

Graphically Depicting East-Central Florida Hazardous Weather Forecasts

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1. Introduction

The National Weather Service (NWS) office in Melbourne, Florida has piloted an experimental project that uniquely presents the daily *Hazardous Weather Outlook* (HWO) and the event-driven *Hurricane Local Statement* (HLS) products in graphical format (Pendergrast et al., 2000). The purpose is to complement the official text versions of these products, exploiting both the communication and display capabilities of the Internet. Due to the diversity of threats, as well as the chance for multiple coincident threats, the text version alone is often insufficient to properly convey all weather concerns. As a result, the text products may become overwhelmingly large in order to accommodate detail, or overgeneralized to allow for product length manageability. Adding a graphical component to these widely used products greatly improves their usefulness and may change the way the NWS provides hazardous weather information to its users.

2. Graphical Hazardous Weather Outlook Depiction

The experimental graphical Hazardous Weather Outlook (gHWO) is issued everyday by 0600 LST, coincident with the official textual HWO release. Users consist of emergency managers, law enforcement, water management districts, media, other government agencies, and the public. The intent is to provide decision makers with detailed hazardous weather information for planning purposes early each day. Routine updates are provided by 1100 LST during the central Florida wet season to better depict convective threats for the remainder of the day, with additional updates issued as necessary. The gHWO consists of text and interactive web graphic products that individually address expected weather threats for the next 12-24 hours. All graphics are manually generated using Microsoft's *Paint*.

The gHWO web page addresses the following categories of hazards inherent to east central Florida: **Thunderstorms, Flooding, Seasonal, Marine, and Fire Weather**. Each category contains one or more specific hazards, e.g. the **Flooding** category addresses: **(Flash) Flooding, River Flooding, and Coastal Flooding**. The **Seasonal** category has two versions; one for the warm season and one for the cool season and includes such hazards as **Heat Stress, Wind Chill, Rip Currents, Fog/Smoke, and Sustained Winds**. Each day, forecast hazard information is depicted upon an assortment of thumbnail images that can be enlarged by the user to show specific detail. Each graphic combines a *Threat Area Map* (TAM) with one or more *Degree of Threat* (DoT) bar charts to adequately describe the particular threat(s). The combined DoT and TAM concept is described further in sections 3 and 4.

Additional supporting information provided on the web-page includes:

- A *Spotter Activation* map with a county-by-county depiction of anticipated SKYWARN activation requirements.

- A *Situation Room* link for when hazardous weather becomes imminent. NWS watches, warnings, advisories, and forecasts can be obtained here, along with radar, satellite, and observational information.
- Links to preparedness information, severe weather safety rules, fact sheets, and frequently asked questions.

3. Degree of Threat (DoT)

The DoT bar charts express the level of threat for particular hazards while providing a mechanism to maintain day-to-day, and forecaster-to-forecaster, consistency during product composition (considered a significant issue). Each DoT has five possible color-coded threat levels, with Level 5 representing the greatest threat. The bar charts are used to depict the greatest level of threat that exists *within east central Florida* for the particular hazard, with considerable care taken not to minimize (or over-emphasize) any of the potential hazards. Forecasters are instructed to guard against inadvertent localization when translating threat information over to the area maps. They must also keep in mind the difficulties regarding forecast precision as it relates to the exactness of hazard magnitude, location, and timing.

For long-fused hazards (i.e., **Fire Weather, Coastal Flooding, Heat Stress**, etc.), threshold definitions were formulated based on historical knowledge, local experience, and the current tiered watch/warning/advisory structure. For example, Fire Weather threat levels were defined as:

- Level 1 - “*Fire Danger*” (Fire Weather Watch conditions forecast).
- Level 2 - “*Moderate Fire Danger*” (Red Flag conditions forecast with winds less than 15 mph and no lightning).
- Level 3 - “*High Fire Danger*” (Red Flag conditions forecast with winds less than 15 mph but with lightning).
- Level 4 - “*Very High Fire Danger*” (Red Flag conditions forecast with winds 15 mph or greater but no lightning).
- Level 5 - “*Extreme Fire Danger*” (Red Flag conditions forecast with winds 15 mph or greater and lightning).

For short-fused hazards (mainly convective events), threat levels were determined based on 1) the confidence of an individual hazard occurring within east central Florida (probability of occurrence - percent value); 2) its expected county coverage (percent number of counties in forecast area possibly affected - percent value); and 3) its potential impacts to life and property (impact coefficient based on magnitude). Each of these parameters are assigned numerical values ranging from lower (confidence, coverage, impact) to higher (confidence, coverage, impact). To compute the maximum DoT, the three variables are multiplied together for each individual (convective) hazard. The resultant value is then compared to an empirically calibrated scale to arrive at the appropriate threat level.

- Level 1 - “*Hazard Threat*” (value of 0.02 - 0.05)
- Level 2 - “*Moderate Hazard Threat*” (value of 0.06 - 0.15)
- Level 3 - “*High Hazard Threat*” (value of 0.16 - 0.25)
- Level 4 - “*Very High Hazard Threat*” (value of 0.26 - 0.35)
- Level 5 - “*Extreme Hazard Threat*” (value 0.36+)

4. Threat Area Map (TAM)

The TAMs are used to highlight specific regions of east central Florida with the greatest risk of a particular hazard and/or to delineate the timing of its occurrence. The TAMs are color-coded to correspond to the current DoT threat levels and to give forecasters the opportunity to depict various geographical threat variations. The TAMs employ the use of plan-view maps with textual annotations for clarity. To minimize confusion by users, forecasters are restricted to the same five colors used within the DoT bar charts (plus black for text) when preparing the TAMs. Finally, white serves as the background color and denotes the absence of noteworthy threat. Using the DoT and TAM combination, the forecaster has a powerful means to relay an abundance of information in a very concise way.

5. Graphical Hurricane Local Statement Depiction

A graphical Hurricane Local Statement (gHLS) was also implemented using a web-based environment similar to that of the gHWO product. The gHLS product is produced in conjunction with textual HLS's once a portion of coastal east central Florida has been placed under a Tropical Storm or Hurricane Watch/Warning. The gHLS's are issued frequently, approximately every 6 hours, and replaces the gHWO until all tropical Watches/Warnings are discontinued for east central Florida.

The gHLS was designed to complement tropical cyclone forecasts and warnings provided by the Tropical Prediction Center (TPC) by addressing the expected *local* hazards. The hazard categories include: **Wind**, **Surge**, **Marine**, **Flooding**, and **Tornadoes**. Each category contains a corresponding thumbnail image with a TAM and DoT, *specific to east central Florida* (again, to be enlarged at the viewer's discretion). Included in the gHLS package is latest TPC track forecast with the average error swath superimposed to emphasize the increasing degree of forecast uncertainty with time.

A combined graphic containing the maximum DoT level for each of the five tropical cyclone hazards is also provided to indicate the individual threat levels relative to each other. For example, assume a category four hurricane was forecast to make landfall over extreme southeast Florida in 8 hours. While official TPC products would primarily highlight dangerous **Wind** and **Surge** effects, the gHLS DoTs could also emphasize **Flooding** and **Tornadoes** as the most significant concerns for east central Florida. Furthermore, the TAMs could geographically delineate the greatest impacts for the southern portions of east central Florida, with lower threat levels for northern areas.

Additional supporting information on the web page includes:

- An *Emergency Preparedness* link containing specific hurricane information (evacuations, shelters, etc.) for each affected county, as well as local hurricane surge maps.
- A *Situation Room* link for when hazardous weather becomes imminent. NWS watches, warnings, advisories, and forecasts can be obtained along with radar, satellite, and observational information. Thumbnail images of TPC graphical and textual products are also shown for the threatening tropical cyclone, as well as graphical severe local storm maps from the Storm Prediction Center, and a link to the Southern Region Headquarters Tropical page.

- A highly visible link to the Tropical Prediction Center web-site.

6. Conclusions

With the ability to present the HWO and HLS graphically, NWS Melbourne can now provide valuable information to decision makers in a more useful format than in the past. Although the production of these graphical products is currently experimental, they do support the National Weather Service's Strategic Plan (NOAA/NWS, 1999) by providing new and innovative products to better serve the user community. So far, feedback has been very positive. Comments from a customer feedback group have been compiled, and many of the suggestions have been incorporated into a recent gHWO upgrade. A gHLS customer feedback group has also been formed and comments are currently being solicited. Future work will include the addition of the lightning hazard into the gHWO, as well as additional upgrades to the current product suites. Also, initiation of a verification scheme is being developed.

7. Acknowledgments

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8. References

NOAA/NWS 1999: National Weather Service Strategic Plan for Weather, Water, and Climate Services 2000-2005. <http://www.nws.noaa.gov/modernize/strategic-plan.htm>

Pendergrast, J.C., D.W. Sharp, D.L. Jacobs, 2000: Graphically Depicting the Hazardous Weather Outlook for East Central Florida, Preprints, 20th Conference on Severe Local Storms, Amer. Meteor. Soc., Orlando, FL.

- **NWS Melbourne Graphical Hazardous Weather Outlook**

<http://www.srh.noaa.gov/mlb/ghwo/ghwomain.shtml>

- **NWS Melbourne Graphical Hurricane Local Statement**

<http://www.srh.noaa.gov/mlb/ghls/index.php>