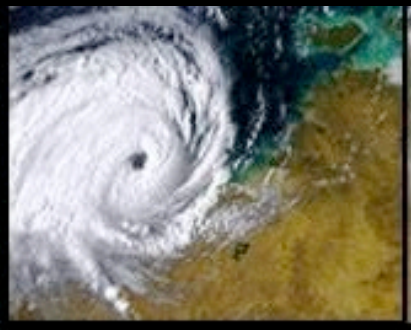
Cyclonic Weather

CYCLONE YASI

Category 5
LANDFALL: Expected to hit between Cairns and Cardwell at 10pm.
SIZE: 500km wide
EYE: 100km wide
WIND GUSTS: 320km/h expected
STORM SURGE: Up to 9m expected
RAINFALL: Up to 1000mm expected
DAMAGE: Potentially large as it is heading towards built-up areas

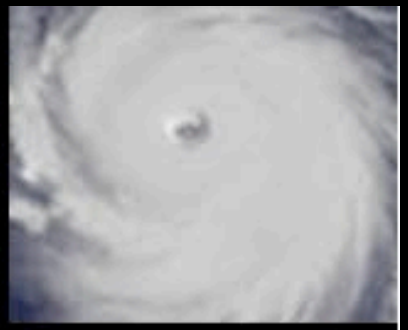


CYCLONE TRACY

Category: 4
LANDFALL: Darwin in the early hours of December 25, 1974.
SIZE: 50km wide
EYE: 12km wide
WIND GUSTS: 217km/h recorded as the measuring system failed. Estimated up to 300km/h.
STORM SURGE: 1.6m in the city harbour, 4m at Casuarina Beach
RAINFALL: 195mm on Darwin in under eight hours
DAMAGE: 65 people killed, including 16 lost at sea, and 25,000 homes destroyed.

CYCLONE LARRY

Category: 4 (briefly Category 5)
LANDFALL: near Innisfail on the morning of March 20, 2006
SIZE: 100km wide
EYE: 25km wide
WIND GUSTS: 294km/h
STORM SURGE: 2.3m (inundation to 4.9m in areas without gauges)
RAINFALL: 500mm in 72hrs near Tully
DAMAGE: Severe damage to infrastructure and crops and a damage bill of $500 million-plus



HURRICANE KATRINA

Category: 5
LANDFALL: Florida, Louisiana and Mississippi, August 2005.
SIZE: 640km wide
EYE: 51km wide
WIND GUSTS: 280km/h
STORM SURGE: Up to 8.5m
RAINFALL: 300mm over eastern Louisiana.
DAMAGE: 1833 people killed, more than $100 billion damage.

What types of Weather are Cyclonic?

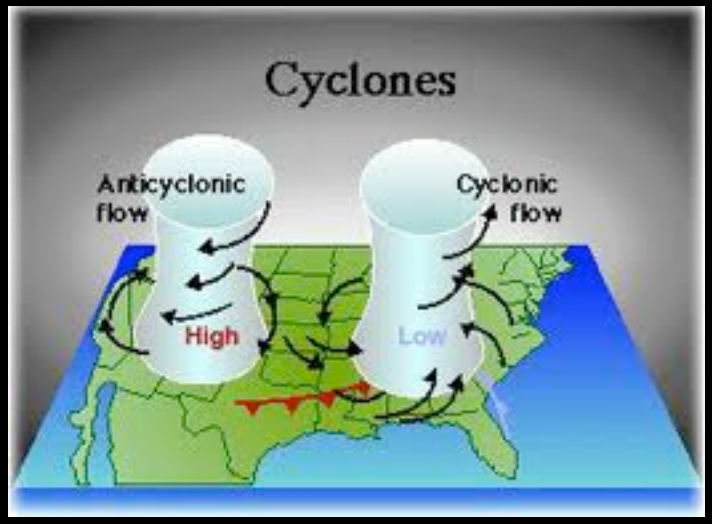
Cyclonic Weather





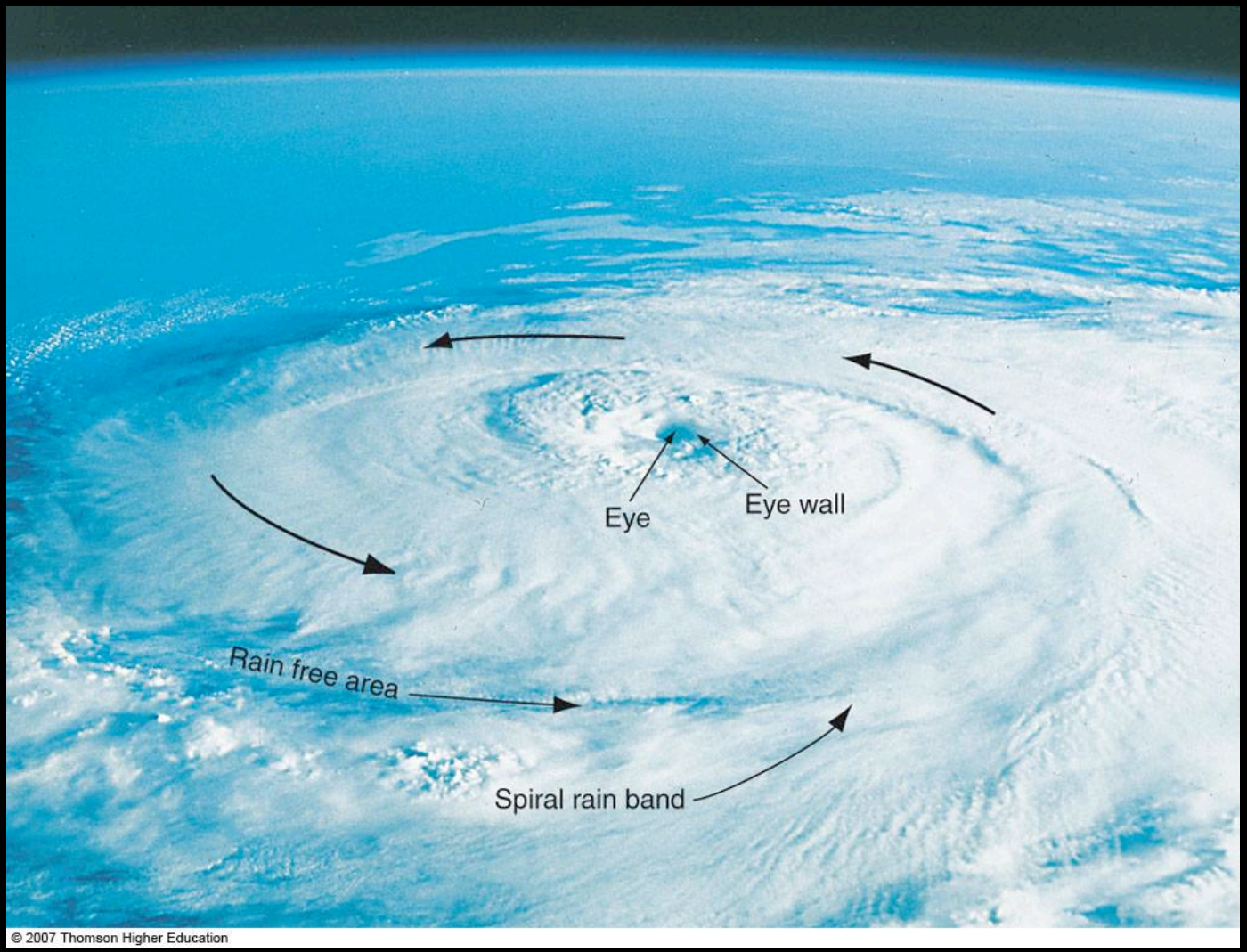

Hurricanes

Cyclonic Weather



HURRICANE - LOW PRESSURE TROPICAL STORM THAT STARTS IN THE WESTERN ATLANTIC AND REACHES WINDS ABOVE 74 MPH

Cyclonic Weather



Hurricane

Cyclonic Weather

HURRICANE STATISTICS

- LARGEST OF ALL THE STORMS
- APPROXIMATELY 10 PER YEAR
- NEARLY 400 DEATHS PER YEAR

Cyclonic Weather

SAFFIR-SIMPSON SCALE -

- SYSTEM FOR CLASSIFYING HURRICANES

Saffir-Simpson Scale

Category	Wind (mph)	Pressure (inches)	Surge (feet)
1	74-95	> 28.94	4 - 5
2	96-110	28.50-28.93	6 - 8
3	111-130	27.91-28.49	9 - 12
4	131-155	27.17-27.90	13 - 18
5	> 155	< 27.16	> 18

Cyclonic Weather

Hurricane Dangers

- SEVERE WINDS FROM 74 - 155

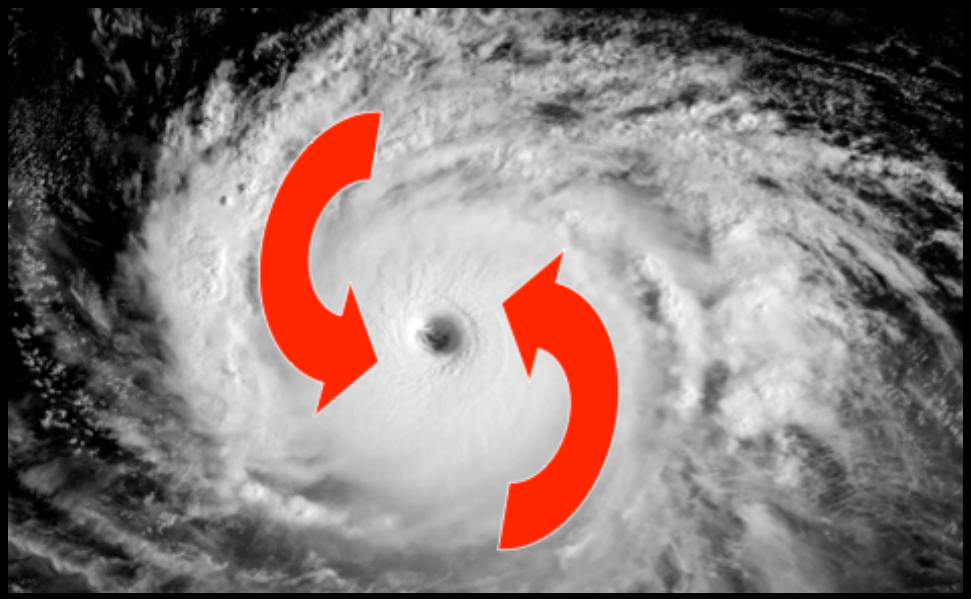


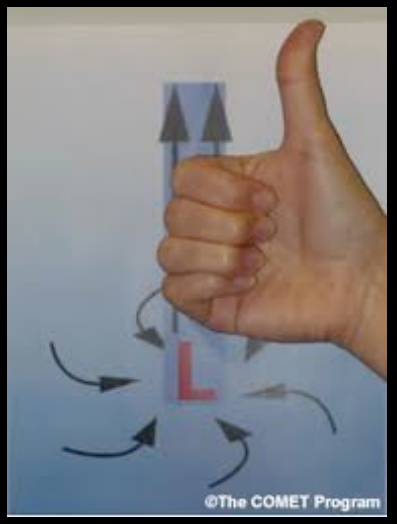


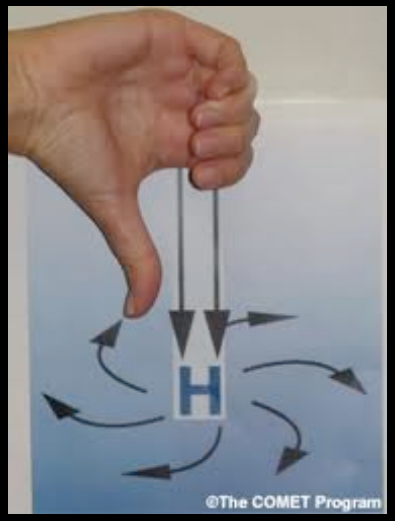

Cyclonic Weather

Hurricane Dangers

- WIND DIRECTION IS COUNTERCLOCKWISE AND INWARD



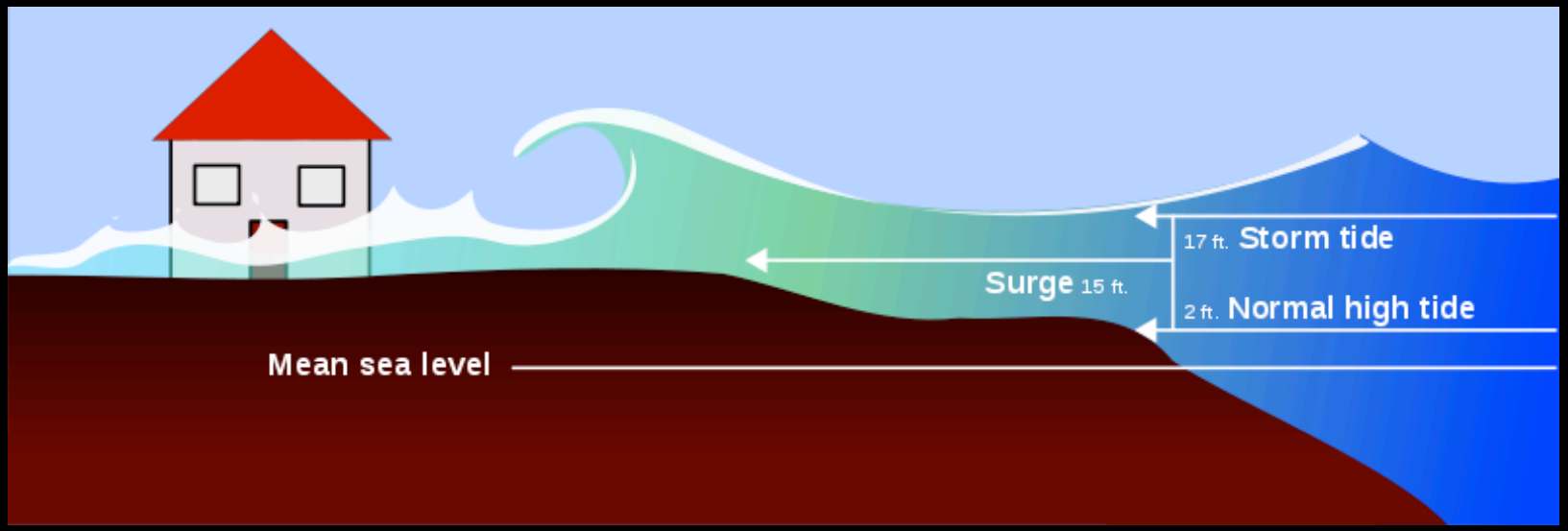




Cyclonic Weather

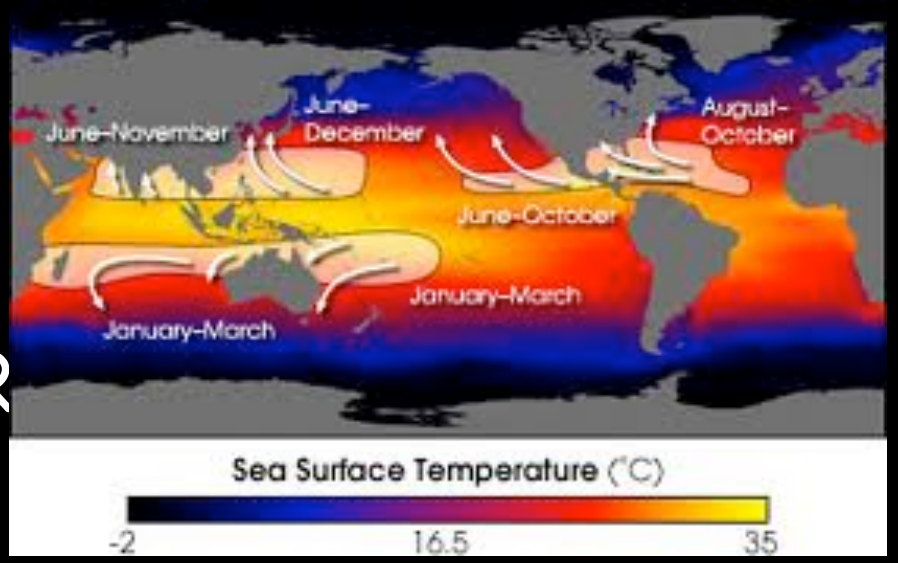
Hurricane Dangers

- **STORM SURGE** – A DOME OF WATER 40 TO 60 MILES LONG THAT MOVES ONTO SHORE NEAR THE LANDFALL POINT OF THE HURRICANE



Cyclonic Weather
Hurricane Formation

1. THE SUN HEATS UP OCEAN WATER (ESPECIALLY NEAR THE EQUATOR)
2. BY THE END OF SUMMER OCEAN TEMPERATURES REACH INTO THE 80'S



3. A THUNDERSTORM MOVES WESTWARD OFF OF AFRICA AND INTO THE ATLANTIC OCEAN
4. WHEN UPPER WIND VELOCITIES ARE LOW, THUNDERSTORMS ARE GIVEN A CHANCE TO GAIN STRENGTH
5. THE FAST RISING AIR (SUPPLIED BY THE WARM OCEAN) ALLOWS THE THUNDERSTORM TO GAIN STRENGTH
6. AS IT GROWS, EARTH'S ROTATION CAUSES IT TO SPIN COUNTERCLOCKWISE (CORIOLIS EFFEC
7. AS THEY BUILD A THUNDERSTORM CHANGES

Cyclonic Weather

- **TORNADO** - A ROTATING COLUMN OF AIR RANGING IN WIDTH FROM A FEW YARDS TO MORE THEN A MILE AND WHIRLING AT DESTRUCTIVELY HIGH WINDS

Cyclonic Weather

TORNADO STATISTICS

- MOST VIOLENT STORMS
- APPROXIMATELY 1000 PER YEAR
- NEARLY 50 DEATHS PER YEAR

Cyclonic Weather

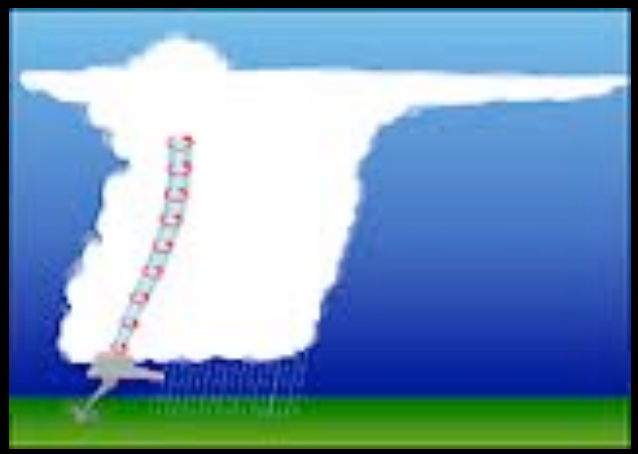
TORNADO DANGERS

- SEVERE WINDS FROM 250 MPH AND ABOVE

Cyclonic Weather

TORNADO FORMATION

1. DEVELOP FROM AN INTENSE THUNDERSTORM
2. HEATING IS VERY INTENSE AND WARM AIR RISES IN STRONG CONVECTION CURRENTS



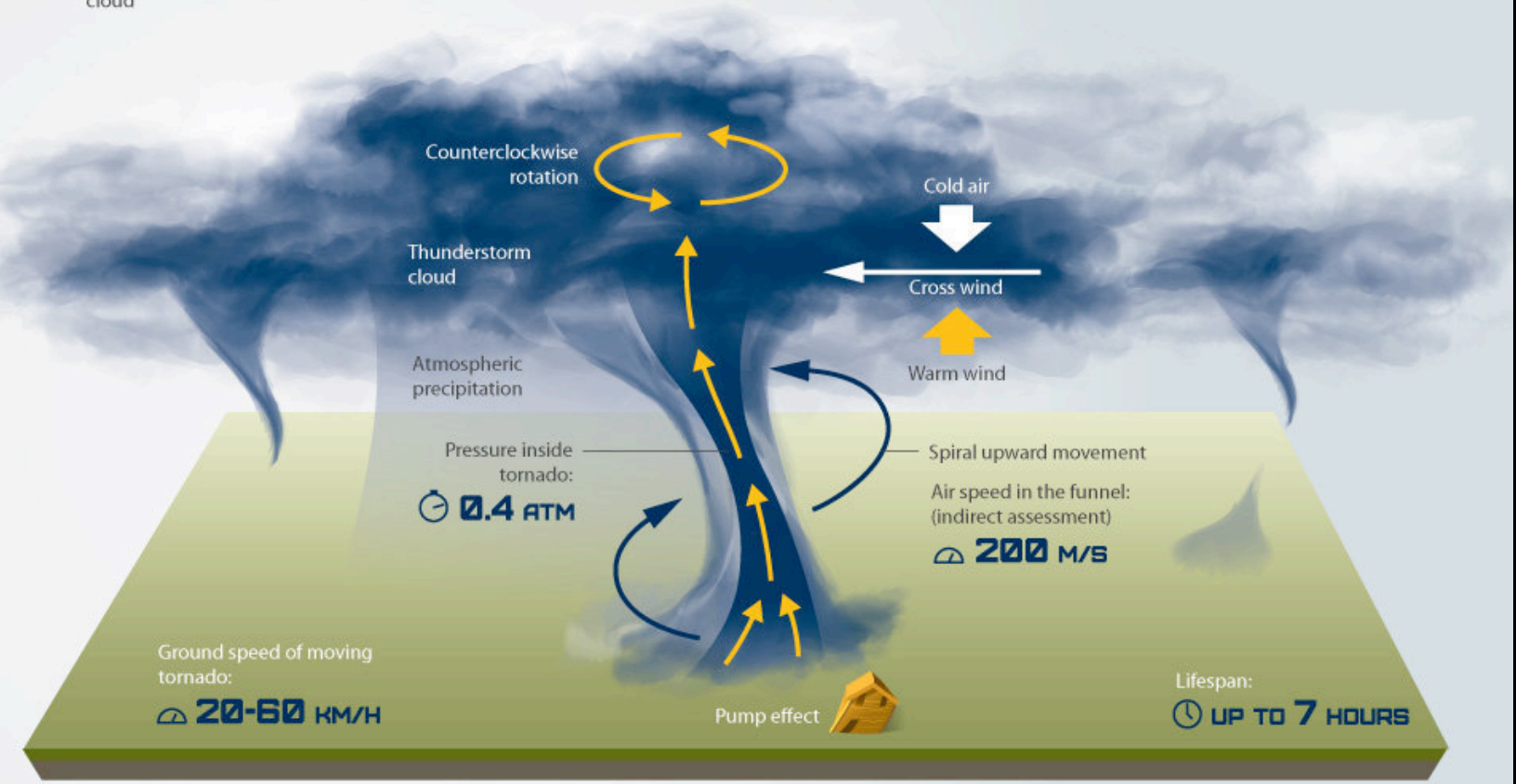
Cyclonic Weather

3. THE RISING AIR CAUSES A LOW PRESSURE CENTER
4. AS AIR RUSHES INTO THE CENTER IT STARTS TO SPIN UPWARD

TORNADO FORMATION

Tornados form when two large air masses of varying temperature and humidity collide, with warm air in the lower layers and cold air in the upper layers

1. The initial funnel, which hovers over the surface, grows from a thunder cloud
2. If conditions are favorable (temperature swings, wind etc.) a tornado takes shape and reaches Earth
3. When the conditions start to change, the funnel narrows and starts to rise gradually toward the cloud



TORNADO CLASSIFICATION:

Waterspout
The most common type

Land spout
The diameter of this type of tornado can exceed its height

Multiple vortex
Most of these are powerful tornados that cause heavy damage

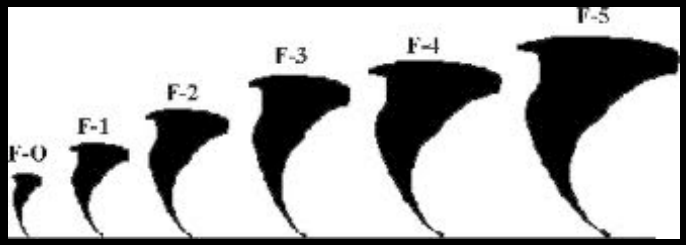
The most devastating tornado in history:

Place: Saturia (Bangladesh)

Date: April 26, 1989

Number of victims: 1,300 people

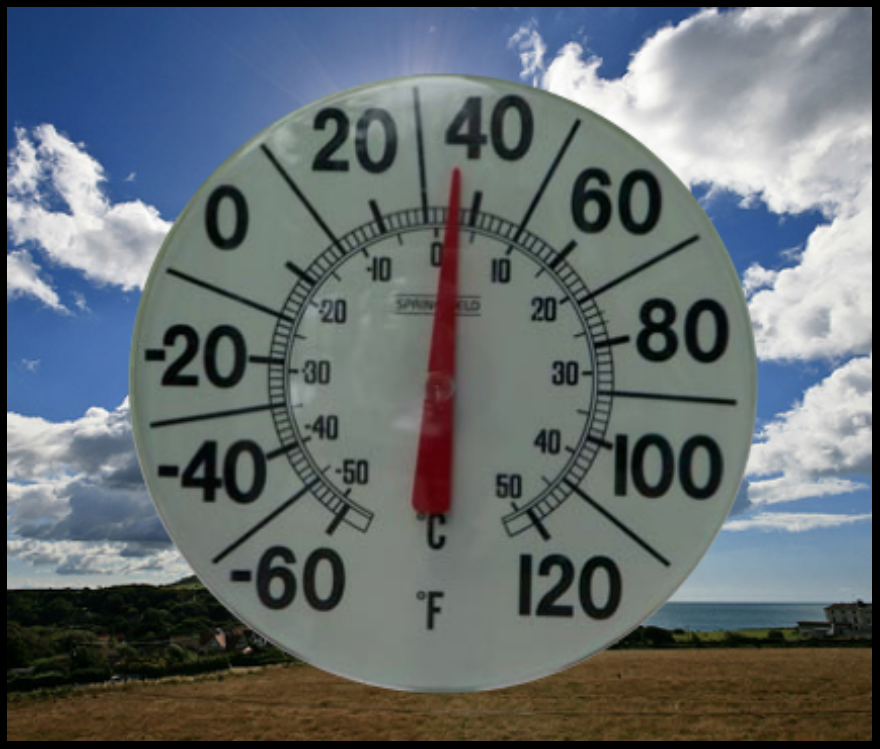
Cyclonic Weather



TORNADO CLASSIFICATION

THE FUJUITA-PEARSON TORNADO INTENSITY SCALE		
CLASSIFICATION	WIND SPEED	DAMAGE
F0	40–72 mph	Mild
F1	73–112 mph	Moderate
F2	113–157 mph	Significant
F3	158–206 mph	Severe
F4	207–260 mph	Devastating
F5	260–319 mph	Incredible
F6	319–379 mph	Inconceivable

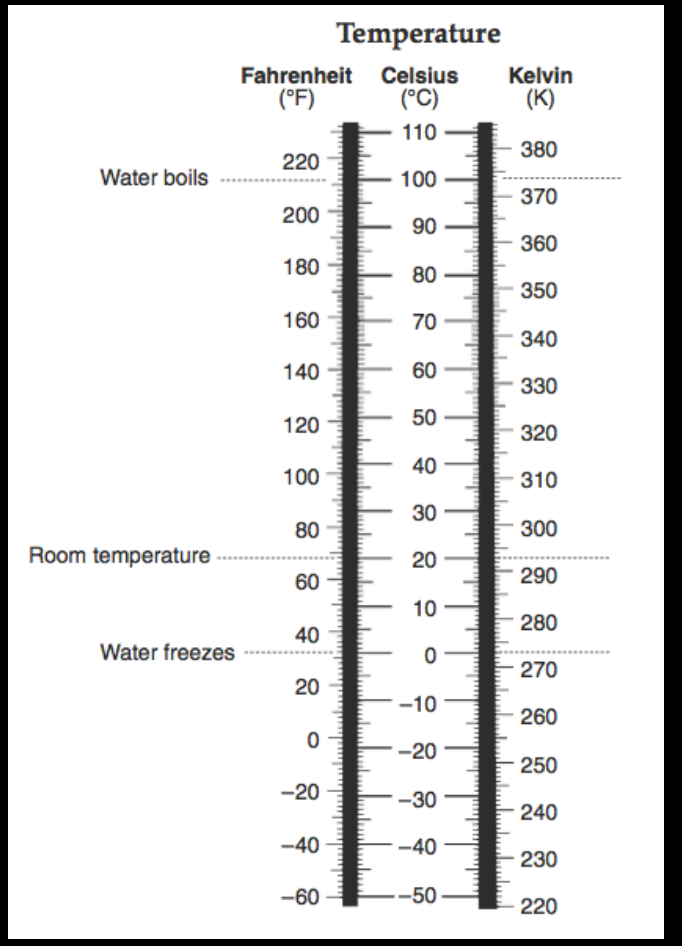
Weather Instruments



WHAT TOOLS DO WE USE TO HELP PREDICT THE WEATHER?

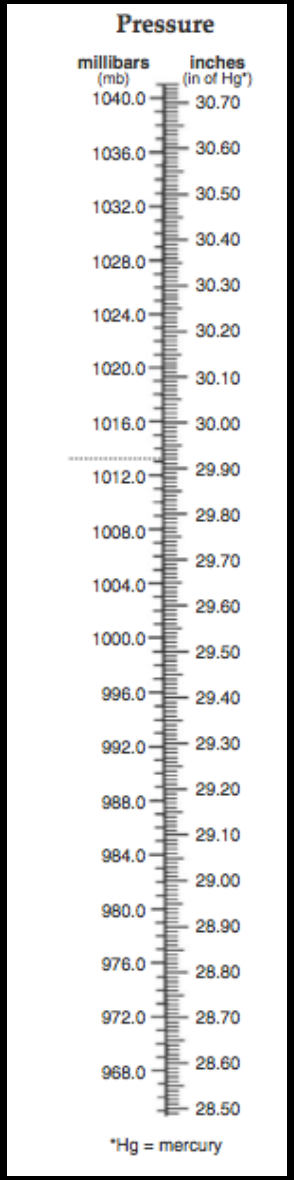
Weather Instruments

- **THERMOMETER** - INSTRUMENT USED TO MEASURE TEMPERATURE
- CELSIUS
  - DIFFERENT SCALES INCLUDE:
    - CELSIUS
    - FAHRENHEIT
    - KELVIN



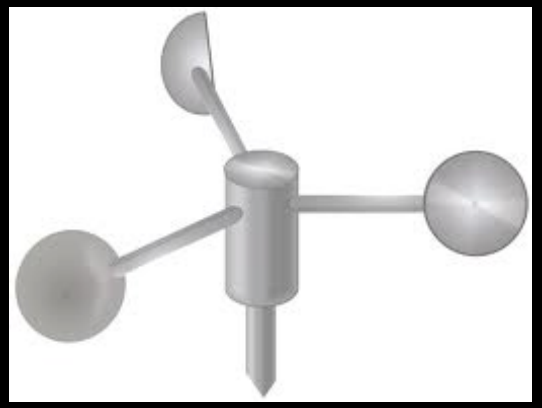
Weather Instruments

- **BAROMETER** - INSTRUMENT USED TO MEASURE AIR PRESSURE
  - DIFFERENT SCALES INCLUDE:
    - INCHES OF MERCURY
    - MILLIBARS



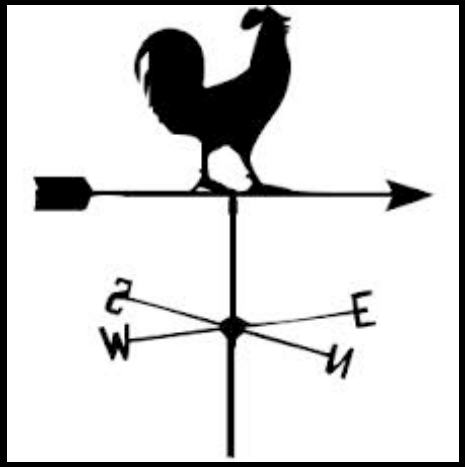
Weather Instruments

- **ANEMOMETER** - INSTRUMENT USED TO MEASURE WIND SPEED
  - DIFFERENT SCALES INCLUDE:
    - KNOTS
    - MILES PER HOUR



Weather Instruments

- **WEATHER VANE** - INSTRUMENT USED TO MEASURE WIND DIRECTION
  - MEASURES DIRECTION USING COMPASS DIRECTIONS



Weather Instruments

- **SLING PSYCHROMETER** - INSTRUMENT USED TO MEASURE DEW POINT AND RELATIVE HUMIDITY

Weather Instruments

- **RELATIVE HUMIDITY** - THE AMOUNT OF WATER VAPOR IN THE AIR AT ANY GIVEN TIME

  - TO CALCULATE RELATIVE HUMIDITY YOU NEED A DRY BULB TEMPERATE, DIFFERENCE IN WET BULB AND DRY BULB TEMPERATURE, AND THE E.S.R.T.

Weather Instruments

Dry-Bulb Temperature (°C)	Difference Between Wet-Bulb and Dry-Bulb Temperatures (C°)															
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
−20	100	28														
−18	100	40														
−16	100	48														
−14	100	55	11													
−12	100	61	23													
−10	100	66	33													
−8	100	71	41	13												
−6	100	73	48	20												
−4	100	77	54	32	11											
−2	100	79	58	37	20	1										
0	100	81	63	45	28	11										
2	100	83	67	51	36	20	6									
4	100	85	70	56	42	27	14									
6	100	86	72	59	46	35	22	10								
8	100	87	74	62	51	39	28	17	6							
10	100	88	76	65	54	43	33	24	13	4						
12	100	88	78	67	57	48	38	28	19	10	2					
14	100	89	79	69	60	50	41	33	25	16	8	1				
16	100	90	80	71	62	54	45	37	29	21	14	7	1			
18	100	91	81	72	64	56	48	40	33	26	19	12	6			
20	100	91	82	74	66	58	51	44	36	30	23	17	11	5		
22	100	92	83	75	68	60	53	46	40	33	27	21	15	10	4	
24	100	92	84	76	69	62	55	49	42	36	30	25	20	14	9	4
26	100	92	85	77	70	64	57	51	45	39	34	28	23	18	13	9
28	100	93	86	78	71	65	59	53	47	42	36	31	26	21	17	12
30	100	93	86	79	72	66	61	55	49	44	39	34	29	25	20	16

Relative Humidity

Weather Instruments

- **DEW POINT** - THE TEMPERATURE AT WHICH AIR MUST BE COOLED FOR WATER VAPOR TO CONDENSE

- TO CALCULATE POINT YOU NEED A DRY BULB TEMPERATE, DIFFERENCE IN WET BULB AND DRY BULB TEMPERATURE, AND THE E.S.R.T.

Weather Instruments

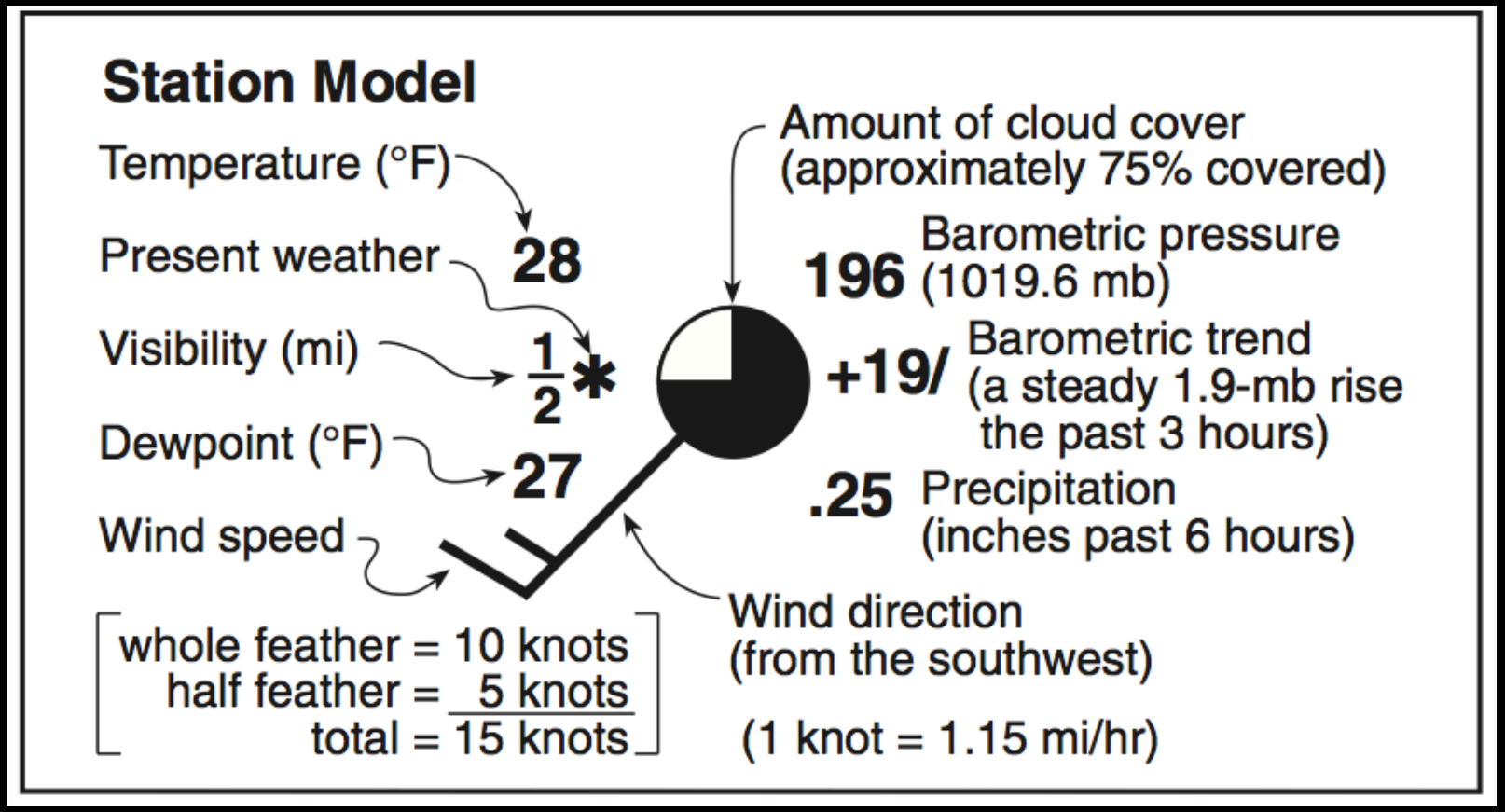
Dry-Bulb Temperature (°C)	Difference Between Wet-Bulb and Dry-Bulb Temperatures (C°)															
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
−20	−20	−33														
−18	−18	−28														
−16	−16	−24														
−14	−14	−21	−36													
−12	−12	−18	−28													
−10	−10	−14	−22													
−8	−8	−12	−18	−29												
−6	−6	−10	−14	−22												
−4	−4	−7	−12	−17	−29											
−2	−2	−5	−8	−13	−20											
0	0	−3	−6	−9	−15	−24										
2	2	−1	−3	−6	−11	−17										
4	4	1	−1	−4	−7	−11	−19									
6	6	4	1	−1	−4	−7	−13	−21								
8	8	6	3	1	−2	−5	−9	−14								
10	10	8	6	4	1	−2	−5	−9	−14	−28						
12	12	10	8	6	4	1	−2	−5	−9	−16						
14	14	12	11	9	6	4	1	−2	−5	−10	−17					
16	16	14	13	11	9	7	4	1	−1	−6	−10	−17				
18	18	16	15	13	11	9	7	4	2	−2	−5	−10	−19			
20	20	19	17	15	14	12	10	7	4	2	−2	−5	−10	−19		
22	22	21	19	17	16	14	12	10	8	5	3	−1	−5	−10	−19	
24	24	23	21	20	18	16	14	12	10	8	6	2	−1	−5	−10	−18
26	26	25	23	22	20	18	17	15	13	11	9	6	3	0	−4	−9
28	28	27	25	24	22	21	19	17	16	14	11	9	7	4	1	−3
30	30	29	27	26	24	23	21	19	18	16	14	12	10	8	5	1

Dew Point

Weather Instruments

- **STATION MODEL** - SYMBOL ON A WEATHER MAP THAT ILLUSTRATE ALL THE WEATHER CONDITIONS AT THAT LOCATION

Weather Instruments



Station Models ESRT

Weather Variables

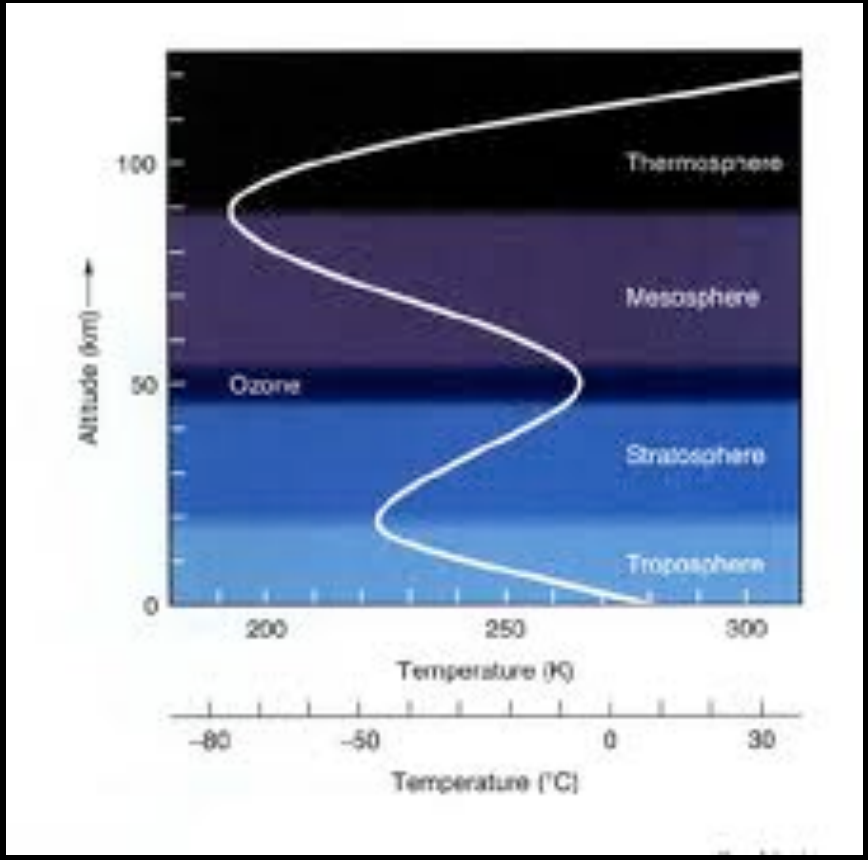
WHAT WEATHER VARIABLES HELP PREDICT WEATHER?

Weather Patterns

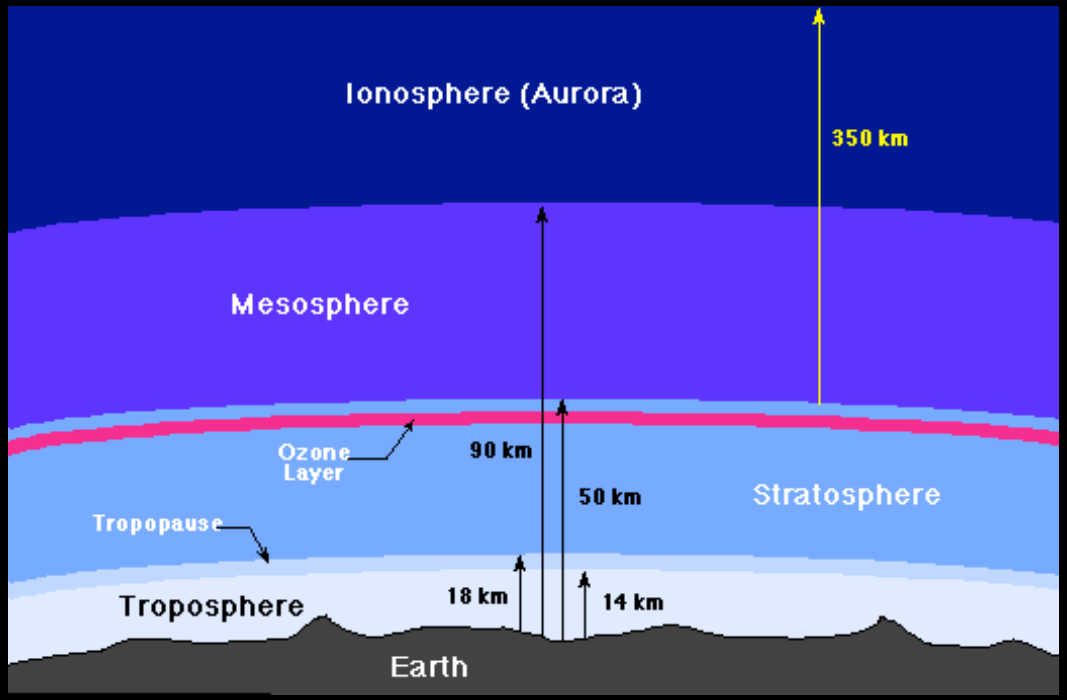
TROPOSPHERE - THE LOWEST PORTION OF THE ATMOSPHERE WHERE TEMPERATURE DECREASES

- WEATHER OCCURS IN THIS LAYER ONLY

Weather Patterns

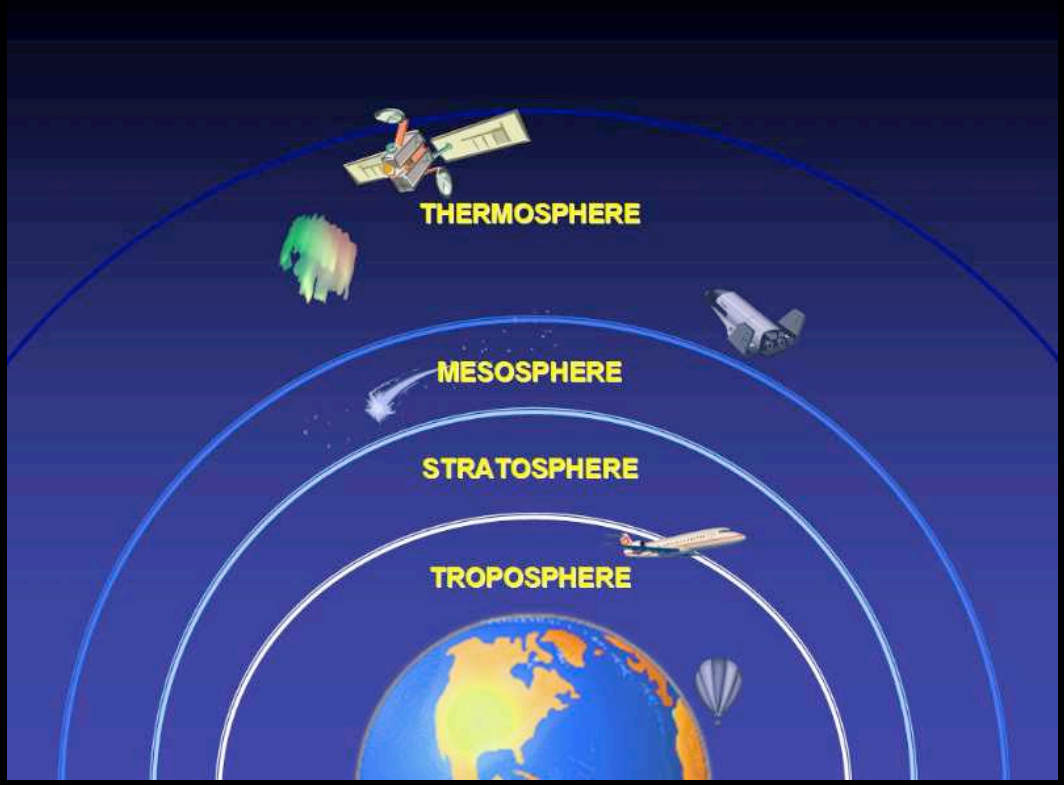


Weather Patterns



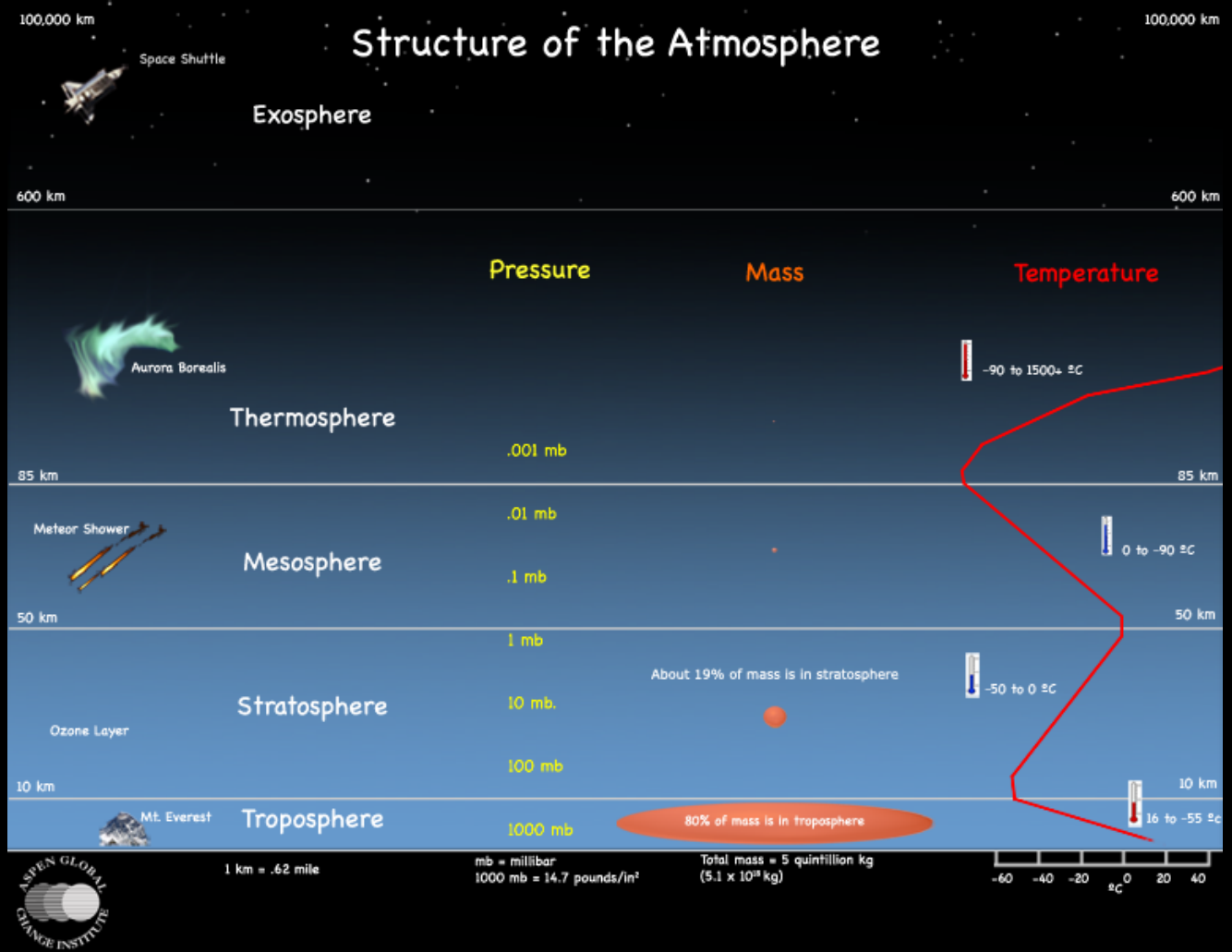
STRATOSPHERE – A REGION OF THE ATMOSPHERE WHERE TEMPERATURE INCREASES

Weather Patterns



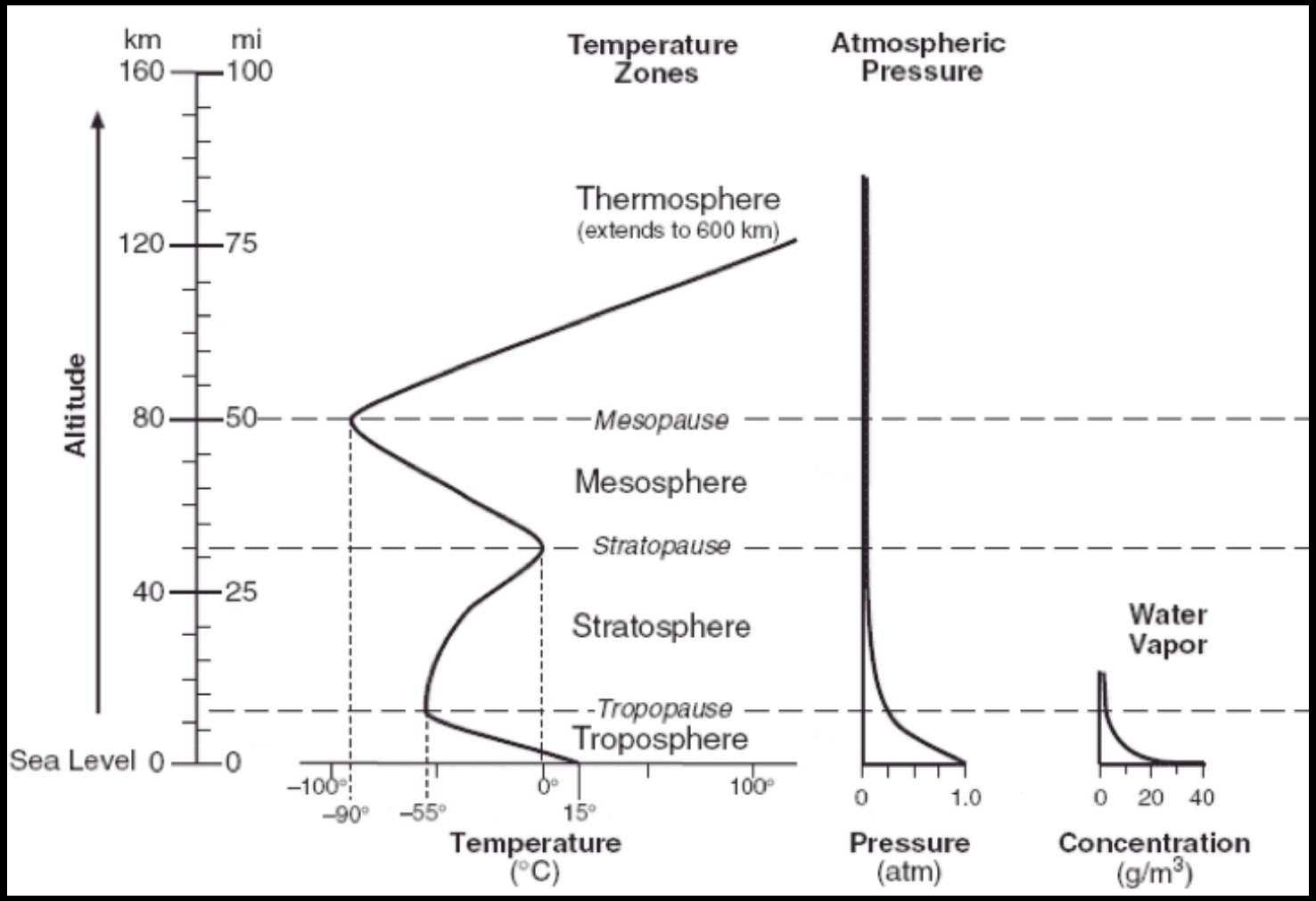
MESOSPHERE – A REGION OF THE ATMOSPHERE WHERE TEMPERATURE DECREASES AGAIN

Weather Patterns



THERMOSPHERE - THE OUTER MOST SHELL OF THE ATMOSPHERE WHERE TEMPERATURE INCREASES

Weather Patterns



Layers of the Atmosphere ESRT

Weather Patterns

WEATHER - THE PRESENT CONDITION OF THE ATMOSPHERE --- INCLUDING TEMPERATURE, PRESSURE, WIND, HUMIDITY, AND MOVEMENT

- CHANGES ARE DUE MAINLY TO UNEQUAL HEATING OF LAND MASSES, OCEANS, AND THE ATMOSPHERE

Weather Patterns

TEMPERATURE - THE HEAT ENERGY PRESENT IN THE ATMOSPHERE AT THAT LOCATION

- INFLUENCES AFFECTING TEMPERATURE ARE SOLAR RADIATION, ANGLE OF INSOLATION, HOURS OF DAYLIGHT, AND REFLECTION OFF THE ATMOSPHERE

Weather Patterns

AIR PRESSURE - THE FORCE EXERTED ON A UNIT OF AREA BY THE AIR THAT IS EXERTED EQUALLY IN EVERY DIRECTION

- AIR IS A MIXTURE OF GASES WITH MOLECULES THAT ARE FAST MOVING AND FAR APART

Weather Patterns

- AIR PRESSURE INCREASES AS YOU DECREASE YOUR ELEVATION

- AIR PRESSURE DECREASES AS YOU INCREASE YOUR ELEVATION

Weather Patterns

- **AIR CURRENTS** - RISING OR SINKING MOVEMENT OF AIR PERPENDICULAR TO THE GROUND

- **WIND** - THE HORIZONTAL MOVEMENT OF AIR PARALLEL TO THE EARTH'S SURFACE

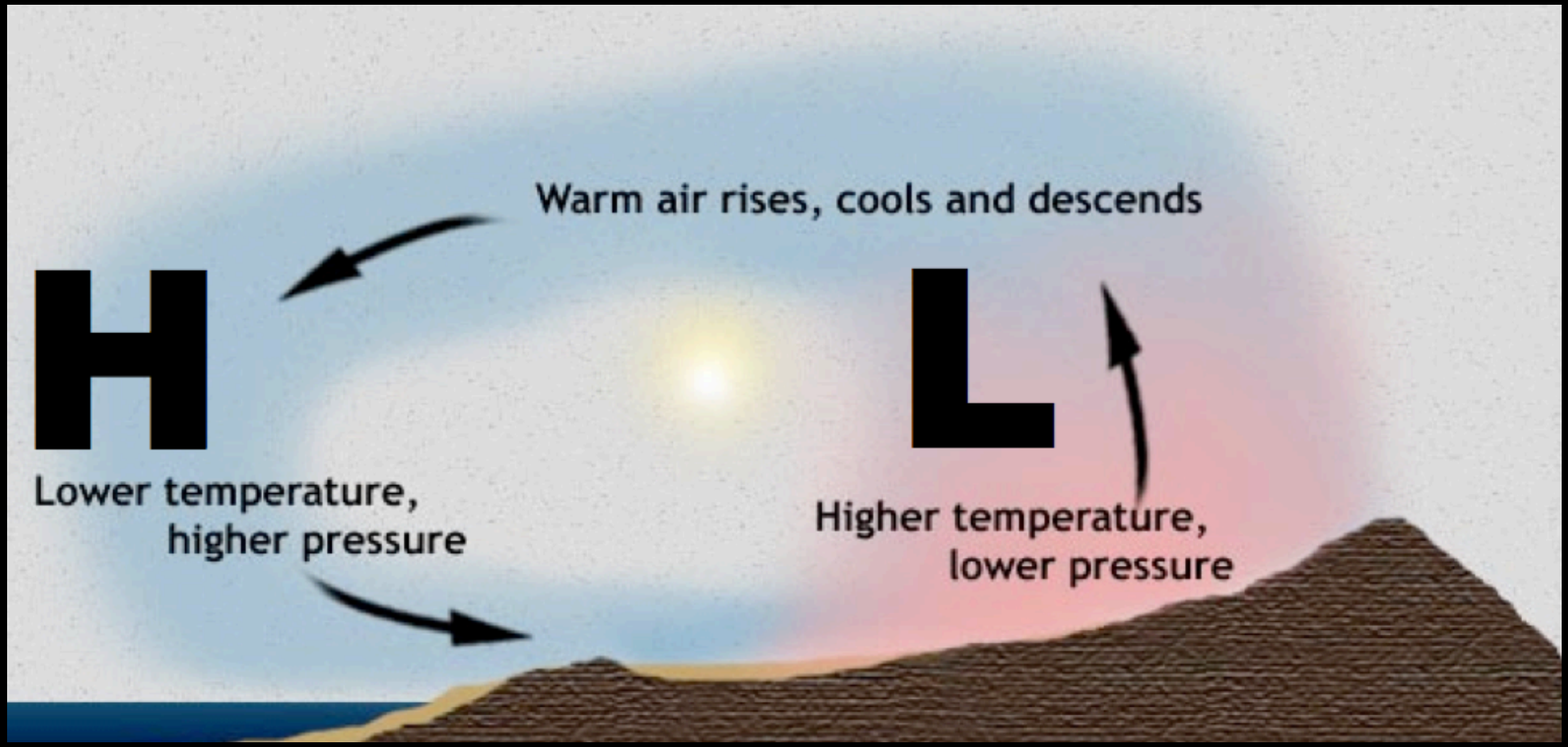
  - WIND BLOWS FROM AREAS OF HIGH PRESSURE TO AREAS OF LOW PRESSURE

Weather Patterns

- **SEA BREEZE** - DURING THE DAY LAND HEATS UP FASTER THAN THE WATER, THUS CREATING A LOW PRESSURE ZONE OVER THE LAND

  - WIND BLOWS FROM AREAS OF HIGH PRESSURE TO AREAS OF LOW PRESSURE

Weather Patterns



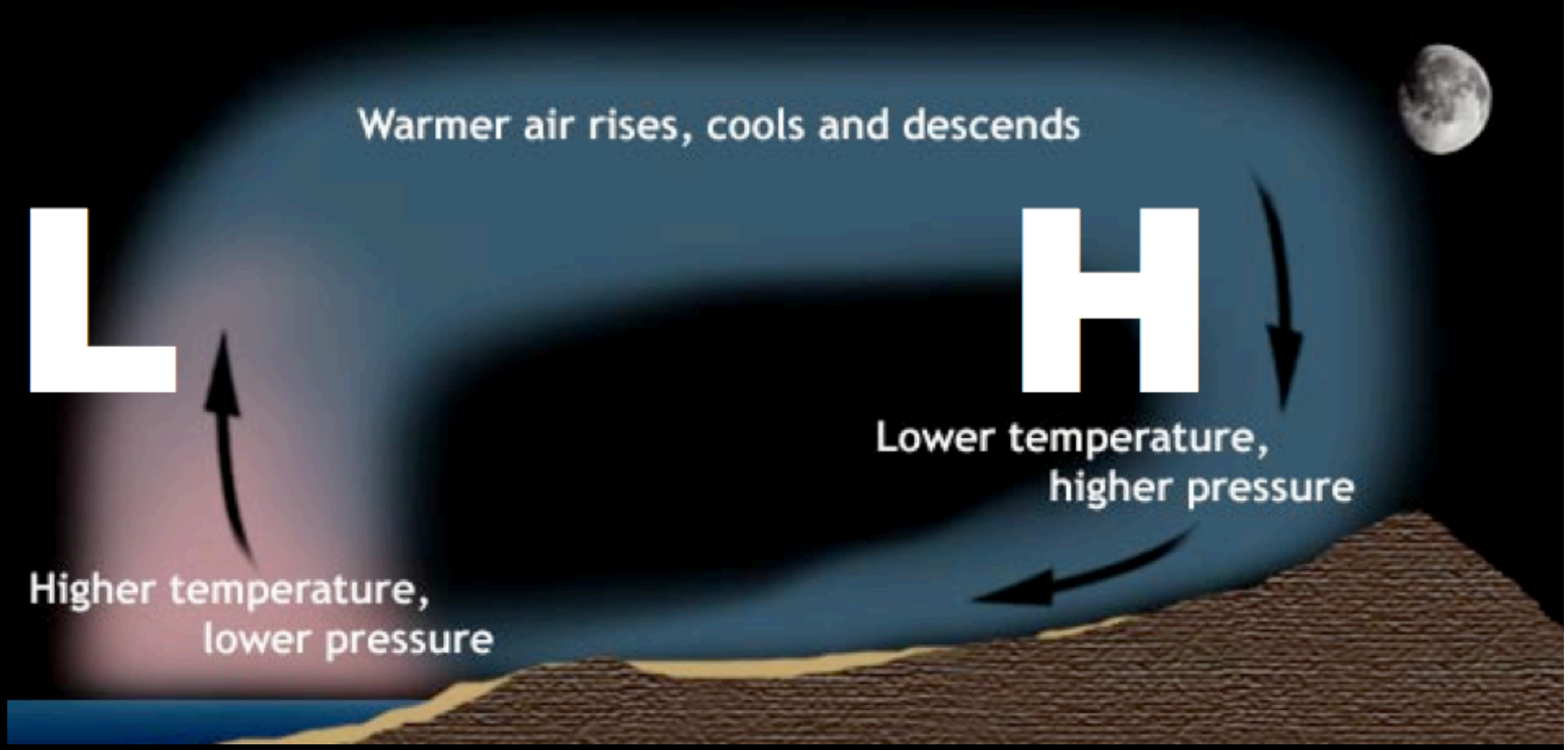
Sea Breeze

Weather Patterns

- **LAND BREEZE** - DURING THE NIGHT LAND COOLS FASTER WHILE WATER HOLDS IT'S HEAT, THUS CREATING A LOW PRESSURE ZONE OVER THE WATER

  - WIND BLOWS FROM AREAS OF HIGH PRESSURE TO AREAS OF LOW PRESSURE

Weather Patterns



Land Breeze

Weather Patterns

CLOUD FORMATION

- AIR IS WARMED FROM SUN HEATED SURFACES BECOMING LESS DENSE AND RISING

- AS IT RISES IT EXPANDS AND DECREASES IN TEMPERATURE AND PRESSURE

Weather Patterns

CLOUD FORMATION

- WATER VAPOR IN THE AIR THEN CONDENSES AS THE AIR IS COOLED TO THE DEW POINT

  - **CONDENSATION** - THE PROCESS WHICH GAS TURNS TO A LIQUID

- REMEMBER RECC
  - RISES - EXPANDS - COOLS - CONDENSES

Air Masses and Fronts

HOW ARE AIR MASSES AND FRONTS RELATED TO WEATHER?

Weather Patterns

- **AIR MASS** - CHARACTERISTICS OF THE AIR IDENTIFIED BY TEMPERATURE AND MOISTURE

- **SOURCE REGION** - LOCATION OVER WHICH AN AIR MASS GETS ITS CHARACTERISTICS

  - AIR MASSES ARE NAMED AFTER THEIR SOURCE REGION AND ARE DESIGNATED BY LETTERS

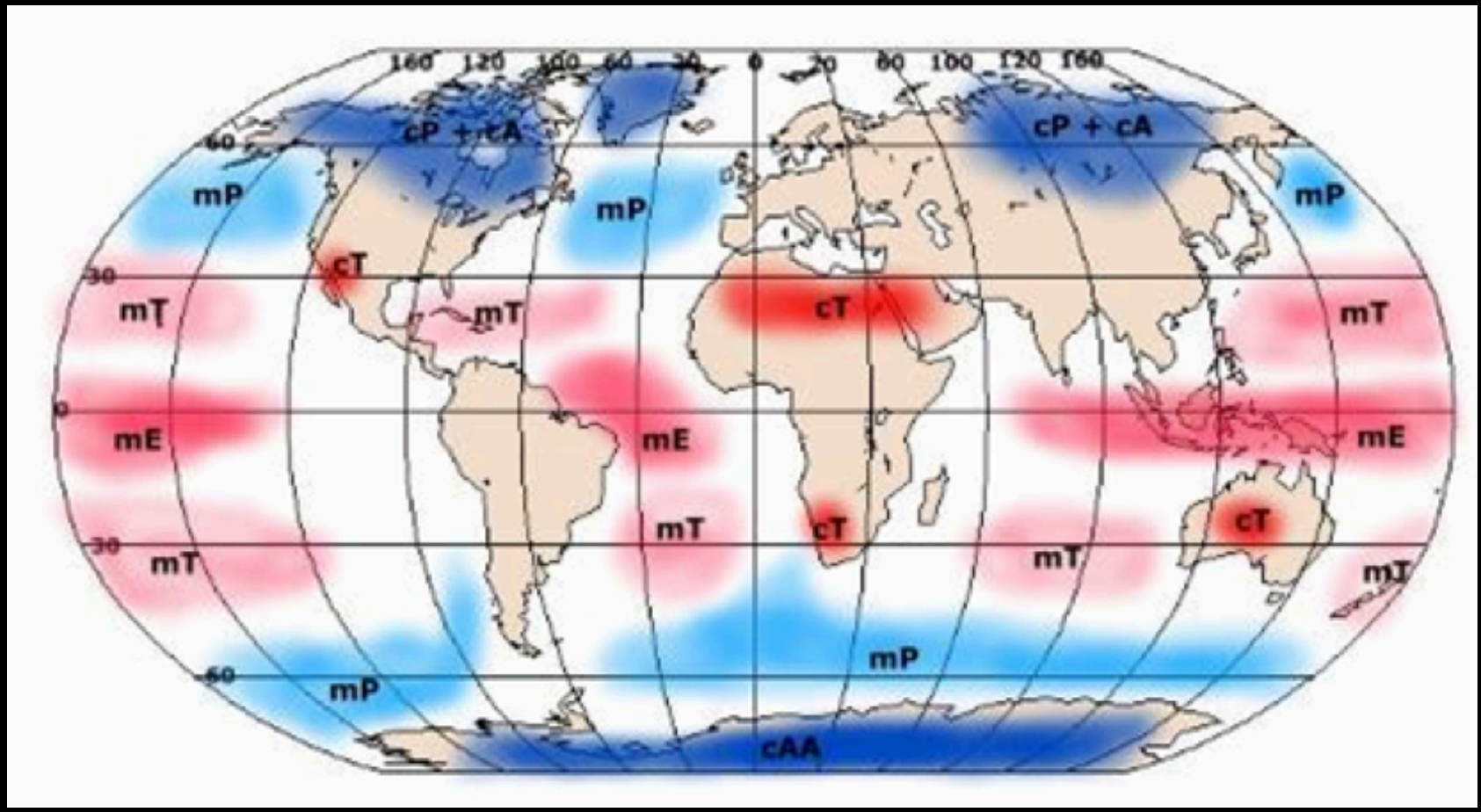
Weather Patterns

Air Masses

cA	continental arctic
cP	continental polar
cT	continental tropical
mT	maritime tropical
mP	maritime polar

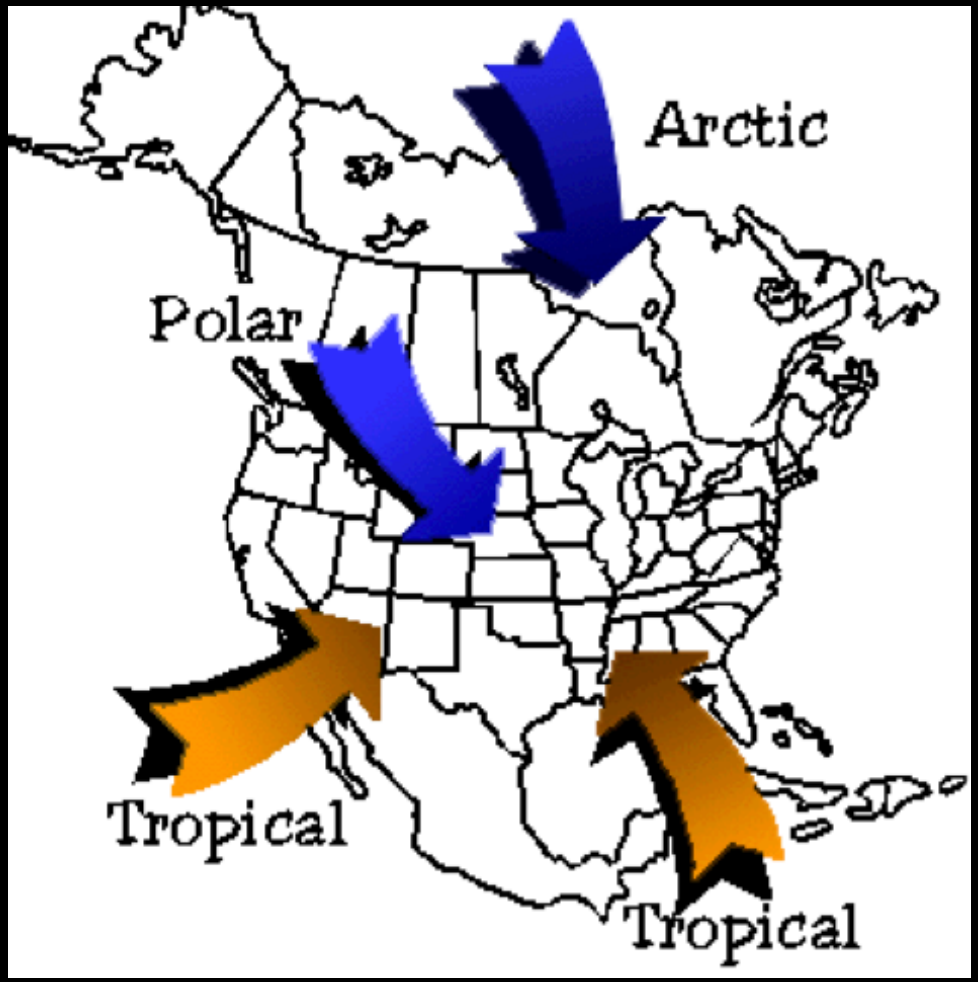
ESRT

Weather Patterns



Air Masses & Source Regions

Weather Patterns



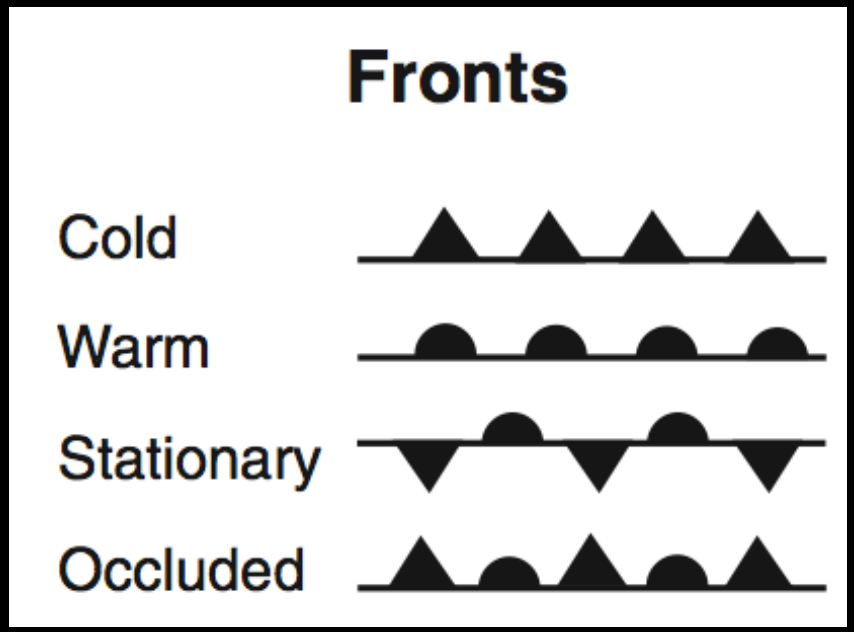
Air Masses & Source Regions

Weather Patterns

WHEN TWO UNLIKE AIR MASSES COLLIDE A WEATHER FRONT IS CREATED

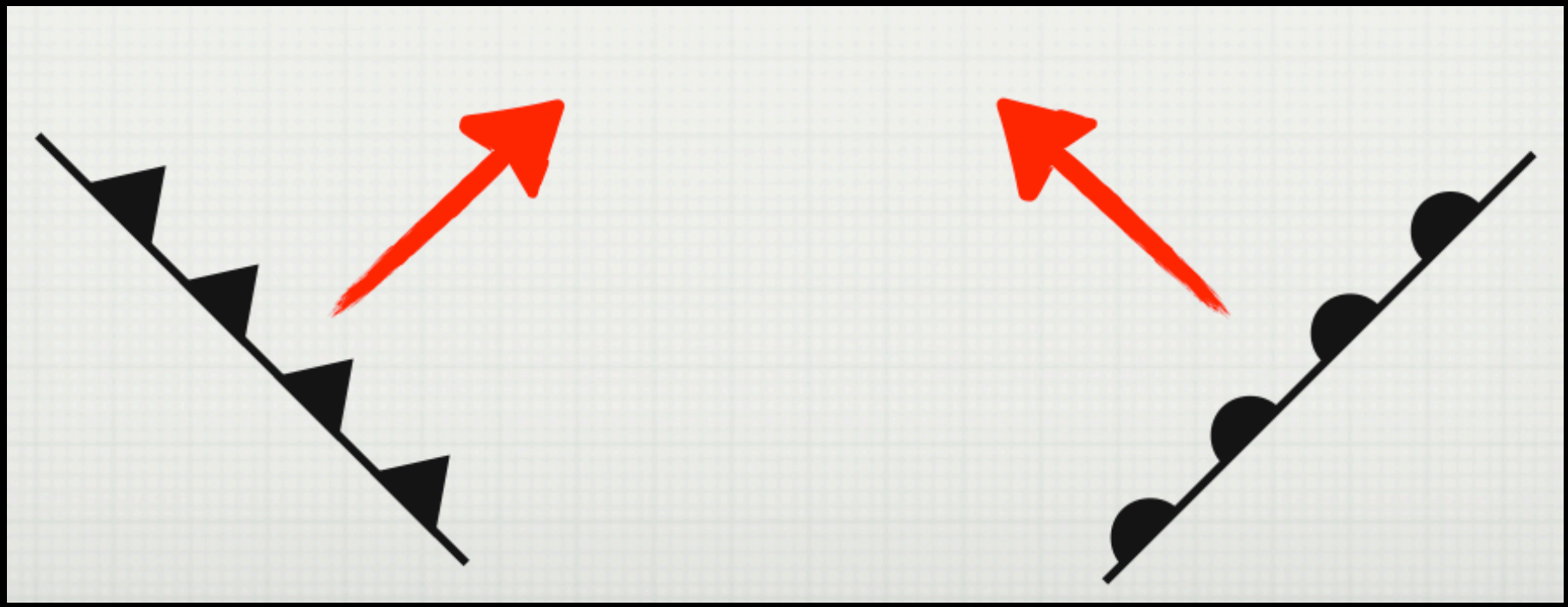
Weather Patterns

THE BOUNDARY BETWEEN THE TWO DIFFERENT AIR MASSES IS REPRESENTED ON A MAP WITH A SYMBOL



Weather Patterns

THE SIDE THAT THE SHAPES ARE ON SHOWS THE DIRECTION THE FRONT IS MOVING TOWARDS

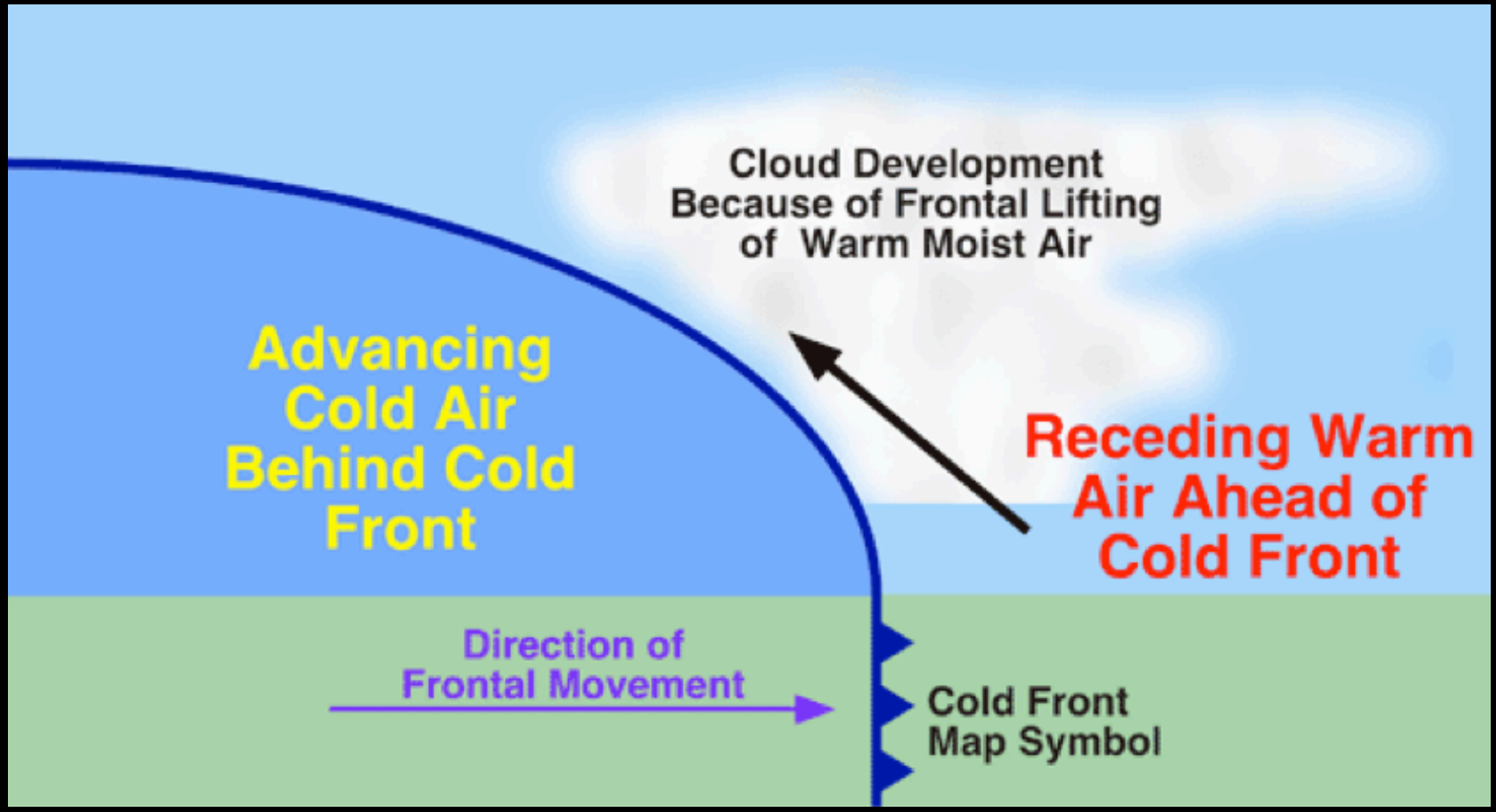


Weather Patterns

COLD FRONT - A BOUNDARY WHERE MORE DENSE COLD AIR ADVANCES UNDER LESS DENSE WARM AIR PUSHING IT UPWARD

- **WEATHER**: THUNDERSTORMS, HEAVY RAIN, AND A SHARP DECREASE IN TEMPERATURE

Weather Patterns



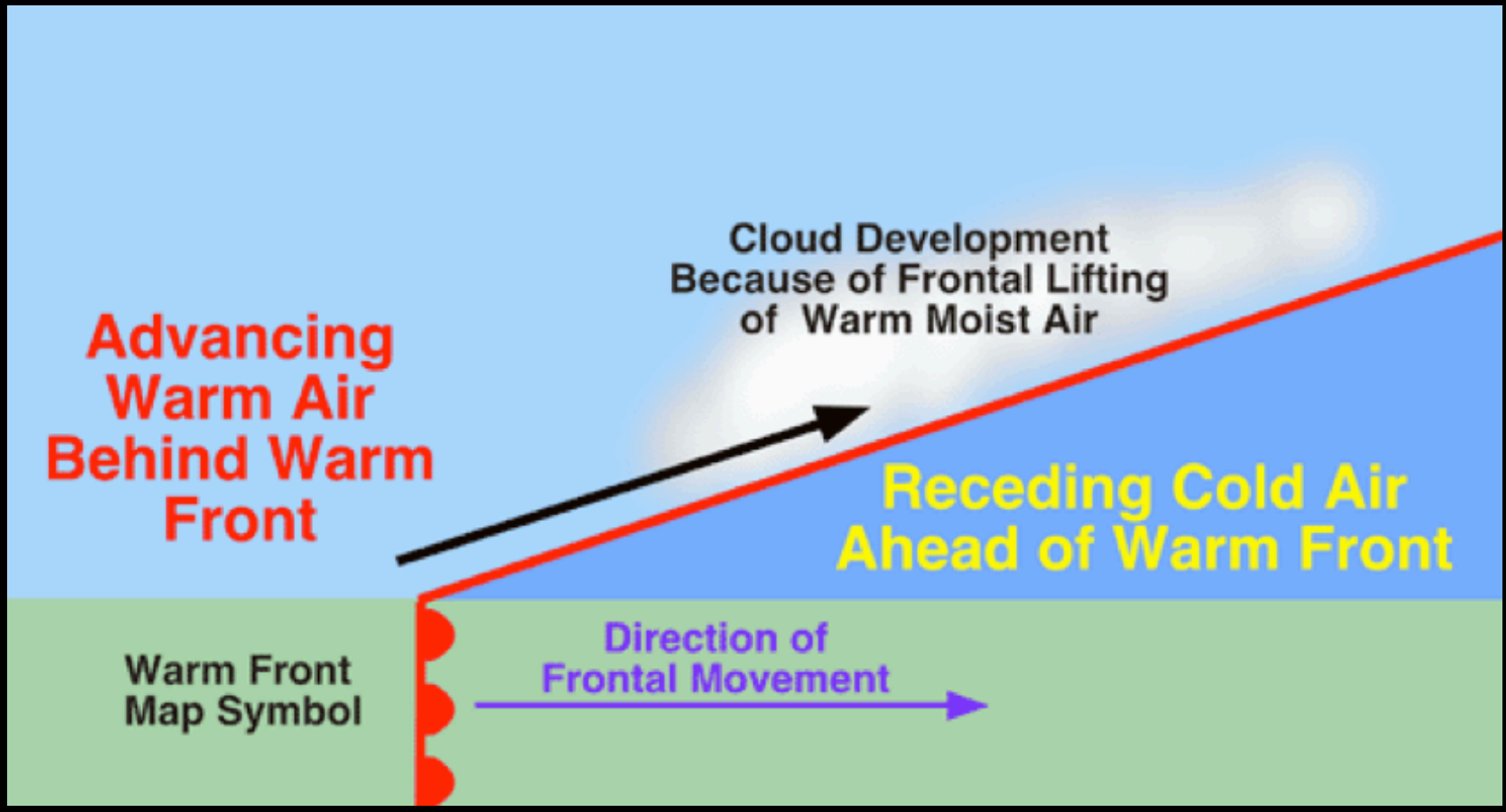
Cold Front

Weather Patterns

WARM FRONT - A BOUNDARY WHERE LESS DENSE WARM AIR ADVANCES OVER TOP OF MORE DENSE COLD AIR

- WEATHER: LOW CLOUDS AND WIDESPREAD RAINFALL

Weather Patterns



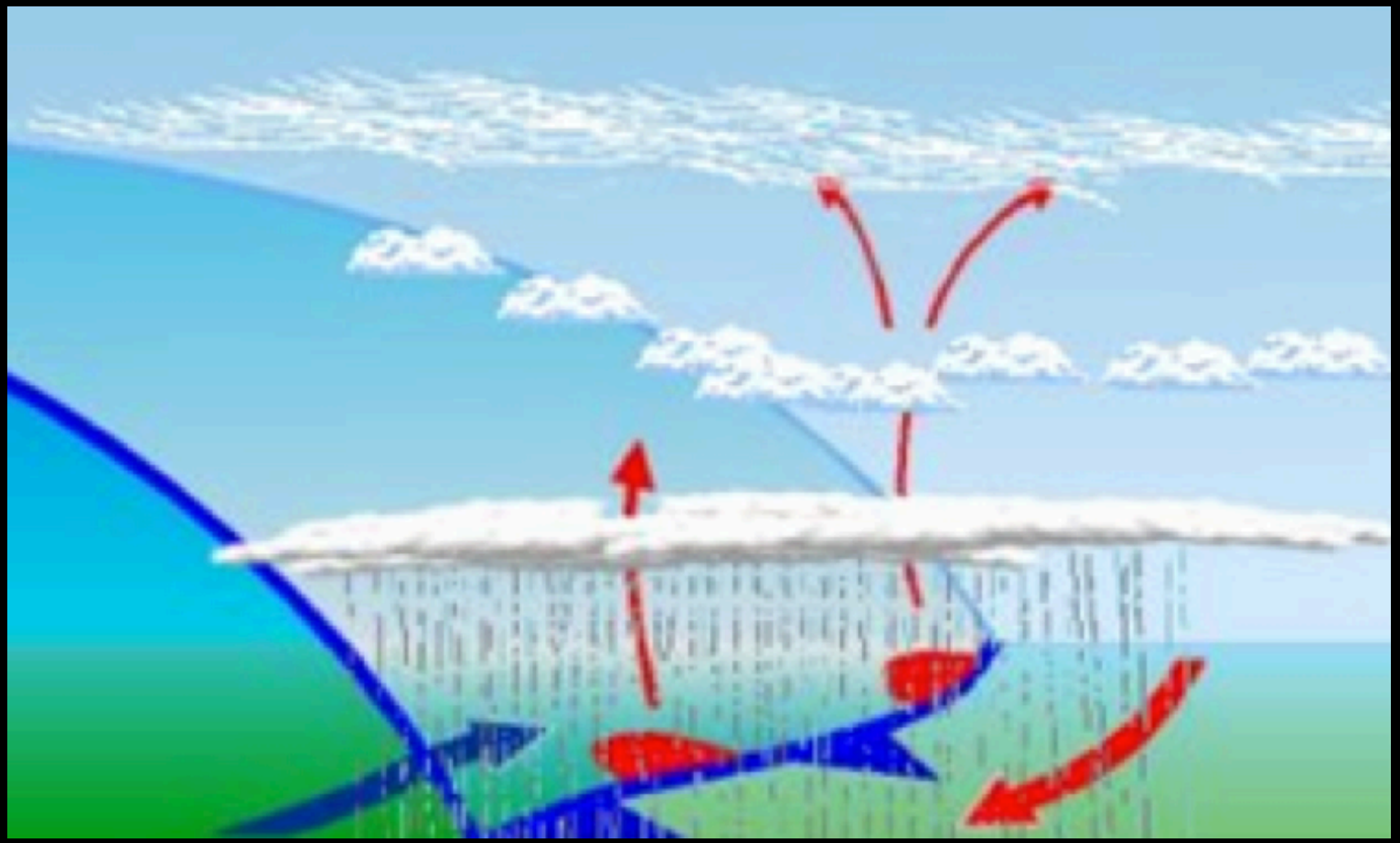
Warm Front

Weather Patterns

STATIONARY FRONT - FORMS ALONG A BOUNDARY WHERE NEITHER AIR MASS IS MOVING

- **WEATHER**: LONG WIDESPREAD RAIN

Weather Patterns



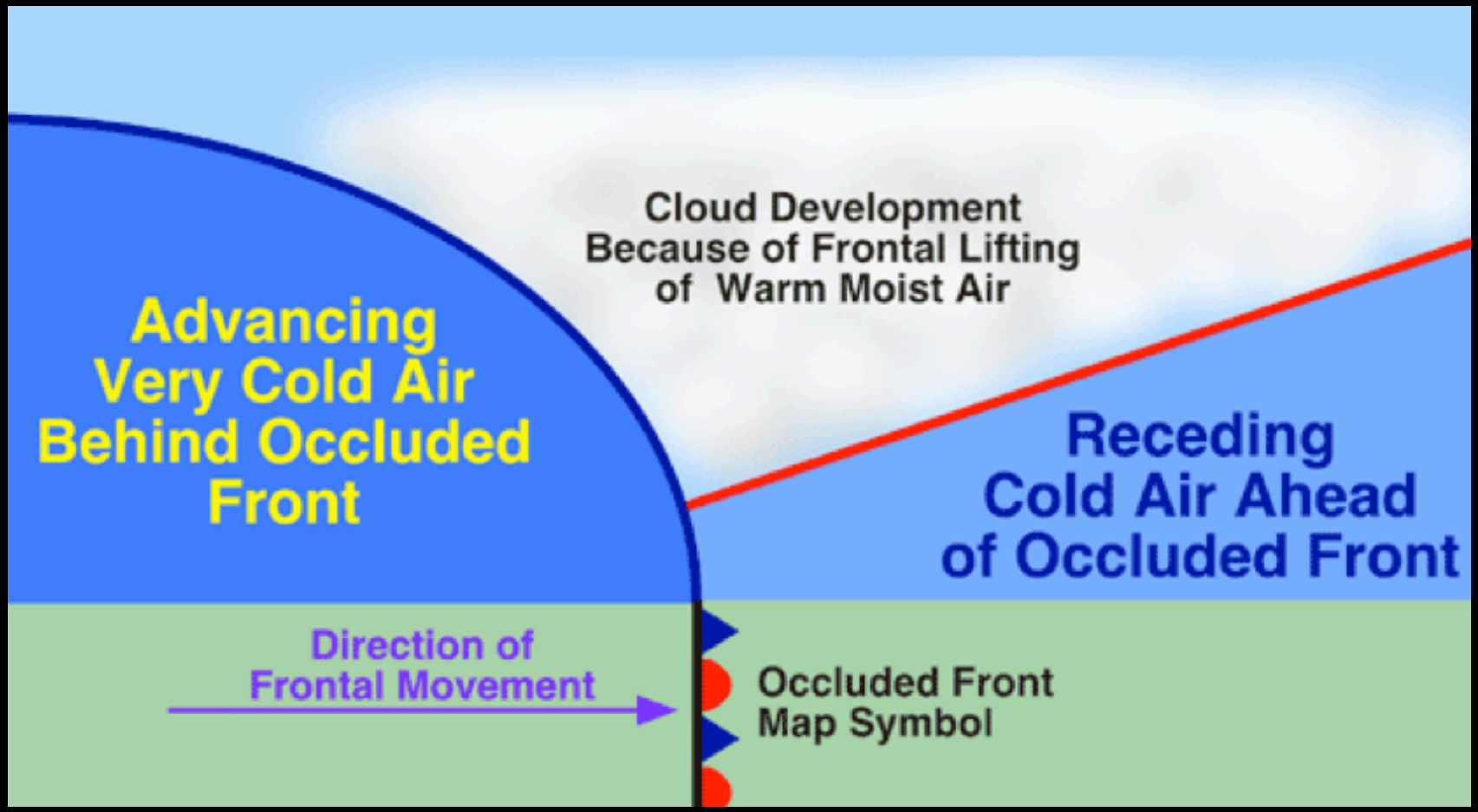
Stationary Front

Weather Patterns

OCCLUDED FRONT - A BOUNDARY WHERE A FAST MOVING COLD FRONT PUSHES A WARM AIR ENTIRELY ALOFT

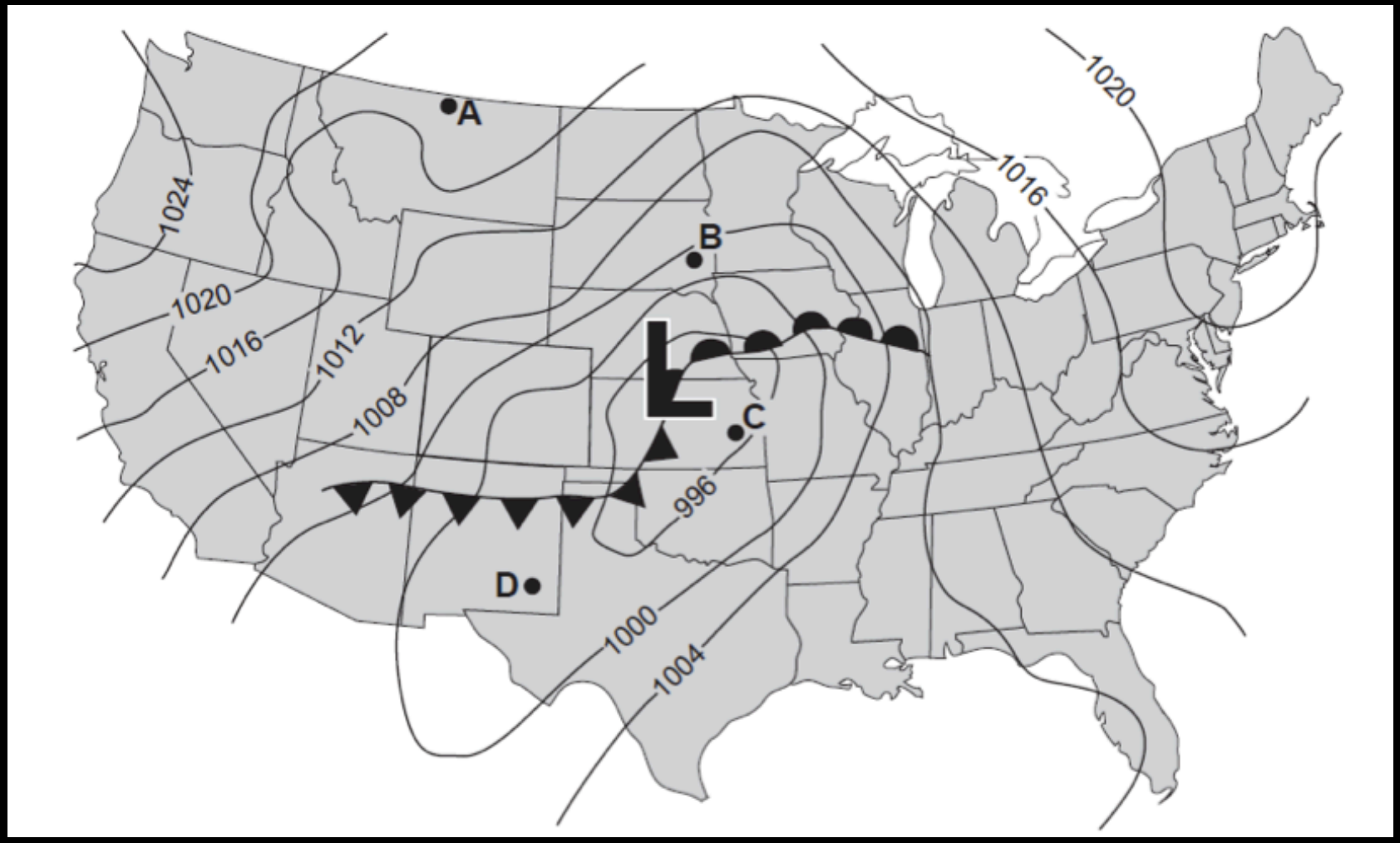
- **WEATHER**: LONG WIDESPREAD RAIN AND THUNDERSTORMS

Weather Patterns



Occluded Front

Weather Patterns



Synoptic Weather