



## **Safety Thursday - Weather Resources, Part 1**

**By Mark Thornton - LakeErieWX**

### **Introduction**

Sailing and weather are intrinsically linked. Experienced Mac sailors understand that developing a pre-race weather forecast and monitoring its evolution on the racecourse is an important strategic and safety aspect of participating in the Chicago Yacht Club's Race to Mackinac. Misjudging the wind forecast can quickly send you to the back of your fleet, while failing to properly assess the risk for severe weather can unnecessarily jeopardize the safety of the crew.

This *Safety Thursday* article is the first of a two-part series and focuses on helpful resources for developing your pre-race forecast. The second article will discuss the more challenging task of monitoring weather developments after the starting gun. A companion webpage containing hyperlinks to the resources presented in these articles can be found [here](#).

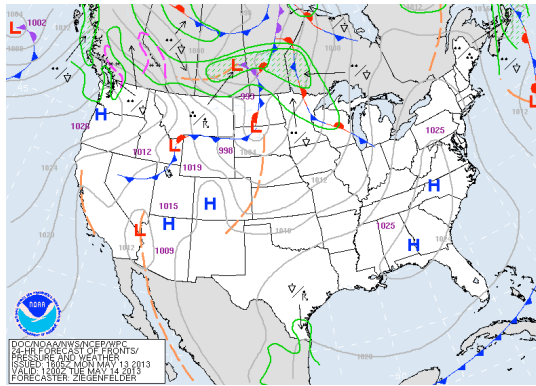
## **The Big Picture**

### **Large-Scale Dynamics**

Your Mac forecast should begin with an understanding of the large-scale weather features. Is a low pressure system expected to transit Lake Michigan during the race? If so, when is the warm and/or cold front and accompanying wind shift expected to arrive? Is the system expected to produce strong winds, large waves, or thunderstorms? Or, will the Mac be dominated by the fluky, thermally-driven lake and land breezes associated with a high pressure system?

NOAA's Weather Prediction Center (WPC) (click [here](#)) produces a variety of products that focus on predicting the development and evolution of large-scale weather features. The WPC's surface forecasts are divided into short-term and long-term periods with the short-term period covering the first 2 ½ days of the forecast period (in 12-hour intervals) and the long-term period covering days three through seven in 24-hour intervals. By carefully reviewing the forecasts in chronological order, you can determine how large-scale weather features will affect the racecourse, and then use the data to chart the fastest course to Mackinac.

Graphics published by the WPC contain a variety of unique symbols and meteorological shorthand to show the anticipated position of high pressure systems, low pressure systems and their accompanying frontal boundaries, and additional features such as ridges, troughs and squall lines. Sailors who are unfamiliar with this meteorological shorthand are encouraged to review the legend published by the WPC (click [here](#)).



WPC products, along with the majority of weather forecasting materials available on the Internet, are based on Greenwich Mean Time (GMT) sometimes called Zulu Time (Z). Converting from GMT (or Z) to Central Time during the summer is straightforward – simply subtract five hours from GMT/Z. Below is the legend for a 24-hour surface forecast which provides an opportunity to review the GMT/Z conversion process and other nomenclature used to describe the graphics.

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DOC/NOAA/NWS/NCEP/WPC
24-HR FORECAST OF FRONTS/
PRESSURE AND WEATHER
ISSUED: 1605Z MON MAY 13 2013
VALID: 1200Z TUE MAY 14 2013
FORECASTER: ZIEGENFELDER

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The first line contains the acronyms for the various NOAA entities that contributed to the preparation of the forecast. The second and third lines describe the parameters that are included in the forecast product. The term *Issued* in the fourth line provides the time and date the graphic was published. In this example, the graphic was published at 1605Z or 11:05 am Central (1605Z minus 5 hours) on May 13, 2013. The fifth line indicates when the forecast is *Valid*, which is the date and time for which the forecast was prepared. The surface forecast shown above displays the surface weather features as they were expected to be at 1200Z / 7:00 am Central time on Tuesday, May 14, 2013.

### **Precipitation**

The WPC also issues Quantitative Precipitation Forecast Graphics (QPF) (click [here](#)) which show the amount of liquid precipitation anticipated across the country. This product covers the first three days of the forecast period in 24-hour increments, and combines days four through five and six through seven into two separate 48-hour forecasts.

## **Thunderstorms**

### **Storm Prediction Center**

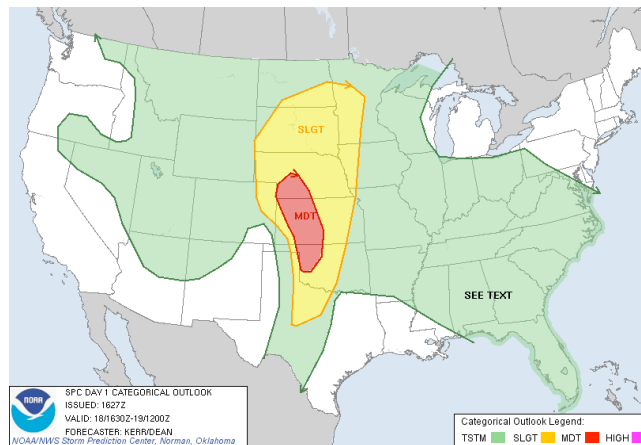
Thunderstorms, and the associated hazards of downburst winds, lightning, and locally higher wave heights, are a relatively common occurrence across the Great Lakes during the summer. Forecasting the location, timing and type of severe weather that is expected to develop across the United States is one of meteorology's most challenging tasks – a task assigned to the staff of NOAA's Storm Prediction Center (SPC) in Norman, Oklahoma.

Note: It is important to understand that the NWS defines a severe thunderstorm as one that produces 1" diameter hail, a wind gust of at least 58 mph, or a tornado. Although frequent lightning is an obvious hazard to sailors, it is not a factor in meeting the threshold of a severe thunderstorm.

### **SPC Convective Outlooks**

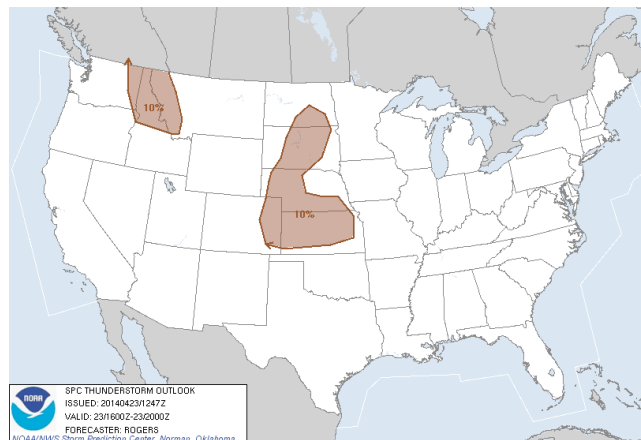
Each day, the SPC issues Convective Outlooks for days 1, 2, and 3, and a combined Outlook for days 4 through 8 (click [here](#)). The Outlooks contain a graphic that identifies the areas of the country where organized storm development is expected, along with a narrative describing the details of the risk.

The Convective Outlooks present the risk by category – *Slight*, *Moderate* and *High* – based upon the statistical probability of severe weather occurring within 25 miles of any given point in the highlighted area. A description of the risk categories used by the SPC can be found on its FAQ page (click [here](#)) Because the risk of severe weather affecting a specific location on any given day is very small, even a *Slight* risk deserves a sailor’s respect, as it represents a significant increase in the potential for severe weather. It should be noted that even thunderstorms that fail to meet the NWS’s severe threshold often present a significant risk to mariners in the form of strong winds and frequent lightning.



Although SPC Convective Outlooks are an excellent resource for identifying the areas at risk for severe weather and displaying the geographic progression of the risk over time, they are written for meteorologists and therefore tend to be rather technical in nature.

In addition to the traditional Convective Outlooks, the SPC also publishes Thunderstorm Outlooks (click [here](#)) which identify the regions at risk for any strength of thunderstorms and the probability of development. In contrast to the one-day period covered by Convective Outlooks, each Thunderstorm Outlook only cover a 4-hour period.



### **Hazardous Weather Outlooks**

In contrast to the Convective and Thunderstorm Outlooks from the SPC, Hazardous Weather Outlooks (HWO) are issued in text form by each local office of the National Weather Service (NWS) and describe the risk of severe weather for the general public. HWOs are issued each day and address the overall probability, geographic coverage, storm type (single cell storms, squall line, etc.), and timing of severe weather for the current day along with a combined summary of days 2 through 7.

While SPC Convective and Thunderstorm Outlooks cover the entire United States, Hazardous Weather Outlooks focus exclusively on the County Warning Area (CWA) assigned to each NWS office. There are six NWS offices with CWAs that cover a portion of Lake Michigan -- Chicago, IL; Syracuse, IN; Milwaukee, WI; Green Bay, WI; Grand Rapids, MI; and Gaylord, MI. In order to assess the risk of severe weather where you intend to sail, you must consult the HWO of the NWS office which has responsibility for that area of the lake. Click [here](#) for a map showing NWS responsibilities for Lake Michigan.

## **MARINE FORECASTS**

### **Text Forecasts**

The Chicago NWS office is responsible for issuing off-shore (beyond 5 nautical miles) marine forecasts for all of Lake Michigan. Several times each day, NWS Chicago publishes a text version of the marine forecast which begins with a synopsis of the current weather pattern and a forecast covering the next several days. This synopsis is followed by a forecast of wind and wave conditions covering a five-day period. Because conditions often vary dramatically across the expanse of Lake Michigan, the text wind and wave forecast focuses on pre-determined regions that allow mariners to quickly obtain the forecast for their area. A chart showing these regions may be found [here](#).

### **Graphic Forecast Products from the NWS**

The NWS offices surrounding the Great Lakes cooperatively maintain an excellent website devoted to marine weather forecasting (click [here](#)). While the home page provides forecasts for the entire Great Lakes basin, the data for an individual lake can be accessed by clicking the appropriate hyperlink along the left-hand column of the home page. The graphics, which are designed for the recreational community, are easy to interpret and don't require a conversion from GMT to local time.

The forecasts extend for 4 ½ days in three-hour increments for the following meteorological parameters:

- **Wave Height:** in feet and shown using color-shading and values at selected stations.
- **Wave Period:** the time interval between each wave presented in seconds using color-shading and numerical values at selected stations.
- **Wind Speed & Direction:** in knots, using standard wind barbs, color-shading and numerical values at selected stations.
- **Wind Gust:** in knots, using color-shading and values at selected stations.
- **Weather:** color-shading is used to indicate if precipitation is expected during the three-hour period covered by the graphic. In addition, a short text code is provided at selected stations to describe the type of weather that is expected. For example, the appearance of a "T" in the code indicates that thunderstorms are forecast for the 3-hour period.
- **Surface Water Temperature:** in degrees Fahrenheit, presented using color-shading and values at selected stations.

### **Other Graphic Marine Forecast Products**

Gridded Binary files (GRIBs) pack a lot of information into a small file size and are a convenient method of obtaining marine forecasts. Chris Bedford, of [Sailing Weather Services](#), provides low resolution GRIB files free to Chicago-Mac participants (click [here](#)) or higher resolution files on a subscription basis.

Routing software, such as Expedition, while relatively expensive, integrate navigation, yacht performance and weather data into a single race-management interface.

There are many sources of computer model wind and wave forecasting resources on the Internet. While offering the advantages of higher resolution and shorter time intervals, these products require conversion from GMT to local time and are published without modification by a meteorologist. Several of these products are available on the Chicago-Mac Resource page (click [here](#)).

## CONCLUSION

### **A Plan For The Mac**

The next several weeks are a perfect time to investigate and get comfortable with the resources presented in this article and on the Mac resource webpage (click [here](#)). There is no better way to learn a new skill than practicing. Over the next few Wednesdays, I encourage you to prepare a trial forecast for the upcoming weekend. In addition to analyzing the graphics and making the necessary GMT conversions, these practice forecasts will allow you to witness how high and low pressure systems evolve and how the speed and direction of the wind changes in response.

The accuracy of weather forecasts diminishes as the forecast period increases. For example, a forecast valid in 48 hours is typically more accurate than one valid in 7 days. For this reason, beginning the preparation of your official Mac forecast more than a week before the start isn't recommended.

I typically start a daily review of the WPC surface forecasts and SPC Convective Outlooks a week before an event and will often save the graphics in a folder to compare to later forecasts. This allows me to track the movement of the large scale weather systems across the country and gauge the changes in the forecast from day to day. I typically begin a daily analysis of the wind and wave forecasts on Monday or Tuesday for a weekend event.

The final forecast should be based upon the most current forecast data available and is usually prepared the morning of the event. If you have been analyzing the forecast for the preceding week and using the data to steadily hone in on your strategy, the creation of your final forecast shouldn't be too time-consuming. And hopefully it won't reveal any surprises.

### **Looking Ahead**

Managing the forecast and keeping tabs on rapidly deteriorating conditions becomes far more difficult once you are offshore. In part two of this series, we'll investigate the resources available after the starting gun has sounded.

### **About the Author**

Mark Thornton began sailing on Lake Erie in 1994 and he currently owns Osprey, a 1985 C&C 35. His interest in weather forecasting grew from his experiences racing and cruising on the lake. In addition to sailing and weather forecasting, Mark maintains a website devoted to Great Lakes meteorology ([www.LakeErieWX.com](http://www.LakeErieWX.com)) and enjoys publishing [summaries of interesting Great Lake weather events](#) and [teaching basic weather forecasting skills to sailors](#).

Questions regarding this article are encouraged and should be directed to [LakeErieWX@gmail.com](mailto:LakeErieWX@gmail.com).



# LakeErieWX

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*Note: The purpose of this article is to highlight some of the Mac Safety Regulations and how your crew can race the Mac as safely as possible. As always, ultimate responsibility for the safety of the crew and the decision whether to race or to stop racing is that of the skipper (RRS4, MSR2). This email is meant as a courtesy only and you should always refer to the Race Documents section of the website for the Notice of Race, Sailing Instructions and Mac Safety Regulations, which govern the race.*