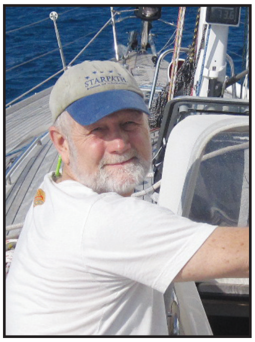


BURCH at the Helm

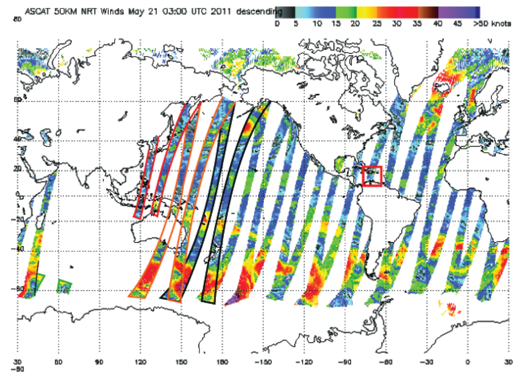


Fig. 1

ASCAT—Wind at Sea

Granted, there are such things as fog and rain, even snow and ice, but in the end, marine weather boils down to wind. For sailors, wind is our engine. For all mariners, it is the wind that makes the waves, which is the ultimate threat to the progress and safety of any vessel.

We naturally think most often of the threats presented by very strong winds, but as prudent sailors, we will far more often use our knowledge of marine weather to find more wind or better wind rather than to avoid too much wind. That is why we are prudent—we do not go sailing where and when we expect strong winds.

To plan a route we need to know the wind. In coastal waters we have many observations to rely on. Some are broadcast on NOAA VHF weather (usually updated every three hours), but we can find even better data at the National Data Buoy Center (NDBC) online at www.ndbc.noaa.gov, updated every hour. In 3G phone range you can get the winds on a smartphone. There are apps for that—but if you use an app, check that it is right! I see some that are more than an hour late, which totally defeats the purpose. Remember that you can view the latest data directly from the NDBC website and then save the link on your phone screen for later quick access. You can also get the data on a dumb phone. Use the Dial-a-Buoy service by calling 888-701-8992. When the smartphone is wrong, the dumb phone becomes smart.

Once land drops below the horizon, we need a satellite phone or SSB radio to get wind data. But where would this data come from? There are a few buoys floating around that measure and report the wind, but not nearly enough to count on. What we do have is a European satellite circling the earth every 101 minutes that is recording a continuous radar image of the ocean surface in six directions, and from these data a computer analysis can determine the speed and direction of the ocean surface winds, worldwide.

As with conventional radar, the amount of microwave backscatter available to detect by radar depends on the roughness of the surface and the angle of incidence. The roughness of the sea surface depends on the strength of the wind blowing over it. Stronger winds make bigger and deeper cat's paws on the surface of the waves, leading to stronger radar signals, implying stronger winds. The cat's paws are always lined up with the instantaneous direction of the true wind, unlike the waves and swells that the cat's paws are riding on, whose direction may differ from the true wind direction.

Needless to say, a complex scientific analysis is required to extract wind data from the radar data, but it is much aided by empirical results. In other words, the satellite can measure the radar backscattering near buoys that have known winds, the analysis can be adjusted to match these known values, and then these adjustments can be applied to cases without buoy data.

The satellite name is Metop-A. The instrument it carries that is doing the job is called the Advanced Scatterometer, or ASCAT. It is operated by the European Organization for the Exploitation of Meteorological Satellites (www.eumetsat.int). Available data are analyzed by several organizations, notable ones being the Royal Netherlands Meteorological Institute (www.knmi.nl/scatterometer) and the Ocean Surface Winds Team (OSWT) of the Center for Satellite Application and Research, a division of NOAA (manati.orbit.nesdis.noaa.gov/datasets/ASCATData.php).

Although ASCAT has been operational since 2007 and the data have been available to U.S. meteorologists since 2009, it only recently became available to the public. Mariners so far have only limited access via graphic images of the wind fields, but hopefully in the near future we will have access to digital vector data

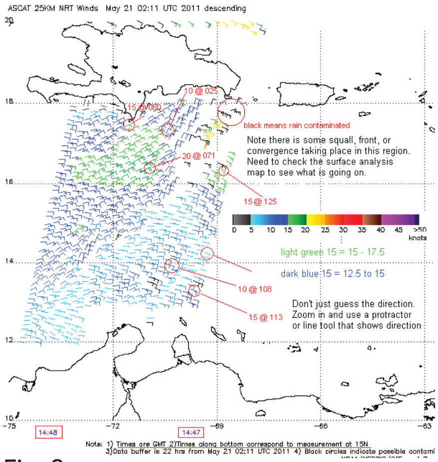


Fig. 2

Fig. 1 Graphic index to the last 22 hours of ASCAT wind data, updated hourly from manati.orbit.nesdis.noaa.gov/datasets/ASCATData.php. Click any part of a pass to see actual data. The red box is shown in Fig. 2. The red track on the left is the most recent data, orange is 1h 41 earlier, black is another 1h 41m earlier. In the next hour the red track will be completed and then continue down across the Indian Ocean. The oldest data is the green in the bottom left corner. It will not show up in the next plot. These are the descending passes; another plot shows the ascending passes. Notice the nadir gaps of missing data that are directly under the satellite. Thus a single pass has two swaths of data.

Fig. 2 Data from the red square of Fig. 1 showing color coded ocean surface winds. Black feathers mean the wind data are corrupted by rain, implying local or large scale convection. Valid times are on the bottom of the picture along with the specific latitiude they apply to. It takes the satellite about 30 min to go from top to bottom of the swaths in Fig 1.

as we once had with the American QuikSCAT satellite and its SeaWinds scatterometer. That instrument failed in late 2009 after a much longer than expected lifetime of tremendous service to meteorological science. QuikSCAT winds were available to mariners via GRIB files, which is a format very popular with oceangoing sailors.

In a sense, QuikSCAT came and went like Loran-C did. It was gone before the majority of mariners knew the nuances of using it to its full potential. ASCAT promises to be more enduring in that it is funded for at least two more satellite lifetimes. QuikSCAT was a onetime program, but we have very much to thank for it, not the least of which is the wonderful Climatology of Global Ocean Winds (COGOW) program (cioss.coas.oregonstate.edu/cogow), which is now the state-of-the-art global winds atlas that replaces *all* earlier work, including U.S. and British pilot chart wind data. We also owe the now commonly used wind category "hurricane force winds" to studies of extratropical storms using QuikSCAT data. These studies revealed that more than expected high latitude storms had winds higher than 64 kts, and thus the value of the new descriptor.

To view the latest ASCAT data, go to the OSWT website, where you find a graphic index to the latest 22 hours of satellite passes. Then click a region of interest to see the wind fields. Wind speeds are color coded, and with a little practice, values can be read to within a few knots. The earth rotates beneath Metop-A's low earth polar orbit, so each plot on earth of the satellite track in the same direction is tilted to the west and shifted by about 25° of longitude. The valid times of each pass are listed in small print at the bottom of each page of the zoomed selections. Each pass will be 101 minutes (1 hr 41min) apart. The two directions, ascending and descending tracks, are presented in separate plots so the data do not get confused.

The first thing we learn from this data is that, unlike QuikSCAT, the ASCAT data has a large gap of missing data along the sub-satellite track, called the nadir gap. This comes about because of the type of scatterometer used, which is a different design from what QuikSCAT used. QuikSCAT did not have this gap. This is definitely a handicap to work around, as we do not get as full a picture of the wind pattern. But we are getting near real time ocean winds and all such information is helpful. Remember, these are observations; they are not forecasts or interpola-

Fig.3

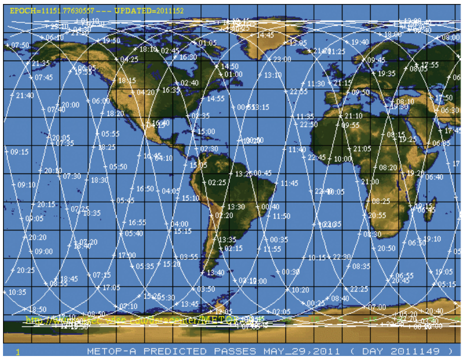


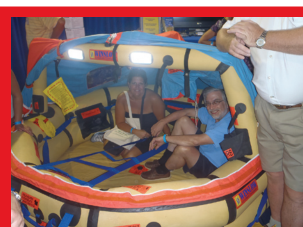
Fig. 3 One way to predict when ASCAT data will become available. Check this plot from www.ssec.wisc.edu/datacenter/METOP-A, find the time of closest passage (keeping in mind the nadir gap), add 2h and 30m to that time, then round up to the next whole hour and that will be the UTC of next available data at the website listed in Fig. 1. You may get data a bit earlier than that or a bit later if your corrected time is near a whole hour time, but that is our working guideline.

tions from isobars. The latest data are between two and three hours old.

These wind data are not only what we need to confirm the latest weather map and plan a route—they are also exactly what the NWS needs for their numerical weather models such as the Global Forecast System (GFS). The ASCAT observed wind field implies the lay of the true isobars, which is one of the main surface results of the models. When we download a GRIB wind field to the boat from one of the various commercial suppliers, they are giving us the GFS model predictions of the winds—some services offer other numerical models as well. The quality of these predictions depends in large part on the quality of the wind and pressure observations that seed the computations.

The ASCAT wind data have been assimilated into the GFS model since May 2011. This means when we compare ASCAT winds at a synoptic time (00, 06, 12, 18 UTC) with the corresponding *initial* wind map from a GRIB download, these two ought to agree fairly well. In this case, the GFS winds are pretty much forced to match the ASCAT winds. Recall that the initial map of any GRIB download is essentially a surface analysis at a synoptic time, but subsequent ones are forecasts.

If the area you care about most



has ASCAT data at the nearest synoptic time, then chances are you get a better than average forecast. Other times these resources may not coincide in time or space, and then we have to use them separately. For example, if we need to choose where to cross the doldrums, we can look at the model predictions for best location, and then check the closest place in space and time between model forecast and ASCAT observations. If there is a difference, remember the ASCAT winds are real data; the GRIBs are predictions. When the times coincide, we can see remarkable detail in the initial GRIB wind map as shown in the illustration.

The ASCAT data can be especially valuable, i.e. gold-like, for ocean racing sailors trying to figure how close they can cut the corner of a mid-ocean High. Instead of relying on the raw fate of a computer model and an isolated ship report or two, you can now look at actual winds on the edge of the High.

As of June 2011, the only way I know of to get the ASCAT data at sea—short of having a friend email them to you—is to download a graphic file from the Internet by sat phone. File names and links for specific locations must be tabulated individually before you leave. Then predict the satellite passage times and request the files as outlined in the figure captions here. File sizes are some 50 kb. By the time this column hits the streets, there may be better options. Several groups are working on this. Tactical navigators should all keep their fingers crossed. ≈

David Burch is the director of Starpath School of Navigation, which offers online courses in marine navigation and weather at www.starpath.com. He has written eight books on navigation and has received the Institute of Navigation's Superior Achievement Award for outstanding performance as a practicing navigator.