Service 2000-2005", U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Weather Service [Available on-line from http://205.156.54.206/sp/strplan.htm

(2) Center for IT Accommodation (CITA), Office of Governmentwide Policy, U.S. General Services Administration, cited 2001: "1998 Amendment to Section 508 of the Rehabilitation Act". [Available on-line from http://www.section508.gov/508law.html]