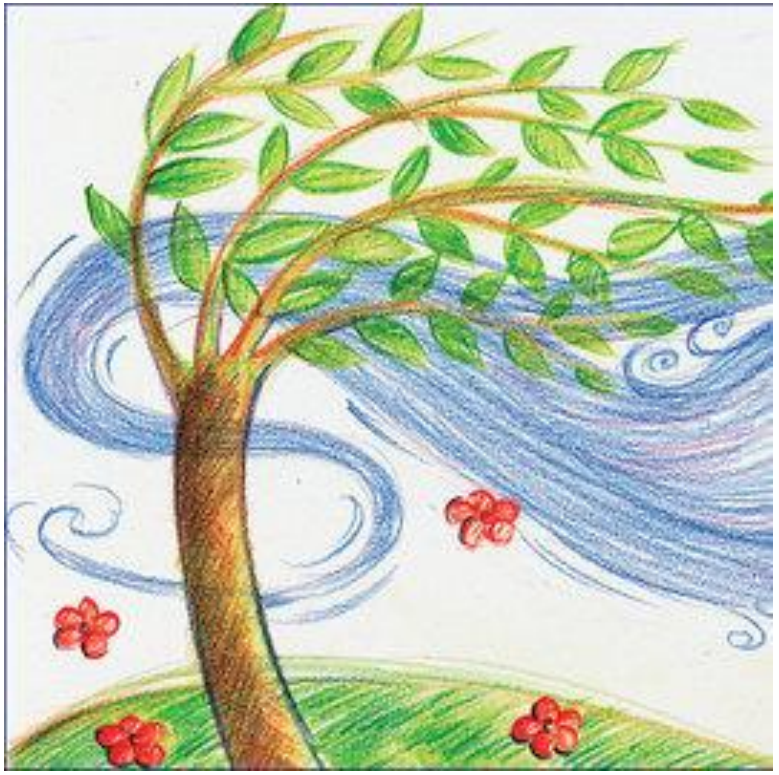
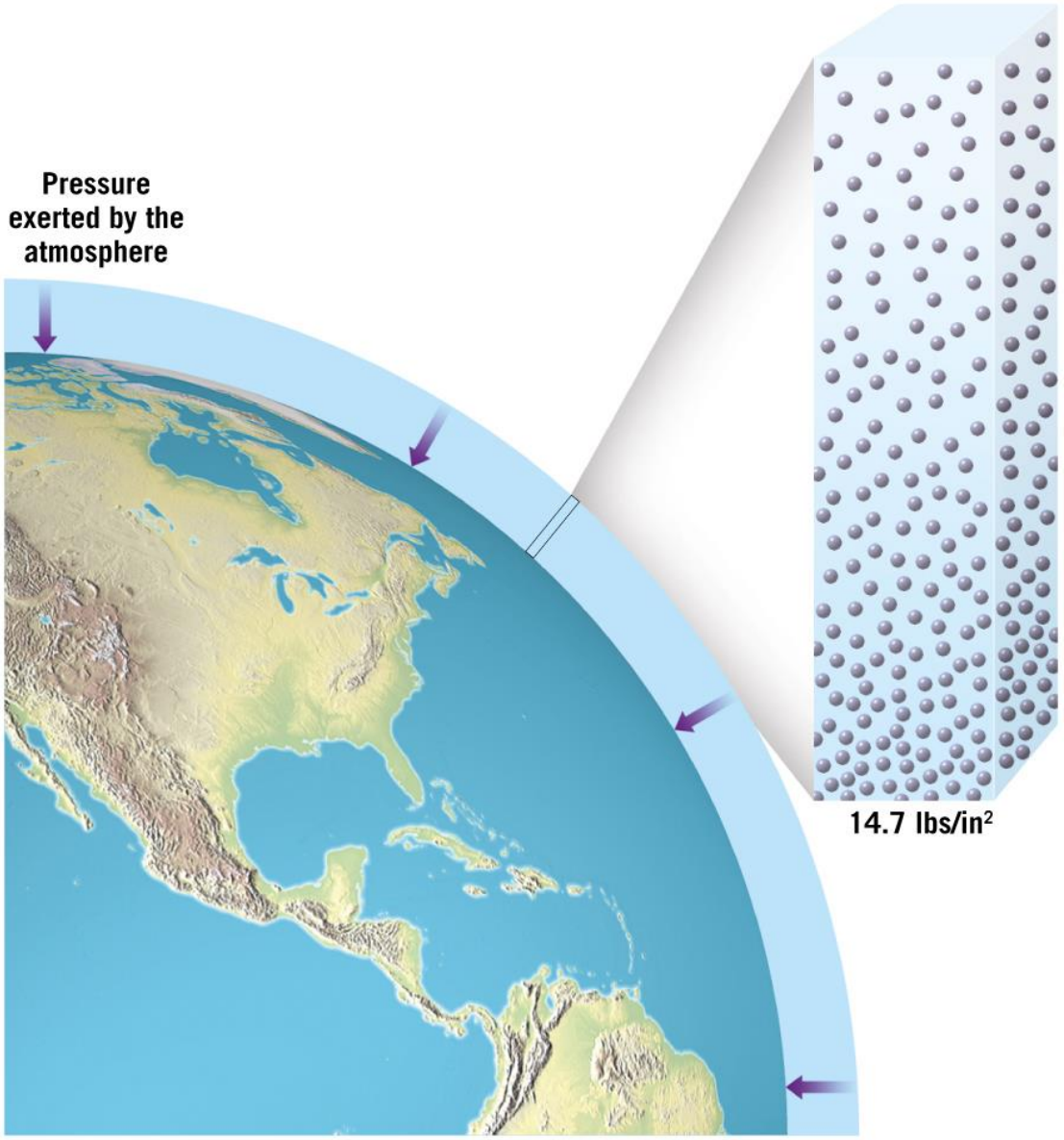
The Wind

Where I come from
nobody knows and
where I am going
everything goes.
The wind blows,
the sea flows,and
nobody knows.



Pressure varies over the surface of the Earth.



Units of Pressure

14.7 psi or lbs/in^2

1 atm

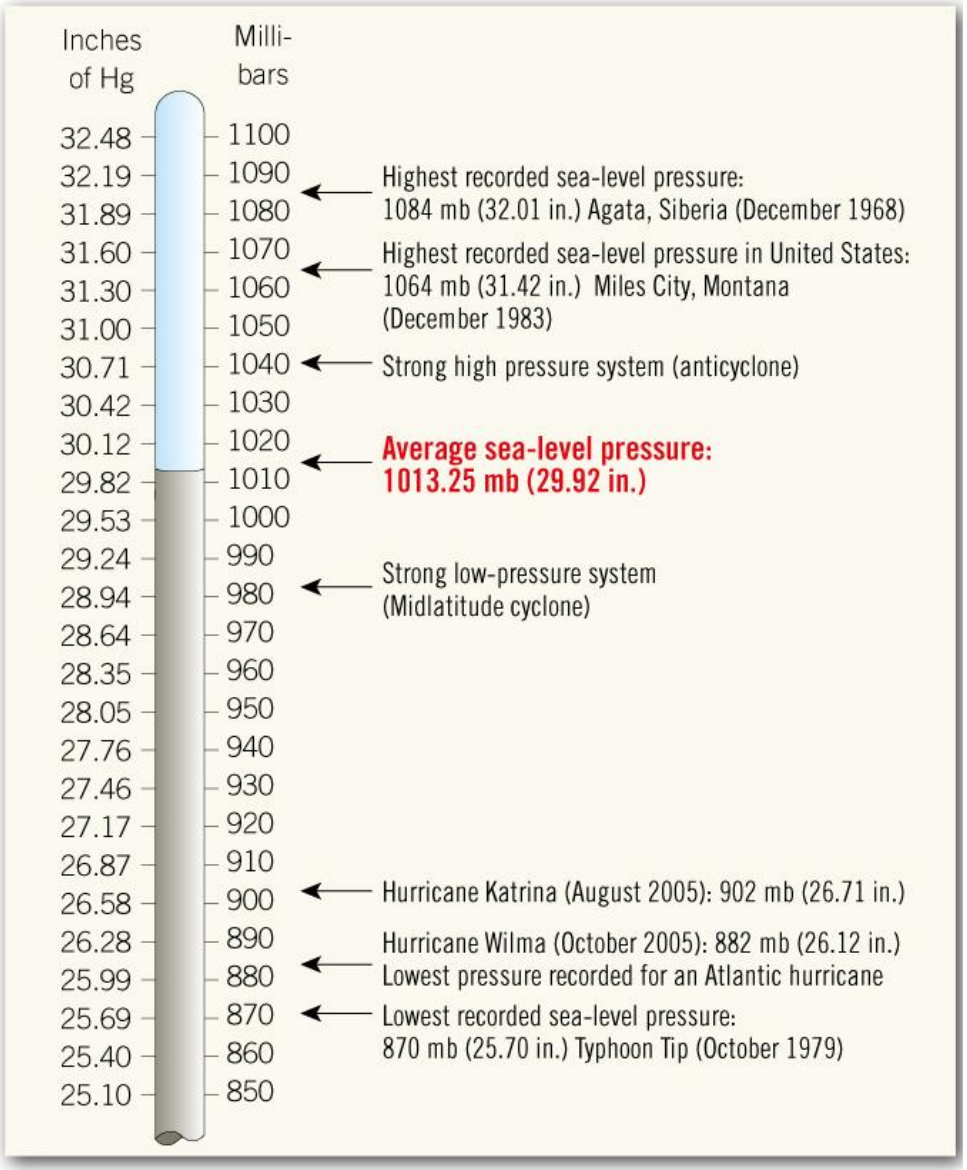
101.325 kPa

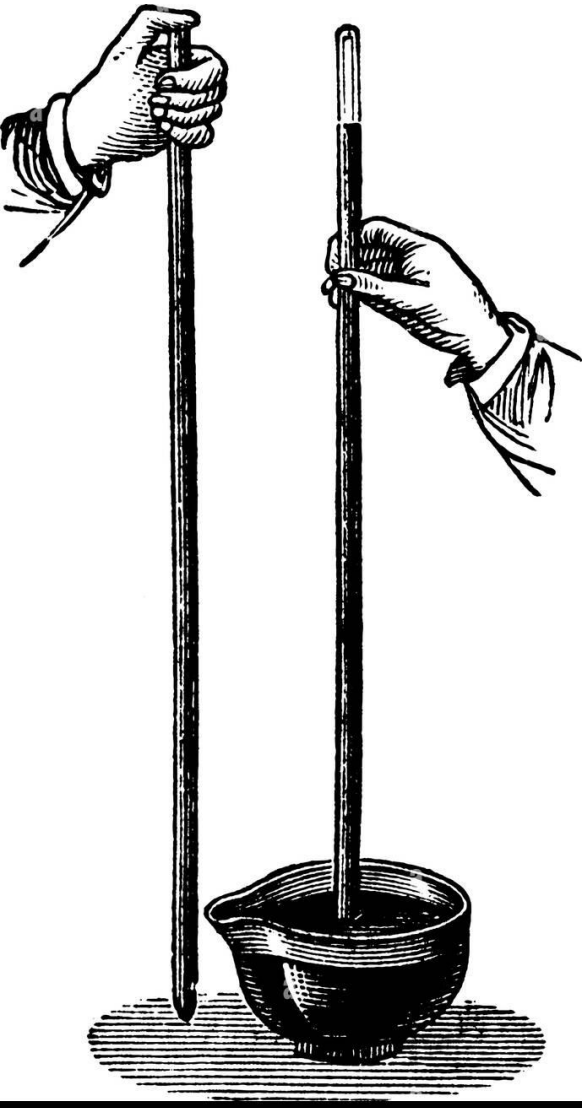
1.01325 bar

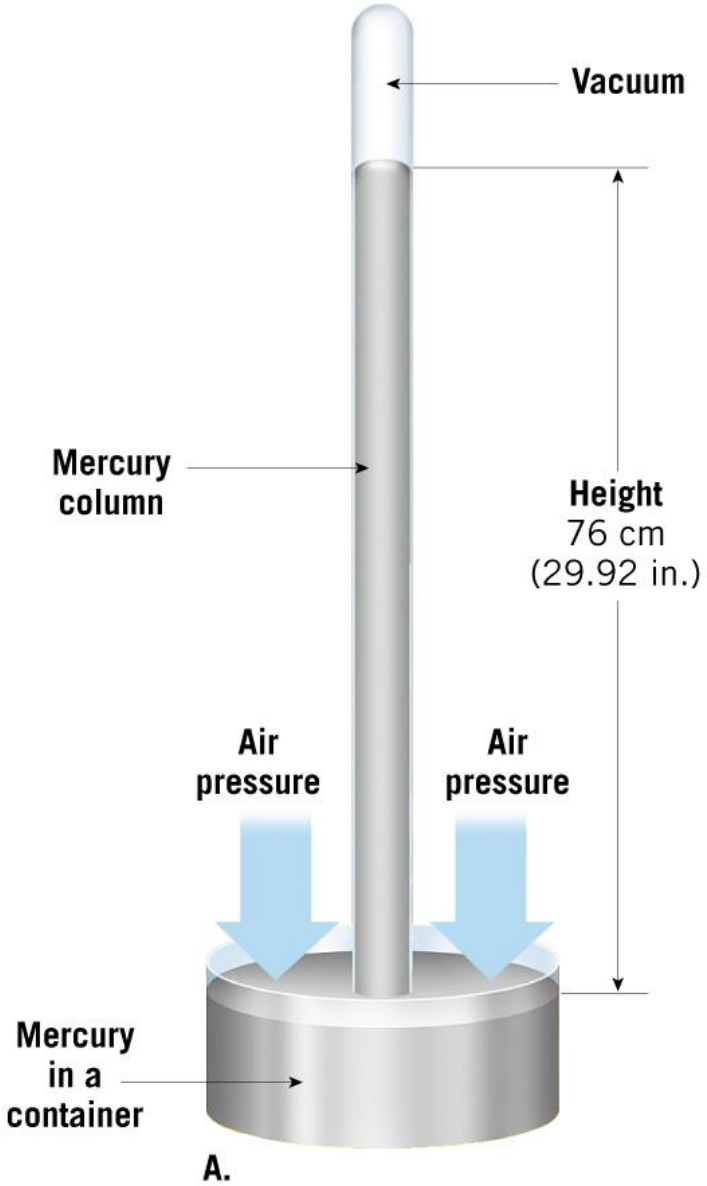
1013.25 mbar

760 torr or mmHg

29.9213 inHg

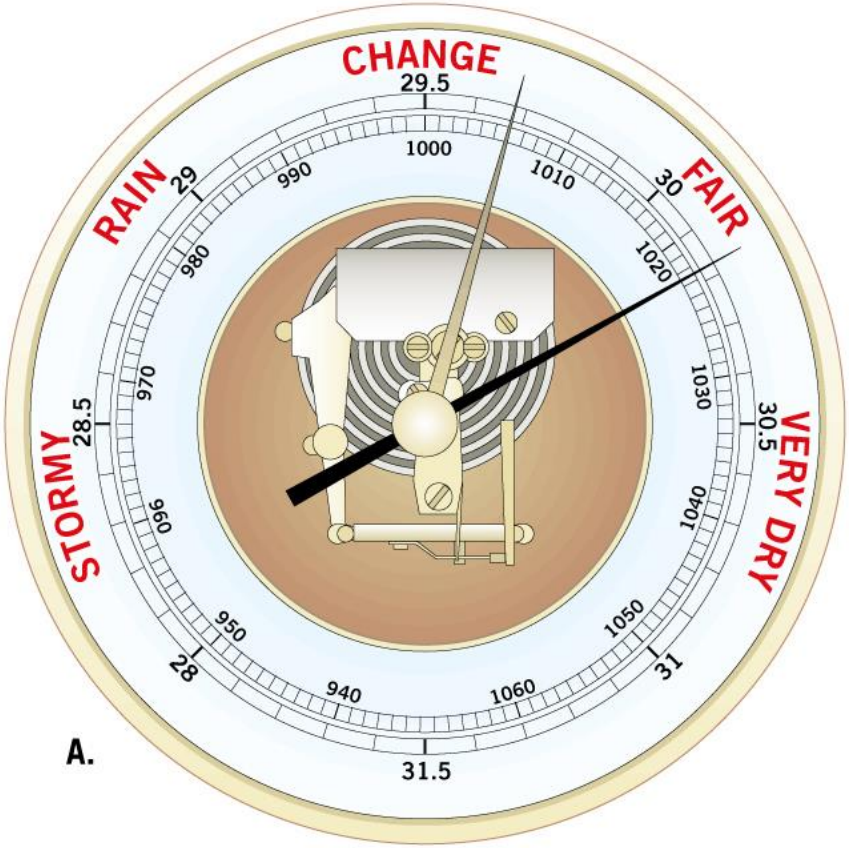

Inches of Hg
Milli-bars
32.48
32.19
31.89
31.60
31.30
31.00
30.71
30.42
30.12
29.82
29.53
29.24
28.94
28.64
28.35
28.05
27.76
27.46
27.17
26.87
26.58
26.28
25.99
25.69
25.40
25.10
1100
1090
1080
1070
1060
1050
1040
1030
1020
1010
1000
990
980
970
960
950
940
930
920
910
900
890
880
870
860
850
Highest recorded sea-level pressure:
1084 mb (32.01 in.) Agata, Siberia (December 1968)
Highest recorded sea-level pressure in United States:
1064 mb (31.42 in.) Miles City, Montana
(December 1983)
Strong high pressure system (anticyclone)
Average sea-level pressure:
1013.25 mb (29.92 in.)
Strong low-pressure system
(Midlatitude cyclone)
Hurricane Katrina (August 2005): 902 mb (26.71 in.)
Hurricane Wilma (October 2005): 882 mb (26.12 in.)
Lowest pressure recorded for an Atlantic hurricane
Lowest recorded sea-level pressure:
870 mb (25.70 in.) Typhoon Tip (October 1979)



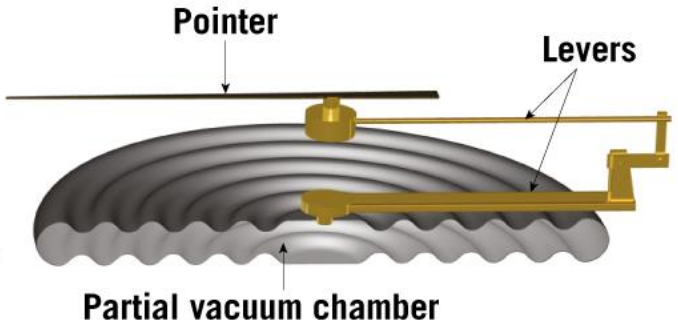

Vacuum
Mercury column
Height
76 cm
(29.92 in.)
Air pressure
Air pressure
Mercury in a container
A.


Change
Camille
RAIN
FAIR
SET-FAIR
STORMY
VERY-DRY
LONDON

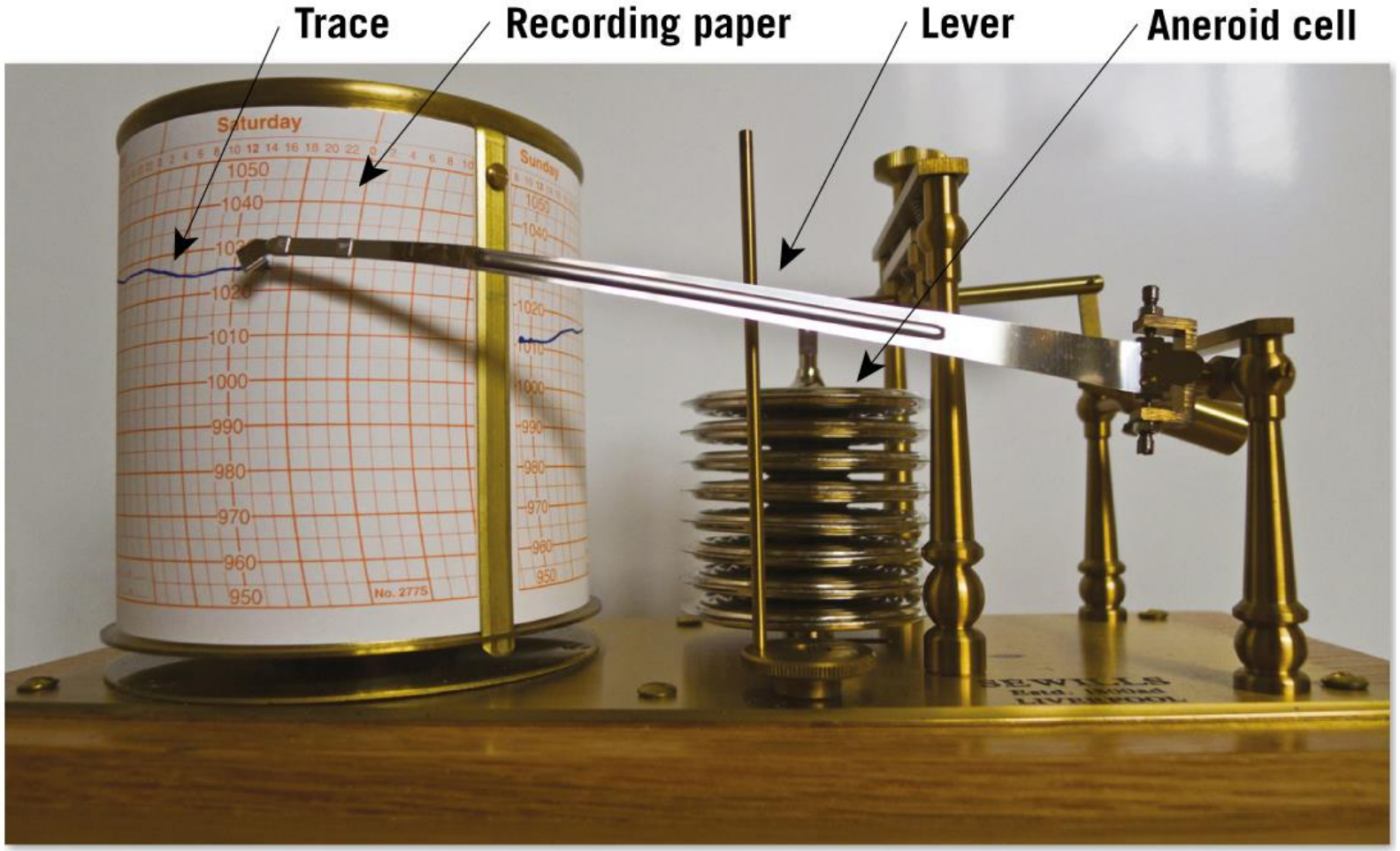
$695


CHANGE
RAIN
FAIR
STORMY
VERY DRY
29.5
28.5
30.5
31.5
28
29
30
31
1000
990
1010
980
1020
970
1030
960
1040
950
1050
940
1060

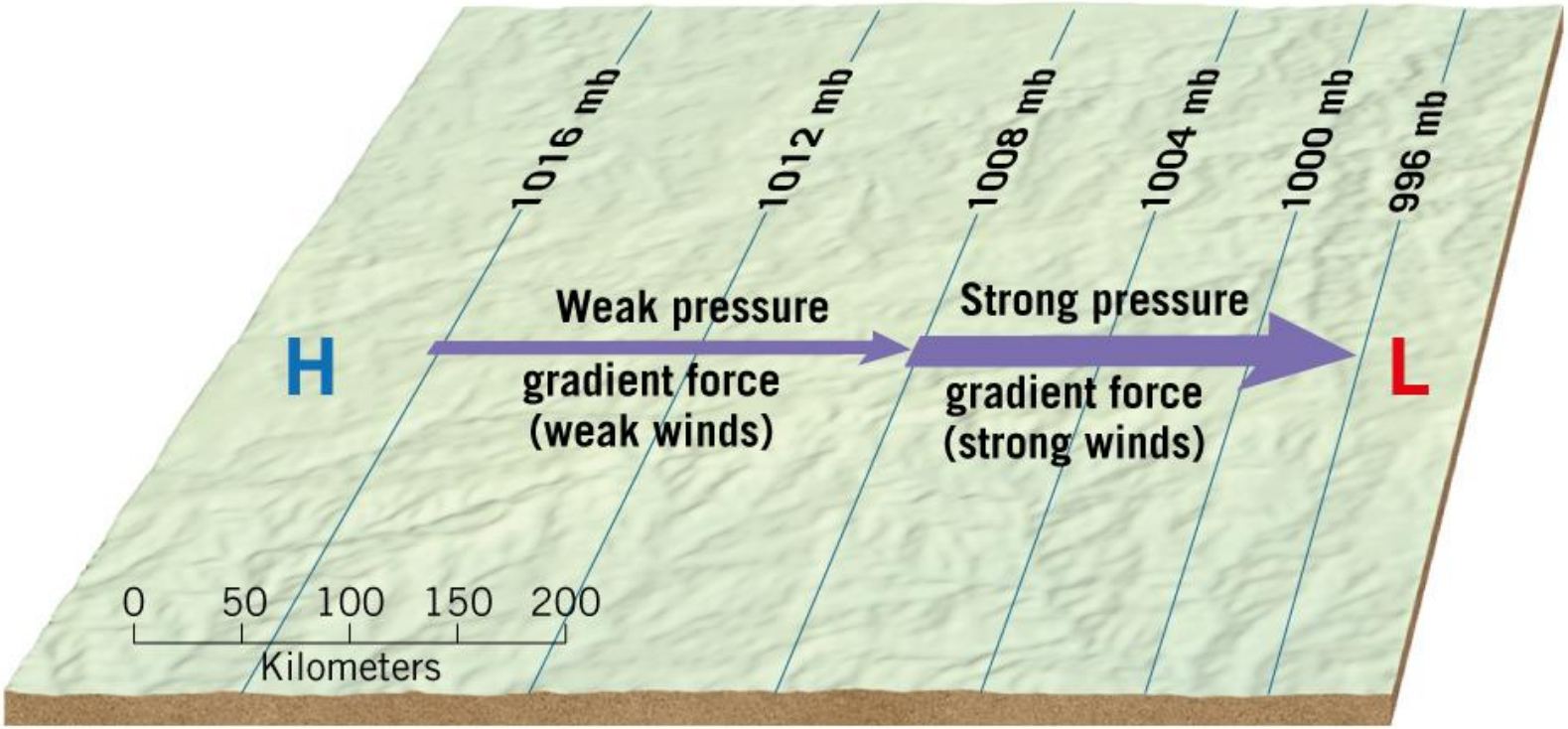
A.

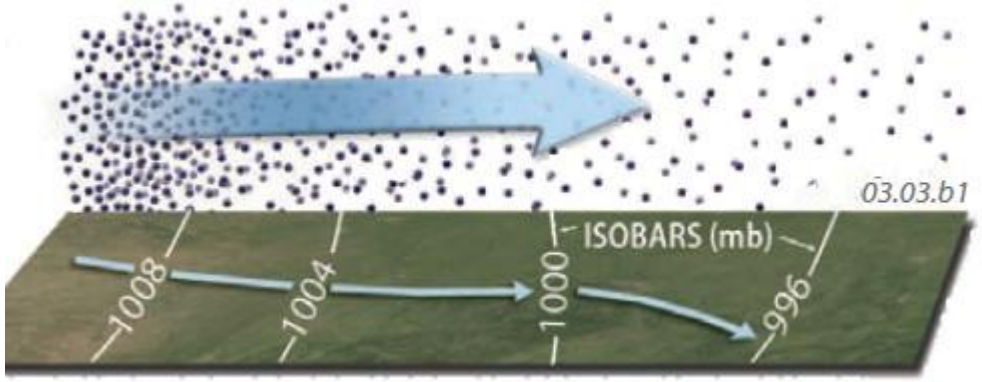

Pointer
Levers
Partial vacuum chamber

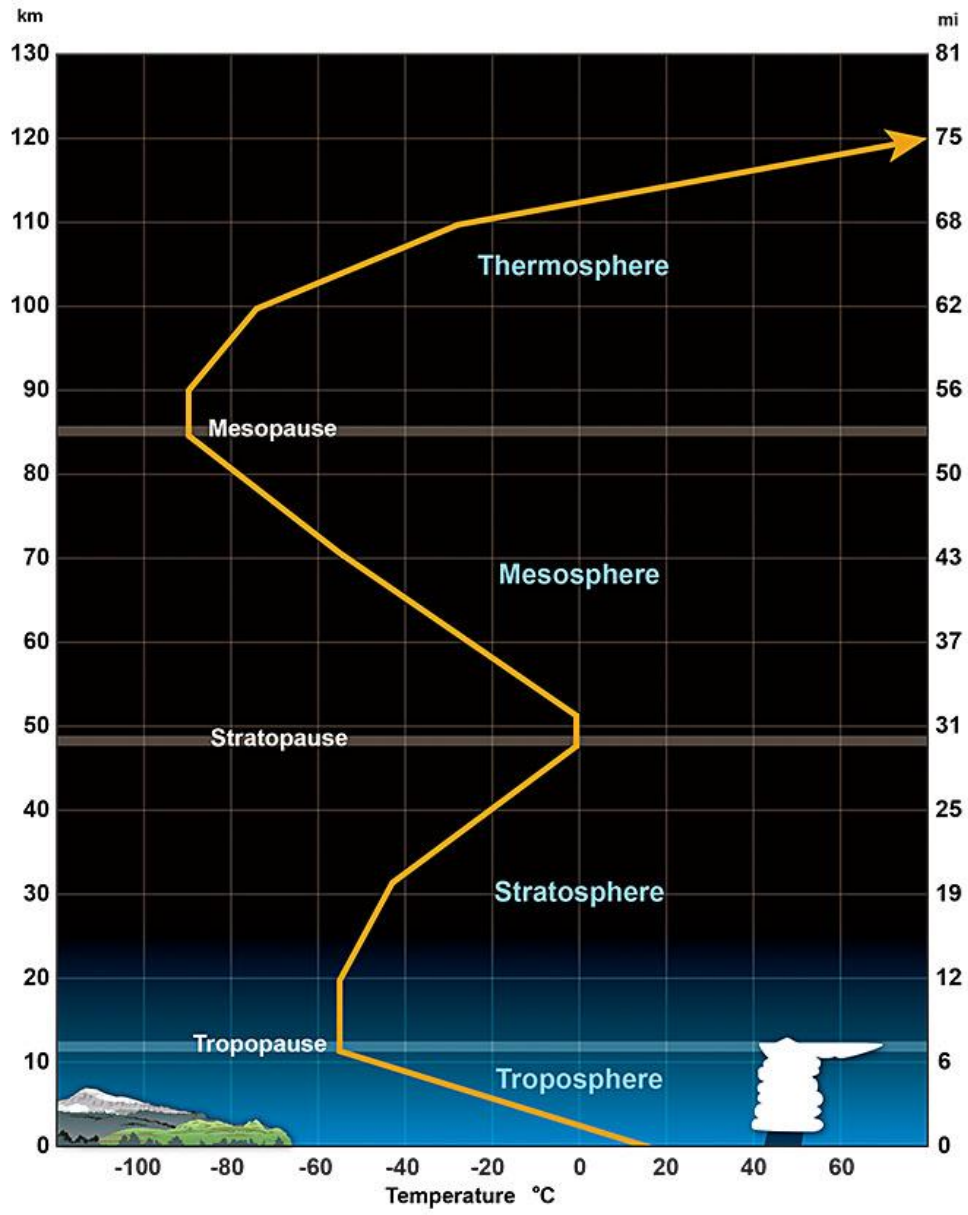
B.

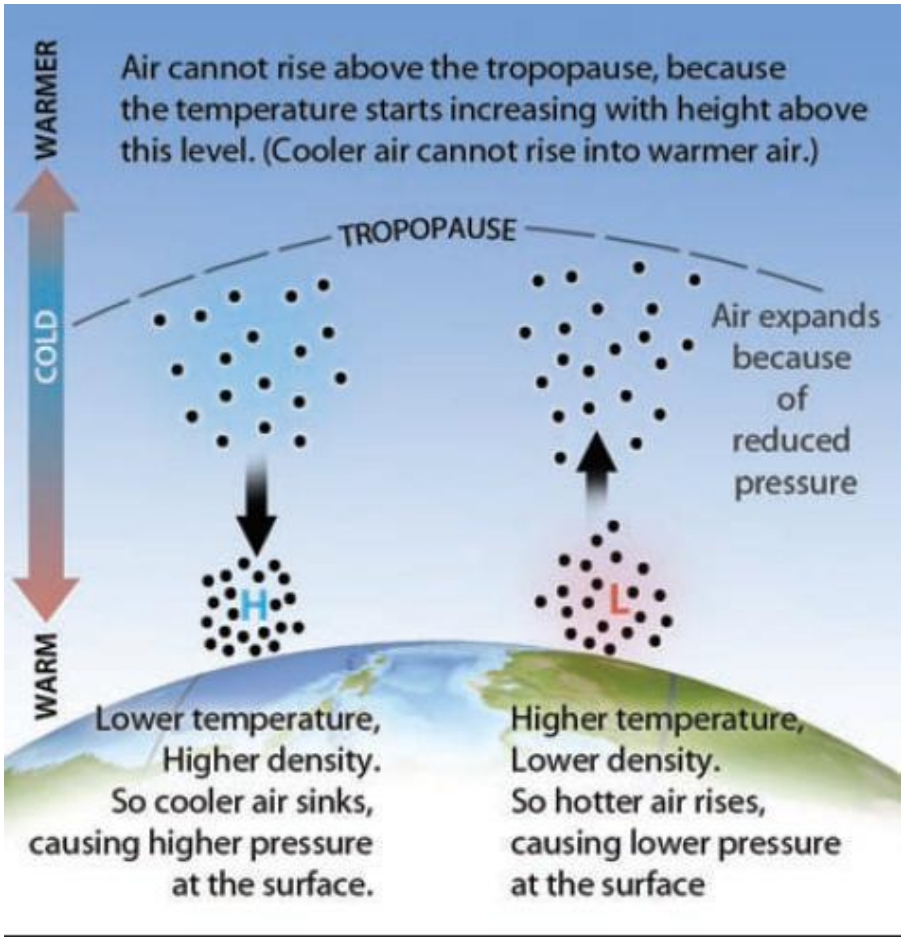

Trace
Recording paper
Lever
Aneroid cell
Saturday
Sunday
1050
1040
1020
1010
1000
990
980
970
960
950
No. 2775

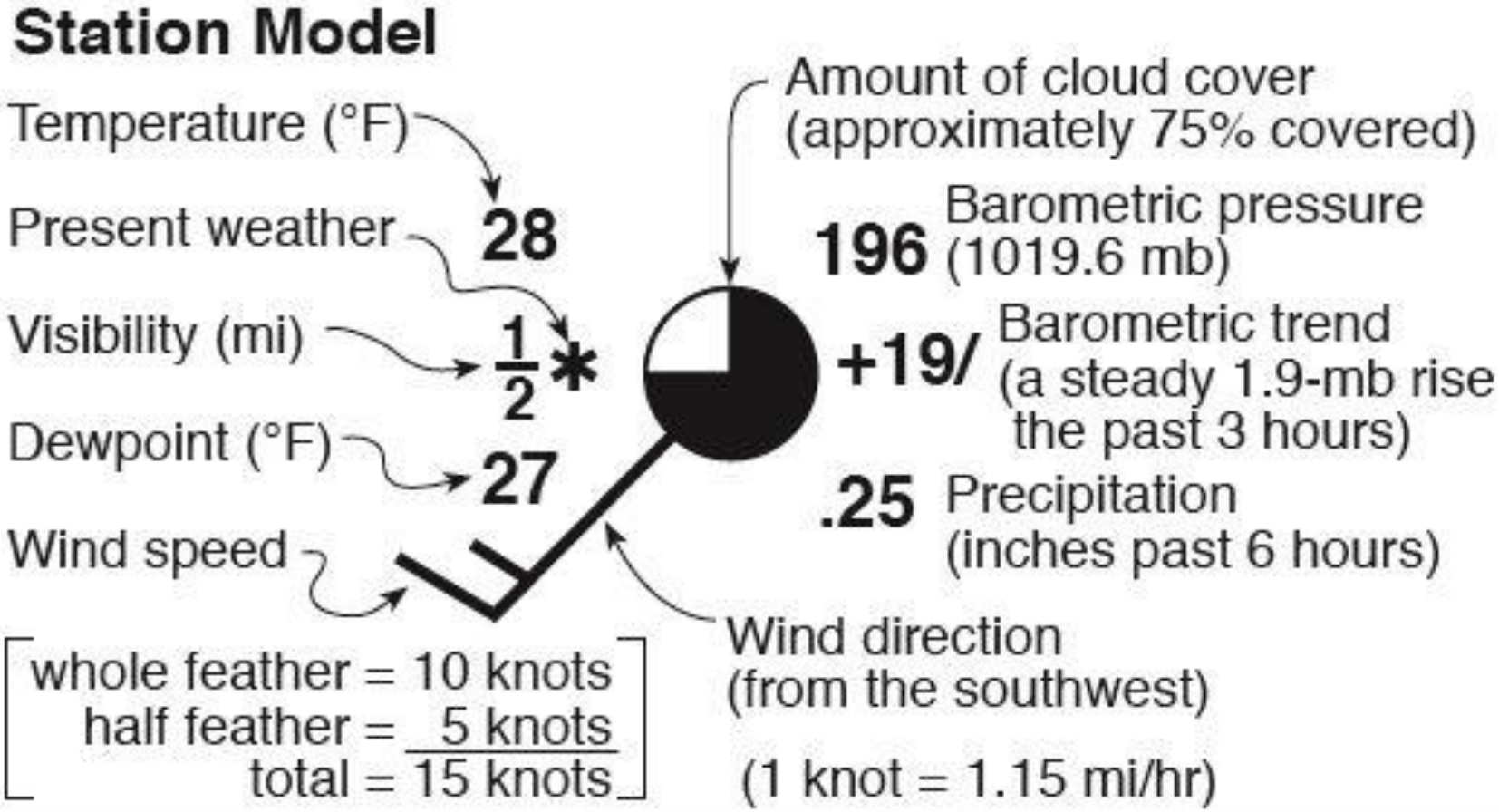
Temperature differences cause pressure differences and pressure differences cause wind.



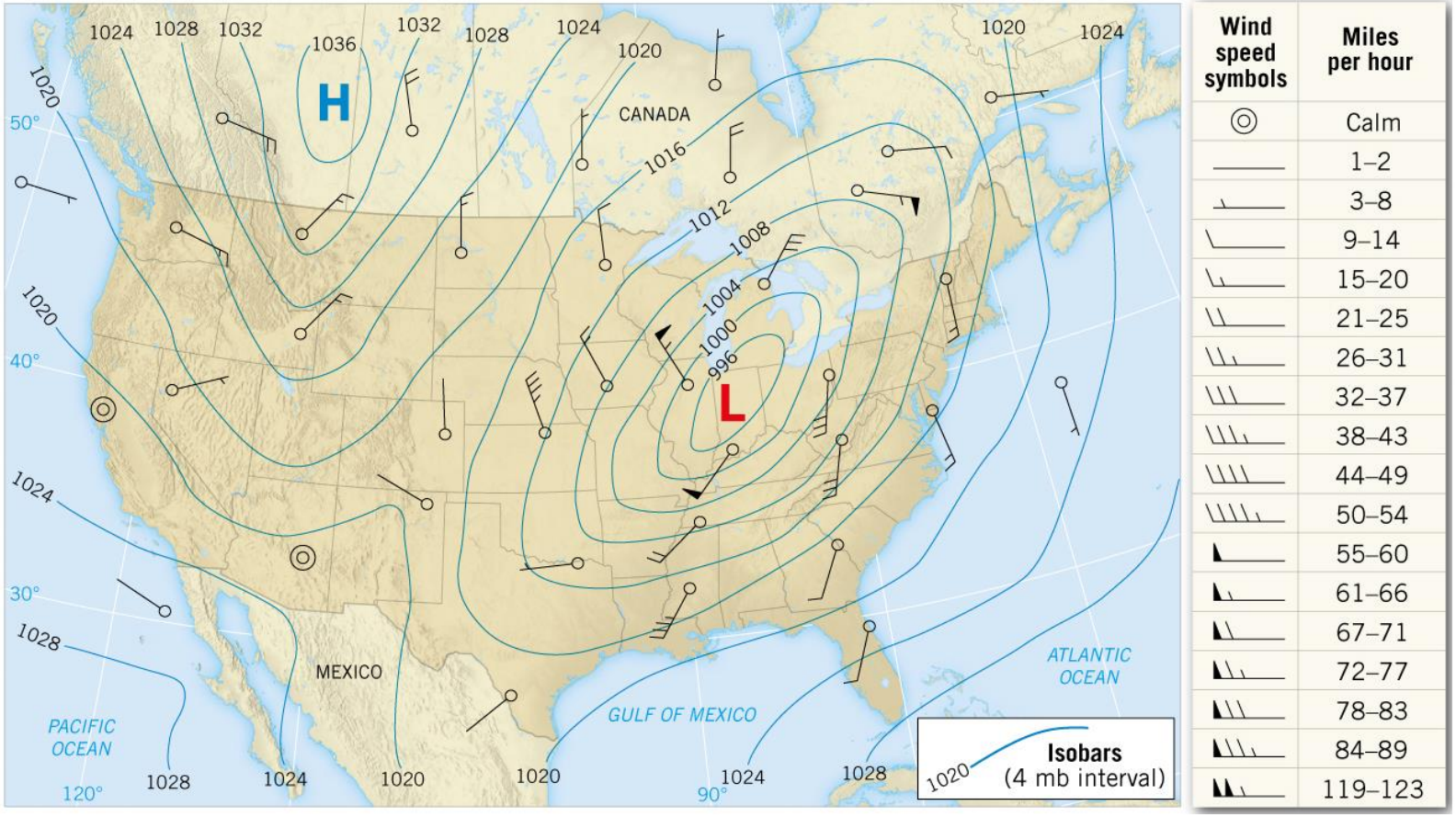



km
mi
130
120
110
100
90
80
70
60
50
40
30
20
10
0
81
75
68
62
56
50
43
37
31
25
19
12
6
0
Thermosphere
Mesopause
Mesosphere
Stratopause
Stratosphere
Tropopause
Troposphere
-100
-80
-60
-40
-20
0
20
40
60
Temperature °C


WARMER
COLD
WARM
Air cannot rise above the tropopause, because the temperature starts increasing with height above this level. (Cooler air cannot rise into warmer air.)
TROPOPAUSE
Air expands because of reduced pressure
H
L
Lower temperature, Higher density. So cooler air sinks, causing higher pressure at the surface.
Higher temperature, Lower density. So hotter air rises, causing lower pressure at the surface

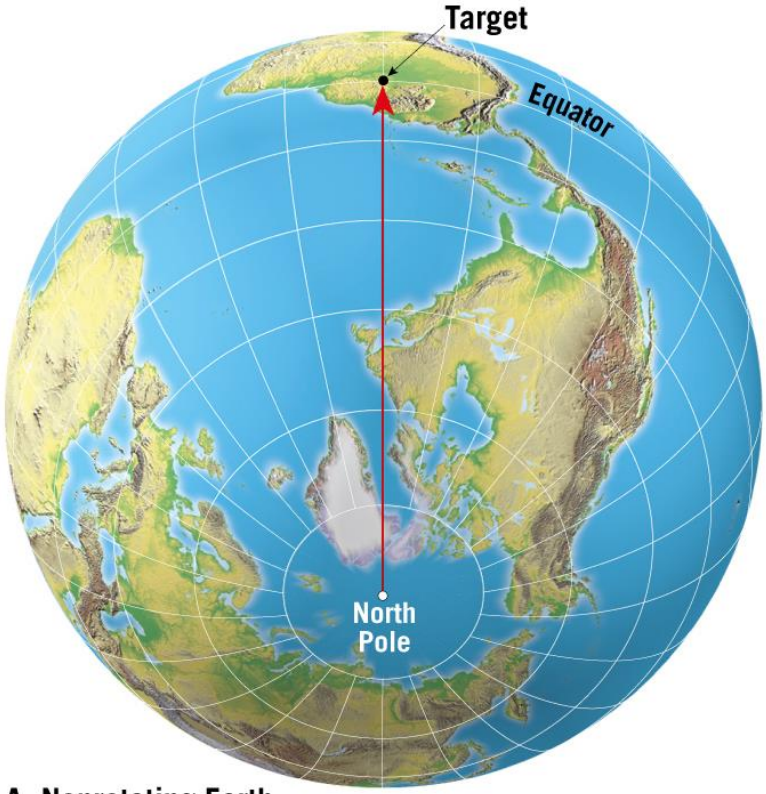

Station Model
Temperature (°F)
28
Present weather
Visibility (mi)
1/2
*
Dewpoint (°F)
27
Wind speed
whole feather = 10 knots
half feather = 5 knots
total = 15 knots
Amount of cloud cover
(approximately 75% covered)
196
Barometric pressure
(1019.6 mb)
+19/
Barometric trend
(a steady 1.9-mb rise
the past 3 hours)
.25
Precipitation
(inches past 6 hours)
Wind direction
(from the southwest)
(1 knot = 1.15 mi/hr)

Marking wind on a weather map

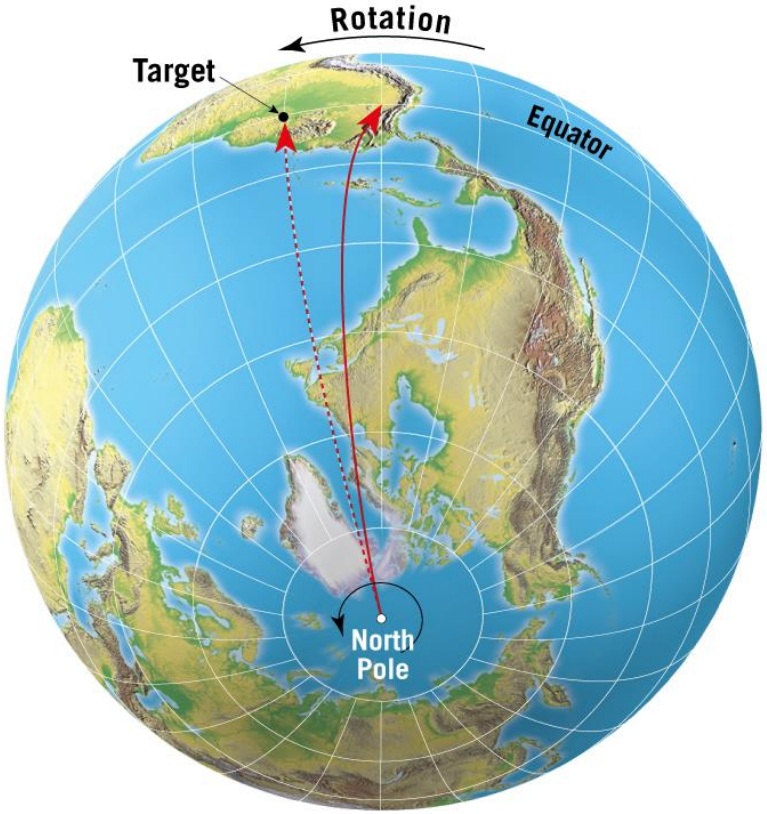


Current Surface Analysis: https://www.wpc.ncep.noaa.gov/html/sfc2.shtml

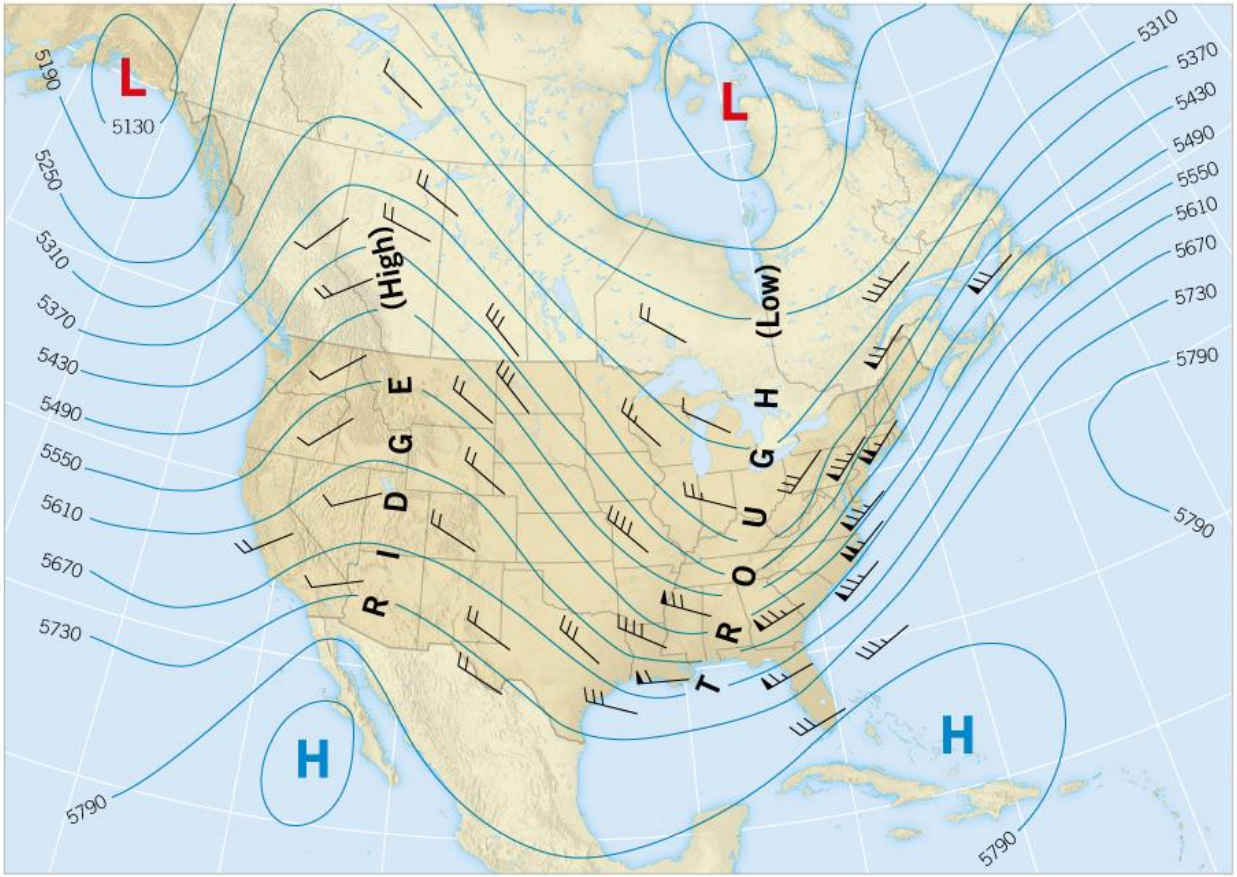
https://www.youtube.com/watch?v=dt_XJp77-mk&t=94s



A. Nonrotating Earth

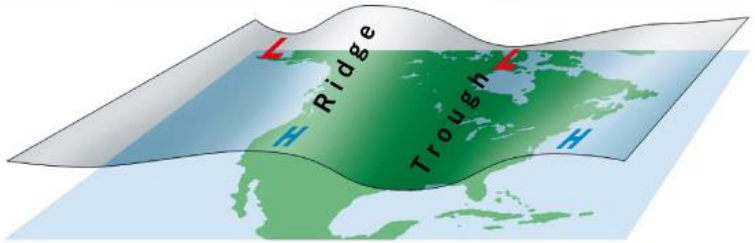


B. Rotating Earth

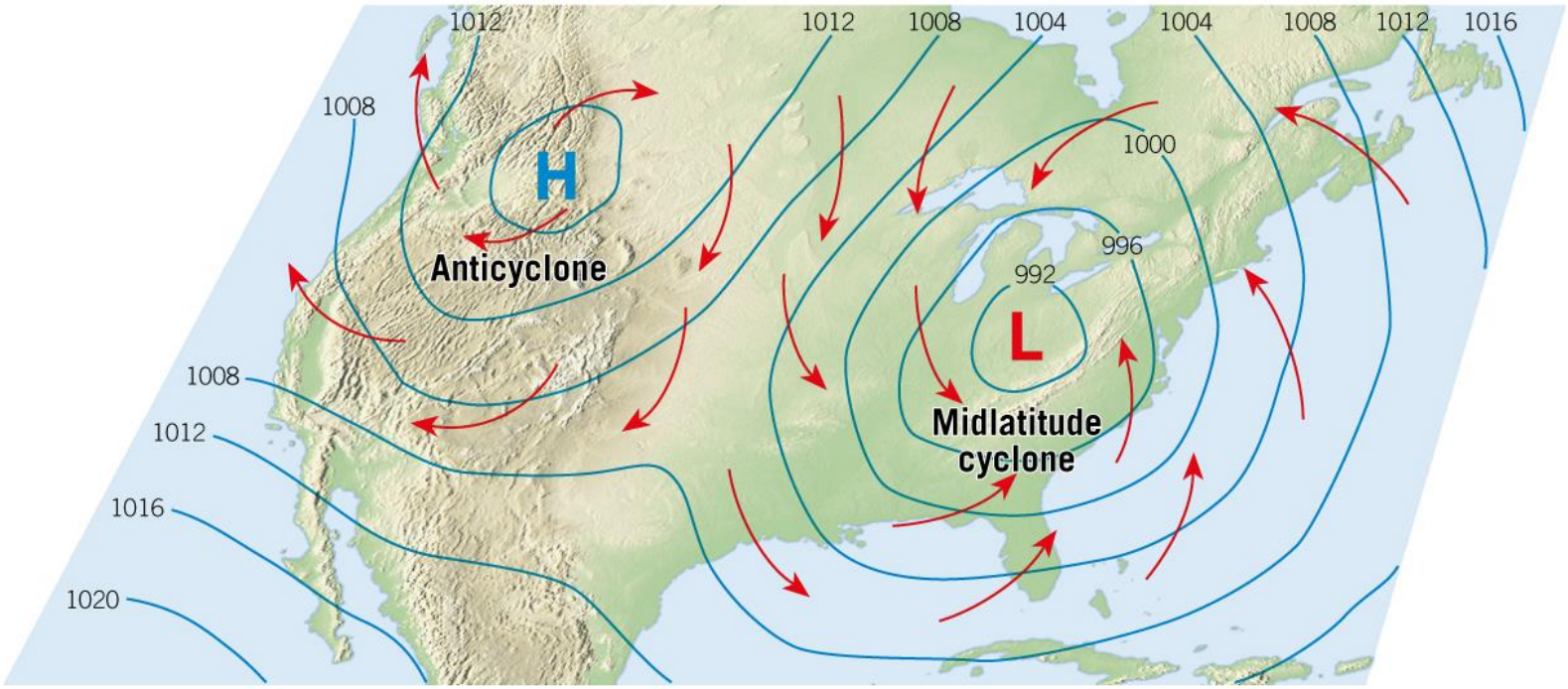


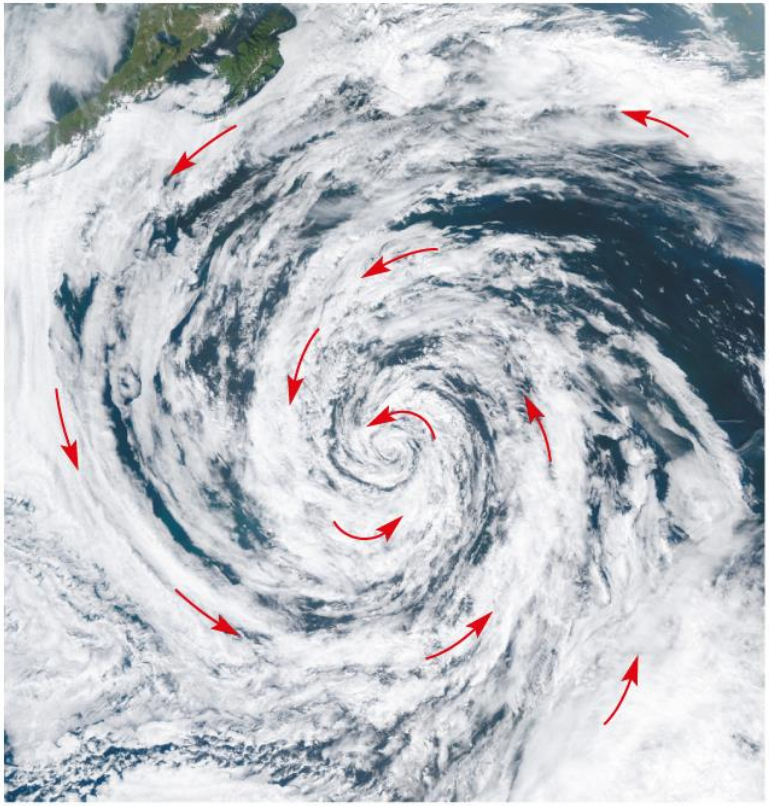
A. Upper-level weather chart

Wind speed symbols	Miles per hour
◎	Calm
	1–2
	3–8
	9–14
	15–20
	21–25
	26–31
	32–37
	38–43
	44–49
	50–54
	55–60
	61–66
	67–71
	72–77
	78–83
	84–89
	119–123

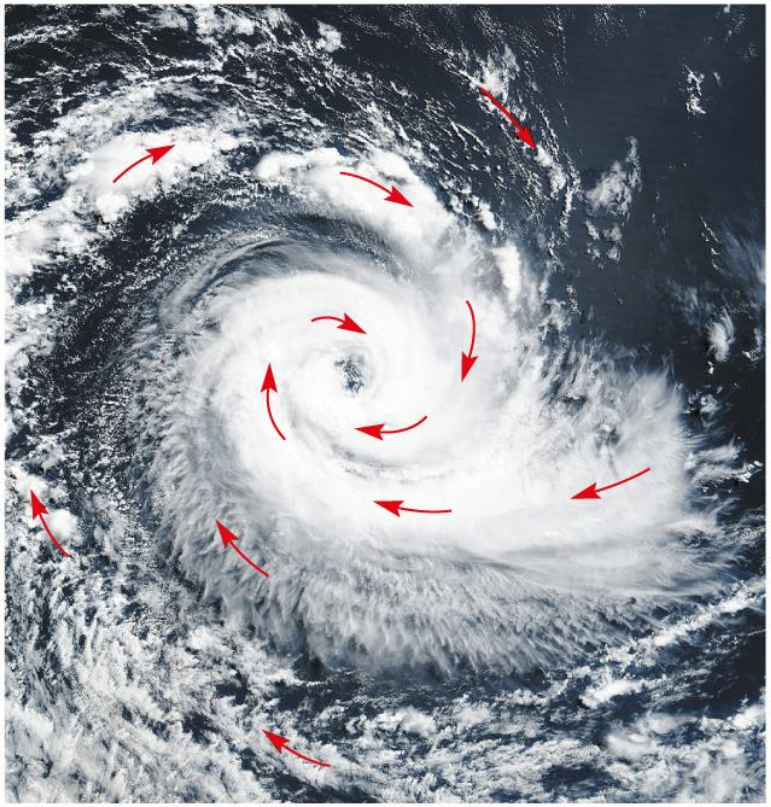


B. Representation of upper-level chart

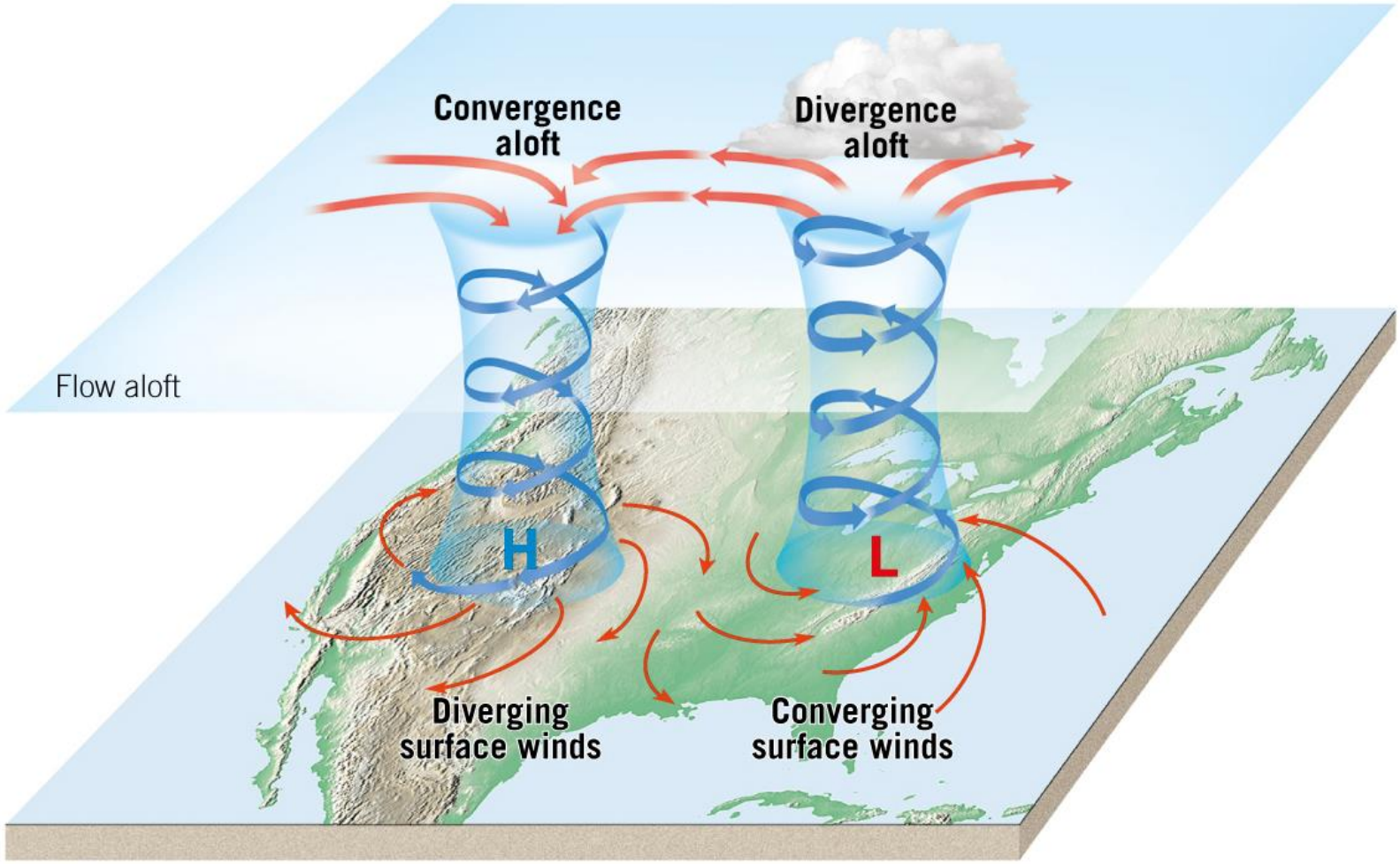

1012
1012
1008
1004
1004
1008
1012
1016
1008
H
Anticyclone
1000
996
992
L
Midlatitude
cyclone
1008
1012
1016
1020

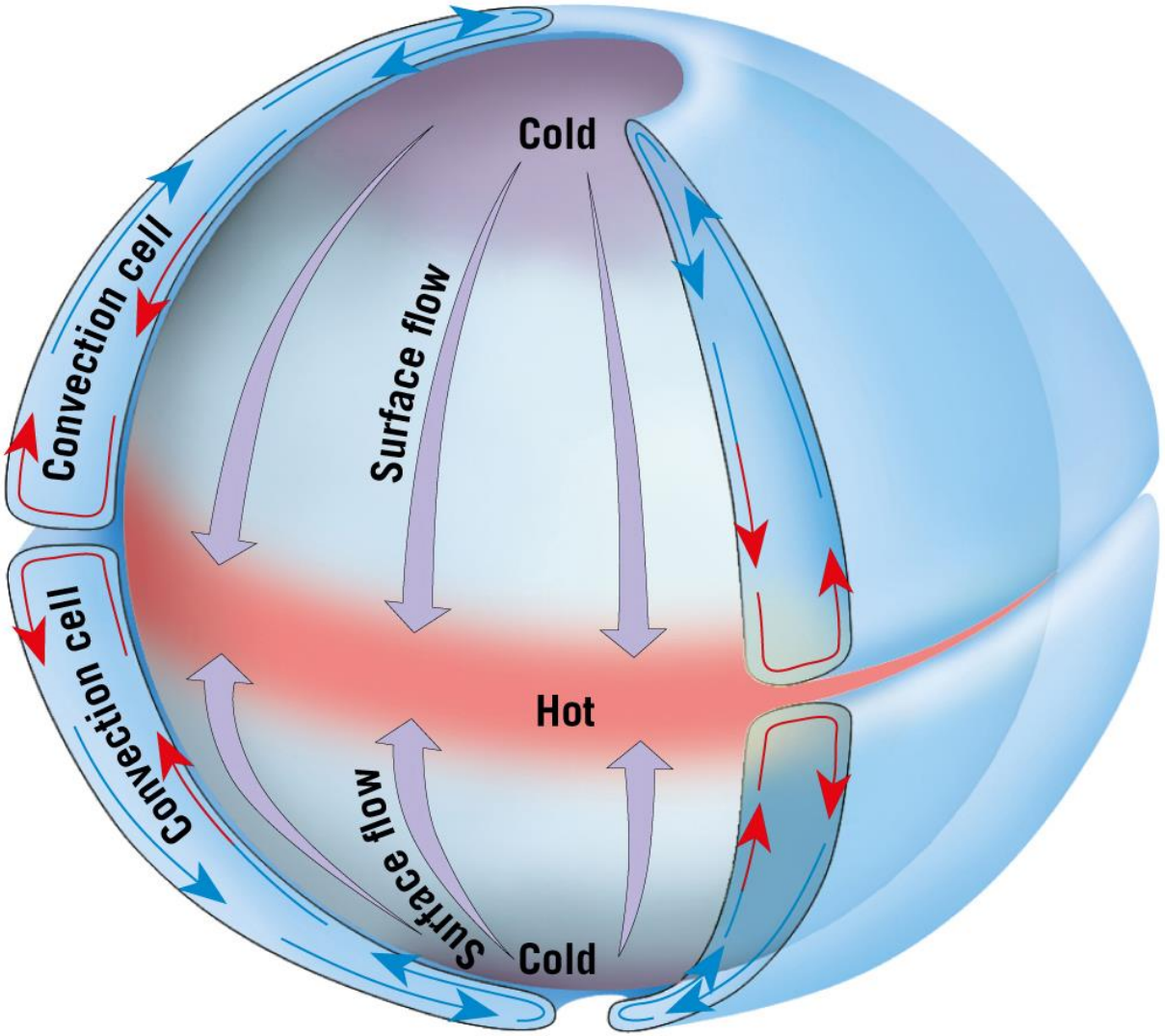


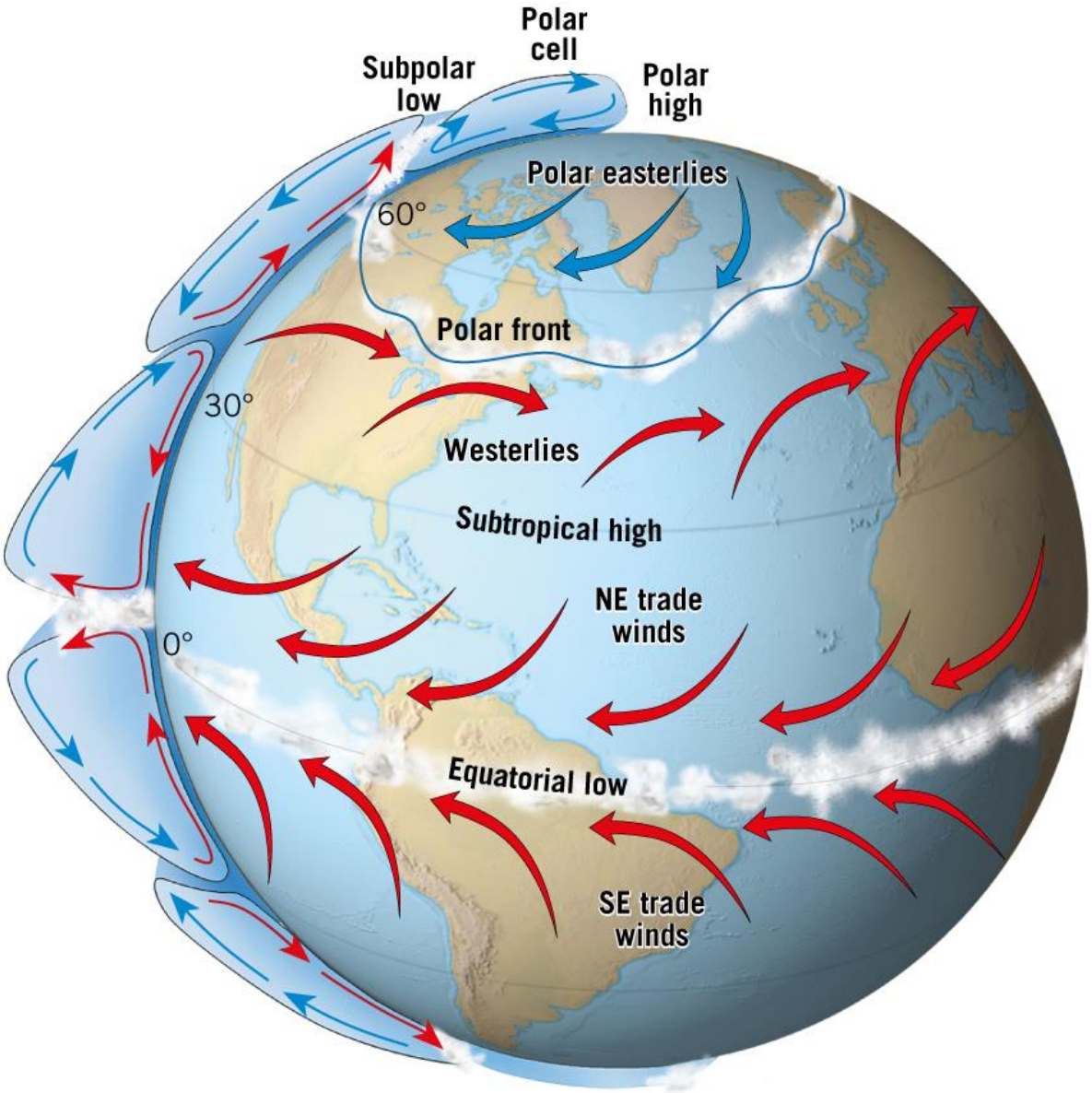
A. This satellite image shows a large low-pressure center in the Gulf of Alaska. The cloud pattern clearly shows an inward and counterclockwise spiral.

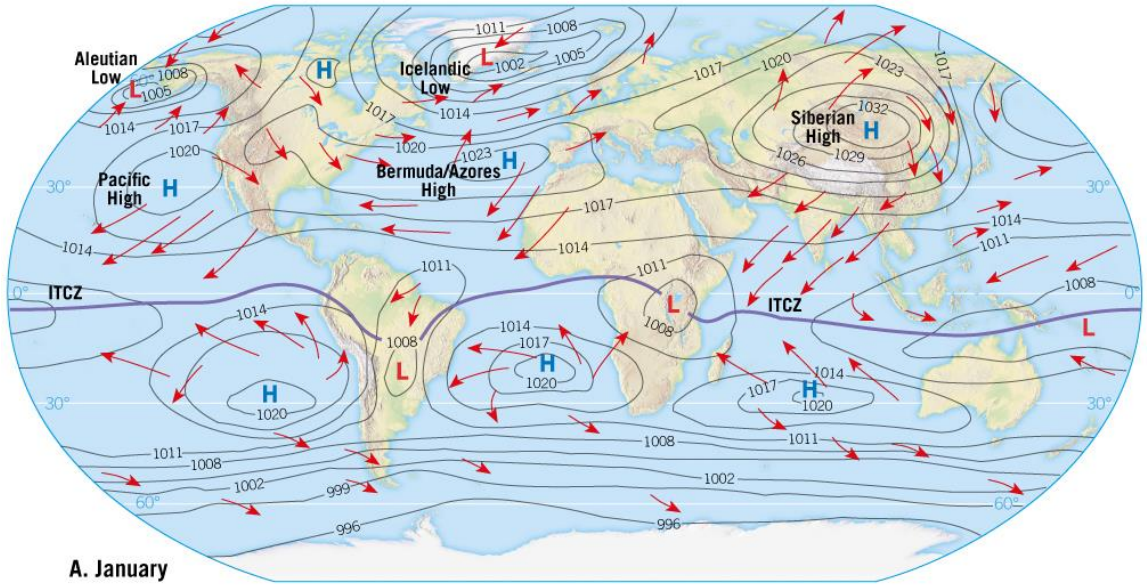


B. This satellite image shows a strong cyclonic storm in the South Atlantic near the coast of Brazil. The cloud pattern shows an inward and clockwise circulation.

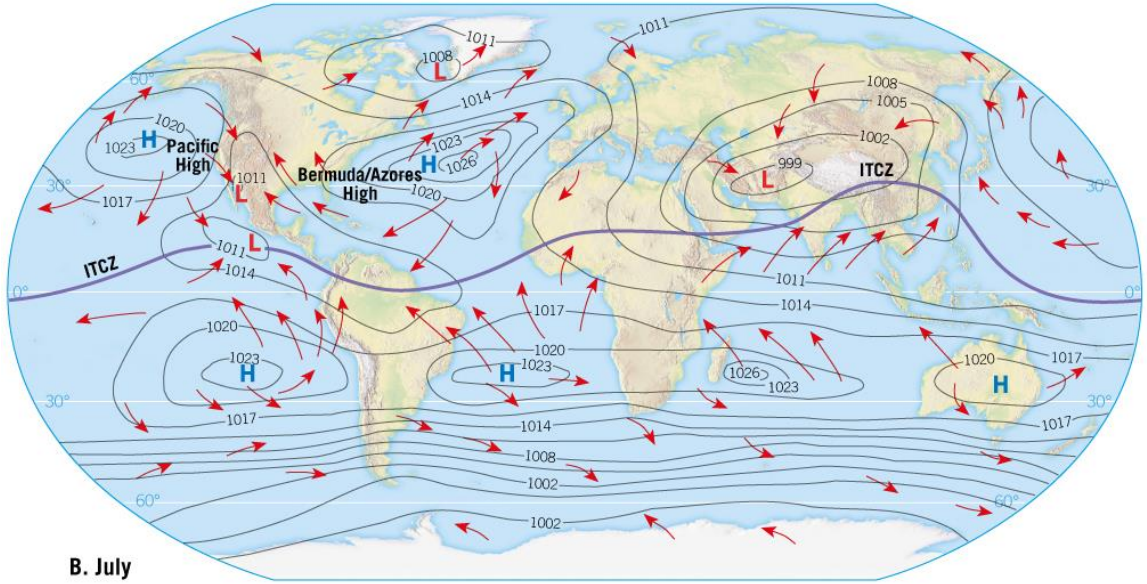

Convergence aloft
Divergence aloft
Flow aloft
H
L
Diverging surface winds
Converging surface winds


Cold
Surface flow
Convection cell
Convection cell
Hot
Surface flow
Cold

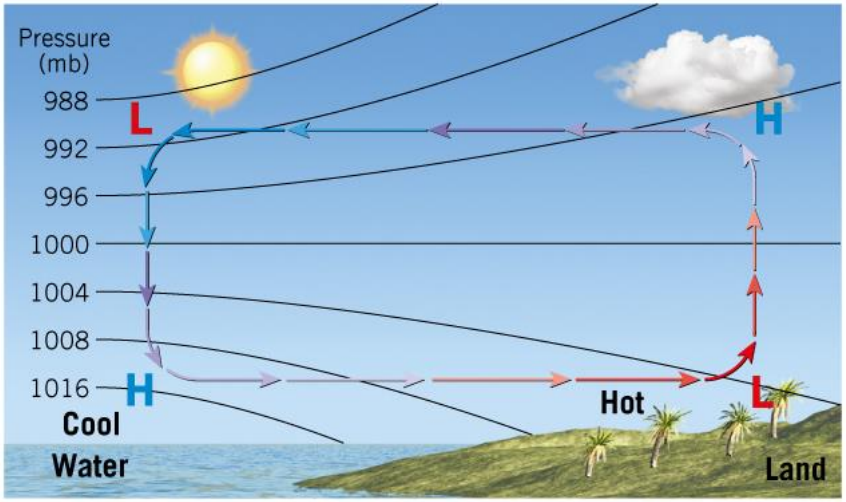

Polar cell
Subpolar low
Polar high
Polar easterlies
60°
Polar front
30°
Westerlies
Subtropical high
NE trade winds
0°
Equatorial low
SE trade winds



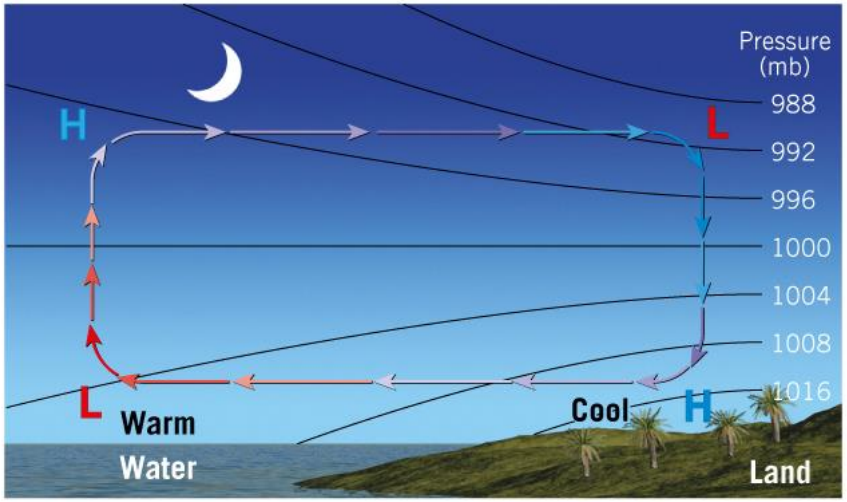
A. January



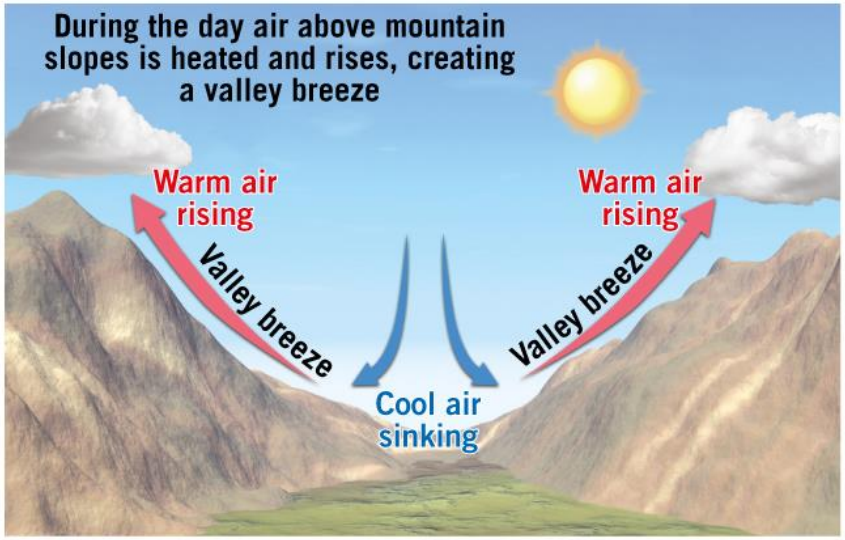
B. July



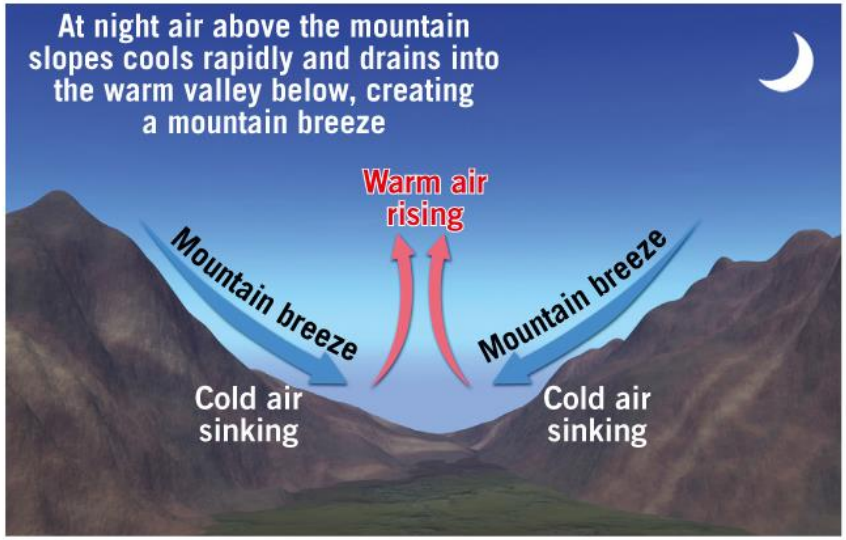
A. During daylight hours, cooler and denser air over the water moves onto the land, generating a sea breeze.



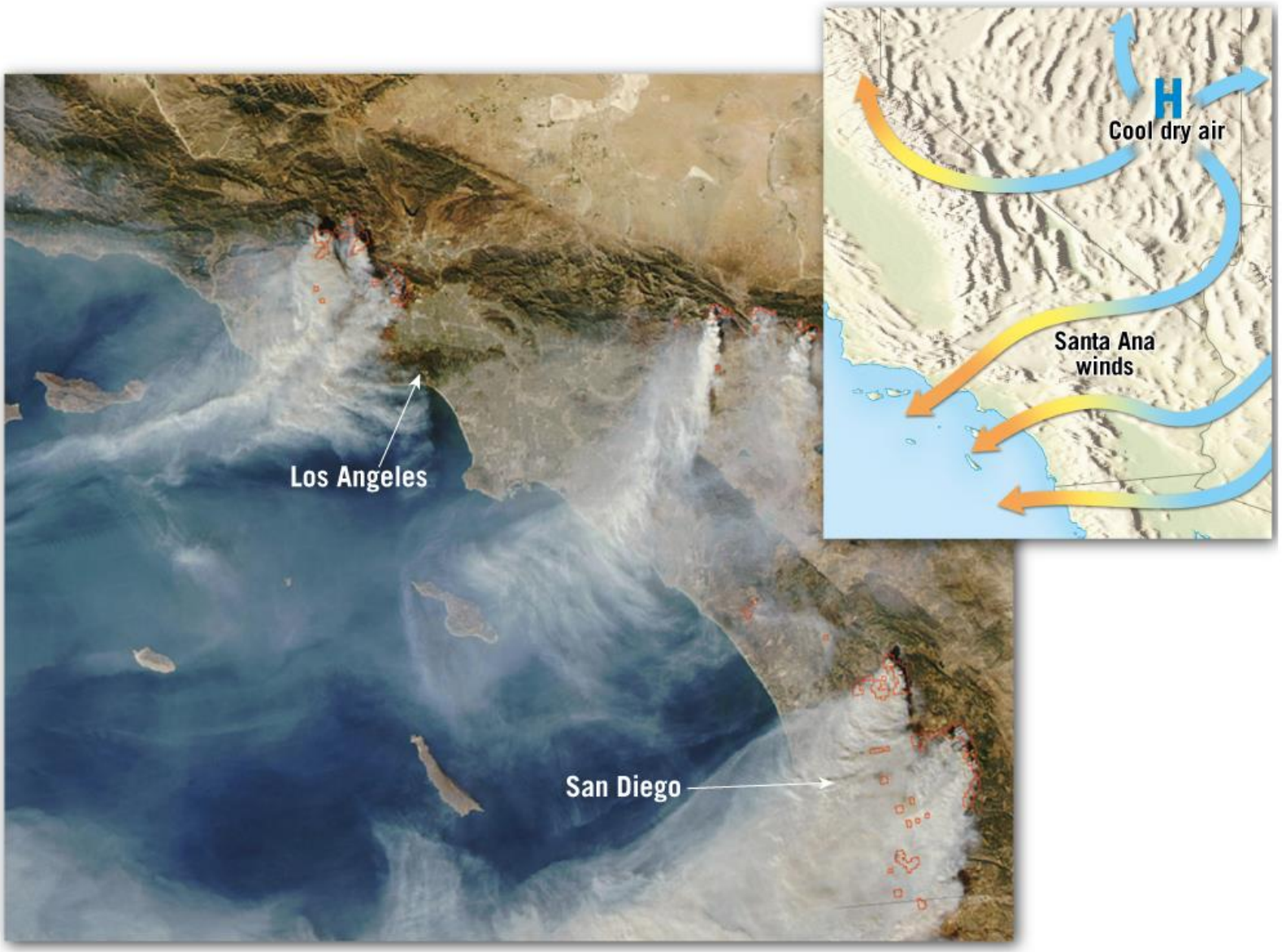
B. At night the land cools more rapidly than the sea, generating an offshore flow called a land breeze.



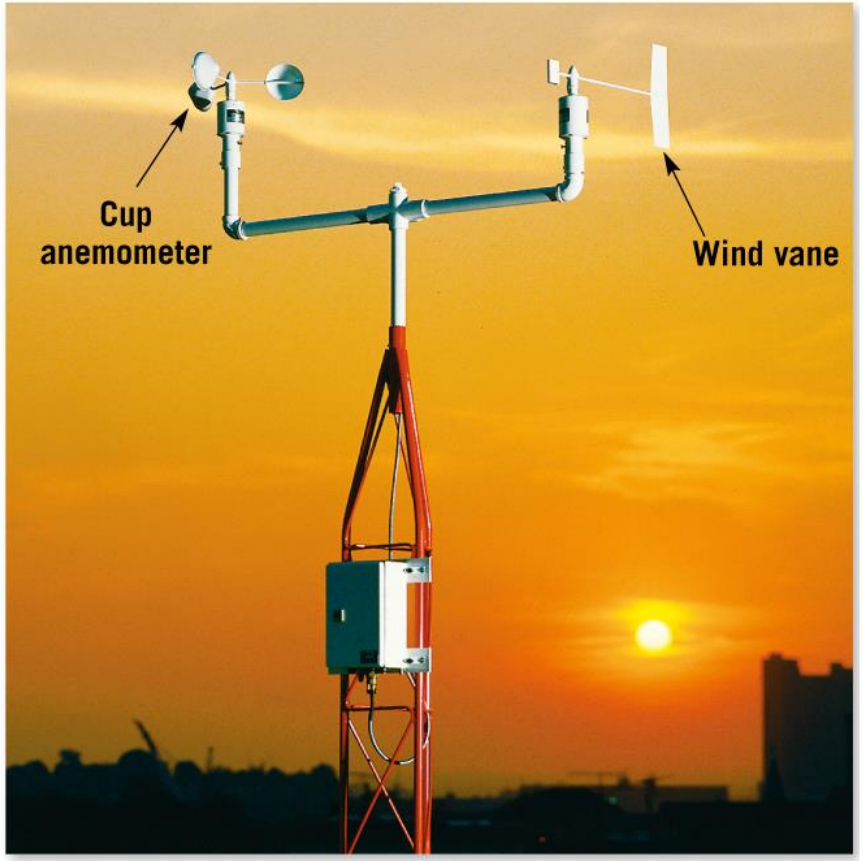
A. Valley breeze



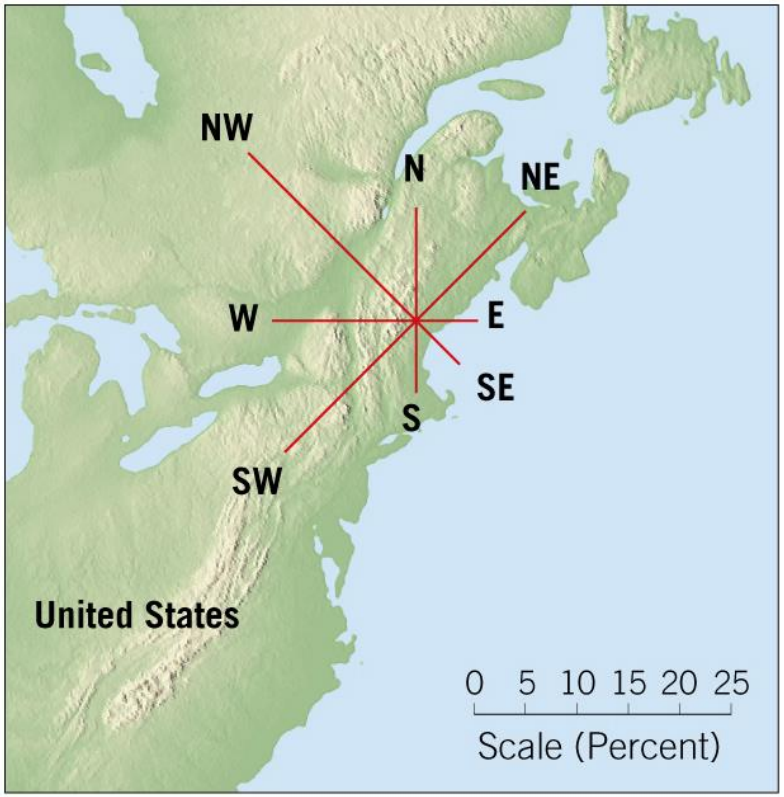
B. Mountain breeze


Los Angeles
San Diego
H
Cool dry air
Santa Ana
winds

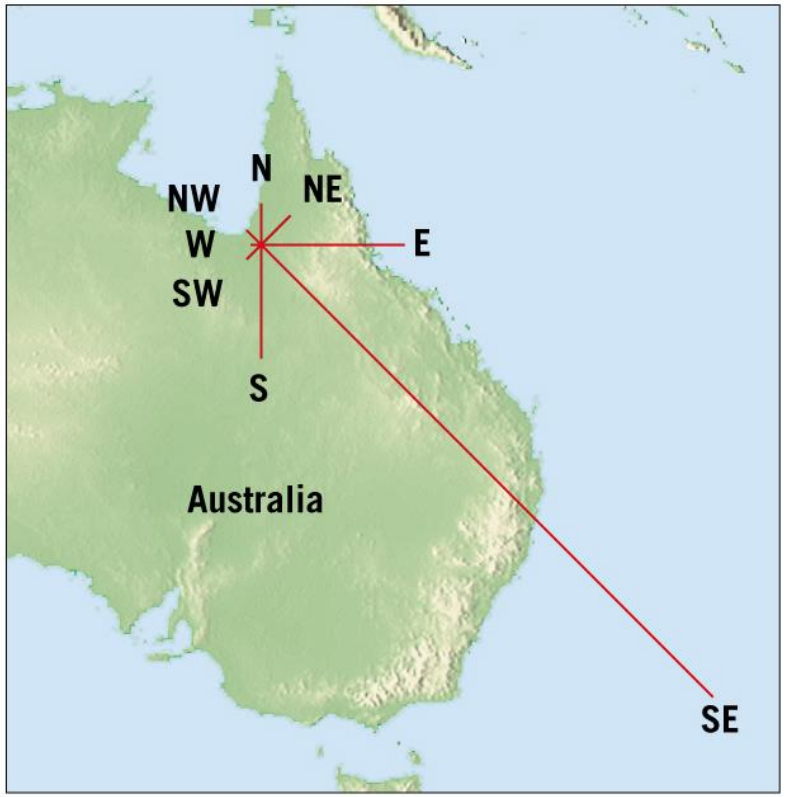
A.



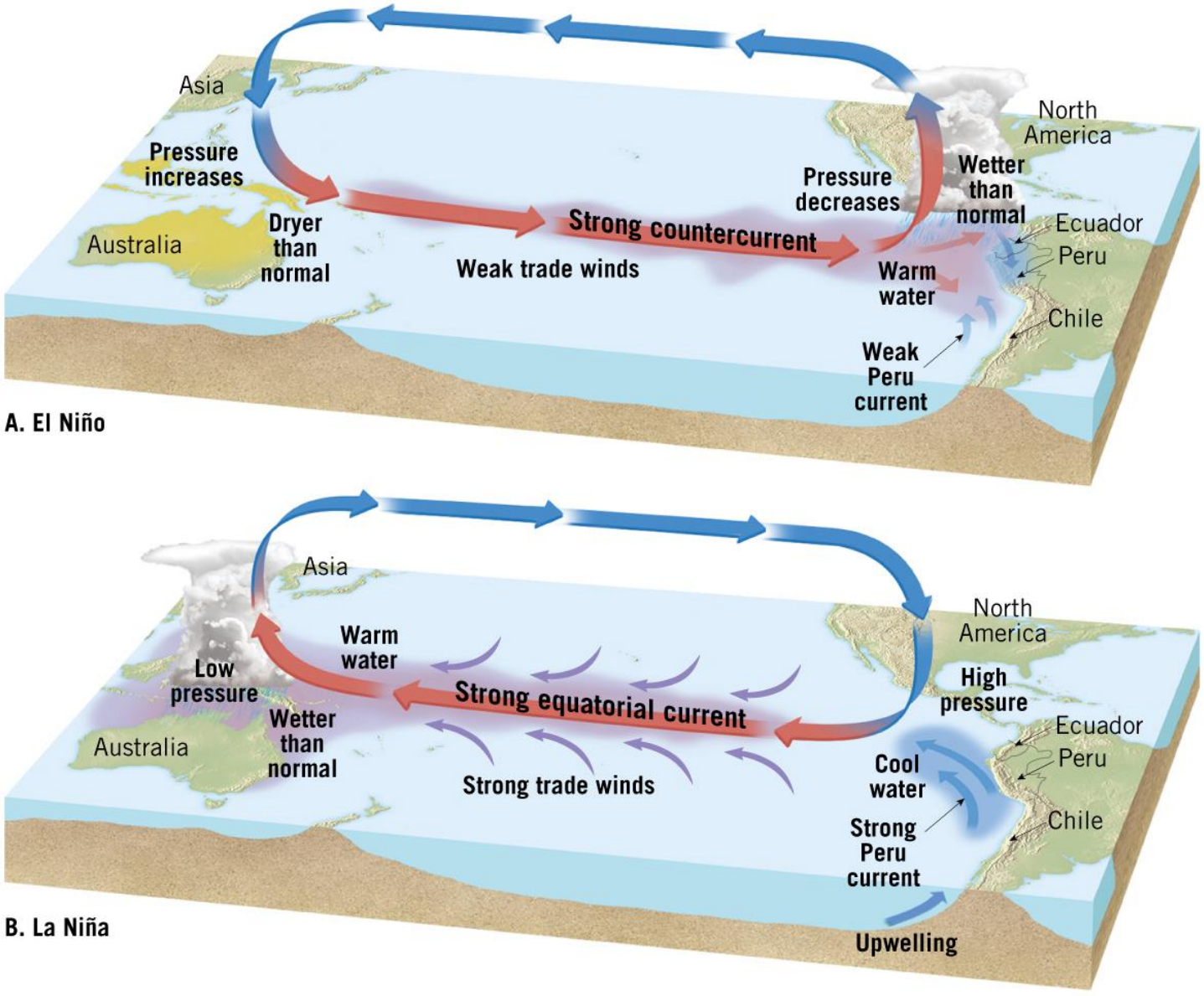
B.

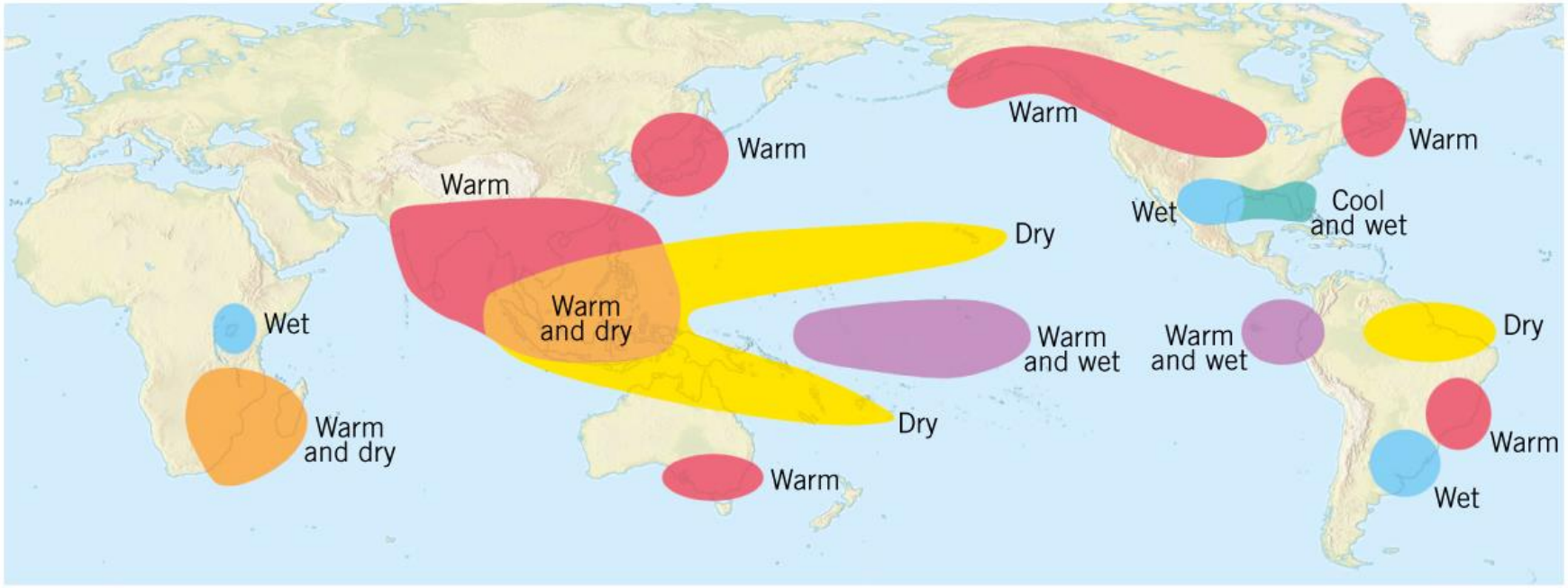


A. Wind frequency for winter in the northeastern United States.



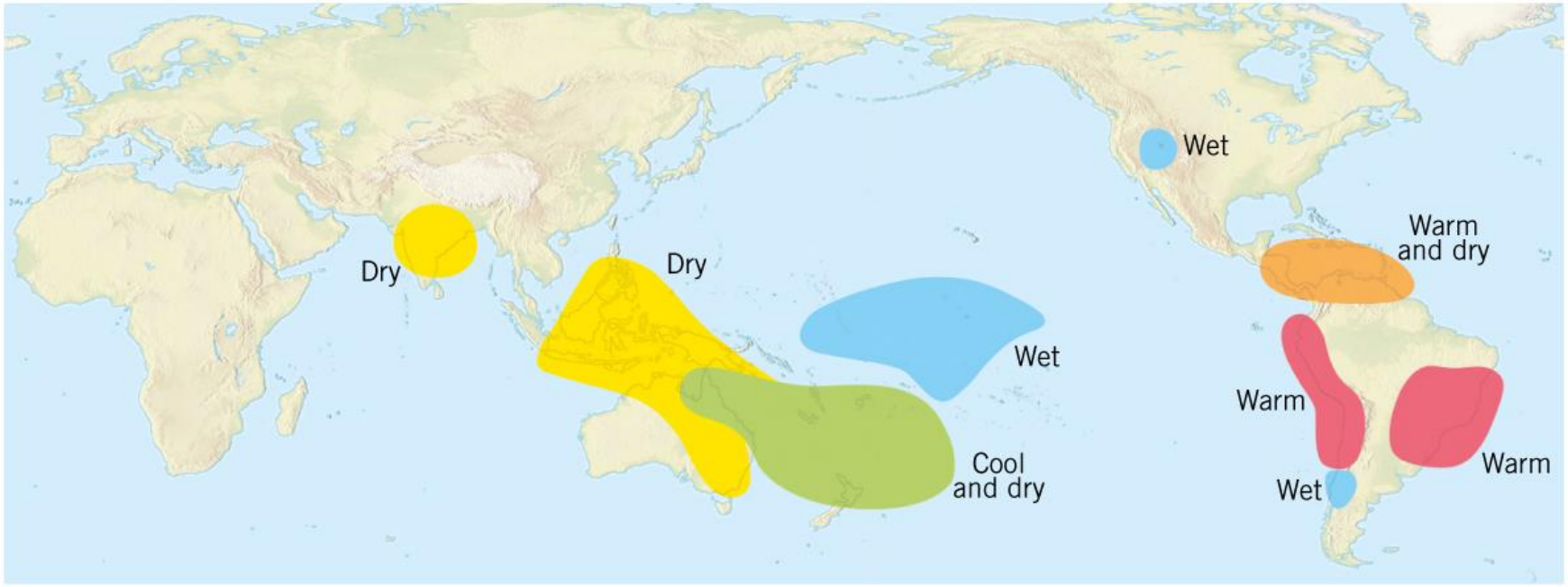
B. Wind frequency for winter in northeastern Australia. Note the reliability of the southeast trade winds in Australia as compared to the westerlies in the northeastern United States.


Asia
Pressure increases
Australia
Dryer than normal
Weak trade winds
Strong countercurrent
Pressure decreases
Wetter than normal
North America
Ecuador
Peru
Chile
Warm water
Weak Peru current
A. El Niño
Asia
Warm water
Low pressure
Wetter than normal
Australia
Strong equatorial current
Strong trade winds
North America
High pressure
Ecuador
Peru
Chile
Cool water
Strong Peru current
Upwelling
B. La Niña



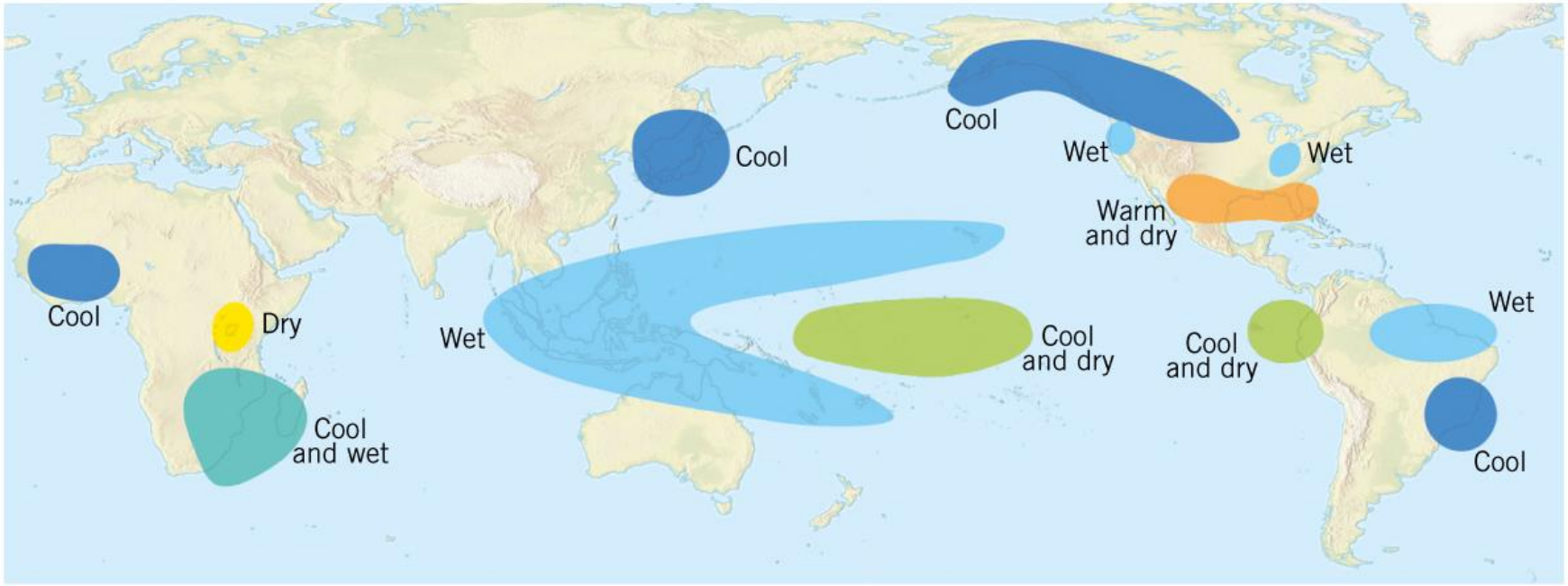
A. El Niño: December to February

Cool | Warm | Dry | Wet | Cool and dry | Cool and wet | Warm and dry | Warm and wet



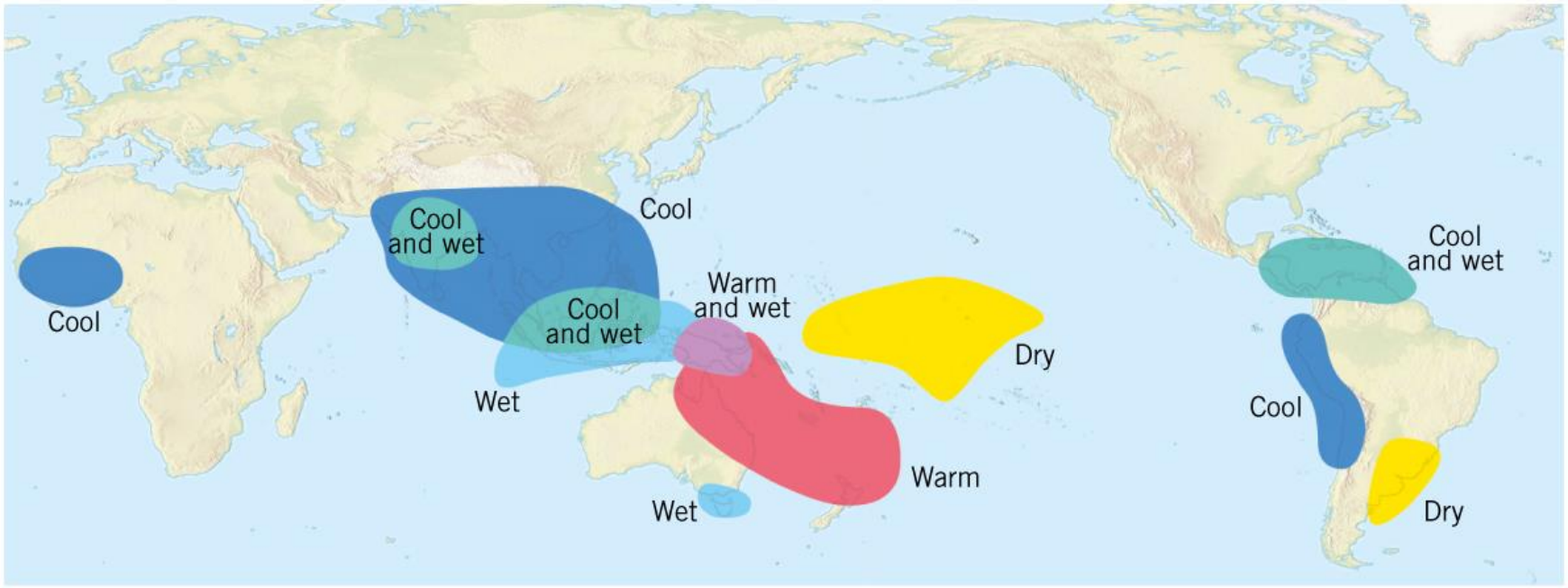
B. El Niño: June to August

Cool | Warm | Dry | Wet | Cool and dry | Cool and wet | Warm and dry | Warm and wet



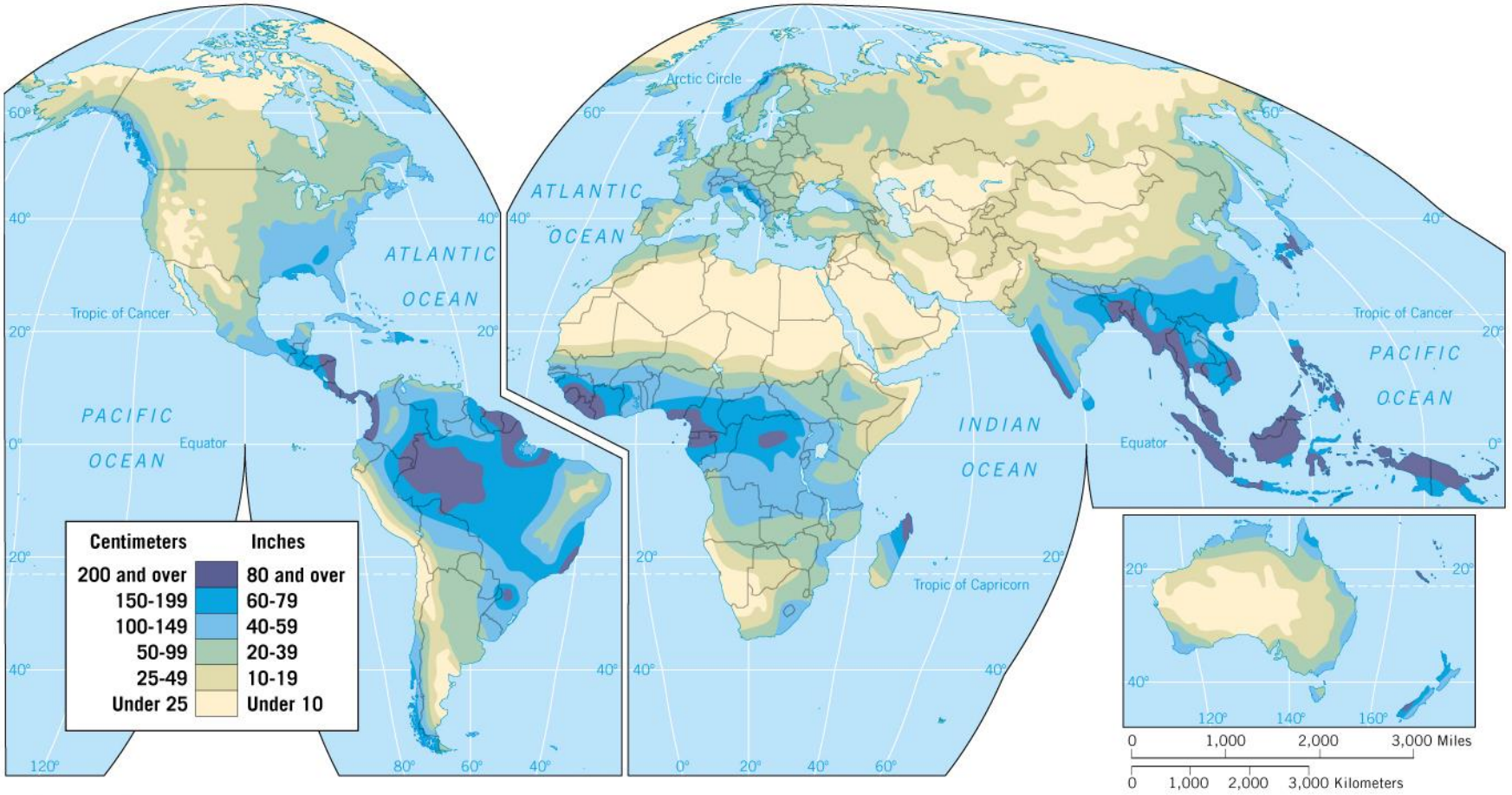
C. La Niña: December to February

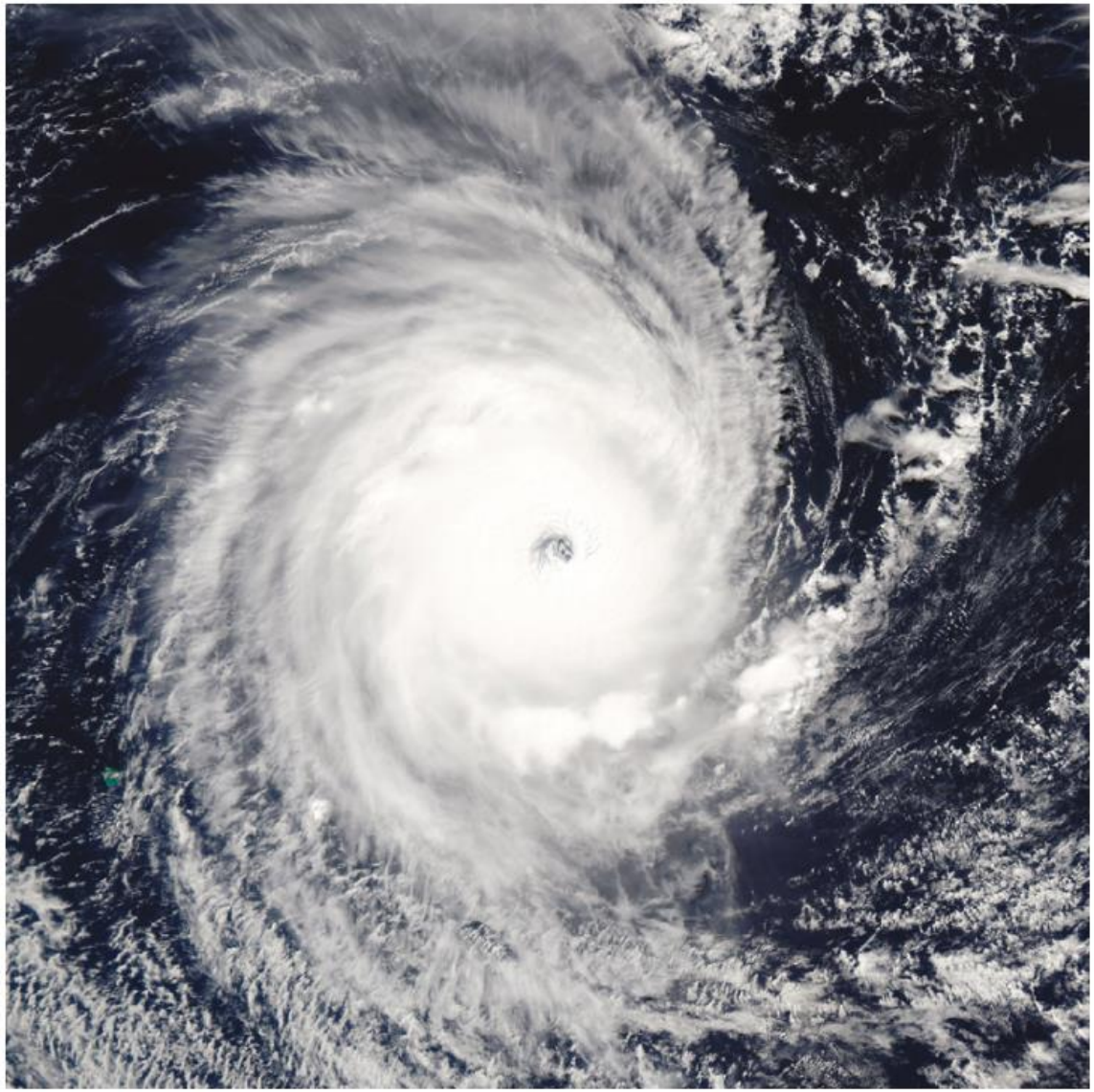
Cool | Warm | Dry | Wet | Cool and dry | Cool and wet | Warm and dry | Warm and wet



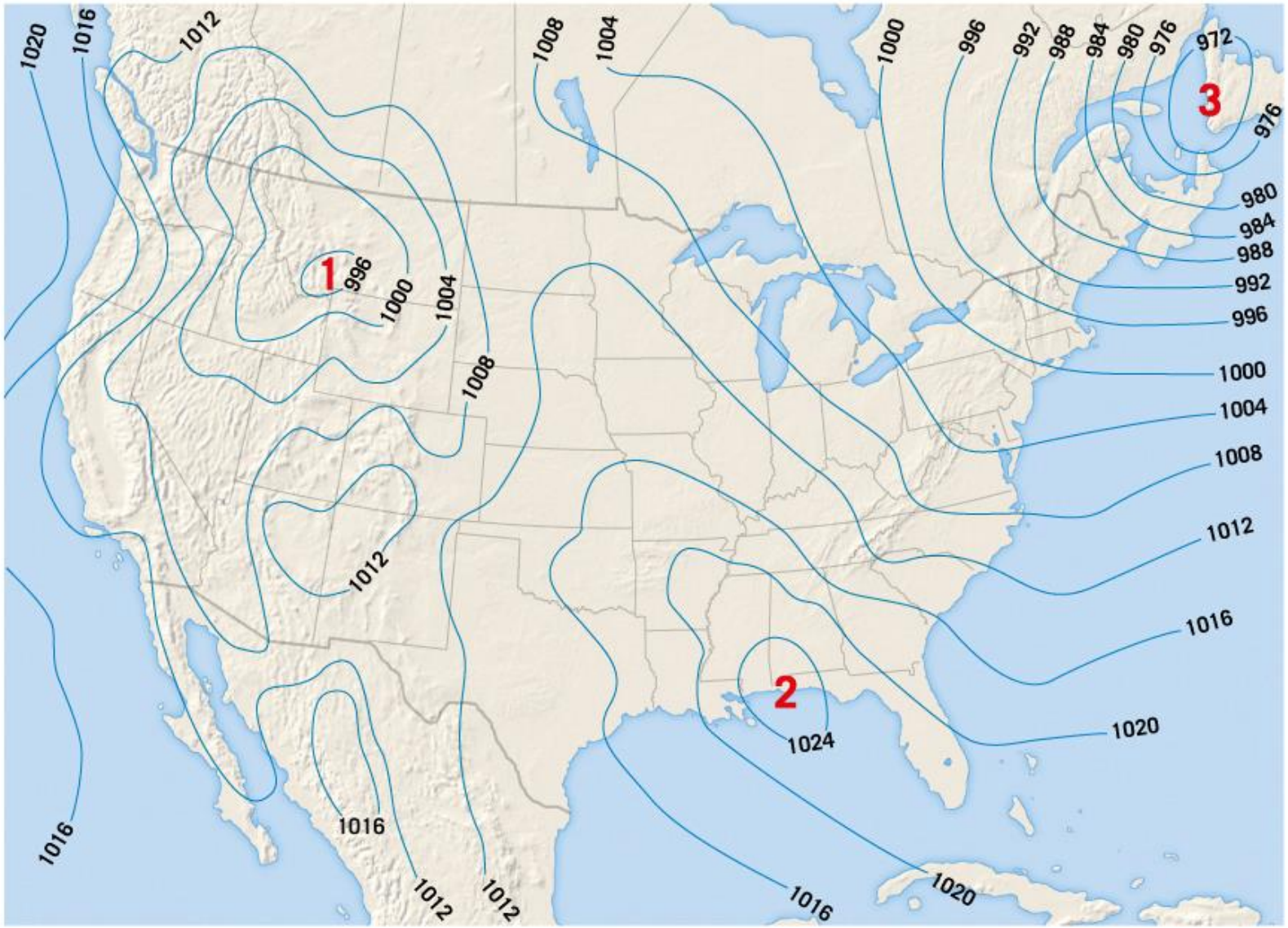
D. La Niña: June to August

Cool | Warm | Dry | Wet | Cool and dry | Cool and wet | Warm and dry | Warm and wet


Arctic Circle
Tropic of Cancer
Equator
Tropic of Capricorn
ATLANTIC OCEAN
PACIFIC OCEAN
INDIAN OCEAN
Centimeters
Inches
200 and over
80 and over
150-199
60-79
100-149
40-59
50-99
20-39
25-49
10-19
Under 25
Under 10
0 1,000 2,000 3,000 Miles
0 1,000 2,000 3,000 Kilometers



NASA


1
2
3
1020
1016
1012
1008
1004
1000
996
992
988
984
980
976
972
1024