



ONTARIO SAILING & ROW ONTARIO 2018 Annual Conference

A collage of various weather-related images including satellite maps, radar scans, cloud formations, and a view of Earth from space, serving as a background for the title text.

Weather For Sailing

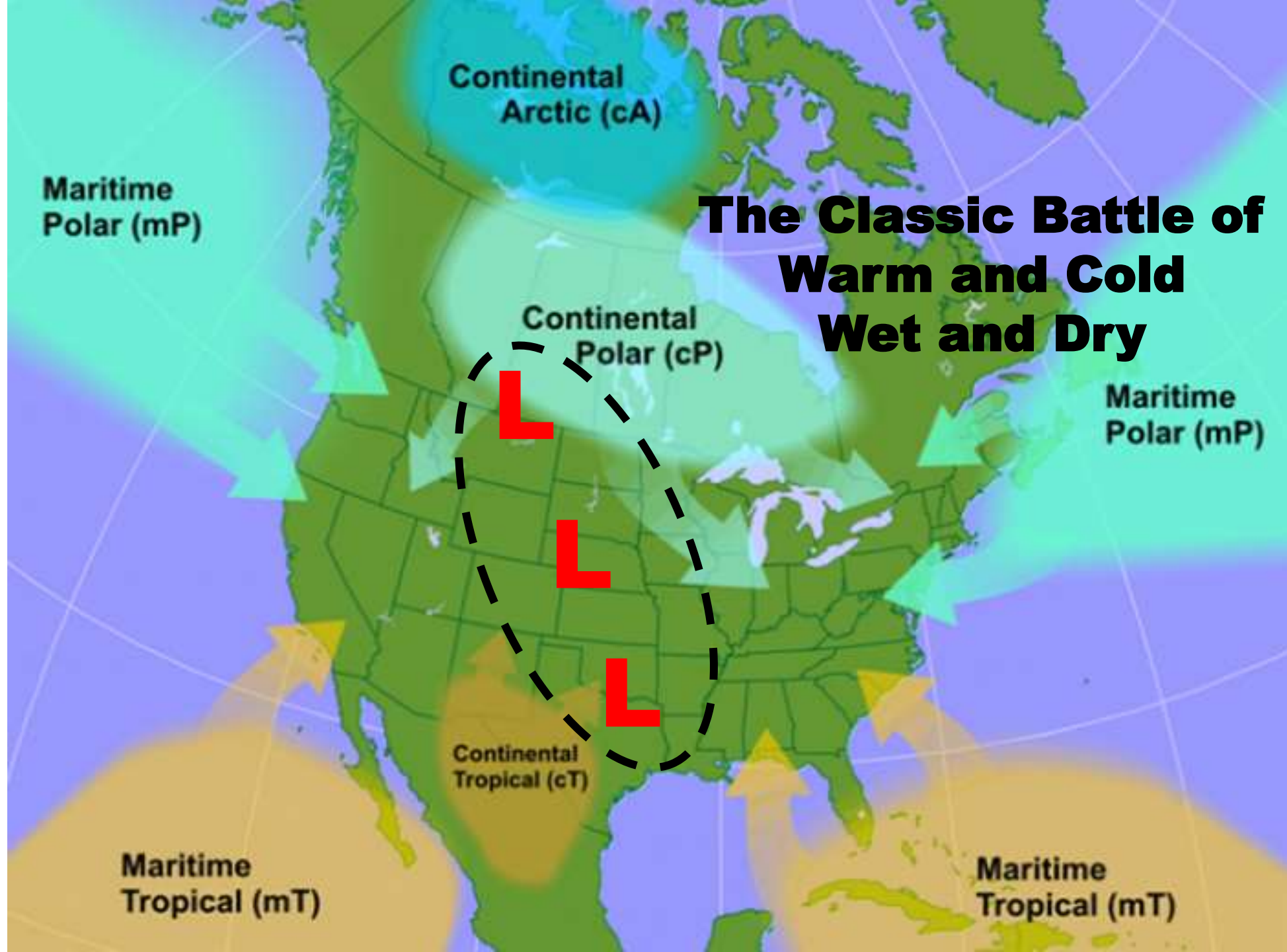
Presented by: Ron Bianchi - Meteorologist/Sailor

About Me

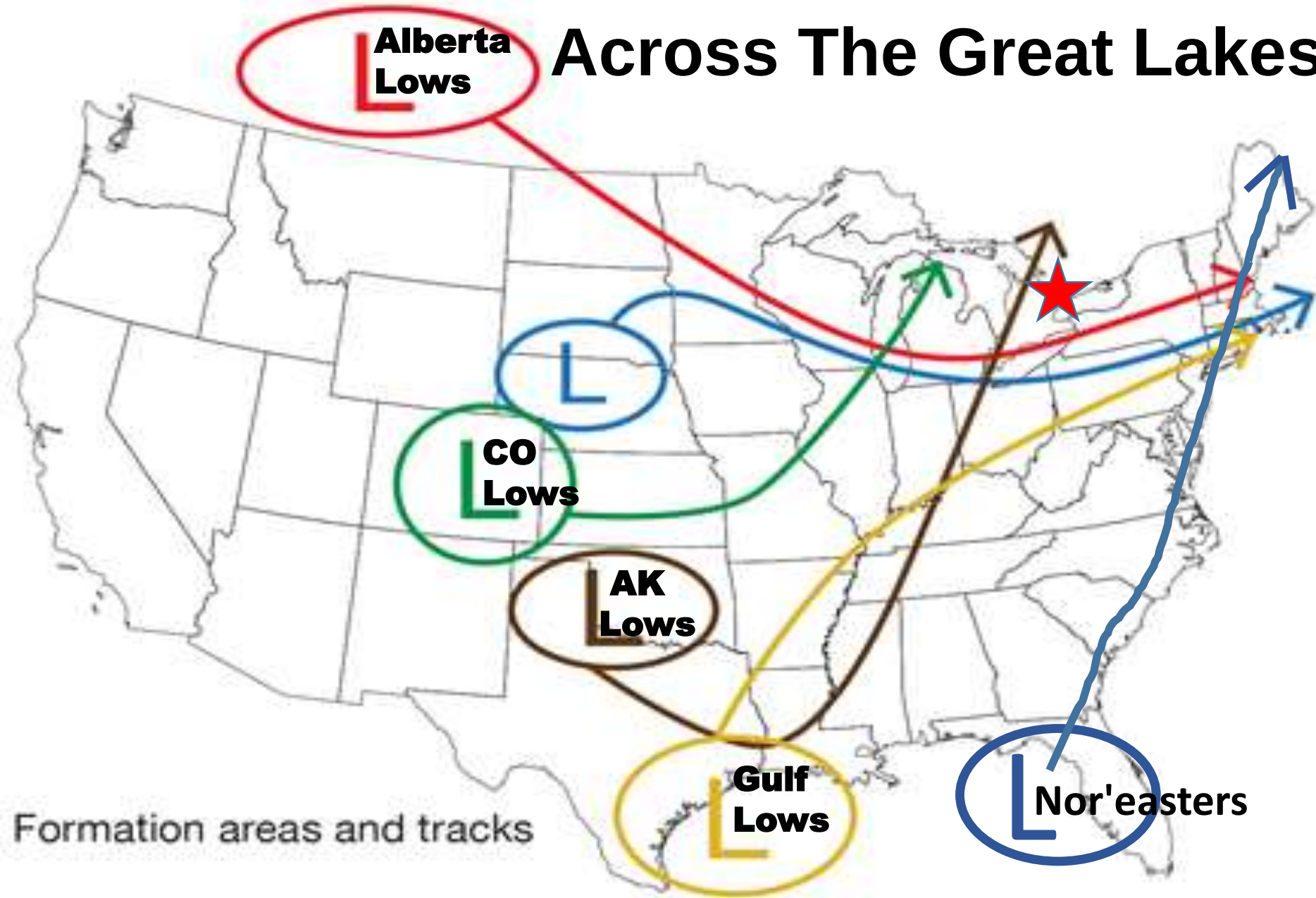
- ▶ Meteorologist by Training; B-School (Ivey); Government of Canada School
- ▶ Senior Associate, Director of Strategic Development - Climate and Terrestrial Weather – Wood –Engineering Firm 160 + Years, 600+ Countries, 60K+ Employees
- ▶ Work History (Government/Private Sector/Non-Profits) 25+
- ▶ PANAM Lead Meteorologist, Sailing Venue
- ▶ The Weather Network/Pelmorex -Vice President of Meteorology and Executive Meteorologist
- ▶ Environment Canada Operations Manager, Ontario Storm Prediction Centre
- ▶ Sailing Manager at Several Schools in the GTA
- ▶ Canadian Coast Guard - SAR

What we are going to cover today

- ***The Basics – How does the weather work?***
- ***Basic Cloud Identification***
- ***The Pressure and Gradient***
- ***The Local Winds***
- ***Lightning***
- ***Weather Apps***
- ***Q & A***



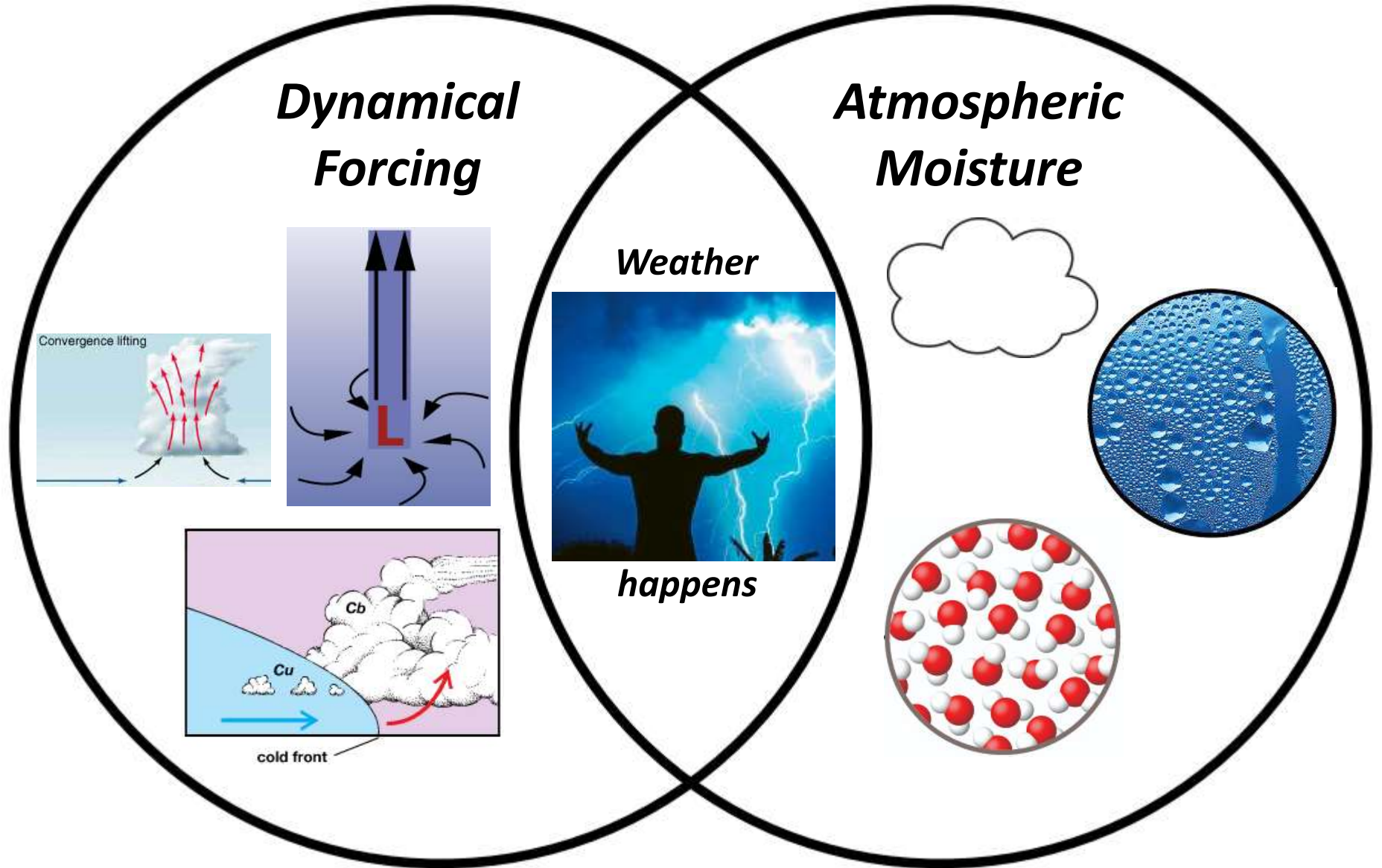
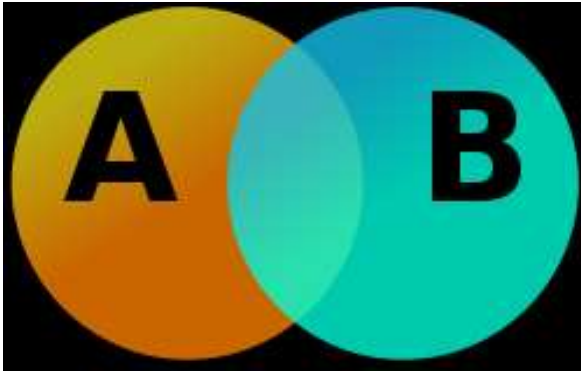
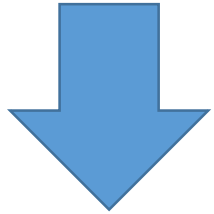
General Movements of Weather Systems Across The Great Lakes



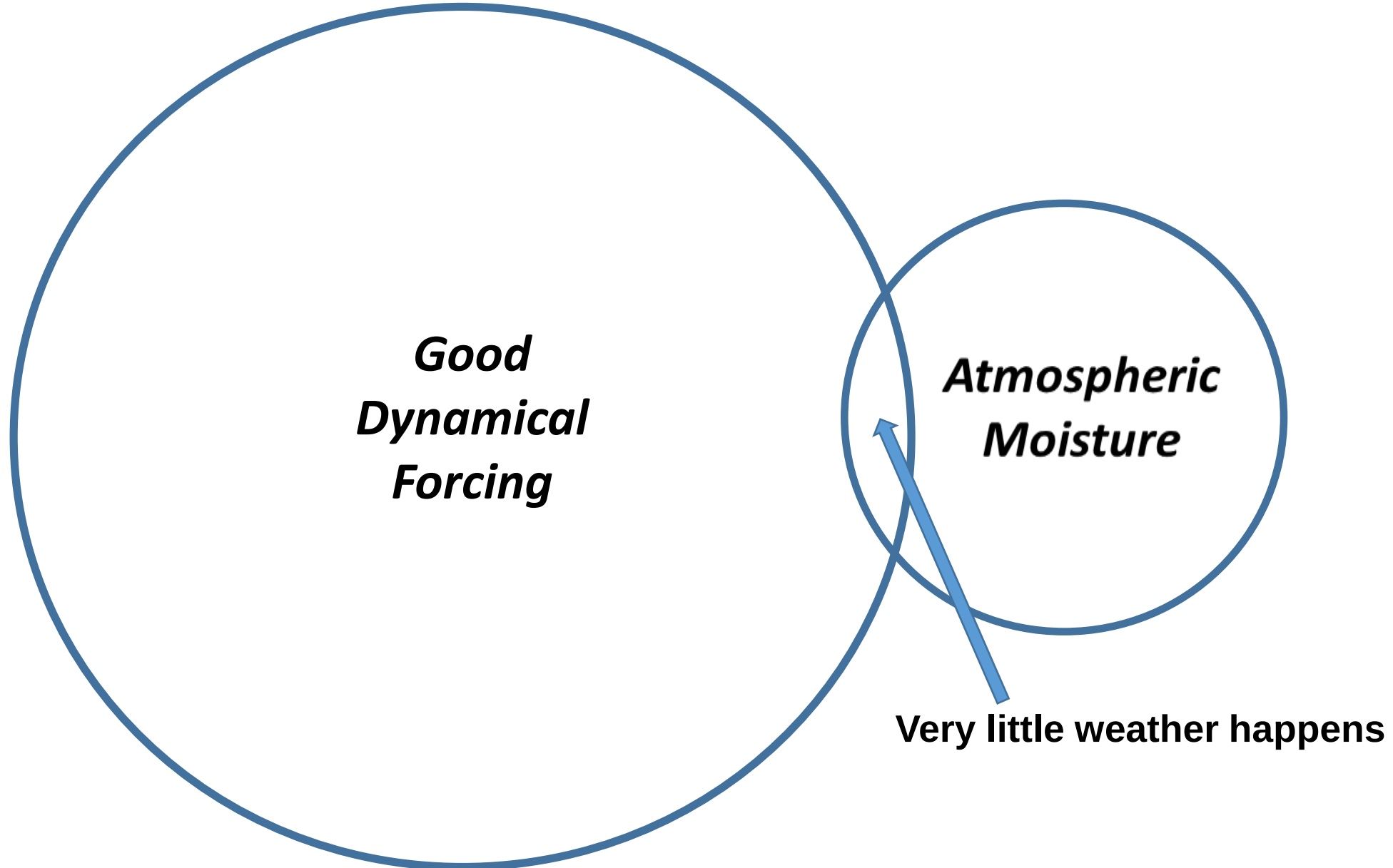
Weather – It is really this simple?



John Venn

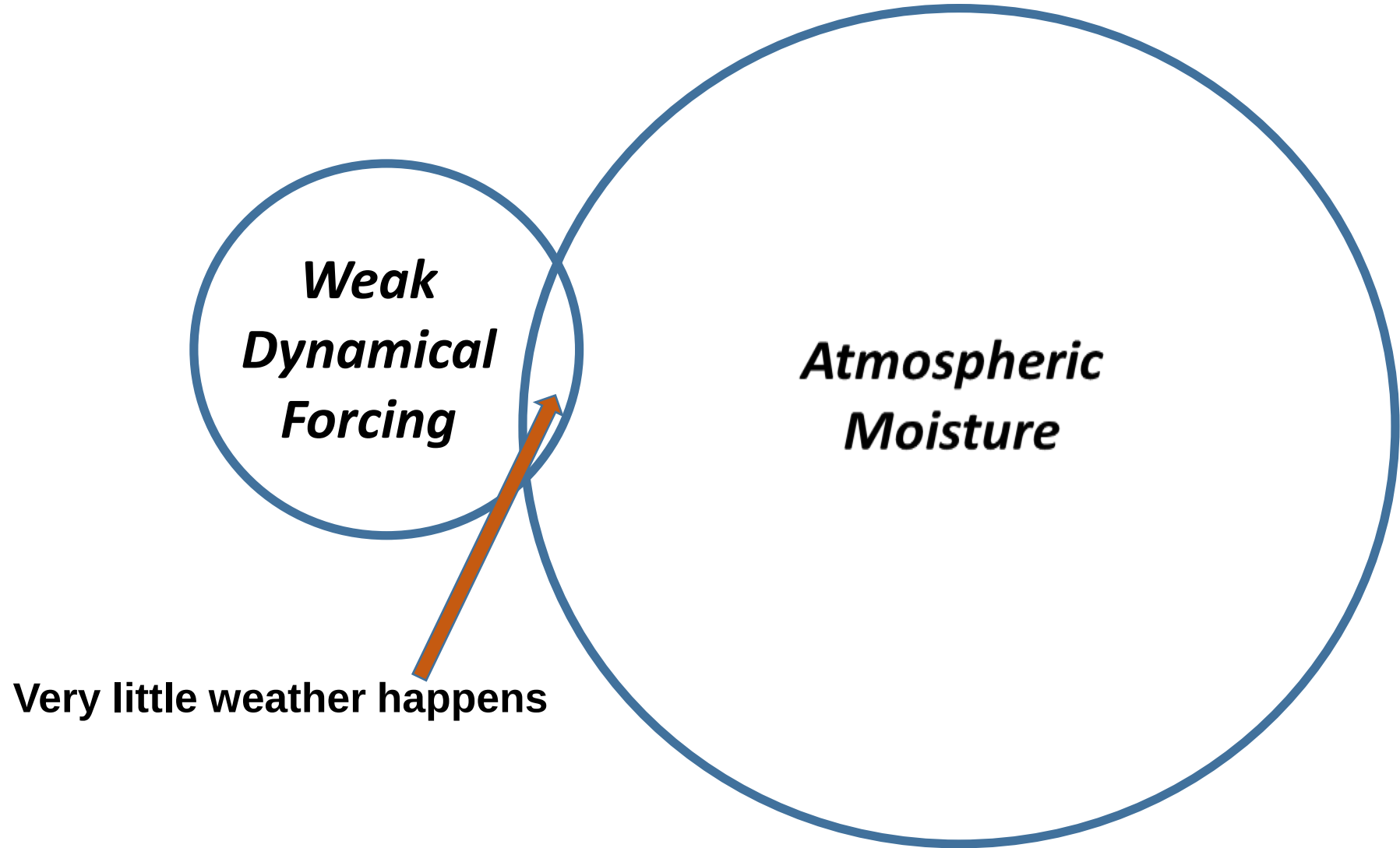


***Good Upward Forcing + Very Little Moisture =
Very Little Weather Happens***

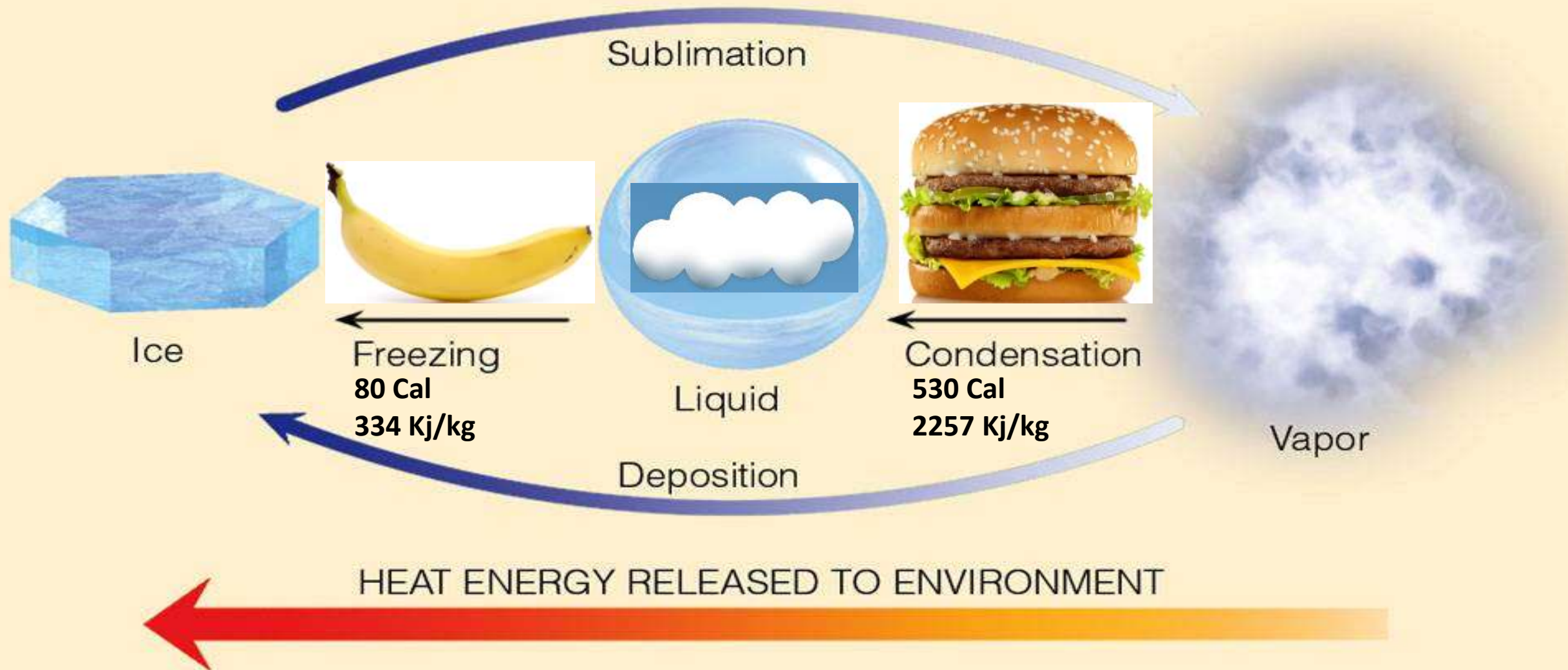


Weak Upward Forcing + Lots of Moisture =

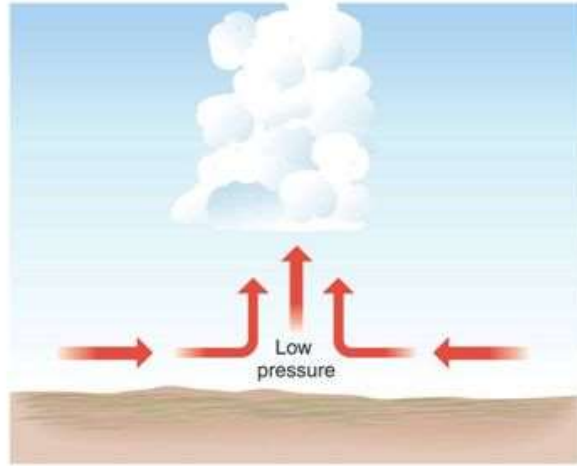
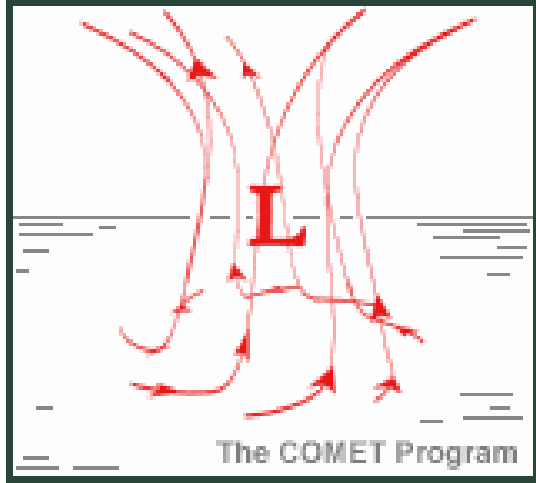
Very Little Weather Happens



HEAT ENERGY TAKEN FROM ENVIRONMENT

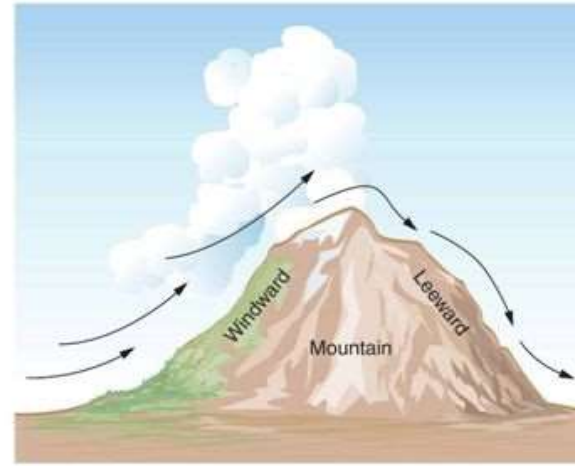


Atmospheric Lifting Mechanisms



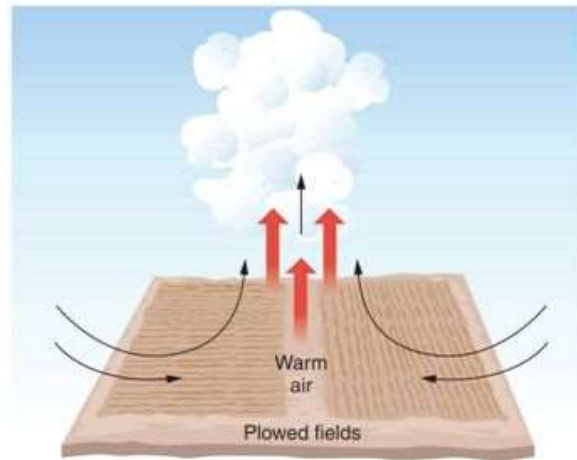
(a) Convergent

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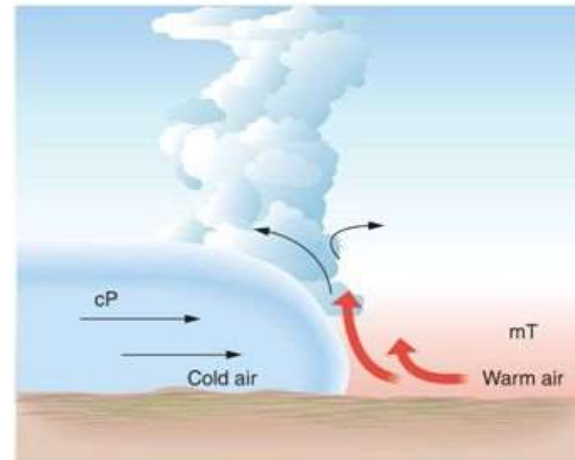
(c) Orographic (barrier)

Copyright © 2006 Pearson Prentice Hall, Inc.



(b) Convectional (local heating)

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(d) Frontal (e.g. cold front)

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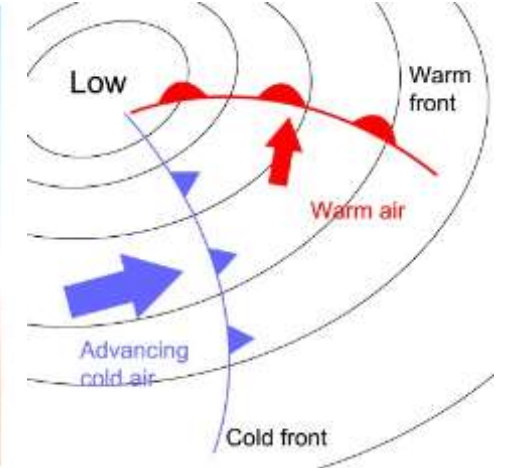


Figure 8.6

Moisture + Lift = Clouds...more clouds.....

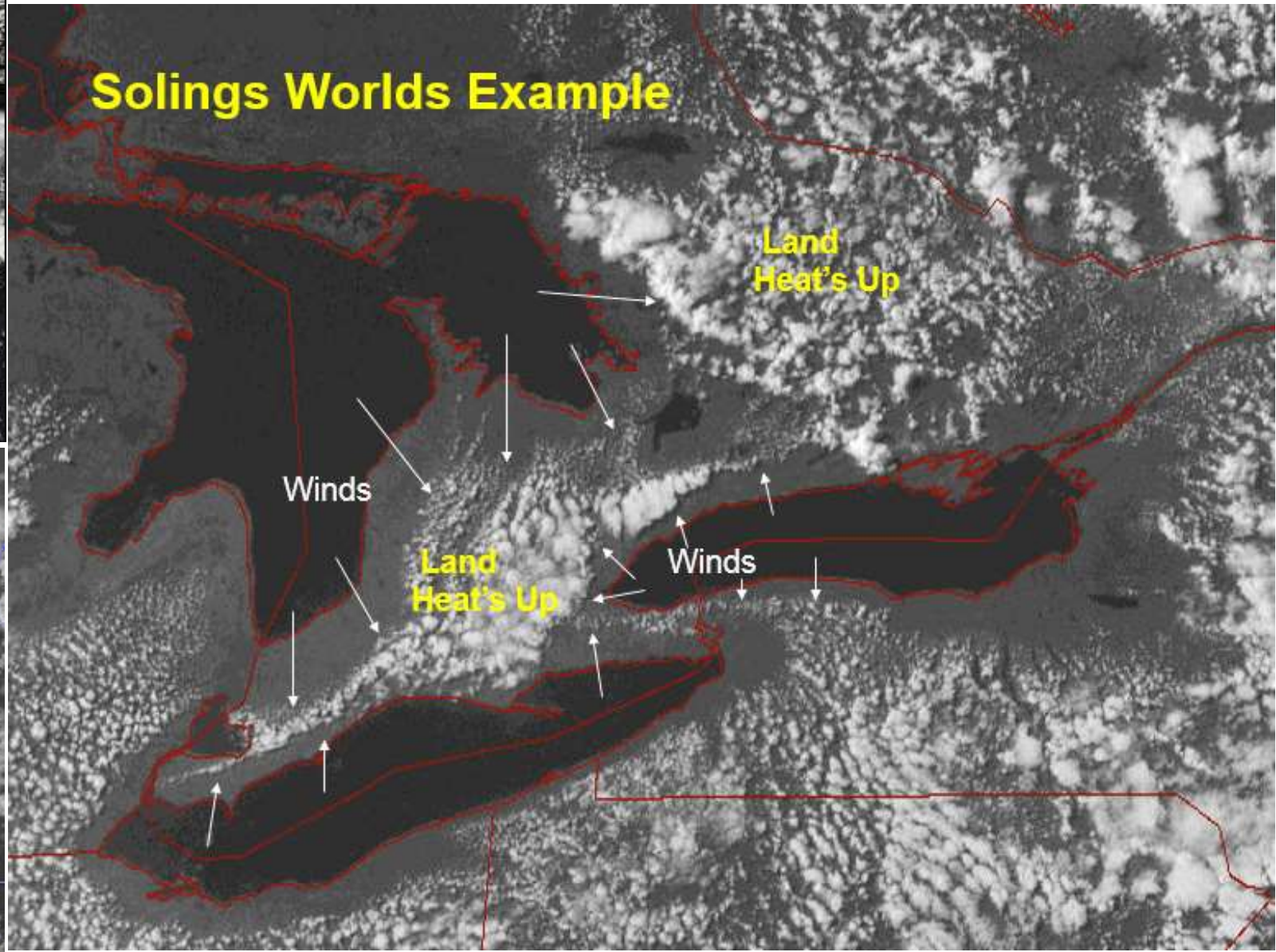
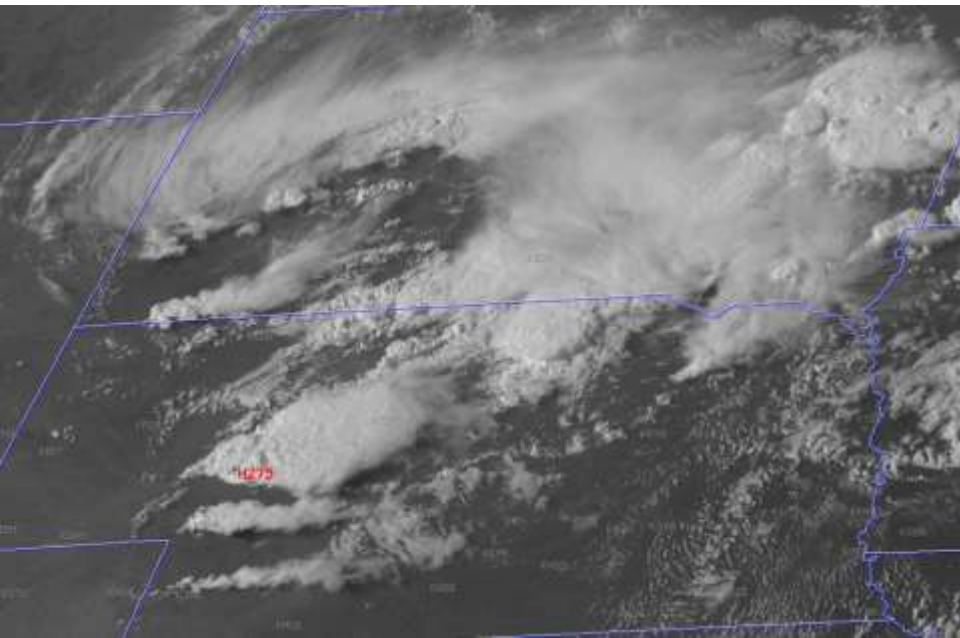
Who invented the cloud classification system?



Luke Howard - "the father of meteorology" (28 November 1772 – 20 March 1864) was a British manufacturing chemist and an amateur meteorologist with broad interests in science.

His lasting contribution to science is a nomenclature system for clouds, which he proposed in an 1802and stands today

Why Study or Look At Clouds



Keep it Simple



Cirrus



Cumulus



Stratus



Cirrus clouds with fog rolling in

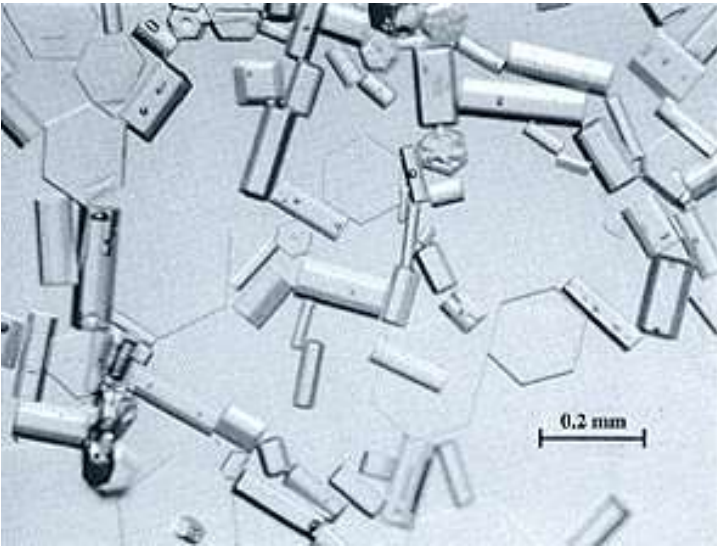
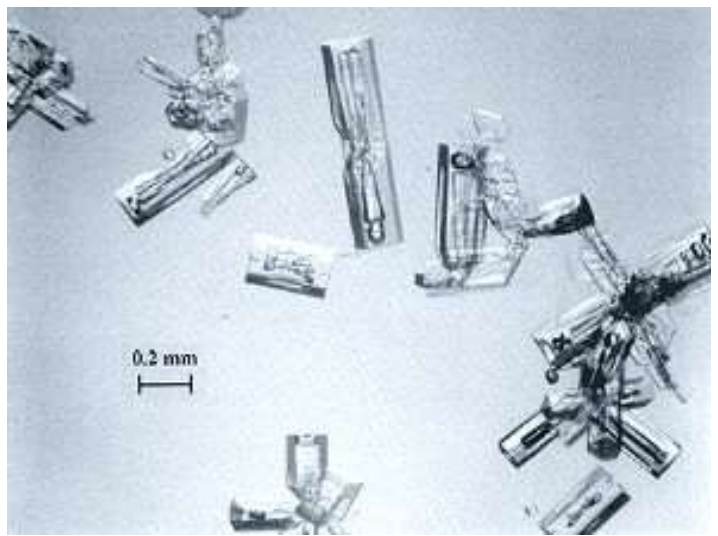
Photo by Albert E. Theberge, Jr.

NOAA Central Library/ NWS

High-Level Clouds

- High-level clouds form above 20,000 feet (6,000 meters)
- Made up of all Ice Crystals





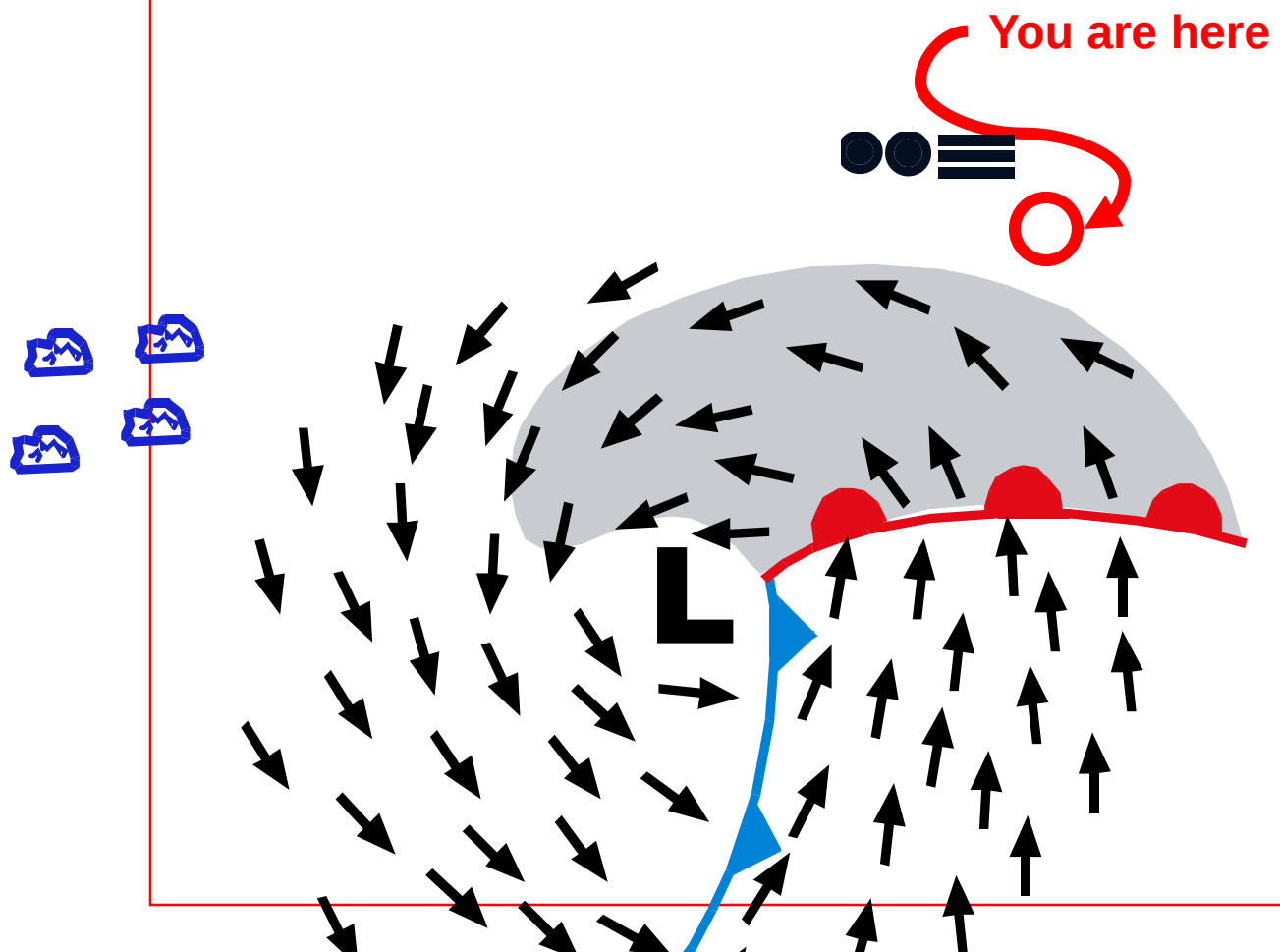




**So what does it tell the Mariner –
Falling Barometer, Winds from
the East, Weather Change is
~24 hours away.**

**- So enjoy you day out on
the water**







Cirrostratus Clouds

sheet-like and nearly transparent
Weather Change is ~24 hrs. away

Cirrostratus Clouds

**High clouds
that thinly
cover the
entire sky
with ice
crystals.**

**Light
passing
through
these
crystals may
form a halo.**



Cirrocumulus Clouds



High clouds that are rounded puffs, possibly in rows, are less common than cirrus.



Cirrocumulus clouds

Small, rounded white puffs.

small ripples in the cirrocumulus
resemble the scales of a fish.

"mackerel sky."



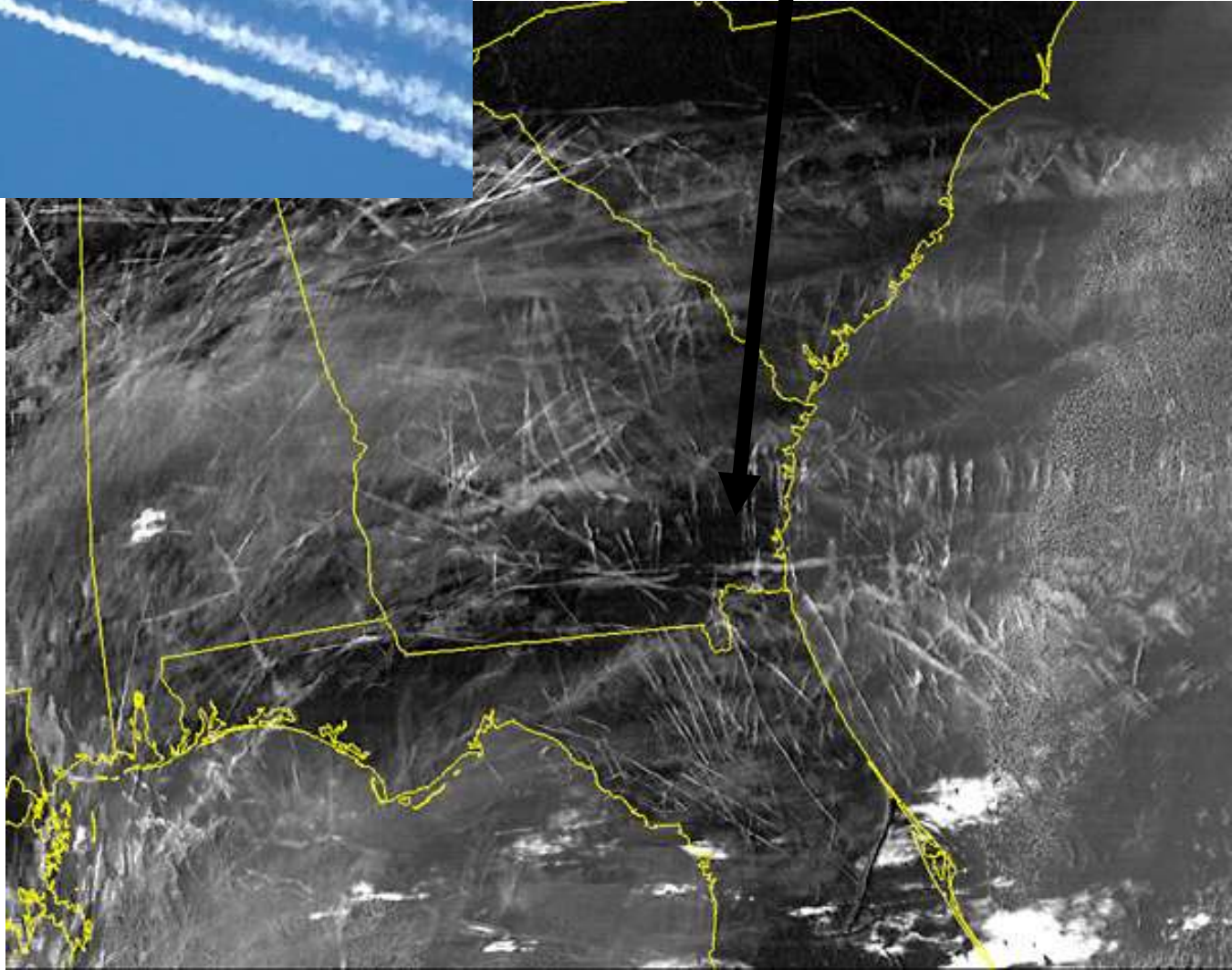
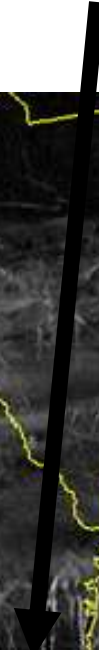
Again Change is ~24 hrs. away

Altostratus Clouds





**What are
these????**

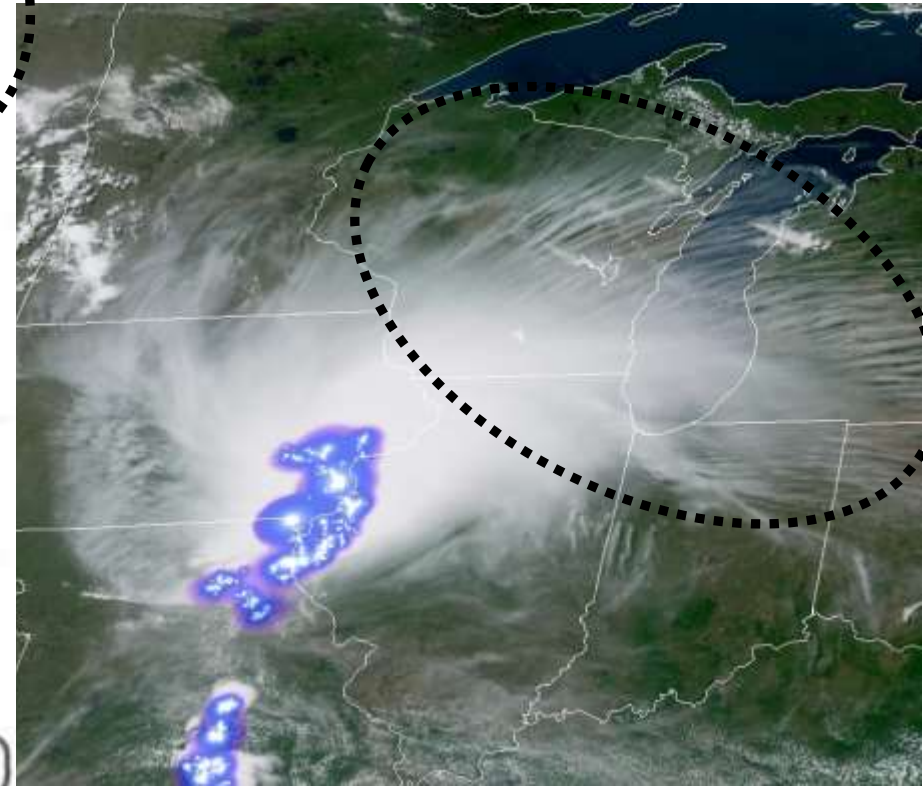
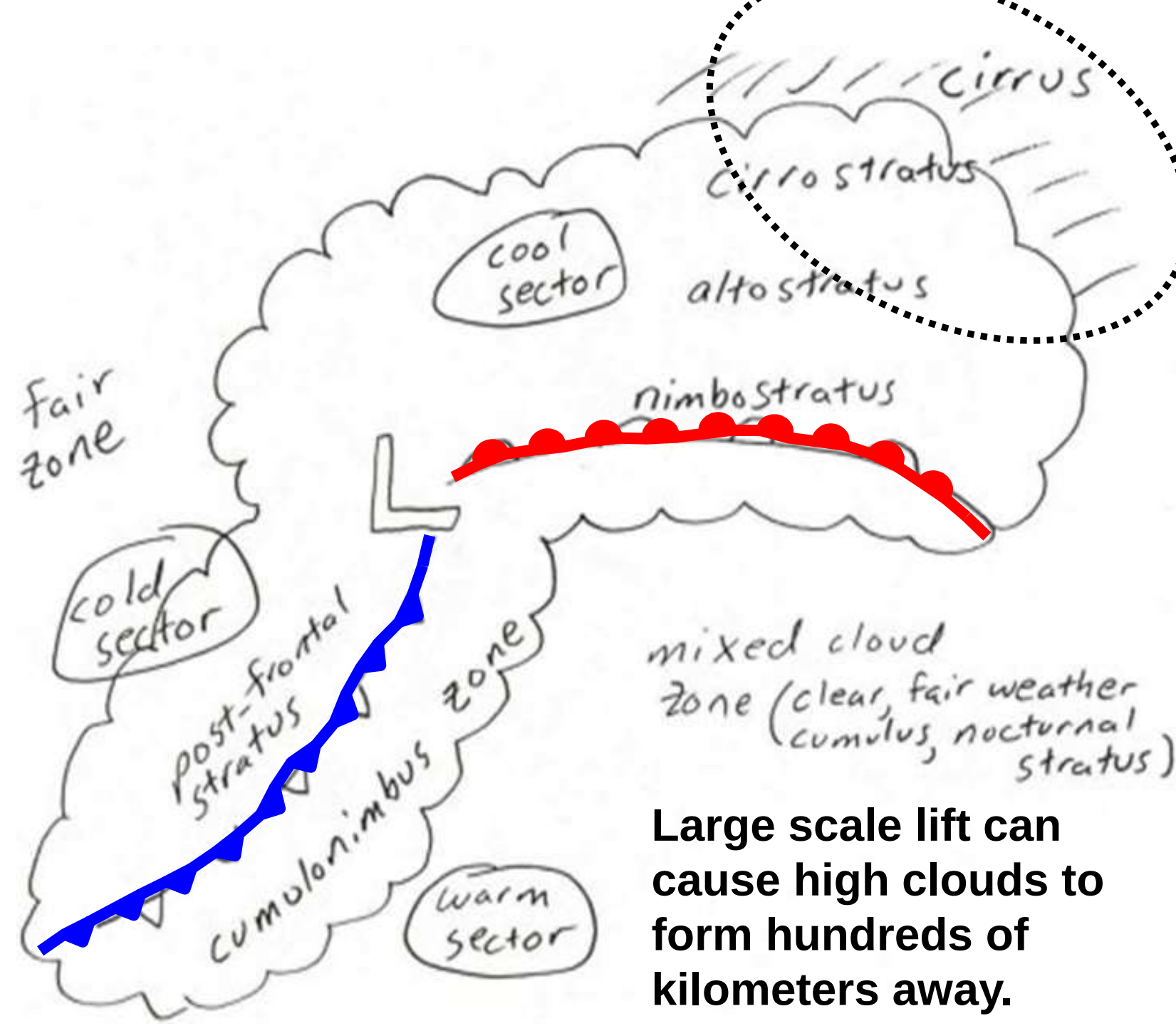




**Picture
Taken
Wed at
3:45pm**



**Picture
Taken Next
Day
at 3:45 pm
(light snow)
(~23 hrs)**

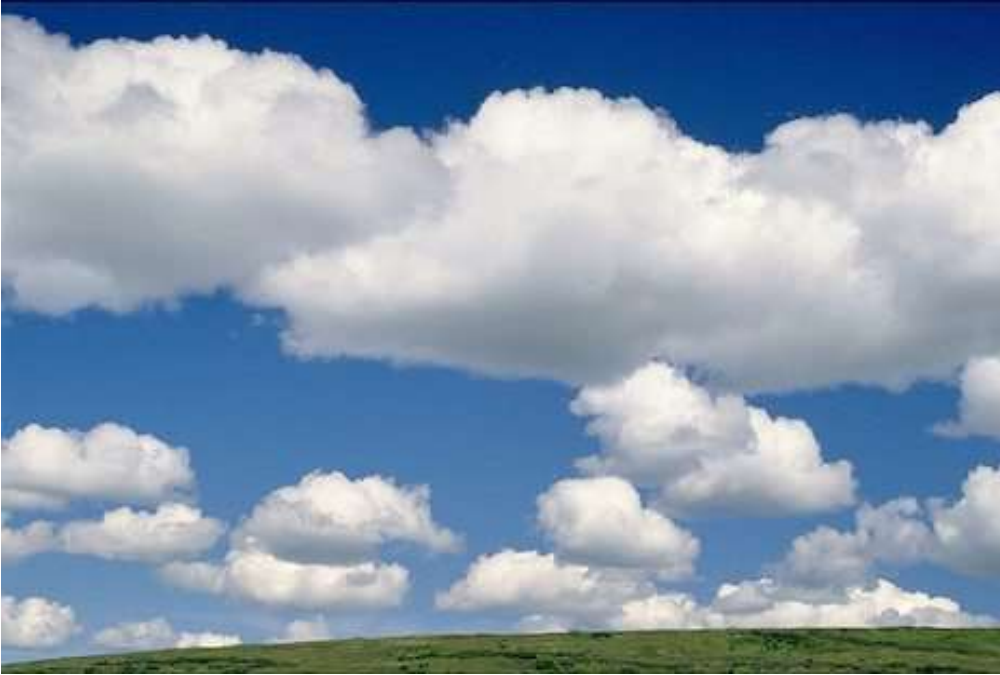


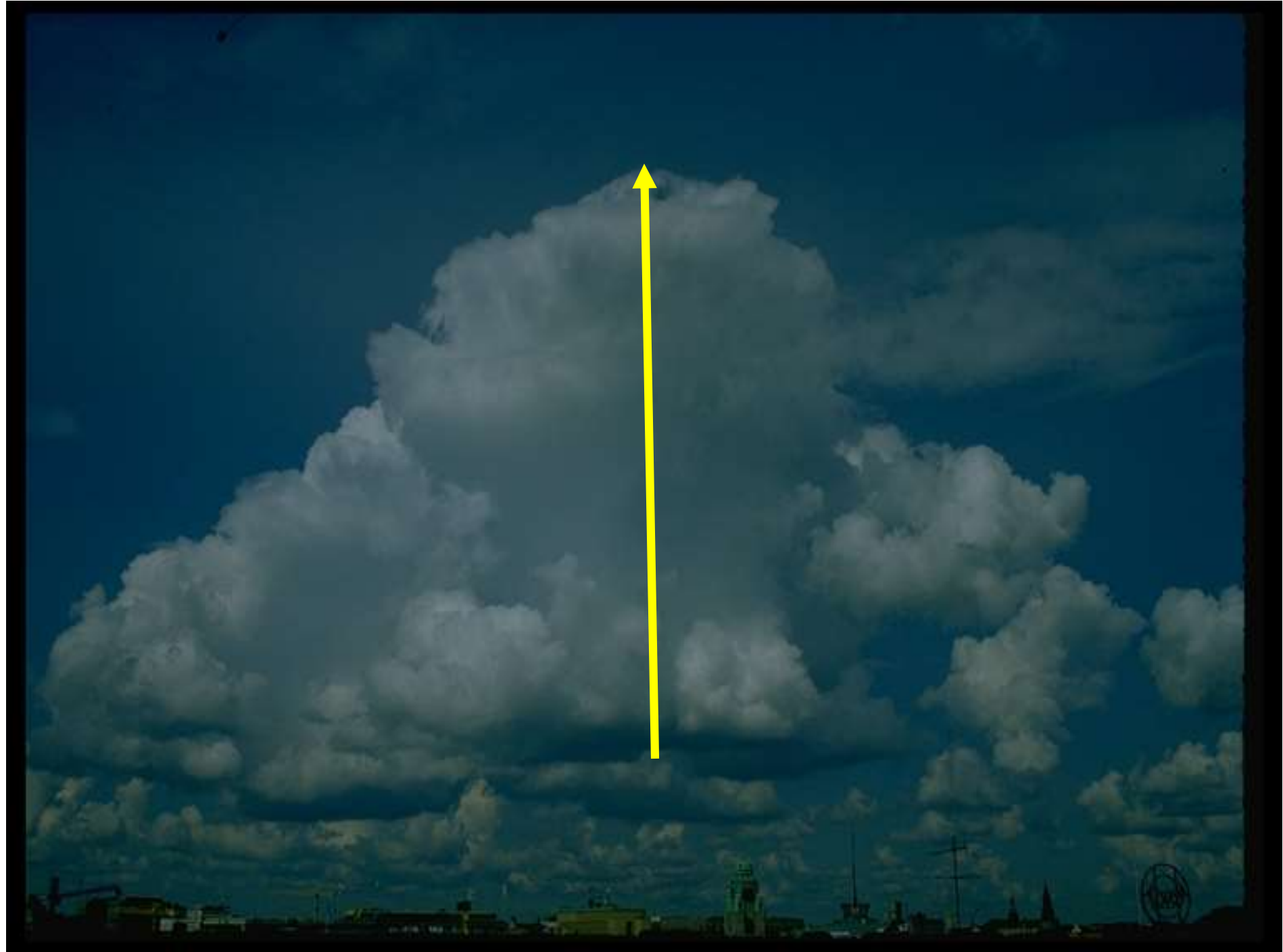
Large scale lift can cause high clouds to form hundreds of kilometers away.

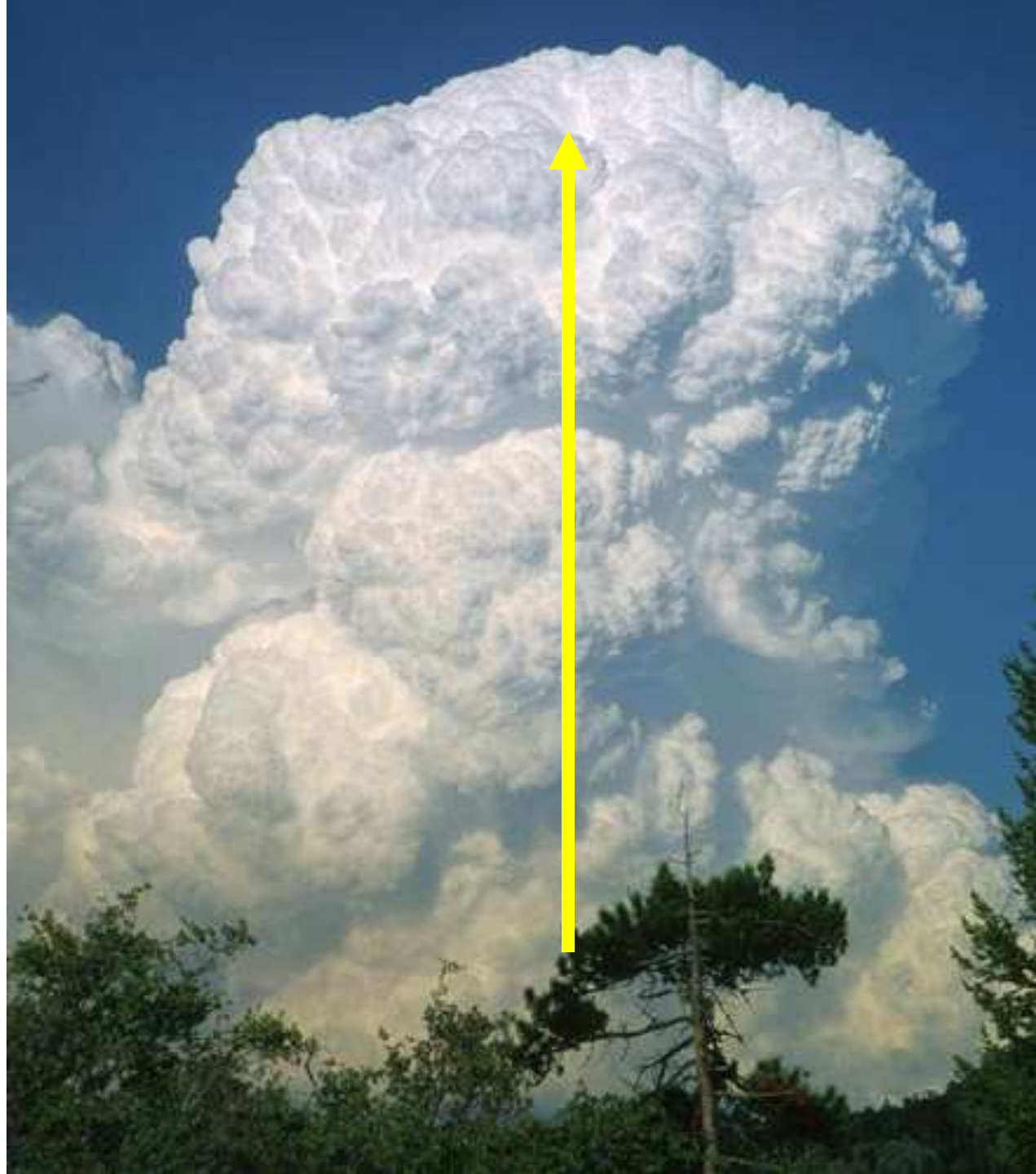
If these Cumulus do not change height in 3-5 hrs then fair weather continues

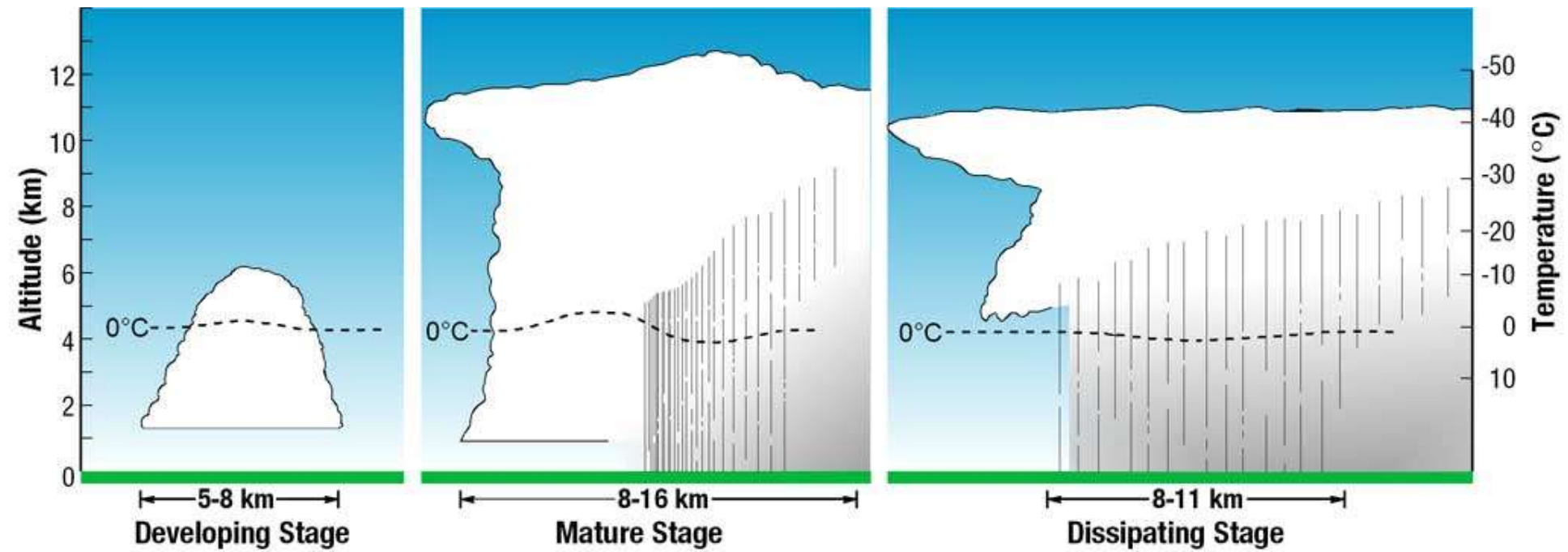


Fair Weather Cumulus









Cumulus Congestus Clouds



Clouds with vertical development that become larger in height, with tops taking a ragged shape similar to cauliflower. Change is certain! maybe just 1 or 2 hrs away



**Weather Change maybe minutes
away**





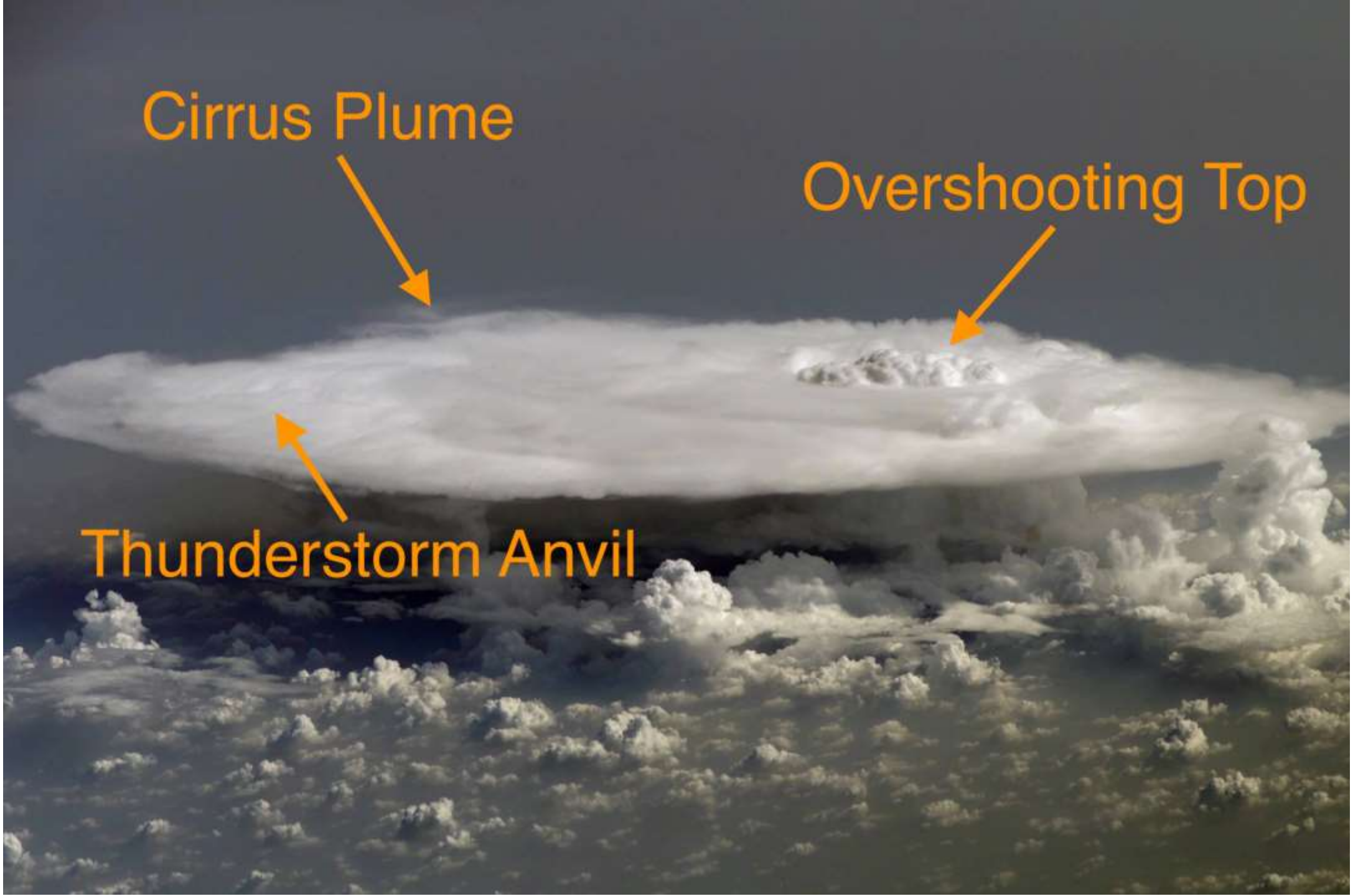




Cirrus Plume

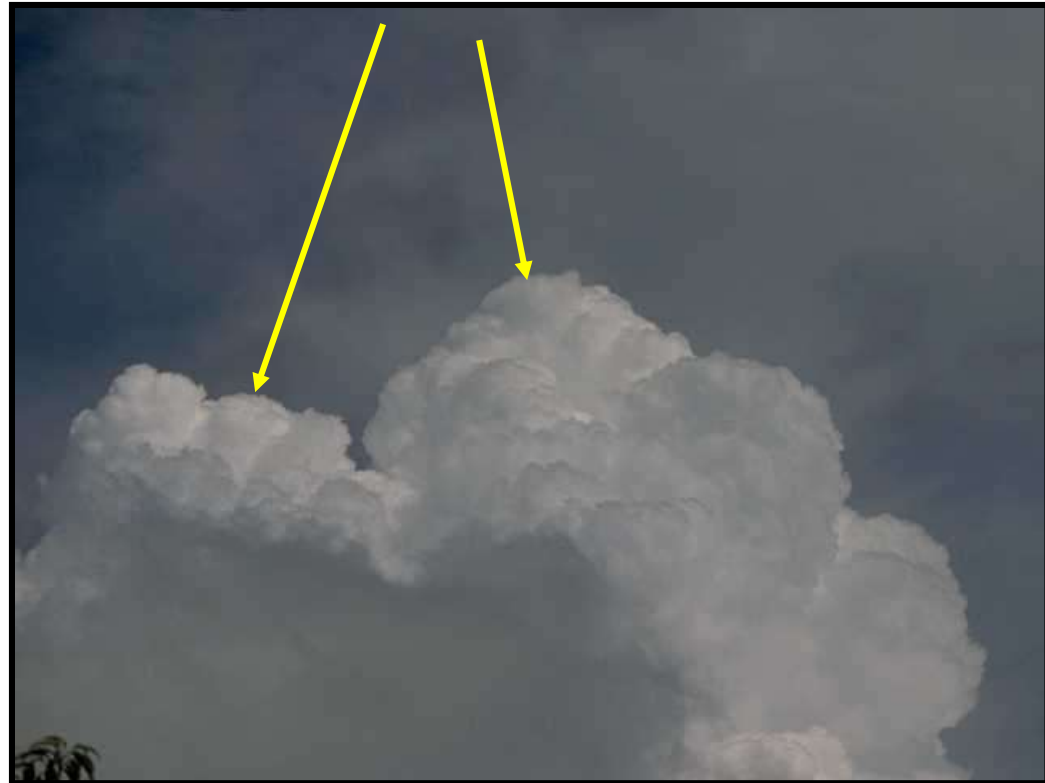
Overshooting Top

Thunderstorm Anvil



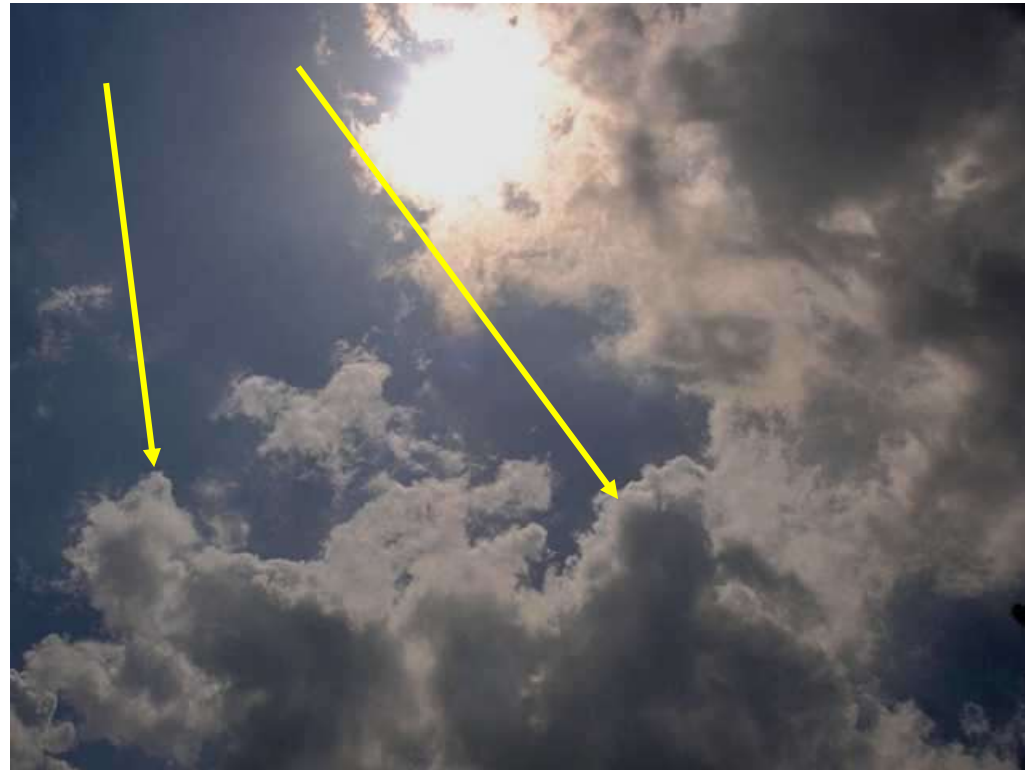
Rules of Thumb for Convection - 1

- If cumulus tops are 'crisp' and 'well defined'...
- the cloud will continue to grow.



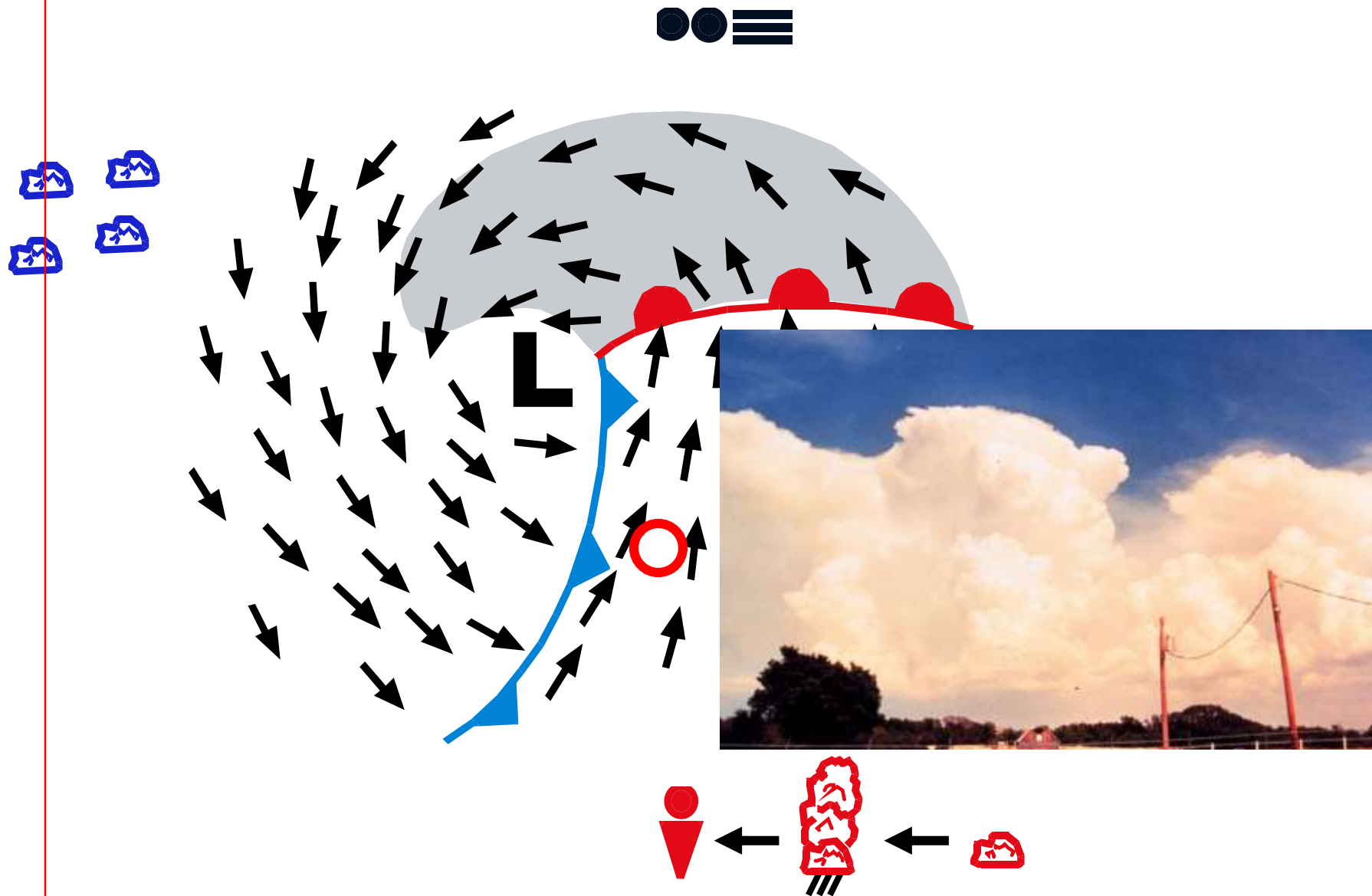
Rules of Thumb for Storm Development - 2

- If cumulus tops are 'ragged' and 'ill-defined'...
- the cloud **will not** continue to grow.



Cloud Formation Leading to Sudden Severe Weather





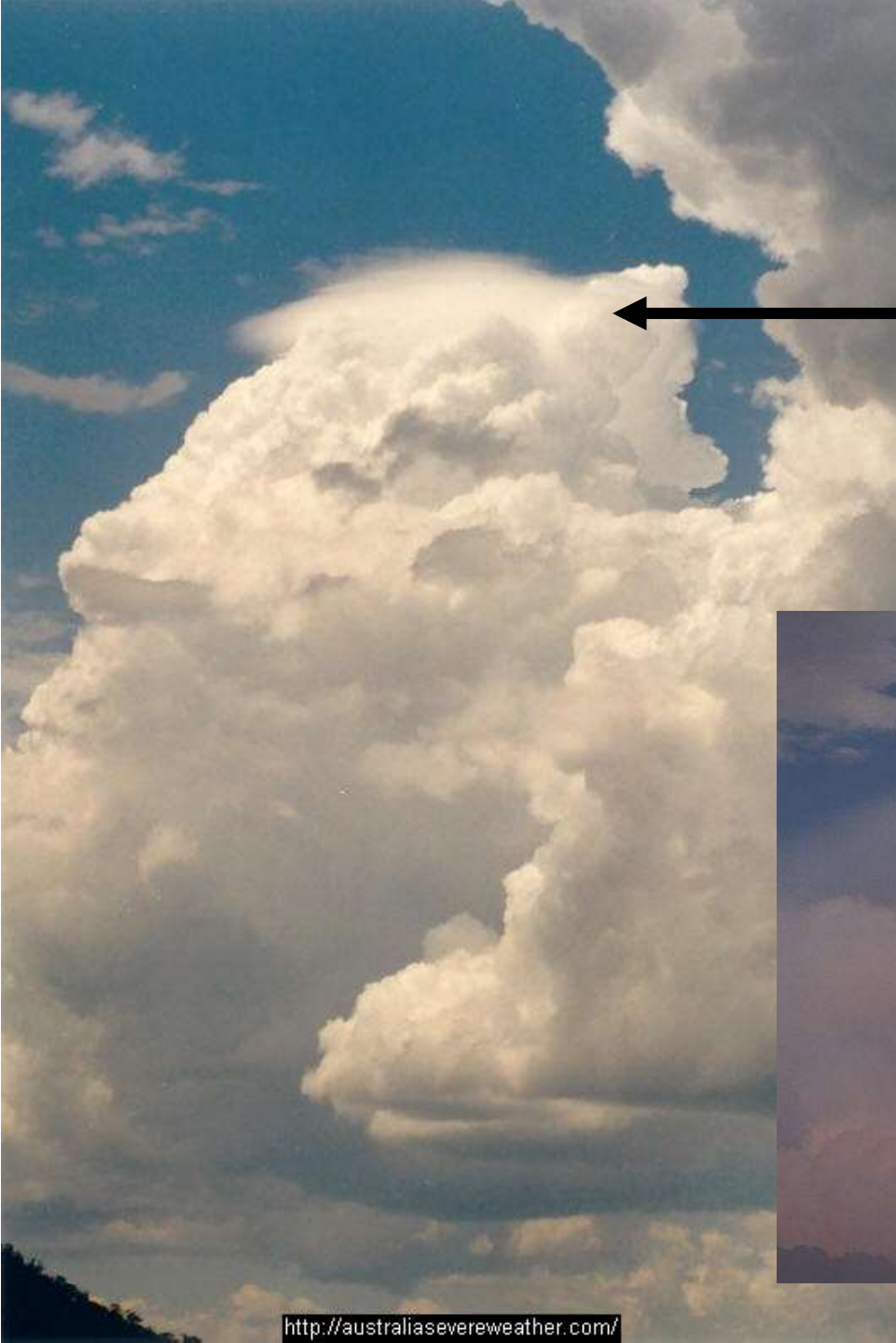


Pileus Cloud

An unusual cloud that forms above a building cumulus by deflected moist winds.



Pileus Cloud



Anvil

Overshooting Top





Mammatus Cumulus

Copyright © 2004 - Jorn C. Olsen

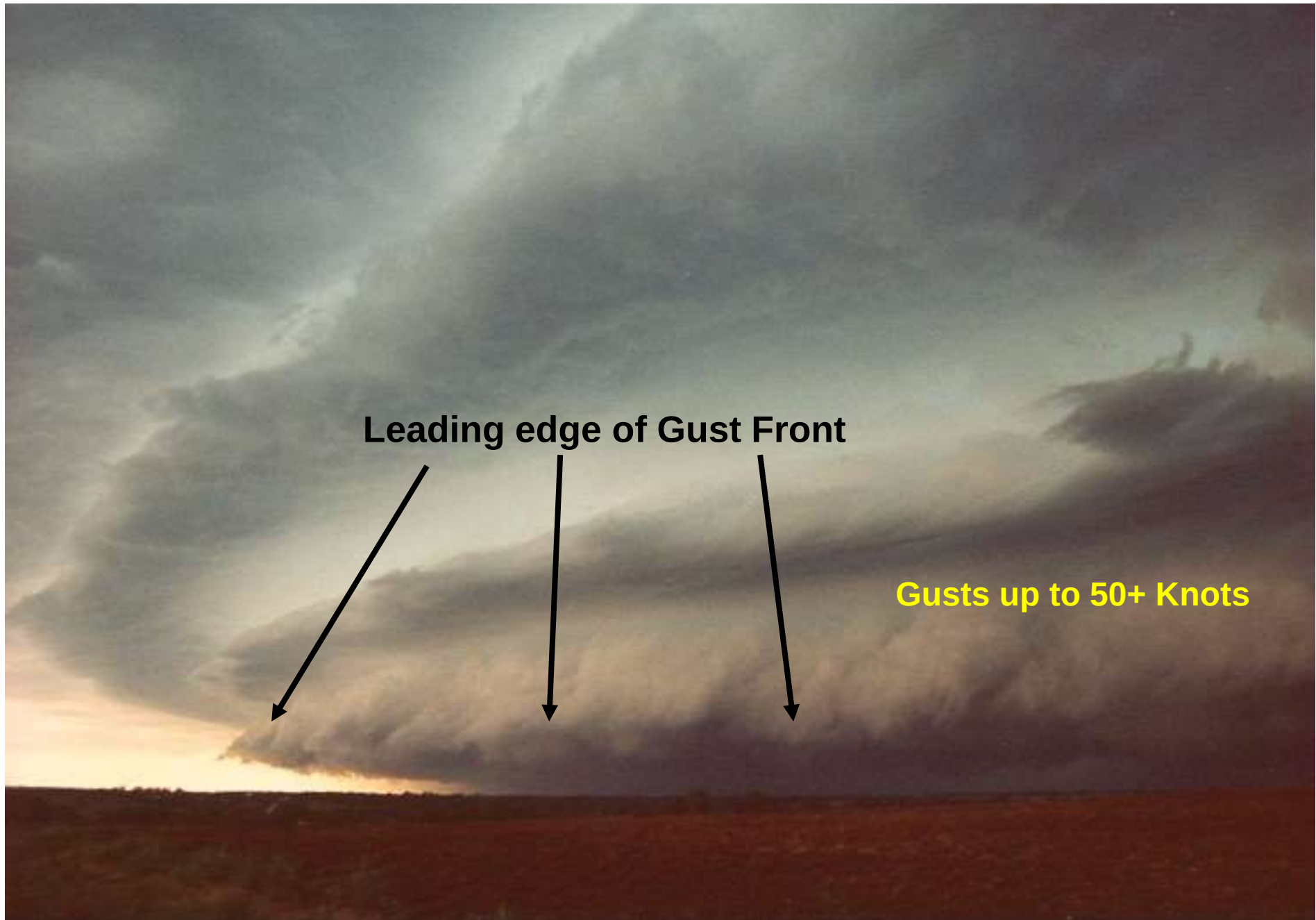


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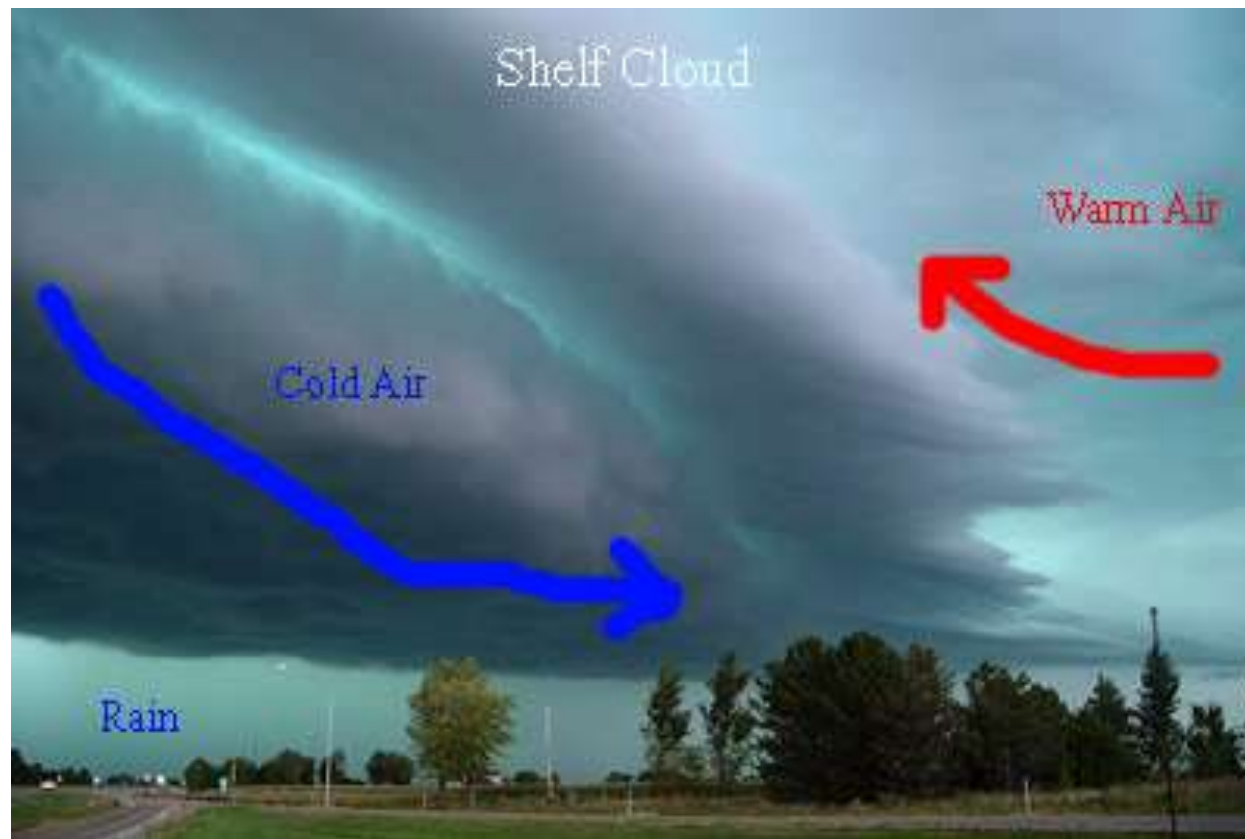
The image shows a vast sky filled with large, puffy white clouds that have a greenish-yellow tint. At the bottom, three tall stadium light towers are visible against the sky.

Green and Yellow Colouring



Leading edge of Gust Front

Gusts up to 50+ Knots



Back to the Basic's of Forecasting



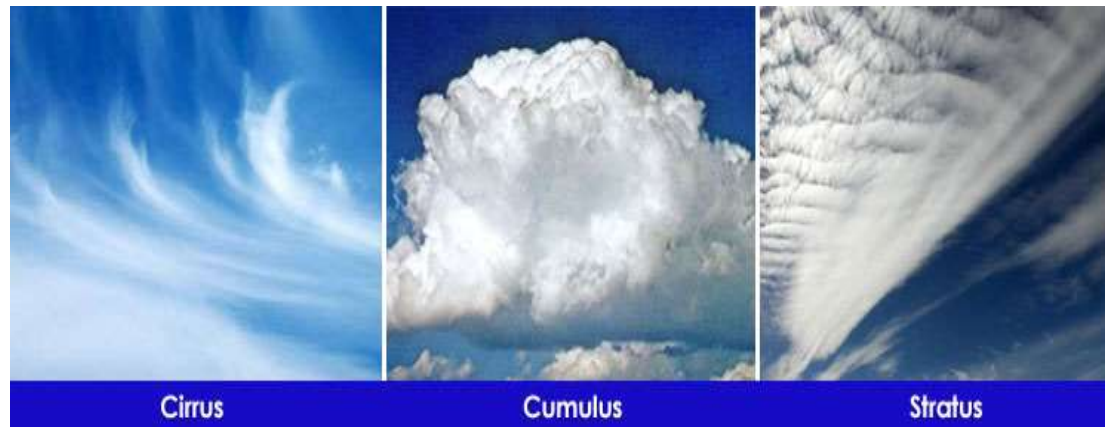
Barometers



Wind Vane



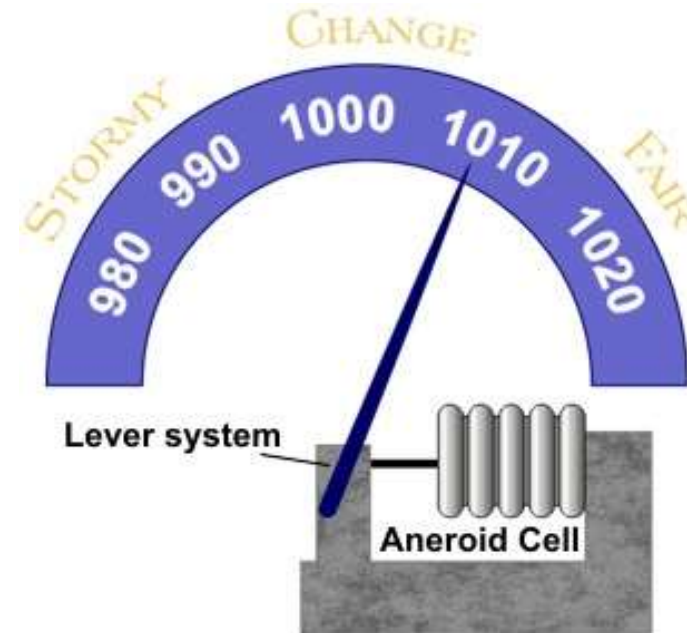
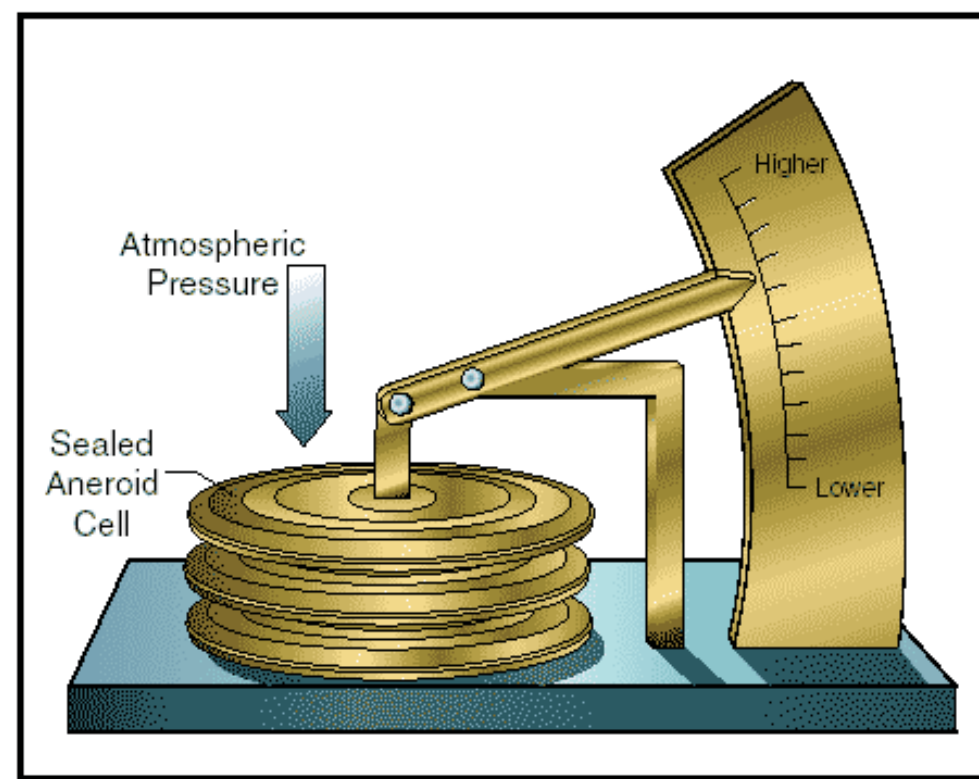
Cloud Identification





Evangelista Torricelli
(1608–1647) was an Italian
physicist and mathematician,
best known for his invention
of the barometer

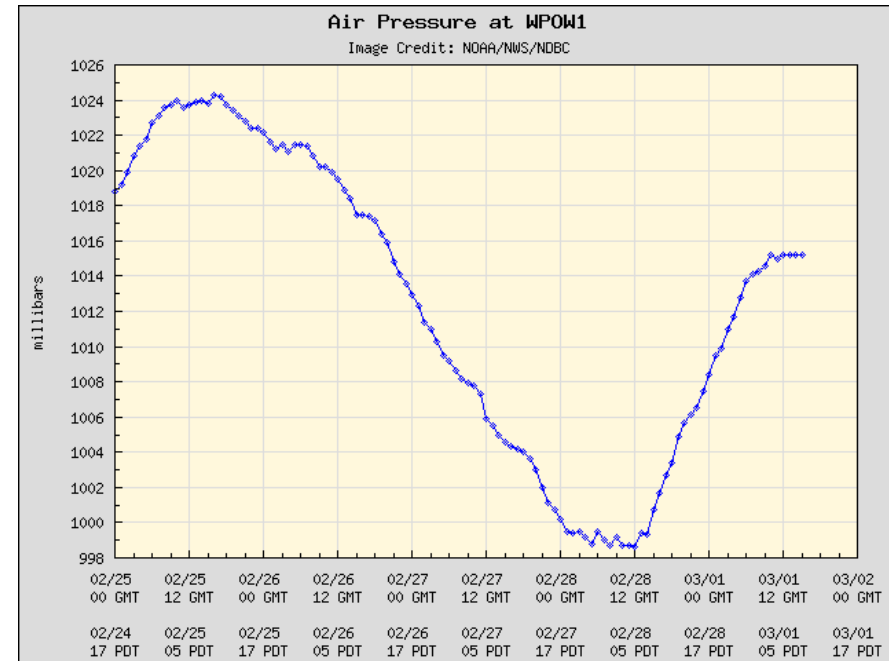
•Aneroid



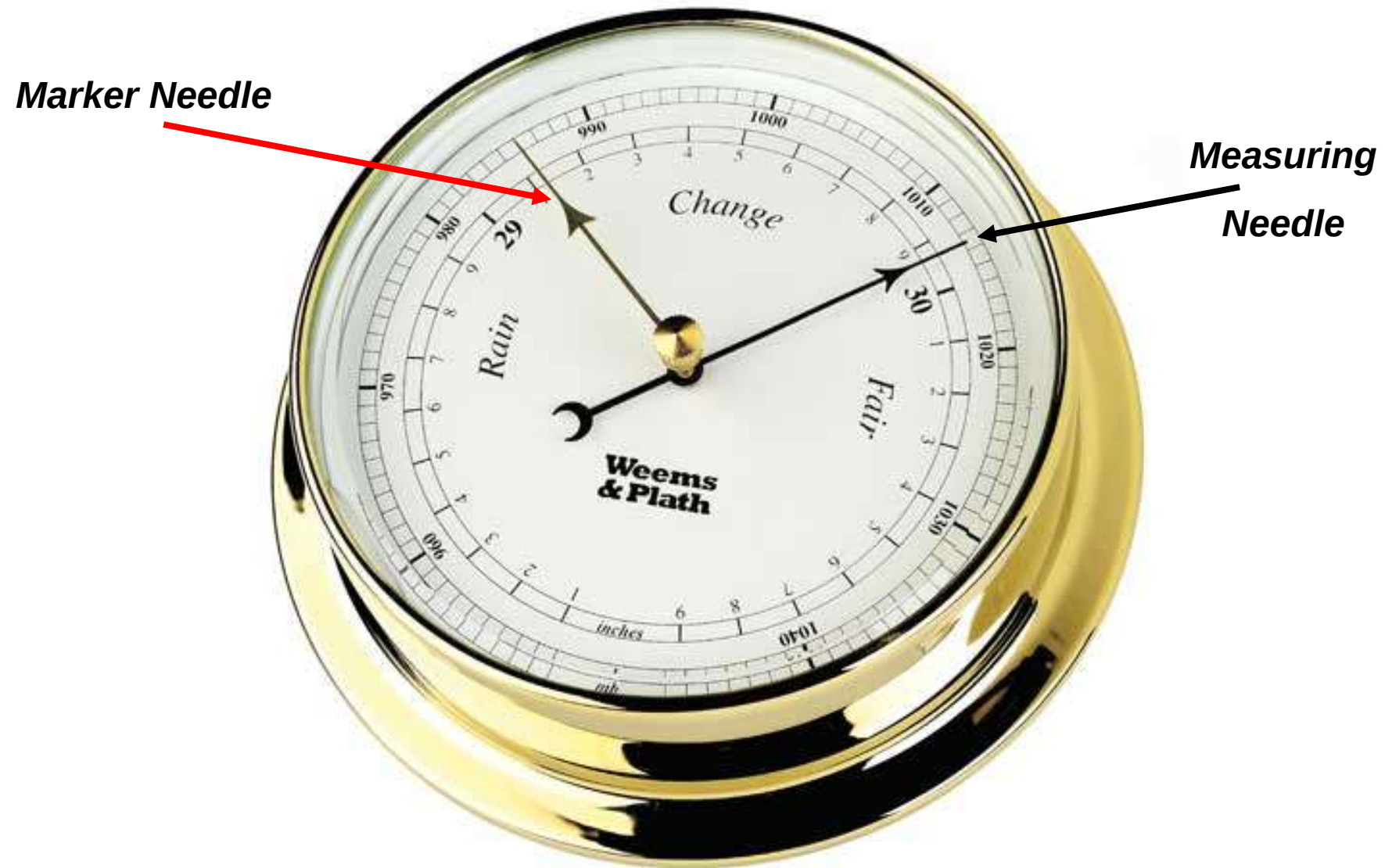
- Digital/Electronic*



Typical sensor

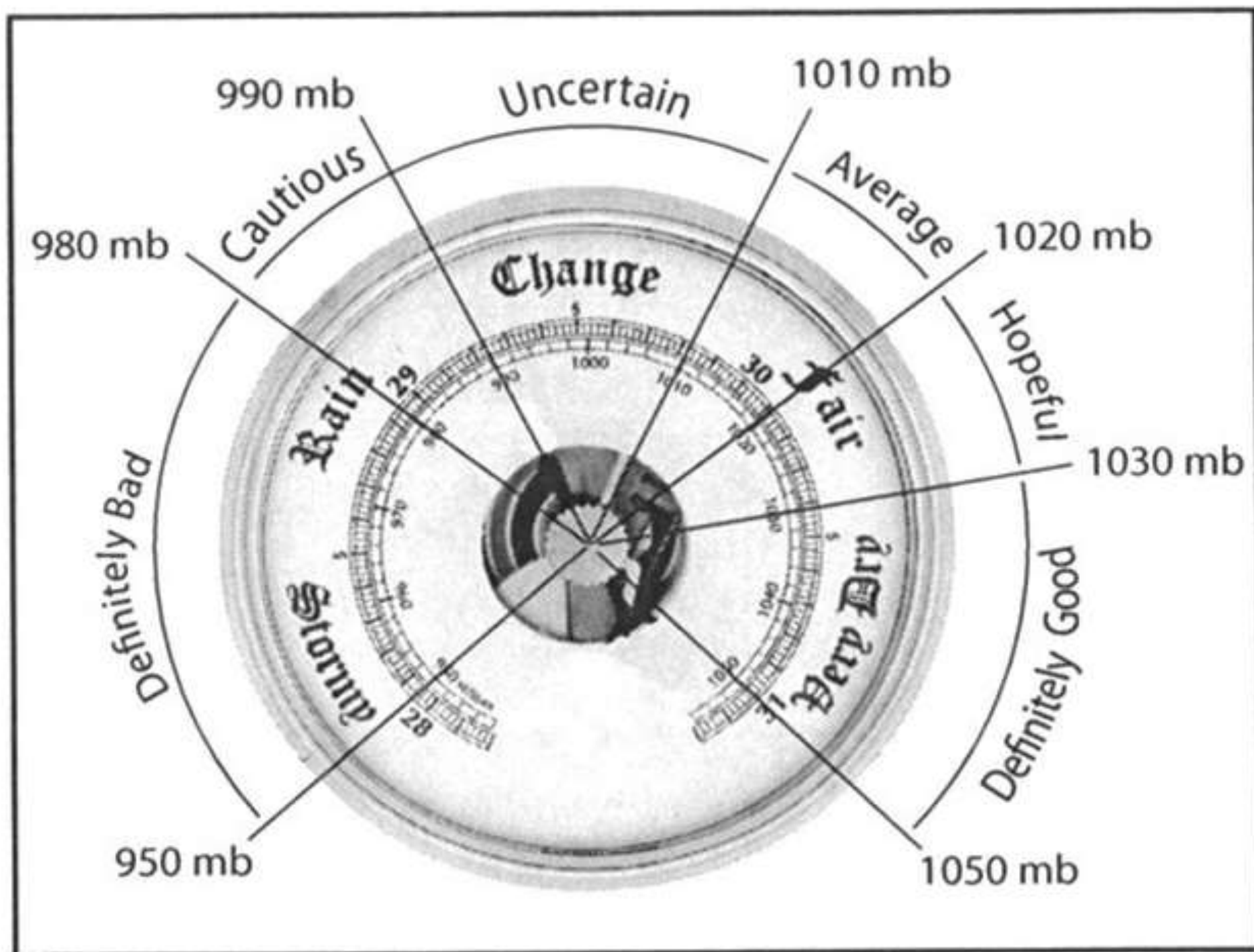


How to use, read and calibrate the Barometer



***“Adjusting” or “Calibration” Screw on the back of an
Aneroid Barometer***





Barometers and Weather Forecasting

Actual Pressure vs Change of Pressure

Table 5.5-2 NWS Definition of Rapid Change ¹		
<i>Term</i>	<i>Pressure change over 1 Hour</i>	<i>Minimum change over 3 Hours</i>
Rising or falling rapidly	2 mb or more	at least 1 mb

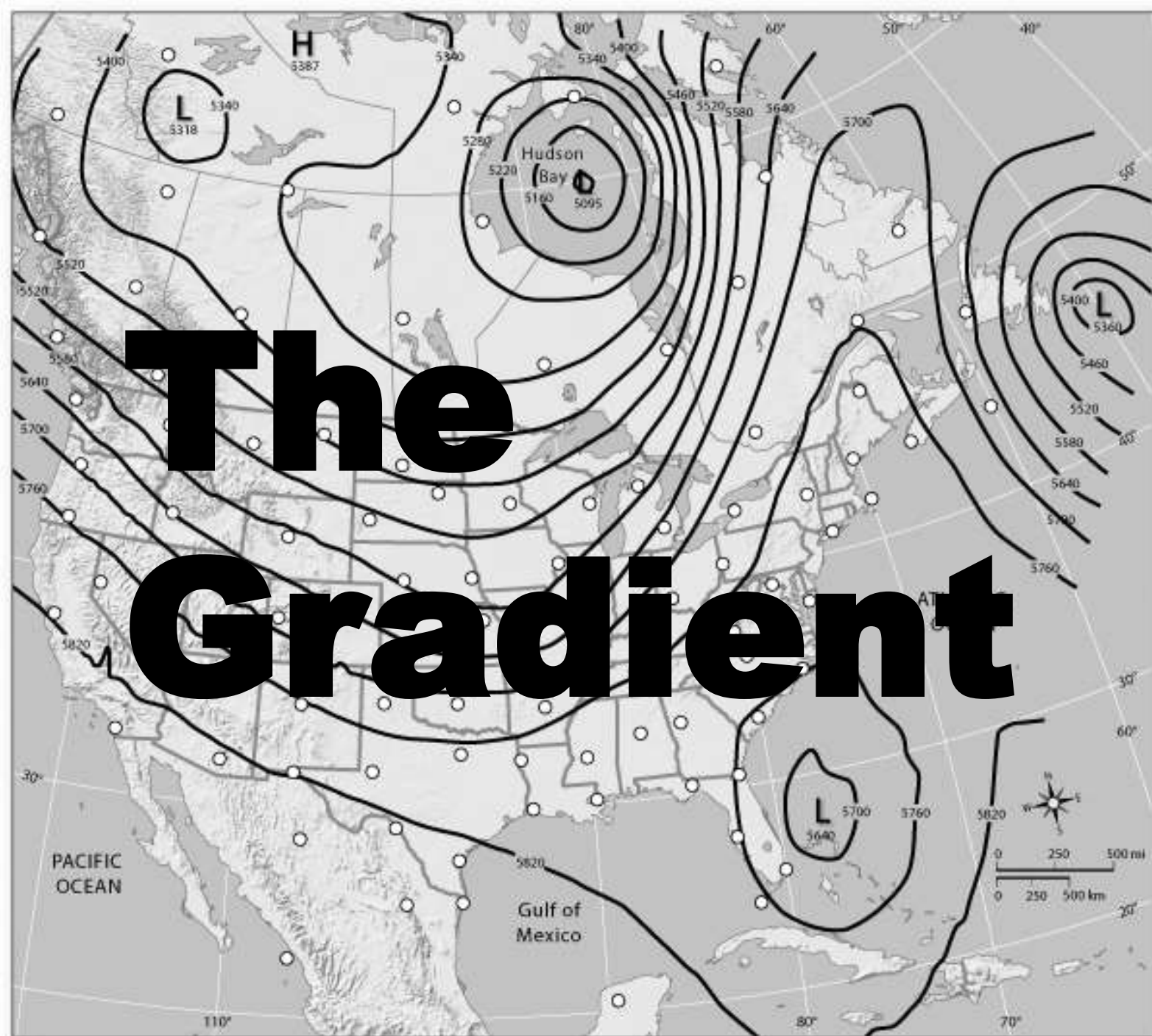
Table 5.5-3 Met Office Definition of Pressure Change ¹		
<i>Term</i>	<i>Pressure Change Over 3 Hours</i>	<i>Pressure Change Over 6 Hours²</i>
Steady	Less than 0.1 mb	Less than 0.2 mb
Rising or falling slowly	0.1 to 1.5 mb	0.2 to 3 mb
Rising or falling	1.6 to 3.5 mb	3.2 to 7 mb
Rising or falling quickly	3.6 to 6.0 mb	7.2 to 12 mb
Rising or falling very rapidly	More than 6.0 mb	More than 12 mb

General Rule for Wind Speed Increase and Pressure Change

“4-5-6” Guideline to Pressure as Wind Forecaster

<i>Likely Significance</i>	<i>Steady pressure drop over 6 Hours</i>
Alert	Less than 3 mb
Caution	3 to 4 mb
Definite warning	4 to 5 mb
Too late for forecasting	More than 5 mb

Appendix 5a. Weather Forecasting Table — Northern Hemisphere*			
BAROMETER AT SEA LEVEL		WIND	CHARACTER OF WEATHER
Rising			
1019 to 1023	Rising rapidly	SW to NW	Fair followed within 2 days by rain.
≤ 1016	Rising slowly	S to SW	Clearing within a few hours and fair for several days.
≤ 1009	Rising rapidly	Going to W	Clearing and colder
Steady			
≥ 1023	Steady	SW to NW	Continued fair with no decided temperature change.
1019 to 1023		SW to NW	Fair with slight temperature changes for 1 or 2 days.
Falling			
≥ 1023	Falling slowly	SW to NW	Slowly rising temperature and fair for 2 days.
	Falling slowly	E to NE	In summer with light winds, rain may not fall for several days. In winter, rain in 24 hours.
1019 to 1023	Falling slowly	S to SE	Rain within 24 hours.
		SE to NE	Rain in 12 to 18 hours.
	Falling rapidly	S to SE	Wind increasing in force; rain within 12 to 24 hours.
		SE to NE	Increasing wind and rain within 12 hours.
≥ 1019	Falling rapidly	E to NE	In summer, rain probably in 12 hours. In winter, rain or snow with increasing winds will often set in when the barometer begins to fall and the wind sets in from the NE
≤ 1016	Falling slowly	SE to NE	Rain will continue 1 or 2 days.
	Falling rapidly	SE to NE	Rain with high winds, followed within 36 hours by clearing and, in winter, colder temperatures.
		S to E	Severe storm imminent, followed within 24 hours by clearing and, in winter, colder temperatures.
≤ 1009	Falling rapidly	E to N	Severe NE gale and heavy rain; in winter, heavy snow followed by a cold wave.



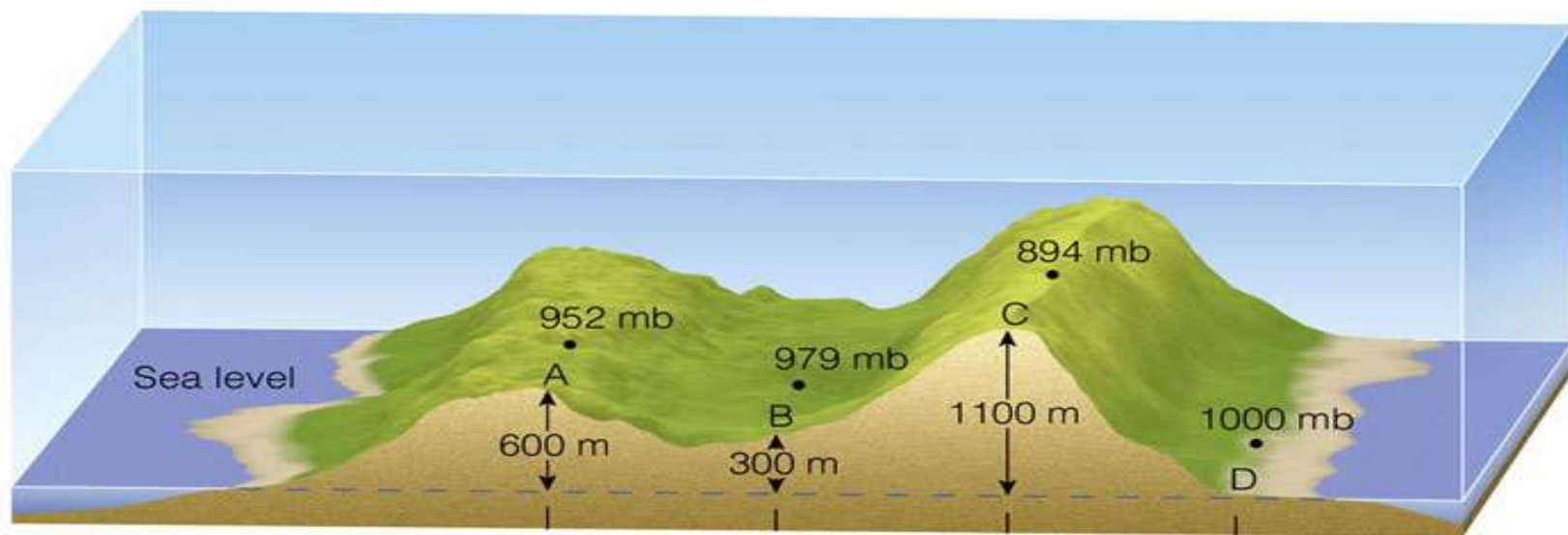


Diagram (a)

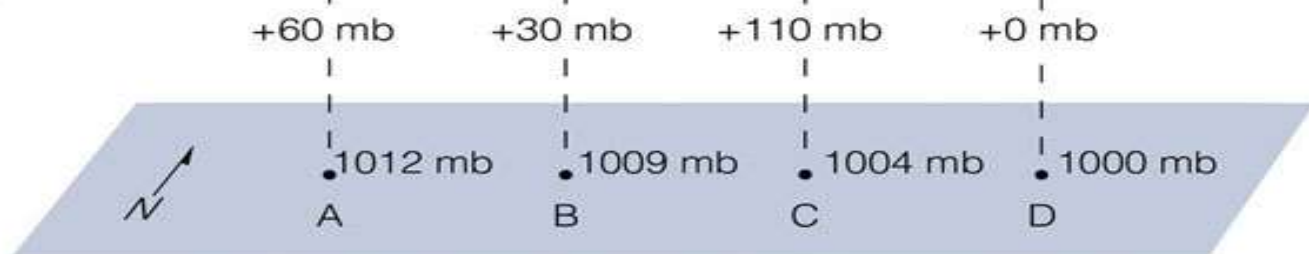


Diagram (b)

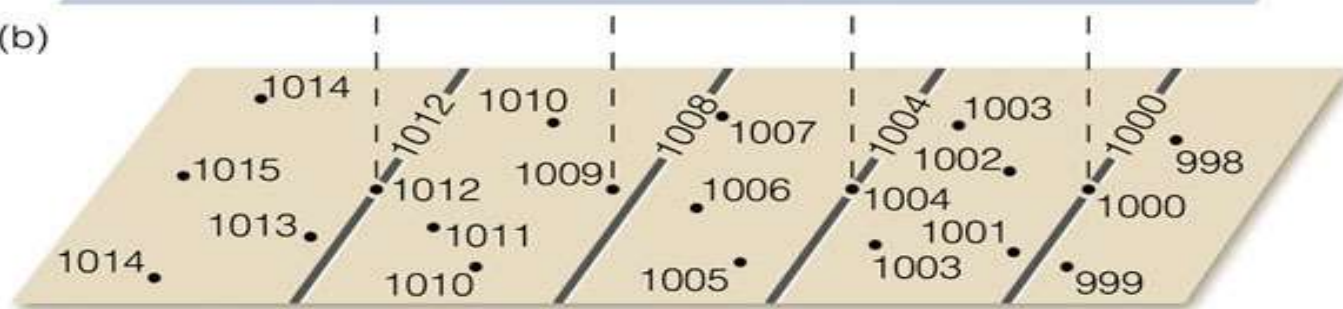
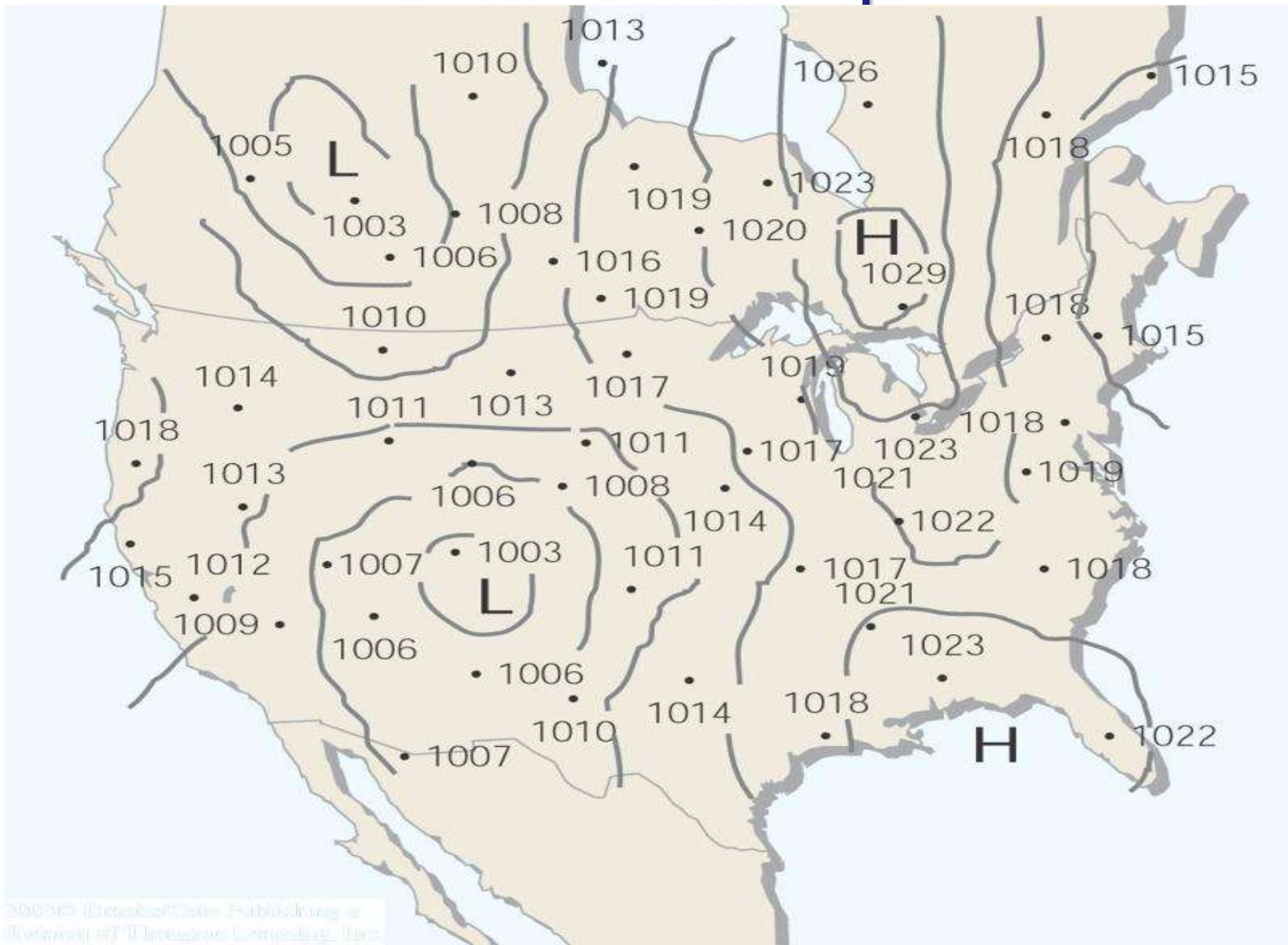


Diagram (c)

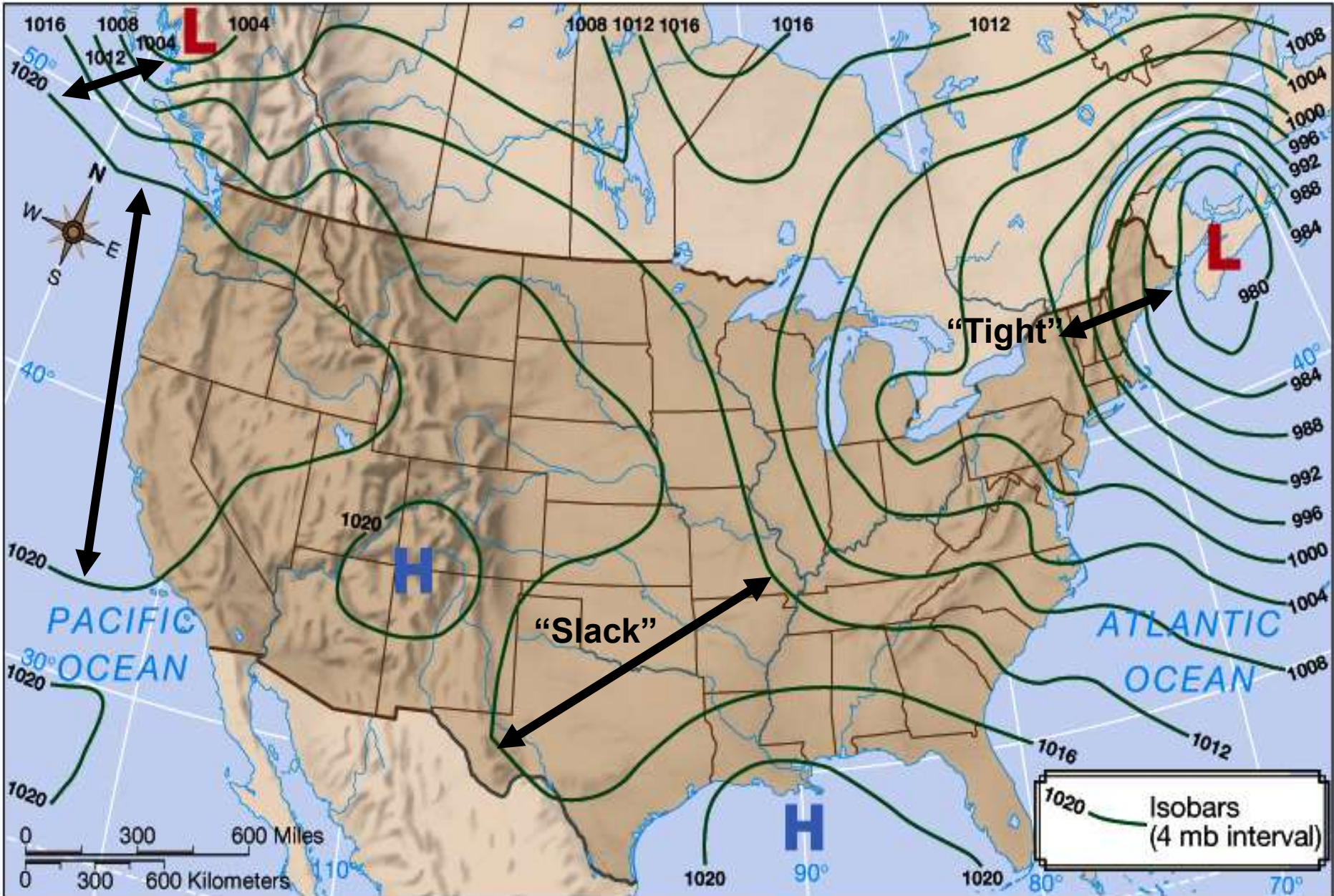
SEA-LEVEL PRESSURE CHART

Isobars

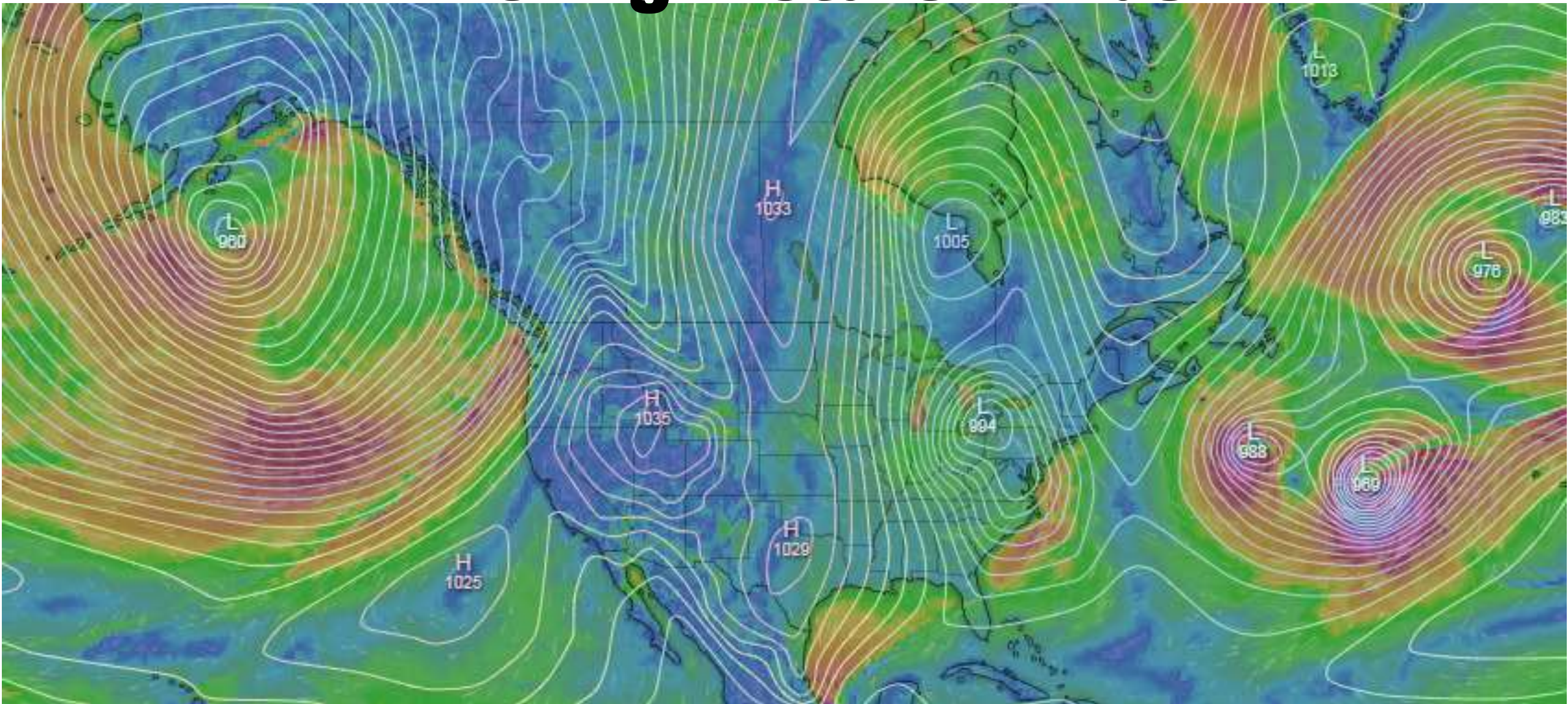
Smoothed Isobar Maps

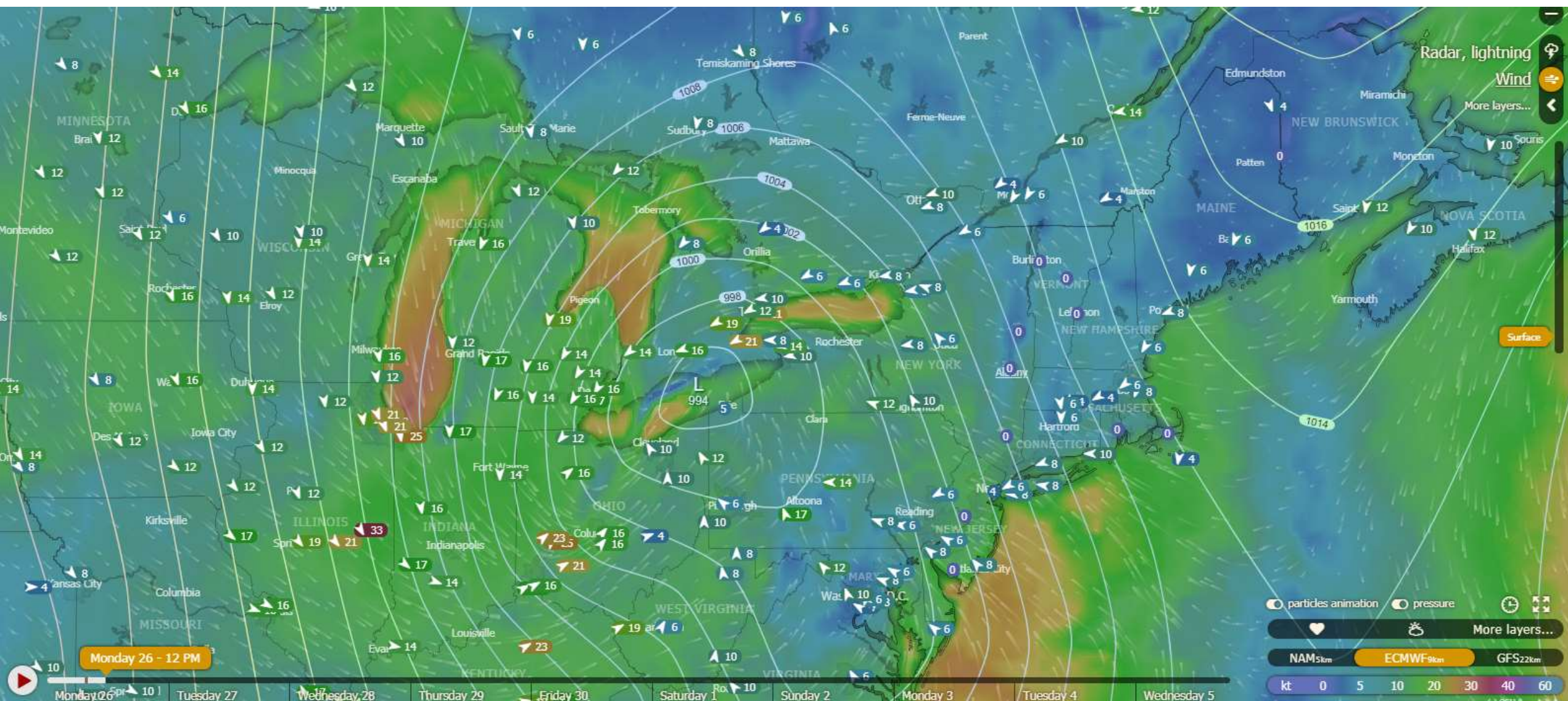


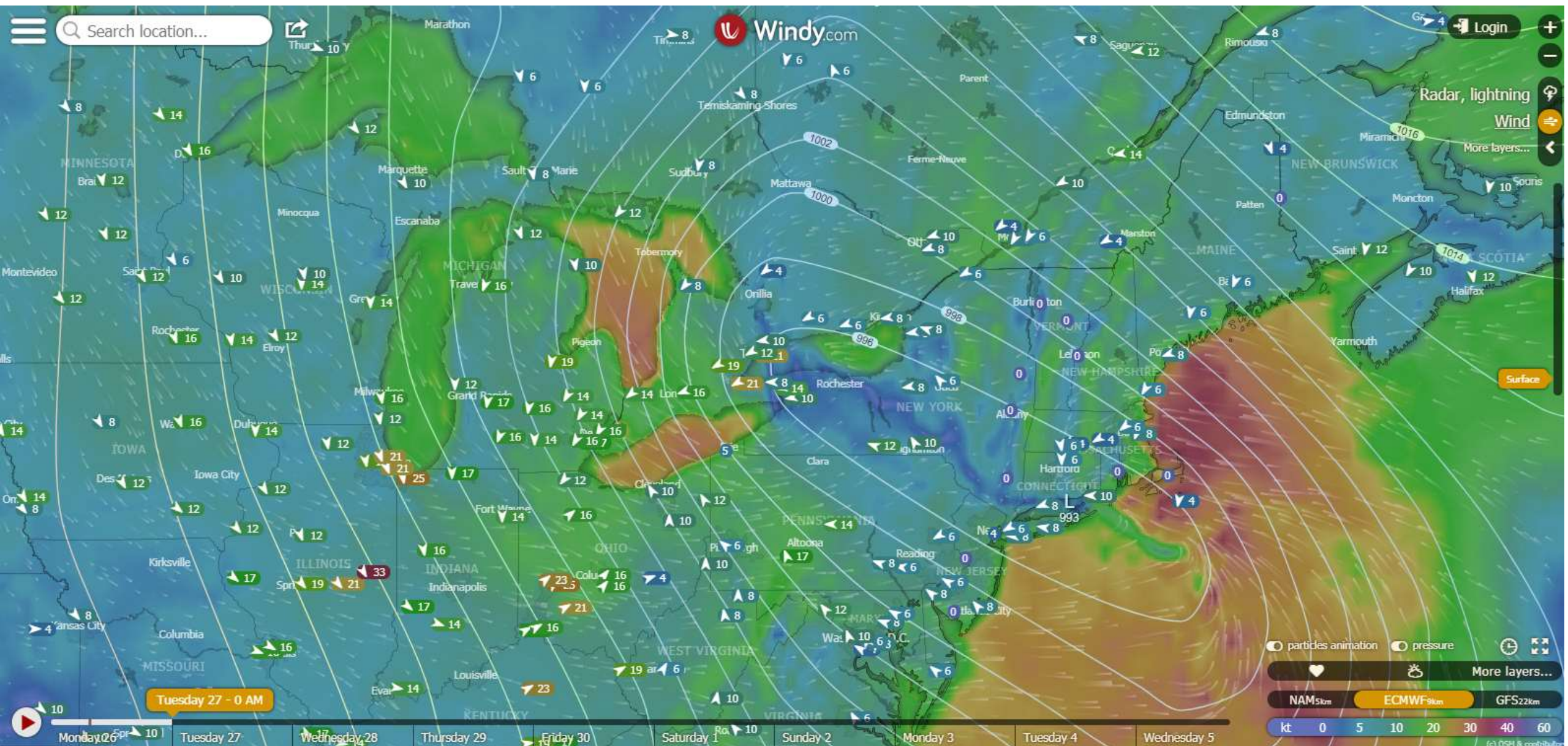
Isobars Basics – The Gradient



The Big Picture Winds







Search location...

Windy.com

Login

Radar, lightning

Wind

More layers...

Surface

particles animation pressure

More layers...

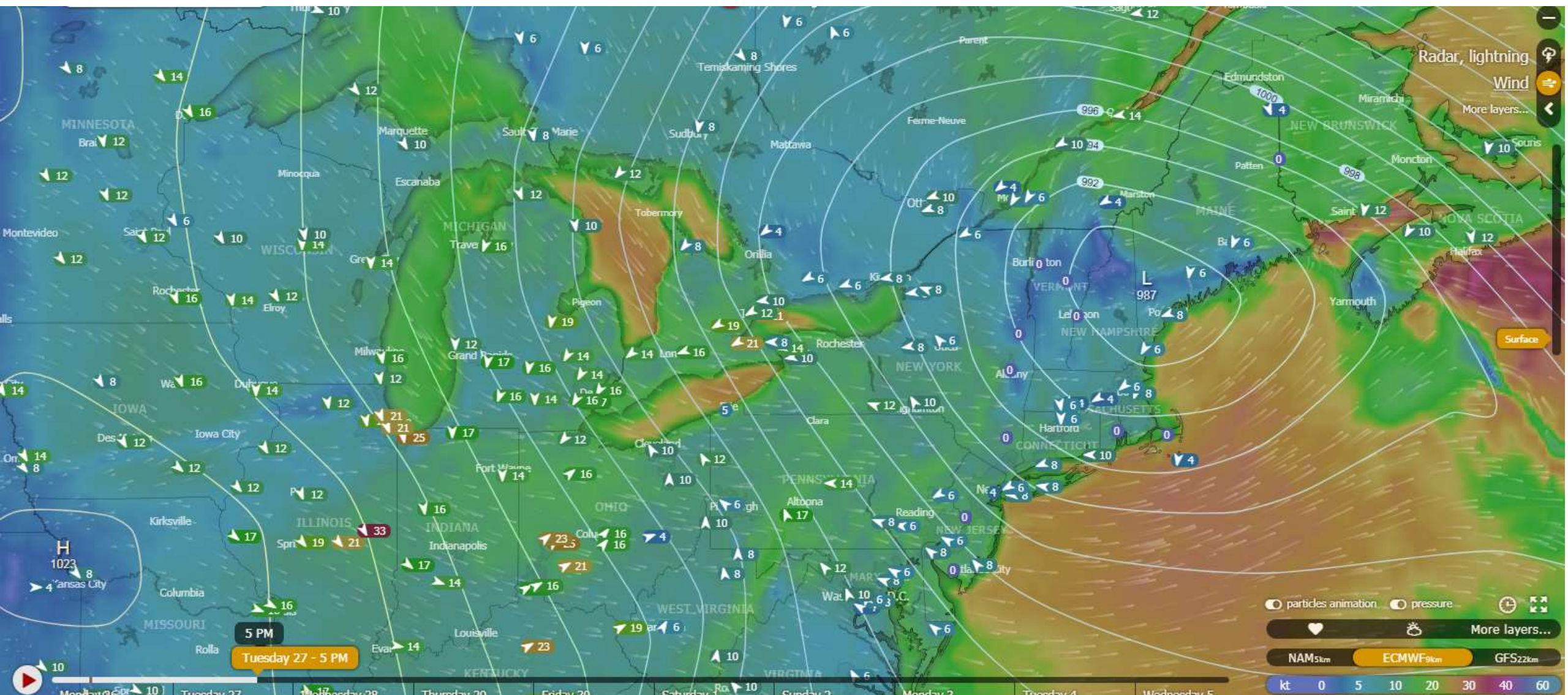
NAM5km ECMWF9km GFS22km

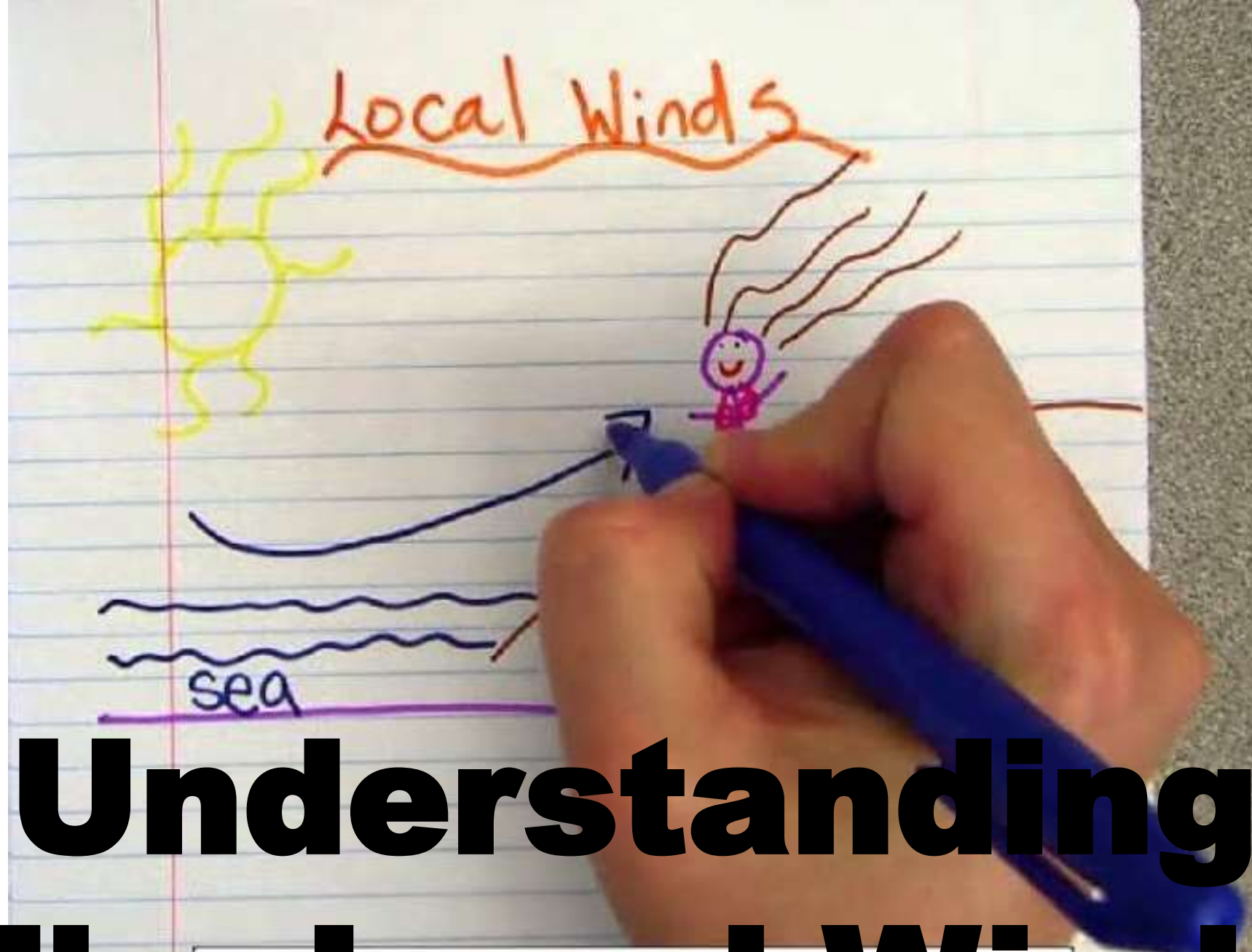
kt 0 5 10 20 30 40 60

(c) GSI & contributors

Tuesday 27 - 0 AM

Monday 26 Tuesday 27 Wednesday 28 Thursday 29 Friday 30 Saturday 1 Sunday 2 Monday 3 Tuesday 4 Wednesday 5

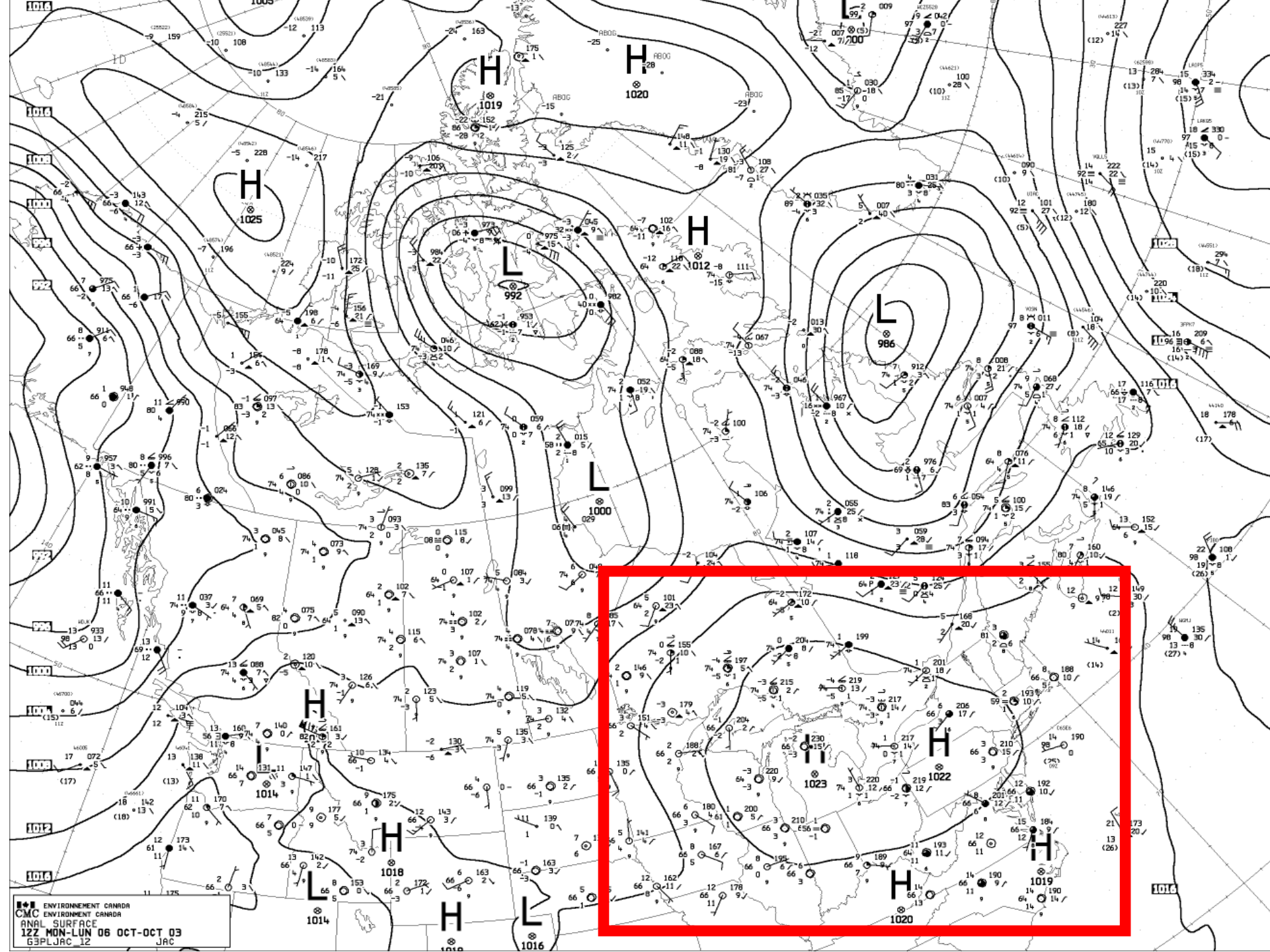




Understanding The Local Winds

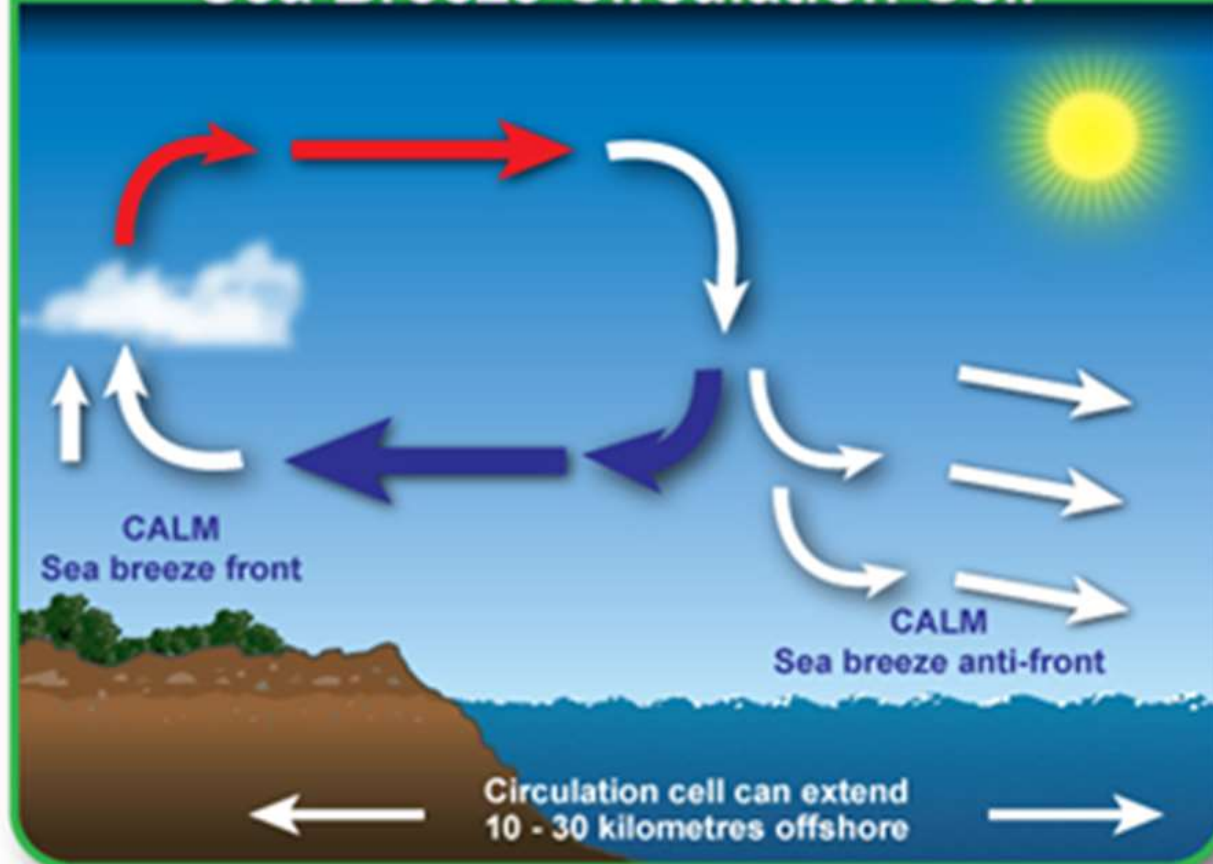
Other Forces That Act On the Local Wind

- **Stable and Unstable air**
- **Time of Day**
- **Inversions**
- **Geography and Topography**
- **Local Lake and Land Breezes**
- **Cumulus Clouds and Storms**

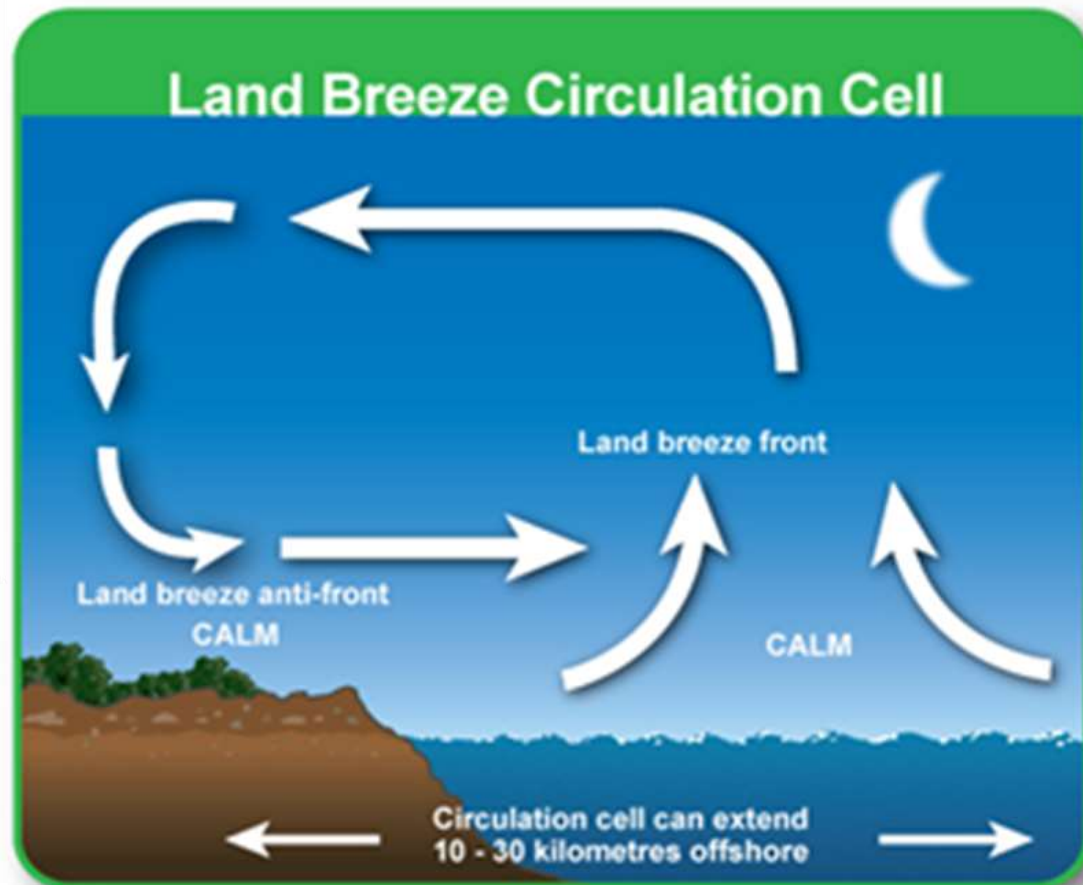


ENVIRONNEMENT CANADA
CMC ENVIRONMENT CANADA
ANAL SURFACE
12Z MON-LUN 06 OCT-OCT 03
63PLJAC 12 JAC

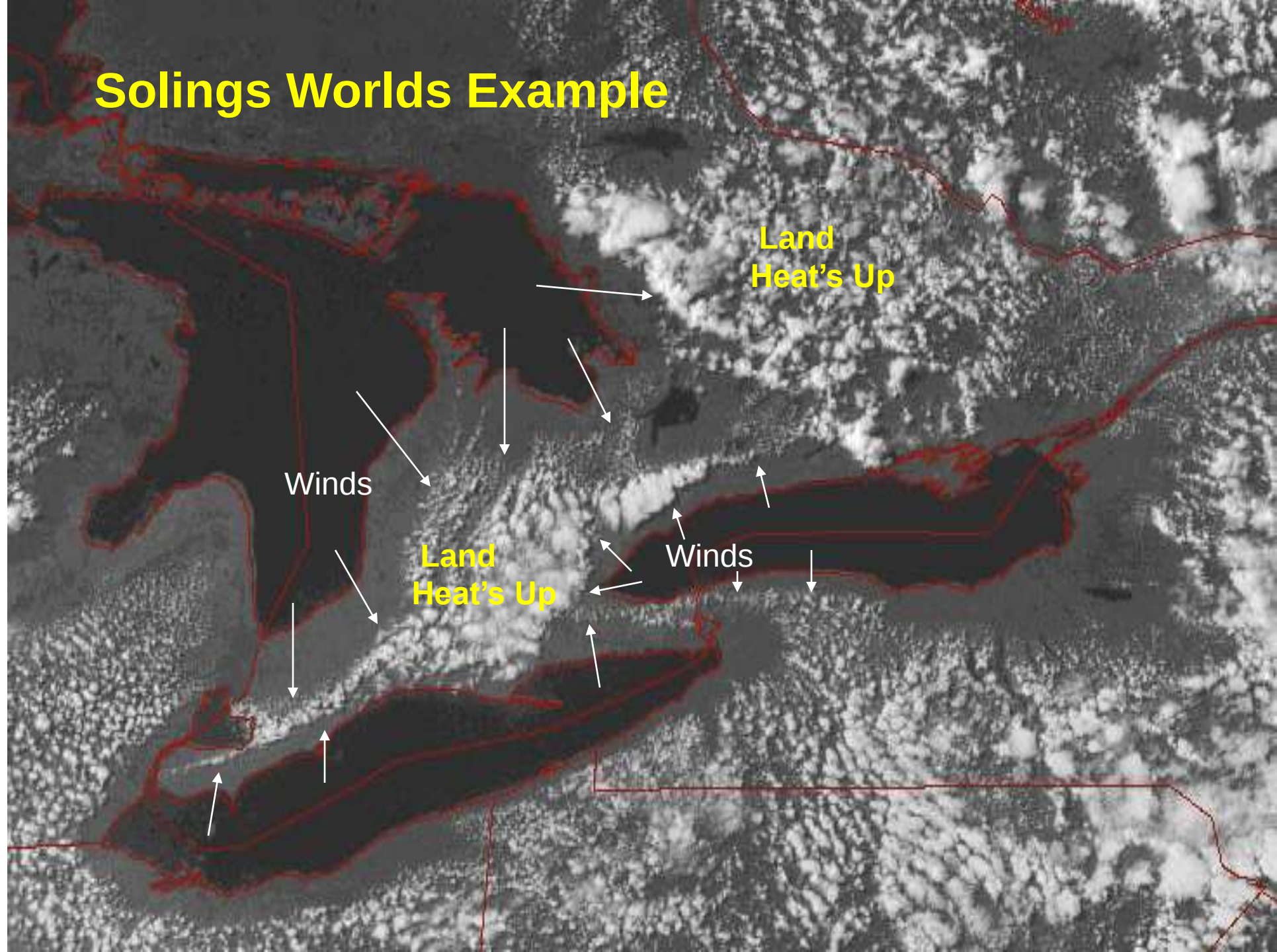
Sea Breeze Circulation Cell



Land Breeze Circulation Cell

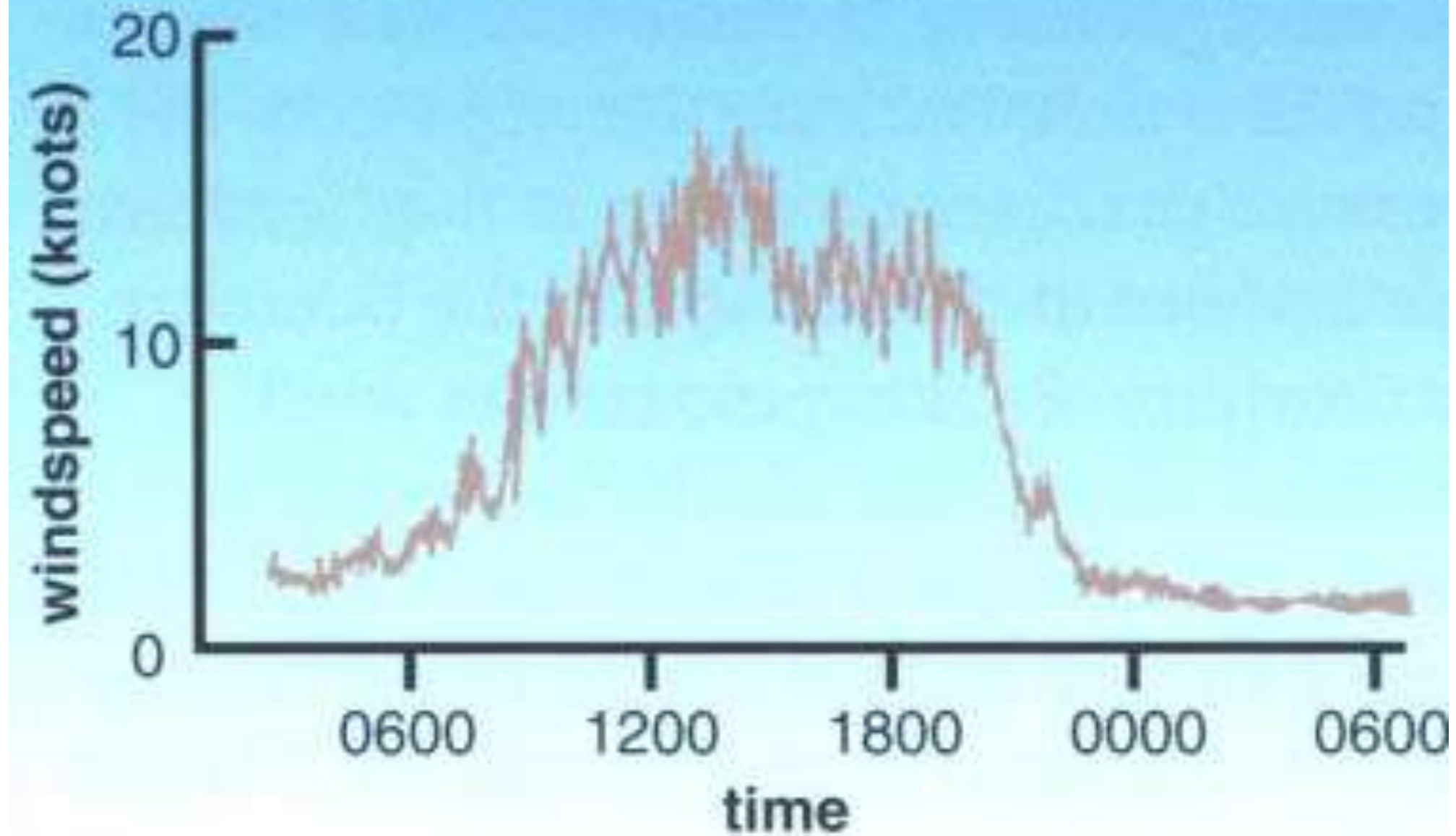


Solings Worlds Example



Under a Weak or Flat Gradient – A weak Weather Regime

Daily Cycle of Wind Speed



Funnelling



Channelling Winds



Coastal Convergence Due to Channelling



Channelling Winds



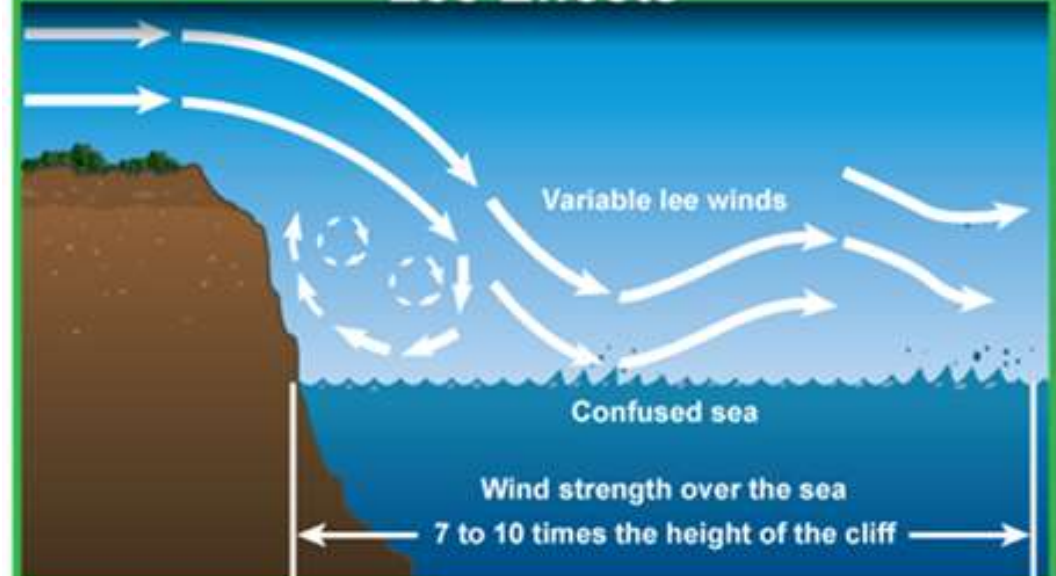
Funnelling of Winds in Eastern Lake Ontario

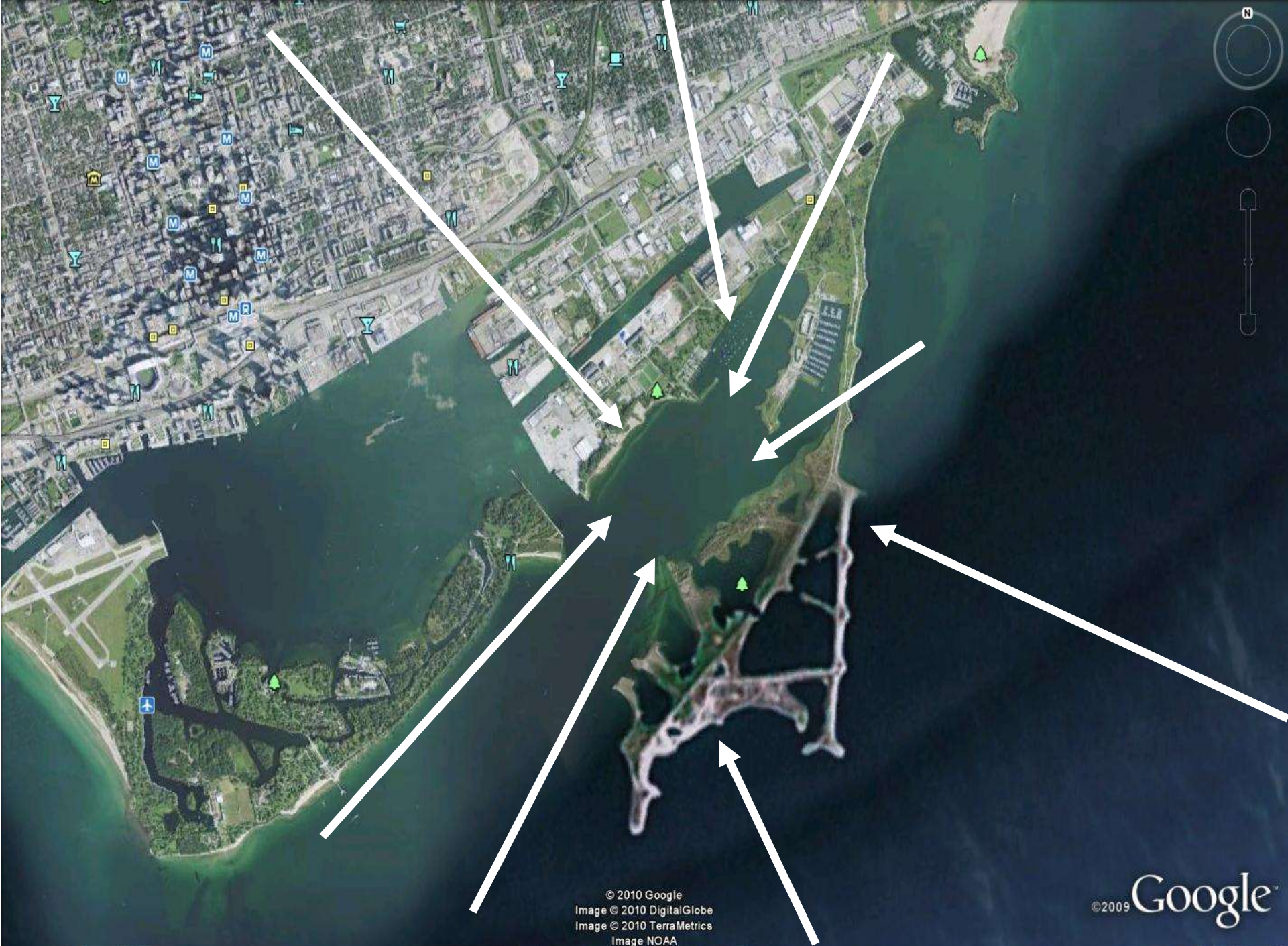


Onshore Winds



Lee Effects





Imagery Date: Aug 31, 2009

43°38'03.34" N 79°20'29.91" W elev 231 ft

©2009 Google

© 2010 Google
Image © 2010 DigitalGlobe
Image © 2010 TerraMetrics
Image NOAA

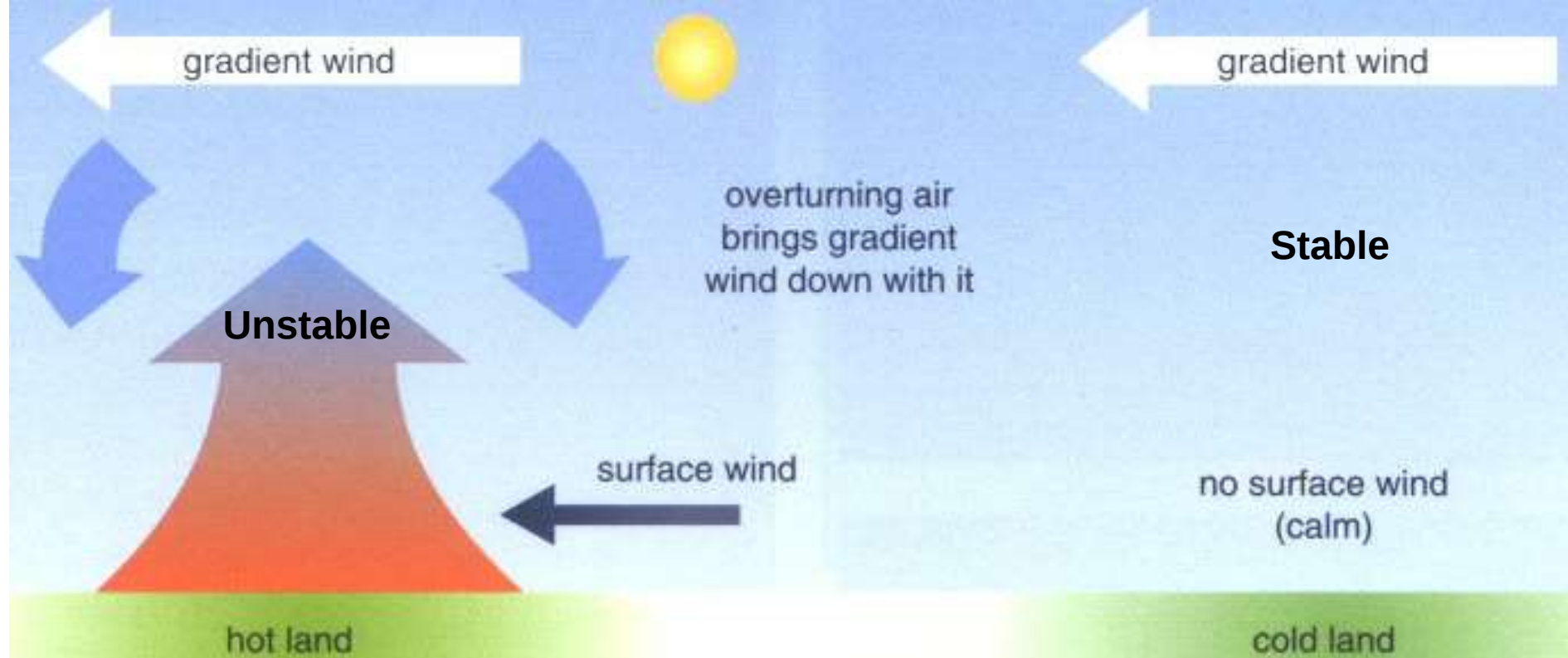
Eye alt 28483 ft



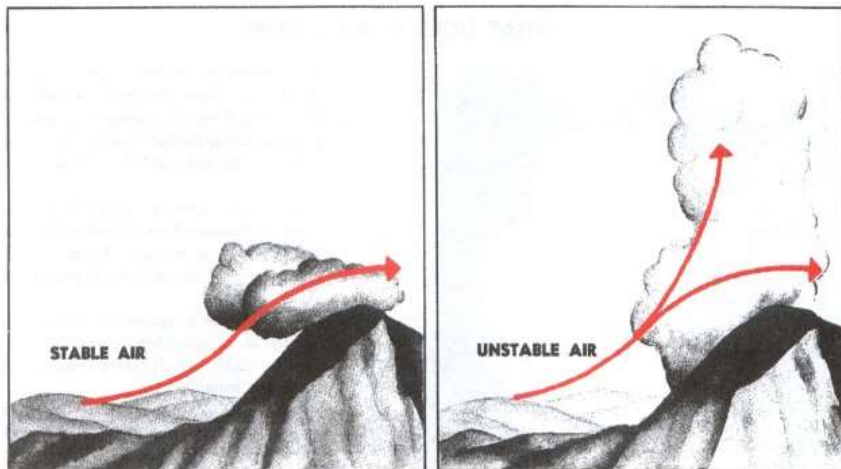
Imagery Date: Aug 31, 2009

© 2010 Google
Image © 2010 DigitalGlobe
Image © 2010 TerraMetrics
© 2010 Europa Technologies
43°38'19.18" N 79°19'50.16" W elev 215 ft

©2009 Google
Eye alt 11562 ft



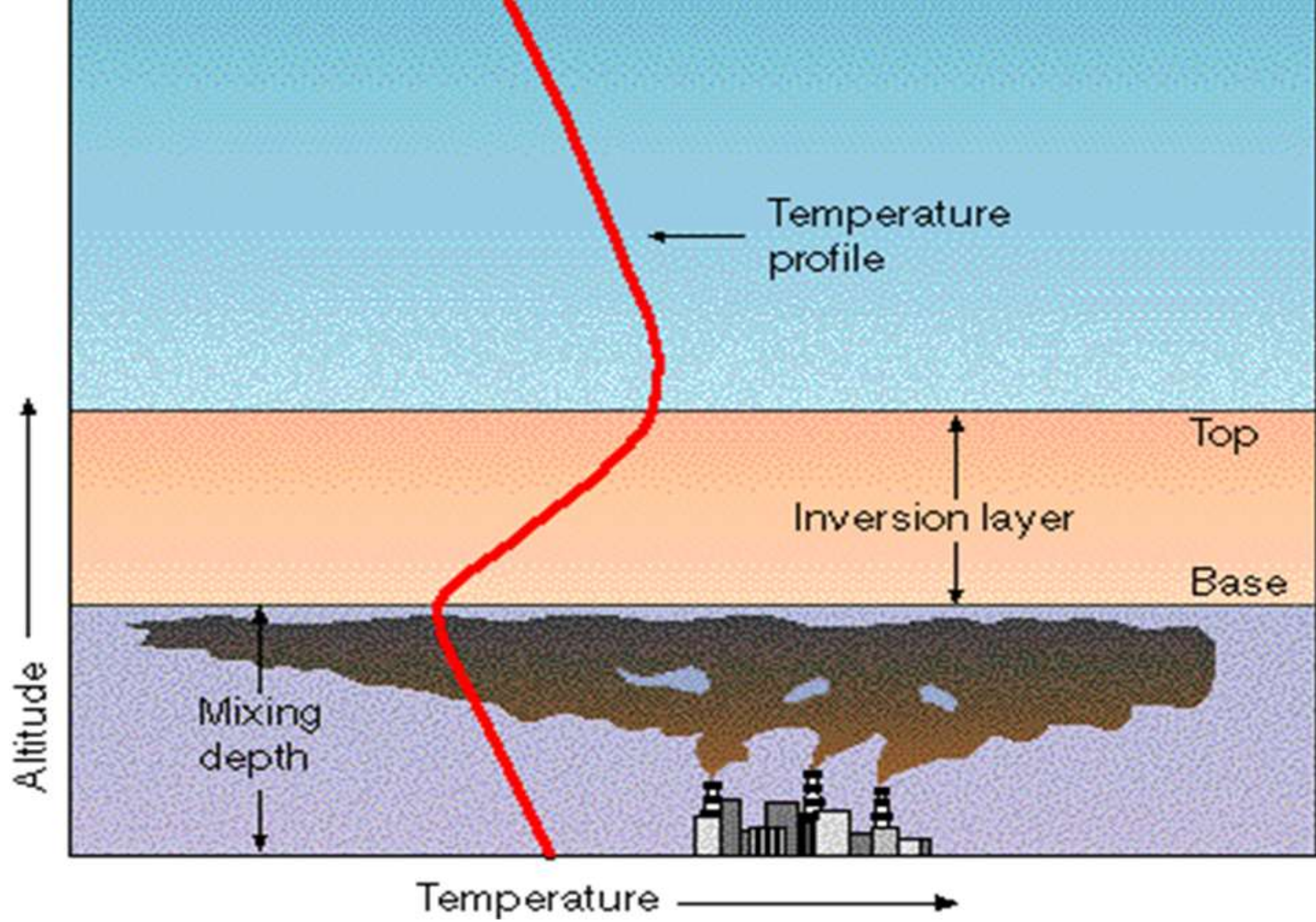
Unstable Air promotes mixing from winds above the ground to the Surface - *Stable does not*

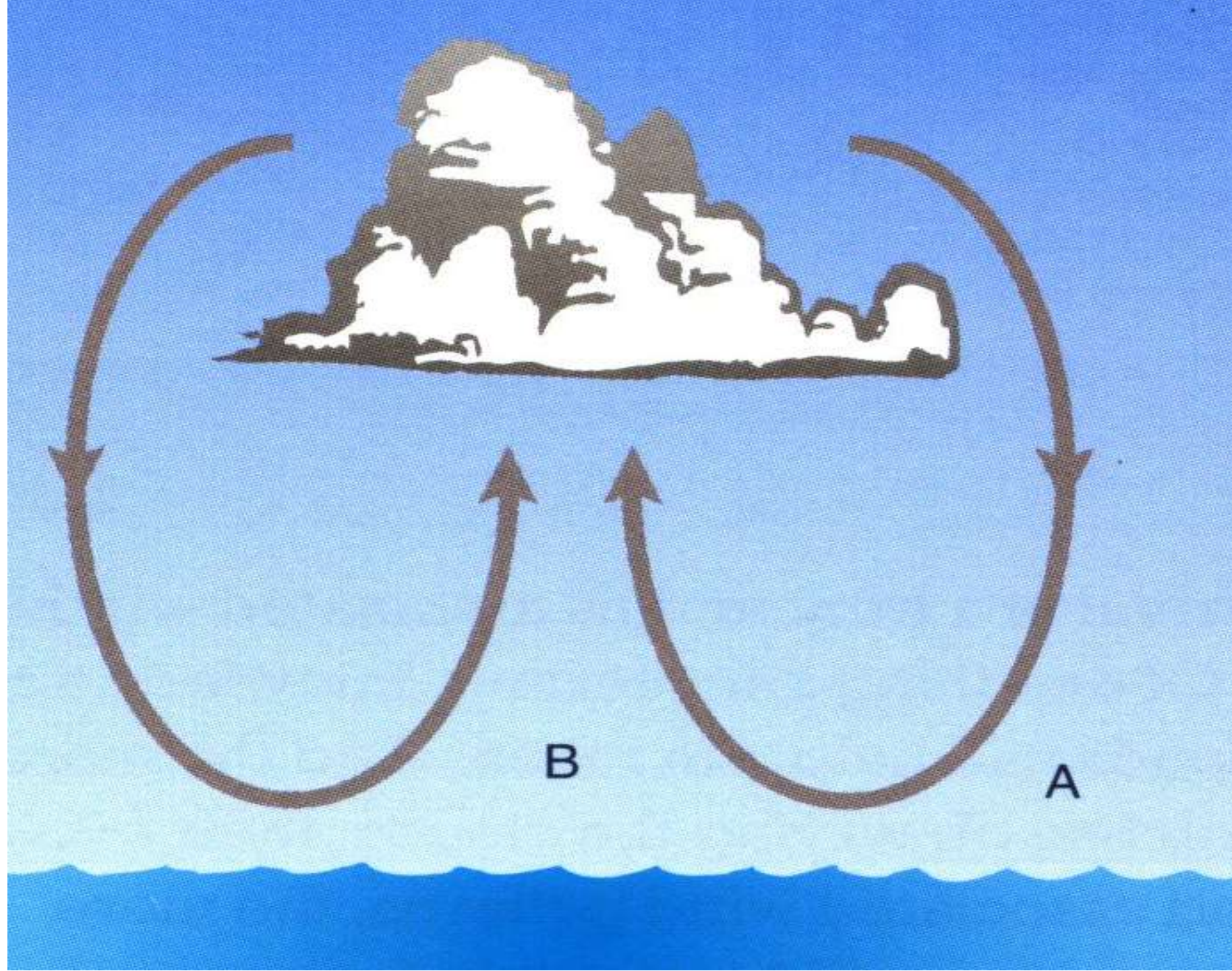


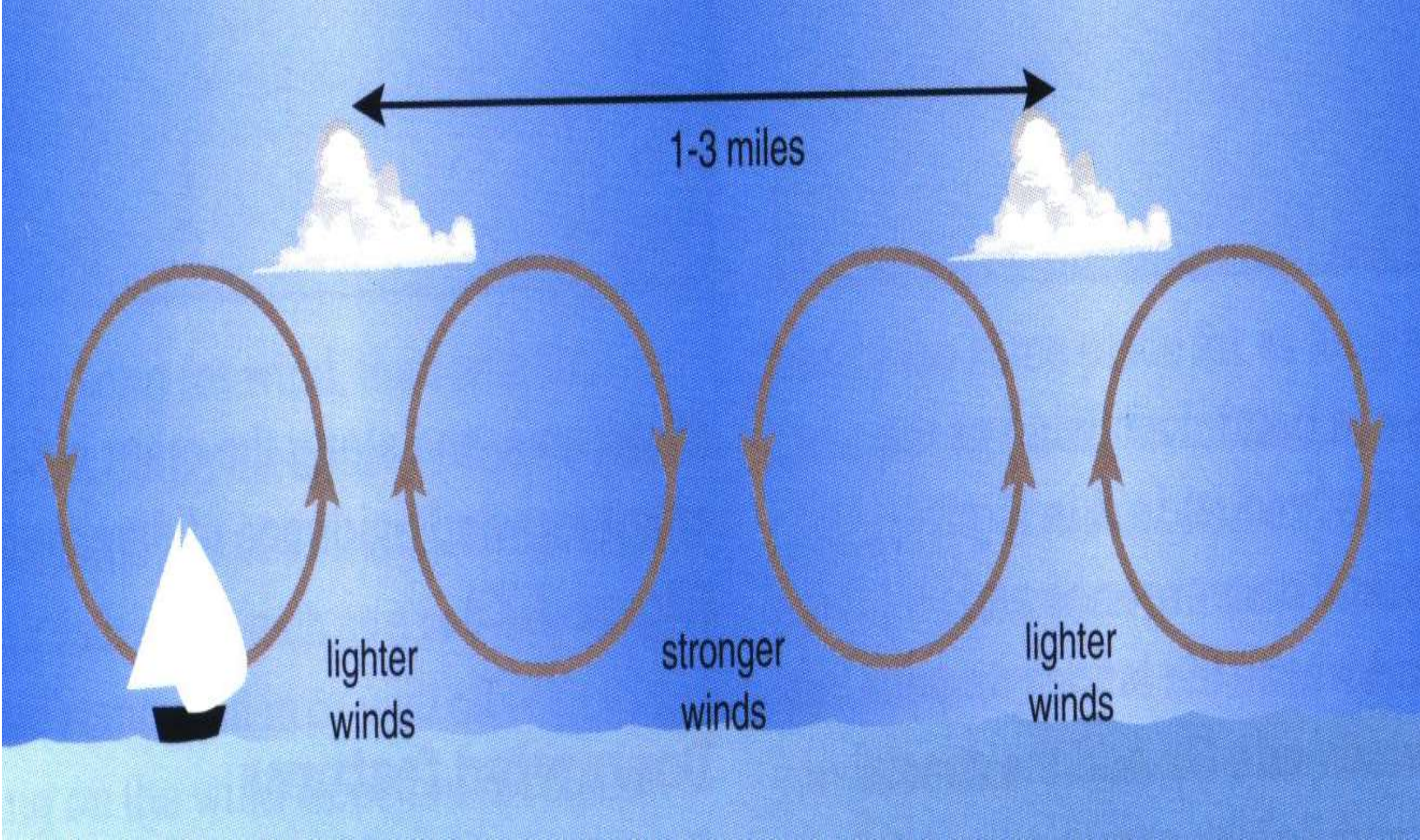
Warmer Air Above

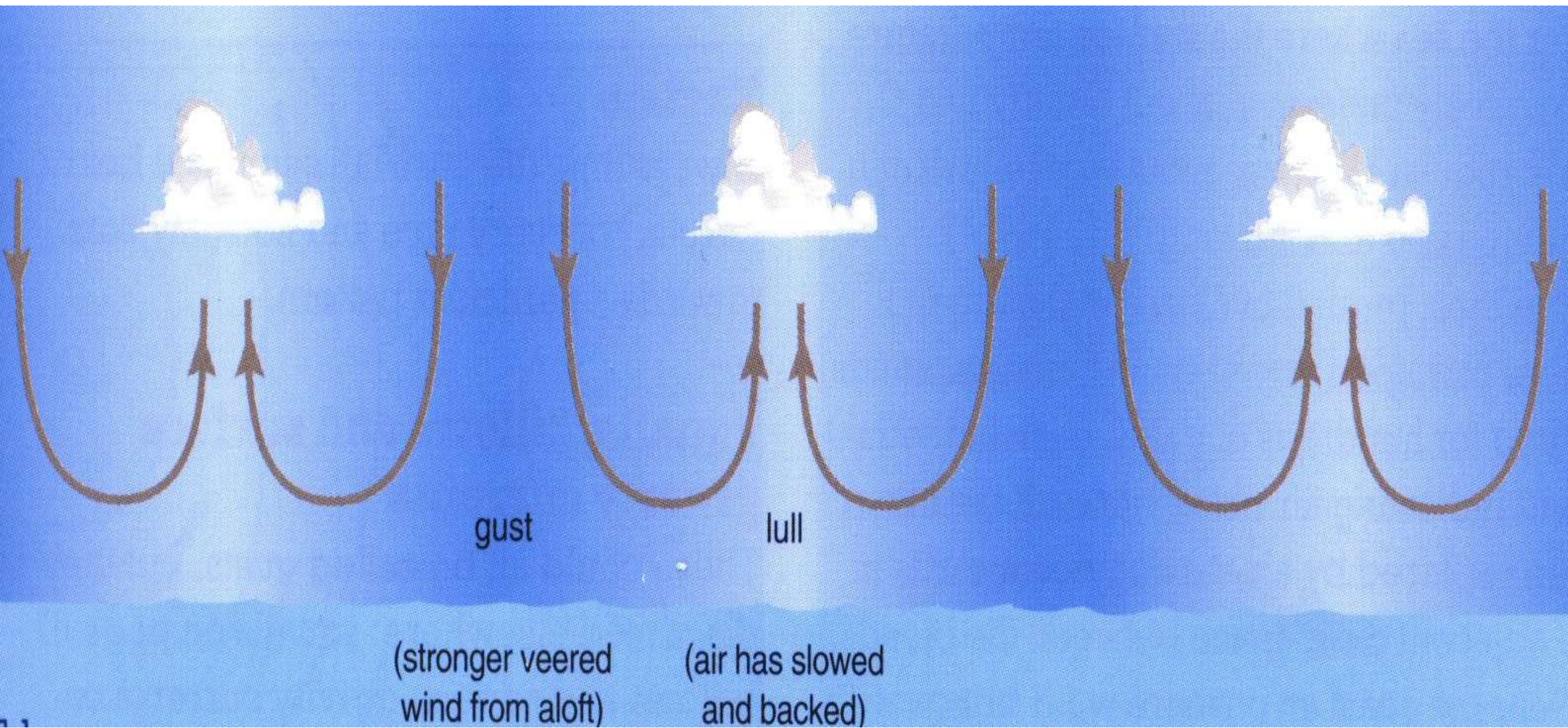
Cooler Air Below













Lightning and the Sailor

Facts and myths about lightning

- The purpose of lightning protection is NOT to stop the lightning from striking. (T or F)
- Lightning grounding systems controls the “PATH” of the lightning after it hits. (T or F)
- Lightning can strike in the same place twice or more. (T or F)
- Lightning always strikes the tallest object. (T or F)
- Rubber tires protect you in a car during a lightning storm. (T or F)

What are the Chances of Lightning Striking Your Boat?

The following statistics are based on all of the BoatUS Marine Insurance claims for lightning damage over a five-year period.

Auxiliary Sail .6% Six out of 1000

Multi-hull sail .5% Five out of 1000

Trawlers .3% Three out of 1000

Sail Only .2% Two out of 1000

Cruisers .1% One out of 1000

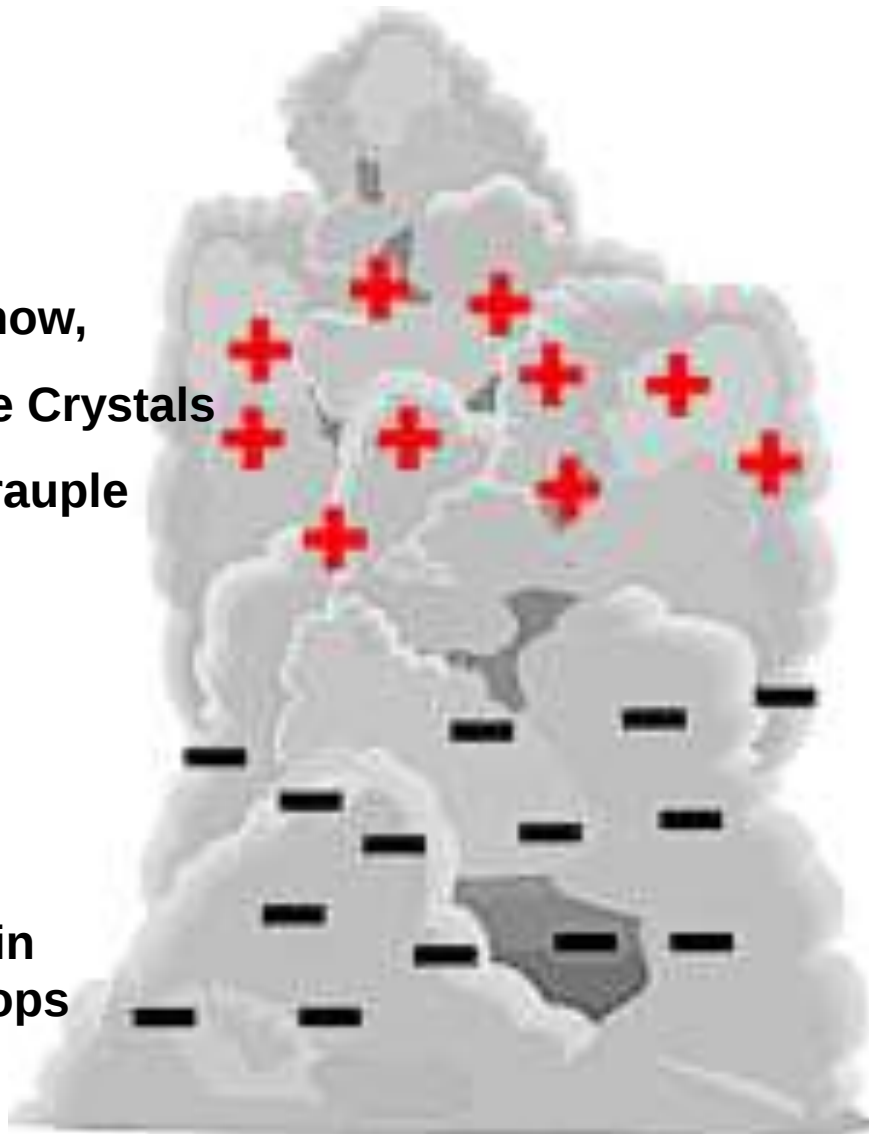
Runabouts .02% Two out of 10,000

Source: BoatUS Marine Insurance Claim Files

****General Population 1 in 14.5 Million****

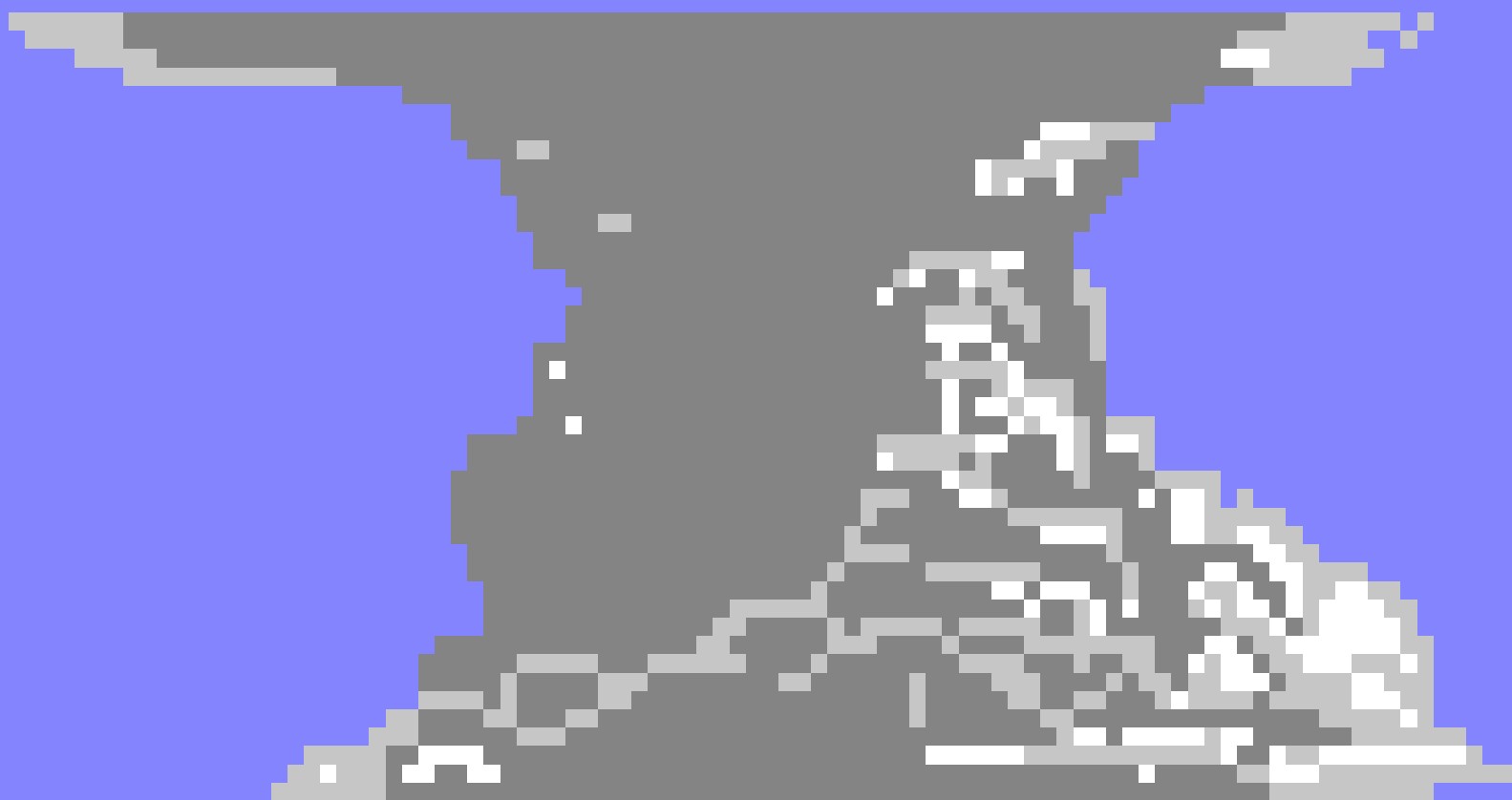
Snow,
Ice Crystals
Grauple

Rain
Drops



Electric charge leaking
from her head





Anatomy of a Strike





A BOLT OUT OF THE BLUE



A storm cloud over
Tampa...

...can send a lightning bolt
into a sunny suburban baseball
field complex 8 miles away.





The top half of the decorative ornament was found some 100 feet on the other side of the building. Notice the shiny melted region, the point of contact with the lightning strike. The top of this ball was “physically” punched from within, most likely a compression burst of air being super heated by the lightning strike.







THUNDER

Thunder is the acoustic shock wave caused by the extreme heat generated by a lightning flash.

- The air is instantaneously heated to as much as 50,000 F (~28,000 C), *five times* the surface of the sun!
- Its expansion rate exceeds the speed of sound, and a sonic boom (thunder) results.

Learn the “30-30 rule”

- Take appropriate shelter when you can count 30 seconds or less between lightning and thunder.
- Remain sheltered for 30 minutes after the last thunder.
- New Rule *“When Thunder Roars – Go Indoors!”*

What to do if you are outside

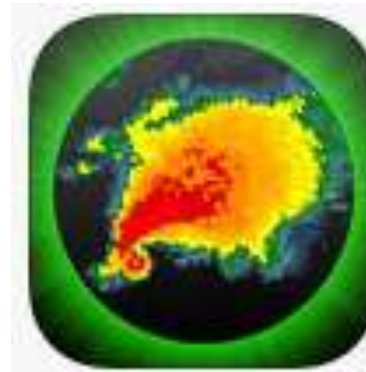
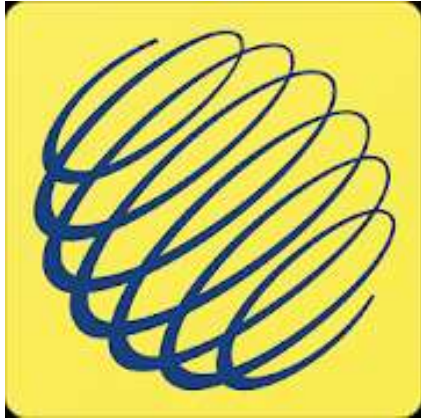
- 1. Seek shelter in a truck, car, or van.**
- 2. Stay 15 feet away from other people to avoid transfer of shock.**
- 3. Stay away from trees, picnic shelters or rain shelters, and canopies.**
- 4. Hide in ditches or places of lower levels, but try to avoid water**
- 5. If this is not an option, crouch down with your feet together and cover your ears to protect them from the thunder.**



WHEN CAUGHT IN A STORM

- Stay in the center of the cabin if the boat is so designed. If no enclosure (cabin) is available, stay low in the boat. Don't be a "stand-up human" lightning mast!**
- Keep arms and legs in the boat. Do not dangle them in the water.**
- Discontinue fishing, water skiing, scuba diving, swimming or other water activities when there is lightning or even when weather conditions look threatening. The first lightning strike can be a mile or more in front of an approaching thunderstorm cloud.**
- Disconnect and do not use or touch the major electronic equipment, including the radio, throughout the duration of the storm.**
- Lower, remove or tie down the radio antenna and other protruding devices if they are not part of the lightning protection system.**
- To the degree possible, avoid making contact with any portion of the boat connected to the lightning protection system.**
- It would be desirable to have individuals aboard who are competent in cardiopulmonary resuscitation (CPR) and first aid.**
- If a boat has been, or is suspected of having been, struck by lightning, check out the electrical system and the compasses to insure that no damage has occurred.**

Weather Apps



Met Tools - Radar

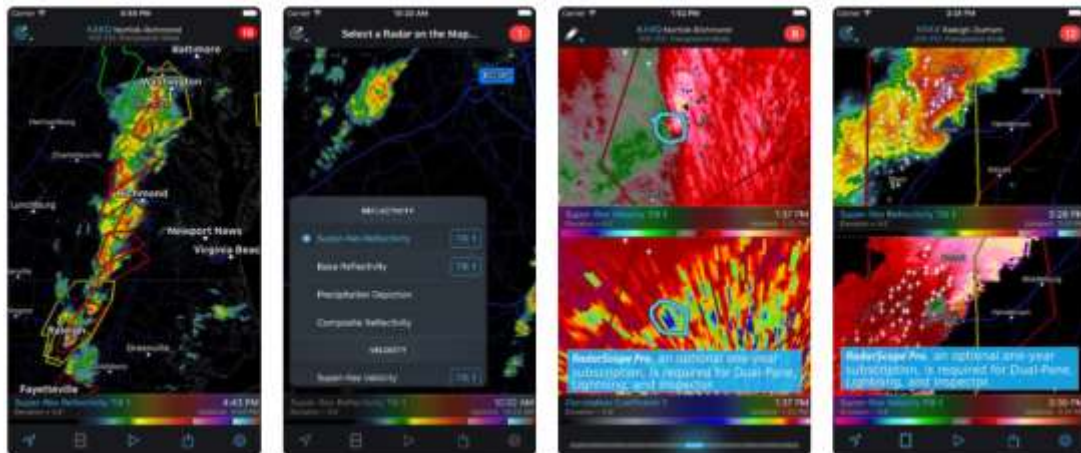
Professional Radar for the Average Joe
Weather radar that goes with you anywhere.

Download on the **App Store**

Download on the **Mac App Store**

GET IT ON **Google Play**

Get it from **Microsoft** NEW



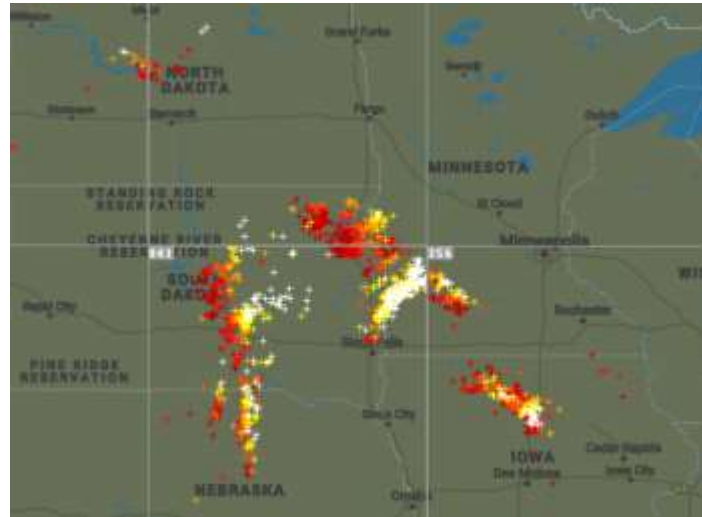
<https://radarscope.io/>



Met Tools - Lightning



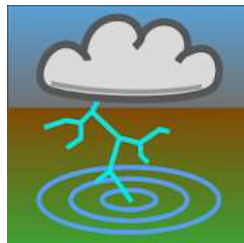
https://weather.gc.ca/lightning/index_e.html



<https://www.lightningmaps.org>
<https://http://en.blitzortung.org>



BlitzortungLive
Iphone/IPAD



Blitzortung Lightning Monitor
Android



<https://skyscancanada.com/>

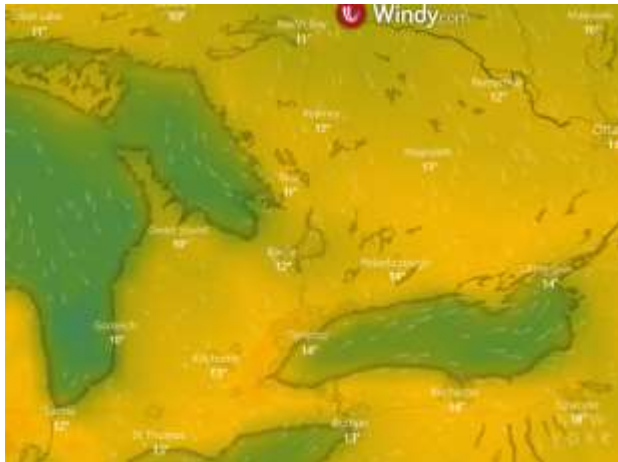
Met Tools - Websites



<https://weather.gc.ca/>

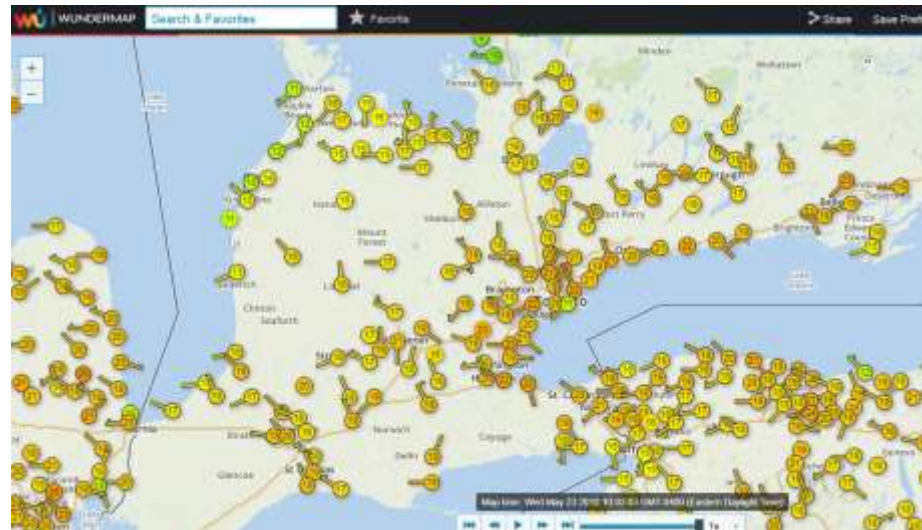


<https://www.theweathernetwork.com/ca>



<https://www.windy.com>

108



<https://www.wunderground.com/wundermap>

But Be Careful....

Lots of free websites and API's are not monitored and are machine only products, May not be current, linkages to Canadian weather incorrect





<https://www.predictwind.com/>



<http://zygrib.org/>



Windy (IOS AND Android)



www.windfinder.com

(IOS AND Android)



www.windguru.cz

