

# Weather Basics

Safety at Sea Seminar, 30<sup>th</sup> March 2019

## Session goals:

- Identify global wind patterns
- Wind flow around surface **Highs** & **Lows**
  - 3 types of **Lows** to look out for
  - Weather on the ground?
- Severe weather on the Bay & in the North Atlantic
- Interpret main features on a surface weather chart



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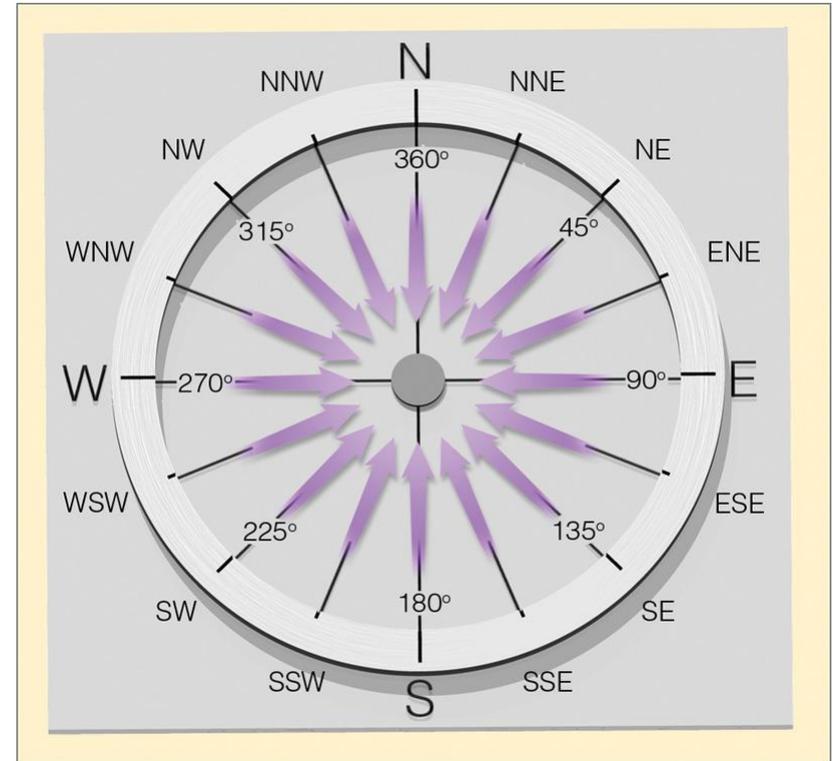


# Let's take a step back to remember some basics:

- Wind → horizontal movement of air
- 'Naming' wind
  - *From source direction*



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Figures courtesy of *Meteorology today, 11th edition*,  
Ahrens, 1st edition, 2016

# Let's take a step back to remember some basics:

- 'Naming' wind
  - From source direction
- Measuring wind speed
  - Knots
  - MPH
  - Beaufort Scale

*What makes air move creating wind?*

Image source:  
[http://www.crh.noaa.gov/image/iwx/publications/Beaufort\\_Wind\\_Chart.pdf](http://www.crh.noaa.gov/image/iwx/publications/Beaufort_Wind_Chart.pdf)

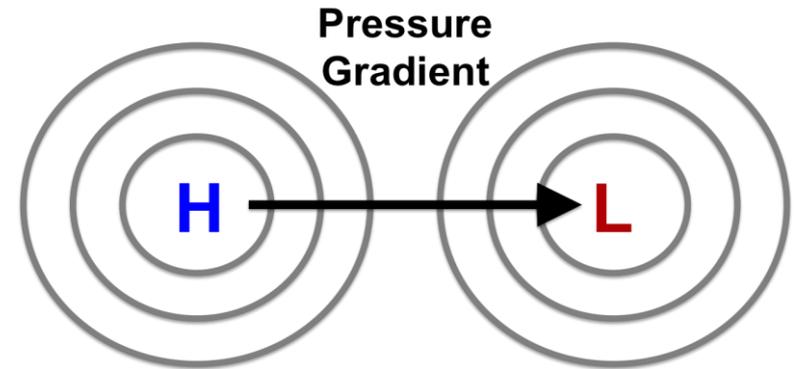
Beaufort Wind Chart – Estimating Winds Speeds

Beaufort Number	MPH		Terminology	Description
	Range	Average		
0	0	0	Calm	Calm. Smoke rises vertically.
1	1-3	2	Light air	Wind motion visible in smoke.
2	4-7	6	Light breeze	Wind felt on exposed skin. Leaves rustle.
3	8-12	11	Gentle breeze	Leaves and smaller twigs in constant motion.
4	13-18	15	Moderate breeze	Dust and loose paper is raised. Small branches begin to move.
5	19-24	22	Fresh breeze	Smaller trees sway.
6	25-31	27	Strong breeze	Large branches in motion. Whistling heard in overhead wires. Umbrella use becomes difficult.
7	32-38	35	Near gale	Whole trees in motion. Some difficulty when walking into the wind.
8	39-46	42	Gale	Twigs broken from trees. Cars veer on road.
9	47-54	50	Severe gale	<b>Light structure damage.</b>
10	55-63	60	Storm	<b>Trees uprooted. Considerable structural damage.</b>
11	64-73	70	Violent storm	<b>Widespread structural damage.</b>
12	74-95	90	Hurricane	<b>Considerable and widespread damage to structures.</b>

# Let's take a step back to remember some basics:

## *What makes wind blow?*

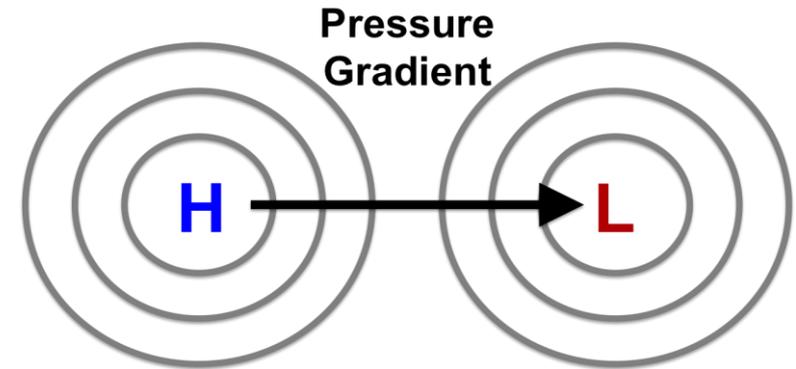
1. Pressure gradient force is directed from **H** to **L**



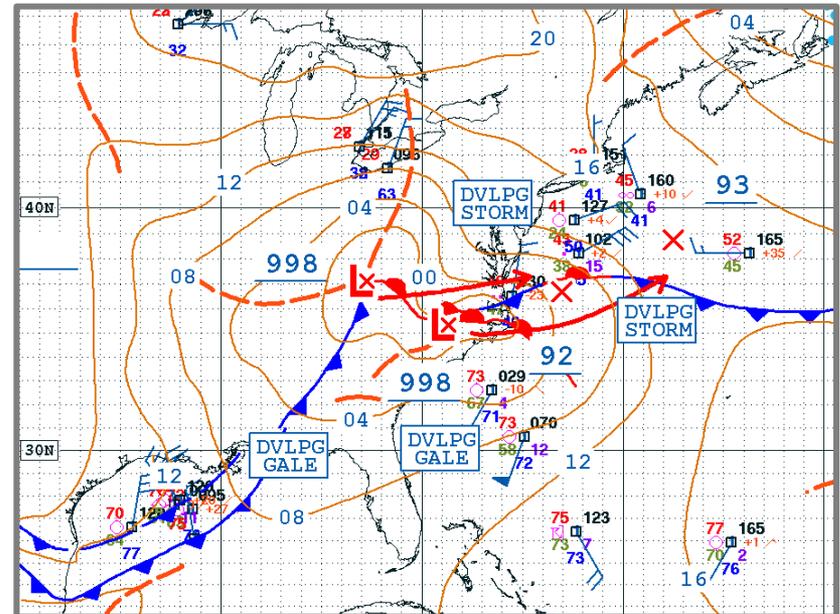
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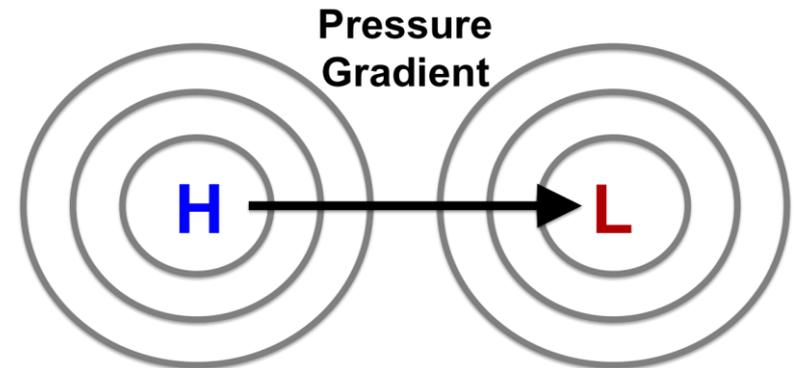


- Increased pressure gradient  
➔ increased wind speed

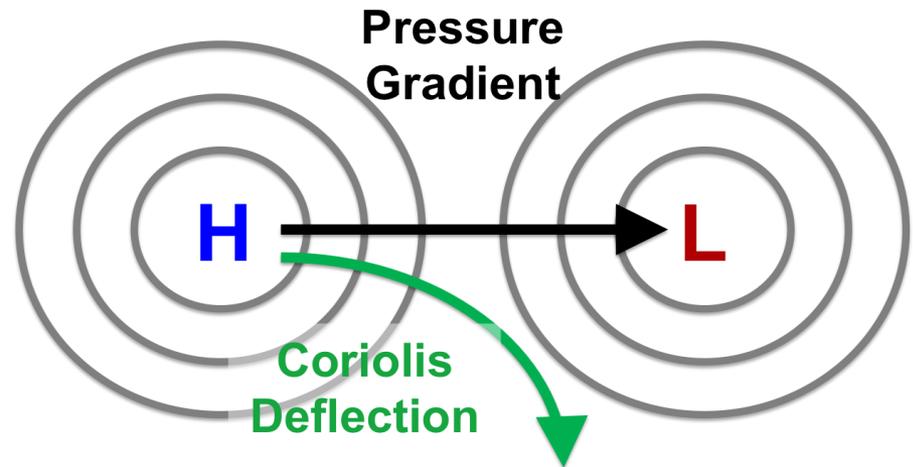


# Let's take a step back to remember some basics: *What makes wind blow?*

1. Pressure gradient force is directed from **H** to **L**

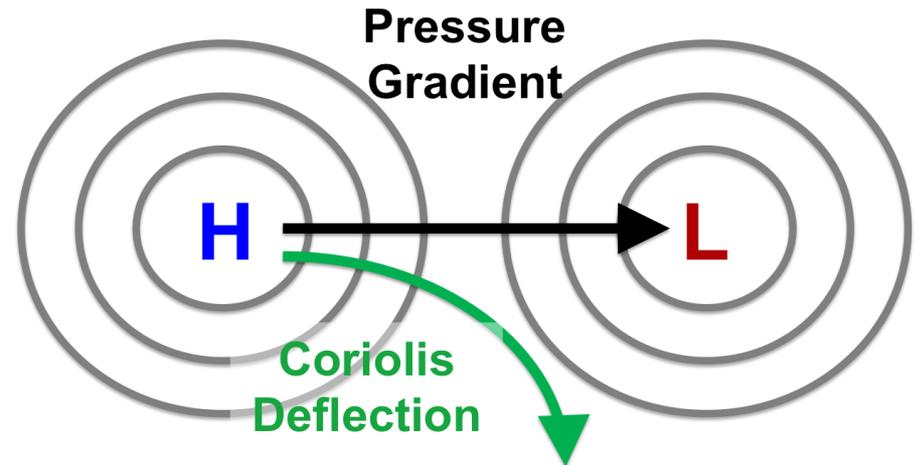


2. Coriolis force, due to Earth's rotation, deflects air to the right of its path of motion

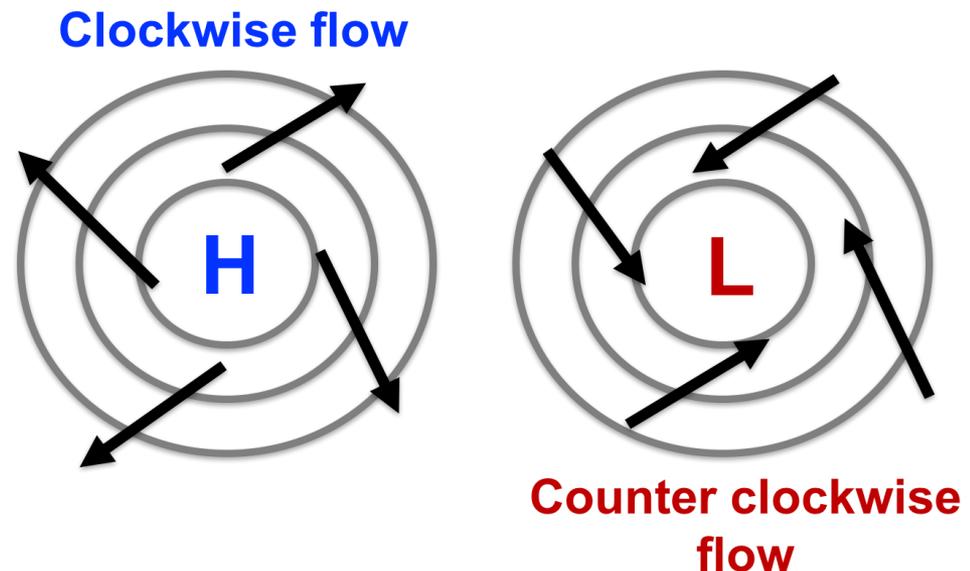


# Let's take a step back to remember some basics: *What makes wind blow?*

1. Pressure gradient force is directed from **H** to **L**
2. Coriolis force, due to Earth's rotation, deflects air to the right of its path of motion



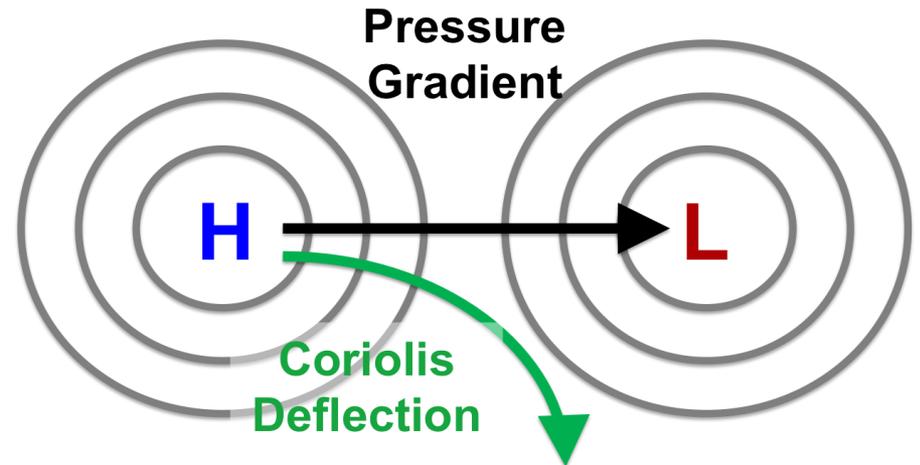
**Pressure gradient** + **Coriolis** =  
wind direction around a surface  
**High** & **Low** pressure



# Let's take a step back to remember some basics:

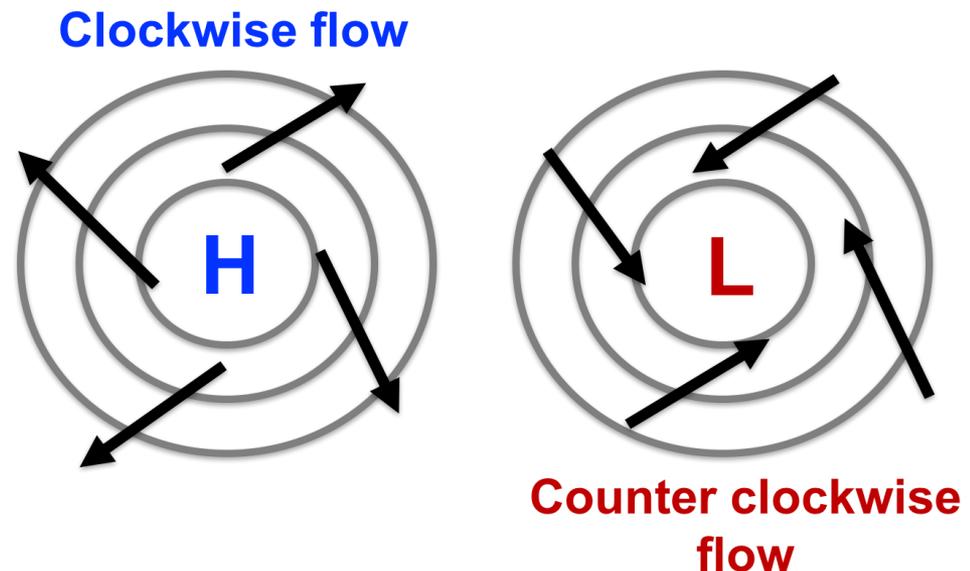
## *What makes wind blow?*

1. Pressure gradient force is directed from **H** to **L**
2. Coriolis force, due to Earth's rotation, deflects air to the right of its path of motion



### *In the Northern Hemisphere:*

- Cyclonic flow → counter clockwise
- Anticyclonic flow → clockwise



# This even translates to global wind patterns.....

Resulting in wind patterns you have all heard of:

- Trade Winds
- Westerlies
- Horse Latitudes
- Doldrums

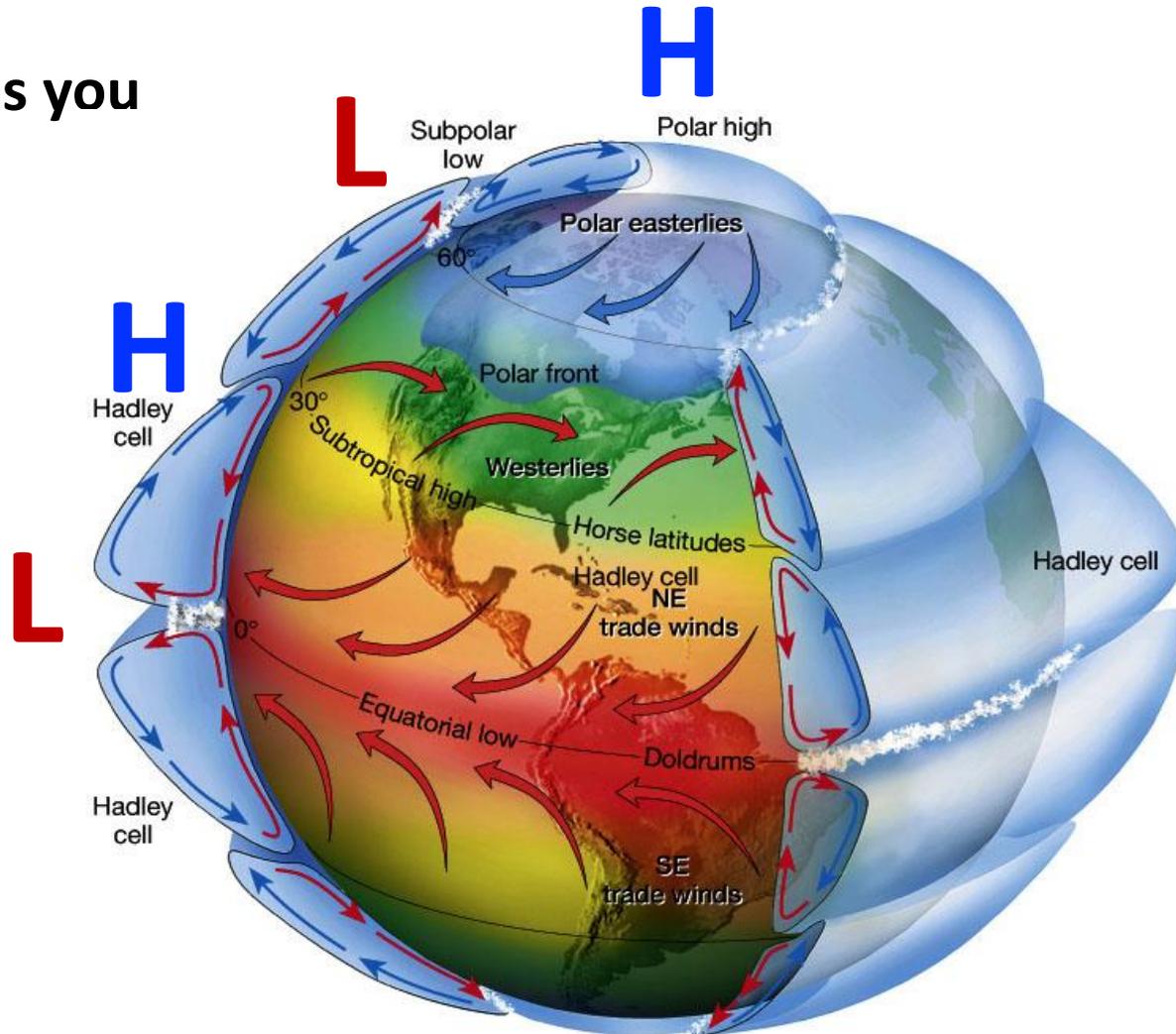


Figure courtesy of *The Atmosphere, 8th edition*, Lutgens and Tarbuck, 8th edition, 2001

# This even translates to global wind patterns.....

Resulting in wind patterns you have all heard of:

- Trade Winds  
*Apply pressure gradient & coriolis → NE trades!*
- Westerlies
- Horse Latitudes
- Doldrums

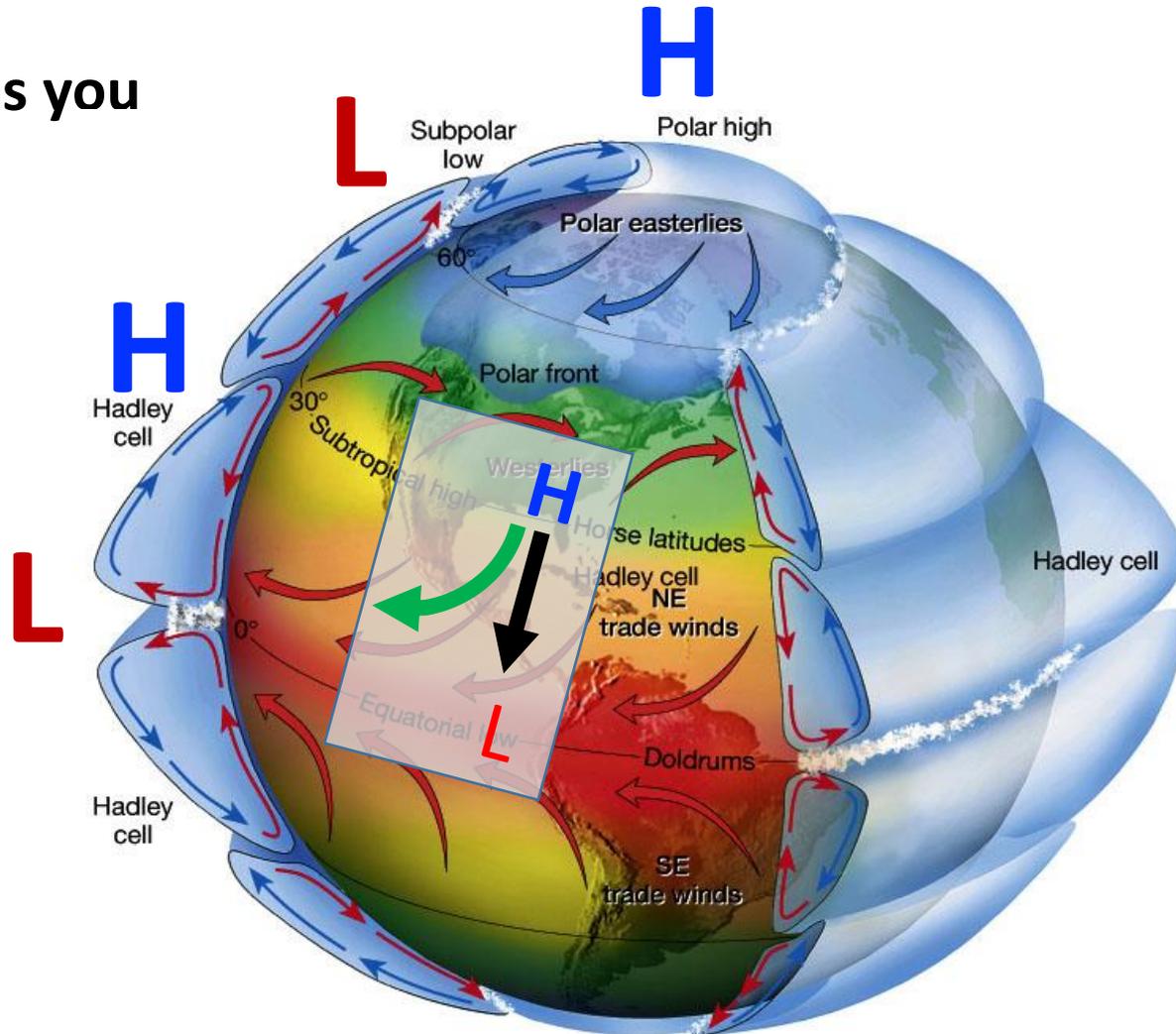
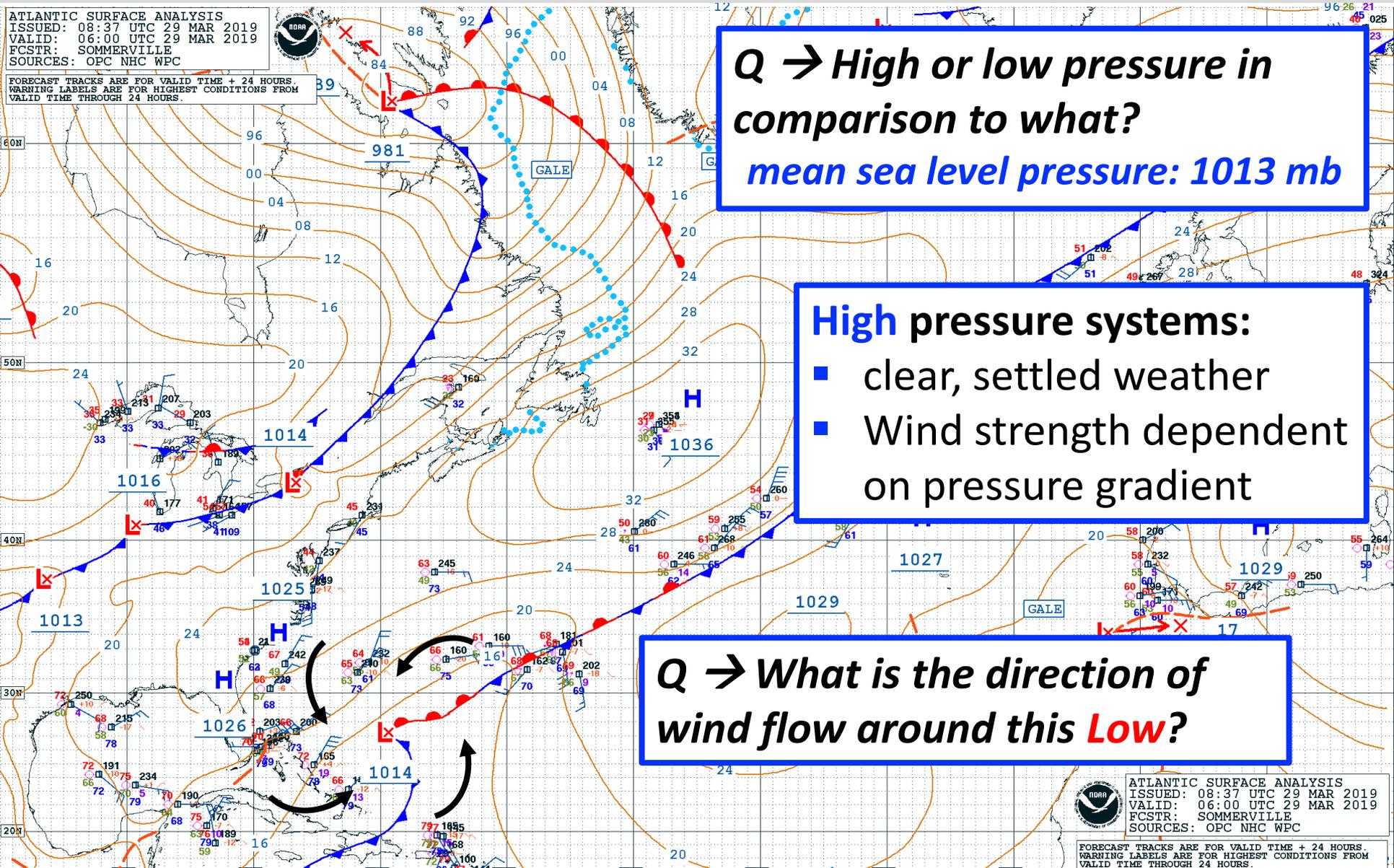


Figure courtesy of *The Atmosphere, 8th edition*, Lutgens and Tarbuck, 8th edition, 2001

# Let's take a look at some Highs & Lows on a surface weather chart.....

ATLANTIC SURFACE ANALYSIS  
ISSUED: 08:37 UTC 29 MAR 2019  
VALID: 06:00 UTC 29 MAR 2019  
FCSTR: SOMMERVILLE  
SOURCES: OPC NHC WPC

FORECAST TRACKS ARE FOR VALID TIME + 24 HOURS.  
WARNING LABELS ARE FOR HIGHEST CONDITIONS FROM  
VALID TIME THROUGH 24 HOURS.



**Q → High or low pressure in comparison to what?**  
*mean sea level pressure: 1013 mb*

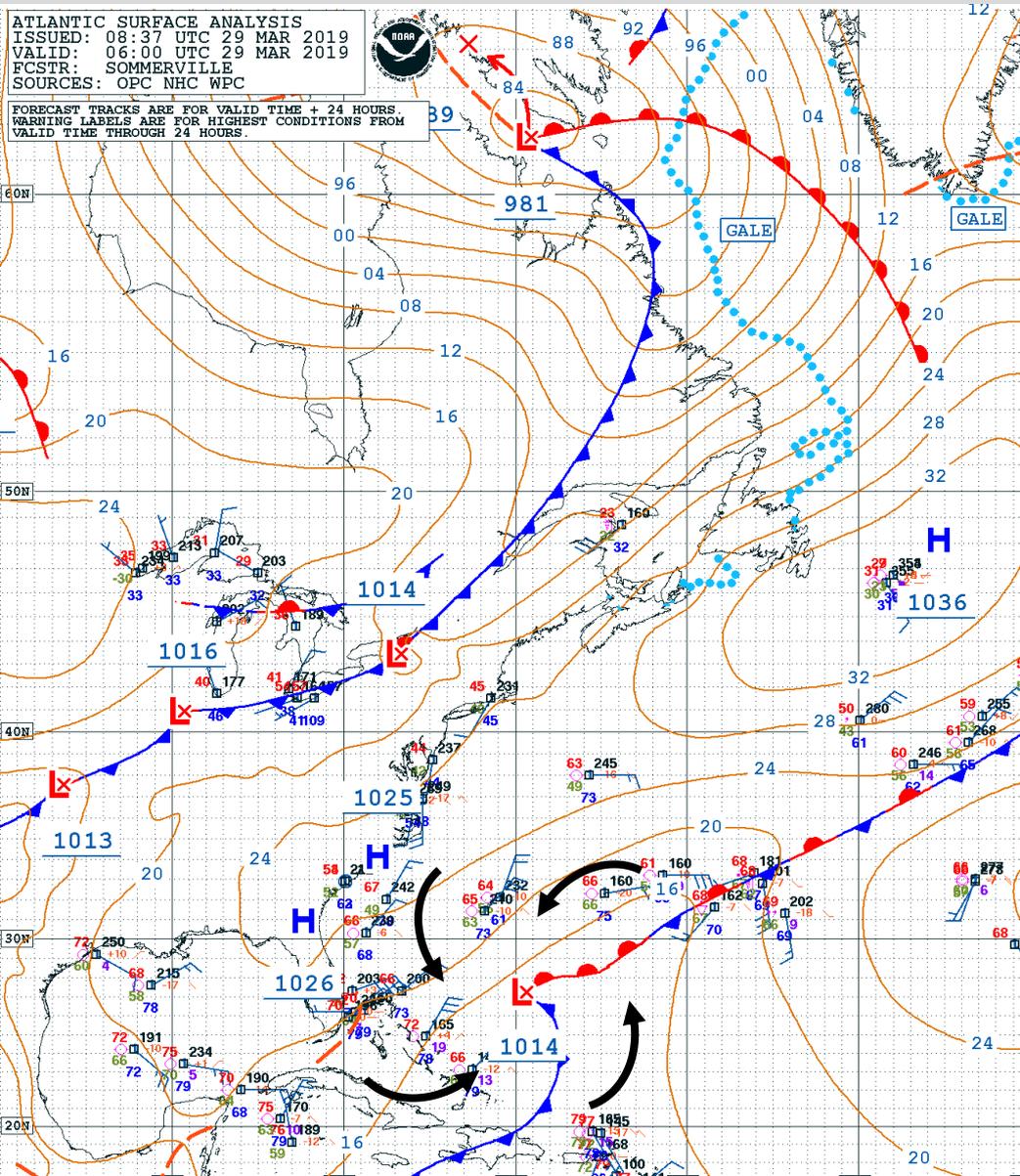
- High pressure systems:**
- clear, settled weather
  - Wind strength dependent on pressure gradient

**Q → What is the direction of wind flow around this *Low*?**

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ISSUED: 08:37 UTC 29 MAR 2019  
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# 3 types of Low pressure systems:



## 1. Mid-latitude Lows:

- most common between 30-60 N/S
- move (in general) from W → E
- associated with **fronts**
  - *boundary between air mass of different characteristics*

## Types of fronts include:

- Cold fronts
- Warm fronts
- Stationary fronts
- Occluded fronts

# 3 types of Low pressure systems:

## 1. Mid-latitude Low – cold front passage

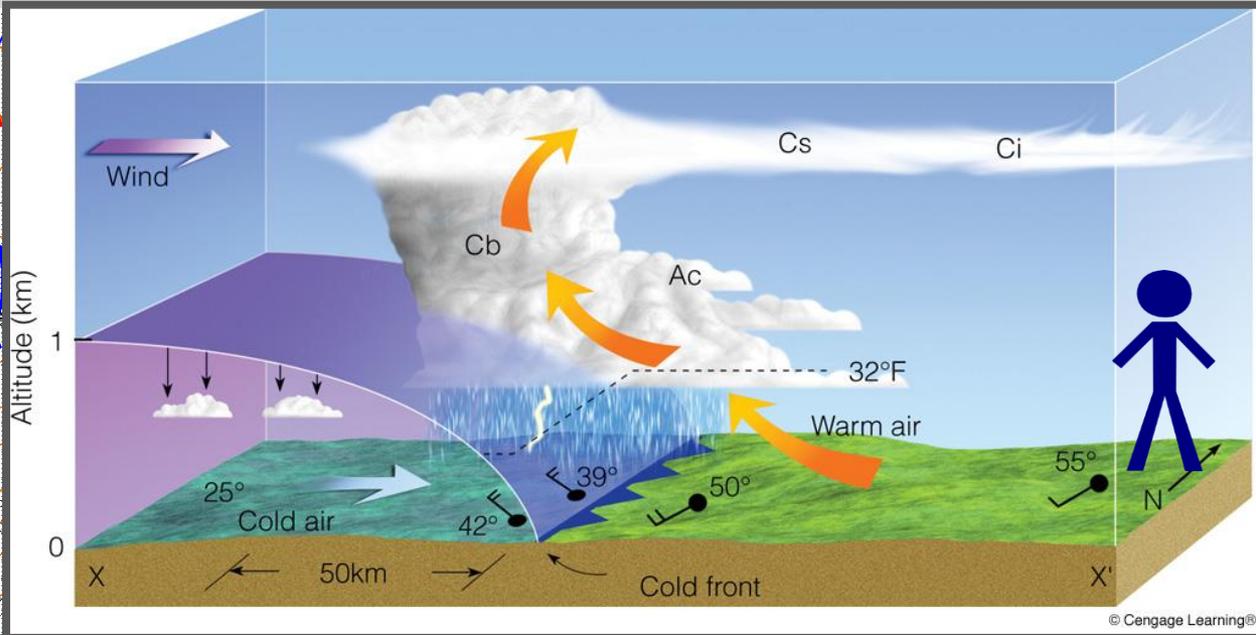
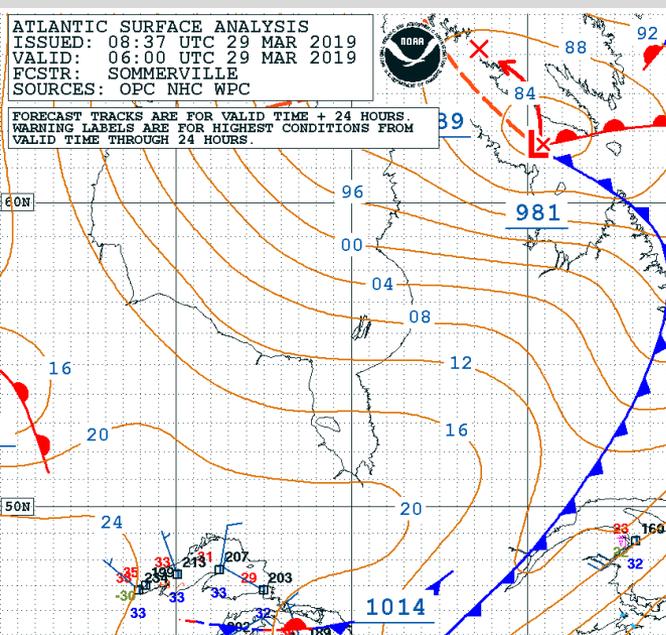
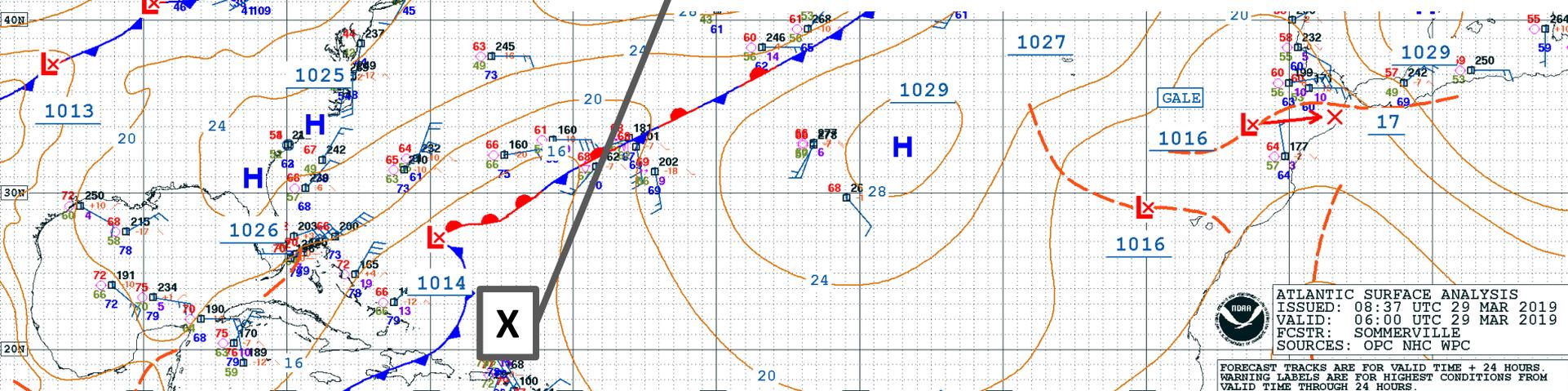


Figure courtesy of *Meteorology today, 11th edition,*  
 Ahrens, 1st edition, 2016



# 3 types of Low pressure systems:

## 1. Mid-latitude Low – warm front passage

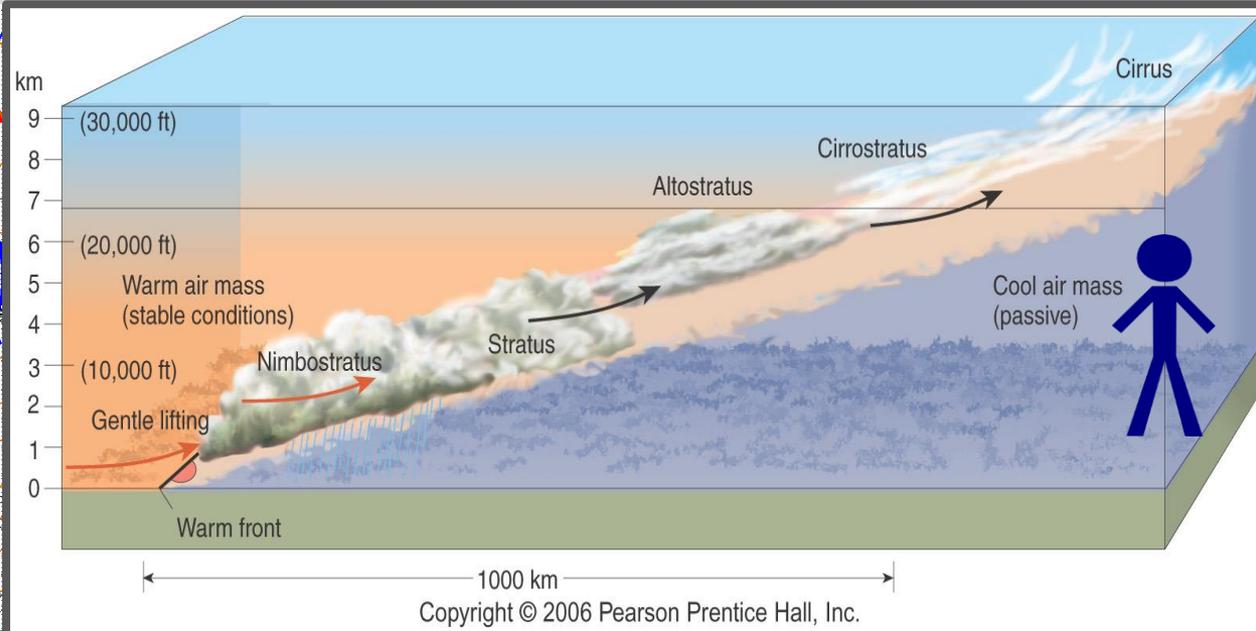
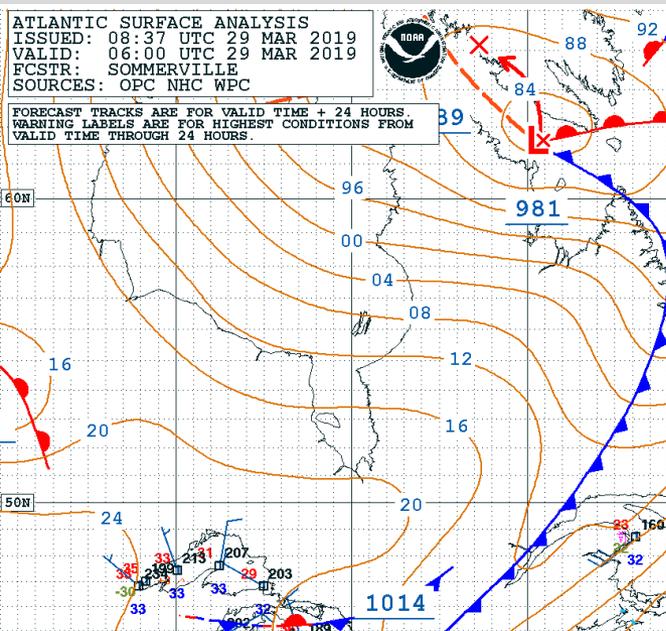
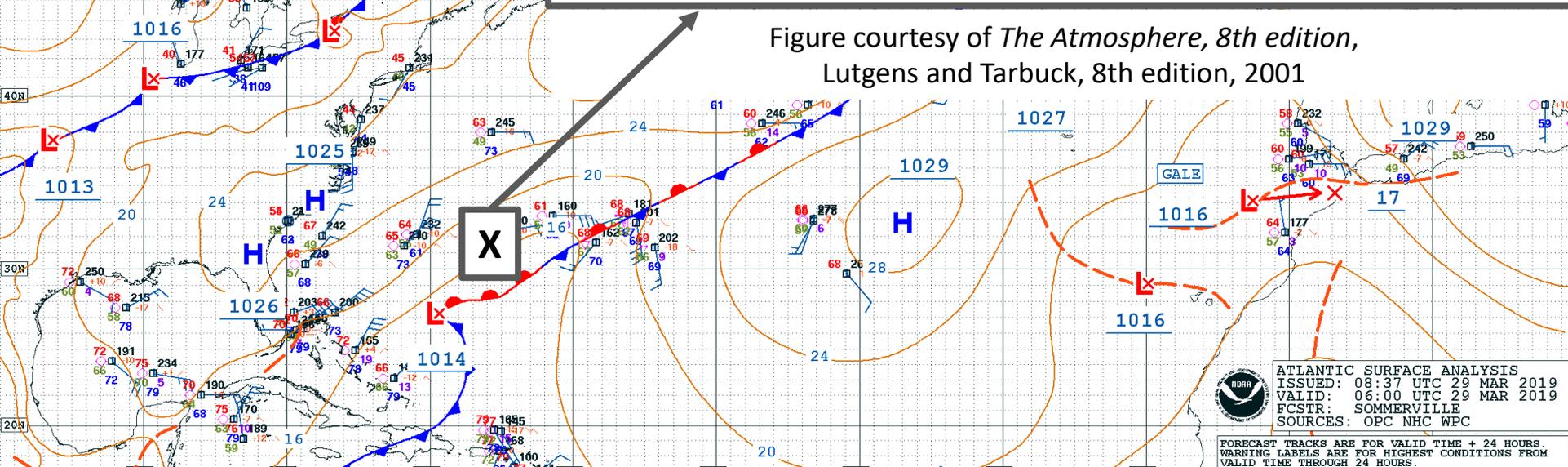
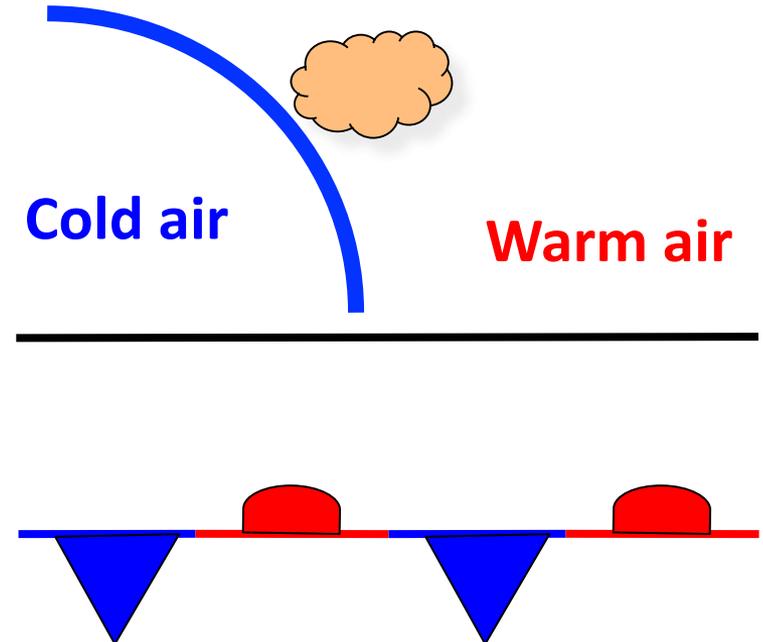
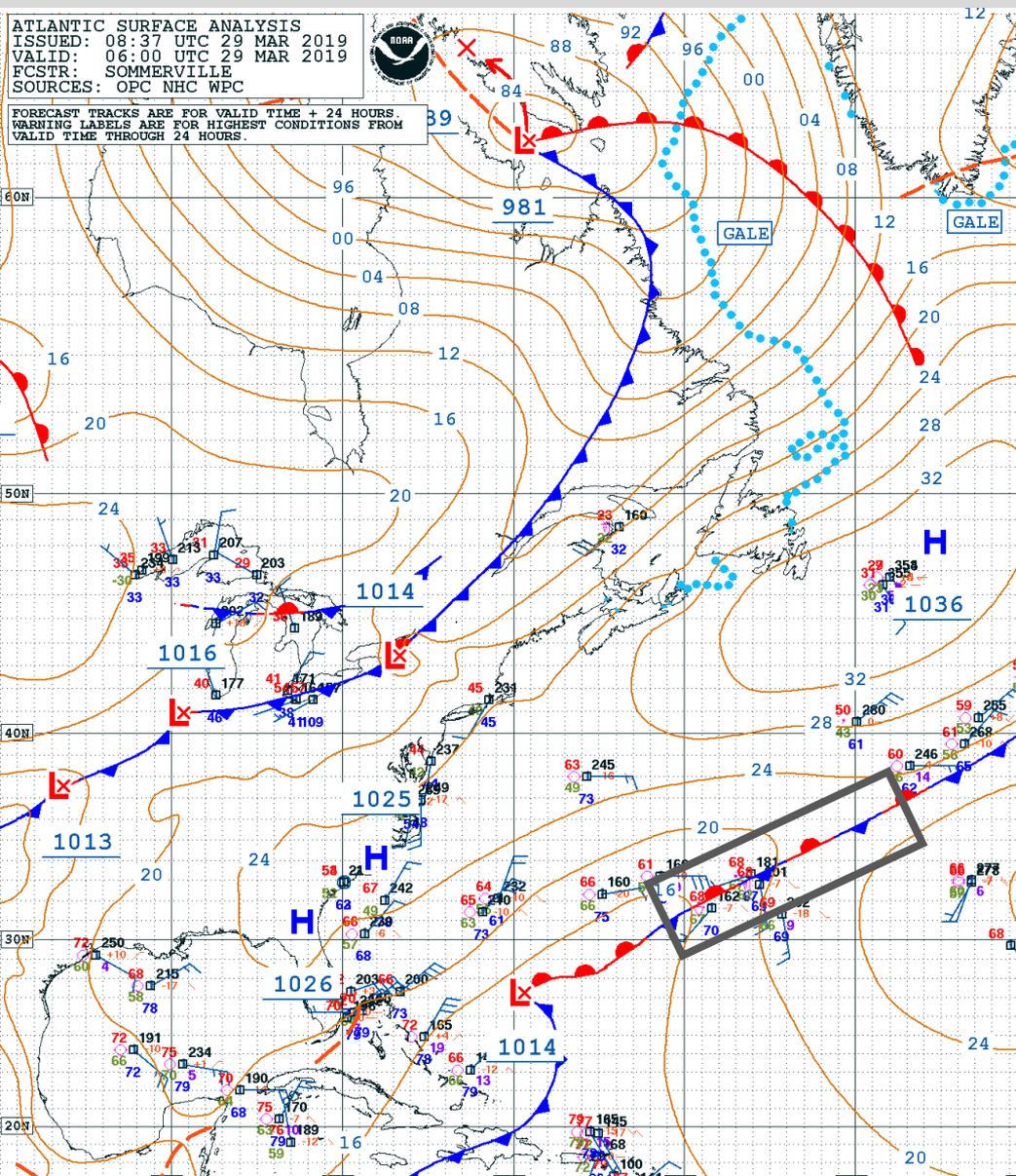


Figure courtesy of *The Atmosphere, 8th edition*, Lutgens and Tarbuck, 8th edition, 2001



# 3 types of **Low** pressure systems:

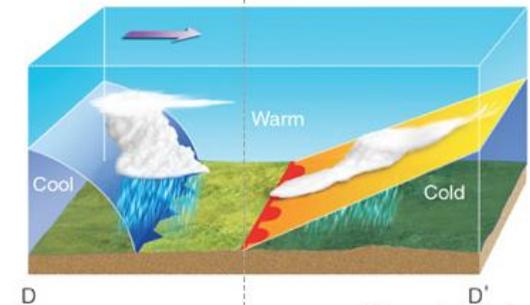
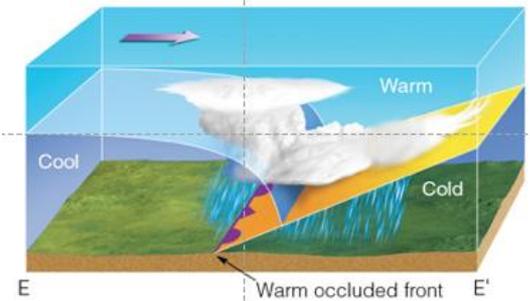
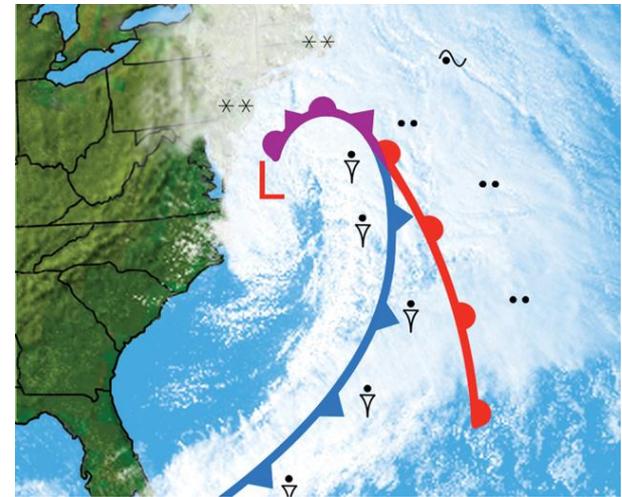
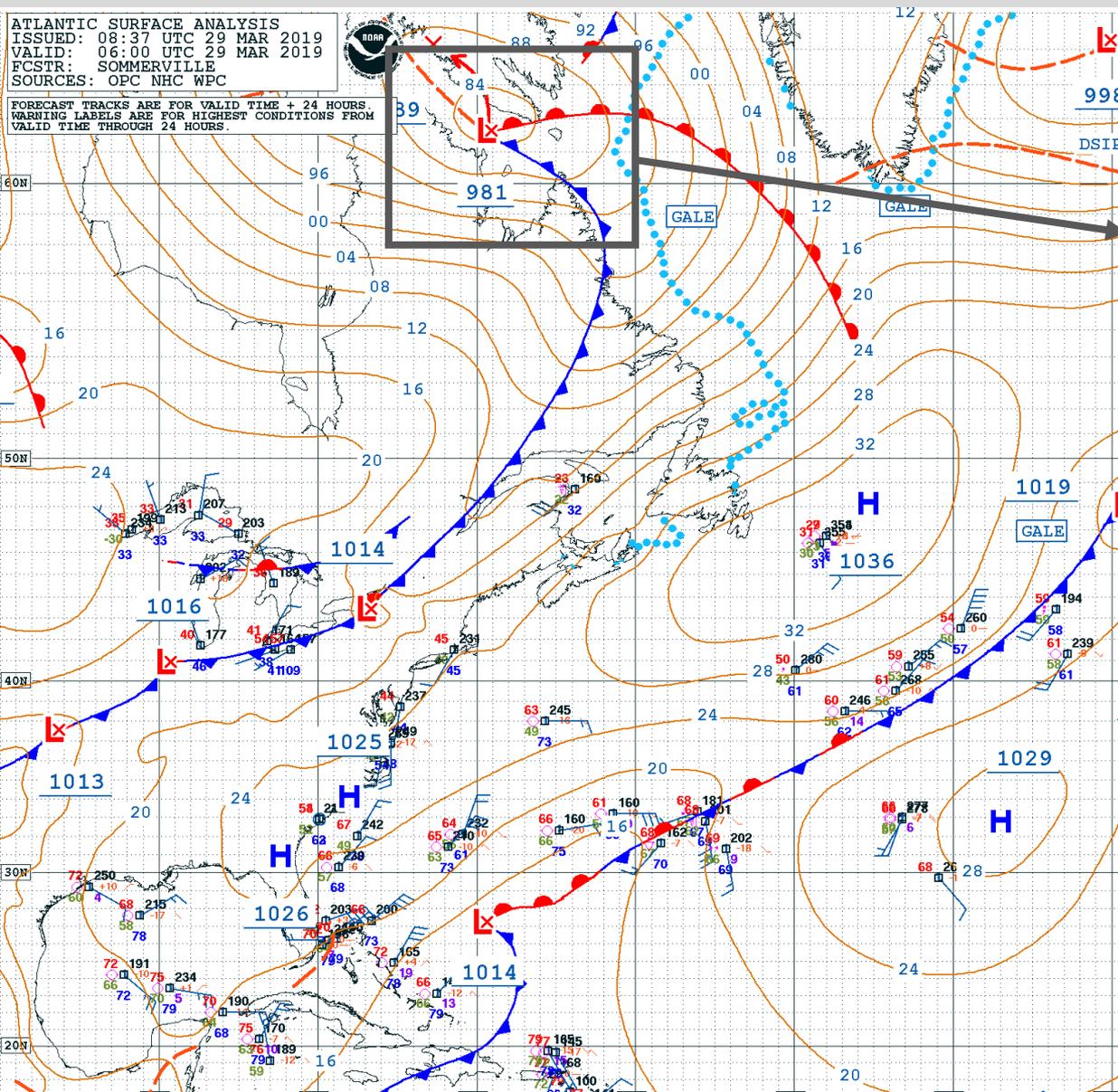
## 1. *Mid-latitude Low – stationary front*



- Clouds will vary
- Precipitation intensity will vary

# 3 types of Low pressure systems:

## 1. Mid-latitude Low – occluded front



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Figure courtesy of *Meteorology today*, 11th

# 3 types of **Low** pressure systems:

## 2. *Cut-off Lows*

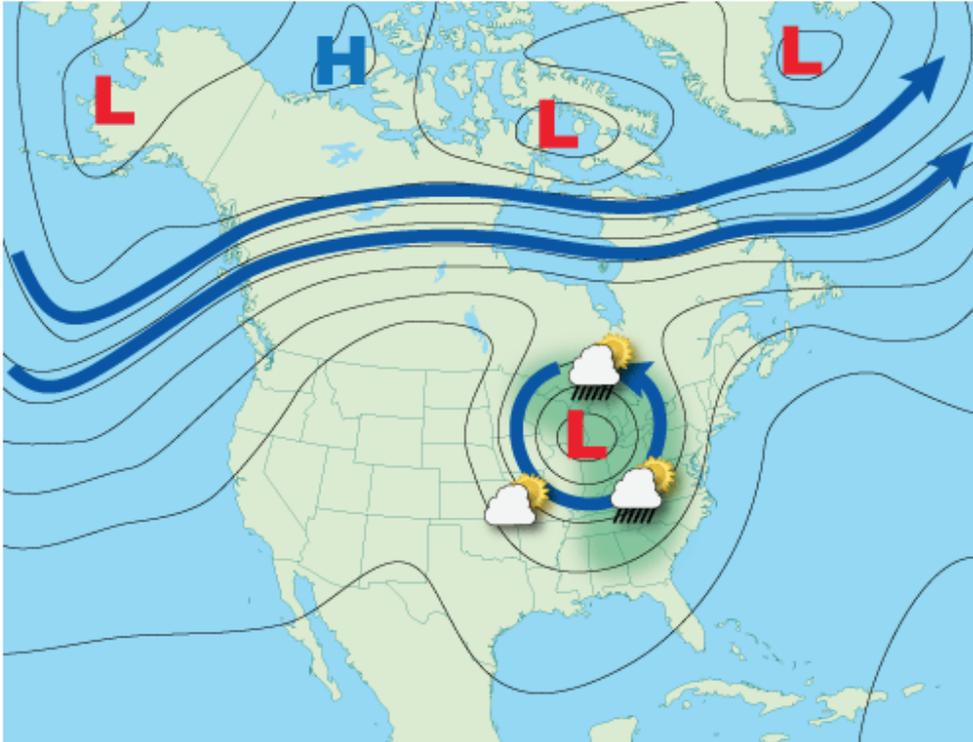


Image source: <https://www.weather.gov/jetstream/basic>, accessed 03/29/19

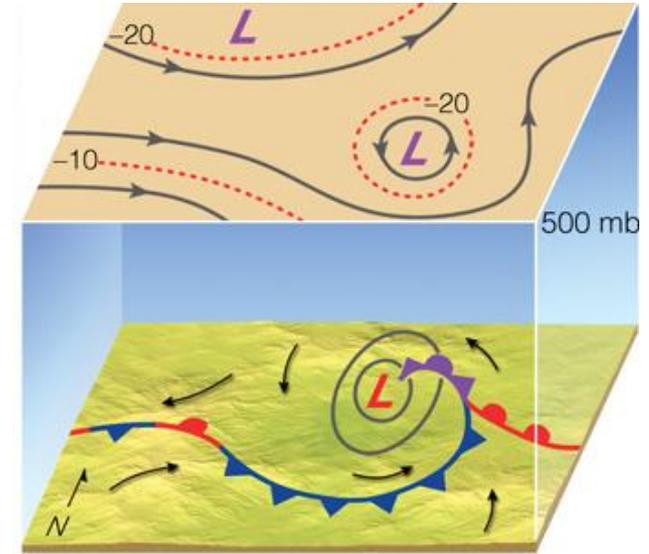
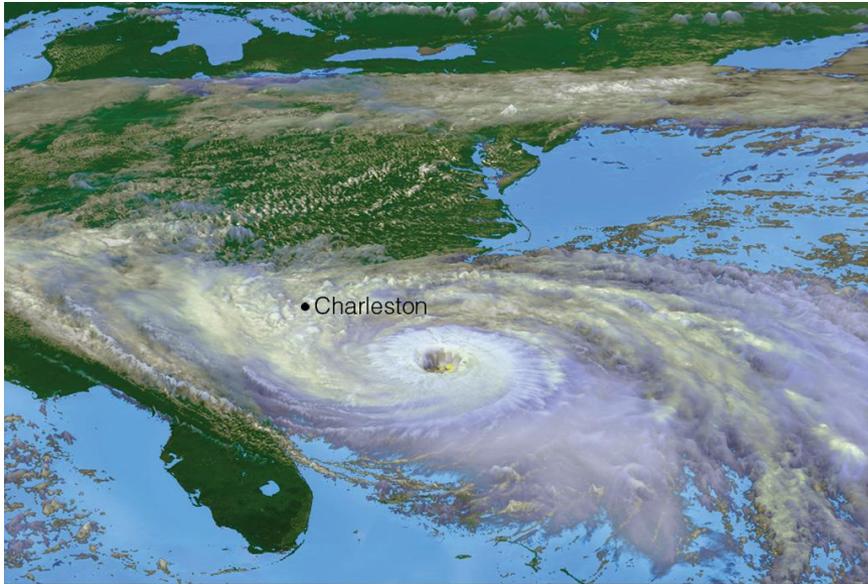


Figure courtesy of *Meteorology today, 11th edition*, Ahrens, 1st edition, 2016

- "*Cut-off low, weatherman's woe*" → move very slowly & can drift for many days
- Challenging to forecast
- Unsettled weather in east and northward quadrants of the low

# 3 types of **Low** pressure systems:

## 3. *Tropical Lows – cyclones/hurricanes*



NOAA/National Weather Service

- Storms fueled by warm tropical waters
  - Hurricanes are really tropical cyclones
  - Atlantic hurricane season is June 1<sup>st</sup> – Nov 30<sup>th</sup>
- Tropical storm: sustained winds 34-63 knts
- Hurricane: sustained winds > 64 knts

# 3 types of Low pressure systems:

## 3. Tropical Lows – cyclones/hurricanes

### Saffir-Simpson Hurricane Wind Scale

[Climatology](#) | [Names](#) | [Wind Scale](#) | [Extremes](#) | [Models](#) | [Breakpoints](#)

The Saffir-Simpson Hurricane Wind Scale is a 1 to 5 rating based on a hurricane's sustained wind speed. This scale estimates potential property damage. Hurricanes reaching Category 3 and higher are considered major hurricanes because of their potential for significant loss of life and damage. Category 1 and 2 storms are still dangerous, however, and require preventative measures. In the western North Pacific, the term "super typhoon" is used for tropical cyclones with sustained winds exceeding 150 mph.

#### Category Sustained Winds

1	74-95 mph 64-82 kt 119-153 km/h
2	96-110 mph 83-95 kt 154-177 km/h
3 (major)	111-129 mph 96-112 kt 178-208 km/h
4 (major)	130-156 mph 113-136 kt 209-251 km/h
5 (major)	157 mph or higher 137 kt or higher 252 km/h or higher

#### Types of Damage Due to Hurricane Winds

**Very dangerous winds will produce some damage:** Well-constructed frame homes could have damage to roof, shingles, vinyl siding and gutters. Large branches of trees will snap and shallowly rooted trees may be toppled. Extensive damage to power lines and poles likely will result in power outages that could last a few to several days.

**Extremely dangerous winds will cause extensive damage:** Well-constructed frame homes could sustain major roof and siding damage. Many shallowly rooted trees will be snapped or uprooted and block numerous roads. Near-total power loss is expected with outages that could last from several days to weeks.

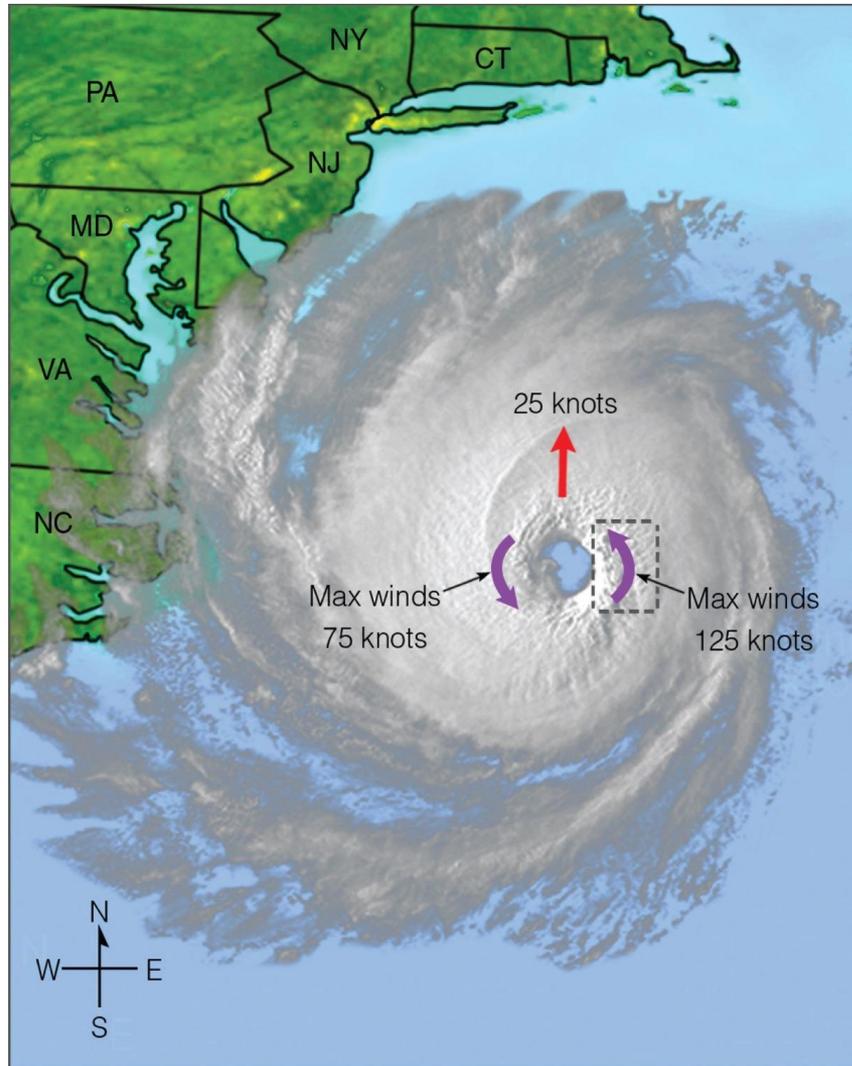
**Devastating damage will occur:** Well-built framed homes may incur major damage or removal of roof decking and gable ends. Many trees will be snapped or uprooted, blocking numerous roads. Electricity and water will be unavailable for several days to weeks after the storm passes.

**Catastrophic damage will occur:** Well-built framed homes can sustain severe damage with loss of most of the roof structure and/or some exterior walls. Most trees will be snapped or uprooted and power poles downed. Fallen trees and power poles will isolate residential areas. Power outages will last weeks to possibly months. Most of the area will be uninhabitable for weeks or months.

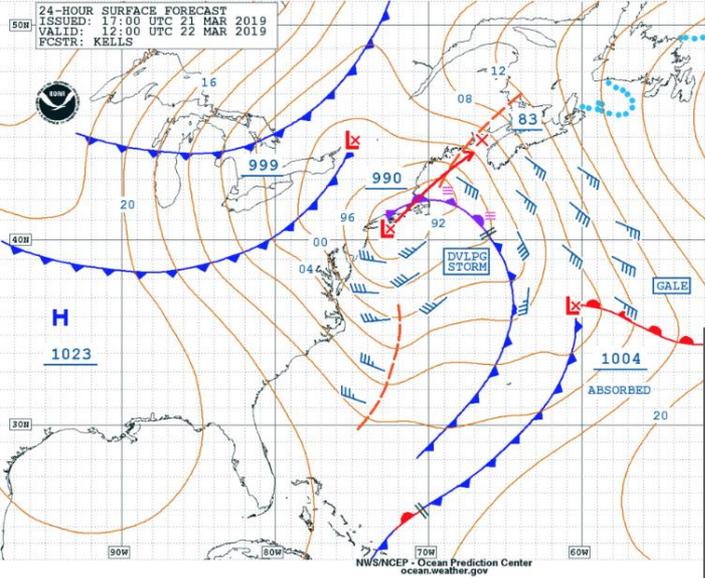
**Catastrophic damage will occur:** A high percentage of framed homes will be destroyed, with total roof failure and wall collapse. Fallen trees and power poles will isolate residential areas. Power outages will last for weeks to possibly months. Most of the area will be uninhabitable for weeks or months.

# 3 types of **Low** pressure systems:

## 3. *Tropical Lows – cyclones/hurricanes*



- Storms fueled by warm tropical waters
  - Hurricanes are really tropical cyclones
  - Atlantic hurricane season is June 1<sup>st</sup> – Nov 30<sup>th</sup>
- Tropical storm: sustained winds 34-63 knts  
→ Hurricane: sustained winds > 64 knts
- Maximum wind speeds found in front right quadrant of tropical cyclone
    - sustained wind + forward movement of storm

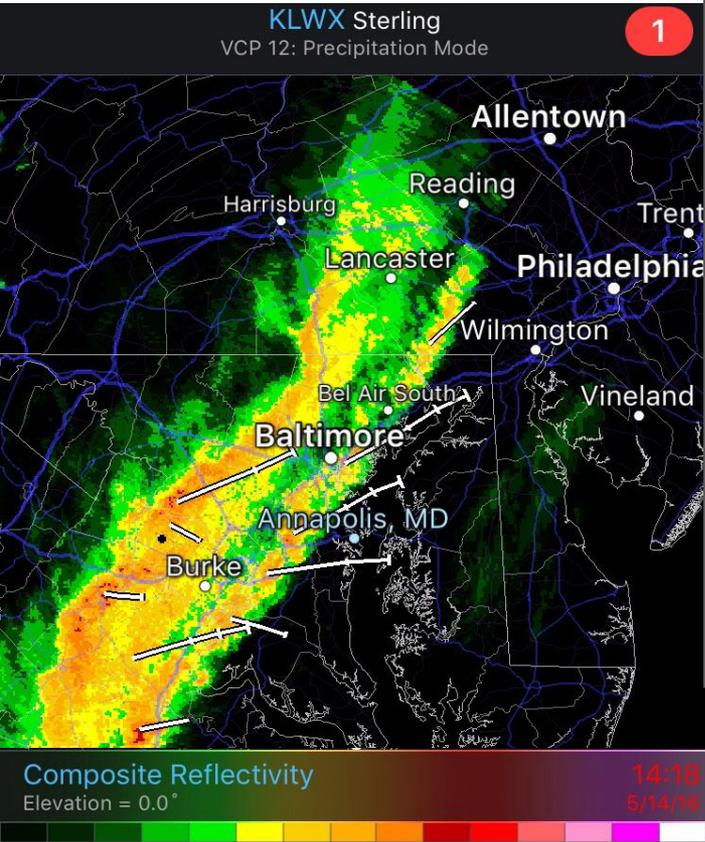


# Weather Basics

Safety at Sea Seminar, 30<sup>th</sup> March 2019

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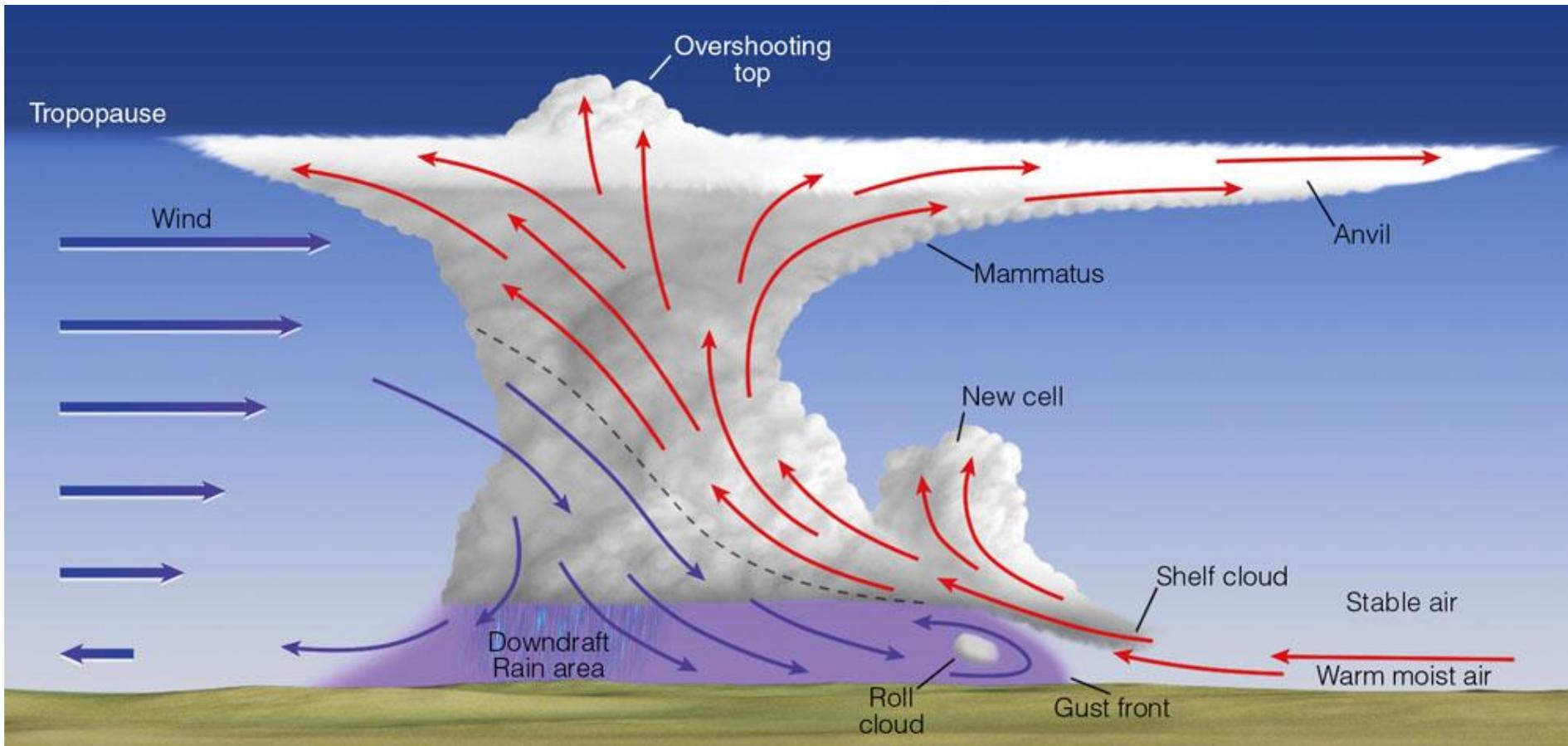
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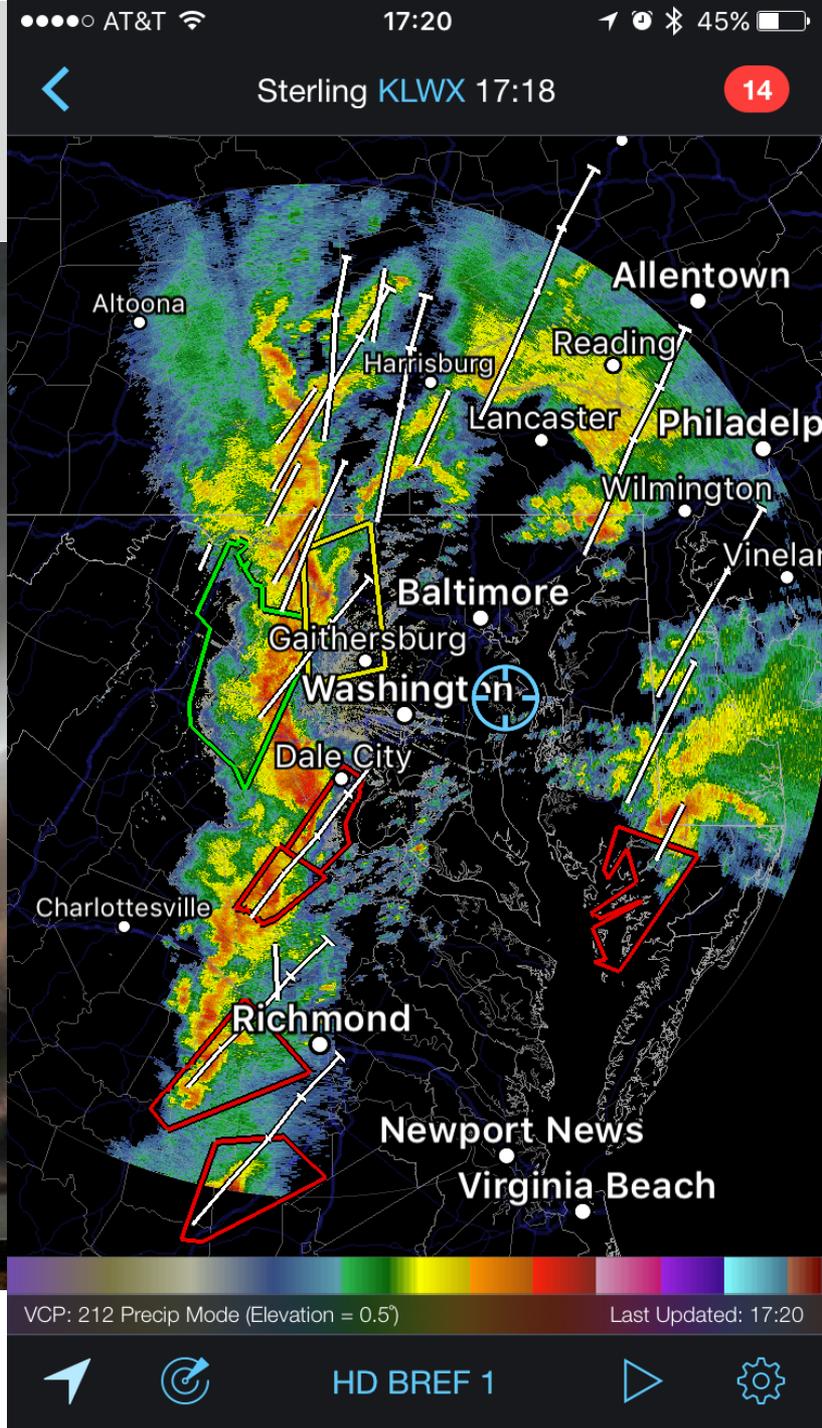
# Extreme weather on the Bay

## 4 main types of thunderstorms

1. **Airmass** → away from frontal boundary
  - driven by intense surface heating, rarely produces hail/tornadoes
2. **Squall line** → a line of storms, often along a frontal boundary
  - Associated with heavy precipitation, winds and potentially hail/tornadoes



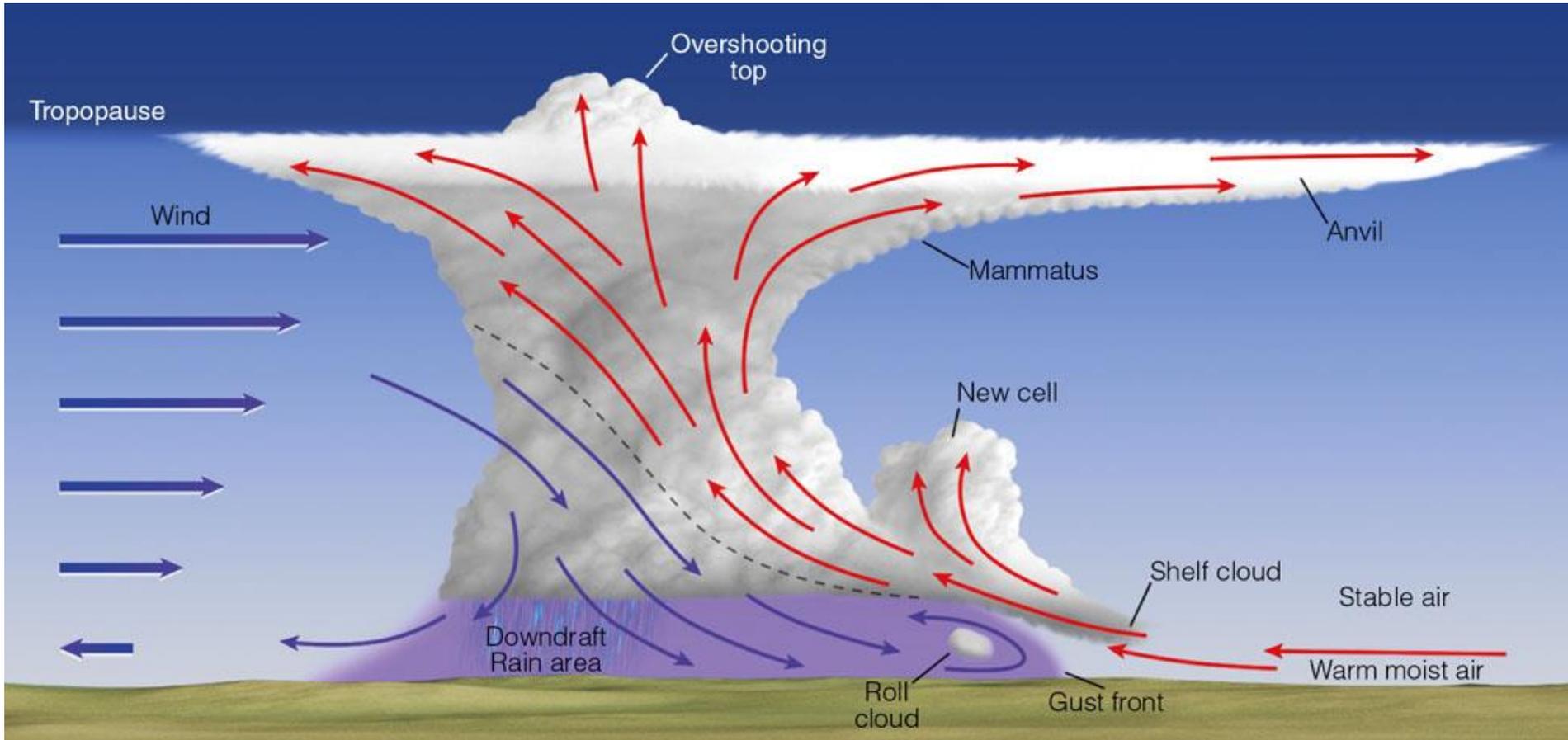
# Squall Lines... a line of thunderstorms



# Extreme weather on the Bay

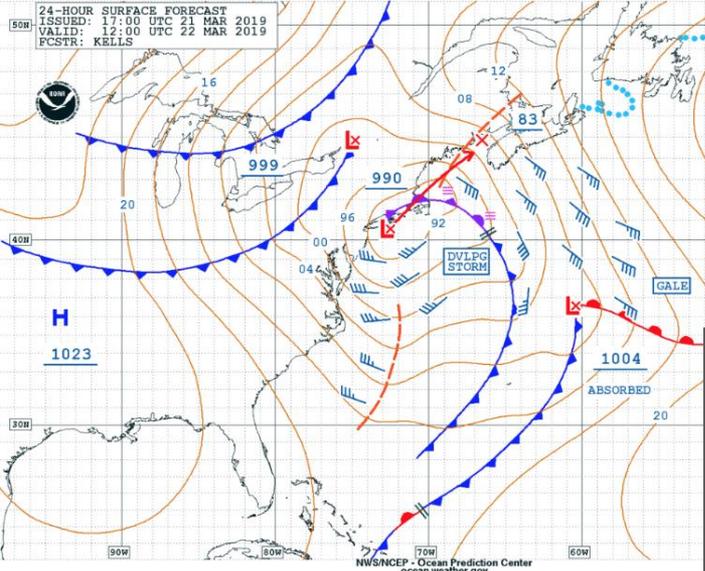
## 4 main types of thunderstorms

3. **Multi-cell** → storms occur in clusters
  - Most common in spring/summer
4. **Supercell** → most intense and severe
  - Supercell thunderstorm updrafts **ALWAYS** rotate





**Supercell thunderstorm with anvil top**



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# Weather products from NOAA Ocean Prediction Center (<http://www.opc.ncep.noaa.gov/>)

The screenshot shows the NOAA Ocean Prediction Center website. The browser address bar displays <https://ocean.weather.gov>. The website header includes the NOAA logo, the text "OCEAN PREDICTION CENTER NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION", and navigation links for Home, Mobile Site, RSS, Local Forecast, and a search bar. A main navigation menu contains "ANALYSIS & FORECAST", "DATA", "INFORMATION", "NEWS", and "SEARCH". A dropdown menu is open under "ANALYSIS & FORECAST", listing various product categories: Weather, Alaska/Arctic Products, Atlantic Products (highlighted with a blue box), Pacific Products, Briefing Pages, Digital Forecast Data, Graphical Product Loops, Other NWS Marine Forecasts, Multinational Text Products, Special Support, Unified Surface Analysis, Ocean, Ocean Products, Ice & Icebergs, NIC Ice Products, NAIS Iceberg Analysis, NAIS Weekly Outlook (pdf), Other Hazards, and Volcanic Ash Information. A red-bordered warning box states: "noaa.gov permanently redirects to https://ocean.weather.gov. On or after July 9, 2019 the old URL will not work. Use the OPC website. More information is available at https://www.weather.gov/media/notification/scn19-". The main content area features a weather map of the North Pacific and North Atlantic regions, showing pressure contours (1000, 1008, 1012, 1016, 1020, 1024) and high (H) and low (L) pressure systems. A sidebar on the right contains a list of product categories: Weather, Ice & Icebergs, Ocean, Observations, Digital Forecasts, and Model Guidance. A small satellite-style weather map is visible at the bottom left of the main content area.

# Weather products from NOAA Ocean Prediction Center (<http://www.opc.ncep.noaa.gov/>)

Ocean Prediction Center - Atl... x +

← → ↻ [https://ocean.weather.gov/Atl\\_tab.shtml](https://ocean.weather.gov/Atl_tab.shtml)

Home Mobile Site RSS Local Forecast Enter City, St or ZIP code Go

  **OCEAN PREDICTION CENTER**  
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

ANALYSIS & FORECAST DATA INFORMATION NEWS SEARCH

The legacy OPC website URL <https://www.opc.ncep.noaa.gov> permanently redirects to <https://ocean.weather.gov>. On or after July 9, 2019 the old URL will not work. Users must use <https://ocean.weather.gov> to access the OPC website. More information is available at [https://www.weather.gov/media/notification/scn19-10opc\\_terminate.pdf](https://www.weather.gov/media/notification/scn19-10opc_terminate.pdf).

PLEASE NOTE: This .shtml webpage is going to be converted to .php format on June 4, 2019. On that date you will need to replace ".shtml" with ".php" in the URL address bar. The actual page content will remain the same. More information is available at [https://www.weather.gov/media/notification/scn19-11opc\\_shtml.pdf](https://www.weather.gov/media/notification/scn19-11opc_shtml.pdf).

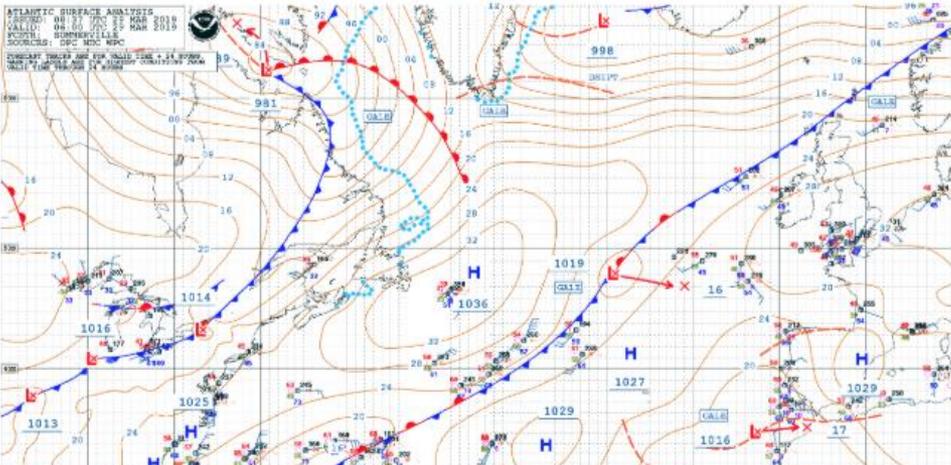
**Atlantic Weather** Pacific Weather Alaska/Arctic Weather

Analysis – Graphical Forecasts – Text Forecasts – Iceberg Analysis/Outlook – Hazards – Gridded – Other Marine

## Atlantic Analysis

Click on the map below or choose from:

W Atlantic Full Atlantic E Atlantic



ATLANTIC SURFACE ANALYSIS  
ISSUED: 04 27 2019 13 MAR 2019  
VALID: 04 28 2019 00 MAR 2019  
PFCM: WINDMIRELLS  
SOURCE: OPC MFC MFC

CHARTER THREE AND FOUR VALID TIME 14 0000Z  
DATE 14 MAR 2019 14 0000Z

The map displays a detailed surface analysis of the Atlantic Ocean. It features isobars (lines of equal pressure) and isotherms (lines of equal temperature). High-pressure systems (marked with 'H') and low-pressure systems (marked with 'L') are clearly visible. Frontal boundaries, including cold fronts (marked with blue triangles) and warm fronts (marked with red triangles), are shown. Wind vectors are represented by blue arrows, and wind speed is indicated by the length of the arrows. The map covers the area from approximately 100°W to 0°W and 20°N to 60°N.

# Weather products from NOAA Ocean Prediction Center (<http://www.opc.ncep.noaa.gov/>)

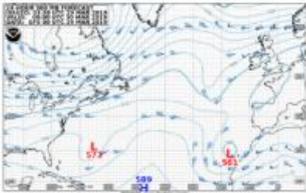
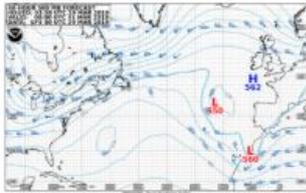
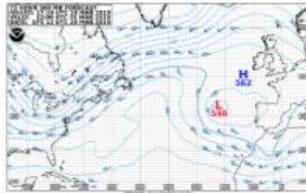
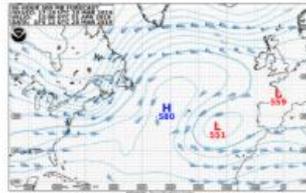
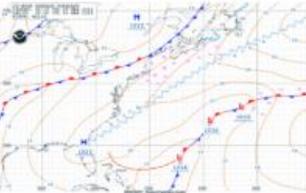
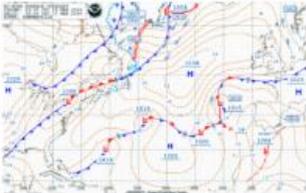
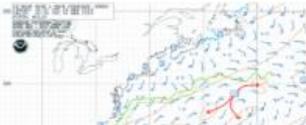
Ocean Prediction Center - Atl... x +

https://ocean.weather.gov/Atl\_tab.shtml

Home Mobile Site RSS Local Forecast Enter City, St or ZIP code Go

## OCEAN PREDICTION CENTER

### Atlantic Graphical Forecasts

			
<b>24-hour 500 mb</b> Loop: [3] [7] [14] Days Updated: Fri, 29-Mar-2019 04:00:18 UTC <a href="#">More 500 MB images</a>	<b>48-hour 500 mb</b> Loop: [3] [7] [14] Days Updated: Fri, 29-Mar-2019 04:02:31 UTC <a href="#">More 500 MB images</a>	<b>72-hour 500 mb</b> Loop: [3] [7] [14] Days Updated: Thu, 28-Mar-2019 17:27:49 UTC <a href="#">More 500 MB images</a>	<b>96-hour 500 mb</b> Loop: [3] [7] [14] Days Updated: Thu, 28-Mar-2019 17:29:12 UTC <a href="#">More 500 MB images</a>
			
<b>24-hour surface</b> Loop: [3] [7] [14] Days Updated: Fri, 29-Mar-2019 04:14:08 UTC	<b>48-hour surface</b> Loop: [3] [7] [14] Days Updated: Fri, 29-Mar-2019 05:01:10 UTC	<b>72-hour surface</b> Loop: [3] [7] [14] Days Updated: Thu, 28-Mar-2019 17:31:02 UTC	<b>96-hour surface</b> Loop: [3] [7] [14] Days Updated: Thu, 28-Mar-2019 13:25:30 UTC
			

SEARCH

URL will not work.  
cn19-

mp" in the URL  
\_.shtml.pdf.

# How do I interpret all the symbols & notation?

Ocean Prediction Center - Atl x +

https://ocean.weather.gov/Atl\_tab.shtml

Home Mobile Site RSS Local Forecast Enter City, St or ZIP code Go

**OCEAN PREDICTION CENTER**  
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

ANALYSIS & FORECAST DATA INFORMATION NEWS SEARCH

The legacy OPC website URL <https://www.opc.noaa.gov/>. Users must use <https://ocean.weather.gov> to access the new website. For more information, see [10opc\\_terminate.pdf](#).

PLEASE NOTE: This .shtml webpage is going to be replaced by a .php webpage at that date you will need to replace ".shtml" with ".php" in the URL. The actual page content will remain the same.

Alaska/Arctic Weather

Product Information

- Base Maps - Atlantic
- Base Maps - Pacific
- Marine Weather Sites
- Product Guides**
- Quality Control

Receiving Products

- Digital Forecast Data
- FTPMail: Products via Email
- Radiofax Schedules
- Text Broadcast Schedules

About OPC

- Accomplishments
- Contact OPC
- General Overview
- Get to Know OPC - our professionals
- Informational Flyer (pdf)
- Informational Pamphlet (pdf)
- Publications
- Staff
- Strategic Plan
- User Training
- Virtual Tour

W Atlantic

ATLANTIC SURFACE ANALYSIS  
FACSIMILE: 08:37 UTC 28 MAR  
VALID: 08:00 UTC 28 MAR  
FCST: 08:00 UTC 29 MAR  
FCST: 08:00 UTC 30 MAR  
SOURCE: OPC MFC MFC

E Atlantic

# How do I interpret all the symbols & notation?

The screenshot shows a web browser window with the URL [https://ocean.weather.gov/product\\_guides.shtml](https://ocean.weather.gov/product_guides.shtml). The page header includes navigation links for Home, Mobile Site, and RSS, along with a Local Forecast search box. The main header features the NOAA logo and the text "OCEAN PREDICTION CENTER NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION". Below the header is a navigation menu with links for ANALYSIS & FORECAST, DATA, INFORMATION, NEWS, and SEARCH. Two red-bordered boxes contain important notices: the first states that the legacy OPC website URL <https://www.opc.ncep.noaa.gov> permanently redirects to <https://ocean.weather.gov> as of July 9, 2019; the second notes that the .shtml webpage will be converted to .php format on June 4, 2019. The main content area is titled "Product Guides" and lists several links: Archive Information, FAQ, Glossary, Multi-national Text Products, Radio Facsimile User's Guide, Reference Publications, and Terminology & Weather Symbols Legend. The last link is highlighted with a blue box. Below this list, a section titled "More from NOAA's Voluntary Observing Ship (VOS) program:" lists two PDF links: Marine Weather Information Guide (PDF) and Marine Radiofax Chart FTP Email Procedures (PDF). The footer contains five columns of links: CURRENT CONDITIONS, MARINE FORECASTS, MARINE RESOURCES, NEWS & INFORMATION, and OPC SOCIAL MEDIA.

Product Guides

- [Archive Information](#)
- [FAQ](#)
- [Glossary](#)
- [Multi-national Text Products](#)
- [Radio Facsimile User's Guide](#)
- [Reference Publications](#)
- [Terminology & Weather Symbols Legend](#)

More from NOAA's Voluntary Observing Ship (VOS) program:

- [Marine Weather Information Guide \(PDF\)](#)
- [Marine Radiofax Chart FTP Email Procedures \(PDF\)](#)

Page loaded: 29 Mar 2019 14:32 UTC | 29 Mar 2019 10:32 Local

**CURRENT CONDITIONS**  
Marine & Buoy Reports  
Tides Online  
Surface Weather

**MARINE FORECASTS**  
Offshore & High Seas  
Tropical Marine  
Gridded Marine

**MARINE RESOURCES**  
Mariner's Weather Log  
Voluntary Observing Ships  
National Ice Center

**NEWS & INFORMATION**  
OPC News  
NWS Service Changes  
NWS News

**OPC SOCIAL MEDIA**  
Facebook  
Twitter  
YouTube

# How do I interpret all the symbols & notation?

Terminology and Weather Symbl x +

https://ocean.weather.gov/product\_description/keyterm.shtml

Home Mobile Site RSS Local Forecast Enter City, St or ZIP code Go

**OCEAN PREDICTION CENTER**  
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

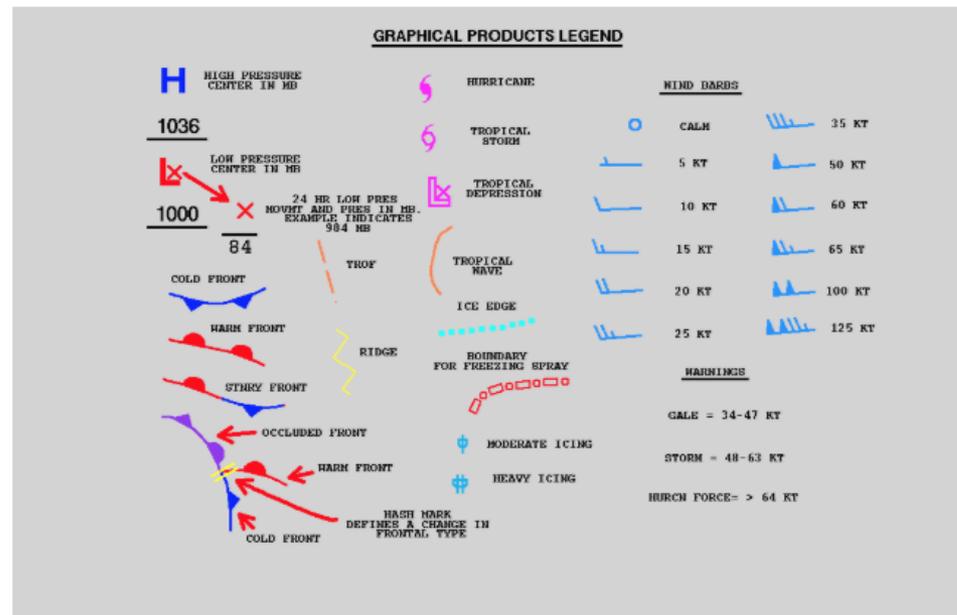
ANALYSIS & FORECAST DATA INFORMATION NEWS SEARCH

The legacy OPC website URL <https://www.opc.ncep.noaa.gov> permanently redirects to <https://ocean.weather.gov>. On or after July 9, 2019 the old URL will not work. Users must use <https://ocean.weather.gov> to access the OPC website. More information is available at [https://www.weather.gov/media/notification/scn19-10opc\\_terminate.pdf](https://www.weather.gov/media/notification/scn19-10opc_terminate.pdf).

PLEASE NOTE: This .shtml webpage is going to be converted to .php format on June 4, 2019. On that date you will need to replace ".shtml" with ".php" in the URL address bar. The actual page content will remain the same. More information is available at [https://www.weather.gov/media/notification/scn19-11opc\\_shtml.pdf](https://www.weather.gov/media/notification/scn19-11opc_shtml.pdf).

## Terminology and Weather Symbols

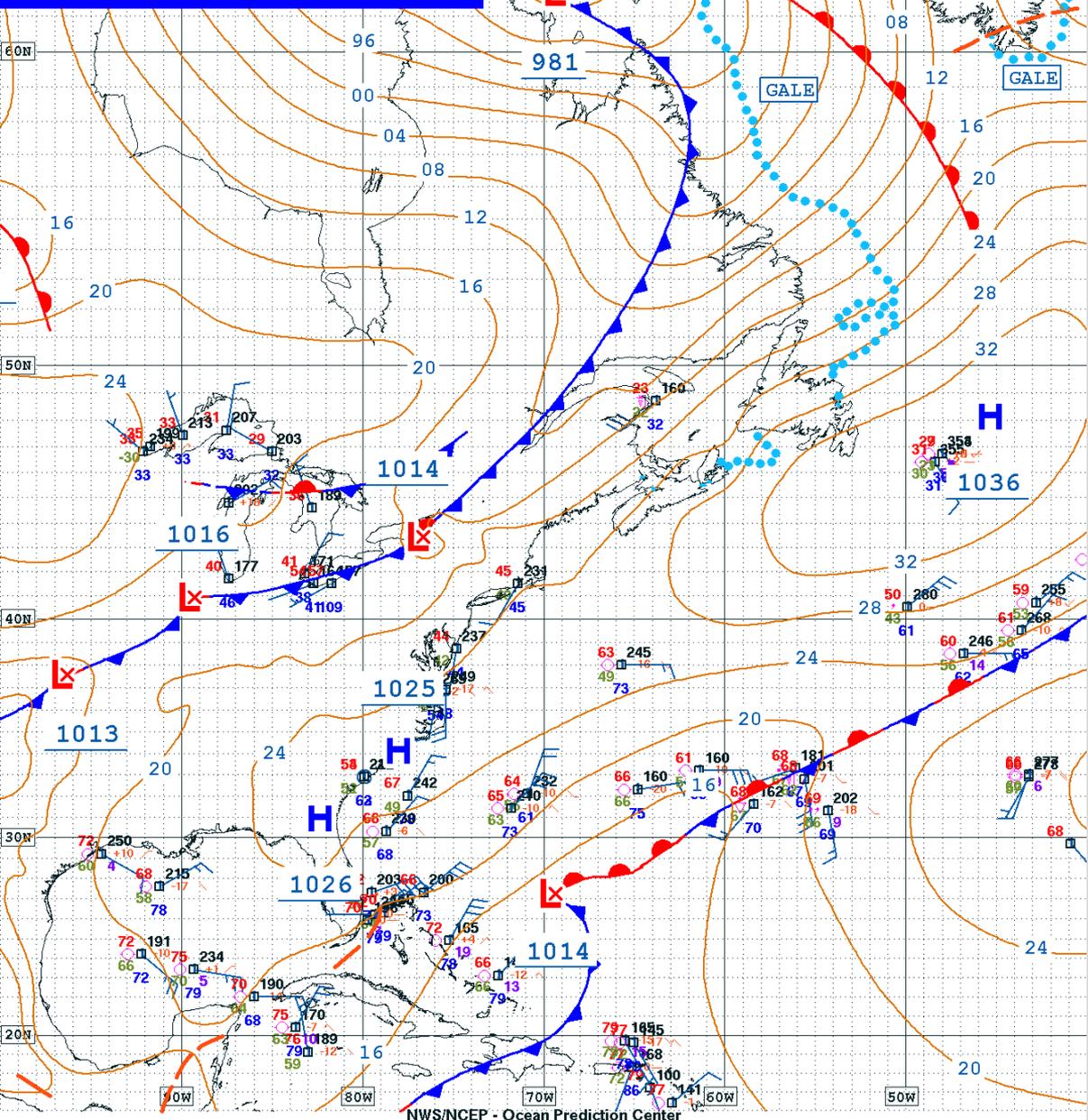
### Graphical Products Legend



ATLANTIC SURFACE ANALYSIS  
ISSUED: 08:37 UTC 29 MAR 2019  
VALID: 06:00 UTC 29 MAR 2019  
FCSTR: SOMMERVILLE  
SOURCES: OPC NHC WPC



FORECAST TRACKS ARE FOR VALID TIME + 24 HOURS.  
WARNING LABELS ARE FOR HIGHEST CONDITIONS FROM  
VALID TIME THROUGH 24 HOURS.



NWS/NCEP - Ocean Prediction Center  
ocean.weather.gov

Let us identify some features on this Surface Analysis map:

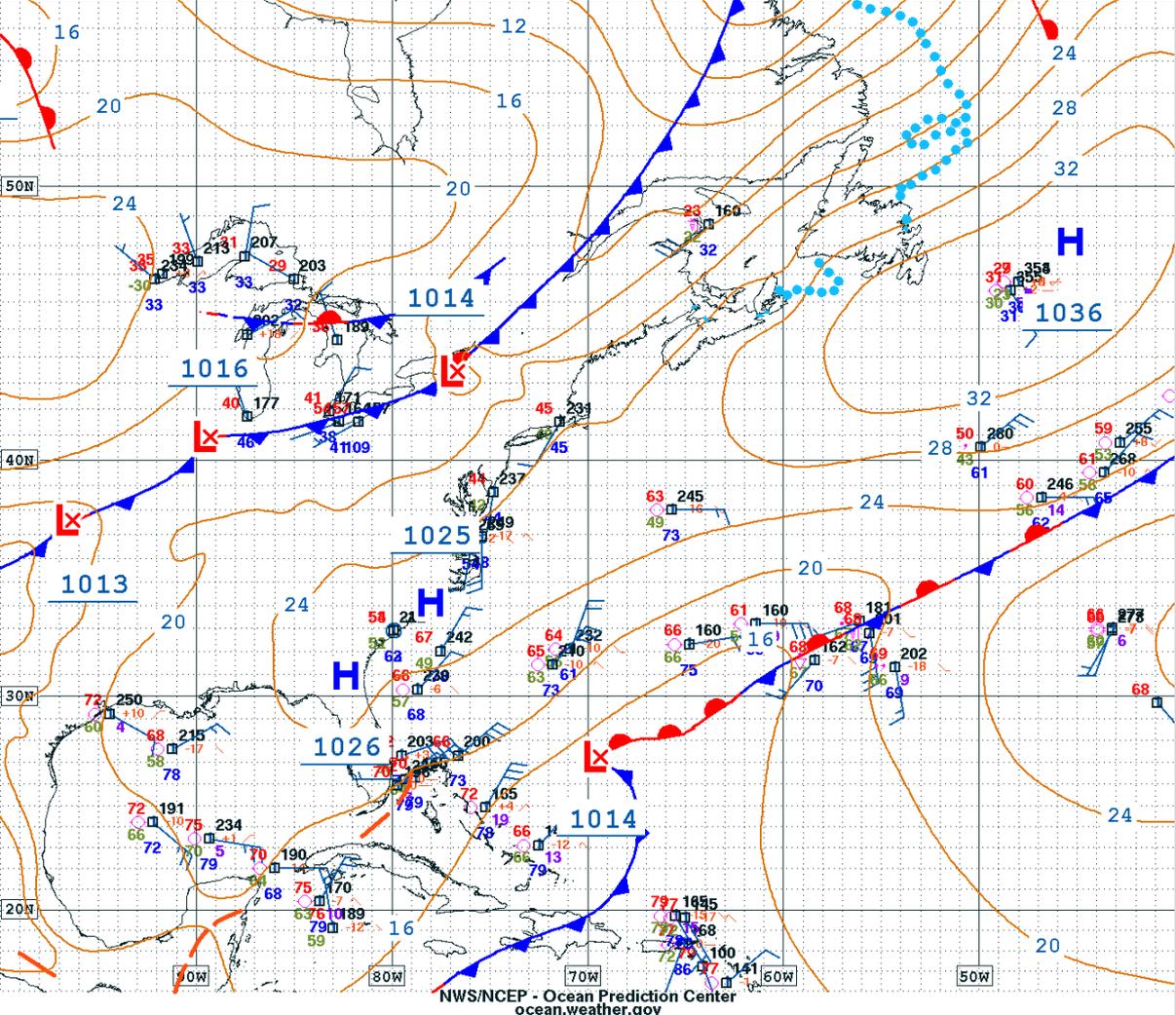
Image source:  
[www.opc.ncep.noaa.gov](http://www.opc.ncep.noaa.gov)

**ATLANTIC SURFACE ANALYSIS**  
 ISSUED: 08:37 UTC 29 MAR 2019  
 VALID: 06:00 UTC 29 MAR 2019  
 FCSTR: SOMMERVILLE  
 SOURCES: OPC NHC WPC

FORECAST TRACKS ARE FOR VALID TIME + 24 HOURS.  
 WARNING LABELS ARE FOR HIGHEST CONDITIONS FROM  
 VALID TIME THROUGH 24 HOURS.



Let us identify some features on this Surface Analysis map:



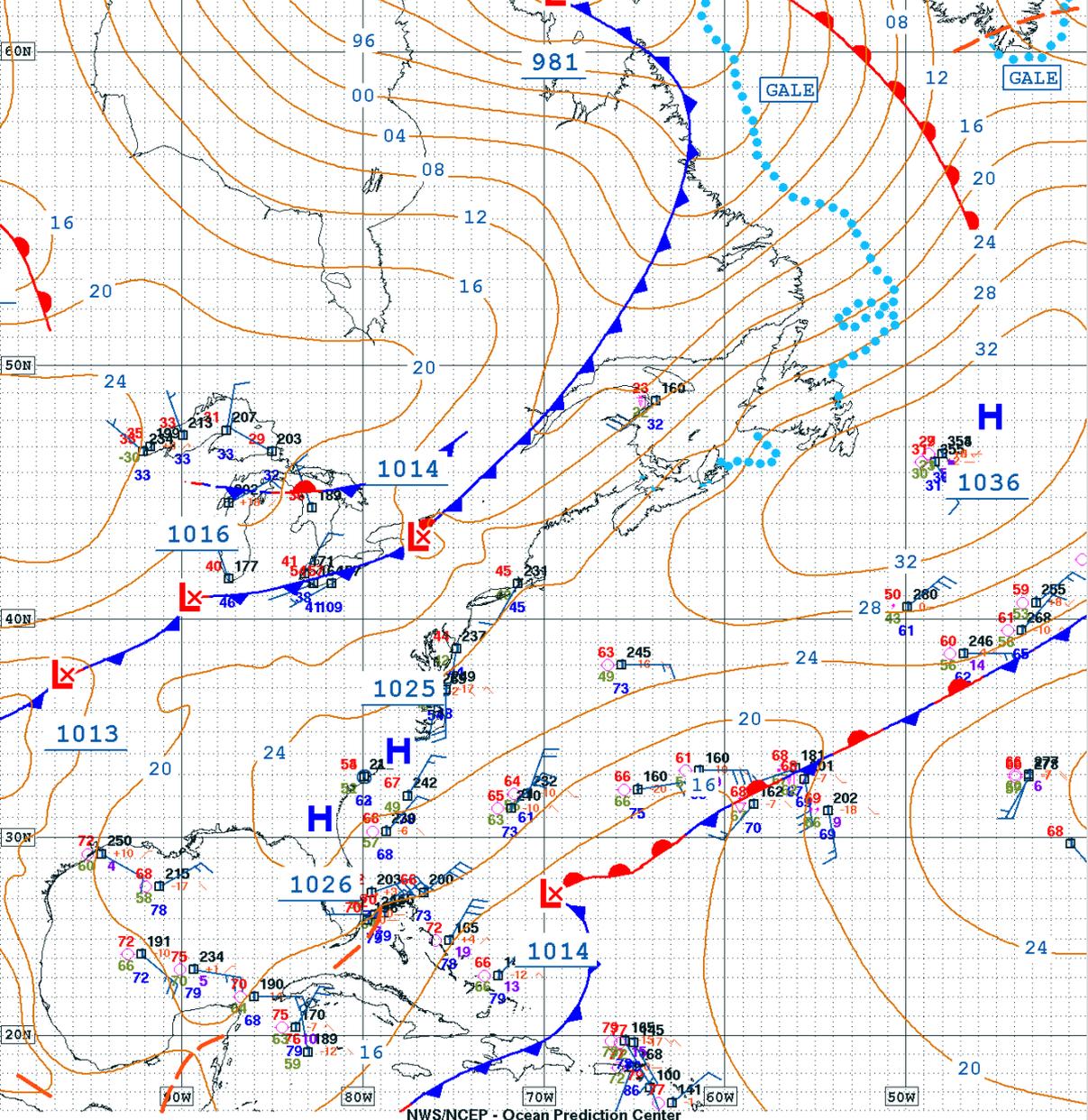
- Surface map
- “ISSUED”
  - ➔ time analysis was released
- “VALID”
  - ➔ Time conditions apply
- UTC/GMT/Zulu time

Image source:  
[www.opc.ncep.noaa.gov](http://www.opc.ncep.noaa.gov)

ATLANTIC SURFACE ANALYSIS  
ISSUED: 08:37 UTC 29 MAR 2019  
VALID: 06:00 UTC 29 MAR 2019  
FCSTR: SOMMERVILLE  
SOURCES: OPC NHC WPC



FORECAST TRACKS ARE FOR VALID TIME + 24 HOURS.  
WARNING LABELS ARE FOR HIGHEST CONDITIONS FROM  
VALID TIME THROUGH 24 HOURS.



# Let us identify some features on this Surface Analysis map:

- H vs. L surface pressure
- H vs. L relative to what?

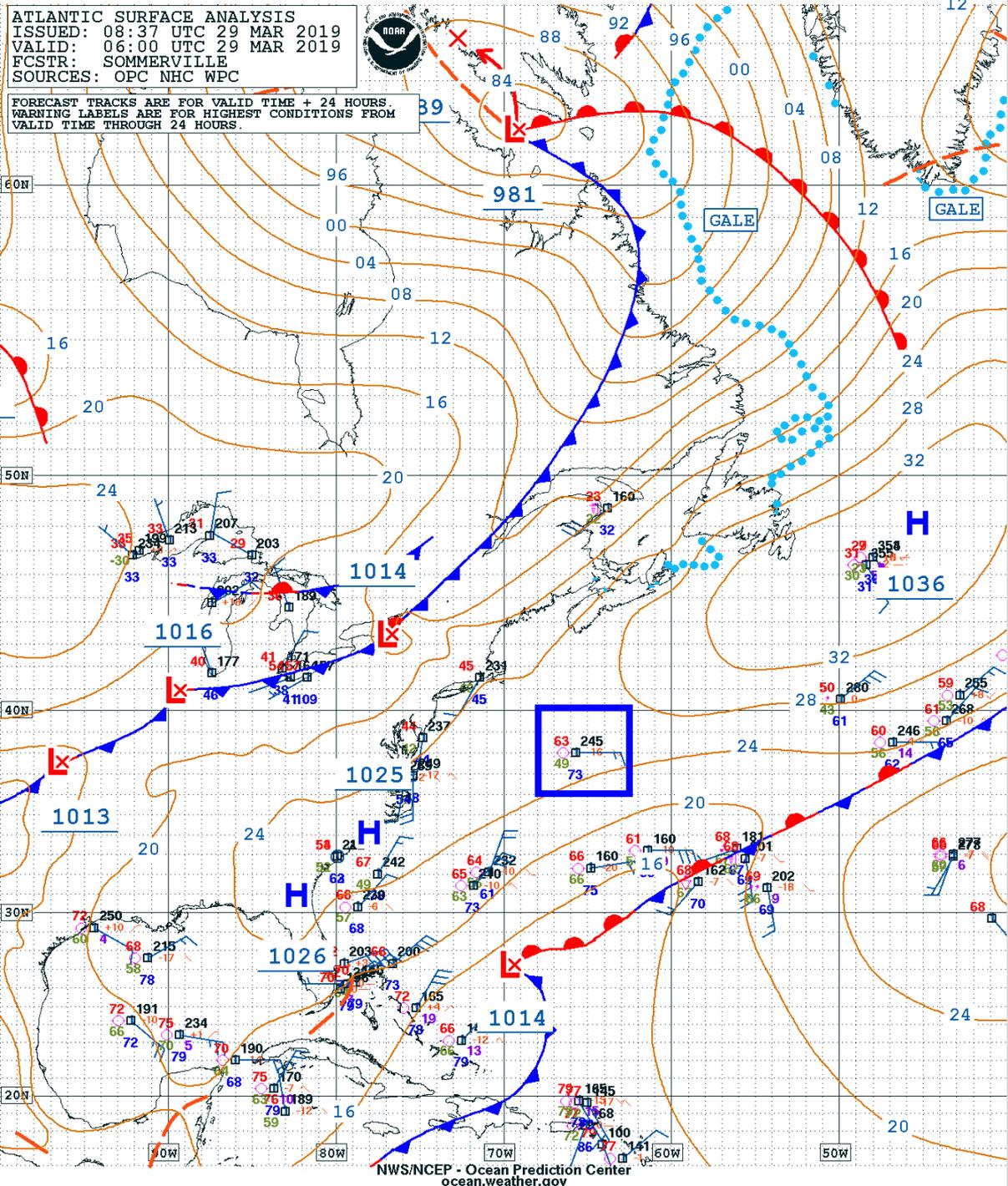
Mean sea level pressure  
→ 1013 millibars

- Pressure gradients?

Image source:  
[www.opc.ncep.noaa.gov](http://www.opc.ncep.noaa.gov)

ATLANTIC SURFACE ANALYSIS  
ISSUED: 08:37 UTC 29 MAR 2019  
VALID: 06:00 UTC 29 MAR 2019  
FCSTR: SOMMERVILLE  
SOURCES: OPC NHC WPC

FORECAST TRACKS ARE FOR VALID TIME + 24 HOURS.  
WARNING LABELS ARE FOR HIGHEST CONDITIONS FROM  
VALID TIME THROUGH 24 HOURS.



# Let us identify some features on this Surface Analysis map:

- Interpreting a station model

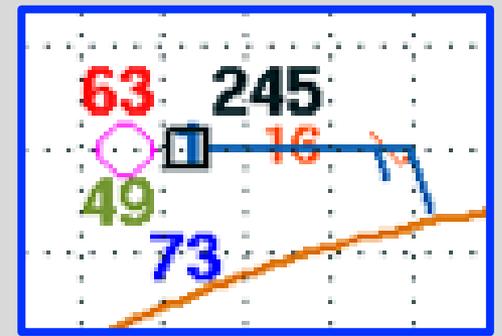
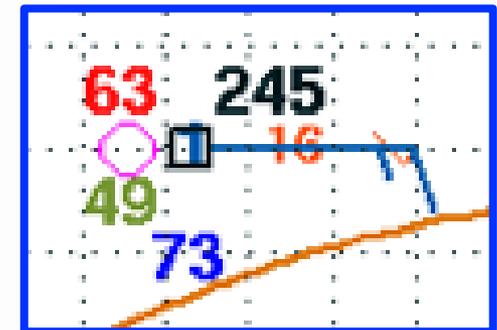
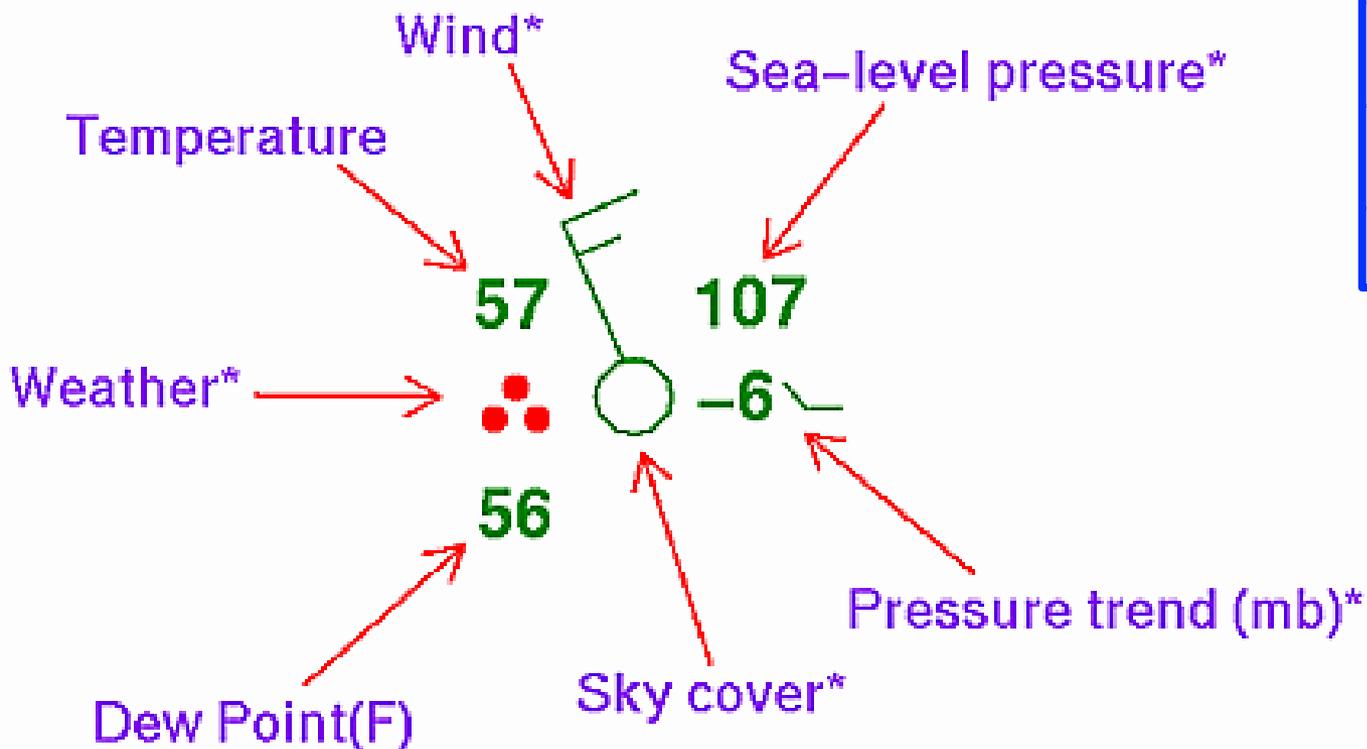


Image source:  
[www.opc.ncep.noaa.gov](http://www.opc.ncep.noaa.gov)

# Interpreting a station model: What information are we given?

Image source:

<http://www.wpc.ncep.noaa.gov/html/stationplot.shtml>

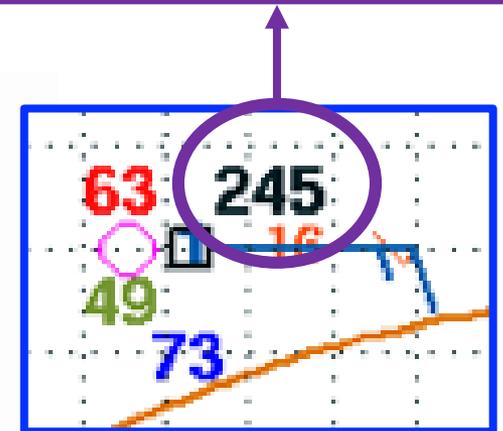
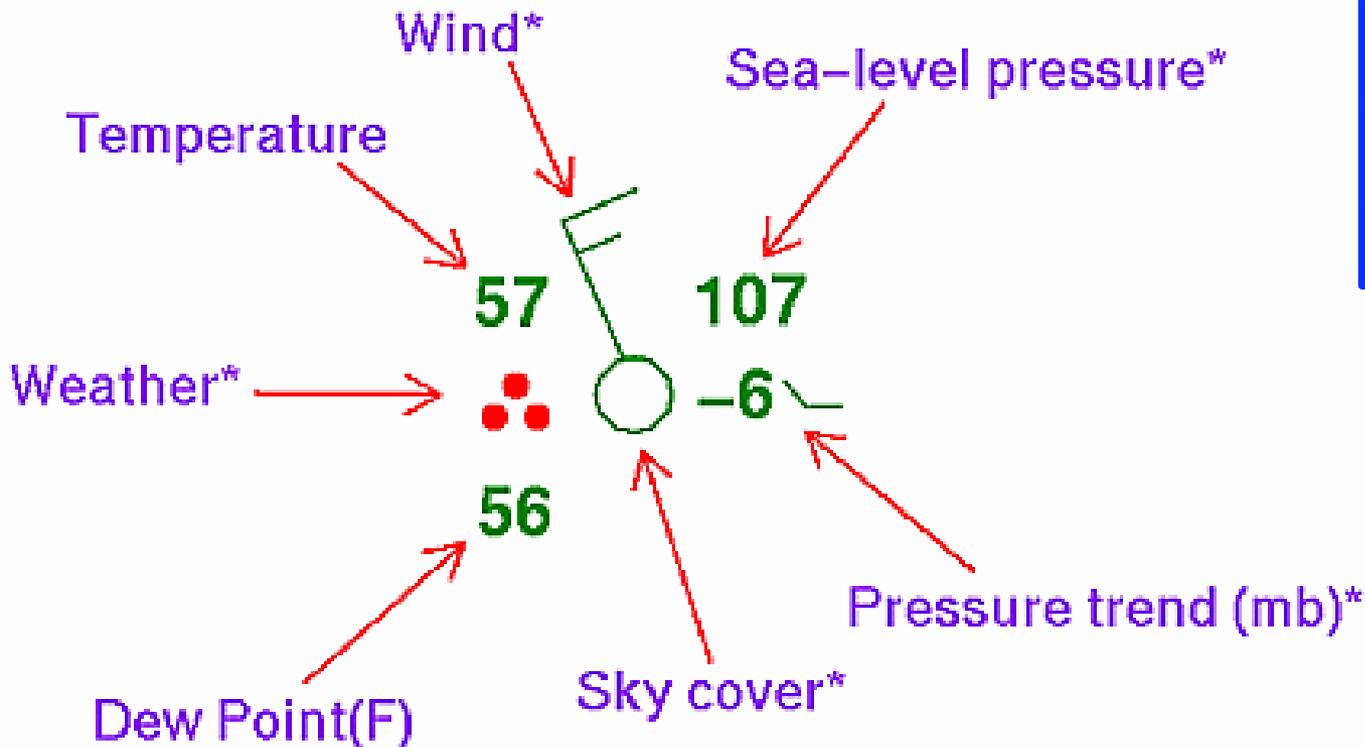


# Interpreting a station model: What information are we given?

*Pressure range is 960 mb to 1060 mb.... Add 9 or 10 to front of number*

Image source:

<http://www.wpc.ncep.noaa.gov/html/stationplot.shtml>



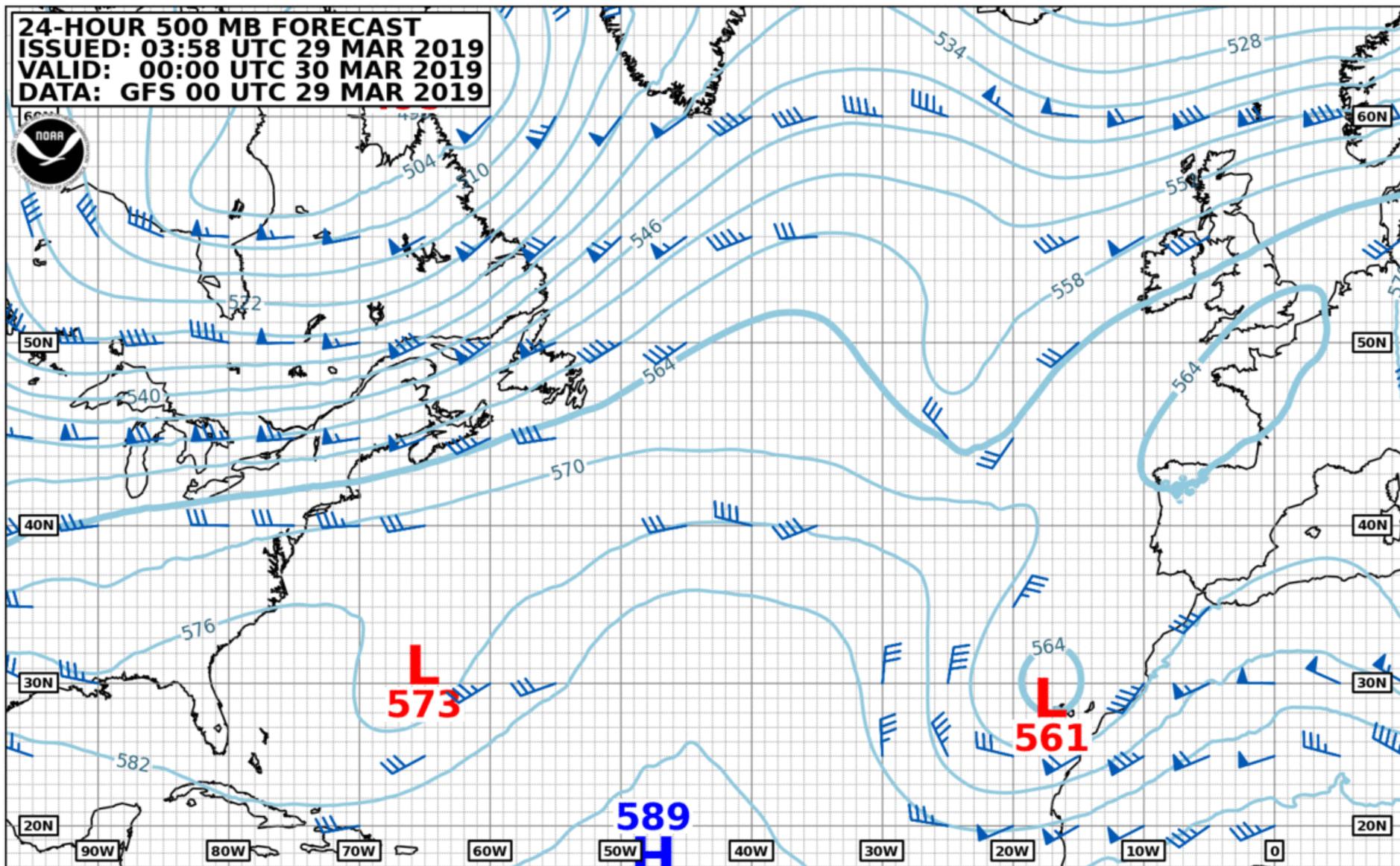
**How do we forecast where surface  
systems will move?**

**Look UP!**

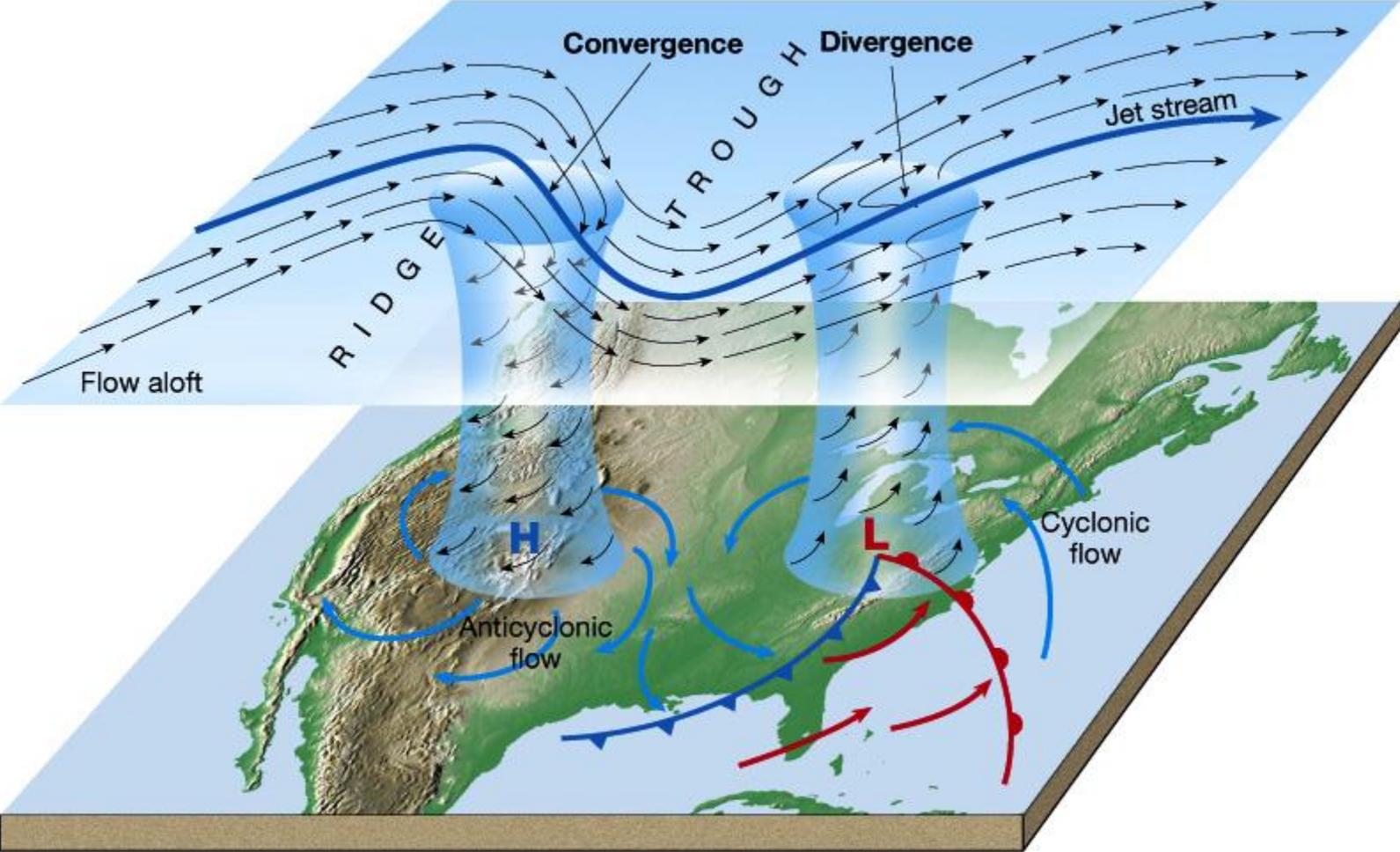


# 500mb Chart: forecast

-- Gives us the height where we reach 500mb of pressure



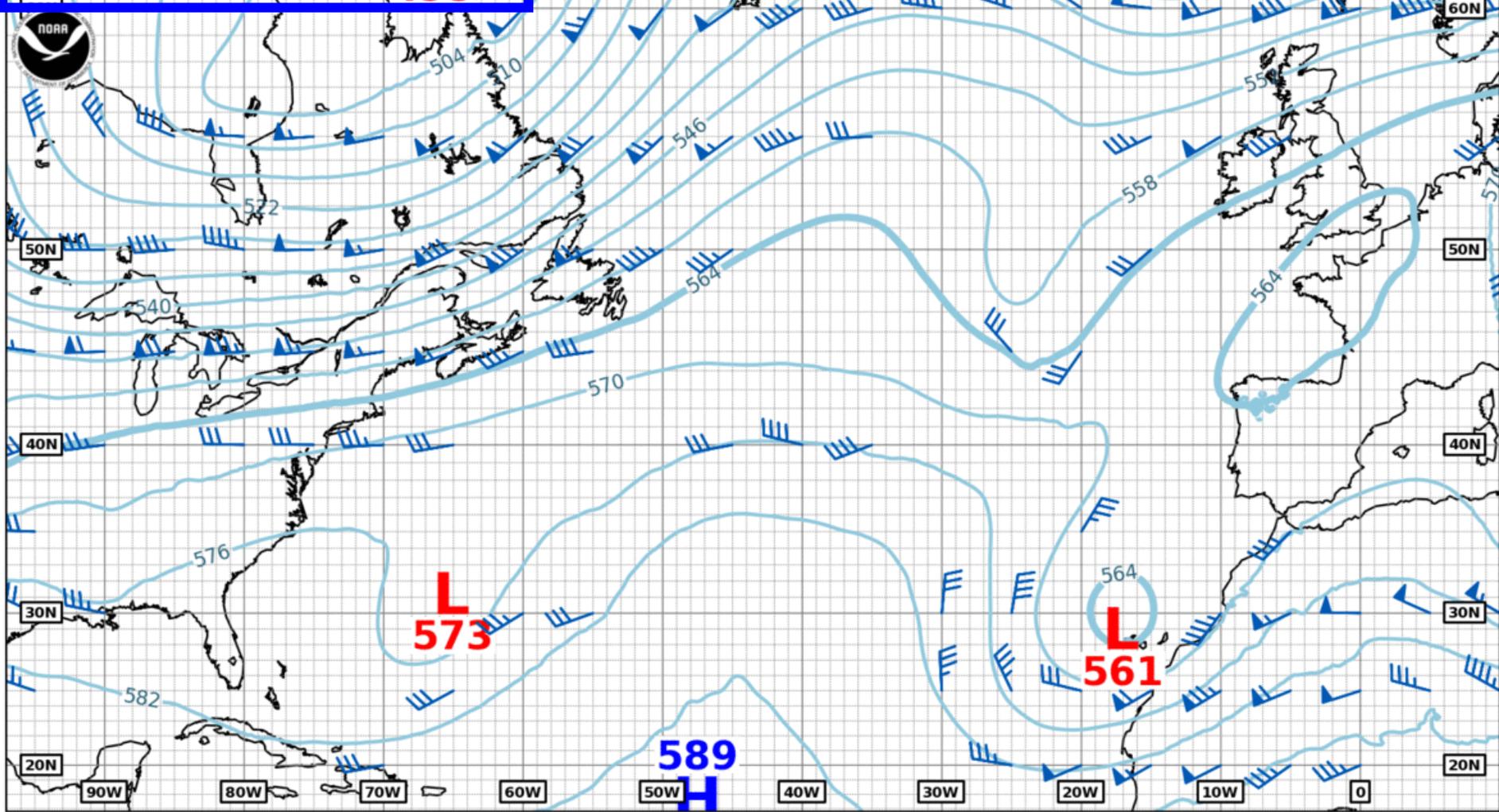
# 500mb Chart vs. Surface chart



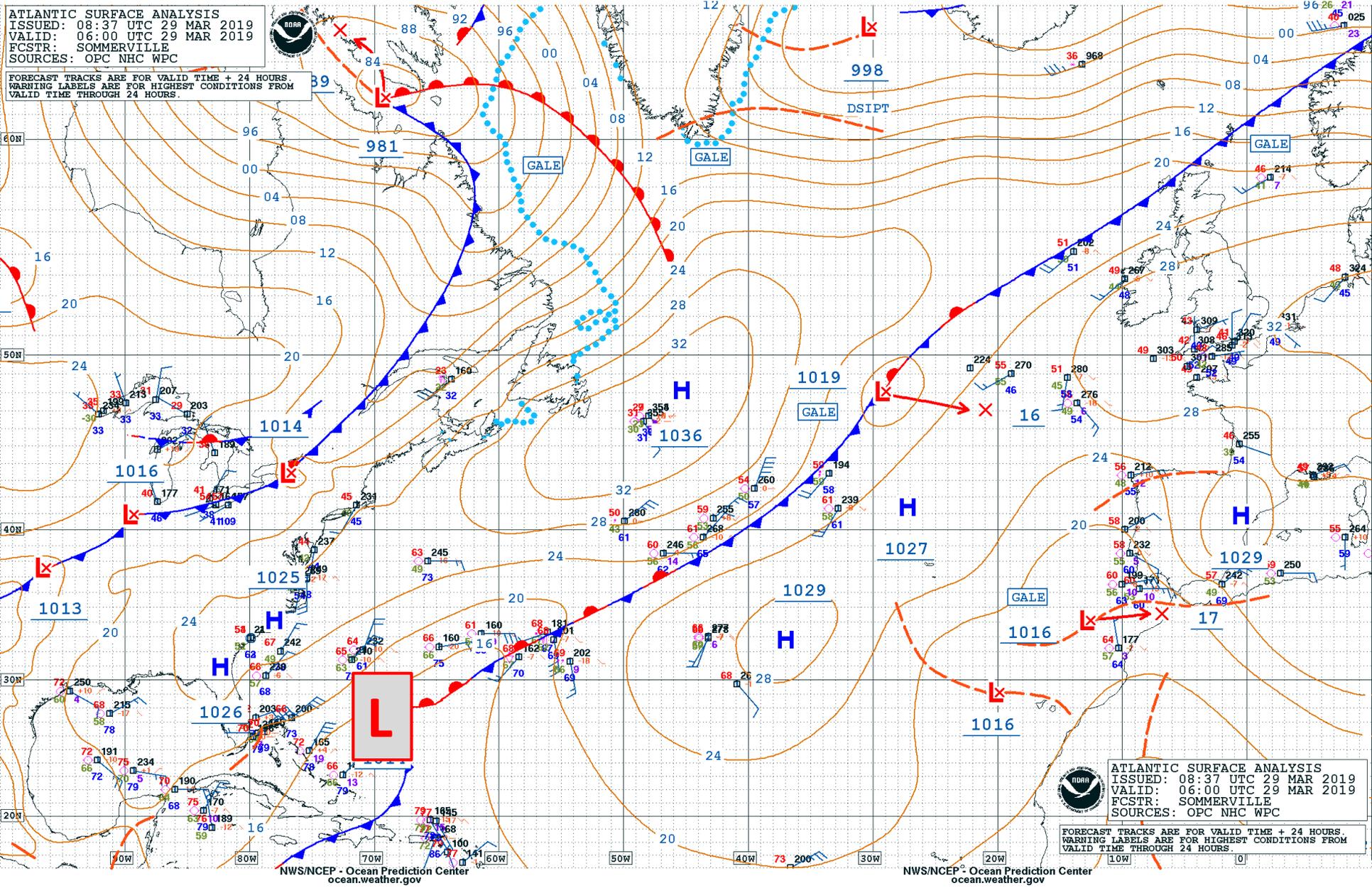
# 500mb Chart: forecast

-- Gives us the height where we reach 500mb of pressure

**24-HOUR 500 MB FORECAST**  
**ISSUED: 03:58 UTC 29 MAR 2019**  
**VALID: 00:00 UTC 30 MAR 2019**  
**DATA: GFS 00 UTC 29 MAR 2019**

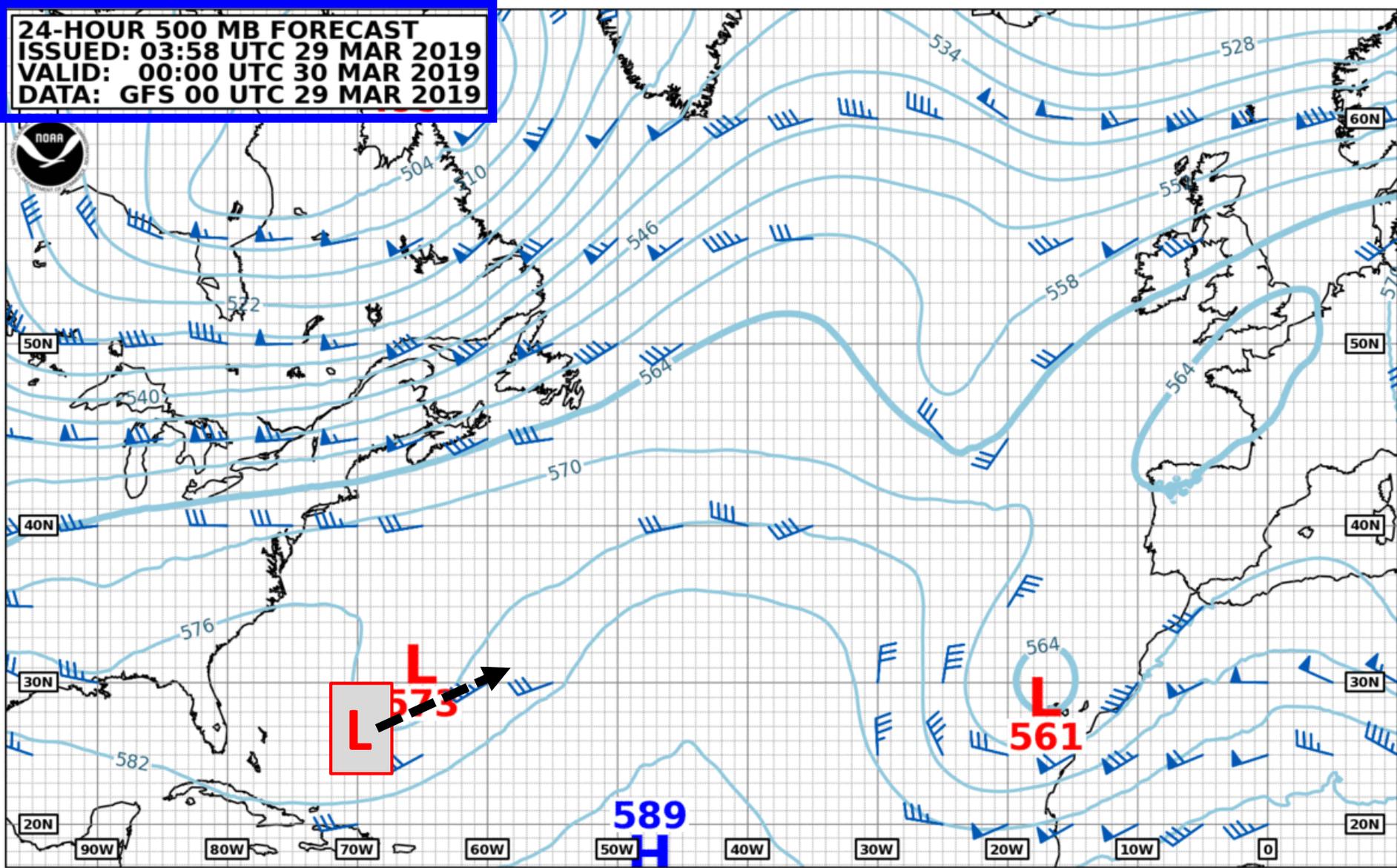


# Let us track where our **surface Low** goes.....



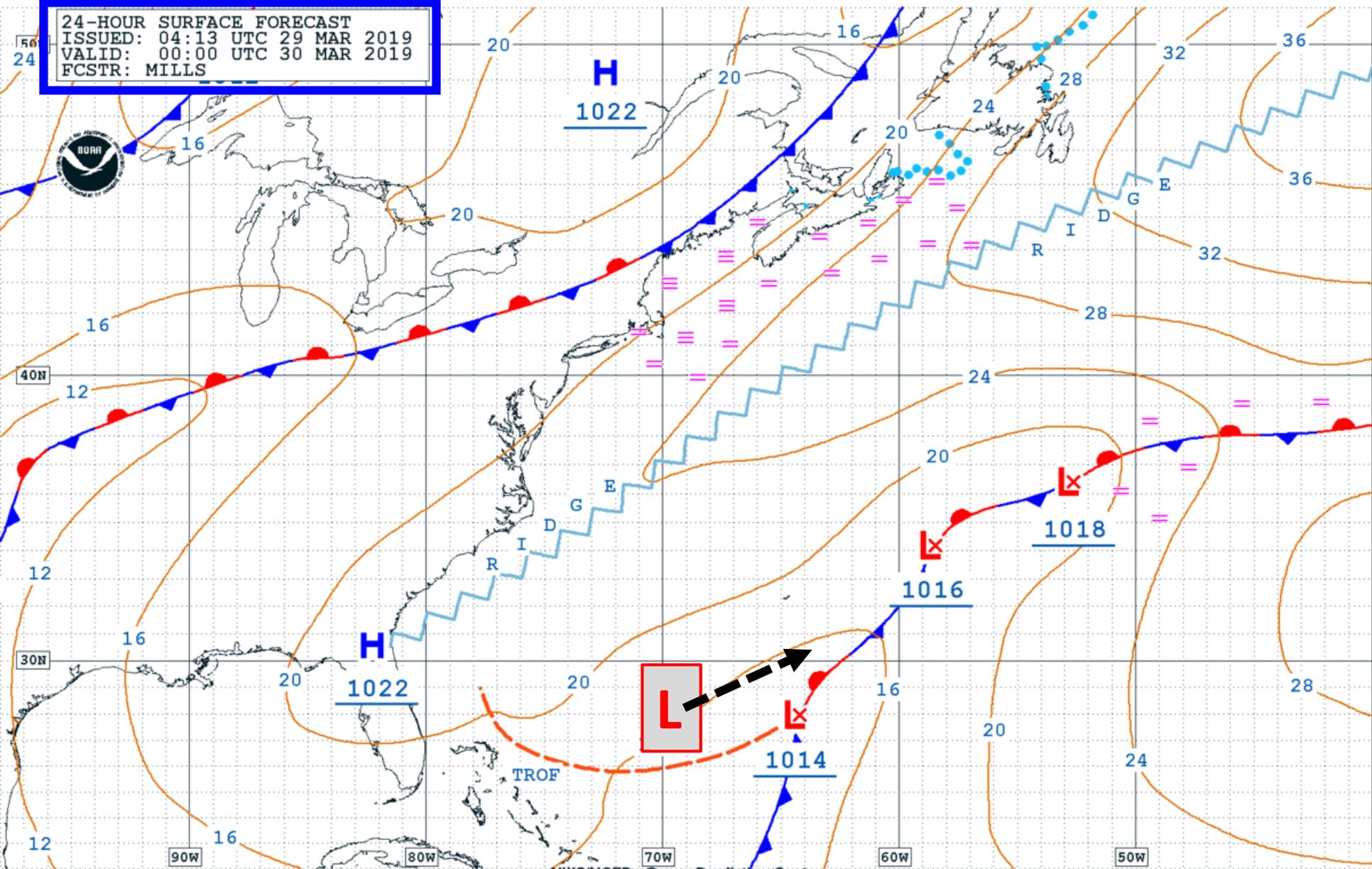
# 500mb Chart: forecast

-- Gives us the height where we reach 500mb of pressure



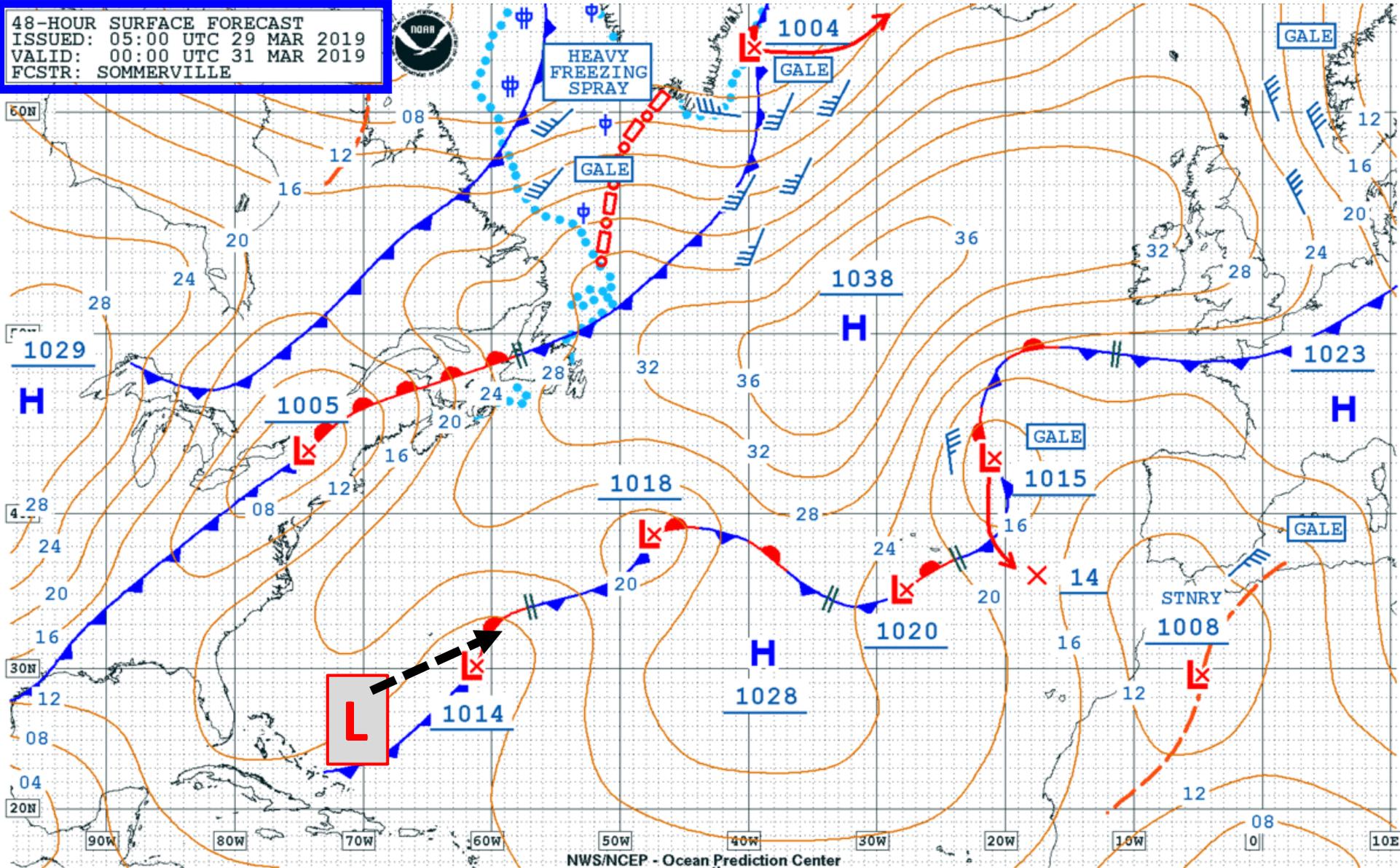
# 24-hour forecasted surface map

24-HOUR SURFACE FORECAST  
ISSUED: 04:13 UTC 29 MAR 2019  
VALID: 00:00 UTC 30 MAR 2019  
FCSTR: MILLS



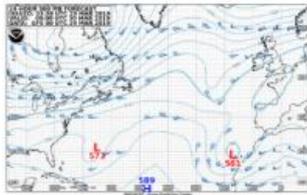
# 48-hour forecasted surface map

48-HOUR SURFACE FORECAST  
ISSUED: 05:00 UTC 29 MAR 2019  
VALID: 00:00 UTC 31 MAR 2019  
FCSTR: SOMMERVILLE



# Weather products from NOAA Ocean Prediction Center (<http://www.opc.ncep.noaa.gov/>)

## Atlantic Graphical Forecasts

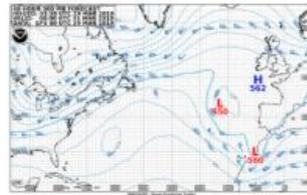


**24-hour 500 mb**

Loop: [3] [7] [14] Days

Updated: Fri, 29-Mar-2019 04:00:18 UTC

[More 500 MB images](#)

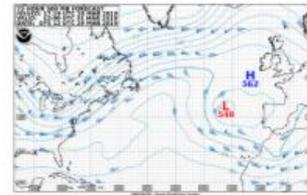


**48-hour 500 mb**

Loop: [3] [7] [14] Days

Updated: Fri, 29-Mar-2019 04:02:31 UTC

[More 500 MB images](#)

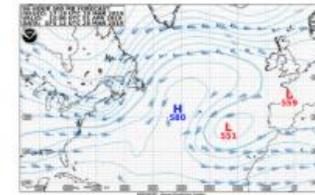


**72-hour 500 mb**

Loop: [3] [7] [14] Days

Updated: Thu, 28-Mar-2019 17:27:49 UTC

[More 500 MB images](#)



**96-hour 500 mb**

Loop: [3] [7] [14] Days

Updated: Thu, 28-Mar-2019 17:29:12 UTC

[More 500 MB images](#)



**24-hour surface**

Loop: [3] [7] [14] Days

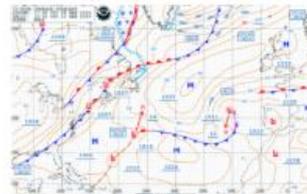
Updated: Fri, 29-Mar-2019 04:14:08 UTC



**48-hour surface**

Loop: [3] [7] [14] Days

Updated: Fri, 29-Mar-2019 05:01:10 UTC



**72-hour surface**

Loop: [3] [7] [14] Days

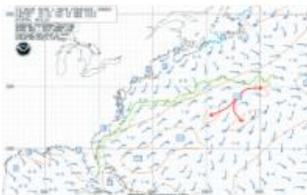
Updated: Thu, 28-Mar-2019 17:31:02 UTC



**96-hour surface**

Loop: [3] [7] [14] Days

Updated: Thu, 28-Mar-2019 13:25:30 UTC



**24-hour wind & wave**

Loop: [3] [7] [14] Days

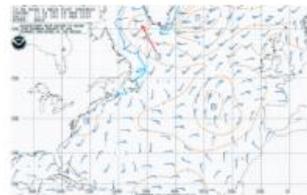
Updated: Fri, 29-Mar-2019 04:48:22 UTC



**48-hour wind & wave**

Loop: [3] [7] [14] Days

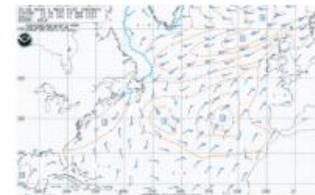
Updated: Fri, 29-Mar-2019 05:28:16 UTC



**72-hour wind & wave**

Loop: [3] [7] [14] Days

Updated: Thu, 28-Mar-2019 17:36:45 UTC



**96-hour wind & wave**

Loop: [3] [7] [14] Days

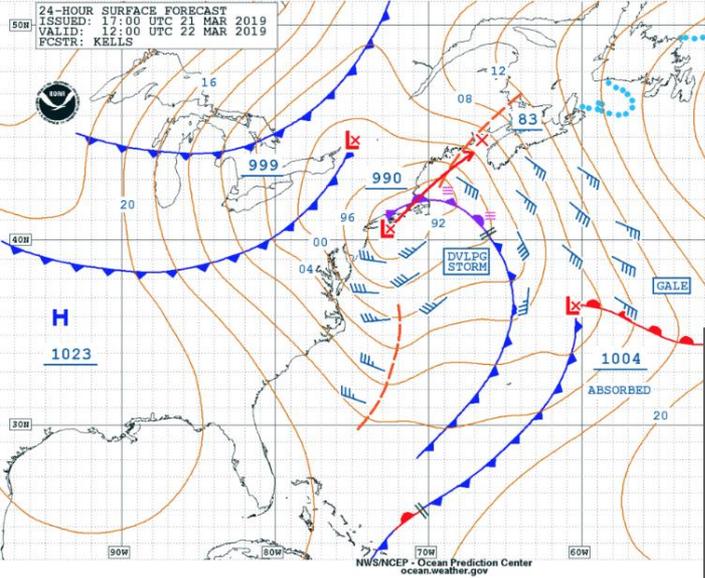
Updated: Thu, 28-Mar-2019 13:58:51 UTC

City, St or ZIP code

SEARCH

RL will not work.  
icn19-

ihp" in the URL  
c\_shtml.pdf.



# Weather Basics

Safety at Sea Seminar, 30<sup>th</sup> March 2019

## Session goals:

- ✓ Identify global wind patterns
- ✓ Wind flow around surface **Highs** & **Lows**
  - 3 types of **Lows** to look out for
  - Weather on the ground?
- ✓ Severe weather on the Bay & in the North Atlantic
- ✓ Interpret main features on a surface weather chart



Dr. Gina Henderson  
 Oceanography Dept., USNA  
[ghenders@usna.edu](mailto:ghenders@usna.edu)



# Resources to learn more.....

- Online "school for weather" called JetStream, that is provided by NOAA and offers lots of information if you would like to learn more
  - <https://www.weather.gov/jetstream/>
- For more in-depth information, the following text book is what we currently use at the Academy for teaching synoptic meteorology:
  - <https://www.amazon.com/Midlatitude-Synoptic-Meteorology-Dynamics-Forecasting/dp/1878220101>