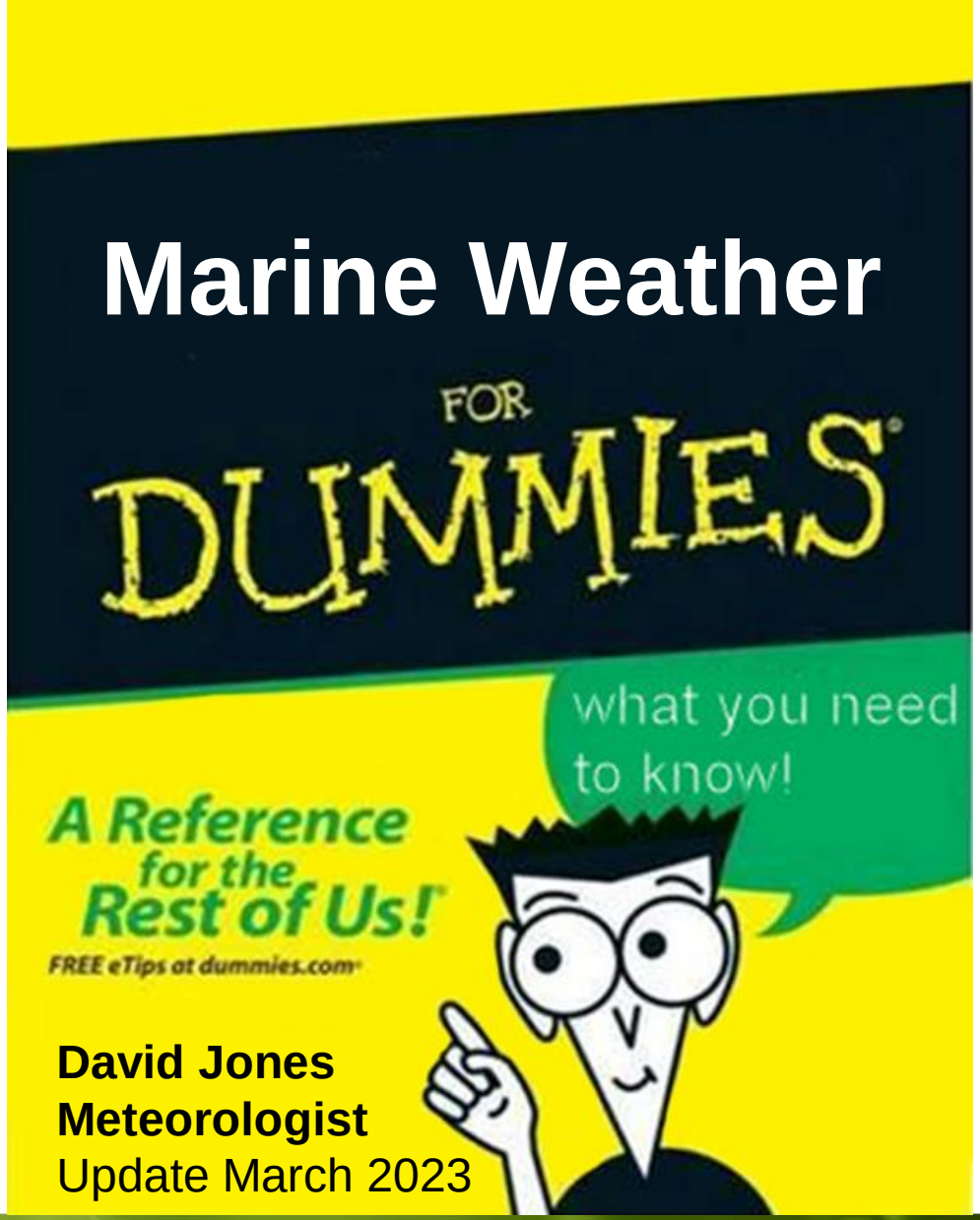
Marine Weather



David Jones
Meteorologist
Update March 2023

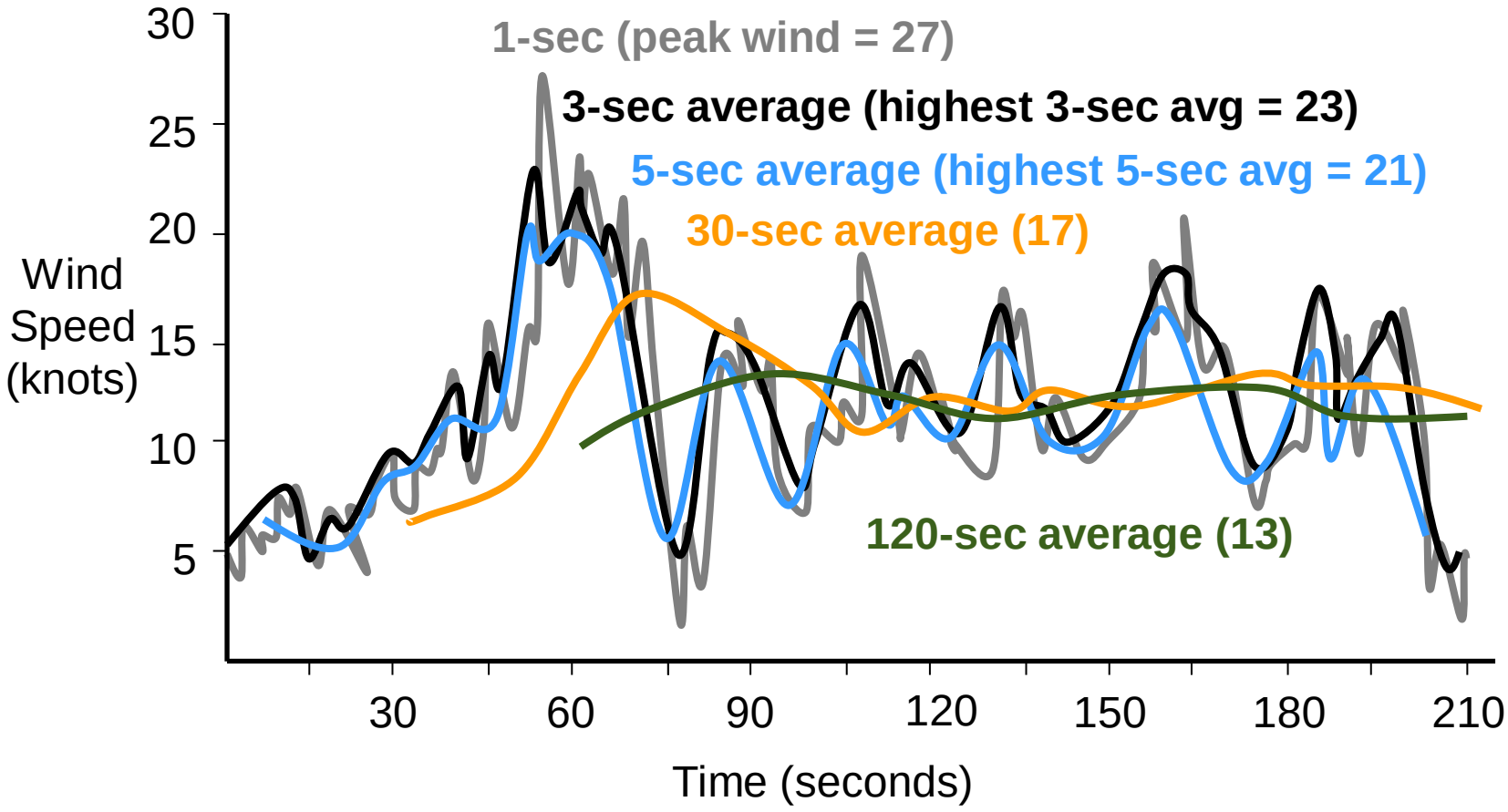
Why you should care

- You don’t know what you don’t know
- Decision-making at sea depends on *what you know*

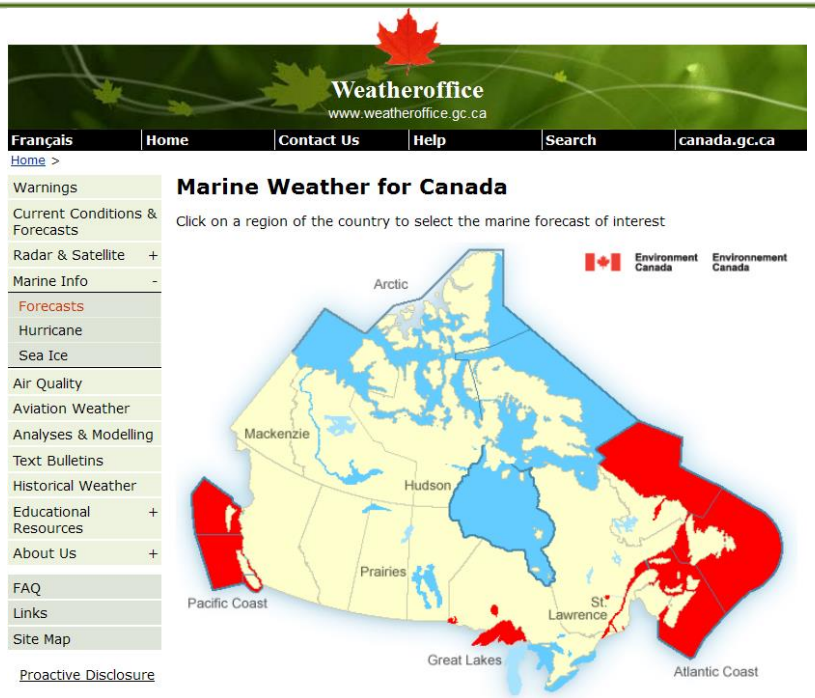
Where we're going

- Which wind are you talking about?
- The 'gust factor'
- Wind measurement systems
- Wave peaks & periods *you need to know about*
- Essential *just-so-you-know's*

Wind Speed Measurement trace

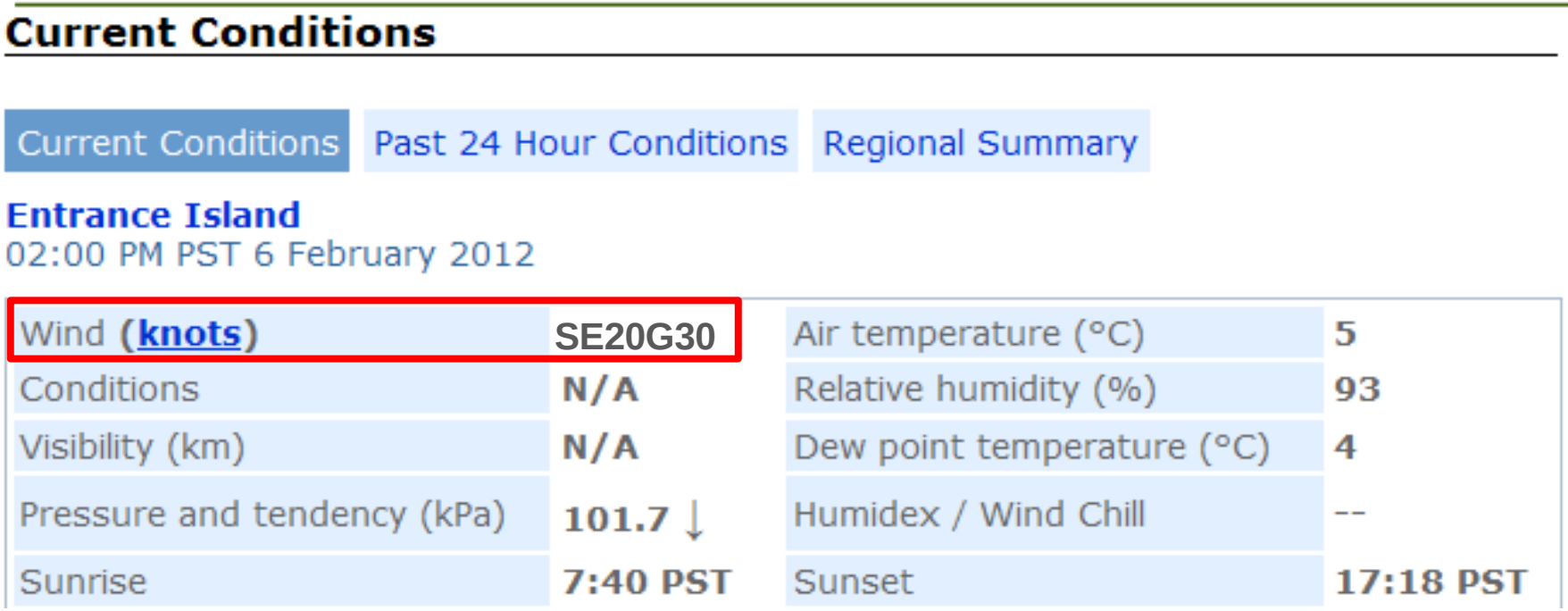


A Wind Forecast



- *"Wind northwest 15 to 20 knots diminishing to light late this afternoon then increasing to southeast 10 to 15 late this evening."*
- The forecast is for the *'sustained'* wind

A Marine Wind Observation



Current Conditions

Current Conditions | Past 24 Hour Conditions | Regional Summary

Entrance Island
02:00 PM PST 6 February 2012

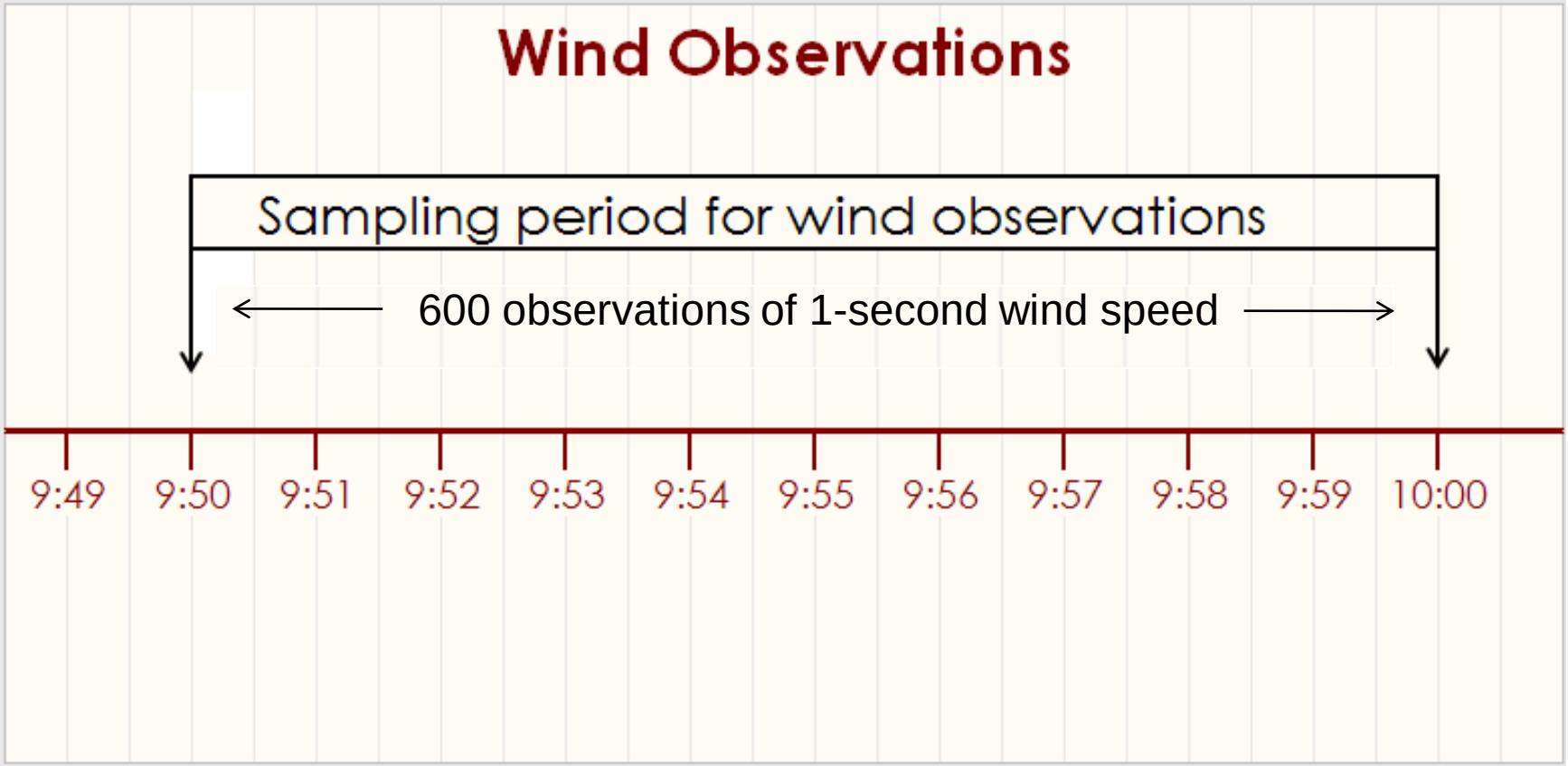
Wind (knots)	SE20G30	Air temperature (°C)	5
Conditions	N/A	Relative humidity (%)	93
Visibility (km)	N/A	Dew point temperature (°C)	4
Pressure and tendency (kPa)	101.7 ↓	Humidex / Wind Chill	--
Sunrise	7:40 PST	Sunset	17:18 PST

- *"southeast **20** gusting **30** knots"*

- ***20*** is the sustained wind, ***30*** is the gust

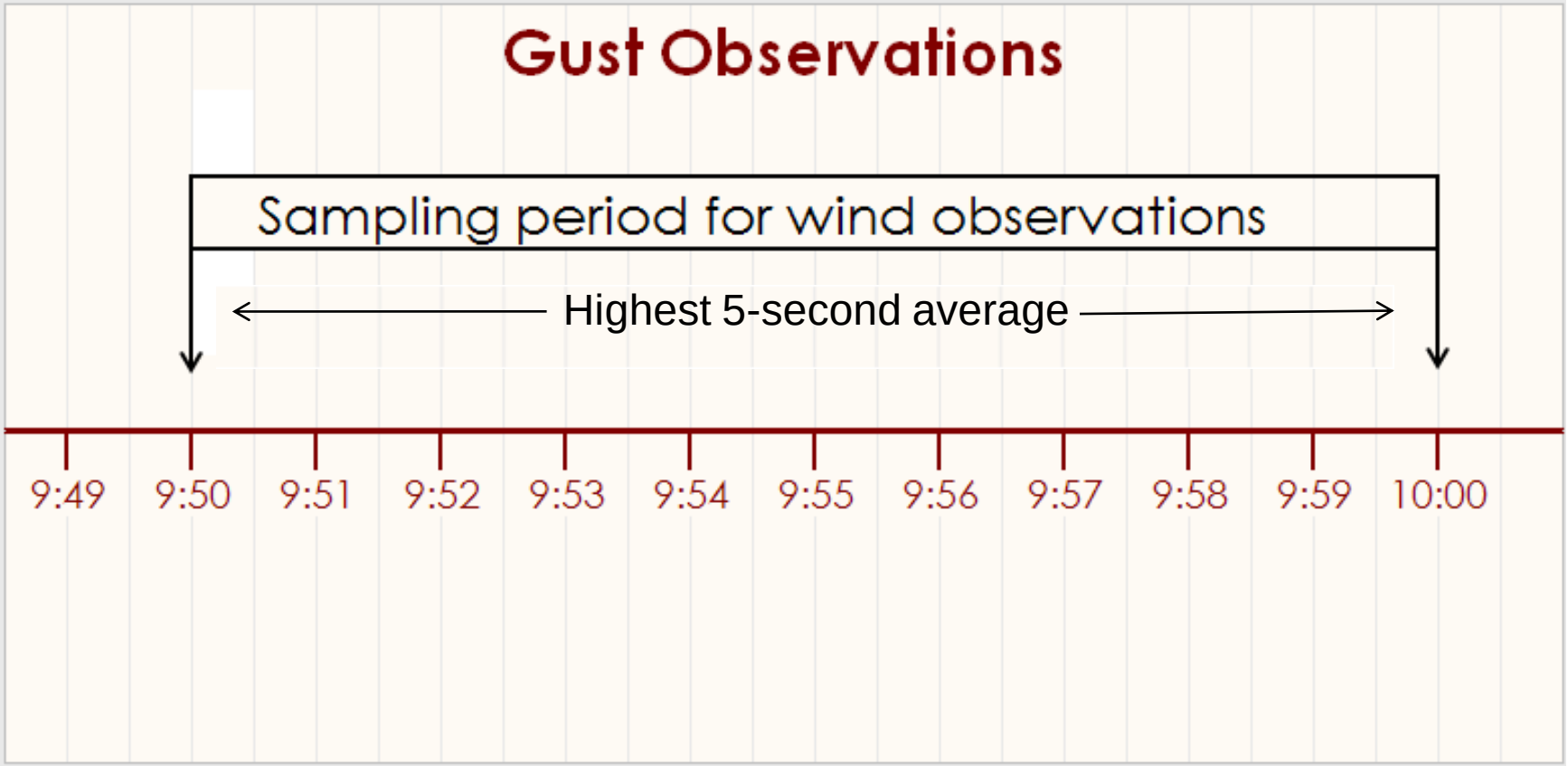
WMO ‘sustained wind’ definition

- The sustained wind is a 10-minute average, observed in the 10 minutes prior to transmission time.



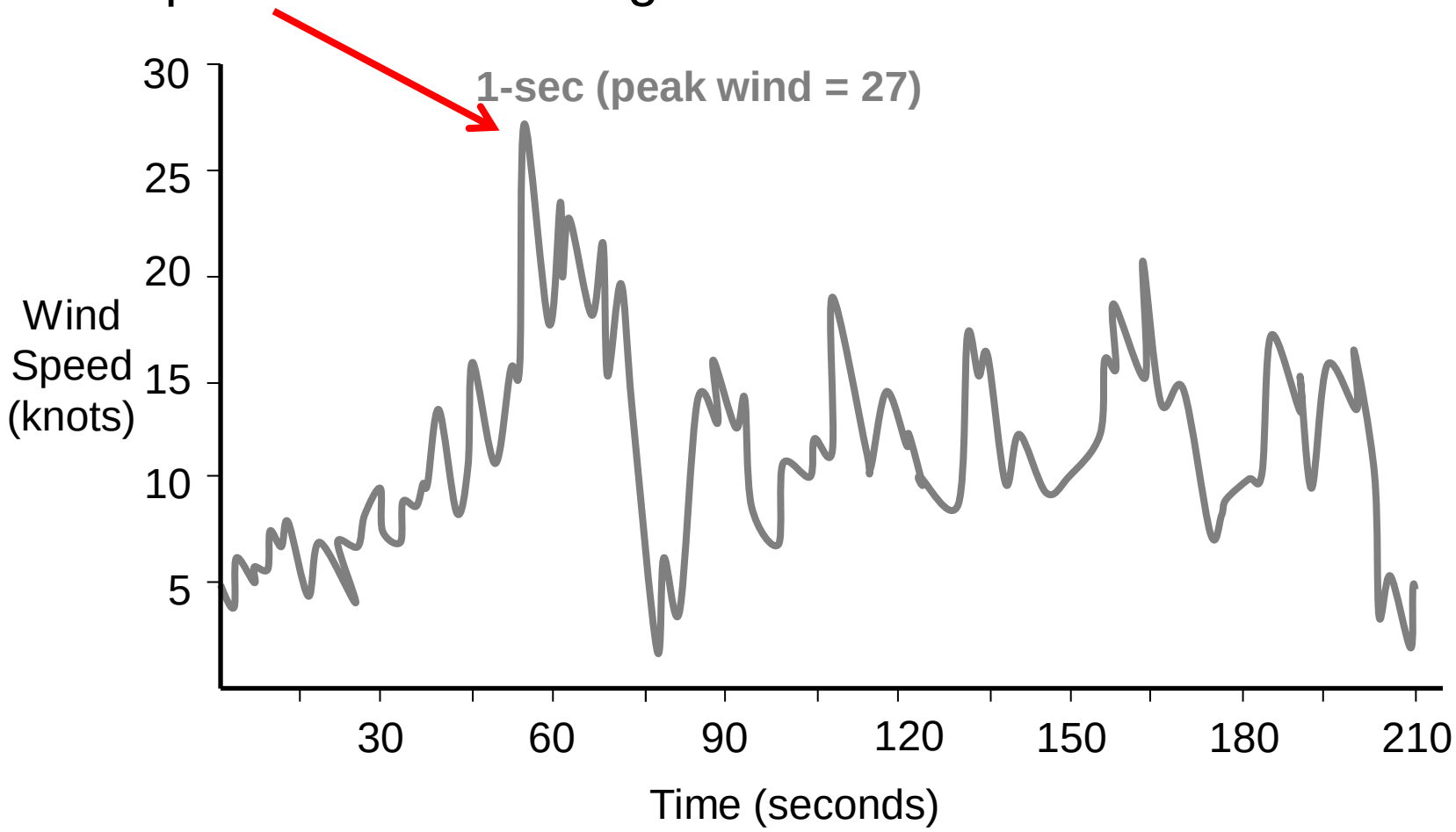
WMO ‘gust’ definition

- The gust is the highest 5-second average, observed in the 10 minutes prior to each hour.



The Peak Wind

- The peak wind is the highest **1-second** observation



Gust Factor

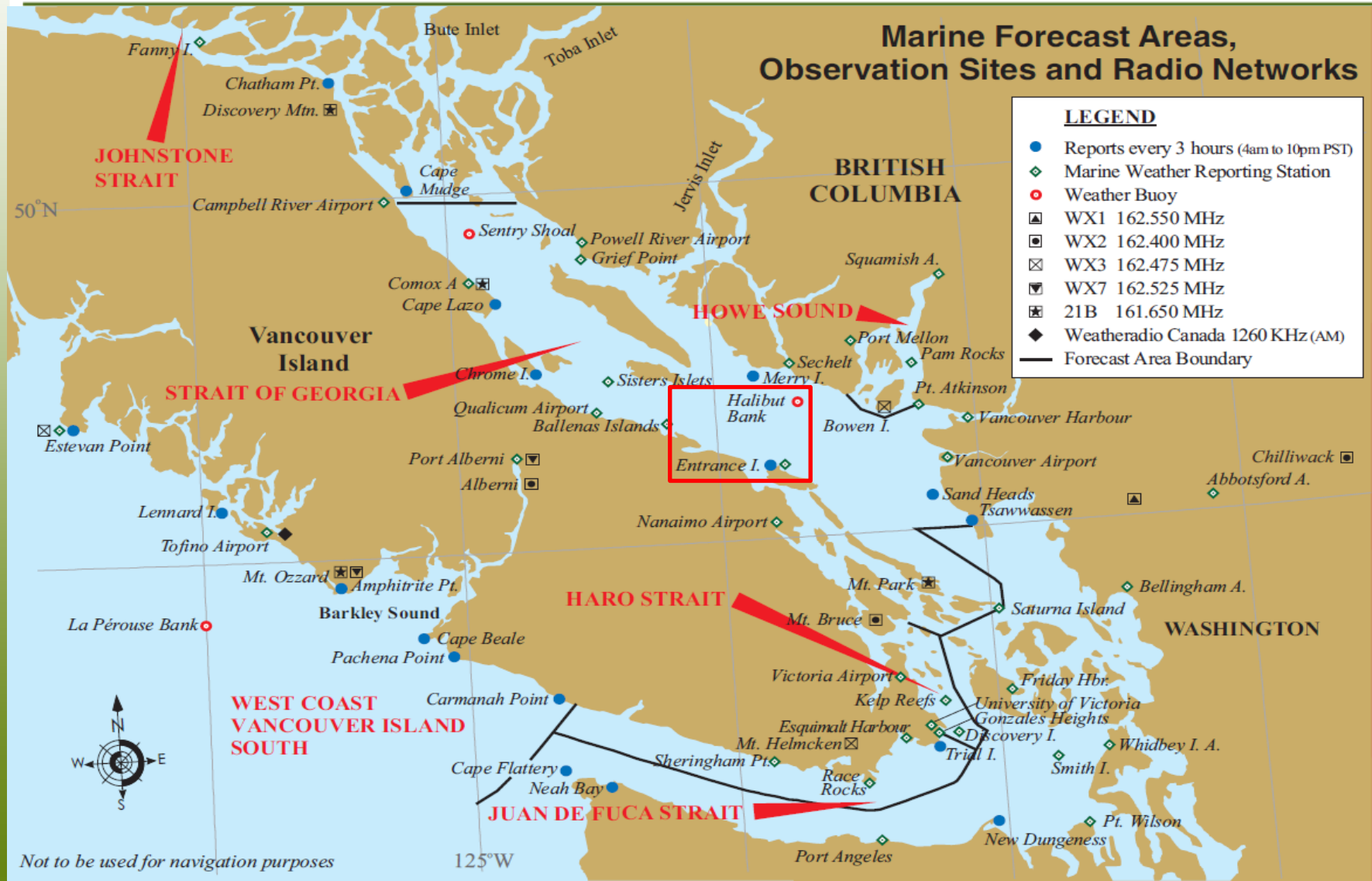
- The ratio of the gust to the sustained wind:

$$\frac{\text{gust}}{\text{sustained wind}}$$

- for a wind SE 20 Gusting 30 knots the gust factor is:

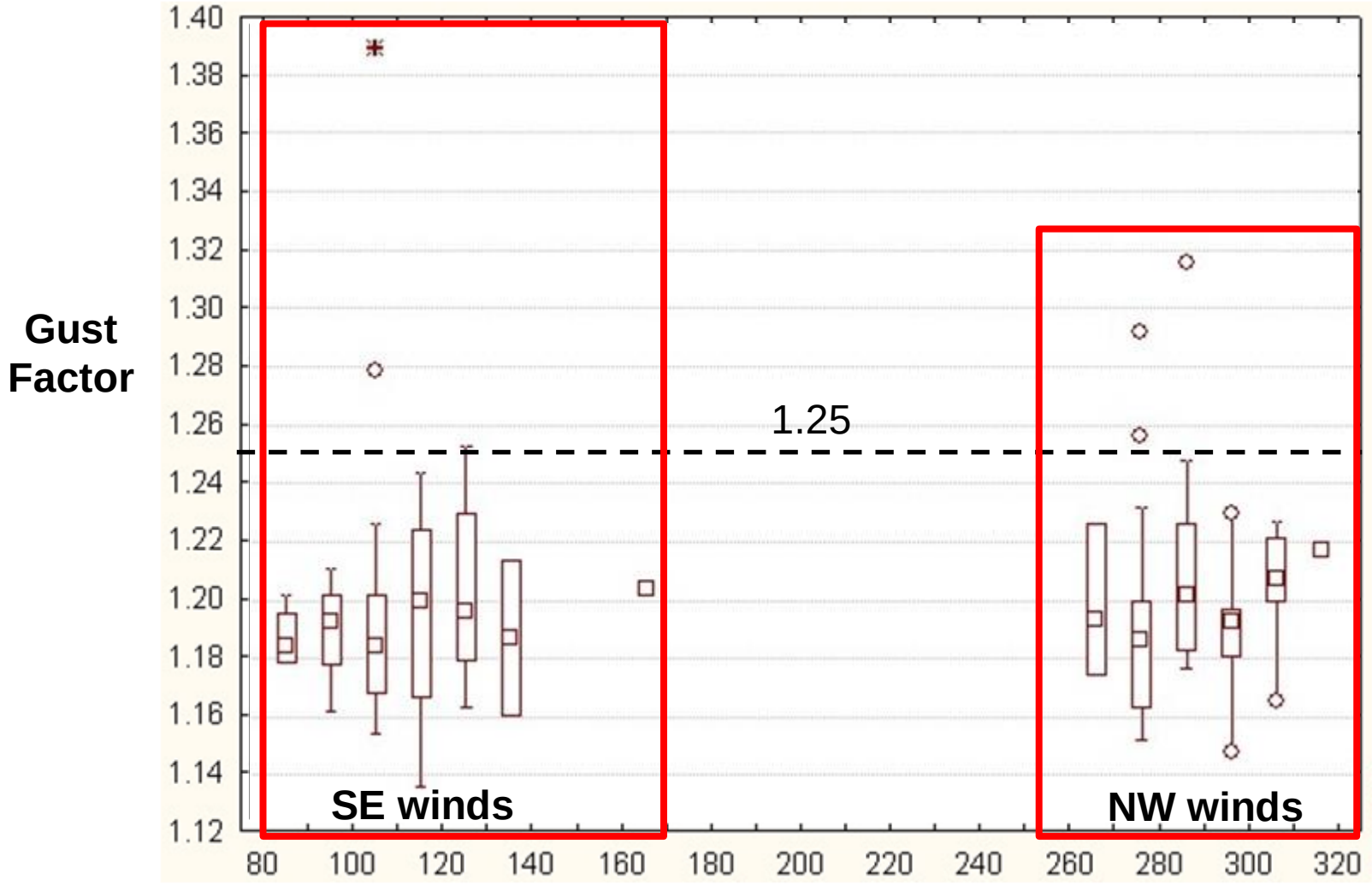
$$\frac{30}{20} = 1.5$$

Entrance Island & Halibut Bank



Summer sustained winds 20-25 knots

Entrance Island & Halibut Bank (June, July & August)

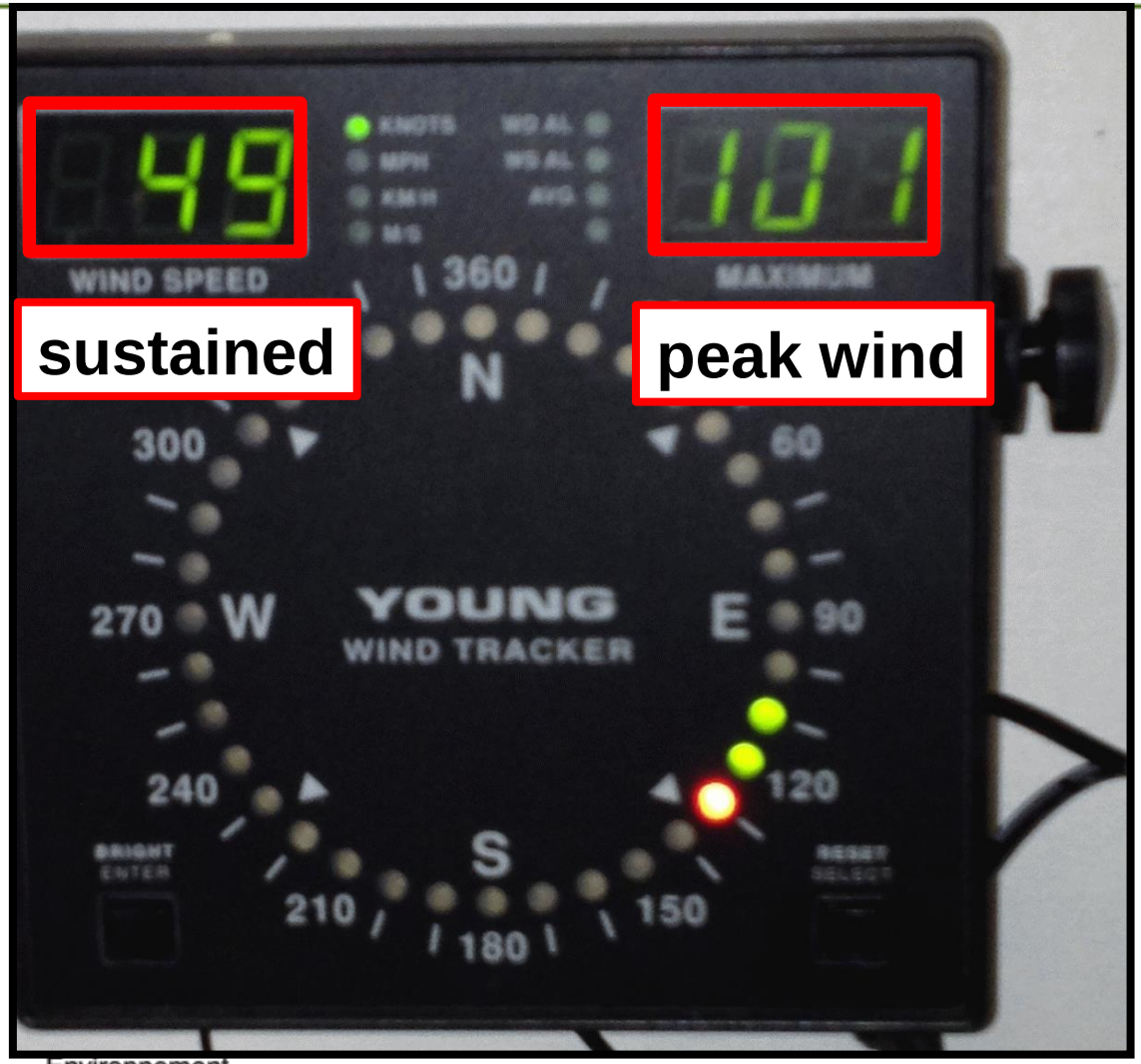


For Entrance Island & Halibut Bank:

- A small proportion of the observations have a gust factor approaching 1.25
- So, add 25% to the wind forecast to get the maximum gust
- e.g. With a strong wind warning forecast of sustained winds to 30 knots, *expect occasional gusts to 38 knots*

Merry Island Lighthouse

March 12, 2012 storm



Environment Canada Environnement Canada

Canada

Gusts vs Peak Wind (km/h)

March 12, 2012 storm

What the forecaster sees…

- **Sisters Island Automatic**
- WGT 0600 **1334**/M/M **PK WND 1444** 0524Z
- WGT 1400 **1250+62/M/M PK WND 1164** 1326Z

This is all that appears on Weatheroffice.gc.ca

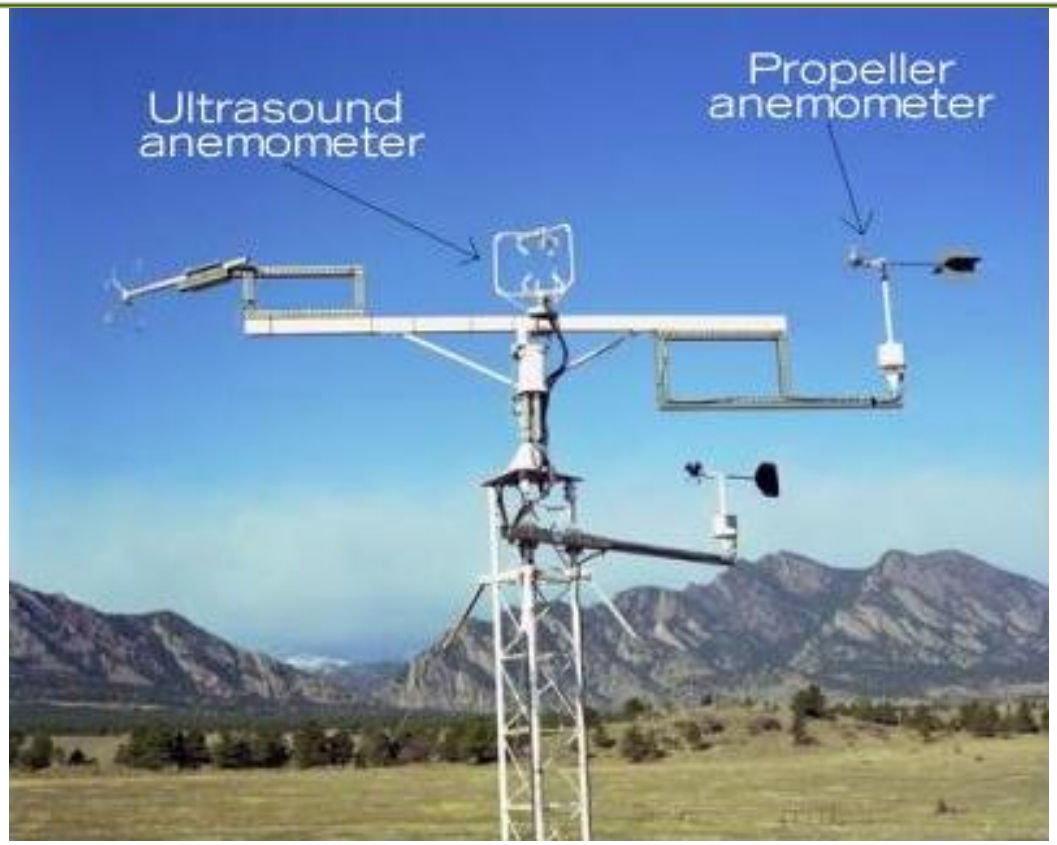
- **Merry Island Lighthouse**
- MERRY; 1400 OVC 8R- **SE50G60** 10FT RUFF 1440 20 OVC
- MERRY; 1700 OVC 8R- **SE48** 9FT RUF **GUSTS TO 101KTS**

Force on a Sail

- Force = ½ ρ x S x C x V^2
- Doubling the wind speed ***quadruples*** the force on a sail

Observation Systems

Automatic Weather Stations



- Anemometer height: 10 metres *above ground*
- (Observations transmitted at: H+ ~ 1minute…or more!)

Lightkeeper Marine Weather Reports

- 27 lightstations report every 3 hours during daytime
- Some lightkeepers *estimate* the wind

Moored Buoys

3-metre Discus

- Anemometers @ ~ 4 or 5 metres *above the water*
- Significant wave height, maximum wave and wave period

Buoy Data Transmission times

Identifier	Buoy Name	Window
46005	West of Aberdeen	:00 (USA)
46207	East Dellwood	:20
46147	South Moresby	:26
46183	North Hecate	:27
46145	Central Dixon	:27
46204	West Sea Otter	:29
46185	South Hecate	:30
46208	West Moresby	:33
46205	West Dixon	:34
46132	South Brooks	:34
46181	Douglas Channel	:35
46004	Middle Nomad	:36
46036	South Nomad	:39

Ships

Wind speed increase with height off the water

Environment Canada Environnement Canada

Canada

Wind realities…

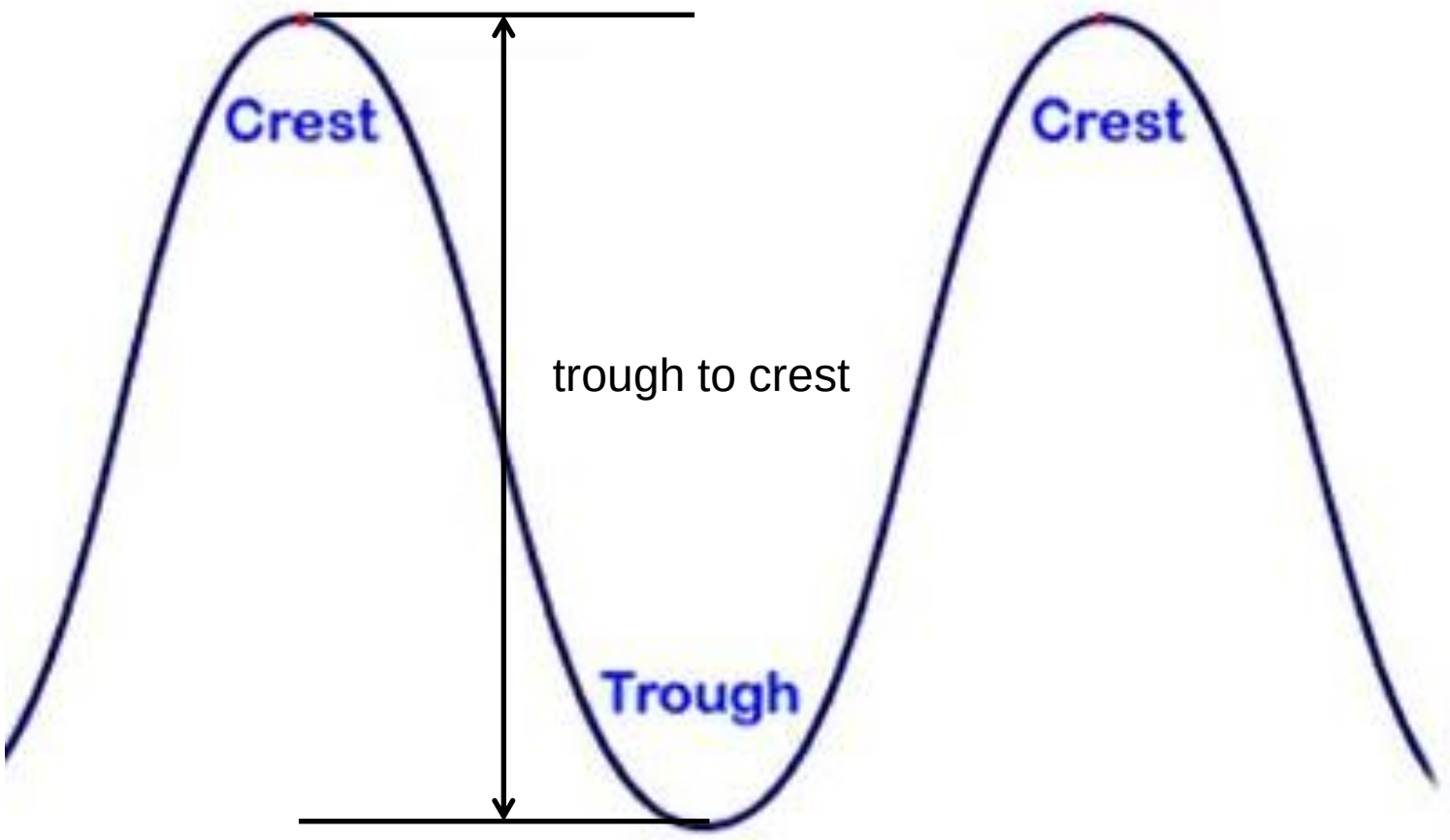
- Wind is measured at different heights, over different surfaces (land, water) at different times, averaged over different periods, using different instruments on different platforms.

- The bottom-line: meteorologists ‘forecast’ to the observations available to them.

- Some stations are favored over others because of exposure to ‘worst case’ conditions…we think!

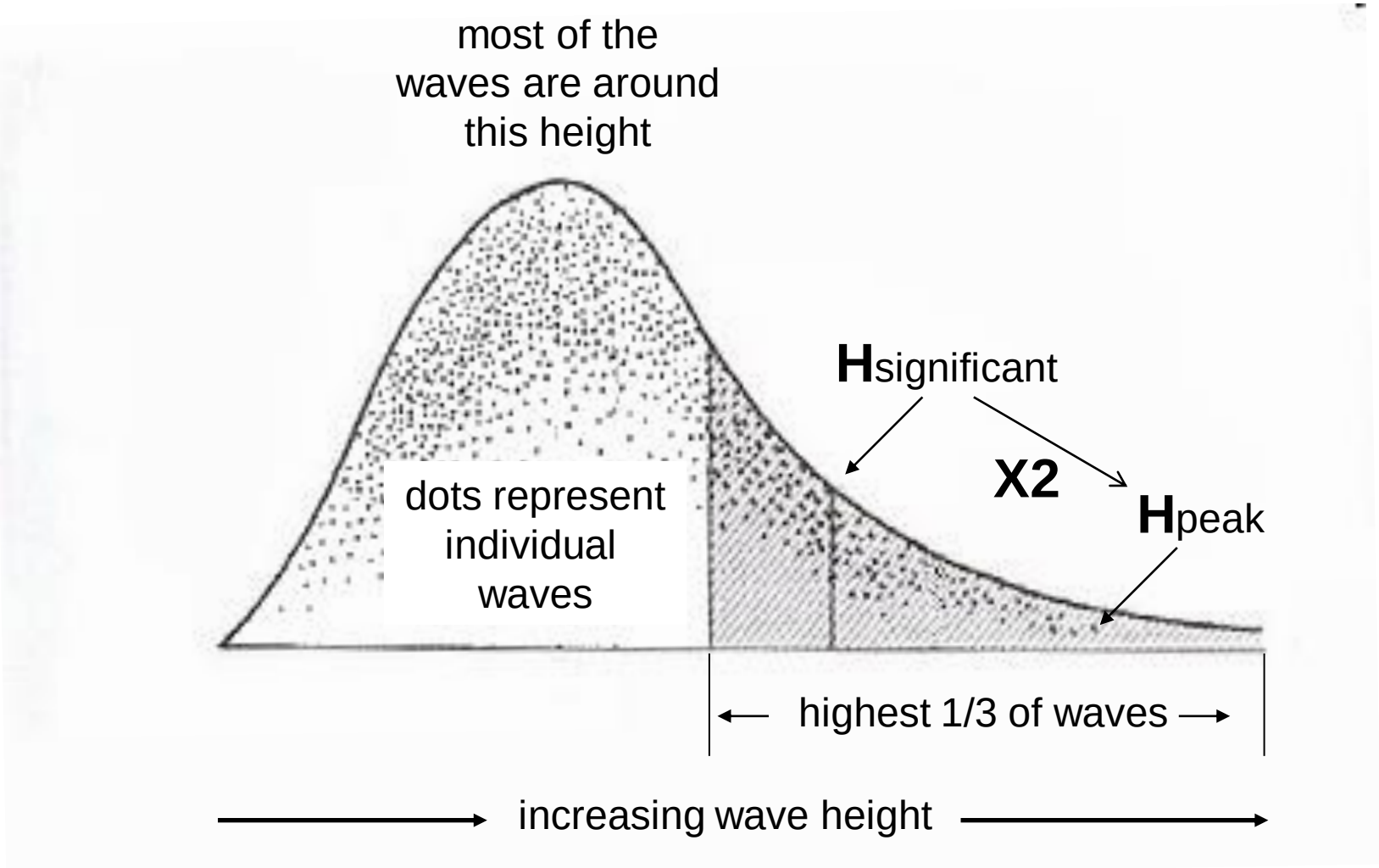
Waves

Wave Height

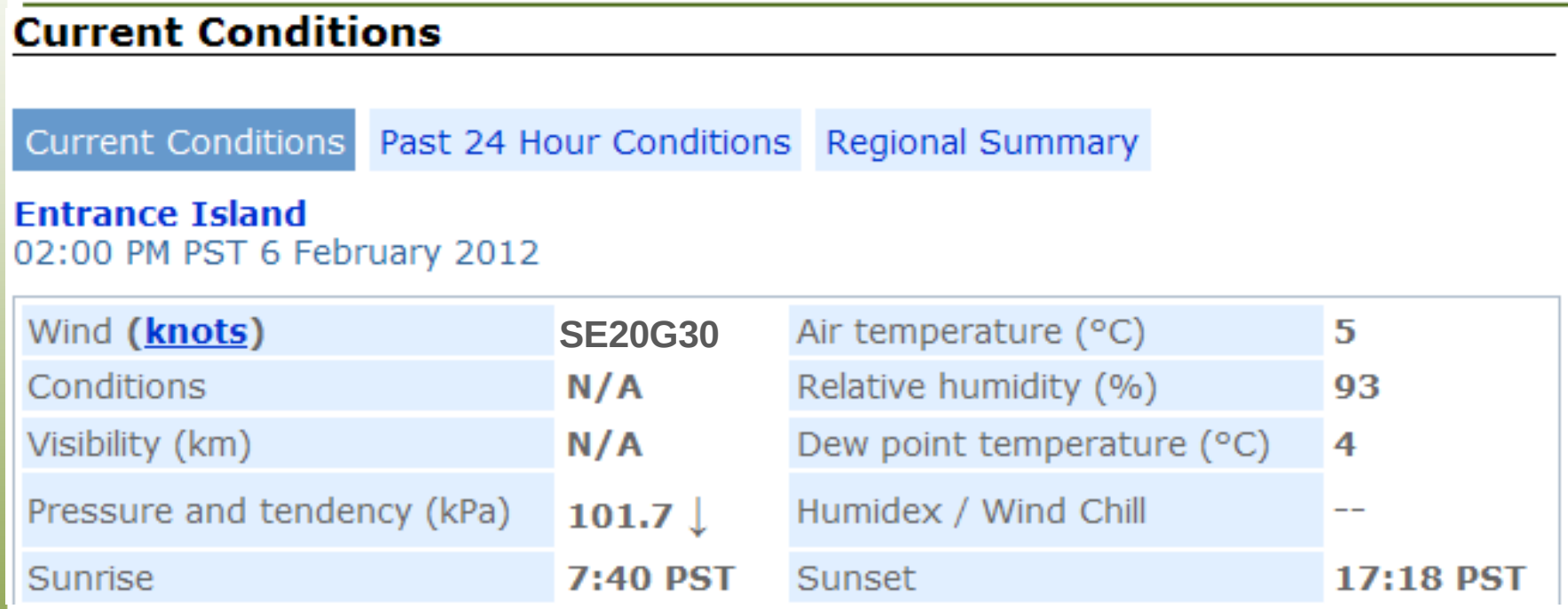


Wave Terms – H_{sig}, H_{peak}

For any large group of waves…



A Wave Forecast



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Sunrise	7:40 PST	Sunset	17:18 PST

- *"Seas 2 to 3 metres building to 3 to 4 Tuesday morning."*

- **The peak wave expected is 6 to 8 metres**

But…consider the tidal interactions

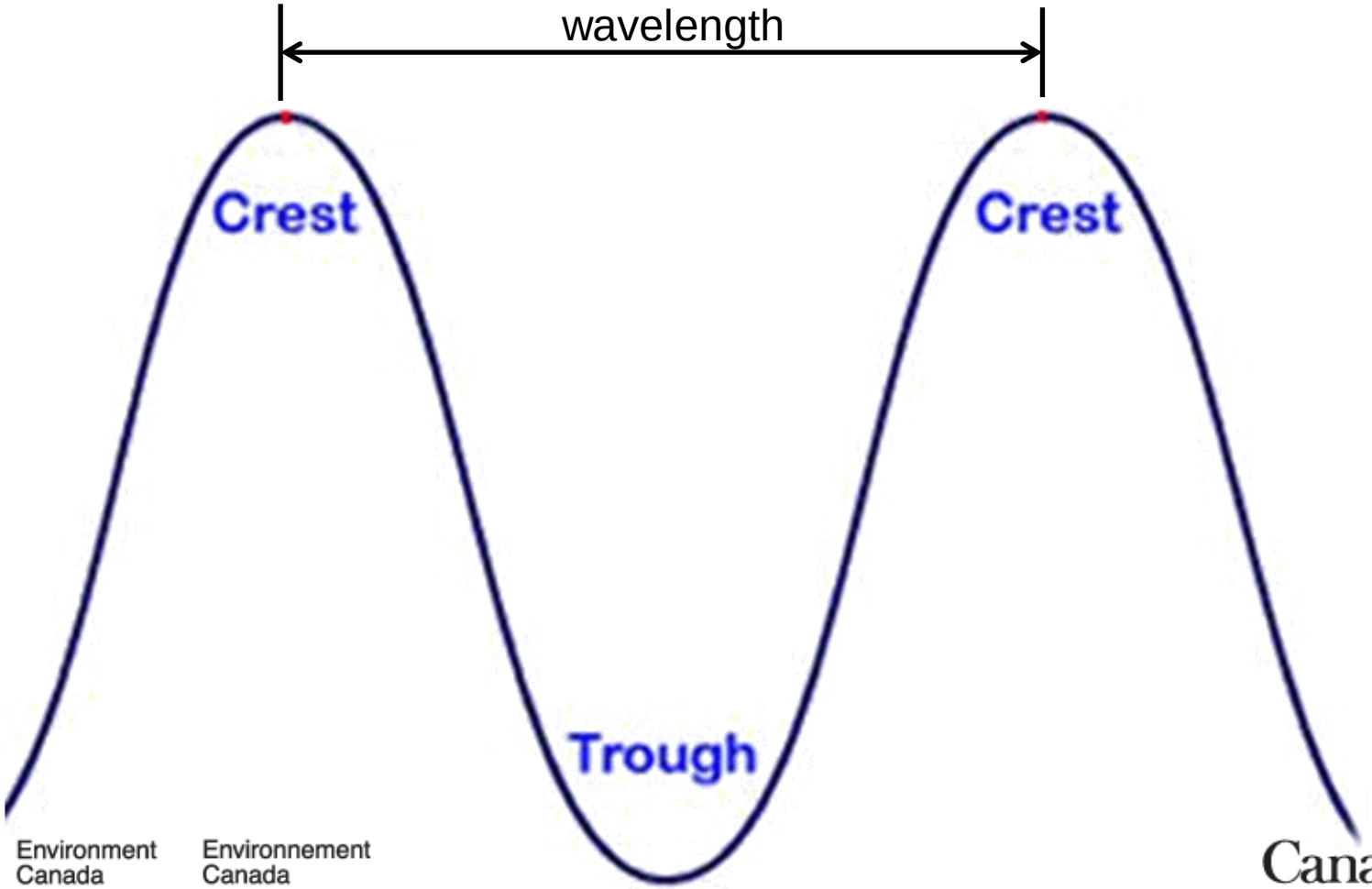
Peak Wave Frequency

How often to expect the Peak Wave?

- *Given* ***Hsig = 5m***
- 1 wave in 10 may be ~ 5m
- ***1 wave in 1000 may be ~ 10m***

Wave Period

- the time it takes for a wave to travel one wavelength



Significant Wave Period

- If the Significant Wave Period = 6 seconds,

  then on the water:

  - 10 waves pass every minute 

  - 600 waves pass every hour (1200 in 2 hours)

- If a Peak Wave occurs every 1000 waves, then about every two hours you may encounter one…

US Marine Forecast

OFFSHORE FORECAST

FZPN25 KWBC 231638

OFFPZ5

OFFSHORE WATERS FORECAST
NWS OCEAN PREDICTION CENTER WASHINGTON DC
930 AM PDT WED MAR 23 2011

WASHINGTON AND OREGON WATERS FROM 60 NM TO 250 NM OFFSHORE.

SEAS GIVEN AS SIGNIFICANT WAVE HEIGHT...WHICH IS THE AVERAGE HEIGHT OF THE HIGHEST 1/3 OF THE WAVES. INDIVIDUAL WAVES MAY BE MORE THAN TWICE THE SIGNIFICANT WAVE HEIGHT.

Just so you know… *rules for buoys*

Calibrating the buoy observations

	Sustained Wind	inner waters Gust	offshore waters Gust
Strong	20	17	--
Gale	34	33	29
Storm	48	47	41
Hurricane	64	59	53

No-forecast Zone

Southern Gulf Islands

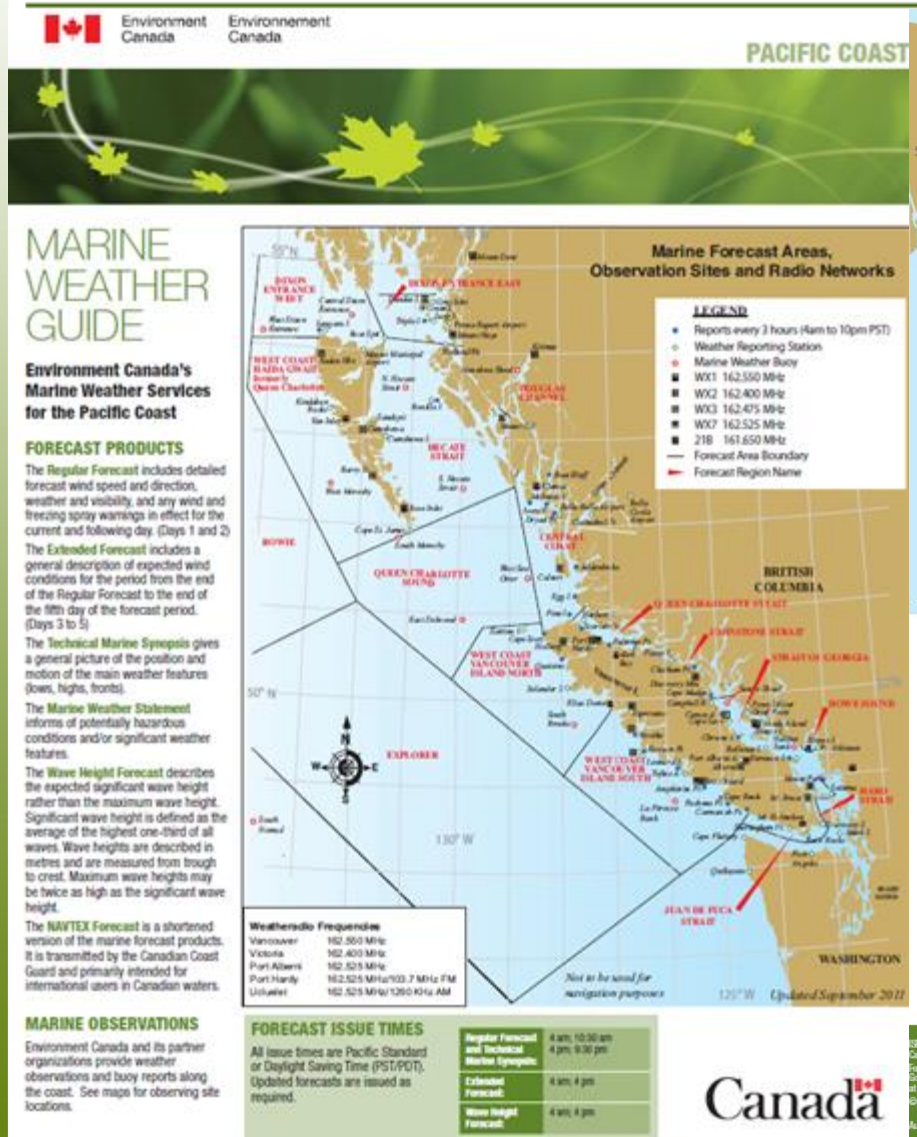
Marine forecast time references

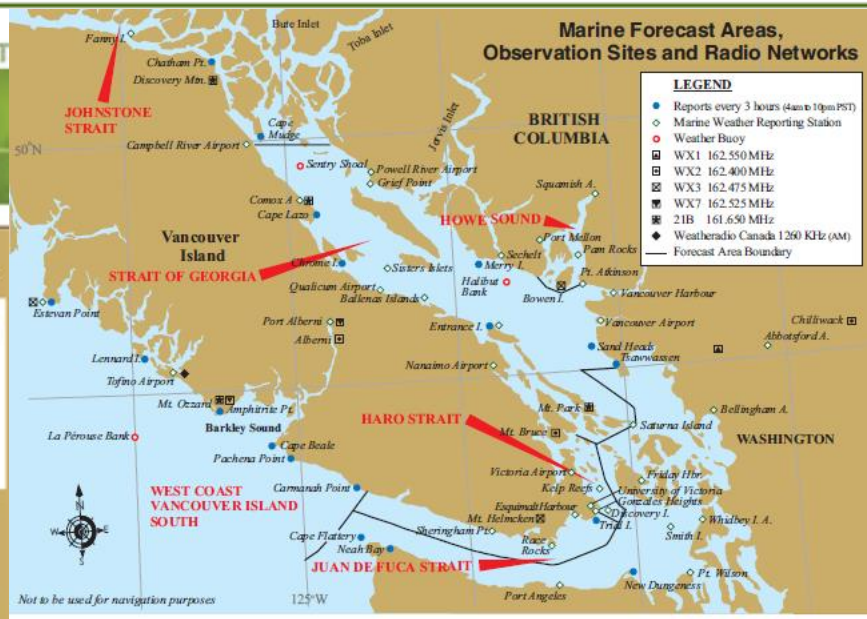
Morning	6 am - noon	*Early* morning	6 am - 9 am
		Late morning	9 am - noon
Afternoon	Noon – 6 pm	*Early* afternoon	Noon - 3 pm
		Late afternoon	3 pm - 6 pm
Evening	6 pm – 12 am	*Early* evening	6 pm - 9 pm
		Late evening	9 pm - 12 am
Overnight	12 am – 6 am		

Time references

Near noon	11 am – 1pm
Near midnight	11 pm – 1 am
Late in the day	3 pm – 6 pm

Marine Weather Guide





OBTAINING FORECASTS

Environment Canada's Weather Website:
www.weatheroffice.gc.ca

Forecast Consultation Service (user fees apply): 1-900-565-6565 (direct billing) or 1-888-292-2222 (cellphone access, credit card account billing)

Weatheradio: Environment Canada's public and marine forecasts and warnings broadcast 24 hours a day. For more details, visit **www.ec.gc.ca/weatheradio**.

Canadian Coast Guard's Continuous Marine Broadcast (CMB): Environment Canada's marine weather forecasts and warnings. For information on Radio Aids to Marine Navigation, visit **www.ccg-gcc.gc.ca**.

MARINE WEATHER WARNINGS

Strong Wind Warning	20-33 knots (Issued only for southern inner coastal waters between March 20th and Remembrance Day)
Gale Warning	34-47 knots
Storm Warning	48-63 knots
Hurricane Force Wind Warning	64 knots or greater (Refers to wind speed and does not imply that a hurricane is occurring or expected to occur)
Freezing Spray Warnings	Ice is expected to build up at a rate of 0.7 cm per hour or greater.
Localized Warnings	Issued for any hazardous weather that requires immediate attention. Examples include water spout or squall warnings.

MARINE FORECAST CONTENT

Wind Speed and Direction: The wind speed is the average wind that is expected over the open water, given in units of knots (1 kt = 1.85 km/h). Wind direction refers to the direction from which the wind is blowing (based on true north and not on magnetic bearings). It should also be noted that with the rugged Pacific coastline, considerable local variations from the forecast winds are possible.

Weather and Visibility: A brief description of the weather is included in the forecast when visibility is expected to be reduced to near or below one nautical mile (1.85 km).

Freezing Spray: Is mentioned in the forecast if conditions are likely to result in ice build up on exposed vessel surfaces.

Air Temperature: Is included in the forecast only if temperatures are expected to be at or below 0° Celsius.

www.weatheroffice.gc.ca

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CONTACT US For general inquiries, comments and to report equipment outages, please call: **1-877-789-7733**
e-mail: **weather.info.meteo@ec.gc.ca**
or visit: **www.weatheroffice.gc.ca/mainmenu/contact_us_e.html**

Weather Information by telephone

- Speak with marine forecaster anytime 1 900 565 6565

  from a mobile phone *1 888 292 2222*

- Free recorded marine weather 604 664 9010

  Howe Sound, Strait of Georgia/Juan De Fuca

For further information

David Jones

Warning Preparedness Meteorologist

e-mail: davidb.jones@ec.gc.ca

Files at:

http://pics2.tdiclub.com/weather.zip