Introduction

Storms at sea are pulled across the globe along a serpentine path defined by the flow of strong winds aloft, some 5,500 meters (18,000 feet) overhead. This is about halfway up through the atmosphere where the atmospheric pressure has dropped to about 500 mb from its average surface value of some 1013 mb.

The Ocean Predictions Center (an agency of the National Weather Service) produces weather maps every 6 hours that tells us what is taking place on the surface of the ocean, as well as 24h, 48h, and 96h forecasts of the surface conditions. They also produce special maps of this 500-mb level of the atmosphere (twice a day, with 48h and 96h forecasts) because these maps show the flow of the winds aloft that steer the surface storms across the ocean.

These "500-mb maps" show the serpentine path of the winds aloft and their speeds, typically in the range of 30 to 130 kts or more. The speed of the winds aloft as well as the actual shape of their path have a direct influence on the severity of surface lows, as well as the speed and direction of their motion on the surface. We sail in a 3-dimensional weather system. To understand the surface weather it is crucial to understand what is taking place well above it.

Former OPC forecaster and well known marine weather lecturer Lee Chesneau has joined forces with the acclaimed deep-sea Captain Ma-Li Chen, known to many as Captain Mike, to produce a book that does just that—brings the winds aloft down to earth, so we can understand how they influence surface weather, and in particular how we can use that special information to help us avoid the worst of it. The book is called *Heavy Weather Avoidance and Route Design — Concepts and Applications of the 500-mb Charts.* It is published by Paradise Cay Publications..

The book is based on Captain Mike's long and successful experience at routing some of the world's largest container ships across the Atlantic and Pacific. Over the years, he developed unique new ways to interpret the shapes and locations of the 500-mb streamlines in order to enhance or extend the surface forecasts, and in particular how to use these methods for specific optimum-route selection under various conditions.

The partnership between Lee Chesneau and Capt Mike on this subject was natural selection. Lee Chesneau (together with Joe Sienkiewicz) wrote the now-famous article on the use of the 500-mb maps for the Mariner's Weather Log back in 1995. It was that article that first brought awareness of the importance of the 500-mb maps to mariners of all stripes, both professional and recreational. There has not been a new book on marine weather since then that does not quote from that work and other tutoring Lee provided in his numerous lectures around the country.

This book is a major extension of that earlier article. Here we see for the first time how bands of "streamlines" can be defined that help us categorize the pattern. The lines on these maps are not isobars, but the actual heights of the 500-mb surface expressed in decameters (the 570 line is 5,700 meters above the surface). But these charted height lines behave in a roughly similar manner to isobars on surface maps. Winds aloft flow along these lines, and the speed of the wind is proportional to the steepness of the surface, which is determined by how close consecutive lines are spaced. The standard spacing is 60m. This book refers to these lines as streamlines, which should be distinguished from other uses of this word in other weather contexts.

In the early work of Chesneau and Sienkiewicz, only one streamline was called out to keep an eye on,

the 564 line. This line often marks the path of Lows, as well as the southern boundary of strong surface winds depending on the season. For that reason it is marked in bold on the OPC maps of the 500-mb surface. When it comes to route planning, this new book now expands that idea and defines a "specialized strong wind belt" that encompasses the 5-streamline band between 570 to the south and 540 to the north. In many circumstances this is the river of wind, along which flows the eddies of the surface lows.

Waves in this band, as it undulates around the globe, slowly slide to the east in the form of a sequence of troughs and ridges. The NE flow up the east side of a trough is the key location for developing surface lows. Surface lows often form below the base of this trough aloft and are in full fury by the time they reach the crest. The authors describe this region on the surface as the D (Difficult) zone.

When possible, it is best to travel in the A (Available) zone which lies entirely south of this special wind band—south of the 570 line on the 500-mb chart. They also define a C (Cautious) zone that is entirely north of the band. Since many surface lows ride up the east side of the trough (along the D zone) and spin out of the band to hang out and die in the C zone, this can be an area with long lasting bad weather. They also define the B (Be careful) zone that is the part of the band on the west side of the trough. You have to be careful here, because these troughs are moving to the east, and behind this B zone will be another D zone.

There are obviously important details to the above reasoning that I have not mentioned here, but in short, they give us a way to look at every wave in the winds aloft with a new insight as to its potential and what we might be thinking about as we sail under it.

Besides direct route planning using vessel performance data and these navigation zone concepts, the book also covers closely related topics of "meteorological bomb" formation (means the central pressure of the surface low drops by 24 mb or more in 24 hr) and other special types of severe surface lows, and how their behavior can be accounted for or even predicted from the behavior of the winds aloft.

They also have a prescription for predicting when and where a tropical cyclone is expected to re-curve. These systems tend to move west to northwest after formation at low latitudes just above the doldrums and then at some point curve north and then back more easterly as they come under the influence of the winds aloft. If and when this happens is, of course, crucial to planning a route around one. The procedure from this new book is easy to apply. Just after reading the book (May 26) typhoon Nakri was born NW of Guam. As an exercise I used the methods of this book and was able to predict when it would re-curve some 5 days later, and it turned out to be right. Even if you happen to have official surface forecasts of the cyclone's path, it is reassuring to see the interplay of winds aloft and surface system motion.

The book has a second subtitle: *A textbook for the professional mariner*. And it is that, but it is also of interest to recreational mariners, especially those who want to do the very best they can on selecting the best route by understanding how the winds aloft interact with the surface systems. Remember, there will always be a forecast, and they are not marked "good" or "not so good." Knowledge of the 500-mb maps as these authors present it can help us make that evaluation.

Part I of the book deals with the basic descriptions of the winds aloft and how to use them. Part II covers actual ship routing examples. Some of this second part is very detailed and requires careful reading. It is not mathematical or particularly complicated in a "technical" sense, but just very

specific—step by step, taking everything into account as you approach and cross each navigation zone on optional routes. Most readers of this review will not be making similar route decisions for ships. Shipping companies are looking to save hours per day, which adds up to half a day or a full day on an ocean passage. They care because the operation of the vessel and its shore side support is very expensive. They also of course want the best route so they don't bang up the vessel and its cargo.

An ocean racing sailor, however, cares just as much about saving an hour or so per day and maybe ending up across the finish line a half day or full day earlier than a competitor. To accomplish this, they have to do more or less the same thing the ship router does as outlined in this book. They just use polar diagrams instead of the slip vs. sea state data used in ship routing to evaluate each leg of the route. The point is this. All that detail you see laid out in Part II is what you have to do. There is no easy way to do it right, regardless of whether you are routing a container ship, or a racing sailboat, or an ocean racing row boat.

Needless to say, smaller vessels are still going to rely on the surface forecasts, but with these new tools at our disposal, we will have much more insight into what is taking place and how we might get a better feeling about the long term prospects of a proposed route. We would all like to stay in zone A, but it is not always possible.

In any event, after studying this book, no mariner will ever look at the 500 mb maps as they used to. The authors have made a valuable contribution to shipboard weather routing.

— David Burch,
author of *Modern Marine Weather*
www.starpath.com/weatherbook