The Barometer:
An Essential On-Board Weather Tool

Wooden Boat Festival 2016

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Marine Meteorologist

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Overview

Barometer Types

What the Barometer Measures

Atmospheric Pressure and Wind

Use the Barometer to Predict the Wind

Tips for On-Board Weather Analysis & Forecasting

What Weather does the Barometer Predict?

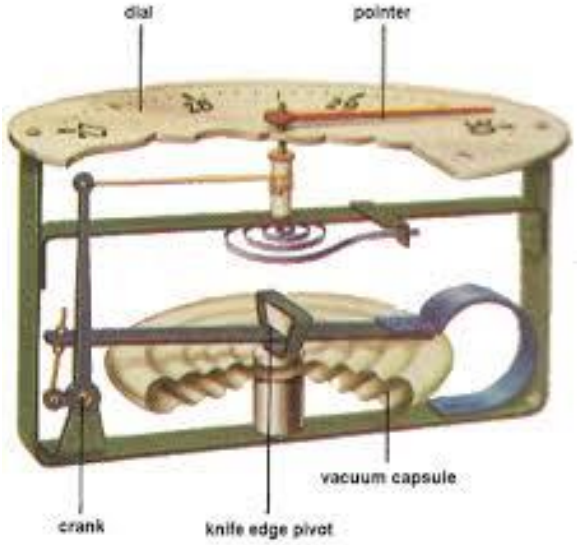
Landlubbers care about Clouds & Rain or Fair Skies

Sailors care about Wind because it determines

- Safety
- Boat speed & course
- Point of Sail
- Sail Plan
- Lee shores
- Tenable anchorages
- Sea state
- Stand On / Give Way Vessels

Mercury Column

Aneroid



Electronic

What is Atmospheric Pressure?

Weight of a column of air on a Unit of Area from surface to top of atmosphere

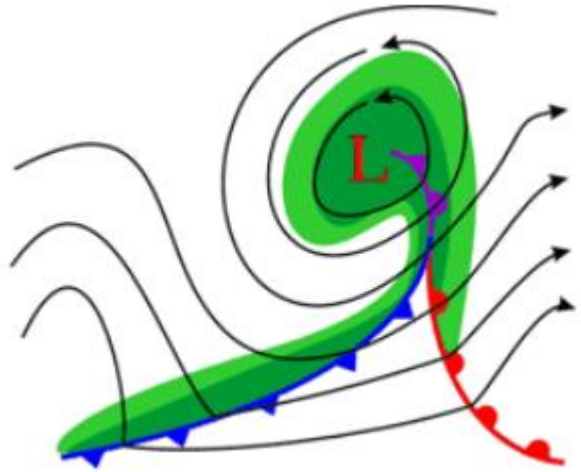
Standard Atmosphere and Units of Pressure

- 14.7 lb/in^2 (pounds per square inch, English)
- 29.92 in. Hg (inches of Mercury in glass column)
- 1013.25 mb (millibars, U.S. maritime)
- 1013.25 hPa (hectoPascal, Standard International)
- 101.3 kPa (kiloPascal, 1 hPa = 10 hPa)

Science and Technology Developments Give New Meaning to the Barometer

Standardized Times Zones, 1883, allow simultaneous weather observation over large geography

Telegraph allows weather data to be collected “instantly” to make weather maps



Norwegian Cyclone Model

- ~ WWI
- Air Masses
- Pressure Pattern
- Winds
- Clouds & Precipitation
- Fronts

Barometer Calibration

Calibration Methods

- Very near buoy or weather station
- Interpolate between 2 or more stations
- Adjust for elevation if not at Sea Level
- Aneroid: at high and low pressures
- Electronic: at one pressure

Dial-A-Buoy
888-701-8992

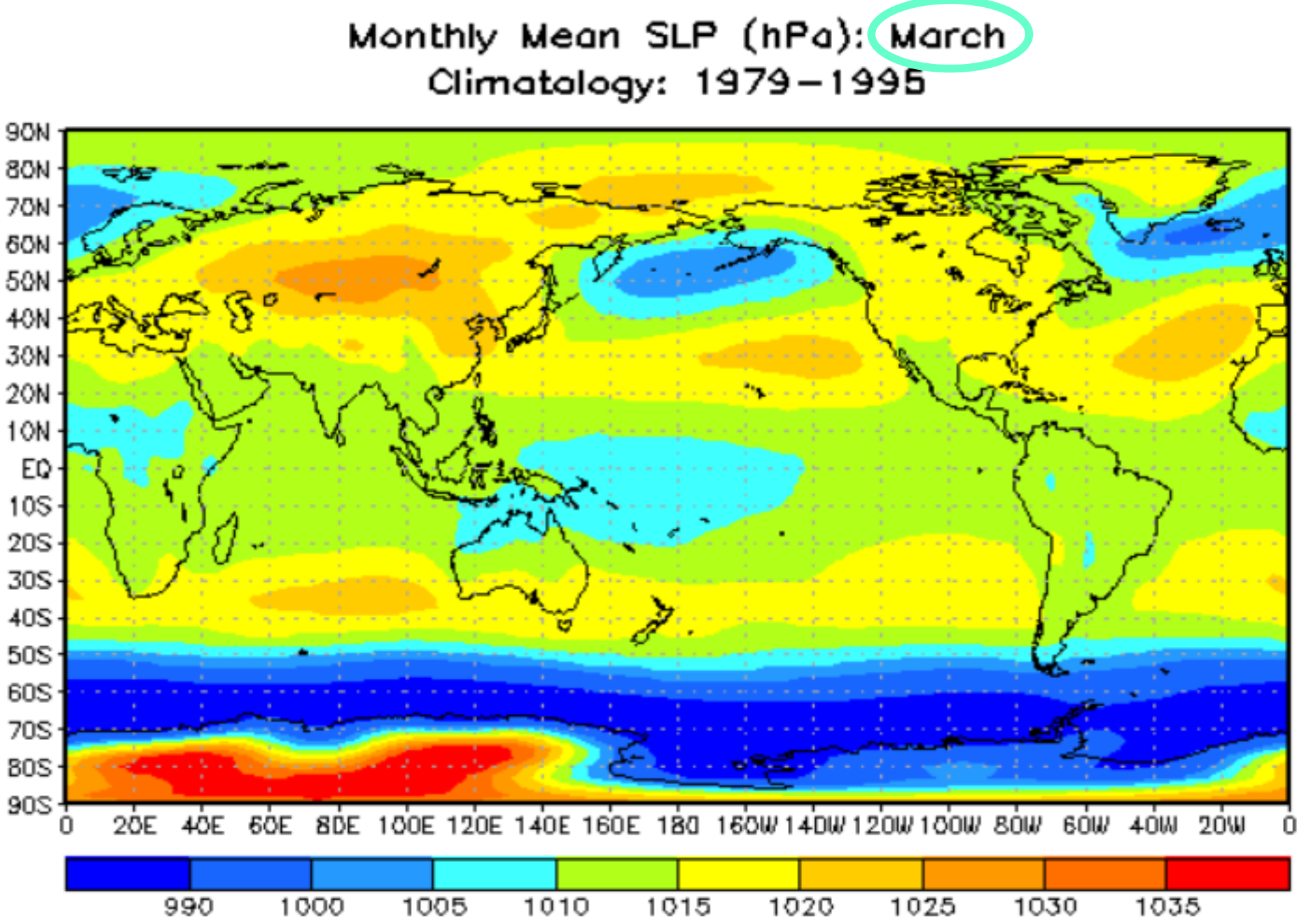
2350 GMT on 01/

f Measure: Metric Time Zone: Station Local Ti

on the graph icon in the table below to see a time ser

Wind Direction (WDIR):	
Wind Speed (WSPD):	
Wind Gust (GST):	
Wave Height (WVHT):	1.2 m
Dominant Wave Period (DPD):	5 sec
Average Period (APD):	4.0 sec
Mean Wave Direction (MWD):	E (91 deg true)
Atmospheric Pressure (PRES):	1004.1 mb
Pressure Tendency (PTDY):	-2.9 mb (Falling)

Atmospheric Pressure varies by Location & Month

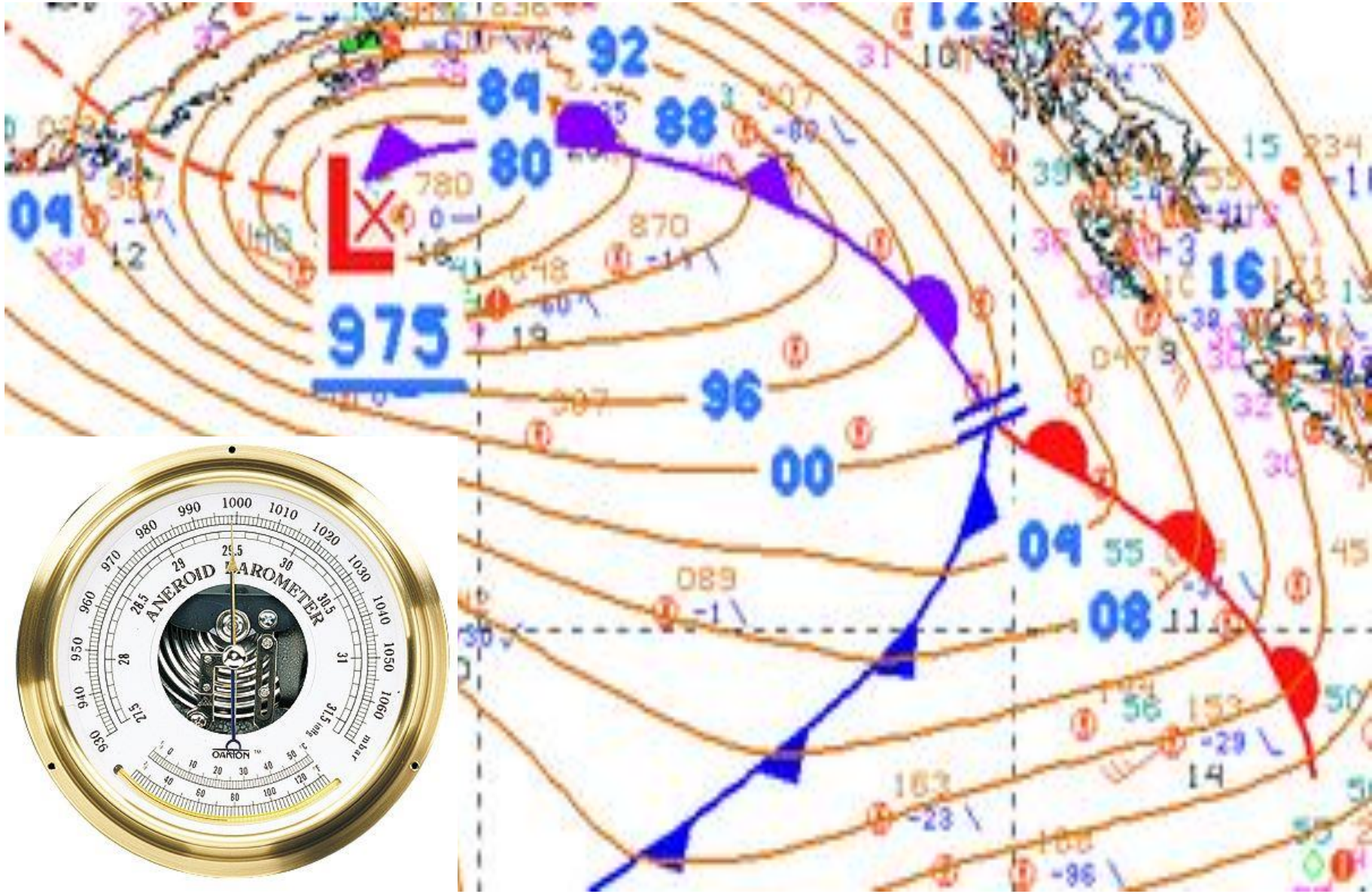


http://www.cpc.ncep.noaa.gov/products/precip/CWlink/climatology/Sea-Lvl-Pressure.shtml

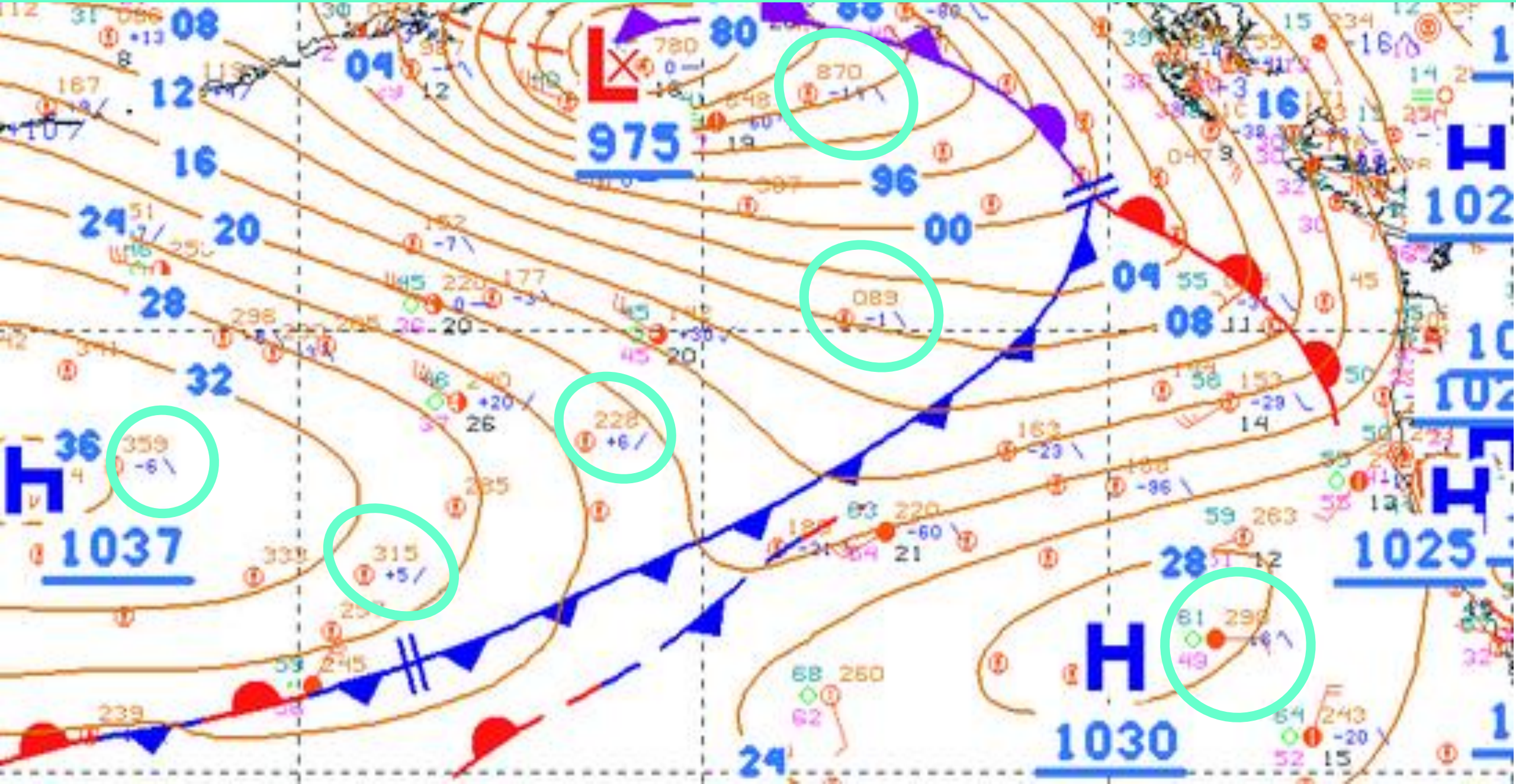
Barometer Interpretation

An accurate barometer allows evaluation of Weather Chart

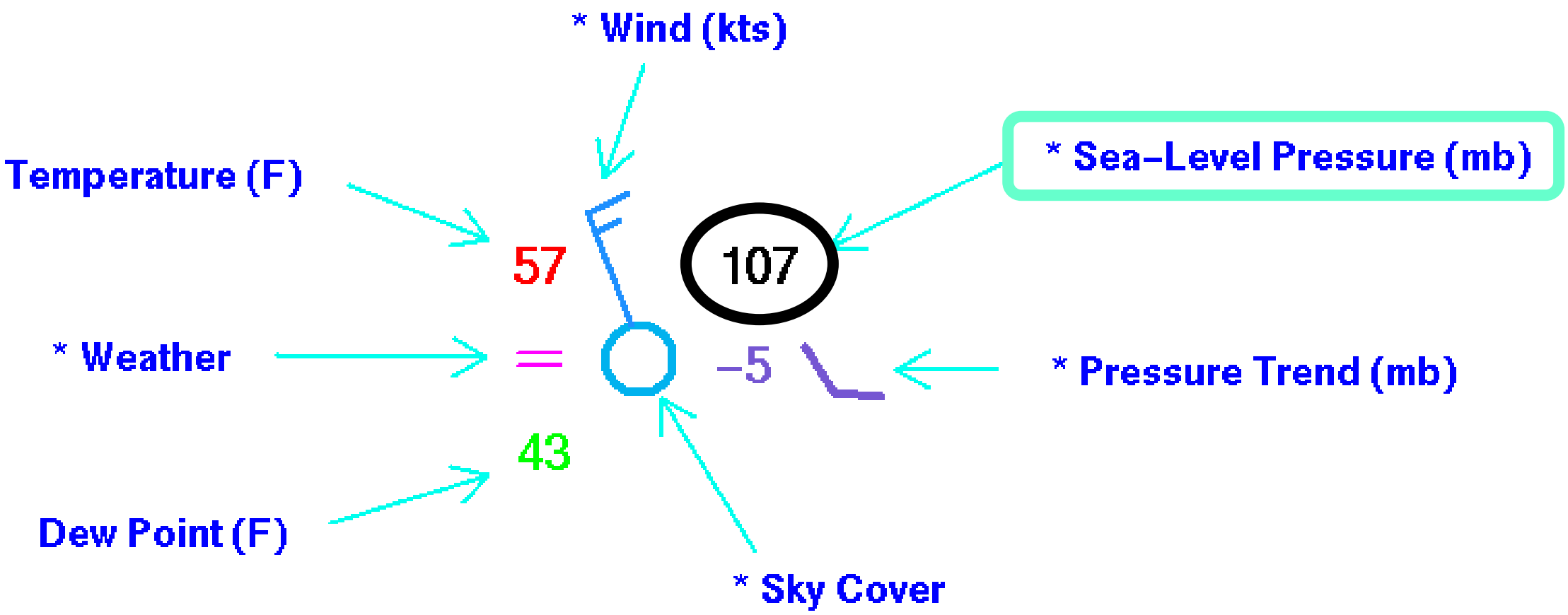
- Pressure relative to climatic average & daily fluctuations
- Patterns of High and Low Pressure
- Type and movement of Fronts



Ships, Buoys, Stations Ashore Report Atmospheric Pressure



Atmospheric Pressure in a Weather Report



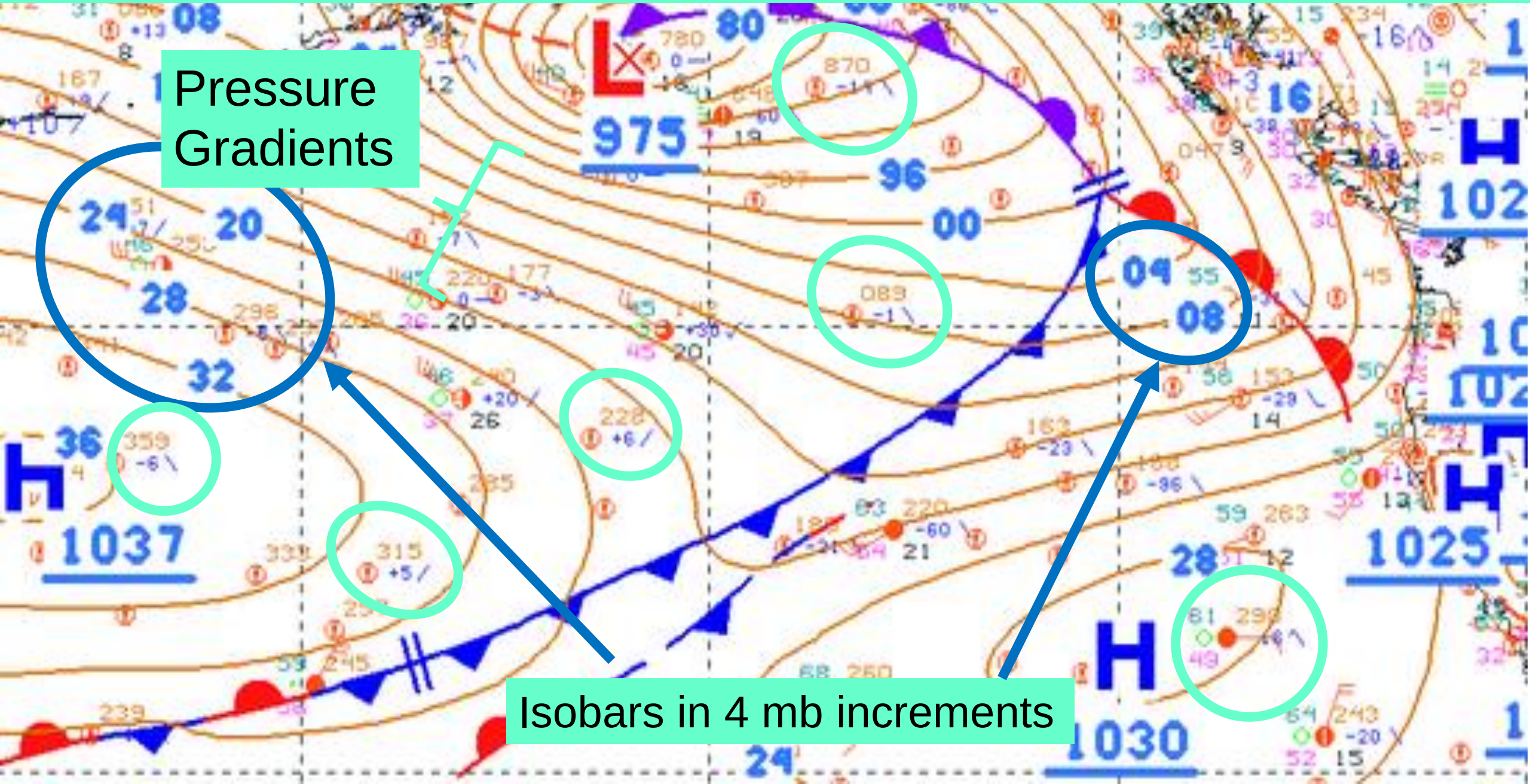
Atmospheric Pressure in Millibars

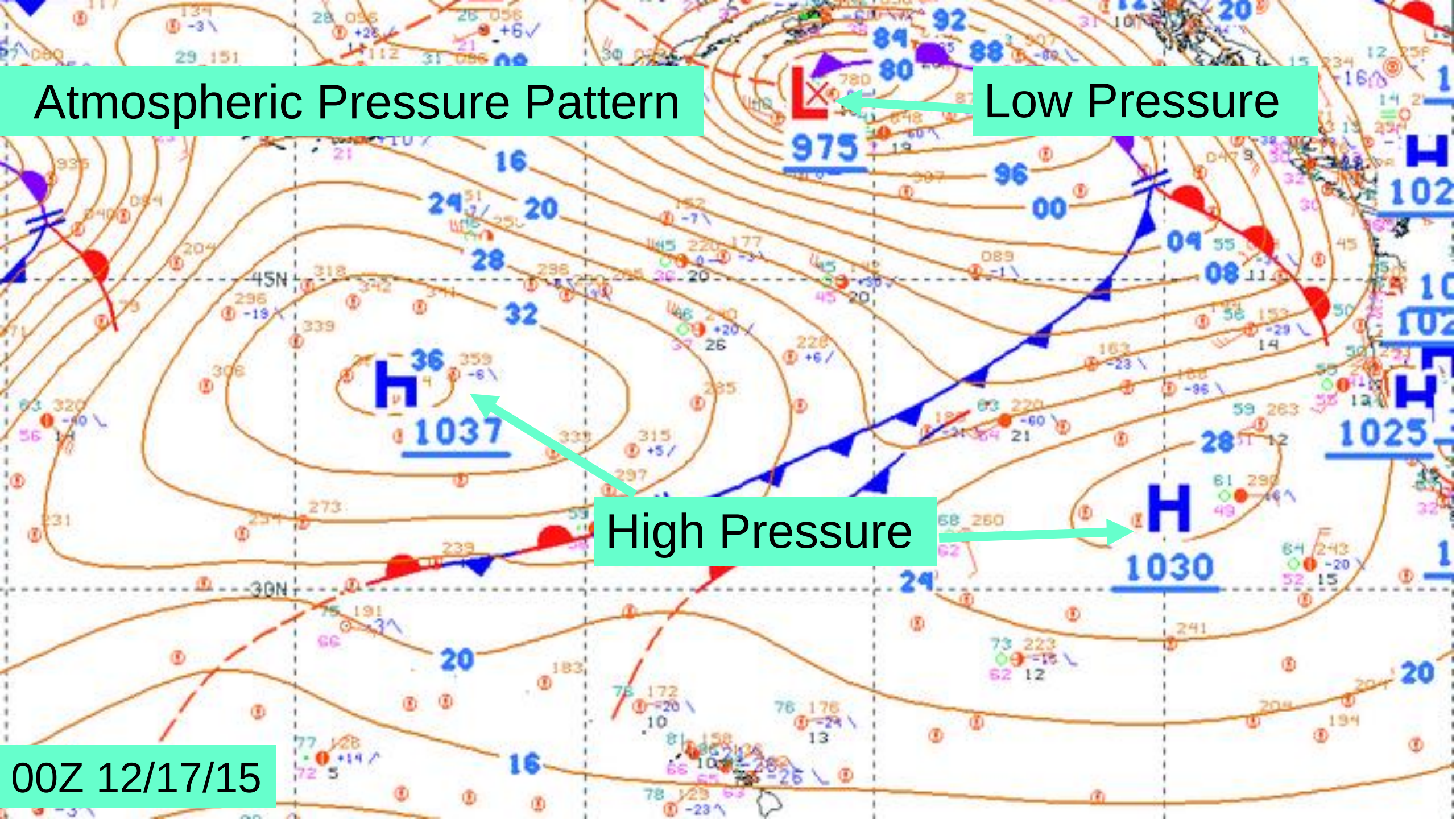
Very High Pressure ~	1040.0 mb
Typical pressure ~	1010.7 mb
Very Low Pressure ~	970.0 mb

Pressure can be accurately measured to 0.1 mb

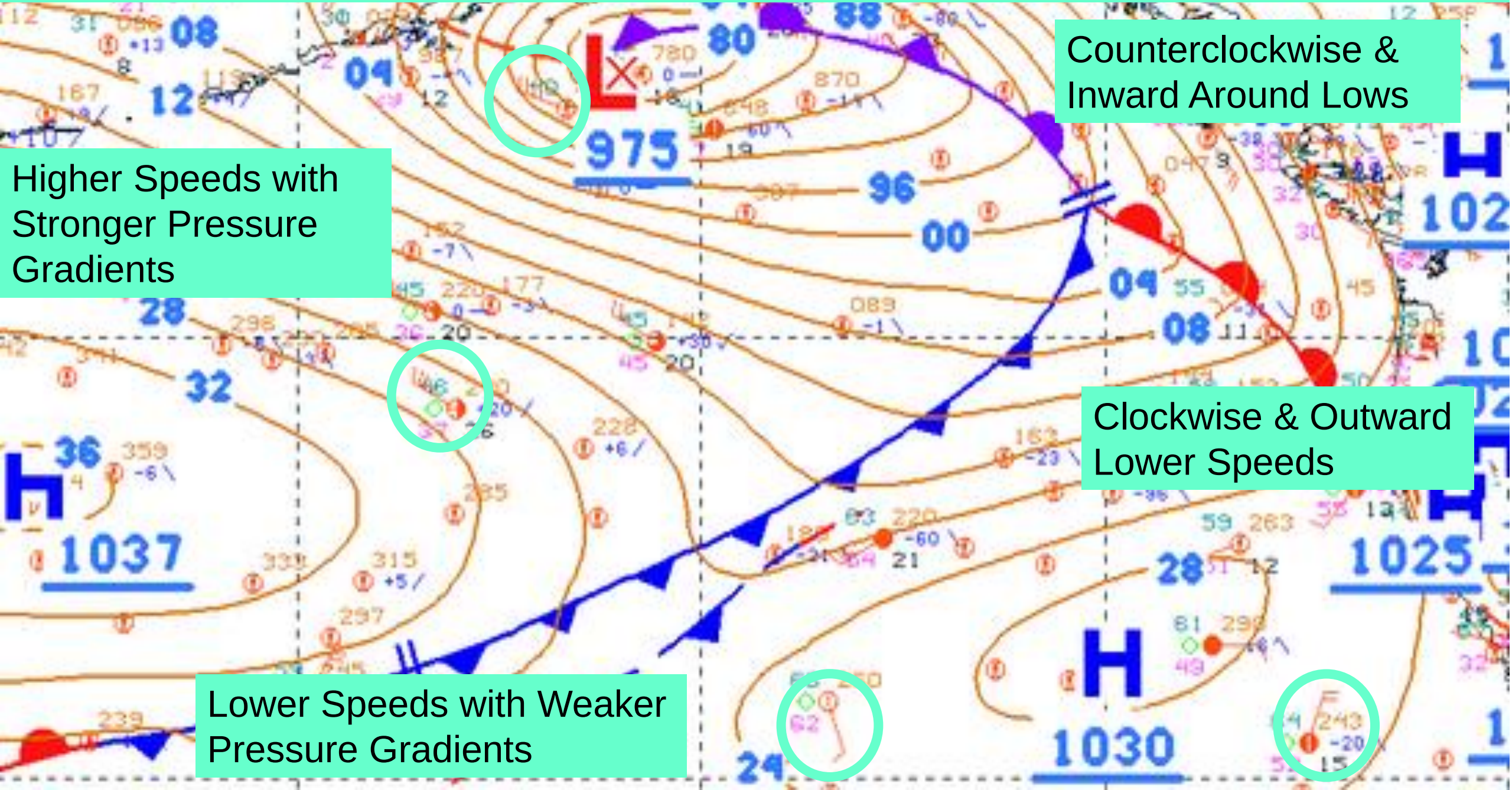
Standard Pressure is 1013.25 mb

Isobars connect areas of Equal Atmospheric Pressure




Atmospheric Pressure Pattern
Low Pressure
High Pressure
00Z 12/17/15
975
1037
1030
1025
45N
30N

Atmospheric Pressure Pattern determines Wind Direction and Speed

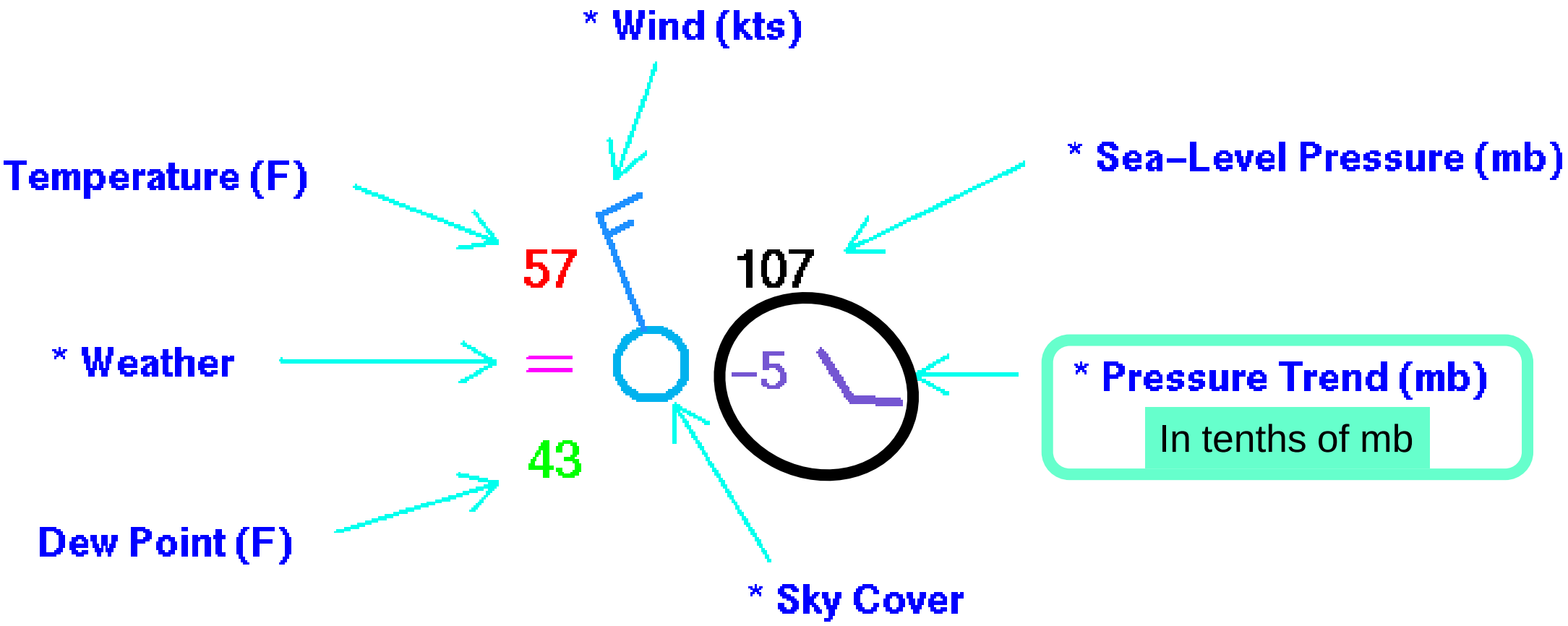


What Does the Barometer tell us about the Wind?

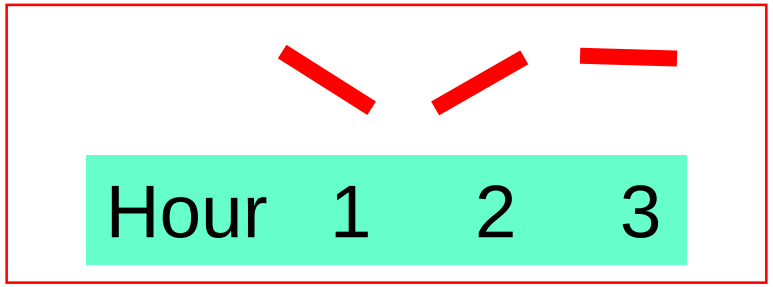
On a Calibrated Barometer

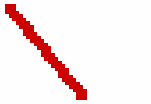
- Low pressure areas tend to have Stronger Wind
- High pressure areas tend to have Lighter Wind

What Does a Changing Barometer Tell Us About the Weather?

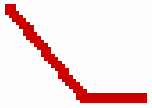


Pressure Tendency in 3 hour Periods





Continuously falling

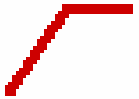


Falling, then steady

Falling before a lesser rise

Rising before a greater fall

Continuously rising

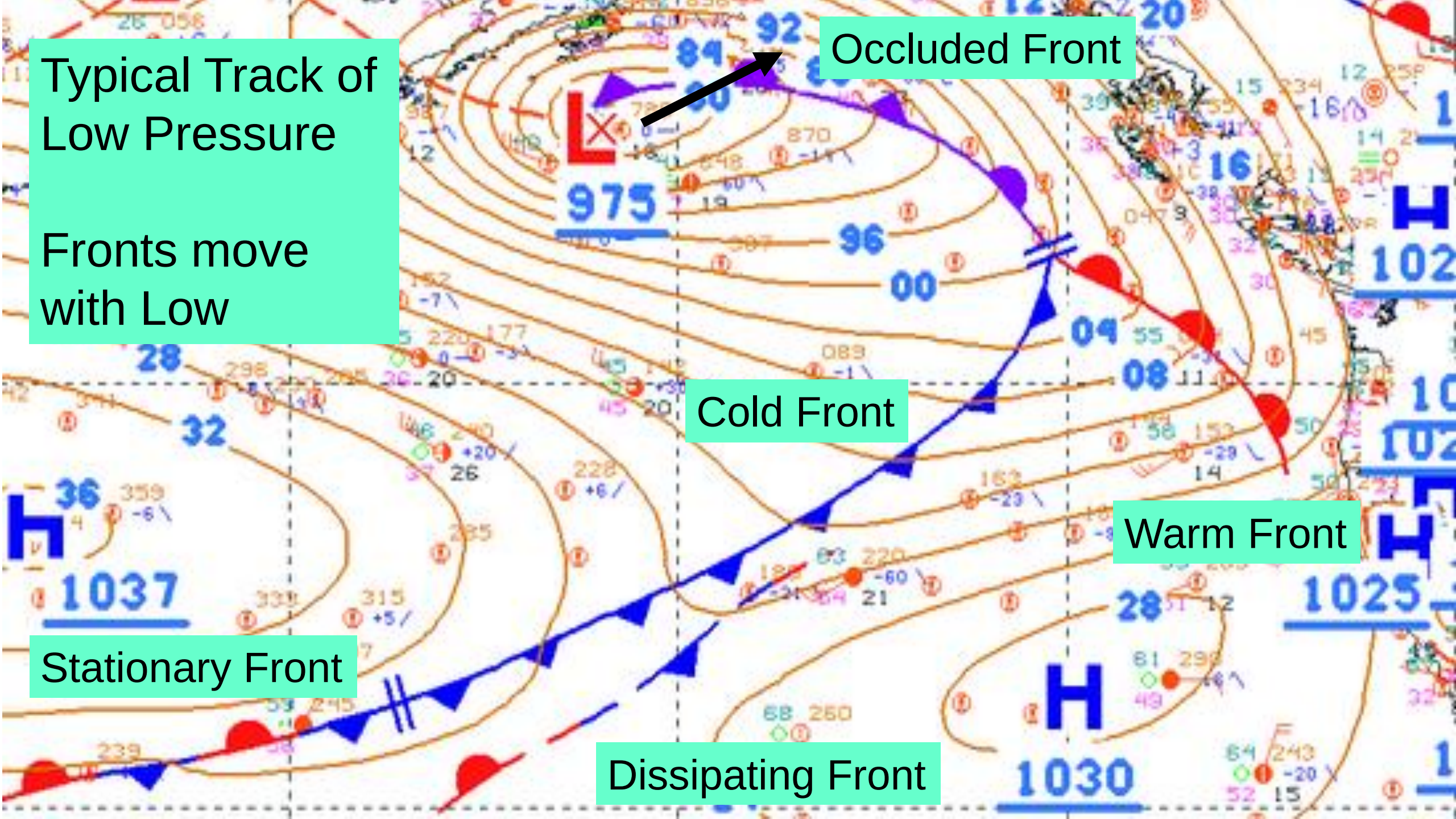


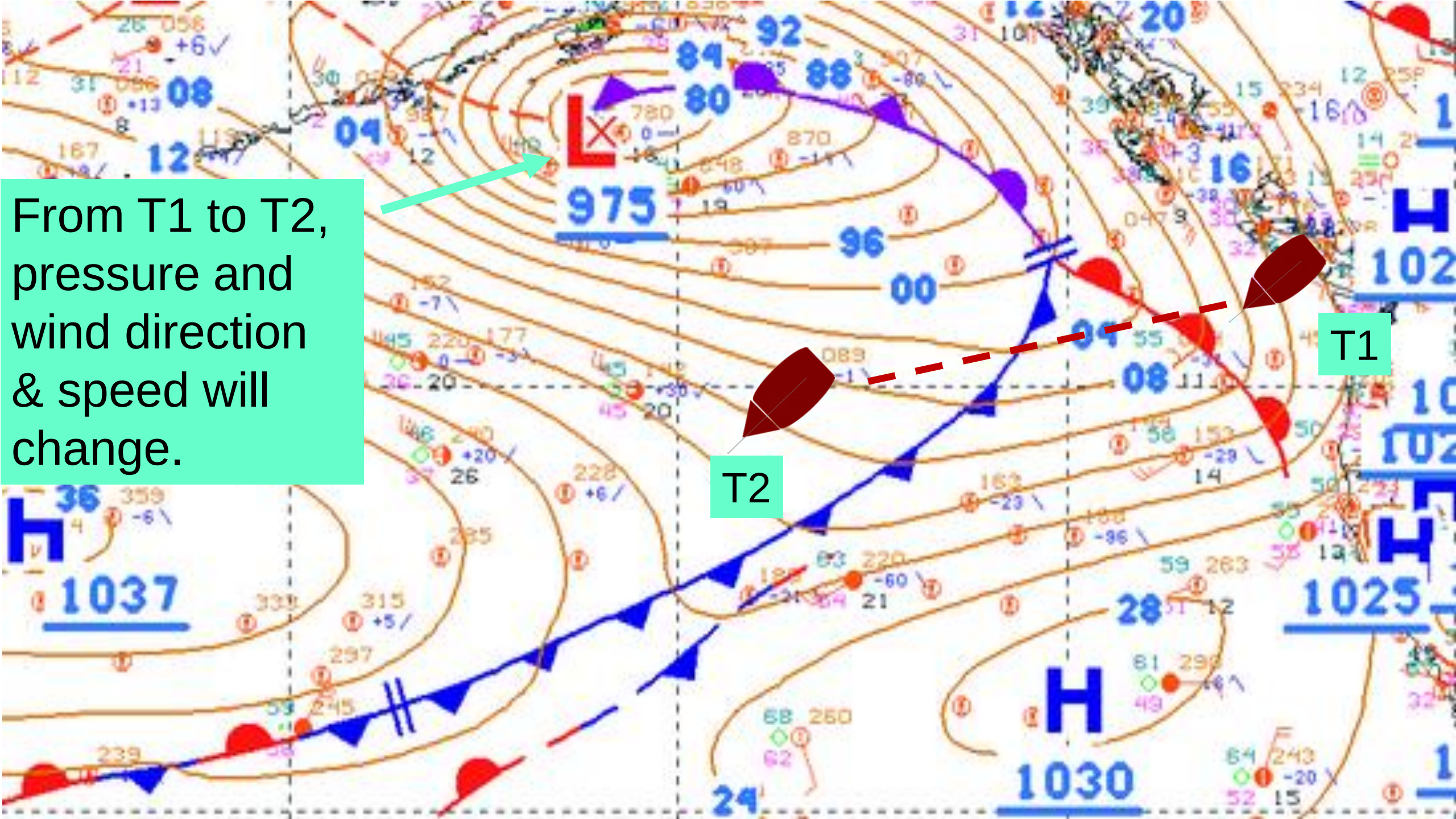
Rising, then steady

Falling before a greater rise

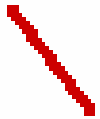
Rising before a lesser fall

Steady

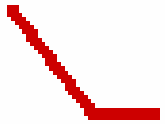

Typical Track of Low Pressure
Fronts move with Low
Occluded Front
Cold Front
Warm Front
Stationary Front
Dissipating Front


From T1 to T2, pressure and wind direction & speed will change.
T1
T2
975
1037
1030
1025

Barometer Indicates Weather Systems Progress

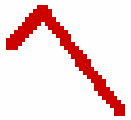


Warm or Cold Front Approaching

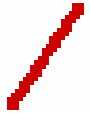


Warm Front Passage

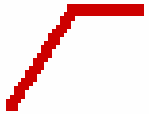
Cold Front Passage



Warm Front Approaching



Post Cold Front



High Pressure

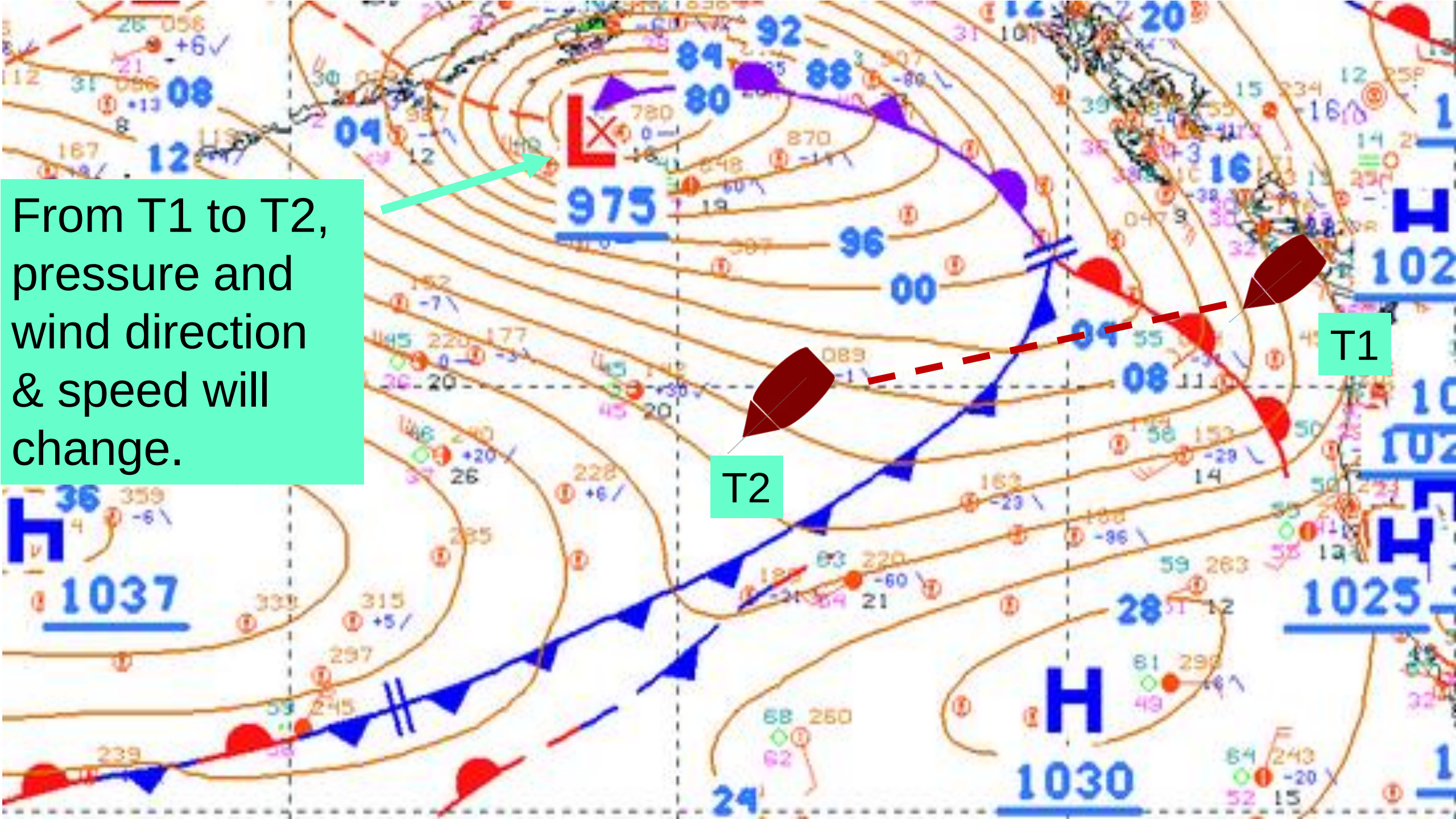
Cold Front Passage

Warm Front Approaching

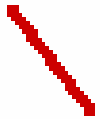
Stationary System or Warm Sector

Fronts and Wind

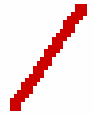
Frontal Type/ Stage	Before	Frontal Passage	After
Warm	Backing Increasing	Sudden veer, May decrease	Steady speed & direction
Cold	Increasing, Gusty	Sudden veer, Gusty	Gusty, Easing Veer slowly


From T1 to T2, pressure and wind direction & speed will change.
T1
T2
975
1037
1030
1025

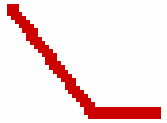
Barometer Helps You Analyze and Predict Wind



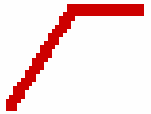
Has Backed & Increasing



Gusty & Easing



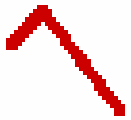
Increases, Veers, then Steady



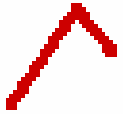
Eases, then Light

Strong & Gusty, then Veers

Veered, Gusty, Easing



Backed & Increasing



Backs, starts Increasing

Stationary System

Tips for On-Board Weather Analysis and Forecasting

Calibrate Ship’s Barometer

235

f Measure: Metric Time Zo

on the graph icon in the table be

Wind Direction (WDIR):	
Wind Speed (WSPD):	
Wind Gust (GST):	
Wave Height (WVHT):	
Dominant Wave Period (DPD):	
Average Period (APD):	
Mean Wave Direction (MWD):	E (91 deg true)
Atmospheric Pressure (PRES):	1004.1 mb
Pressure Tendency (PTDY):	-2.9 mb (Falling)

Keep a Weather Log

MM/DD/YYYY		M/D/Y		LOCATION		FORECAST	OBSERVATION		
UTC	UTC	Ship	Ship	Name or Lat/Long	Log	Wind (True)		Pressure	P Tend
1/1/2016		Friday	PDT	DD MM.M	n mi	Dir/Speed	Dir/Speed	mb/hPa	mb/3 hr
	15Z		700	anacortes					
			843					1033.3	
	18Z		1000						
						ENE 5- 8		1032	
	21Z		1300			ENE 10-13	015 / 6		
			1345	48 23'N, 123 12'W			005 / 14.7		
1/2/2016	00Z		1600	w/in 5 nmi Victoria		NNE 5-10			
Sat.					35				
	03Z		1900						
	06Z		2200						

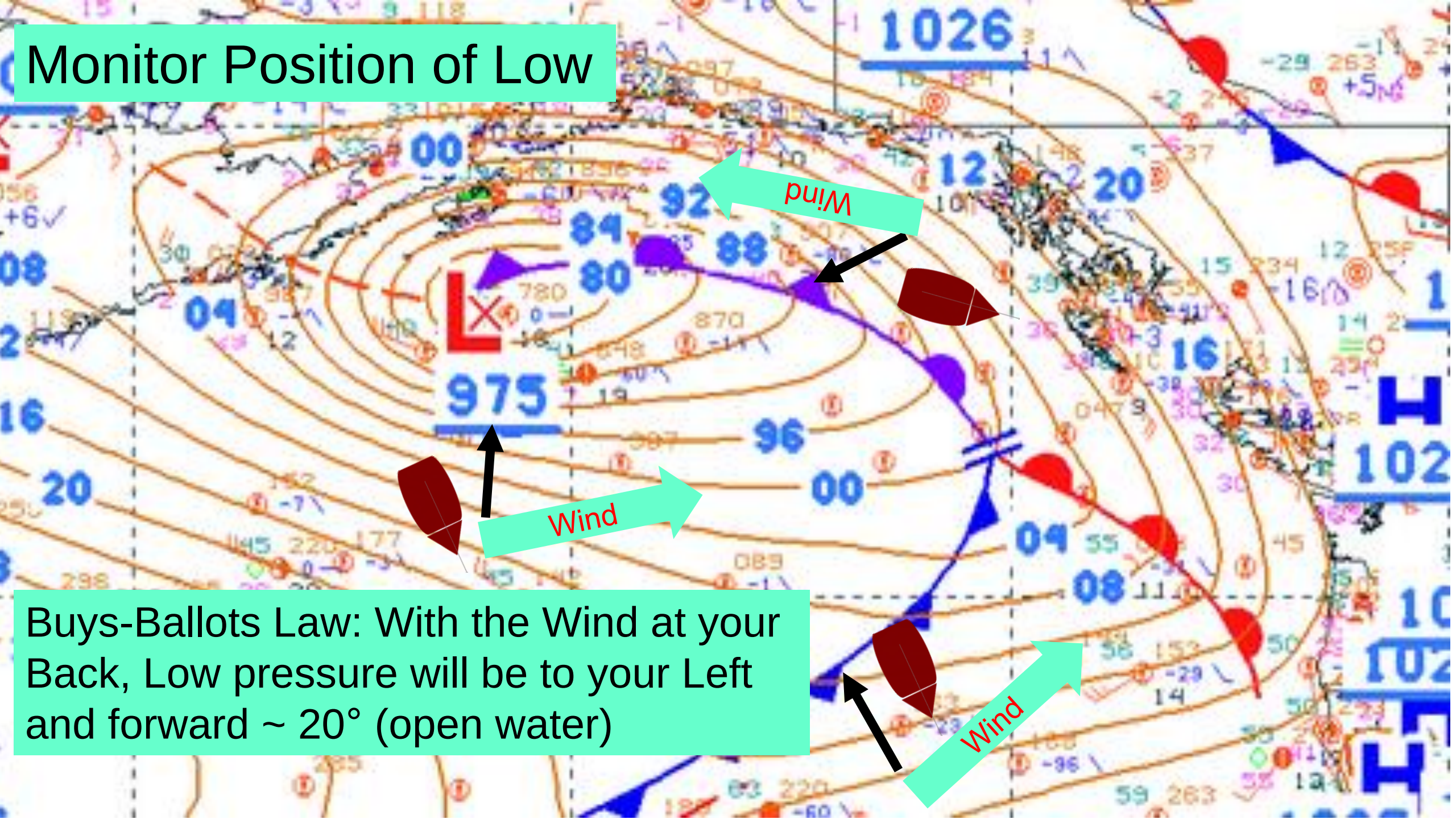
Log observations
- at “valid” times (00Z, 06Z, 12Z, 18Z)
-hourly when conditions are changing

Relate Pressure Drop to Storm Intensity

Table 5.5-4 "4-5-6" Guideline to Pressure as Wind Forecaster	
Likely Significance	*Steady pressure drop over 6 Hours*
Alert	Less than 3 mb
Caution	3 to 4 mb
Definite warning	4 to 5 mb
Too late for forecasting	More than 5 mb

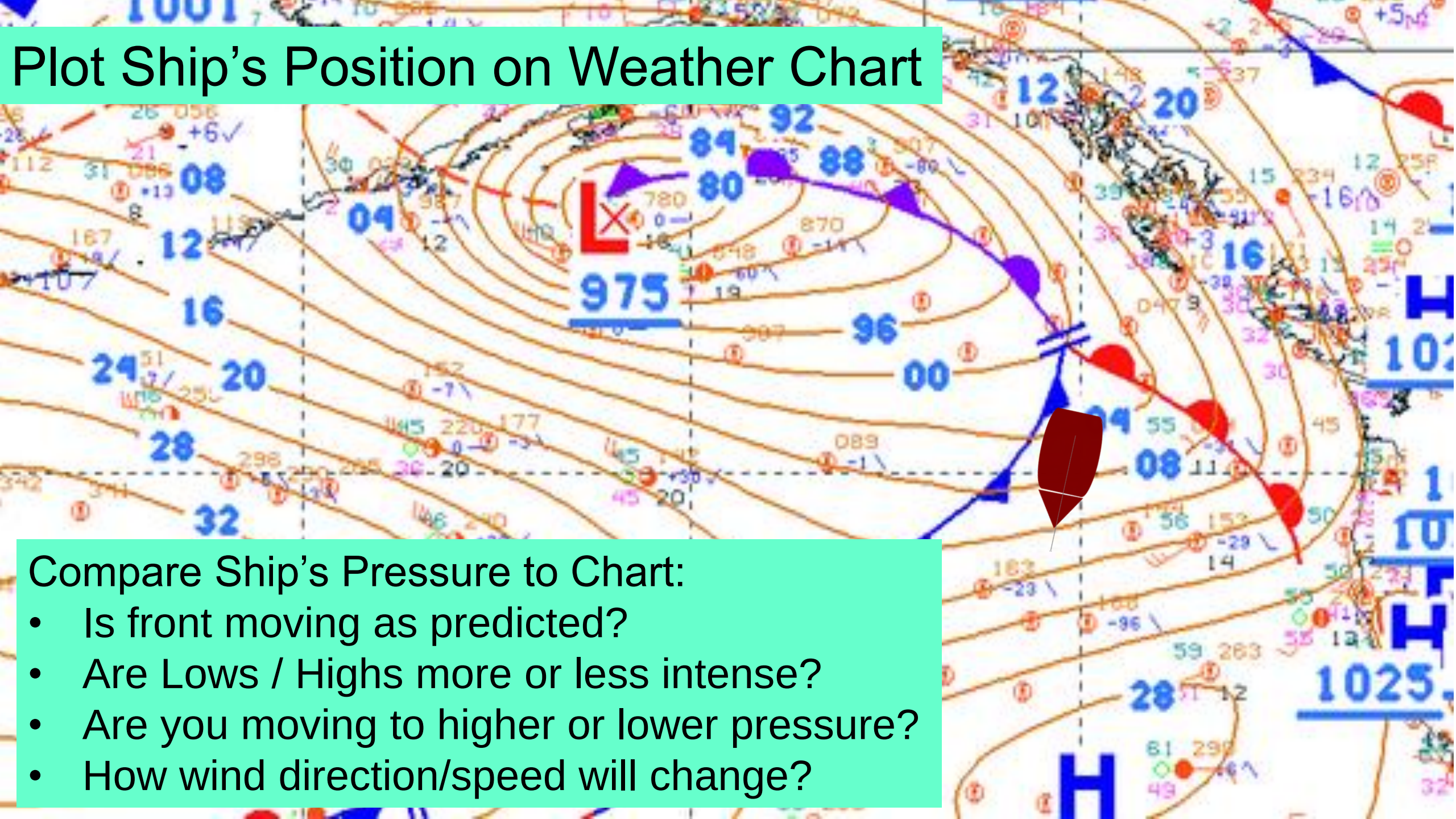
From David Burch, Modern Marine Weather

Monitor Position of Low



Buys-Ballots Law: With the Wind at your Back, Low pressure will be to your Left and forward ~ 20° (open water)

Plot Ship's Position on Weather Chart



Compare Ship's Pressure to Chart:

- Is front moving as predicted?
- Are Lows / Highs more or less intense?
- Are you moving to higher or lower pressure?
- How wind direction/speed will change?

The Barometer helps you

- Anticipate the Future
- Prepare for the Worst

Marine Weather Training

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info@nwmaritime.org 360 385-3628 x 104

UW Sea Grant
sfisken@u.washington.edu 206 543-1225

The Center for Wooden Boats
Lake Union, adultsailing@cwb.org , 206 382-2628

Seattle Sailing Club
Shilshole, www.seattlesailing.com, 206-782-5100

Island Sailing Club
Portland OR, islandsailing.org 503 285-7765

YOUR Yacht Club, Sailing School, or Owner's Association!