Weather Forecasting Tools for Sea Kayakers

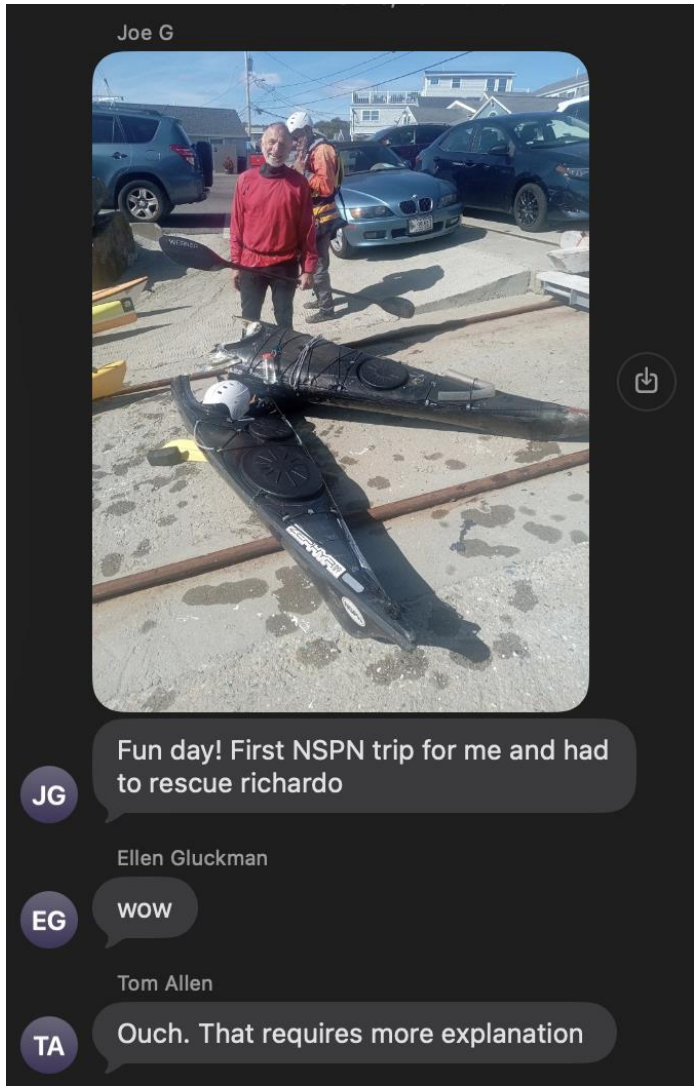
Eric Sofen

21 October 2025

Agenda

- Motivation
- Why listen to me?
- Weather impact on kayaking
- Forecasts
- Apps
- Models
- Surf & Current Models
- Observations
- Final notes

What inspired me to put this talk together?



Ricardo Caivano Posted 12 hours ago

R

Paid Member

149

Location:Salem, MA

The group: Joe Guglielmetti, Bill Doucet, Janet Lorang, Stephanie Golmon, Fred Goodman, Ben Partlow and myself.

The place: Perkins Cove, Maine.

Date: October 6, 2024

Actual observations at buoy #44030 - 8 land miles out from Bald Head - between noon and 2 PM):

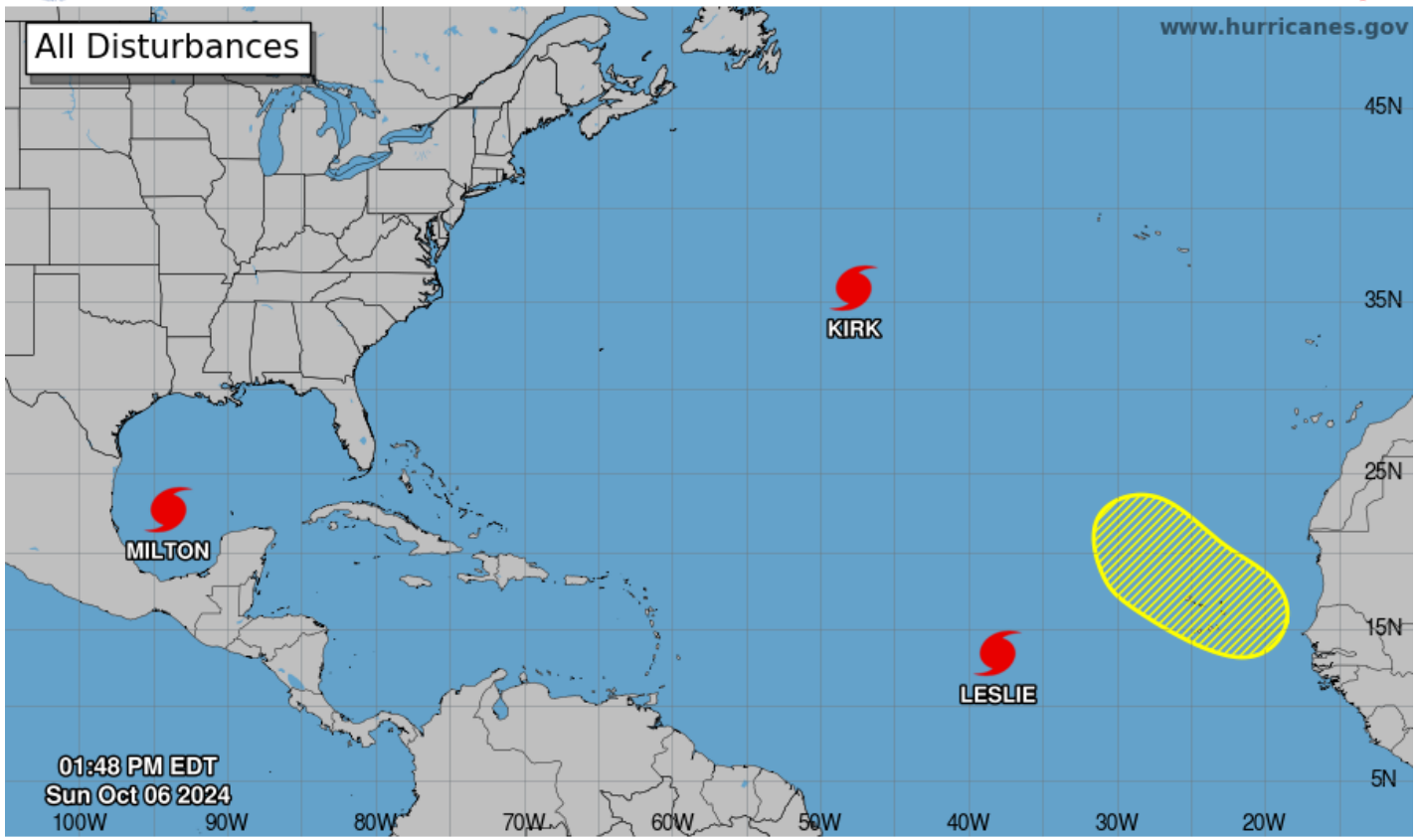
- Wind: N 9 to 13 Kts. Gusts 11 to 17 Kts.
- WVHT (waves height): 2.3 ft. to 4 ft.
- Wave period: 4 to 8 seconds.
- Water temperature: 60 F
- Air temperature: 54 F

The above were the actual conditions at per the buoy data published by NOAA. However, I remembering it as windy but not too strong, and I saw waves that were higher than 4 feet. The period of the larger waves seemed longer as well. Members of the group counted 14 seconds periods. High Tide at 1:51 PM.

https://www.nspn.org/forums/topic/15623-perkins-cove-me-death-of-a-kayak/

Seven-Day Graphical Tropical Weather Outlook

National Hurricane Center Miami, Florida



Current Disturbances and Seven-Day Cyclone Formation Chance: < 40% 40-60% > 60%

Tropical or Sub-Tropical Cyclone: Depression Storm Hurricane

Post-Tropical Cyclone or Remnants

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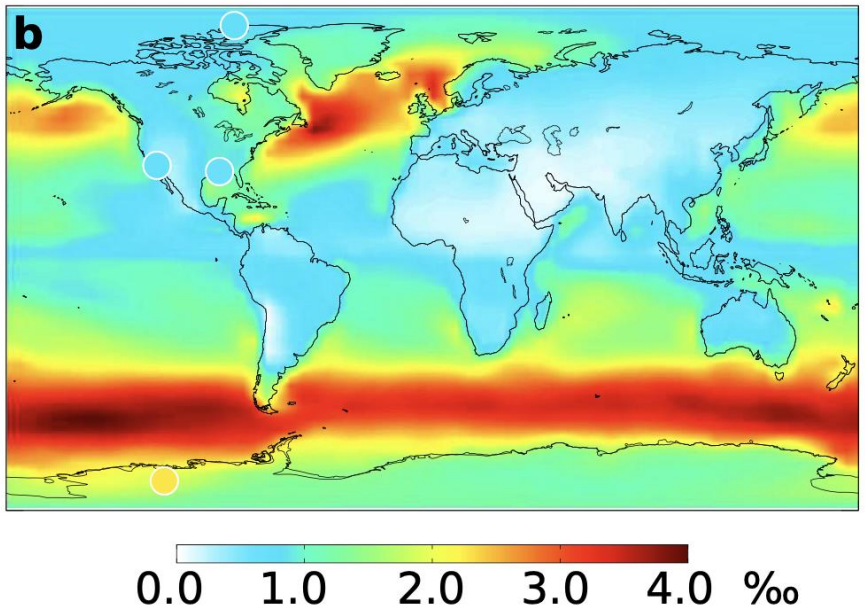
Would you trust this guy for your weather forecast?

Fog: 200 m visibility

Swell: 3'-4' @ 8s

University of Washington
Atmospheric Sciences



TLDR...

WEATHER APPS IN THE US MOSTLY RELY ON NOAA'S GFS MODEL.

TO EVALUATE UNCERTAINTY, SEEK OUT OTHER MODELS AND OBSERVATIONS.

WRITTEN FORECASTS FROM HUMAN FORECASTERS ARE STILL VALUABLE TOOLS.

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What weather variables are important for sea kayaking?

- Wind
- Sea state – wave height and period
- Fog/visibility
- Precipitation
- Temperature
- Lightning
- Dew point/Humidity
- Pressure tendency

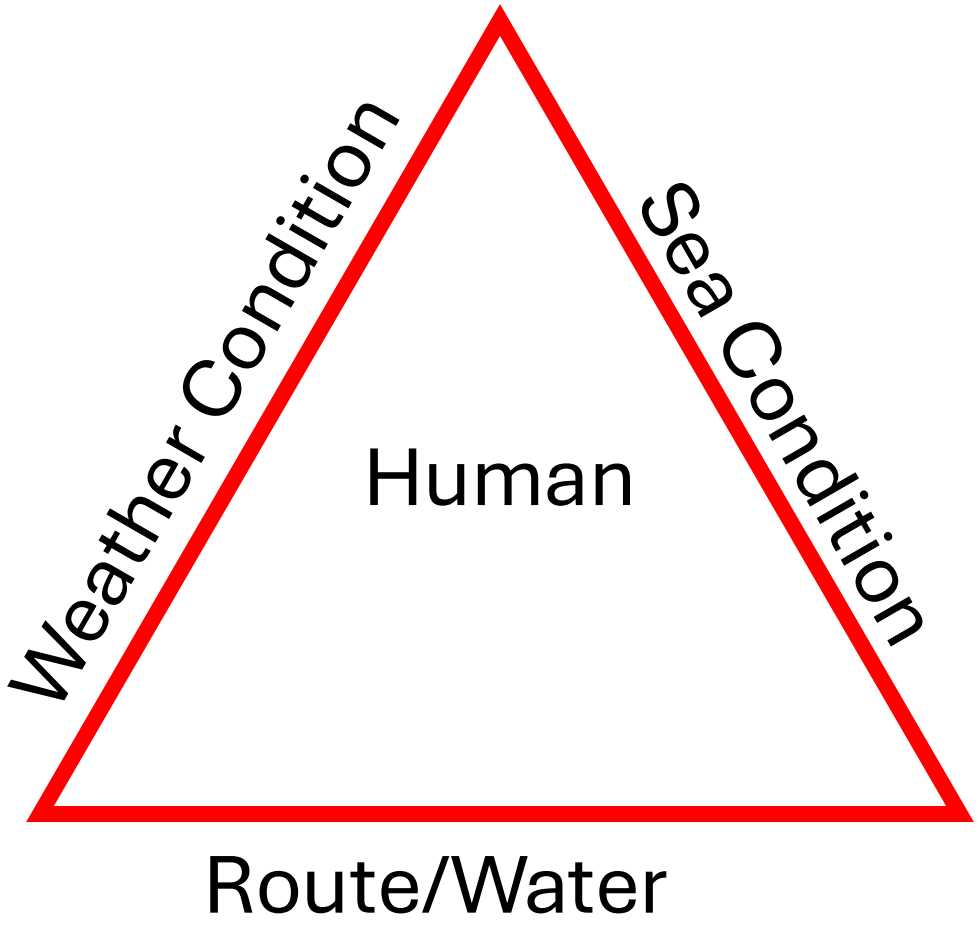
- Tides and tidal currents*

* Not really weather**, but also NOAA's job

** Tides do affect*** the weather!!!

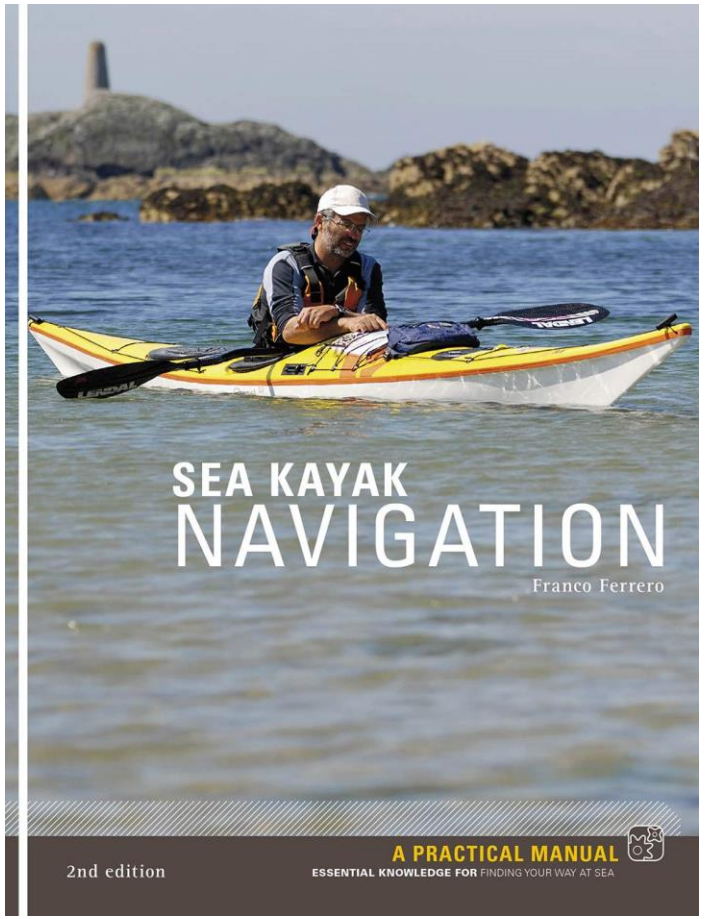
*** A very little bit

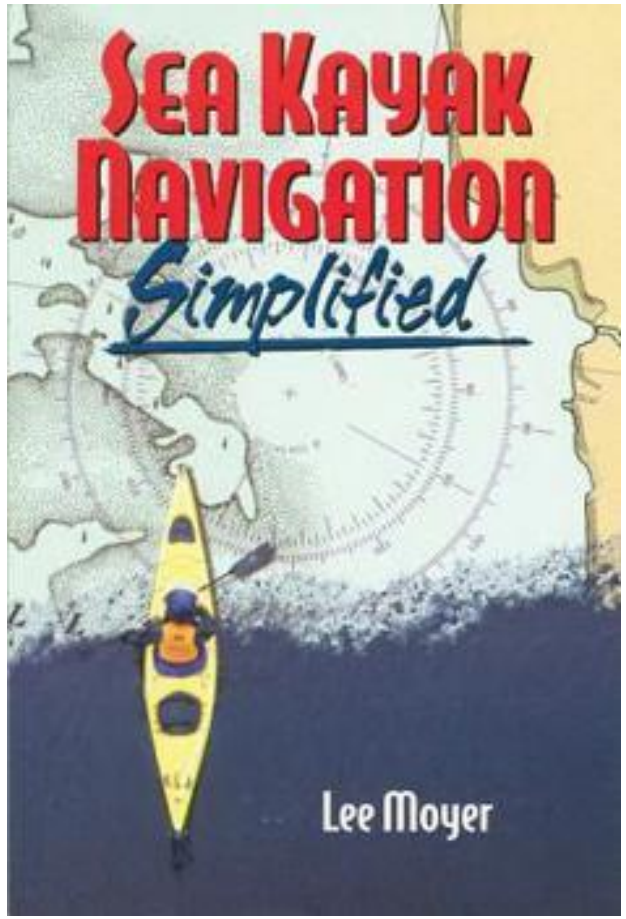
What to do with this weather information



Adapted from SKILS Leadership book
Adapted from Aadland *et al.* "Situation awareness in sea kayaking: towards a practical checklist"
Adapted from NOLS

What to do with this weather information





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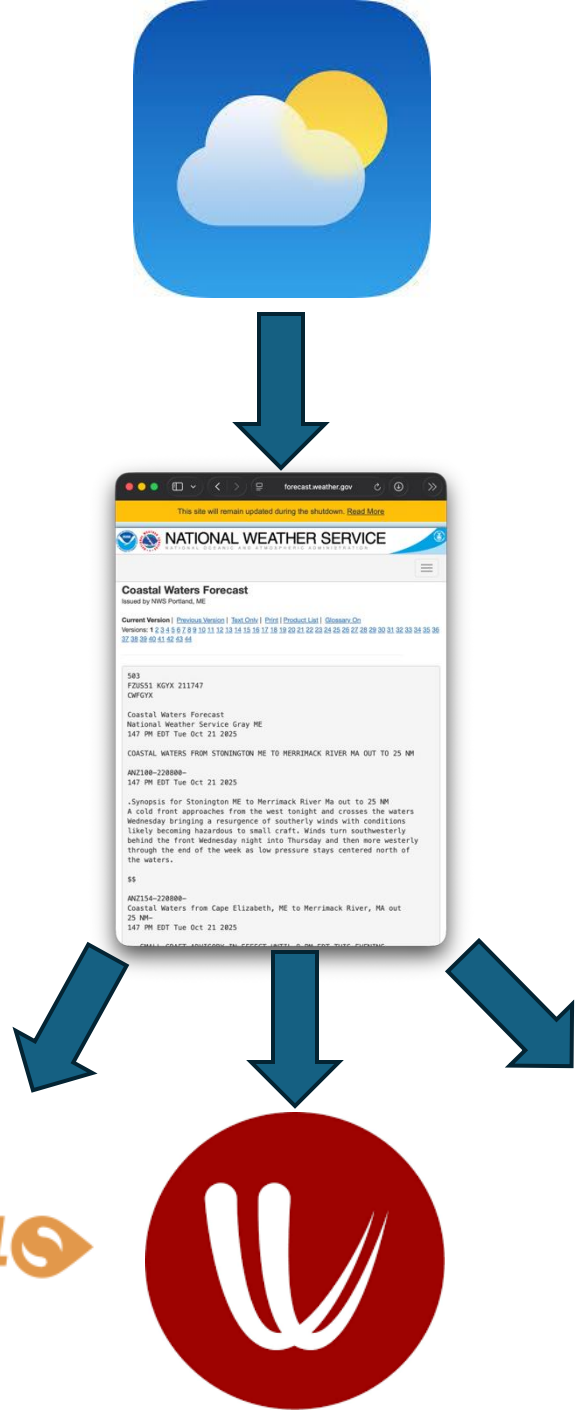
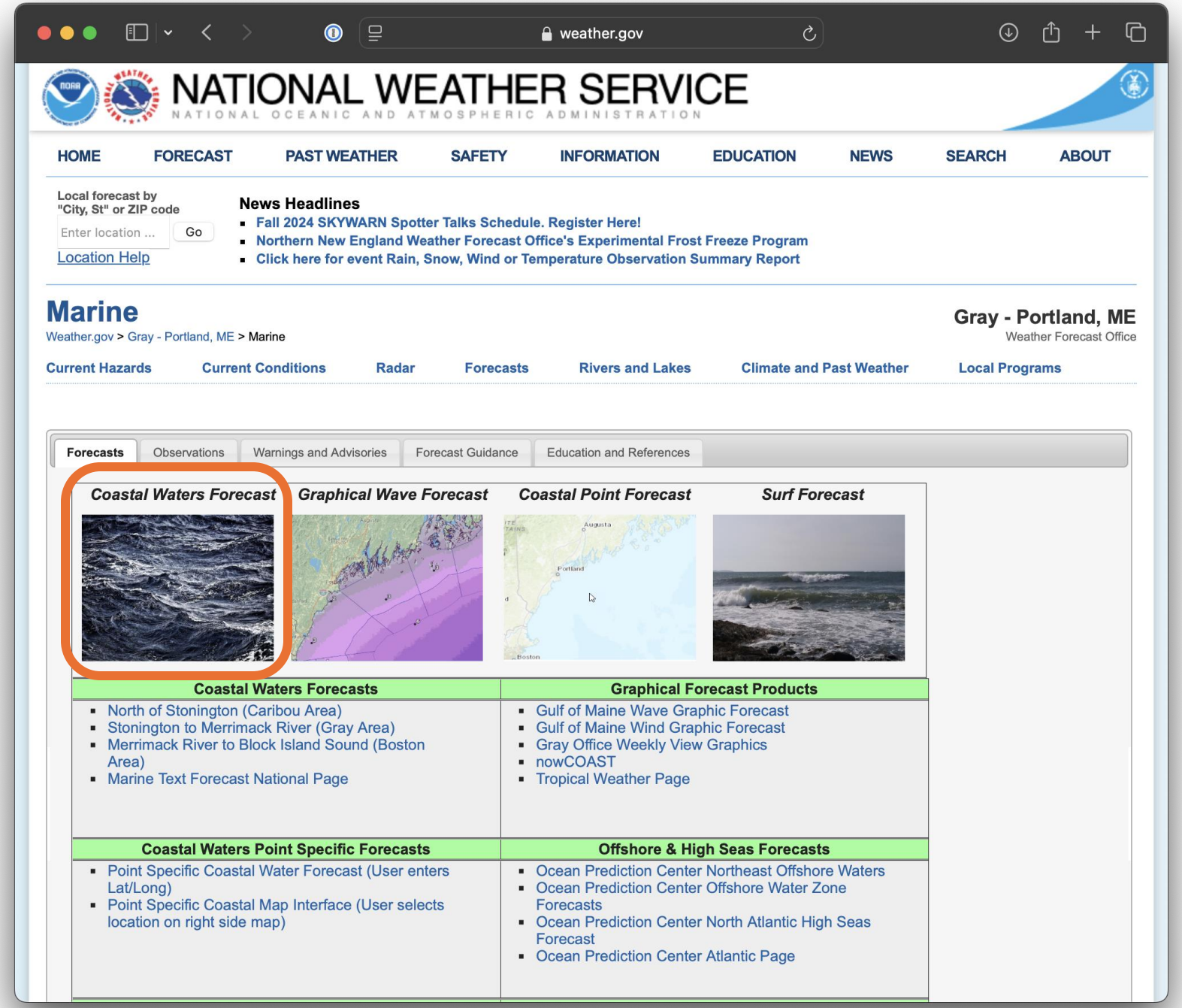
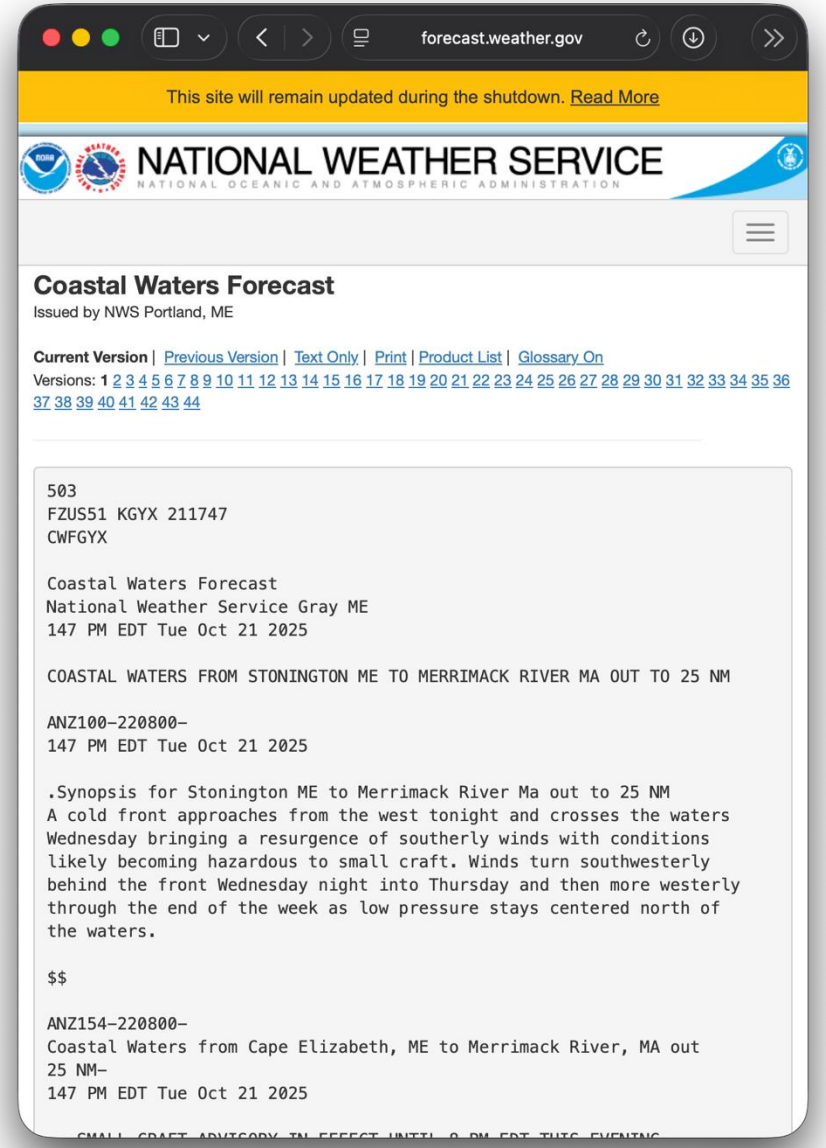


Marine forecast



Coastal Waters Forecast



Coastal Waters Forecast

National Weather Service Gray ME

147 PM EDT Tue Oct 21 2025

COASTAL WATERS FROM STONINGTON ME TO MERRIMACK RIVER MA OUT TO 25 NM

ANZ100-220800-

147 PM EDT Tue Oct 21 2025

.Synopsis for Stonington ME to Merrimack River Ma out to 25 NM

A cold front approaches from the west tonight and crosses the waters Wednesday bringing a resurgence of southerly winds with conditions likely becoming hazardous to small craft. Winds turn southwesterly behind the front Wednesday night into Thursday and then more westerly through the end of the week as low pressure stays centered north of the waters.

ANZ152-220800-

Coastal Waters from Port Clyde, ME to Cape Elizabeth, ME out 25 NM-

147 PM EDT Tue Oct 21 2025

...SMALL CRAFT ADVISORY IN EFFECT UNTIL 8 PM EDT THIS EVENING...

.THIS AFTERNOON...SW winds 15 to 20 kt, diminishing to 10 to 15 kt late. Seas 4 to 6 ft. Wave Detail: SE 5 ft at 7 seconds.

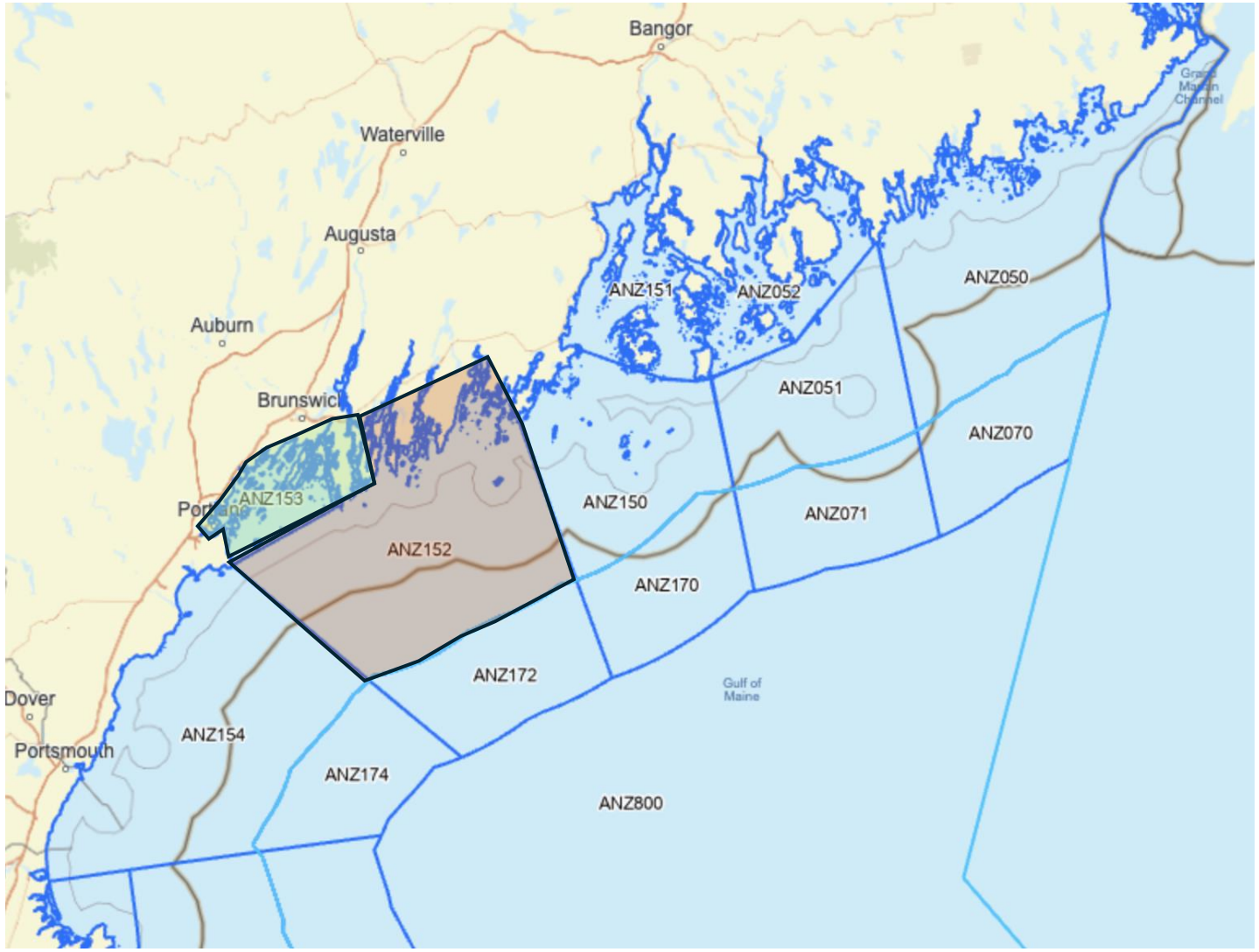
.TONIGHT...S winds 10 to 15 kt with gusts up to 20 kt. Seas 3 to 5 ft. Wave Detail: SE 4 ft at 7 seconds. Patchy fog after midnight with vsby 1 to 3 NM.

.WED...S winds 10 to 15 kt with gusts up to 25 kt. Seas 4 to 6 ft. Wave Detail: S 5 ft at 6 seconds. Patchy fog in the morning. Showers. Vsby 1 to 3 NM.

.WED NIGHT...SW winds 10 to 15 kt with gusts up to 25 kt. Seas 4 to 6 ft. Wave Detail: S 5 ft at 7 seconds.

.THU...SW winds 15 to 20 kt with gusts up to 25 kt. Seas 3 to 5 ft.

Look at "Casco Bay" not "Coastal Waters from Port Clyde, ME to Cape Elizabeth, ME out to 25 NM"



ANZ153-220800-

Casco Bay-

147 PM EDT Tue Oct 21 2025

.THIS AFTERNOON...SW winds 10 to 15 kt with gusts up to 20 kt. Seas 2 to 4 ft.

.TONIGHT...S winds 5 to 10 kt. Seas 2 to 4 ft. Patchy fog after midnight with vsby 1 to 3 NM.

.WED...S winds 10 to 15 kt with gusts up to 25 kt. Seas 2 to 4 ft. Patchy fog in the morning. Showers. Vsby 1 to 3 NM in the morning.

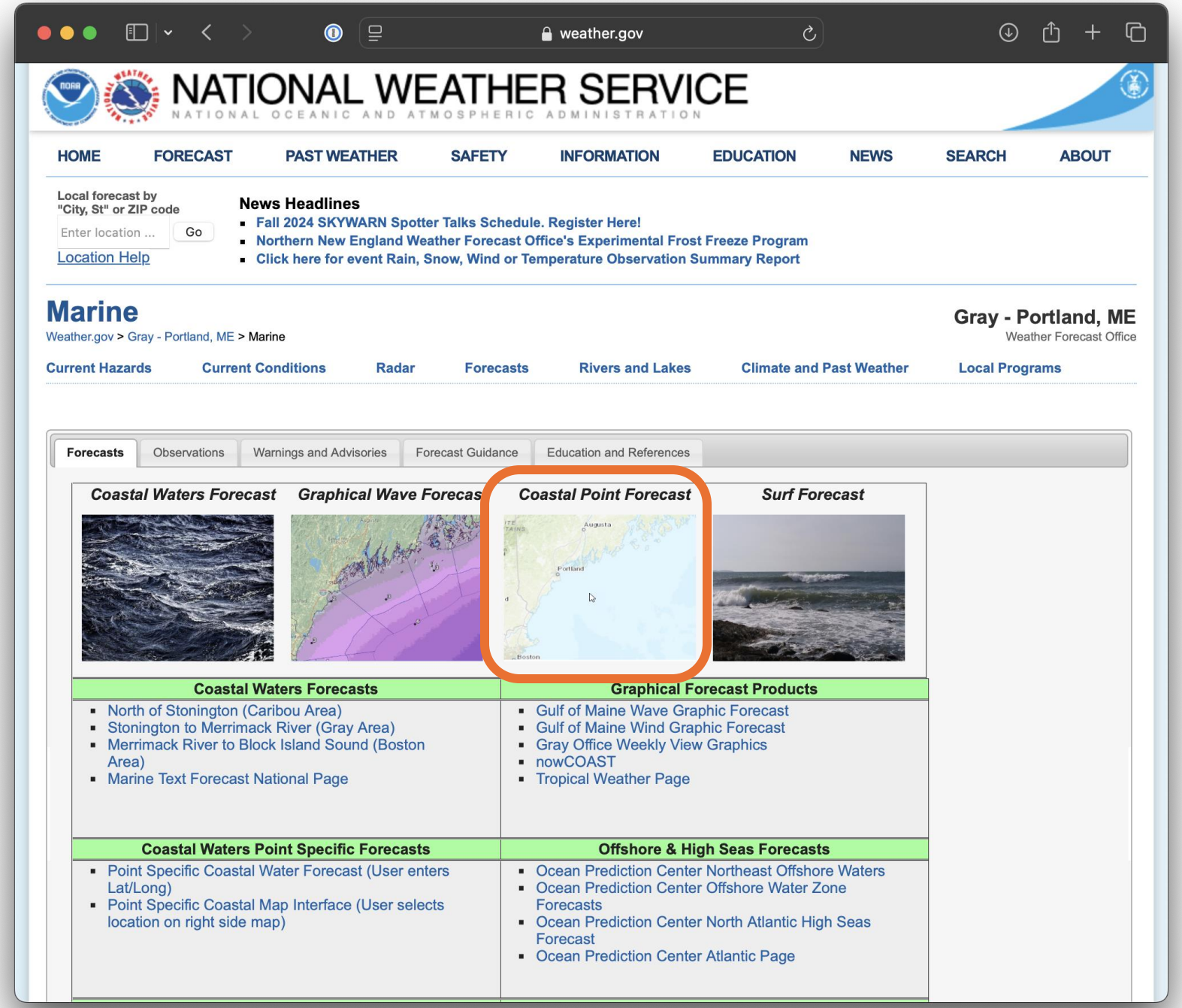
.WED NIGHT...SW winds 10 to 15 kt with gusts up to 20 kt. Seas 2 to 4 ft.

.THU...SW winds 10 to 15 kt with gusts up to 20 kt. Seas 2 to 4 ft.

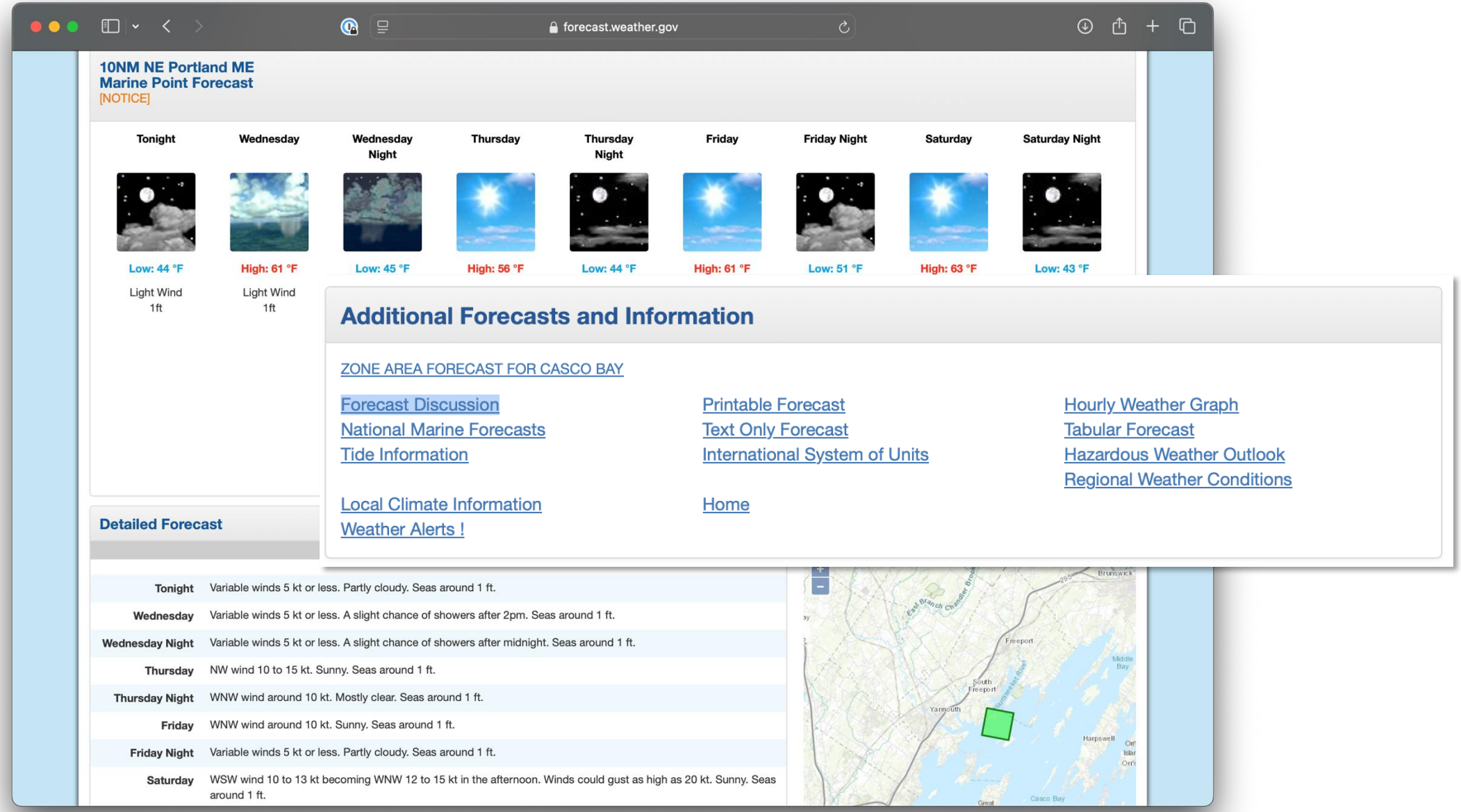
.THU NIGHT...SW winds 5 to 10 kt. Seas 2 to 3 ft.

.FRI...W winds 5 to 10 kt. Seas 2 to 3 ft. A chance of showers in the afternoon.

Marine forecast



Coastal Point Forecast



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Apps

Windy
Windy.com

Surfline

Buoyweather

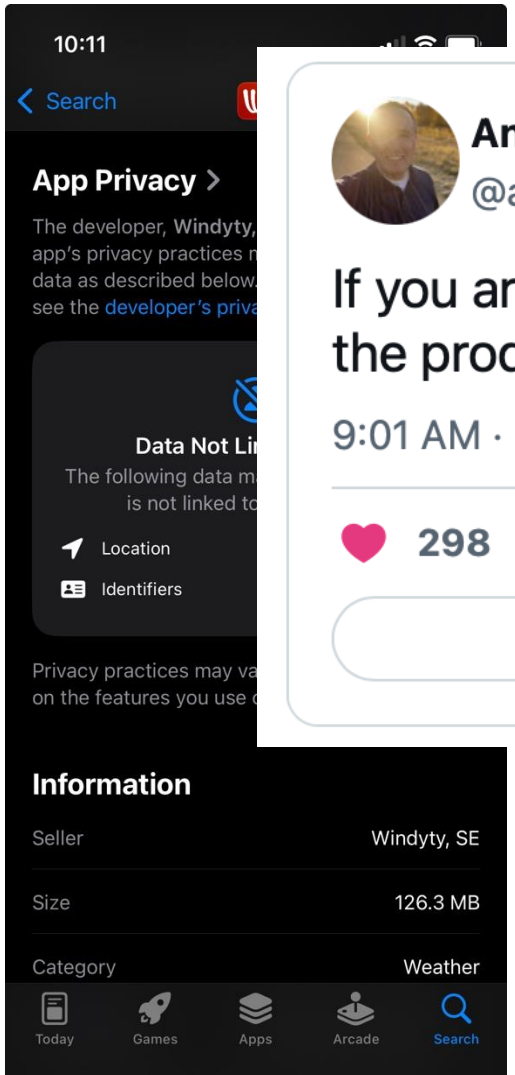
WeatherBug

WINDFINDER

WINDY.APP

Tropical Tidbits

WINDY.APP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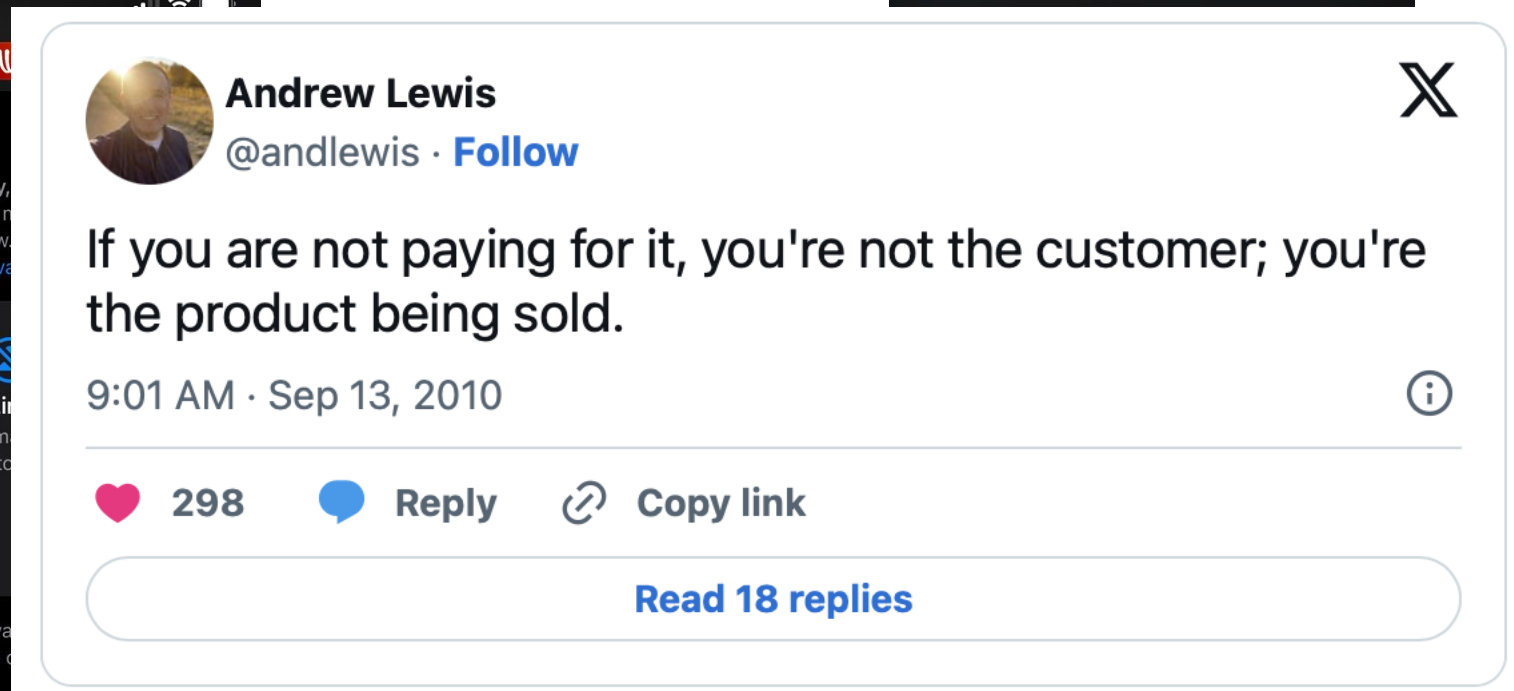
Andrew Lewis
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If you are not paying for it, you're not the customer; you're the product being sold.
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298
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Data Not Linked to You
The following data may be collected but it is not linked to your identity:
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Location
Search History
Identifiers
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Games
Apps
Arcade
Search

Apps

NOAA (GFS?)
The Weather Channel
Others in different countries

NWS + Proprietary

Windy
Windy.com

ECMWF
GFS
ICON
NAM, HRRR
HRDPS

WINDY.APP

ECMWF
GFS
ICON
AROME
OPENSKIRON

OpenWRF
NAM, HRRR
HRDPS
UKMET2

Surfline

Buoyweather

LOTUS swell model
GFS
NAM

WINDFINDER

GFS

Tropical Tidbits

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ECMWF
CMC
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WRF
RGEM
JMA

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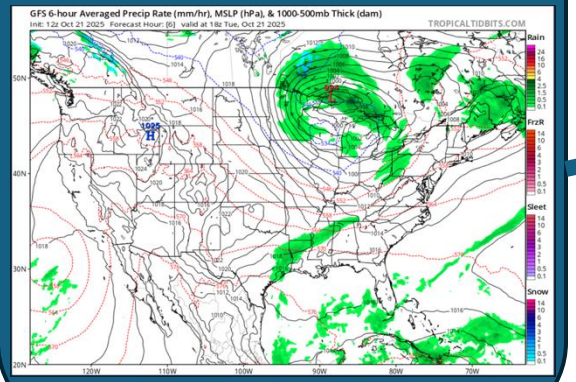
How does a weather model work?

Observations

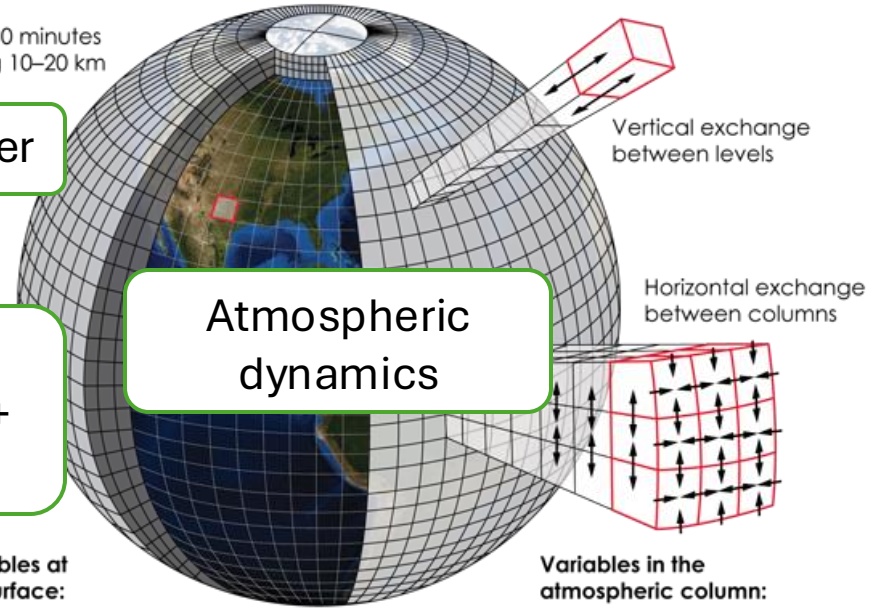
Past model state



Model

Weather forecast modeling

Timestep 5–10 minutes
Grid spacing 10–20 km



Boundary layer

Radiative transfer

Cloud microphysics + precipitation

Atmospheric dynamics

Atmospheric chemistry

Land/ocean model

Vertical exchange between levels

Horizontal exchange between columns

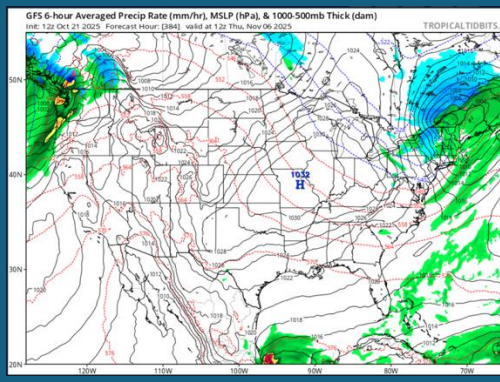
Variables at the surface:

- Temperature
- Humidity
- Pressure
- Moisture fluxes
- Heat fluxes
- Radiation fluxes

Variables in the atmospheric column:

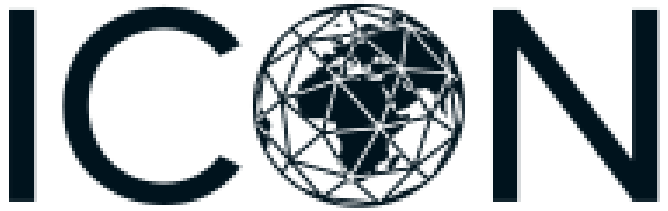
- Wind vectors
- Humidity
- Clouds
- Temperature
- Height
- Precipitation
- Aerosols

Forecast

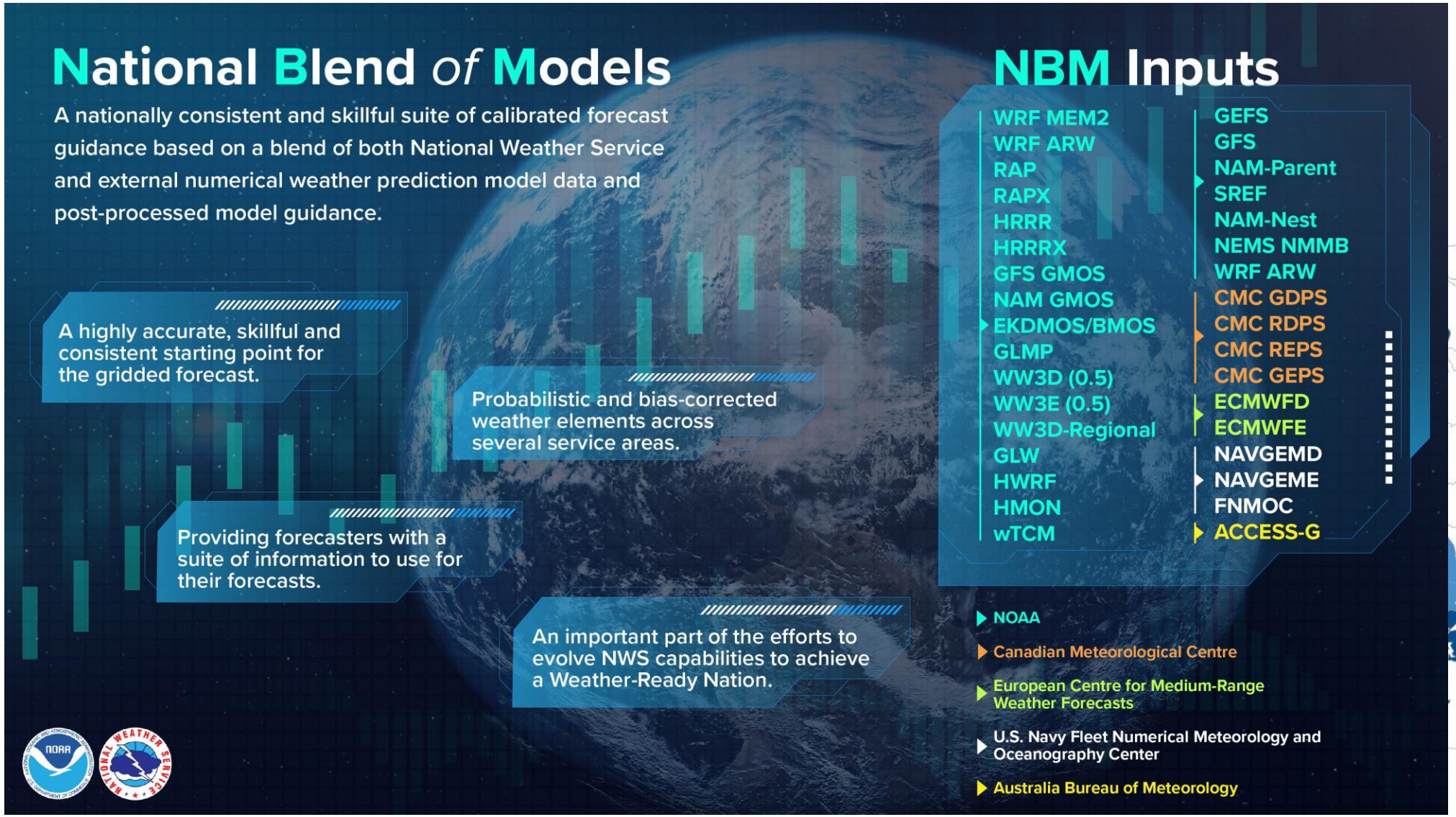


Weather models

NAM, HRRR

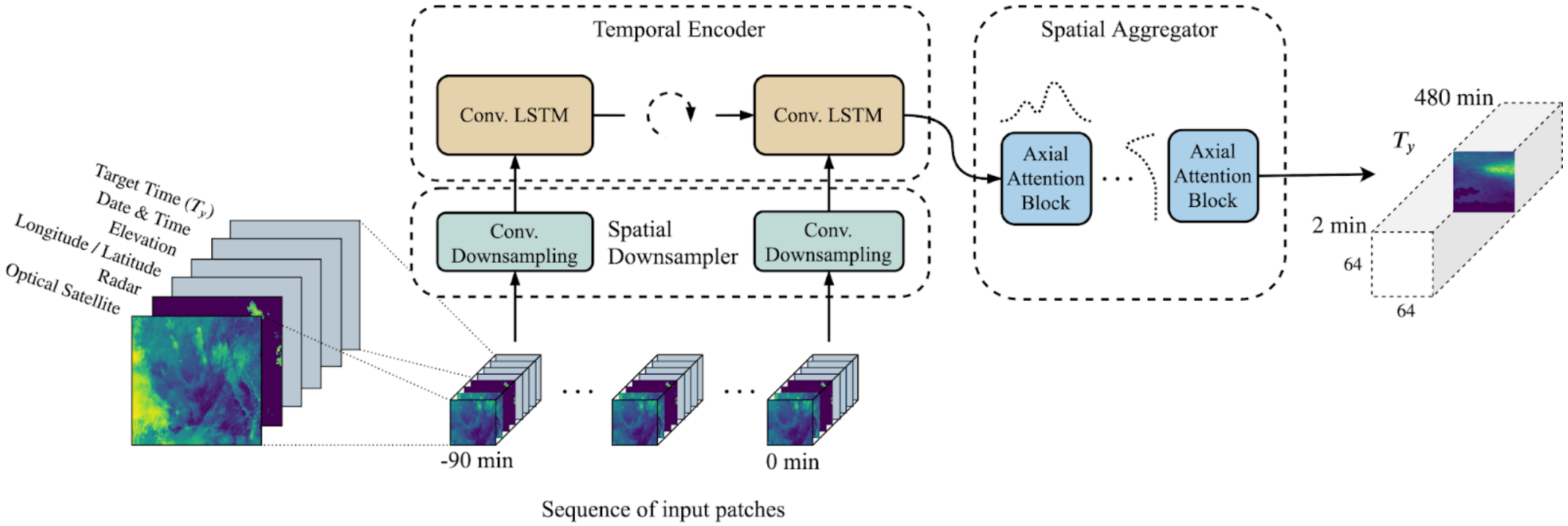


Weather models



Weather models

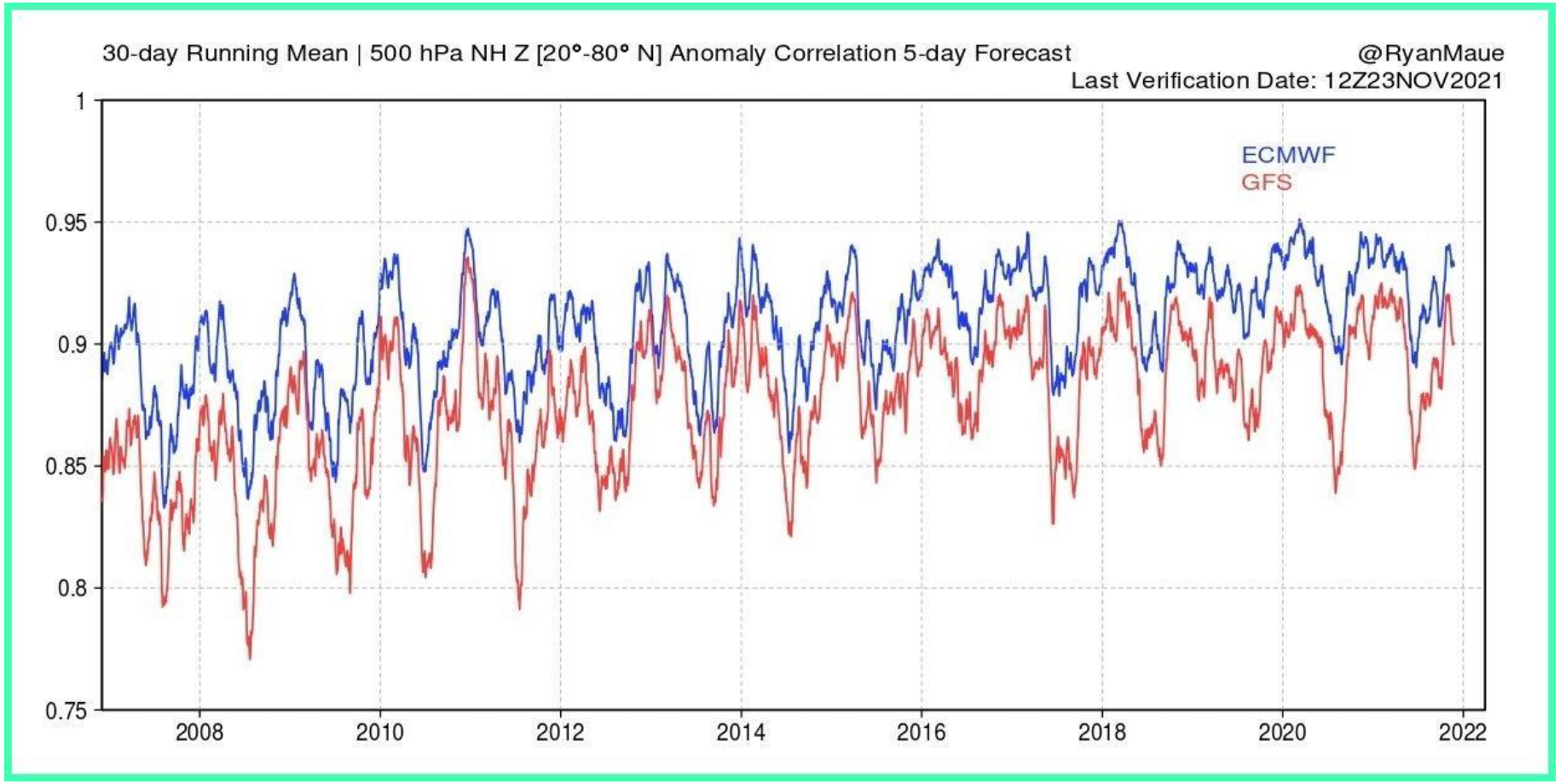
What about The Weather Channel, Apple Weather, AccuWeather, Darksky, …?



Who does best? https://www.forecastadvisor.com/Maine/Freeport/04032/

[Google Research]

ECMWF has been beating GFS for years ☹



Apps

NOAA (GFS?)
The Weather Channel
Others in different countries

NWS + Proprietary

Windy
Windy.com

ECMWF
GFS
ICON
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HRDPS

WINDY.APP

ECMWF
GFS
ICON
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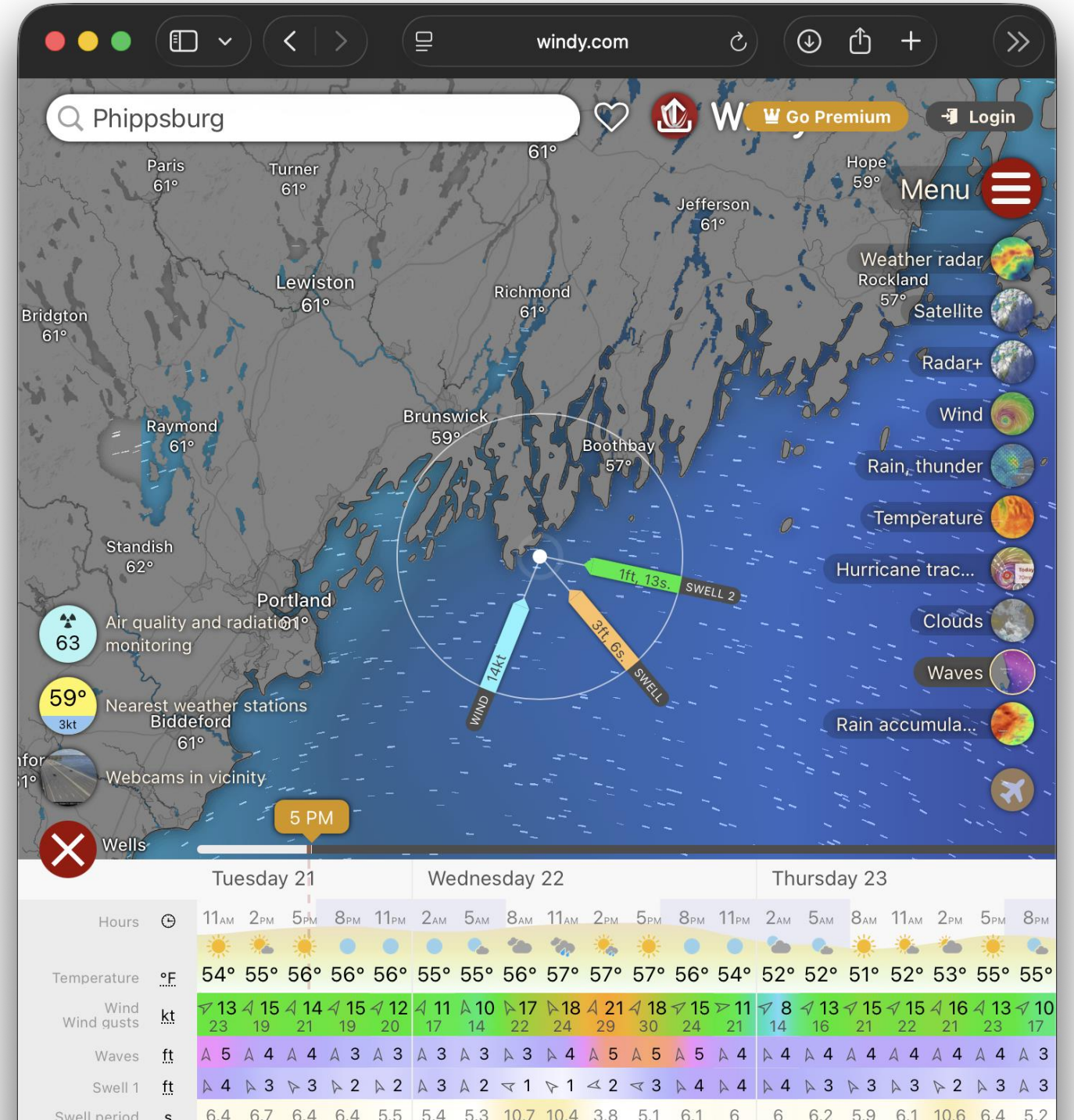
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Jefferson 61°
Hope 59°
Lewiston 61°
Richmond 61°
Rockland 57°
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Raymond 61°
Brunswick 59°
Boothbay 57°
Standish 62°
Portland 61°
1ft, 13s.
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SWELL
14kt
WIND
Air quality and radiation monitoring
63
Nearest weather stations
59°
3kt
Biddeford 61°
Webcams in vicinity
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Tuesday 21
Wednesday 22
Thursday 23
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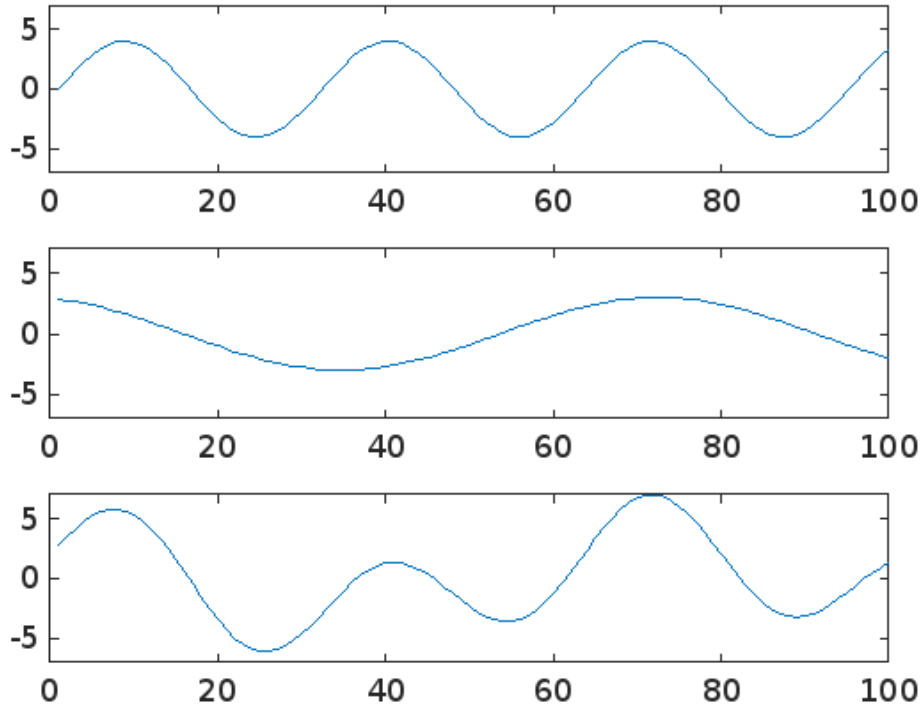
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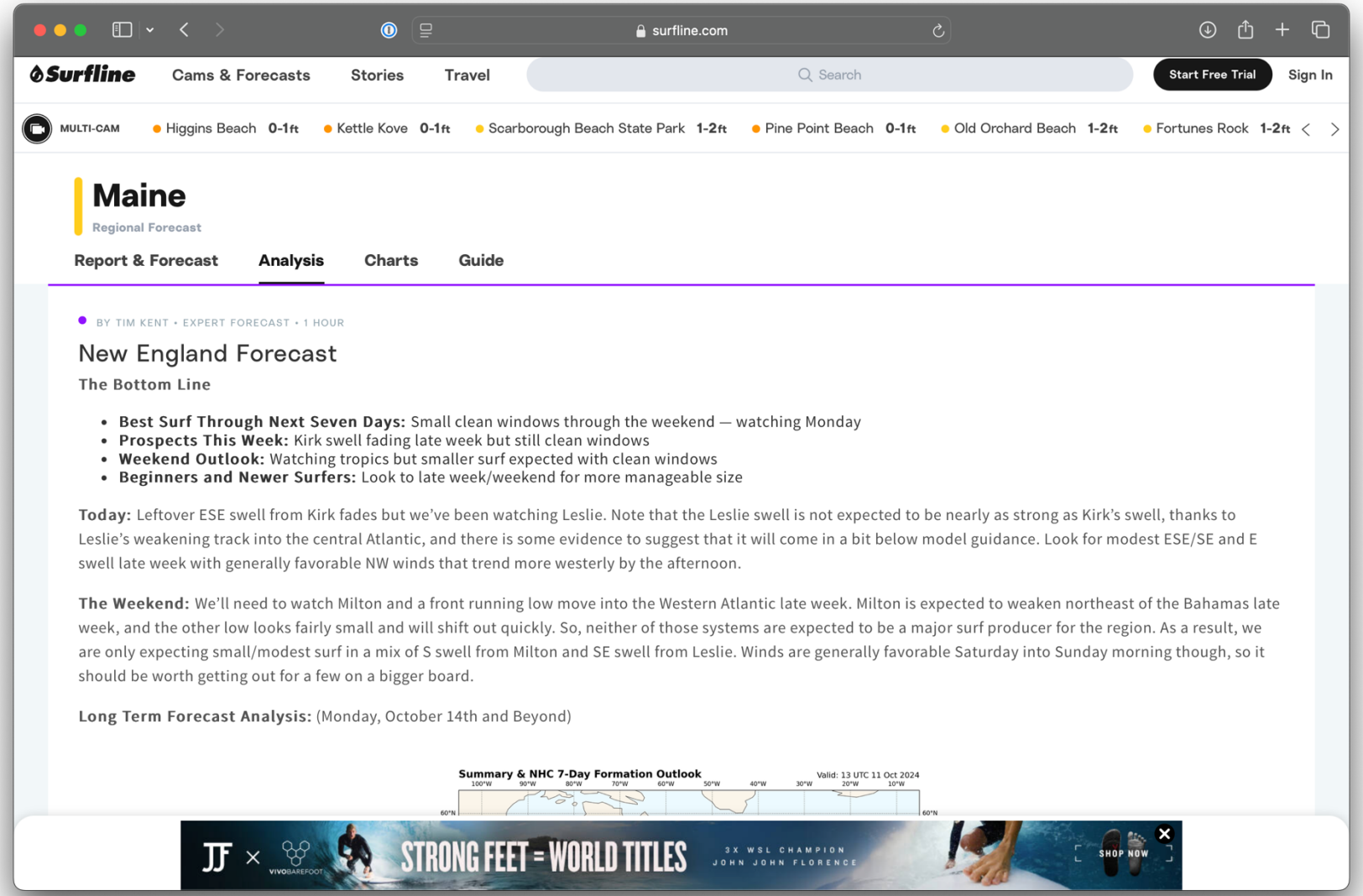
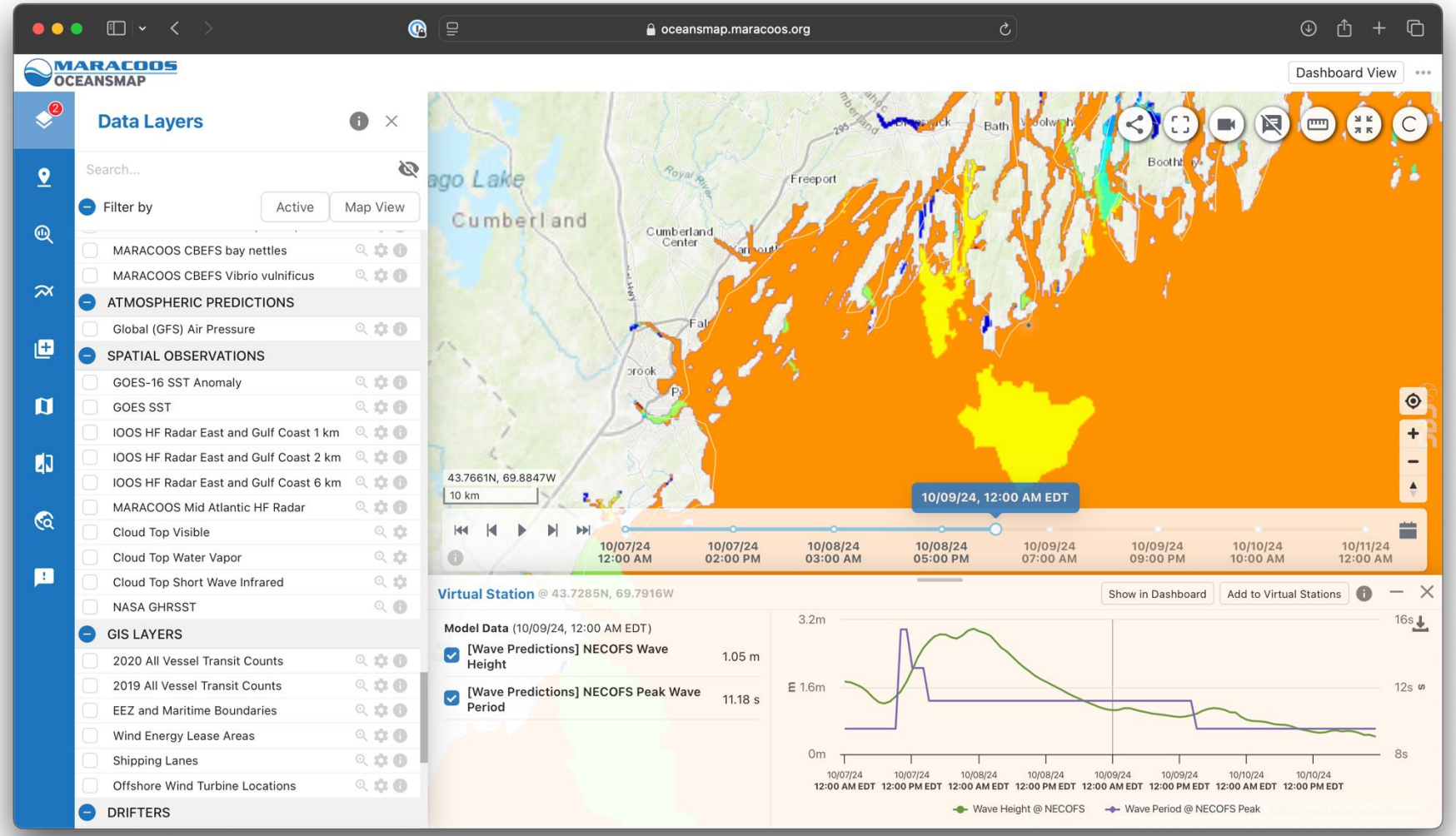
Surfline



www.surfline.com

Very high resolution ocean models NECOFS and FVCOM



https://oceansmap.maracoos.org

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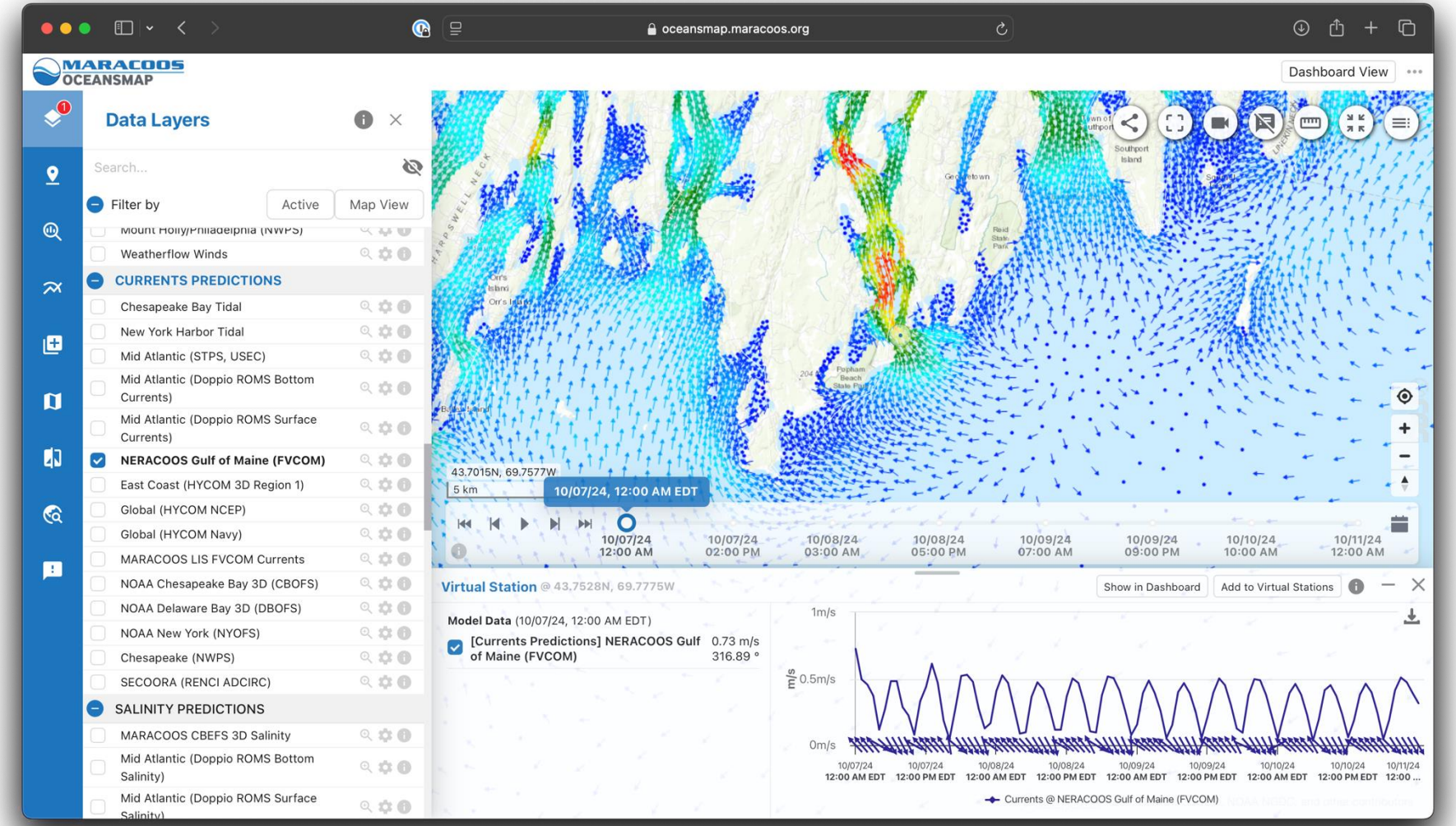

https://oceansmap.maracoos.org

"All models are wrong, but some are useful."

- George Box

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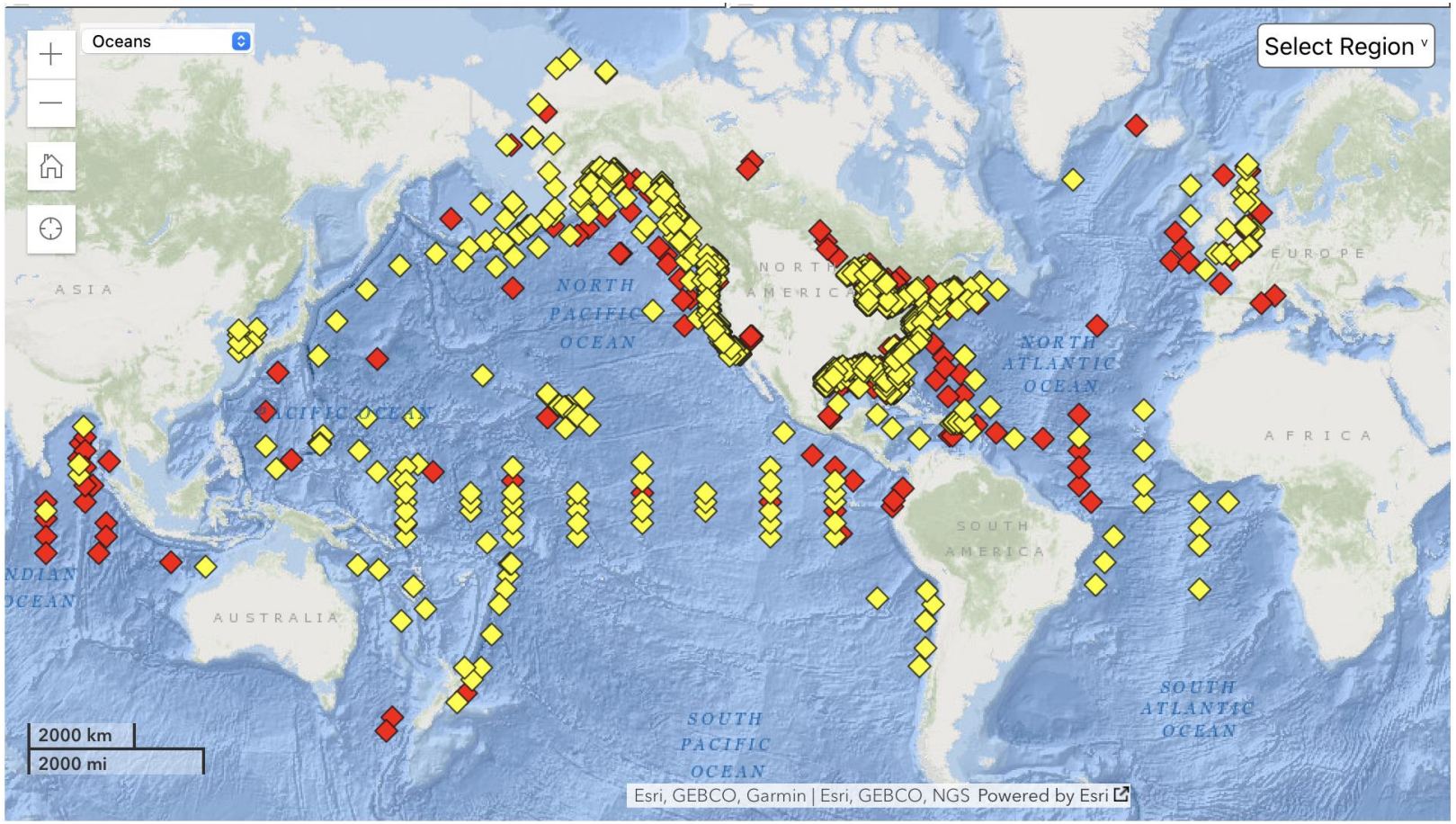
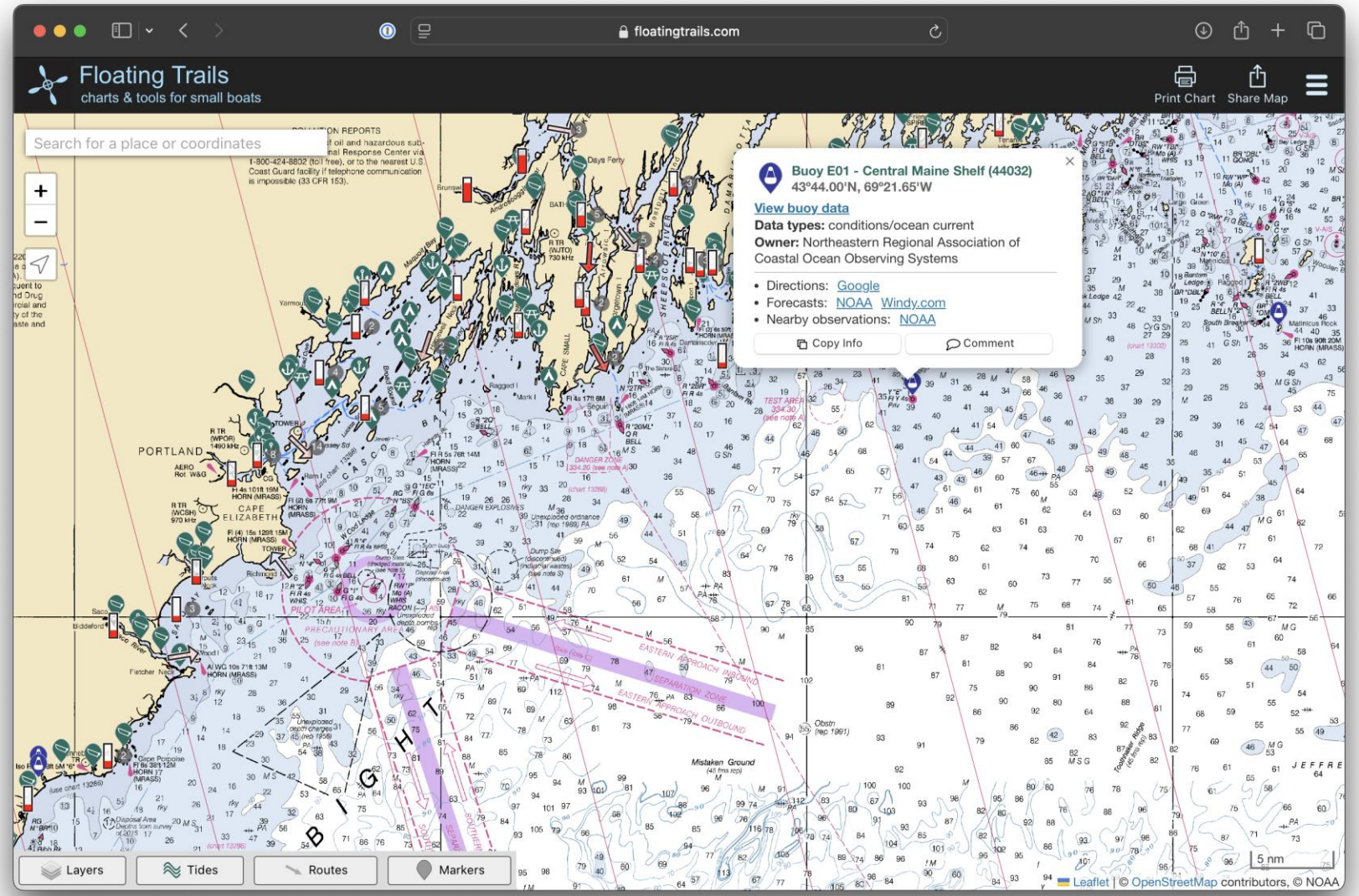
Data buoys

1347 buoys in a global network



Surface data: Buoys



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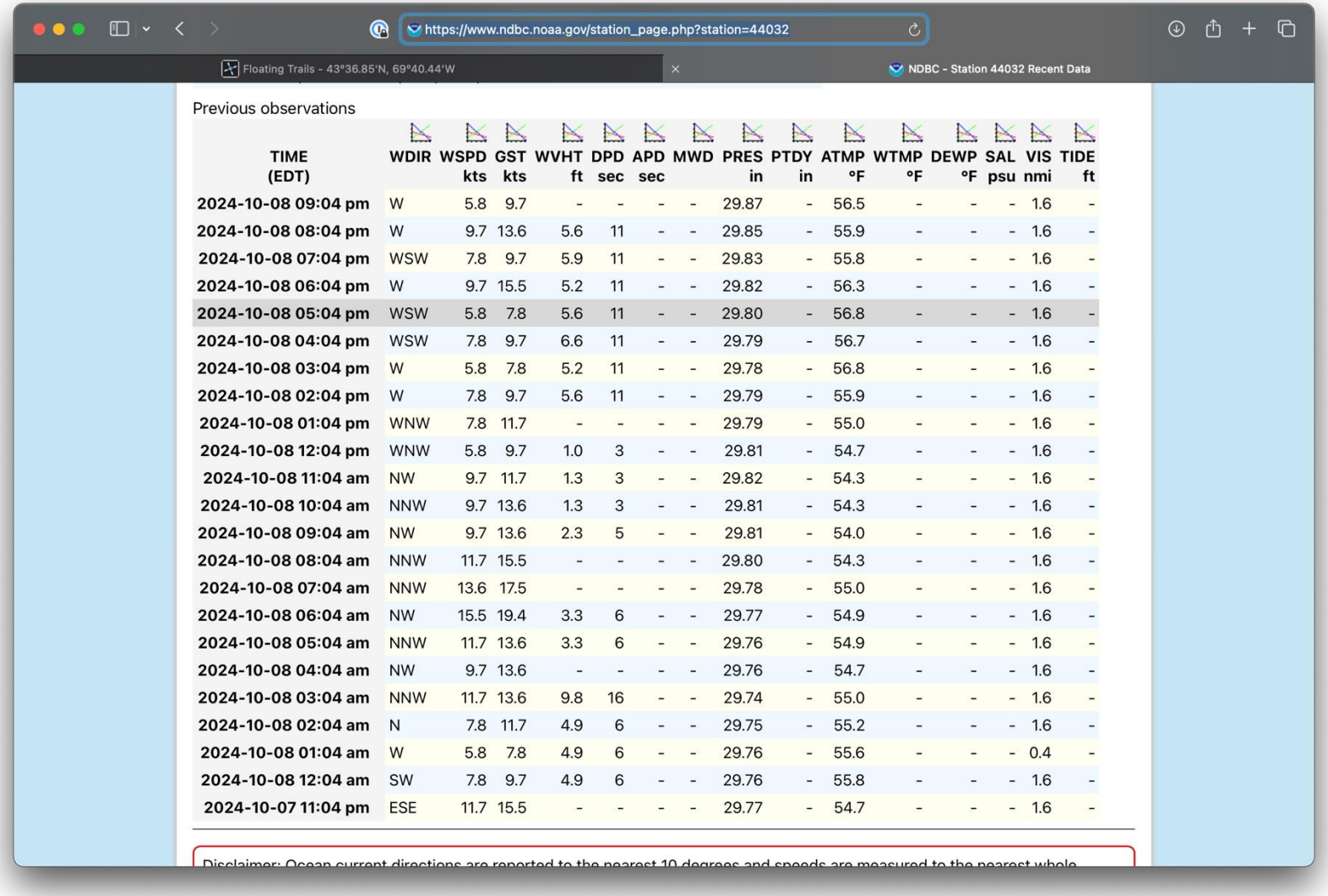
Surface data: Buoys



Previous observations

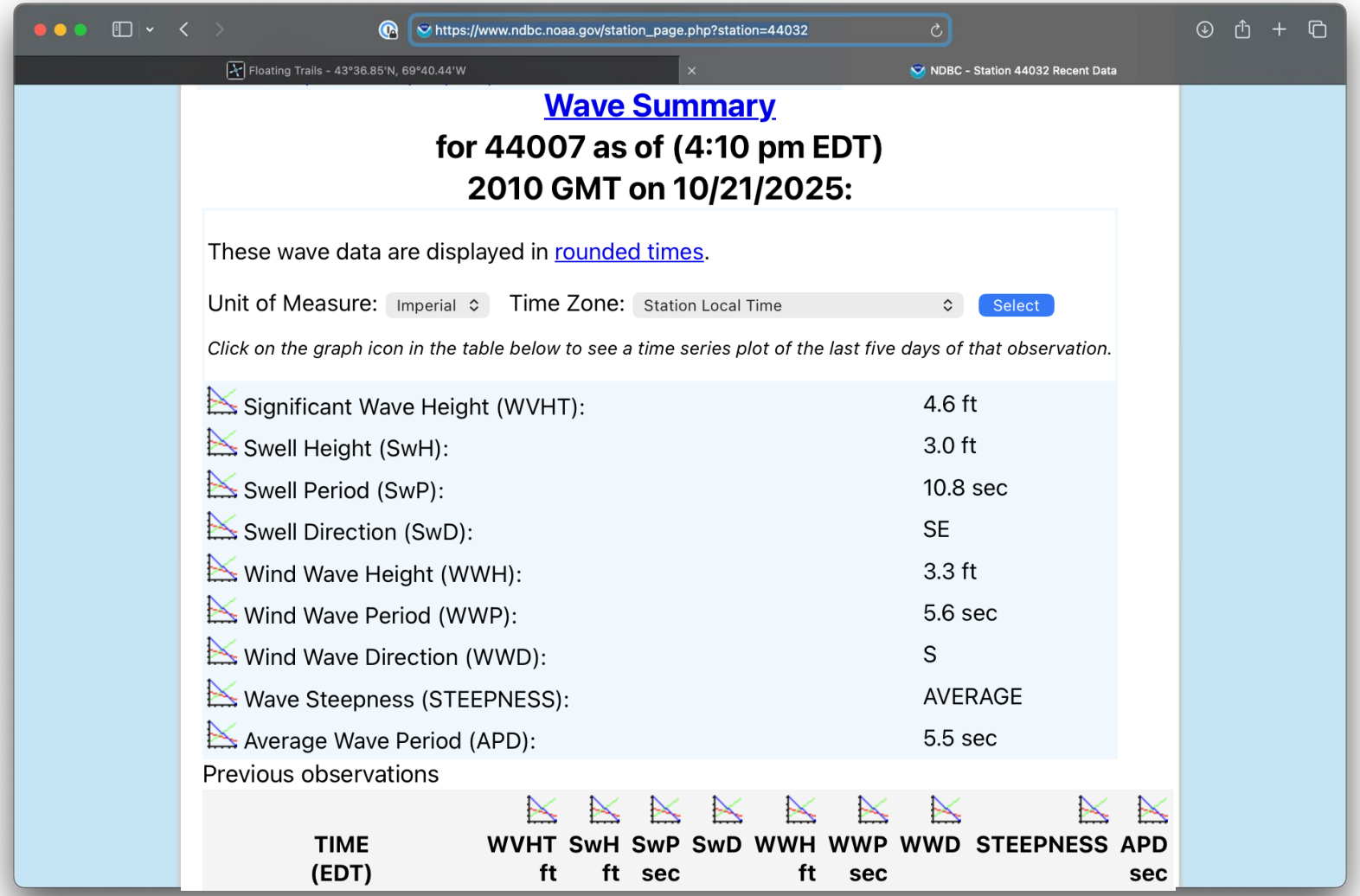
TIME (EDT)	WDIR	WSPD kts	GST kts	WVHT ft	DPD sec	APD sec	MWD	PRES in	PTDY in	ATMP °F	WTMP °F	DEWP °F	SAL psu	VIS nmi	TIDE ft
2024-10-08 09:04 pm	W	5.8	9.7	-	-	-	-	29.87	-	56.5	-	-	-	1.6	-
2024-10-08 08:04 pm	W	9.7	13.6	5.6	11	-	-	29.85	-	55.9	-	-	-	1.6	-
2024-10-08 07:04 pm	WSW	7.8	9.7	5.9	11	-	-	29.83	-	55.8	-	-	-	1.6	-
2024-10-08 06:04 pm	W	9.7	15.5	5.2	11	-	-	29.82	-	56.3	-	-	-	1.6	-
2024-10-08 05:04 pm	WSW	5.8	7.8	5.6	11	-	-	29.80	-	56.8	-	-	-	1.6	-
2024-10-08 04:04 pm	WSW	7.8	9.7	6.6	11	-	-	29.79	-	56.7	-	-	-	1.6	-
2024-10-08 03:04 pm	W	5.8	7.8	5.2	11	-	-	29.78	-	56.8	-	-	-	1.6	-
2024-10-08 02:04 pm	W	7.8	9.7	5.6	11	-	-	29.79	-	55.9	-	-	-	1.6	-
2024-10-08 01:04 pm	WNW	7.8	11.7	-	-	-	-	29.79	-	55.0	-	-	-	1.6	-
2024-10-08 12:04 pm	WNW	5.8	9.7	1.0	3	-	-	29.81	-	54.7	-	-	-	1.6	-
2024-10-08 11:04 am	NW	9.7	11.7	1.3	3	-	-	29.82	-	54.3	-	-	-	1.6	-
2024-10-08 10:04 am	NNW	9.7	13.6	1.3	3	-	-	29.81	-	54.3	-	-	-	1.6	-
2024-10-08 09:04 am	NW	9.7	13.6	2.3	5	-	-	29.81	-	54.0	-	-	-	1.6	-
2024-10-08 08:04 am	NNW	11.7	15.5	-	-	-	-	29.80	-	54.3	-	-	-	1.6	-
2024-10-08 07:04 am	NNW	13.6	17.5	-	-	-	-	29.78	-	55.0	-	-	-	1.6	-
2024-10-08 06:04 am	NW	15.5	19.4	3.3	6	-	-	29.77	-	54.9	-	-	-	1.6	-
2024-10-08 05:04 am	NNW	11.7	13.6	3.3	6	-	-	29.76	-	54.9	-	-	-	1.6	-
2024-10-08 04:04 am	NW	9.7	13.6	-	-	-	-	29.76	-	54.7	-	-	-	1.6	-
2024-10-08 03:04 am	NNW	11.7	13.6	9.8	16	-	-	29.74	-	55.0	-	-	-	1.6	-
2024-10-08 02:04 am	N	7.8	11.7	4.9	6	-	-	29.75	-	55.2	-	-	-	1.6	-
2024-10-08 01:04 am	W	5.8	7.8	4.9	6	-	-	29.76	-	55.6	-	-	-	0.4	-
2024-10-08 12:04 am	SW	7.8	9.7	4.9	6	-	-	29.76	-	55.8	-	-	-	1.6	-
2024-10-07 11:04 pm	ESE	11.7	15.5	-	-	-	-	29.77	-	54.7	-	-	-	1.6	-

Disclaimer: Ocean current directions are reported to the nearest 10 degrees and speeds are measured to the nearest whole

WVGT = Significant Wave height
DPD = Dominant period
APD = Average period
SwH = Swell Height
SwP = Swell Period
WWH = Wind wave height
WWP = Wind wave period

https://www.ndbc.noaa.gov/station_page.php?station=44032

Surface data: Buoys



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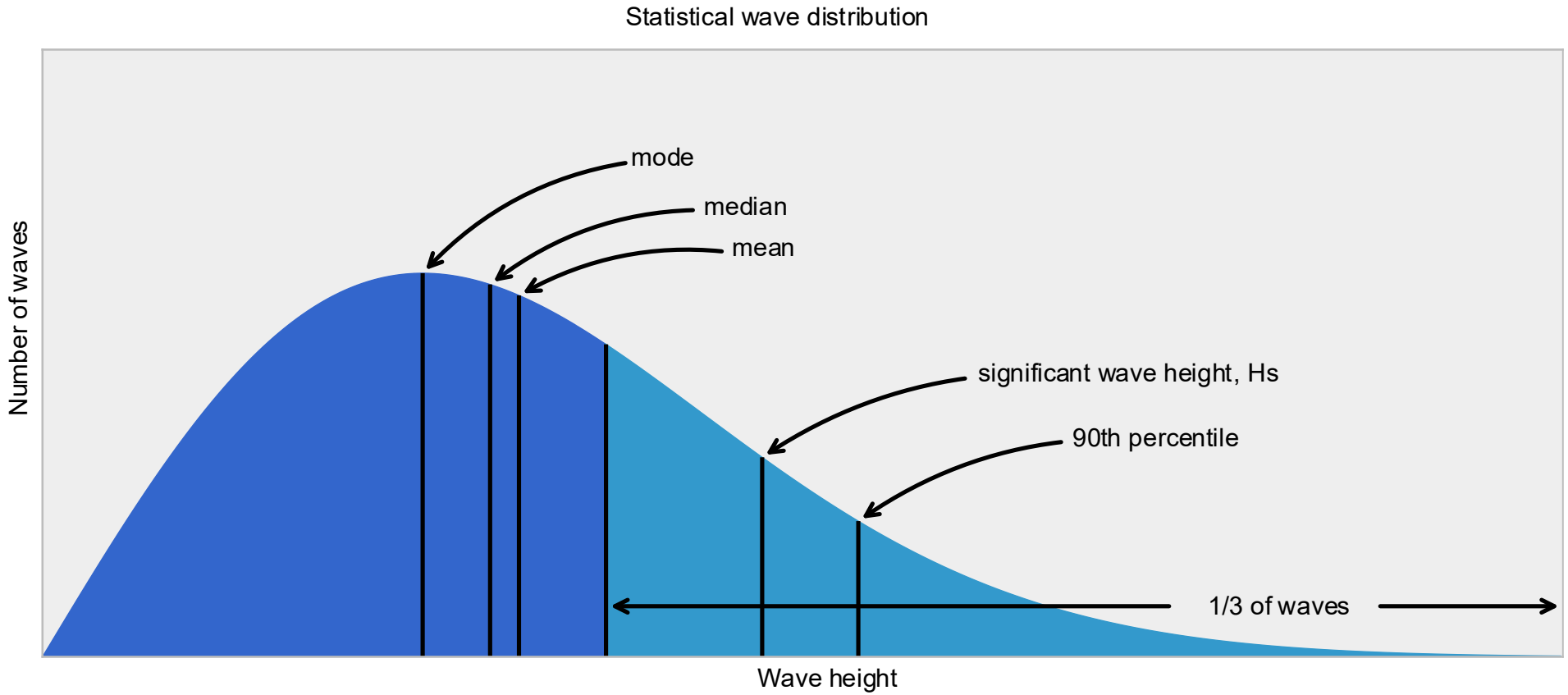
https://www.ndbc.noaa.gov/station_page.php?station=44032

A note on **significant wave height**

"average of the *highest one-third* of the respective wave type"



By NOAA - NOAA UCAR COMET Program via Wikipedia

More on wave height distributions

In the book *Oceanography and Seamanship*, William G. Van Dorn provided an example of what the wave heights would be if a steady **30 knot** (33 mph/53 km/h) wind blew for **24 hours** over a fetch of **340 miles**.

- 10% of all waves will be less than 3.6 ft. (1 m).
- The most frequent wave height will be 8½ ft. (2½ m).
- The average wave height will be 11 ft. (3 m).
- The **significant wave height** will be 17 ft. (5 m).
- 10% of all waves will be higher than 18 ft. (5 m).
- The average wave height of the highest 10% of all waves will be 22 ft. (7 m).
- A 5% chance of encountering a single wave higher than 35 ft. (11 m) among every 200 waves that pass in about 30 minutes.
- A 5% chance of encountering a single wave higher than 40 ft. (12 m) among every 2,600 waves that pass in about five hours.

https://www.noaa.gov/jetstream/ocean/waves

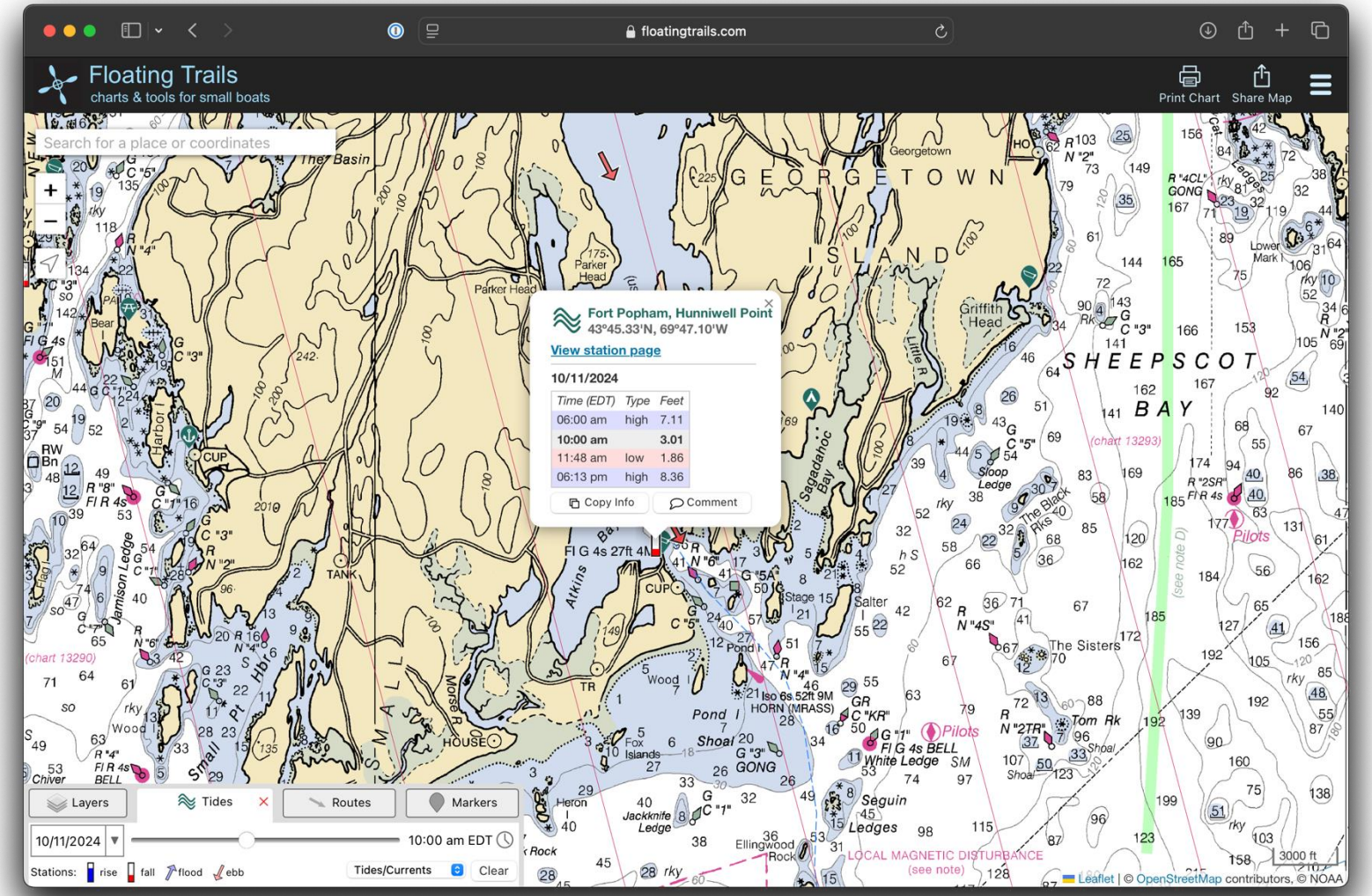
More on wave height distributions

In the book *Oceanography and* [illegible] Dorn provided an example of what the wave heights would b[illegible]h/53 km/h) wind blew for **24 hours** over a fetch of **340 miles**

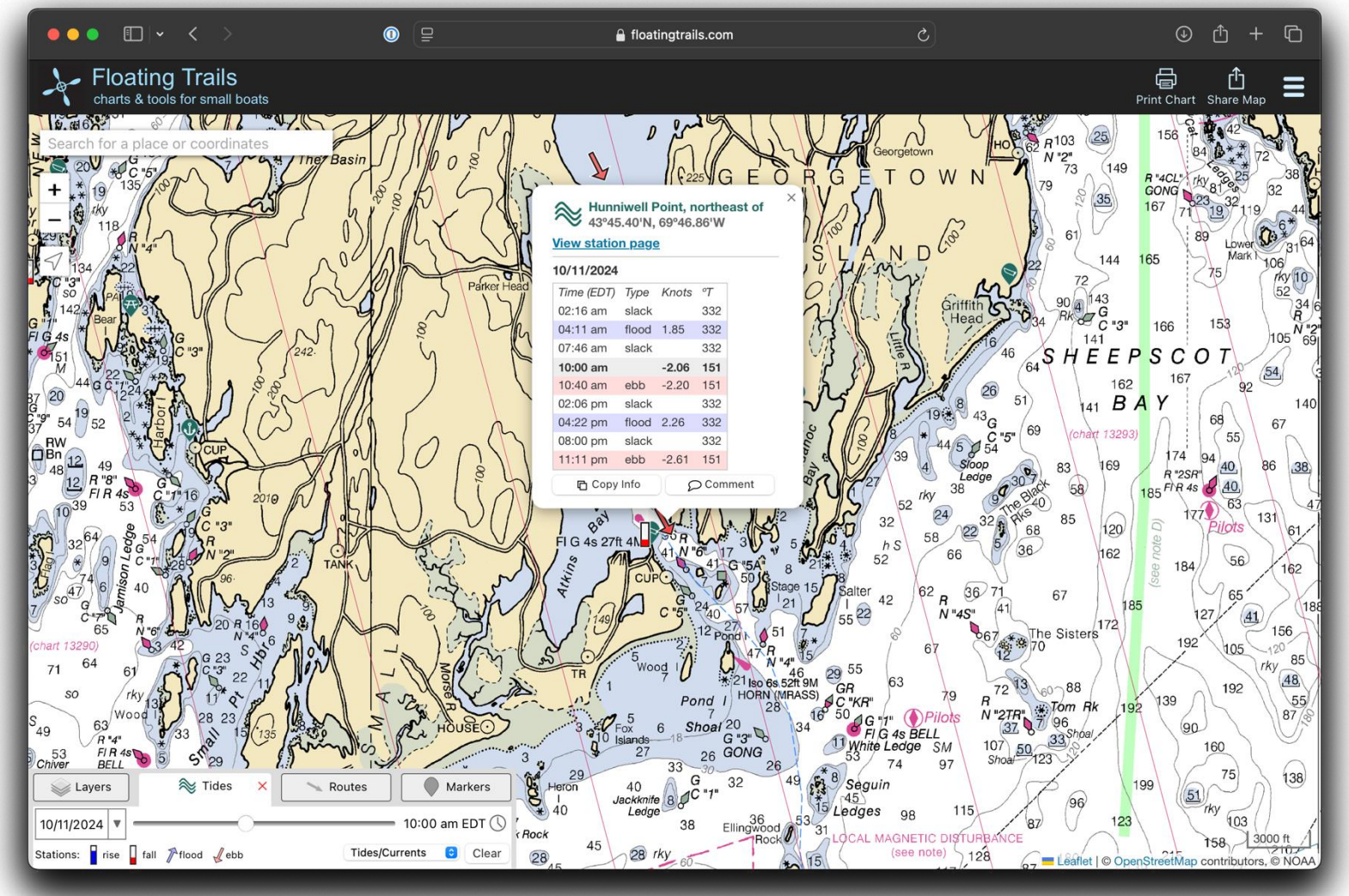
- 10% of all waves will be less
- The most frequent wave heig
- The average wave height wil
- The **significant wave height**
- 10% of all waves will be high
- The average wave height of t[illegible] will be 22 ft. (7 m).
- A 5% chance of encountering[illegible]5 ft. (11 m) among every 200 waves that pass in about 30
- A 5% chance of encountering[illegible]0 ft. (12 m) among every 2,600 waves that pass in about five

https://www.noaa.gov/jetstream/ocean/waves

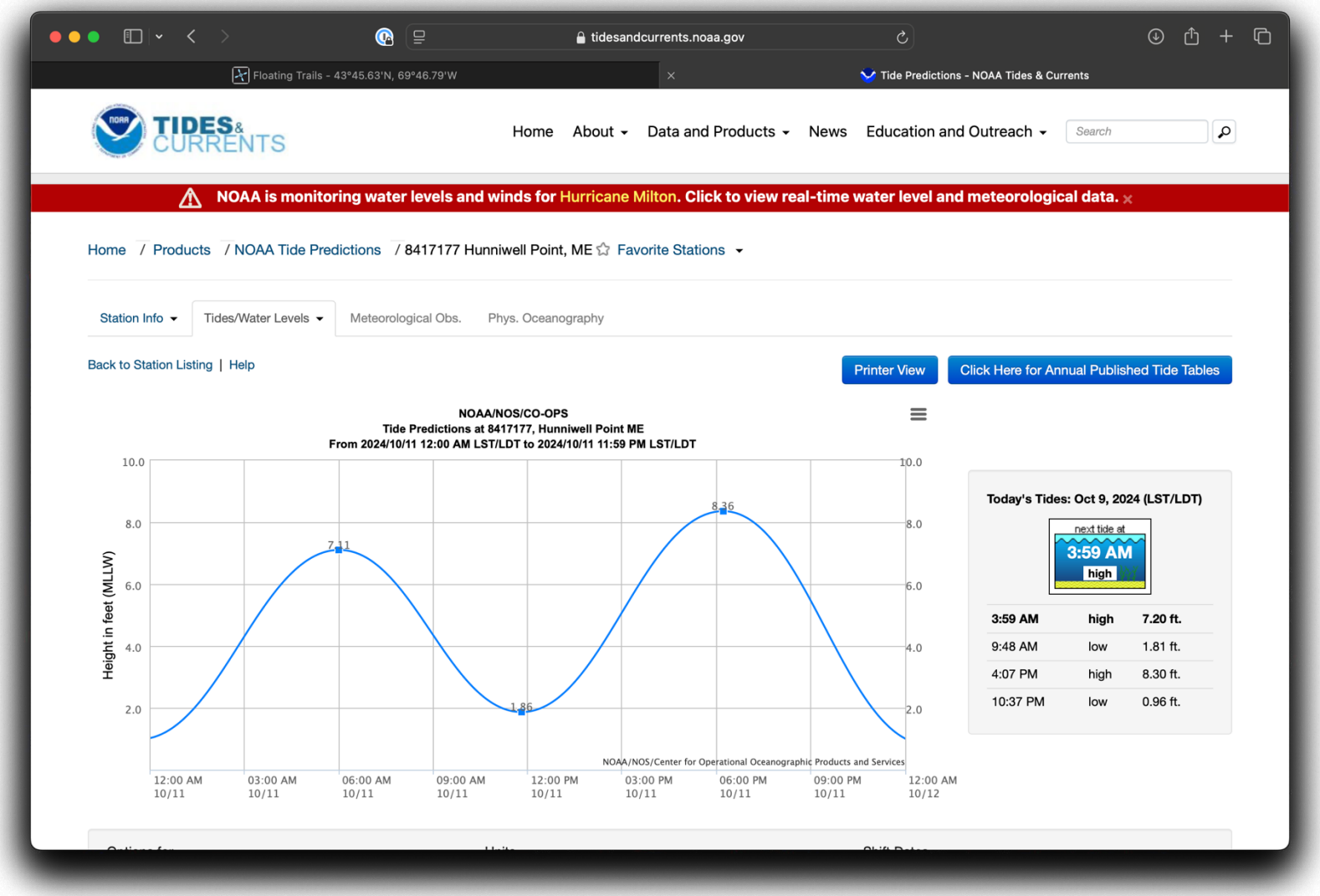
Tide and tidal current



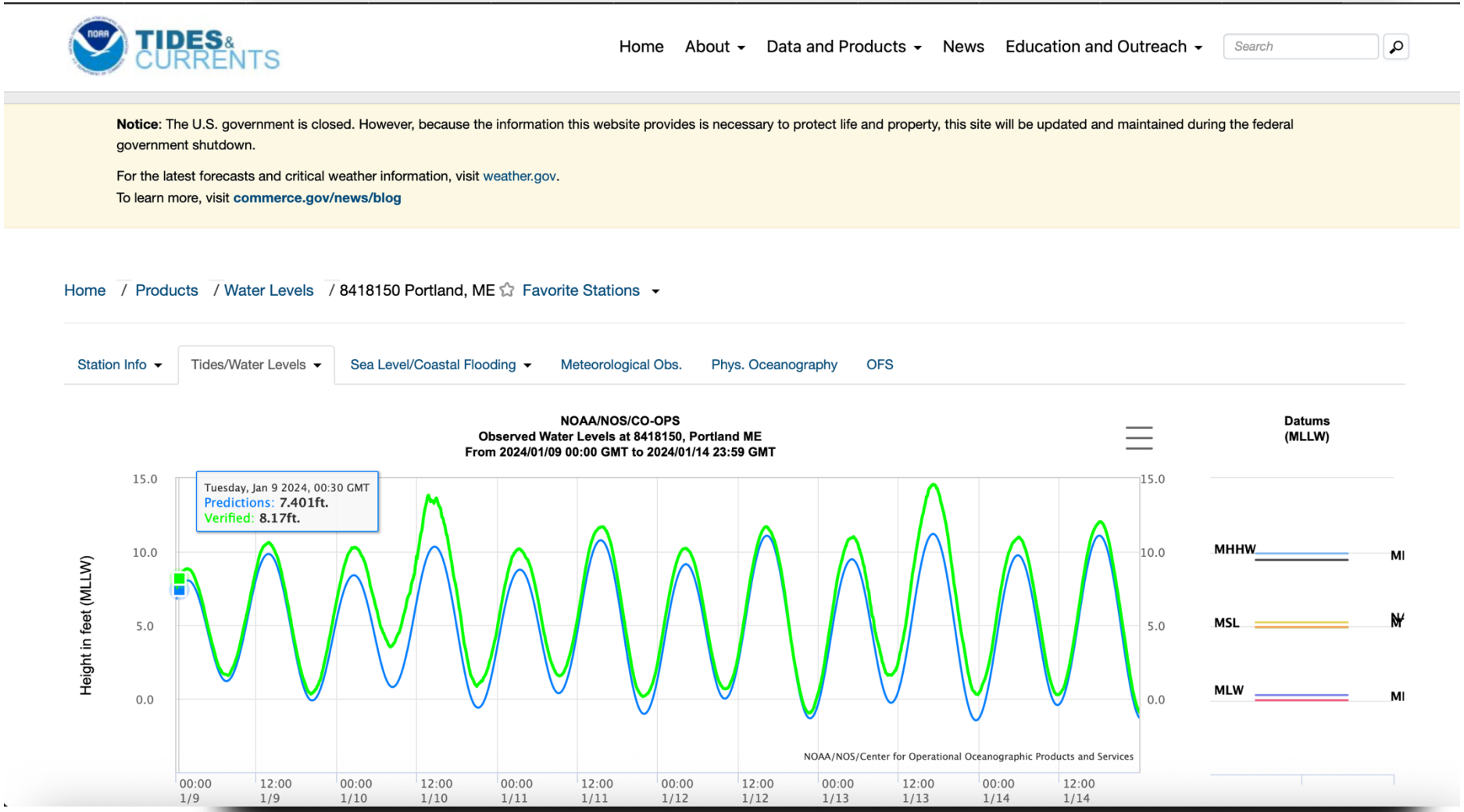
Tide and tidal current



Tide and tidal current



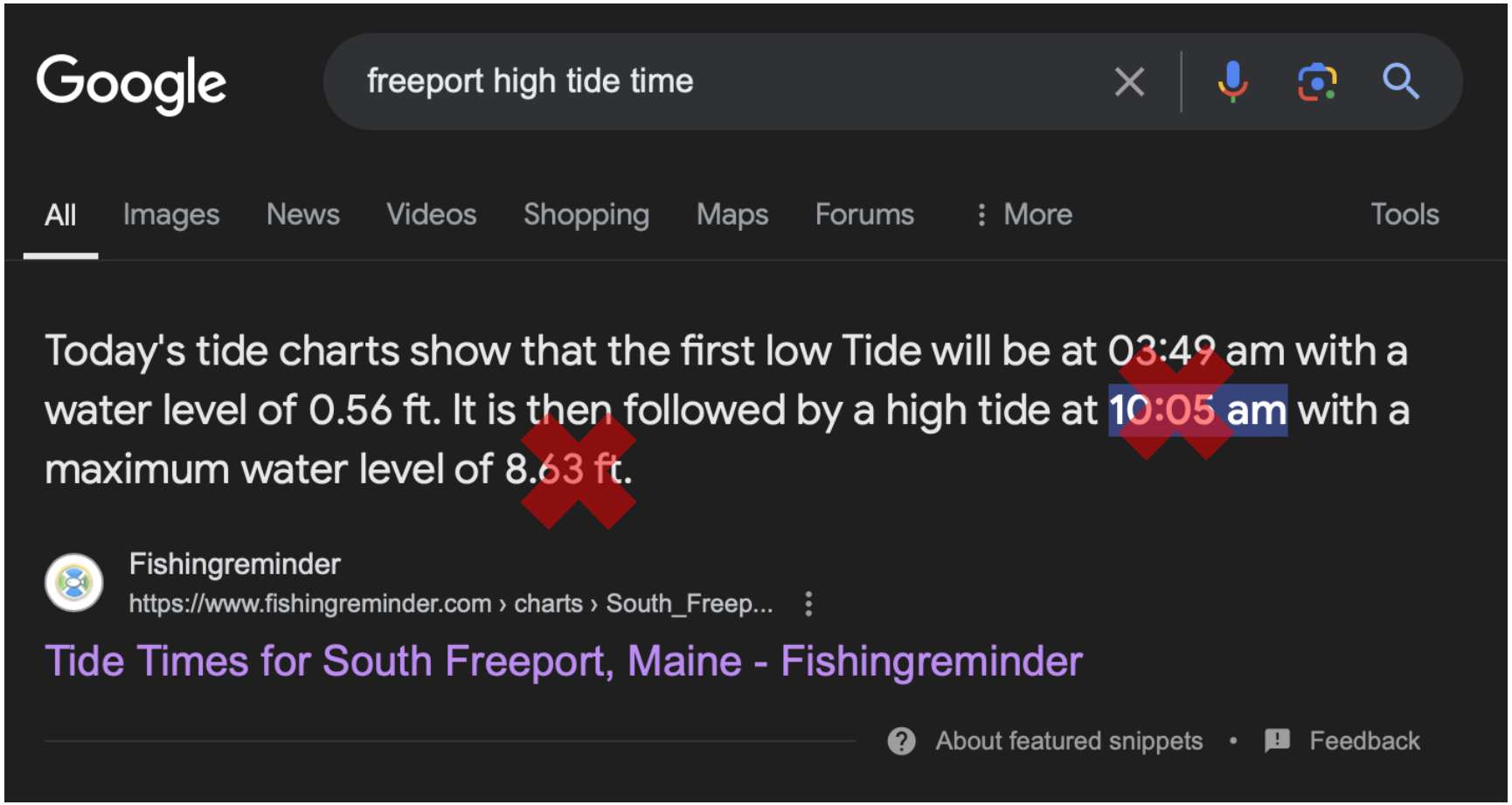
Tide and tidal current



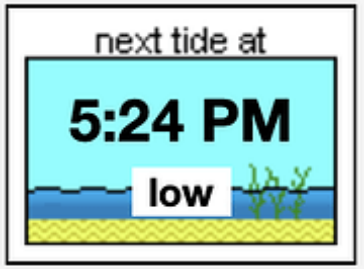
Agenda

- Motivation
- Why listen to me?
- Weather impact on kayaking
- Forecasts
- Apps
- Models
- Surf & Current Models
- Observations
- **Final notes**

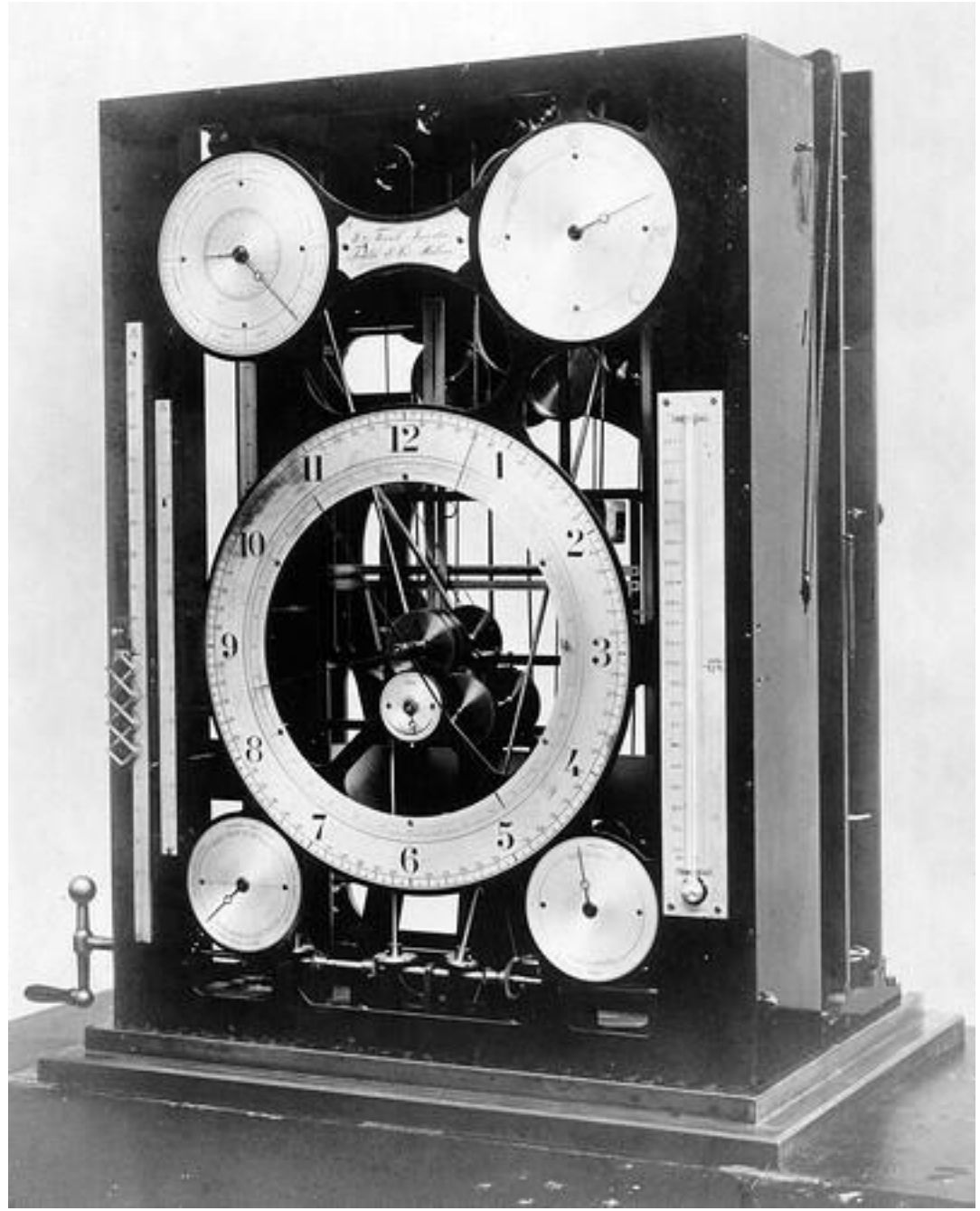
A final note on tides and AI



Today's Tides: Oct 1, 2024 (LST/LDT)



5:09 AM	low	0.50 ft.
11:21 AM	high	9.15 ft.
5:24 PM	**low**	**0.64 ft.**
11:37 PM	high	9.36 ft.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Weather Forecasting Tools for Sea Kayakers

Eric Sofen