



Bermuda Ocean Race Weather & Navigation Seminar

February 8, 2020 9am - 1200pm
Eastport Yacht Club - Conference Room

Introduction

Thank you for sharing your time with me this morning!

(says Greg while audience member says to neighbor who the heck is this guy again??)

Greg Dupier

Greg Dupier, is a veteran racing navigator who has completed and won the Newport to Bermuda Race (2014) three Annapolis to Bermuda (A2B) races. In 2018 he was awarded the prestigious Charles N. Bozenhard trophy as navigator of S/V SLY, capturing line honors by completing the 753 nautical mile course in 5 days, 10 hours, 43 minutes and 34 seconds. Greg knows the technology, weather, science, math, and geometry behind sailing and will share his experiences and recommendations to those competing in the 2020 A2B.

- **Who has raced in the Bermuda Ocean Race (A2B) previously?**
- **Who is this their first Bermuda Ocean Race?**
- **Who has raced in any ocean (bluewater) race?**
- **Who has raced in an overnight race?**

Contents

We will cover the following...

- **Navigation Basics “101”**
- **Race Preparation**
- **O-Day Go Package**
- **Race Navigation**
- **Crossing the Finish Line**
- **Q&A**

Navigation Basics “101”

We will cover the following...

- **Navigation Basics “101”**
 - Navigating “Ethos”
 - Charts & Software
 - Weather
 - Boat Polars
 - Currents
 - Gulfstream
 - Routing
- **Race Preparation**
- **O-Day Go Package**
- **Race Navigation**
- **Crossing the Finish Line**
- **Q&A**

Navigating Ethos

- A big part of navigating is being able to***
- ***see the larger strategic picture,***
 - ***convert that into an actionable plan and***
 - ***adapt as needed...***

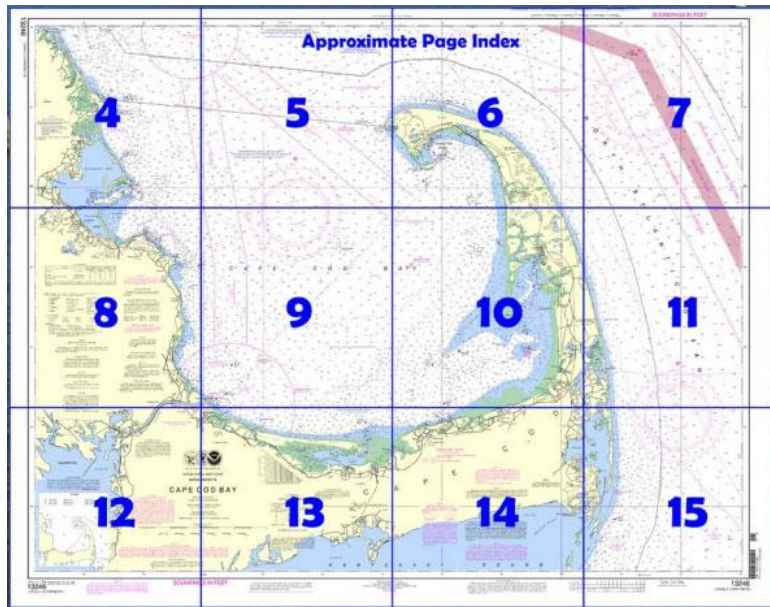
- Understand the conditions
- Understand the boat and crew
- Anticipate the future
- Provide good, actionable data
- Adapt to change



Charts

There are two primary kinds of charts used in navigation: Raster and Vector charts

A **Raster** chart is essentially an electronic picture of the familiar paper chart, obtained through an accurate, detailed scanning process. Raster charts, therefore, have exactly the same information as the paper chart.



Vector charts, also called ENC charts, are a graphics format in which charts utilize a vector database to build the chart display. This data is stored in layers and records every nautical chart feature such as coastlines, buoys, lights, etc.



Software

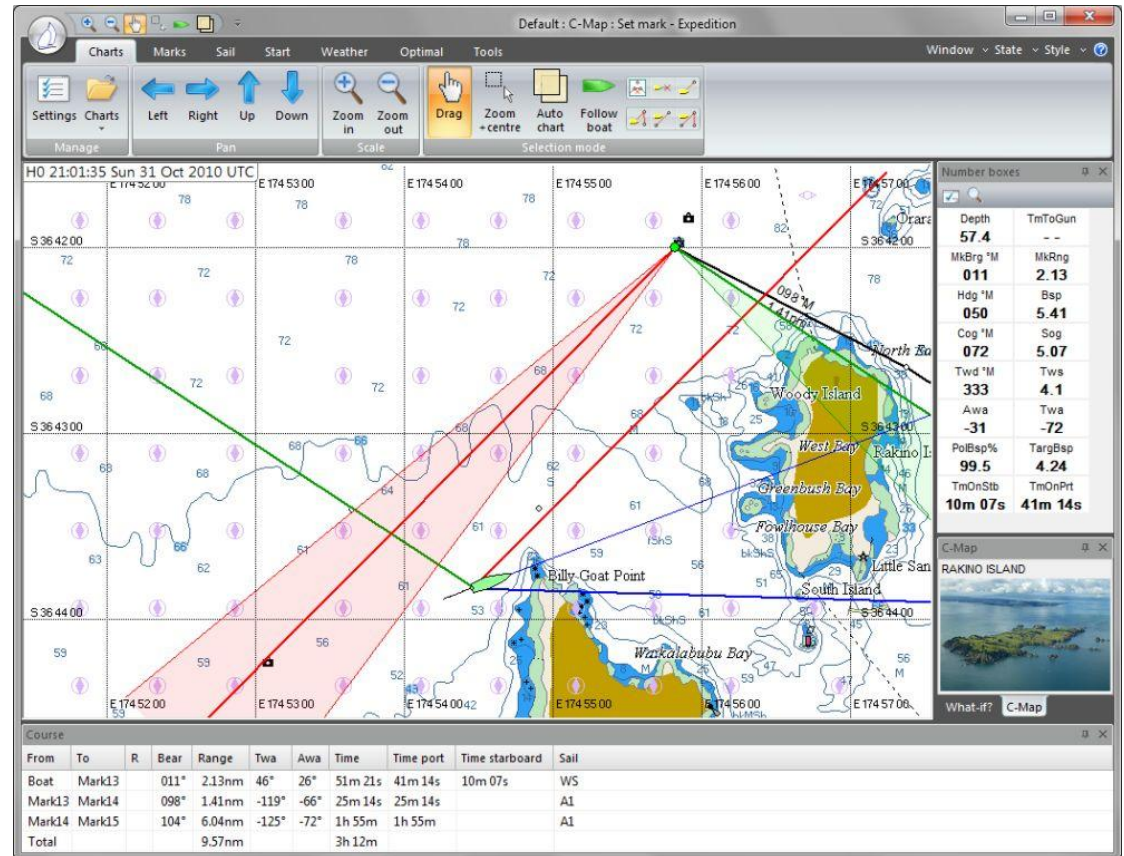
There are a variety of different navigation programs to consider when navigating...

- Must-Have Features

- Charting/Mapping
- Boat Positioning (GPS)
- Instrumentation Inputs
- Course/Route Definition
- Boat Position Tracking
- Logging

- Highly-Desirable Features

- Weather Downloading
- Boat Polar Analysis
- Optimal Course Routing
- “Strip Chart” Data Analysis
- Competitor Tracking
- AIS tracking



- Expedition
- Adrena

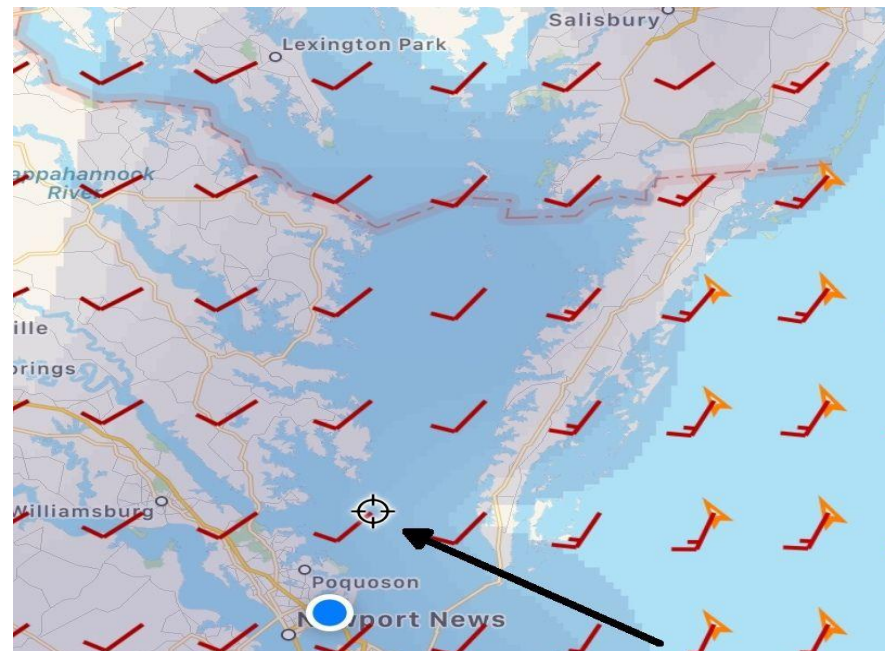
- MaxSea
- TIMEZERO

- Plus Many IOS & Android Apps

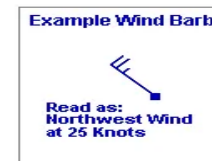
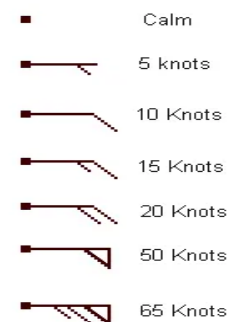
There are a variety of different weather models to consider when navigating...

Weather

- GRIB files are a special binary format of weather data. It is the same forecast as available on the weather forecast site, but as the files are highly compressed, it is ideal for downloading across wireless communication devices.
- Common Weather Models
 - The Global Forecast System (GFS) is a weather forecast model produced by the National Centers for Environmental Prediction (NCEP).
 - The European Centre for Medium-Range Weather Forecasts (ECMWF) is an independent intergovernmental organization supported by most of the nations of Europe and is based at Shinfield Park, Reading, United Kingdom



Wind Speed & Direction



Barbs point to direction wind is coming from.

(1 Knot = 1.15 mph)

More on this from Chris Parker (MWC) later this morning...

Weather Sources and Services

There are a multitude of weather sources and services...

- Key Weather Sources

- Ocean Prediction Center
https://ocean.weather.gov/Atl_tab.php
- NOAA
https://www.cpc.ncep.noaa.gov/products/wesley/fast_downloading_grib.html
- Saildocs (email based) www.saildocs.com

- Websites

- Windy.com
- Predictwind.com
- TideTech.org

- Weather and Routing Services (examples)

- Marine Weather Center, <https://www.mwxc.com>
- Commanders, www.commandersweather.com
- Jennifer Clark's Gulfstream, www.jcgulfstream.com

SAMPLE CUSTOM VESSEL-SPECIFIC FORECAST

Let's look at the Sea Surface Currents 1st:

I'd look for a GulfStream Entry near 34-10N/76-10W.

Direction of GulfStream flow here is 045T...I suggest aiming the boat SE (135T)...but your COG (Course Over Ground) may be closer to 120T across the Stream. Stream is about 40mi wide.

After exiting GulfStream, I'd continue to a WAYPOINT near 33N/74-40W.

There's a clockwise-rotating eddy centered 32-45N/74-50W...you want to pass N&E of this, and the above WAYPOINT should do nicely.

Then turn more SSE...and enjoy a S-flowing current of up-to-2k to a WAYPOINT 31N/74W.

* *

Weather forecast has changed some over past few days...with much more upper-air support for the ColdFRONT exiting US E Coast late Tue16...and that means much-stronger & more due-South wind late Tue16.

SW-WSW wind moderates Wed17 as ColdFRONT nearly-stalls & weakens NW of you.

You'll get another shot of W wind Thu18 when a 2nd FRONT merges with the 1st FRONT & drives the whole mess toward you.

FRONT loses upper-air support again & you see lighter W wind Fri19...then HI pressure in E US finally presses weak ColdFRONT past you about Sat20, and NE Trades establish.

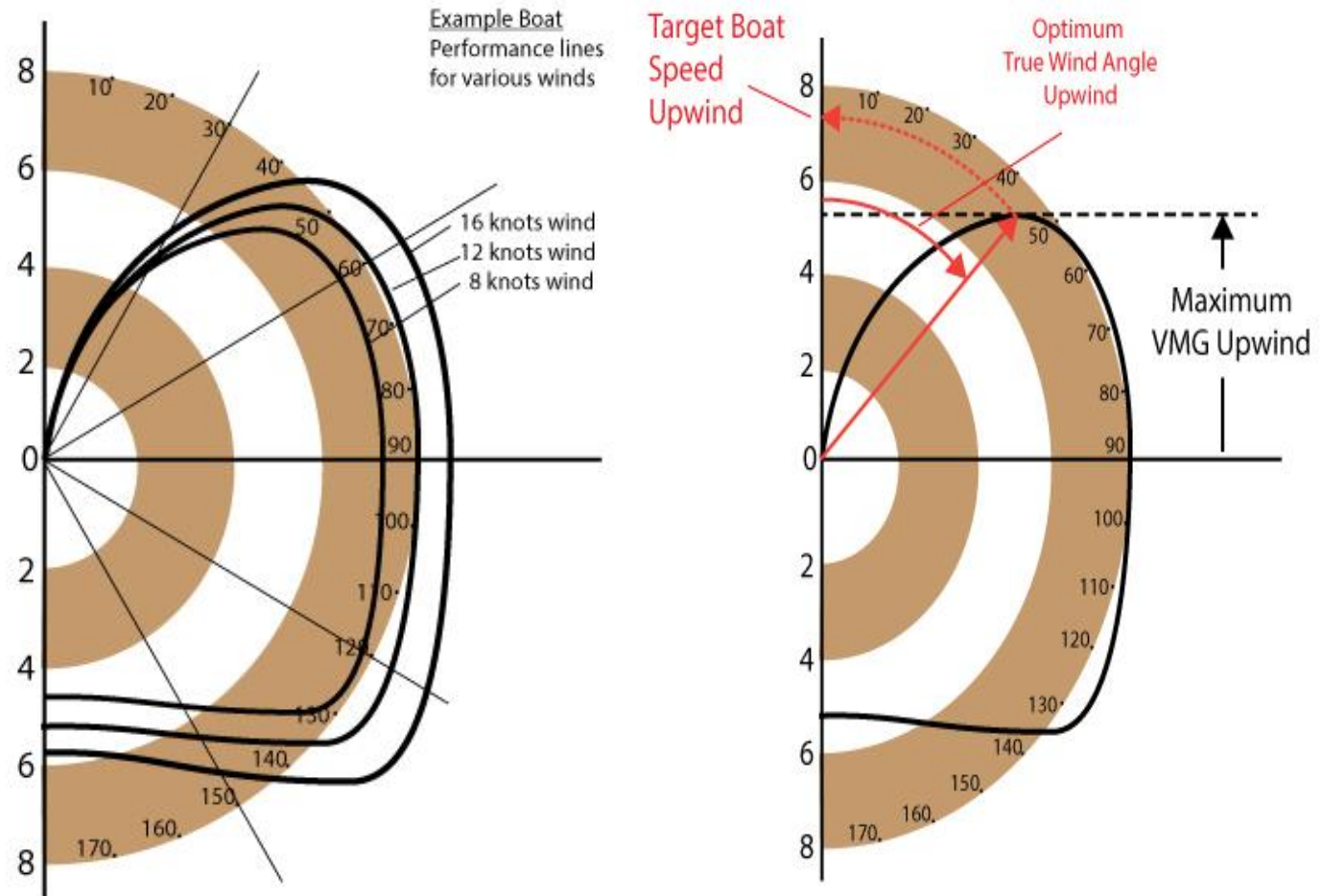
ColdFRONT & associated winds Tue16-Wed17 will be MUCH stronger the farther N you lie. Therefore, your mail goal from Sun14-Tue16 should be to get as far S as possible. The last WAYPOINT I above (31N/74W) is about 280mi SSE of BeaufortNC, and it would be good if you reached this point early Tue16.

<https://www.mwxc.com/>
Marine Weather Center

Boat Polars

I know its early in the morning for math but hang with me...

- Figure 1: If you were traveling at 60 degrees off the wind, below would be your boat speeds (through the water) at the various wind speeds:
 - 16 knots wind: 8.8 knots boat speed
 - 12 knots wind: 8.2 knots boat speed
 - 8 knots wind: 7.2 knots boat speed
- Figure 2: Upwind, the optimum true wind angle is 45 degrees (aka Target True Wind Angle) and the Target Boat Speed is 7.4 knots

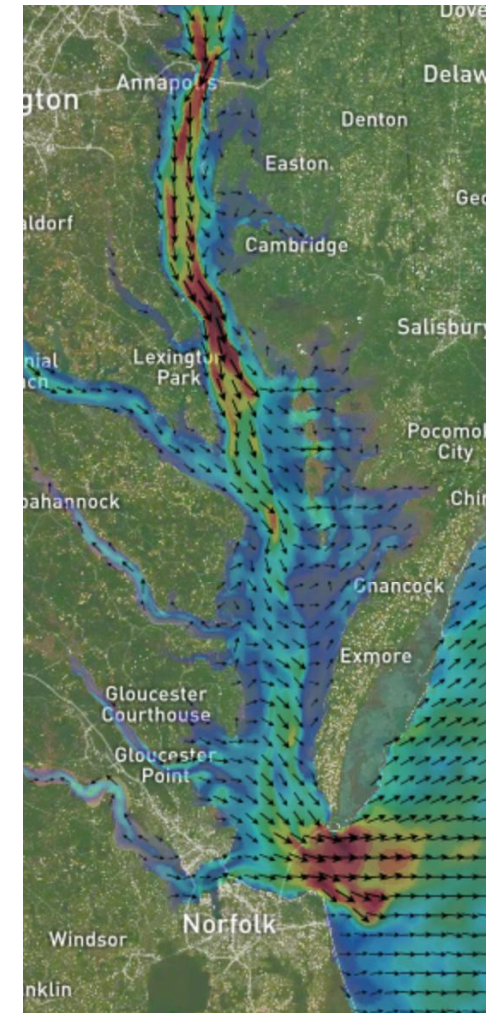
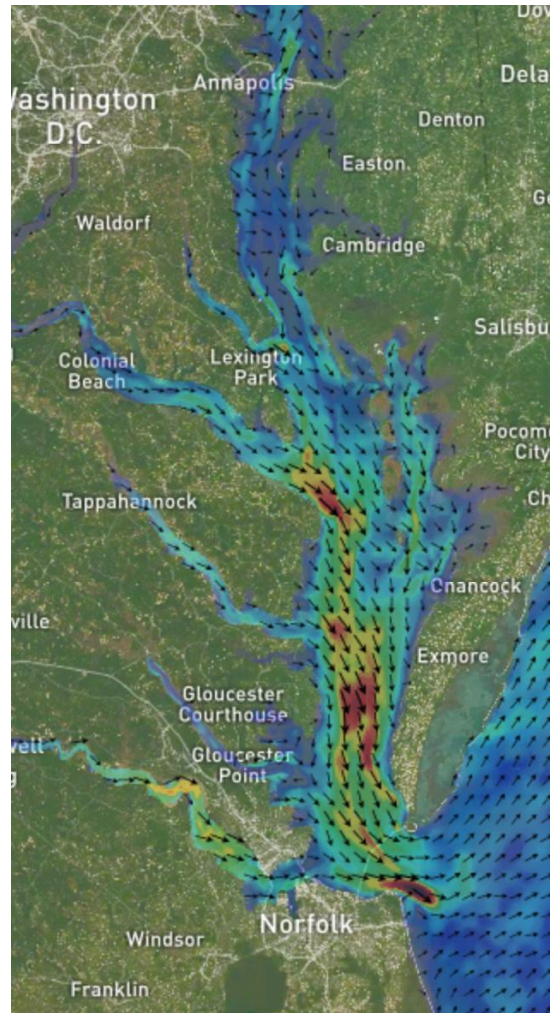


<https://www.nauticed.org/>

Currents

Currents are an extremely important aspect of the Bermuda Ocean Race

- Currents can be driven by wind (surface ocean currents), tides (estuary or near shore), physical features or other factors such as water density.
- Currents “turn” earlier in shallow waters than in deeper waters
- Generally currents will achieve stronger flow in deeper water and slower in shallower water.
- In the Ocean, another important consideration is the effect on the sea state of wind against current.

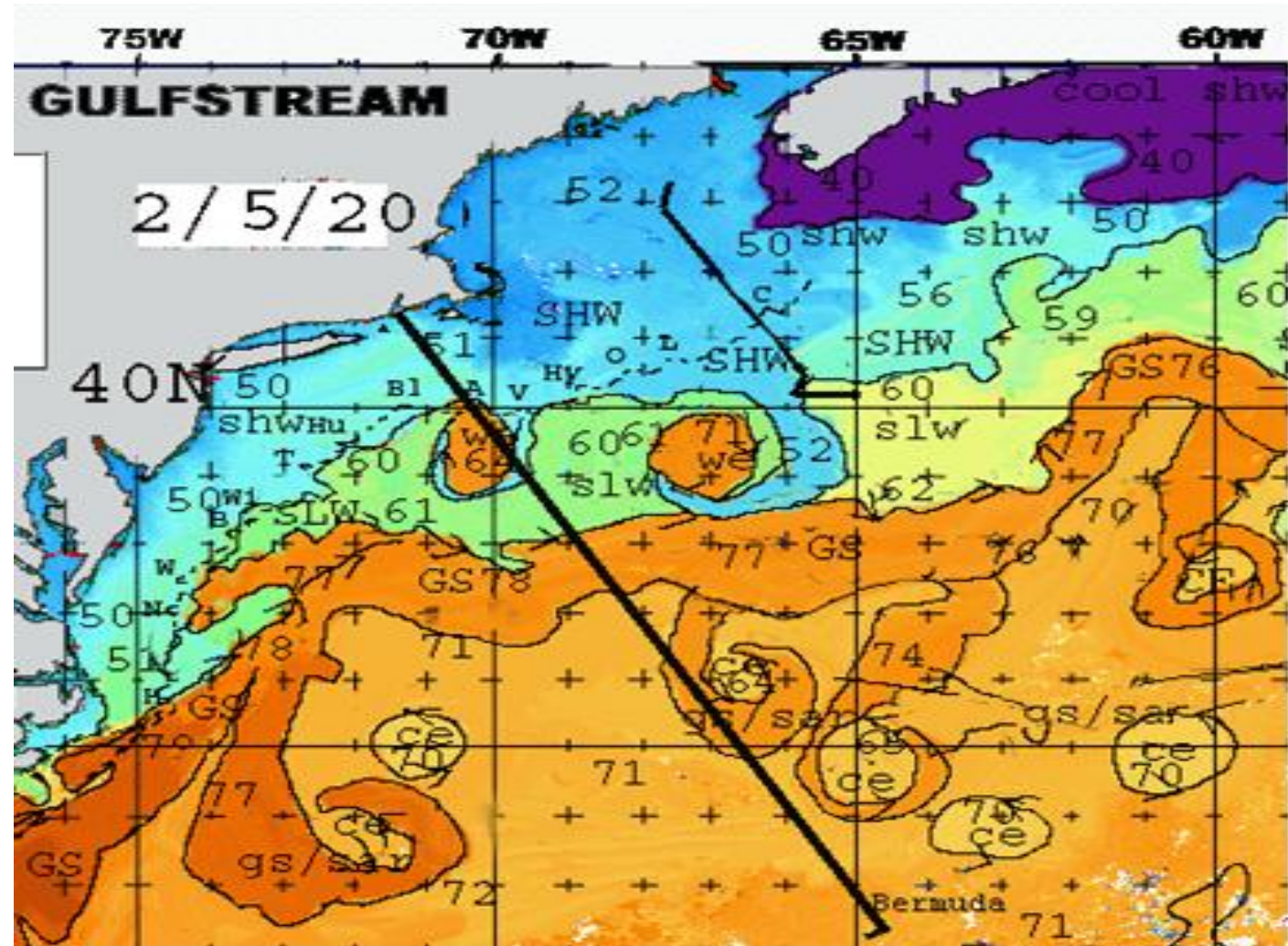


Global RTOFS (Real-Time Ocean Forecast System)

Gulfstream

The Gulfstream can make or break your race!!

- The Gulfstream (GS) is a body of water that continuously flows south to north off the US coast
- “Eddies” are formed when a portion of the GS water separates from the GS to the north into colder water or colder water separates south into the Sargasso Sea
- Warm-water eddies flow clockwise
- Cold-water eddies flow counter-clockwise (C,C-C)
- Eddies move and dissolve
- Current averages 2 – 4kts



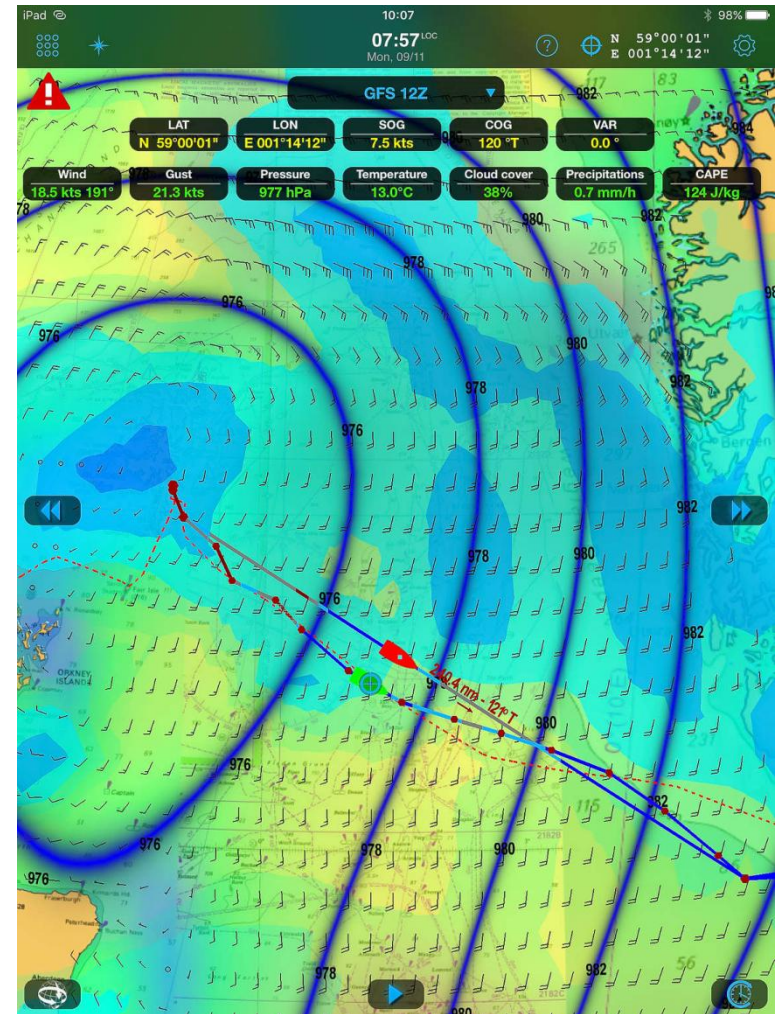
Credit : Jennifer Clark Gulfstream, <http://jcgulfstream.com>

Routing

It is important to be able to plan different routes and assess the potential outcomes...

- Navigation includes running multiple scenarios to consider potential routes.
- Factors to consider include weather, currents, land features, submerged features (e.g. reefs)
- There's an important distinction between weather forecasting and weather routing.
 - The former provides information;
 - The latter provides information with advice.
- But with enough information and foresight, we can avoid the worst gales, slip past the biggest calms, and generally feel much more in control of our weather destinies than at any time in yachting's history.

GO FAST !!!



Race Preparation

We will cover the following...

- **1.0 Navigation Basics “101”**
- **2.0 Race Preparation**
 - A2B Race Characteristics
 - Pre-Race Analysis (Bay Currents, Gulfstream & Weather Modeling)
- **3.0 O-Day Go Package**
- **4.0 Race Navigation**
- **5.0 Crossing the Finish Line**
- **Q&A**

A2B Race Characteristics

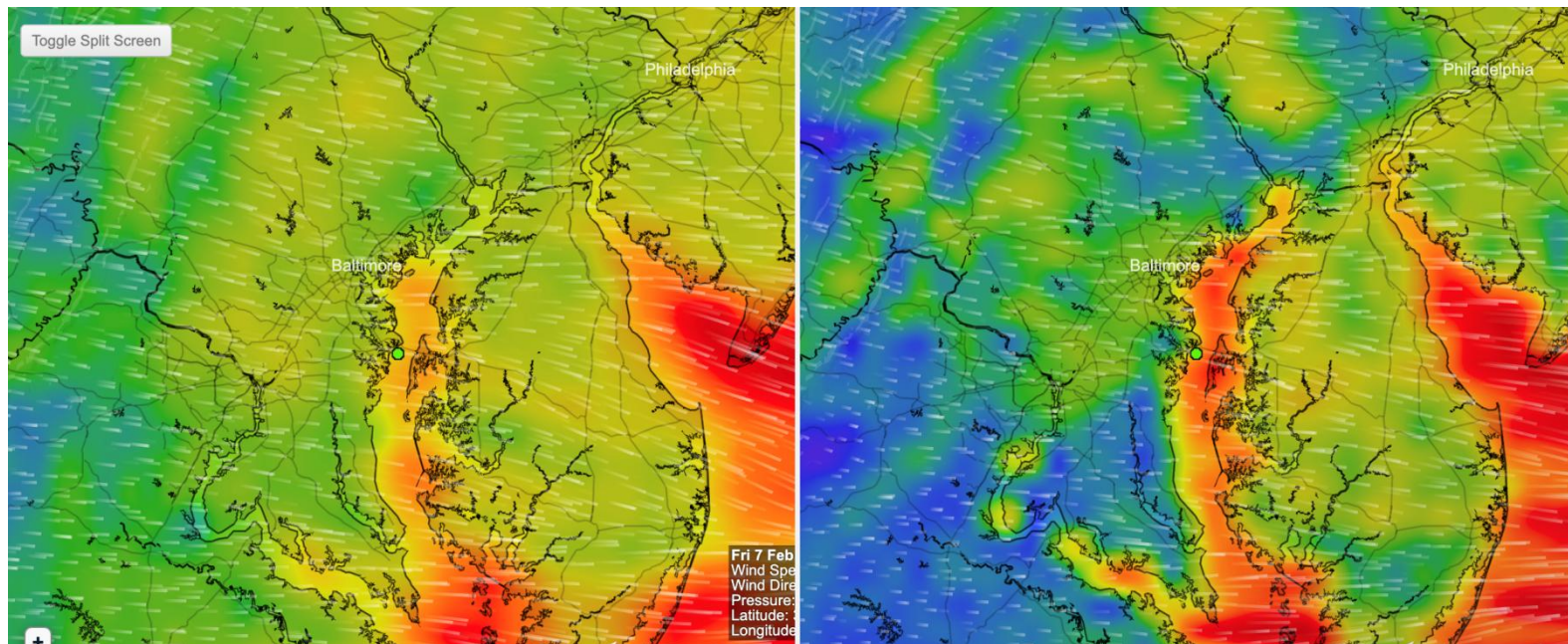
The Bermuda Ocean Race is really 3 races in 1; a Bay Leg, Ocean Leg, and the Bermuda Approach/Finish

- Chesapeake Bay Leg
 - Currents are very important, make sure your course is timed so you are in favorable current and out of adverse current for as much of the bay as possible
 - Night leg/afterdark is important.
 - Must keep focused on trim and boatspeed.
 - Be mindful of commercial traffic in the southern bay (COMMS & AIS are your friend).
 - Make sure your watch shifts get rest during the day and your crew isn't fatigued
- Ocean Leg
 - Target your entry point into the Gulfstream (planning for sweep) where you want to exit the Gulfstream
 - If crossing into the Gulfstream at night, be prepared for local squalls
 - Dodge flying fish in the Sargasso Sea!
- Bermuda Finish/Approach
 - Target your approach to finish line
 - Pay attention to Bermuda currents and the reefs that affect them

Pre-Race Analysis

It is extremely important to start your analysis before the race...

- WIND: Compare different models. Plot forecasts and then track actuals to see which models are more accurate.
- CURRENTS: How to work out whether to take a loss to go into current?
 - Calculate the time lost sailing away from the rhumb line and compare it to the gains made once the yacht is repositioned in favorable current.
 - Consider the time that will be spent in the current and its potential



0-Day Go Package

We will cover the following...

- **1.0 Navigation Basics “101”**
- **2.0 Race Preparation**
- **3.0 O-Day Go Package**
 - Weather Models
 - Current Models
 - Routing, Tipping and Cueing
- **4.0 Race Navigation**
- **5.0 Crossing the Finish Line**
- **Q&A**

Before you leave the dock, download your “0-Day” Kit

0-Day Package

- Weather Models
 - Latest GFS
 - Latest ECMWF
 - NAMS and others you might want to use...
- Current Models
 - Chesapeake Bay Currents
 - Latest Gulf Stream Data/Models
 - Bermuda Currents
- Routing, Tipping and Queuing
 - Download copies of any routing related notes, plans or other documents
 - Be sure to have downloaded the latest race documentation (NOR, SI's, Entry Lists, etc.)
 - Make sure you have your queuing notes (if I see this then it might mean XYZ)



This is fast and easy...



This can be slow and painful...

Race Navigation

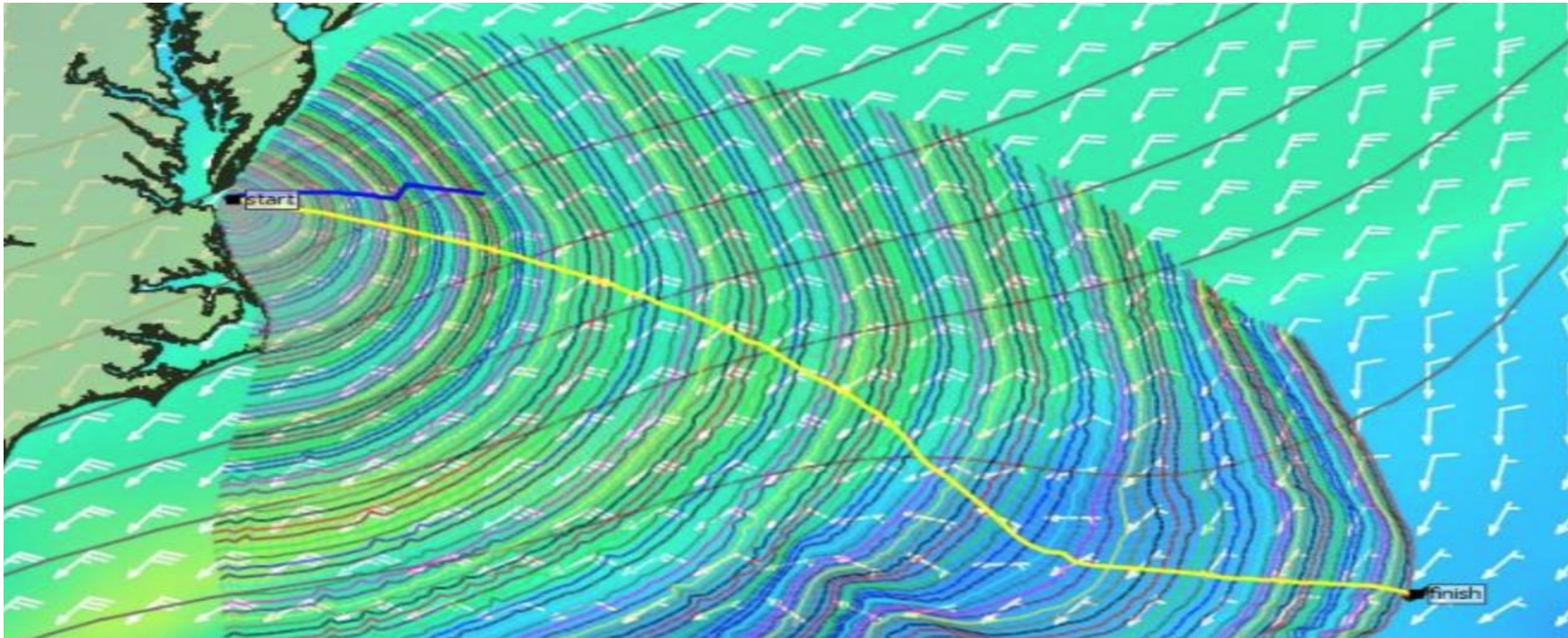
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- **1.0 Navigation Basics “101”**
- **2.0 Race Preparation**
- **3.0 O-Day Go Package**
- **4.0 Race Navigation**
 - Weather Analysis
 - Current Analysis
 - Position, Navigation and Timing
- **5.0 Crossing the Finish Line**
- **Q&A**

Weather Analysis

Continue to monitor changes in the weather...

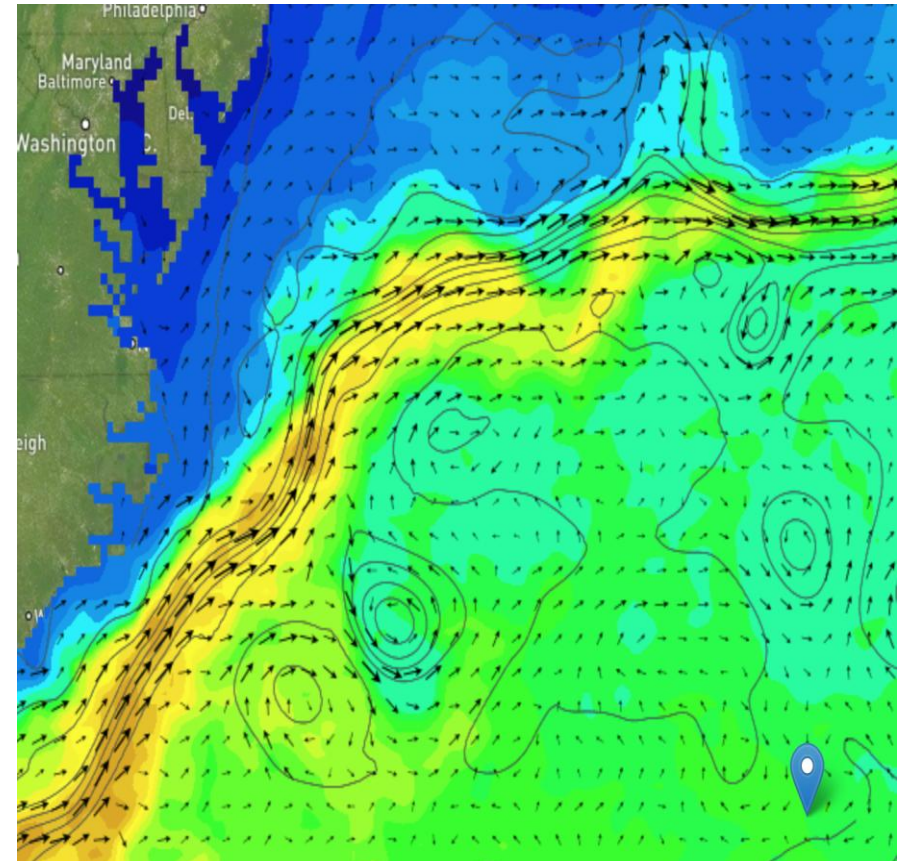
- Make sure the information you are getting from the instruments matches what is happening in real time using observations such as comparing course/COG and boat speed/SOG yourself, looking at navigational buoys, wave disturbances for current or tide lines, and observing the color of the water or cloud lines.



Current Analysis

Continue to monitor changes in the Gulfstream...

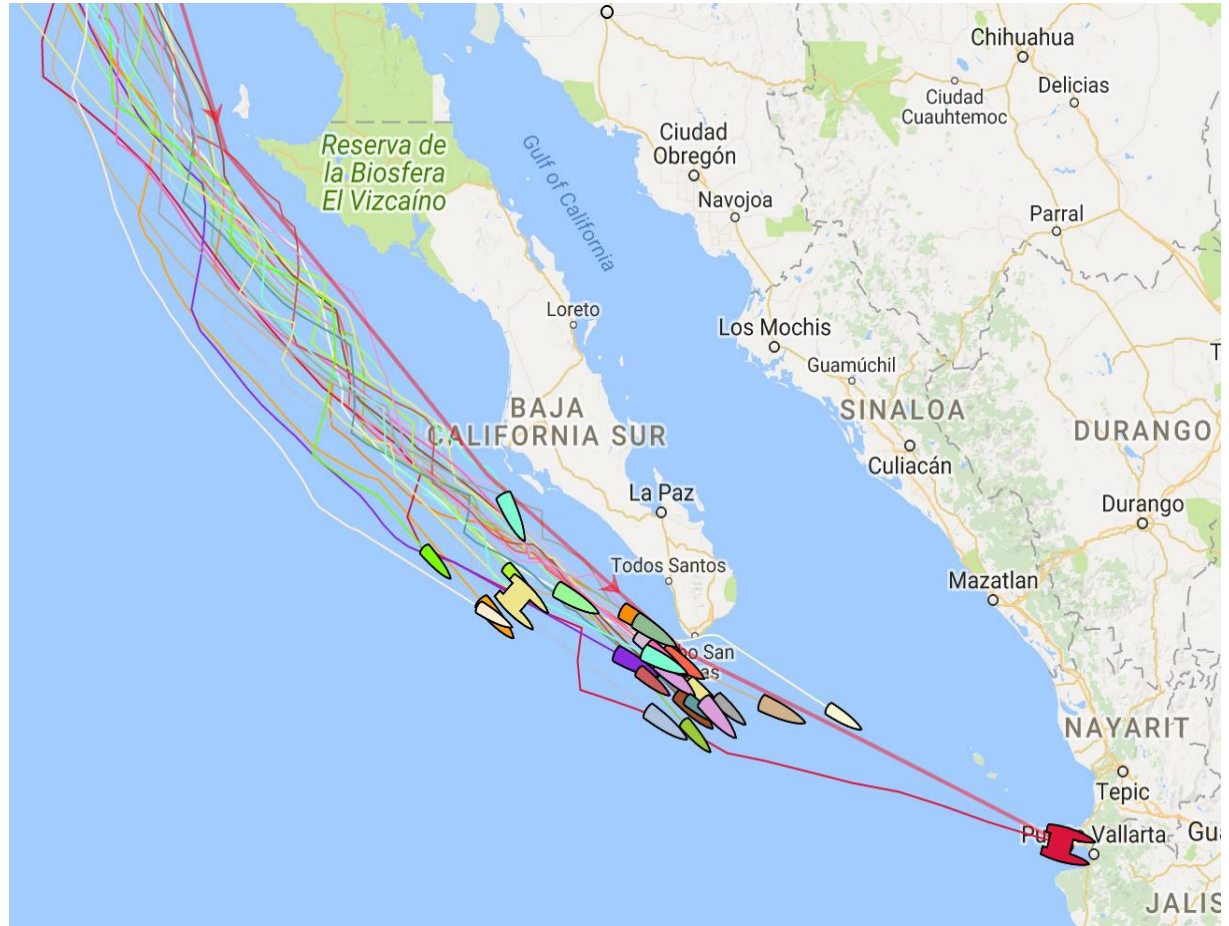
- Once racing, it is up to the navigator to monitor the current relative to the observed conditions and forecast.
- Compare Speed Over Ground (SOG) vs. Boat Speed (BSP)
- Monitor sea state temperature to also understand the potential currents and eddies impacting the boat
- TIP - When observing current on board, it is useful to know that there are differences in the way data is calculated and displayed through different instrument systems (e.g. B&G, Ockam) or navigation software packages (e.g. Expedition, Deckman, Adrena).



Position, Navigation & Timing

Continue to monitor your position in the fleet ...

- Race Position Reports
- Planned Course vs. Track Analysis
- Where is the boat actually on the course vs where you planned to be?
- Where are you relative to the boats you expected –
 - To be around?
 - To be far away from?



Crossing the Finish Line

We will cover the following...

- **1.0 Navigation Basics “101”**
- **2.0 Race Preparation**
- **3.0 O-Day Go Package**
- **4.0 Race Navigation**
- **5.0 Crossing the Finish Line**
 - Celebrate!!!
 - Post Race Notes
 - Log Analysis
- **Q&A**

Celebrate!!!

Congratulations, you've made it !



Post Race Notes

While things are still fresh in your mind, jot down some notes...

- How well did the predicted conditions match the actual?
- What adjustments did you make that worked?
- What adjustments did you make that didn't work?
- What adjustments did you NOT make that you should have?
- Were there any particular patterns or lessons learned for future races?
 - (weather, boat speed, course, etc.)



Log Analysis

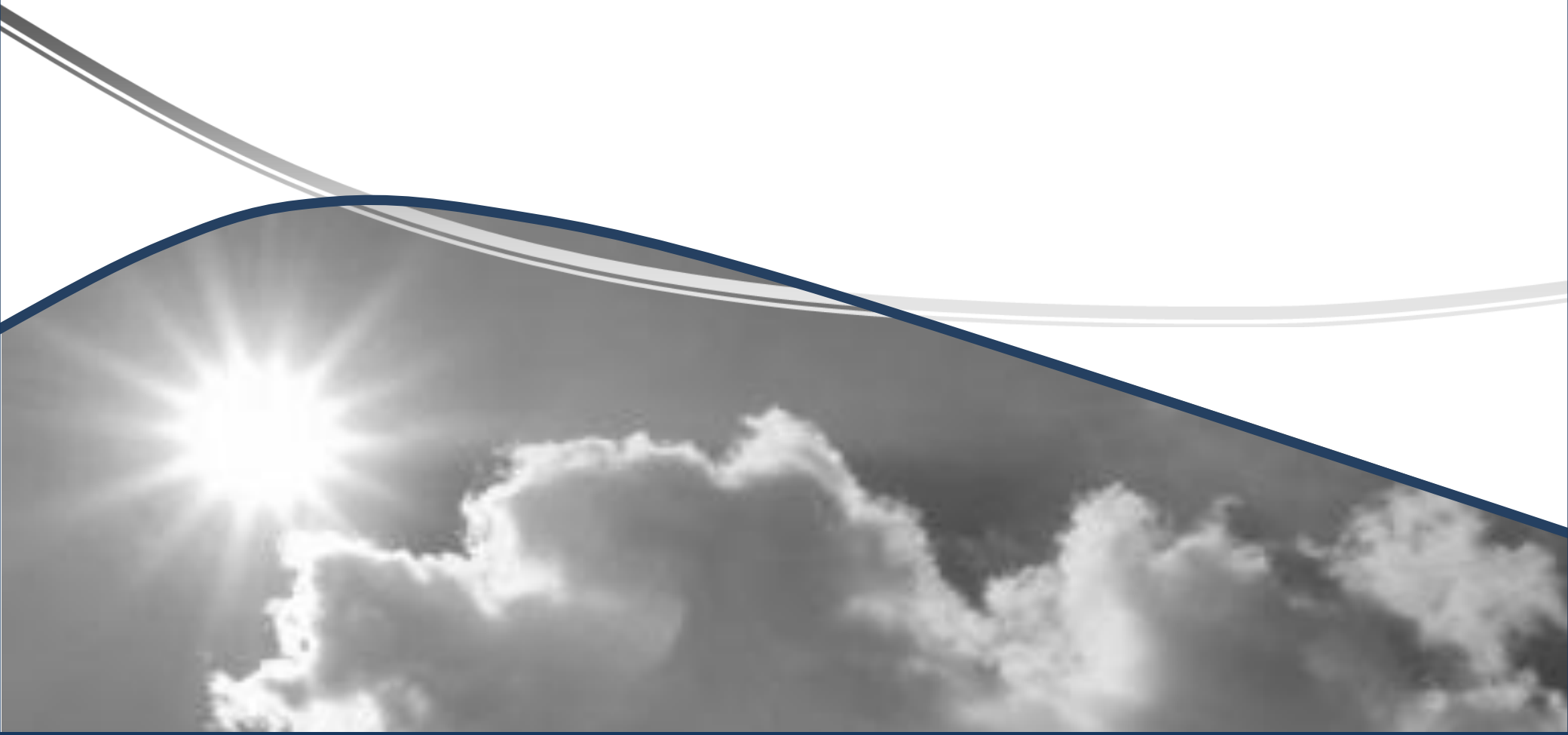
After the race has ended and you've gotten some rest examine the race's log files...

- How well did the actual boat speed and conditions match the polars?
- How well did the forecasted conditions match the actual conditions?
- Were there certain combinations of wind speed, wind angle and boat speed that you were...
 - ... faster in?
 - ... slower in?
- How did your track compare to...
 - ... the planned route
 - ... competitors tracks

Phase Report
 Boat: Angeln Share
 Start: 2024-05-03 14:07:59
 End: 2024-05-03 14:29:56

AllPhases		Boat	StartTime	Duration	Comments	Comments2	Tails	RacePg	Tack	Mode	Trouble	TwistIn	TwistOut	PWA	PWS	EMF	DPDepth	VWMS	VWMS2	AWA	AWV	WOT	WUOOR	WUOOR2	WUOOR3	WUOOR4	WUOOR5	WUOOR6	WUOOR7	WUOOR8	WUOOR9	WUOOR10	WUOOR11	WUOOR12	WUOOR13	WUOOR14	WUOOR15	WUOOR16	WUOOR17	WUOOR18	WUOOR19	WUOOR20	WUOOR21	WUOOR22	WUOOR23	WUOOR24	WUOOR25	WUOOR26	WUOOR27	WUOOR28	WUOOR29	WUOOR30	WUOOR31	WUOOR32	WUOOR33	WUOOR34	WUOOR35	WUOOR36	WUOOR37	WUOOR38	WUOOR39	WUOOR40	WUOOR41	WUOOR42	WUOOR43	WUOOR44	WUOOR45	WUOOR46	WUOOR47	WUOOR48	WUOOR49	WUOOR50	WUOOR51	WUOOR52	WUOOR53	WUOOR54	WUOOR55	WUOOR56	WUOOR57	WUOOR58	WUOOR59	WUOOR60	WUOOR61	WUOOR62	WUOOR63	WUOOR64	WUOOR65	WUOOR66	WUOOR67	WUOOR68	WUOOR69	WUOOR70	WUOOR71	WUOOR72	WUOOR73	WUOOR74	WUOOR75	WUOOR76	WUOOR77	WUOOR78	WUOOR79	WUOOR80	WUOOR81	WUOOR82	WUOOR83	WUOOR84	WUOOR85	WUOOR86	WUOOR87	WUOOR88	WUOOR89	WUOOR90	WUOOR91	WUOOR92	WUOOR93	WUOOR94	WUOOR95	WUOOR96	WUOOR97	WUOOR98	WUOOR99	WUOOR100
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Q&A



Thank You !!!

Gregory Dupier

gdupier@yahoo.com

