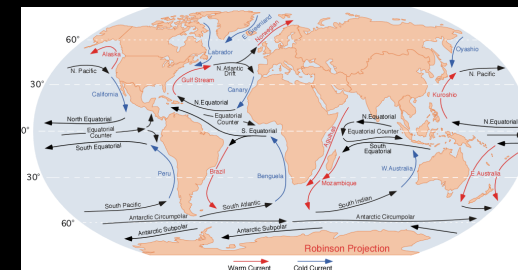
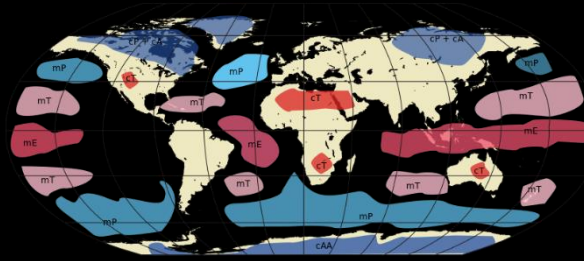
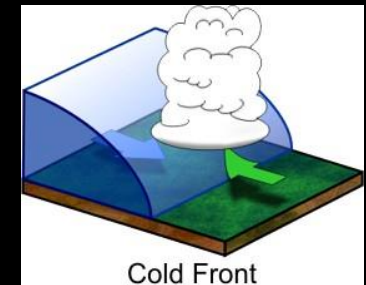
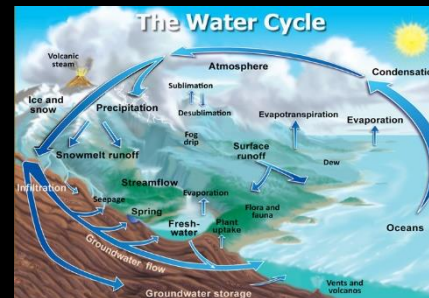
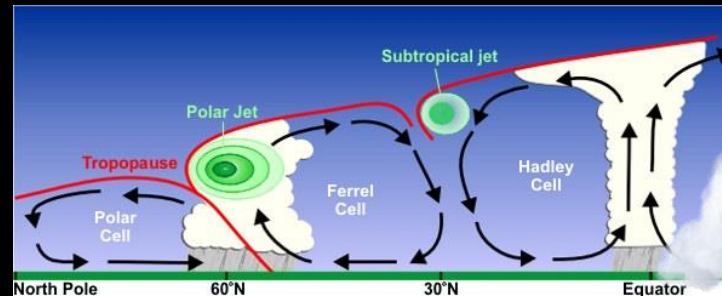
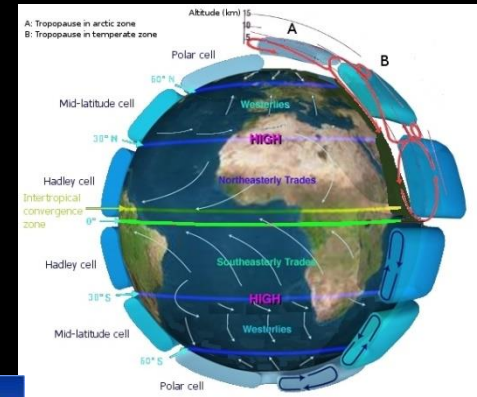


Meteorology

- Weather vs. Climate
- The Atmosphere
- Types of Weather
- What Causes Weather?
- Convection Cells
- Coriolis Effect
- Jet Streams
- Cloud Formation
- Precipitation
- Ten Fundamental Cloud Types
- Storms
- Air Masses
- Ocean Currents
- Gyres



TeachWithFergy

Preview File

Please enjoy this preview of your Student Version of the lesson. I've created this PDF for ease of viewing and to decrease the file size but of course, your lesson will be in PowerPoint format.

- Some slides appear blank because they have been removed.
- Student versions have portions of the text removed which is given in the teacher version and appear as _____
- Other slides may have on them, this represents writing that has been removed.

Weather vs. Climate

- Not the same thing
- Weather: _____
 -
- Climate: _____
 -
 - Averages and extremes



The Atmosphere

-



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The Atmosphere

- Layers



- _____

- Lowest: up to ~11 km above sea level

- _____

- _____

-

- _____

- Above troposphere: ~11 to ~48 km above sea level

-

The Atmosphere

- Layers

-

- _____

- ~48 km to ~80 km above Earth's surface

-

-

- _____

- ~80 km until meeting outer space

-

Types of Weather

- Normal

- _____



- E.g., wind, breeze, sunshine, clouds, rain, snow

- Severe

- _____

- E.g., extreme thunderstorms, tornadoes, hurricanes, flash floods, hailstorms



What Causes Weather?

- Atmospheric pressure

- Air movement

- _____

- _____

- Factors affecting air movement

- _____

- _____

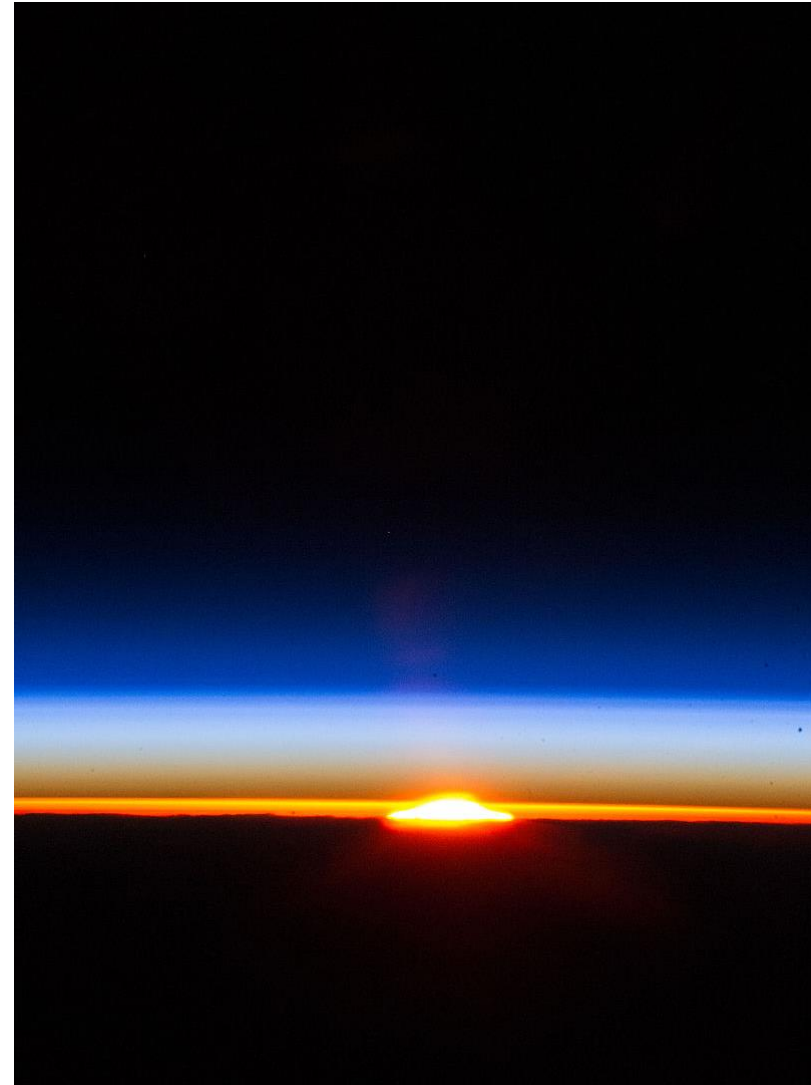
- _____

- _____



What Causes Weather?

- Atmospheric pressure/density
 - _____
 - Gradients
 - Sea level
 -
 - Density: $\sim 1.2 \text{ kg/m}^3$



What Causes Weather?

- _____
 - Due to temperature and pressure changes
 - Air composed of molecules
 -
 - _____
 - Cooler air above
 - _____

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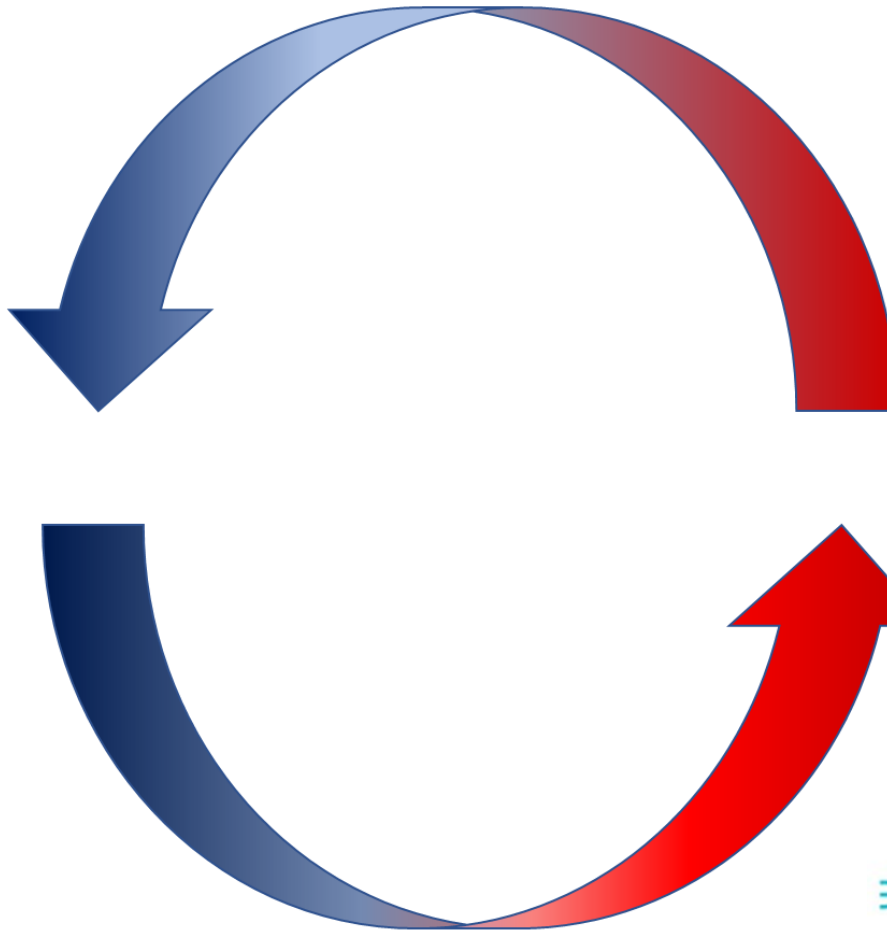
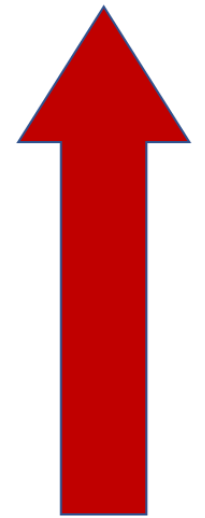
Low pressure
High temperature

High pressure
Low temperature

High pressure
Low temperature

Low pressure
High temperature

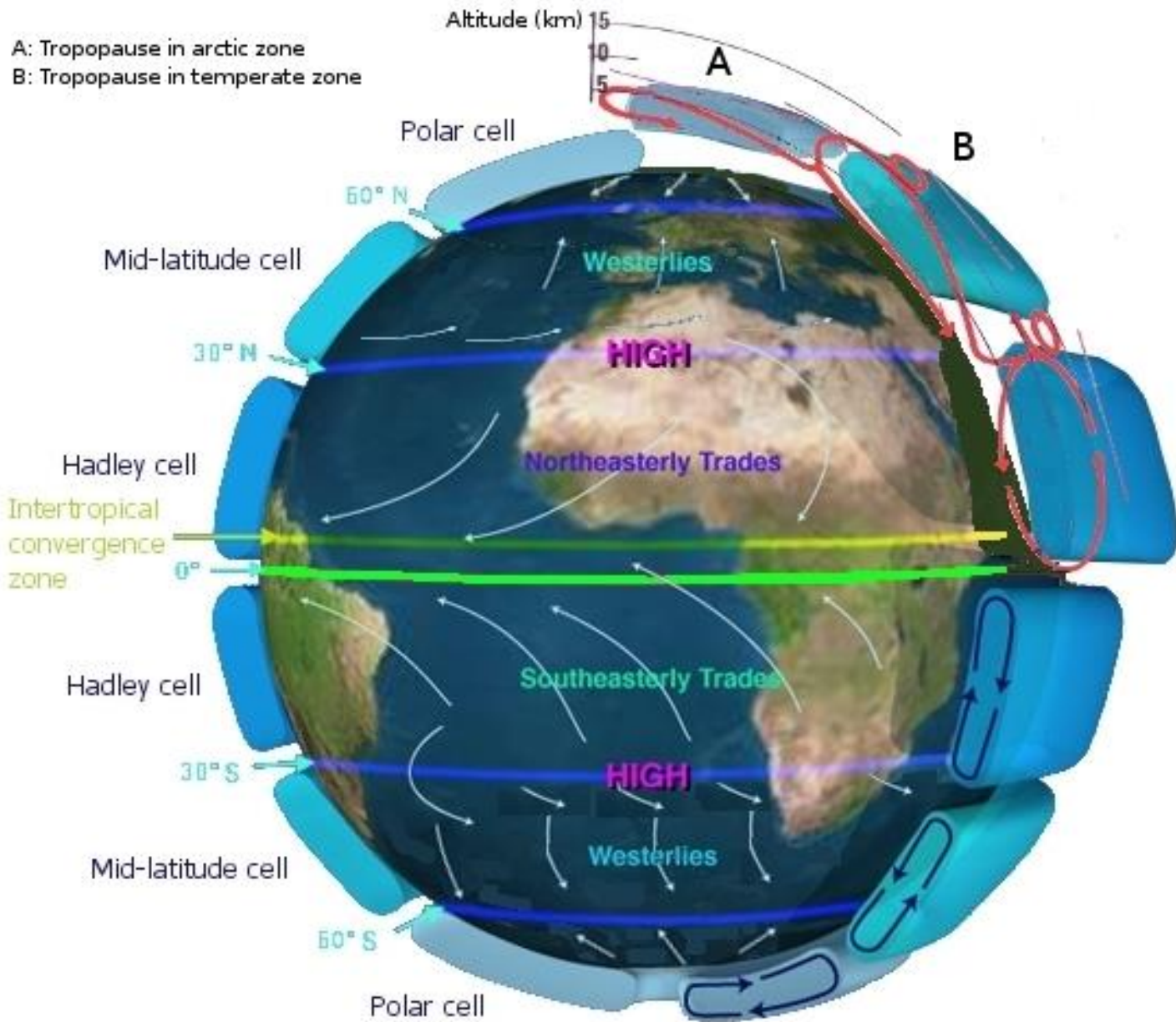
Wind



Convection Cells

- Larger scale air movement
- Convection cells: _____
- Three in each hemisphere
 - _____ : between poles and $\sim 60\text{-}70^\circ$ N and S
 - _____ : between $60\text{-}70^\circ$ N and S and $30\text{-}40^\circ$ N and S
 - _____ : between $30\text{-}40^\circ$ N and S and the equator

Convection Cells



Convection Cells

- Polar

- _____

-

- Ferrel

-

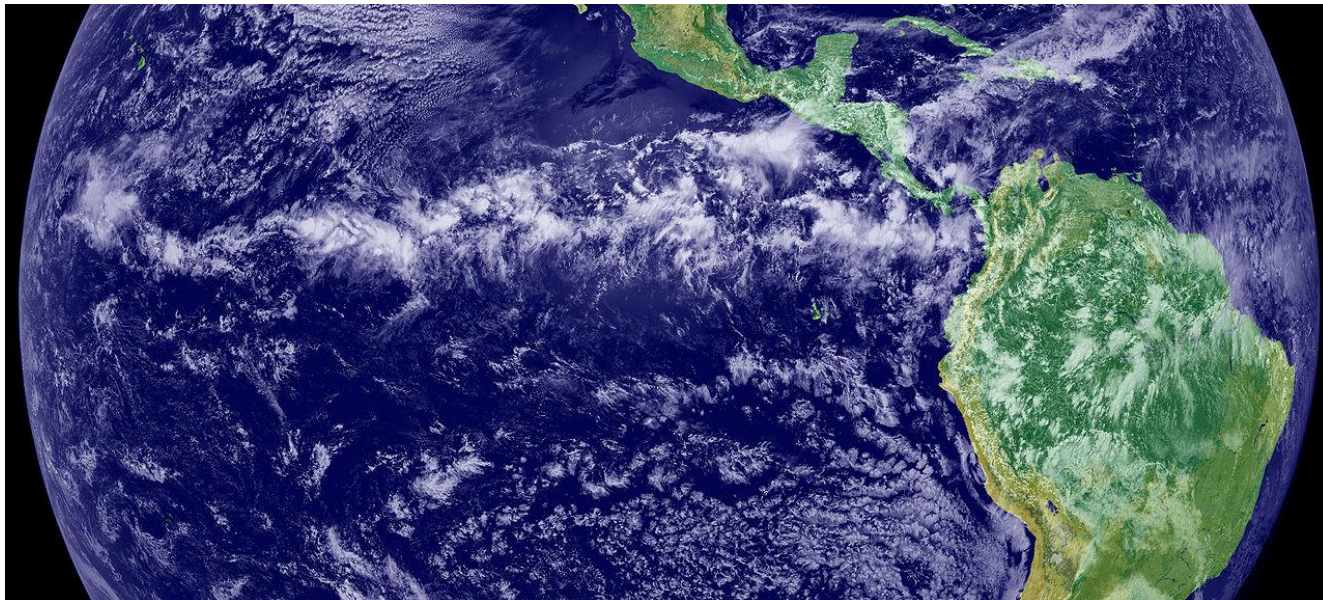
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Convection Cells

- Intertropical Convergence Zone (ITCZ): band where Hadley Cells meet

— _____

— _____



Convection Cells

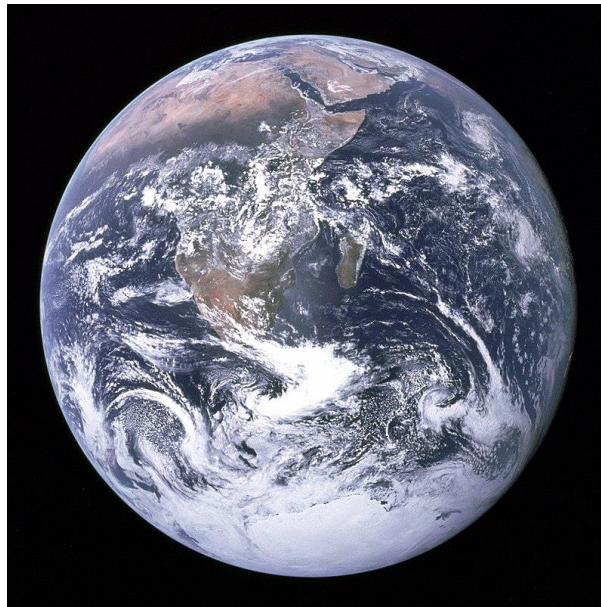
- Why 3 cells?
 - Cyclones and anticyclones: _____
 - Cyclones: _____
 - Anticyclones: _____
 - Coriolis effect
 - Friction: _____

Coriolis Effect

- _____
- Inertial force
- Not present at the equator
-

Coriolis Effect

- Two reasons for apparent deflection
 - _____
 - Tangential velocity of a point on Earth's surface depends on latitude
 - _____



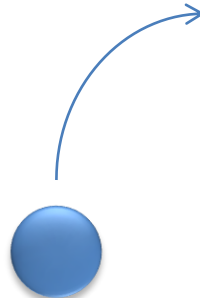
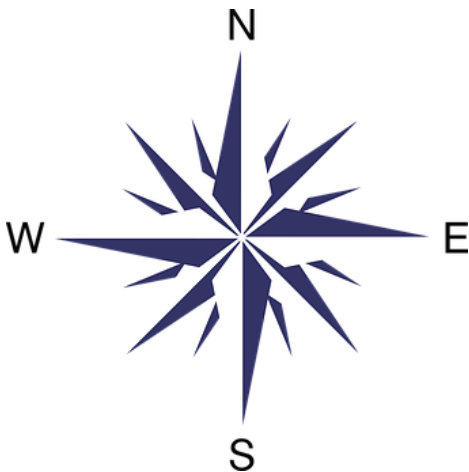
Coriolis Effect

- Example: ball thrown northward from equator

- _____

- Equator is rotating faster

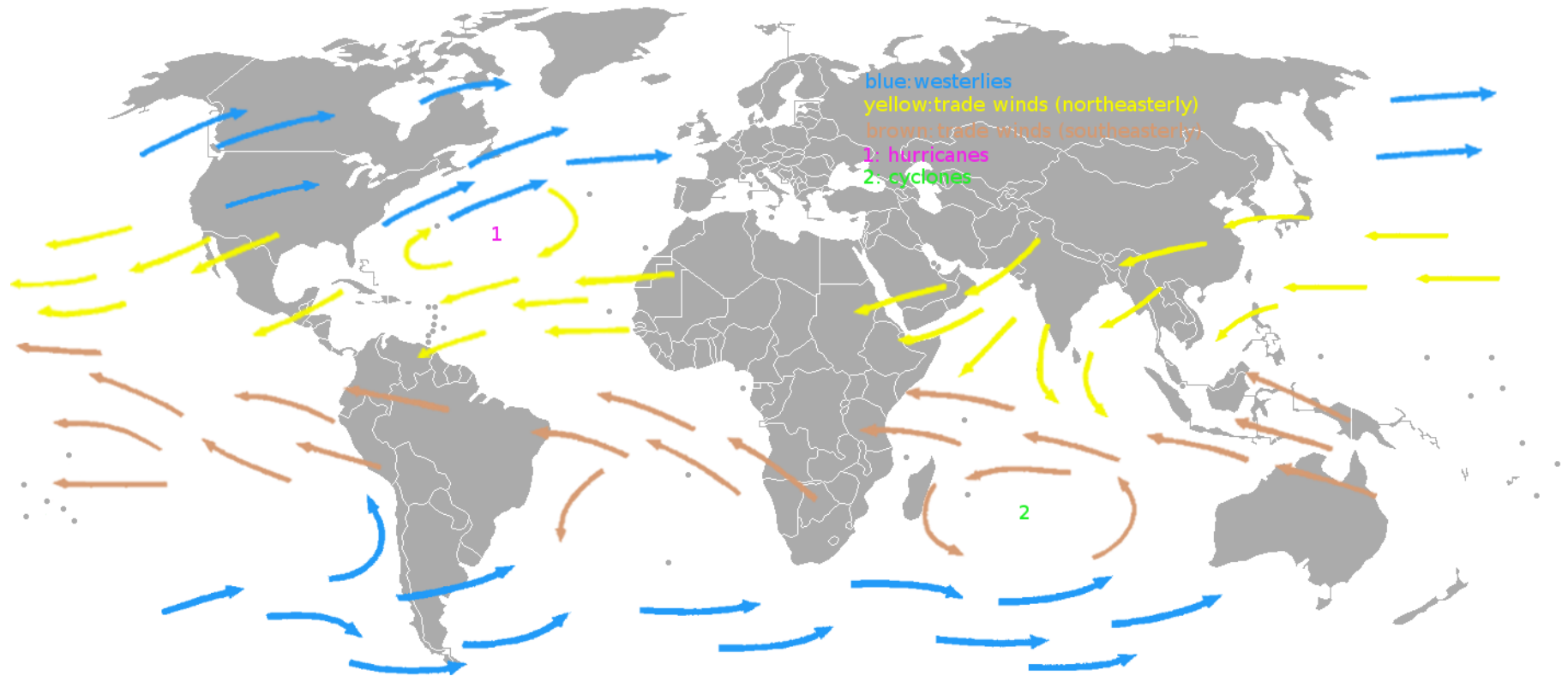
- _____



Coriolis Effect

- Causes trade winds
 - Between $\sim 30^\circ$ N and $\sim 30^\circ$ S
 - _____
 -
 -
 - ITCZ in between trade winds: band of hot, dry air
 - _____

Coriolis Effect



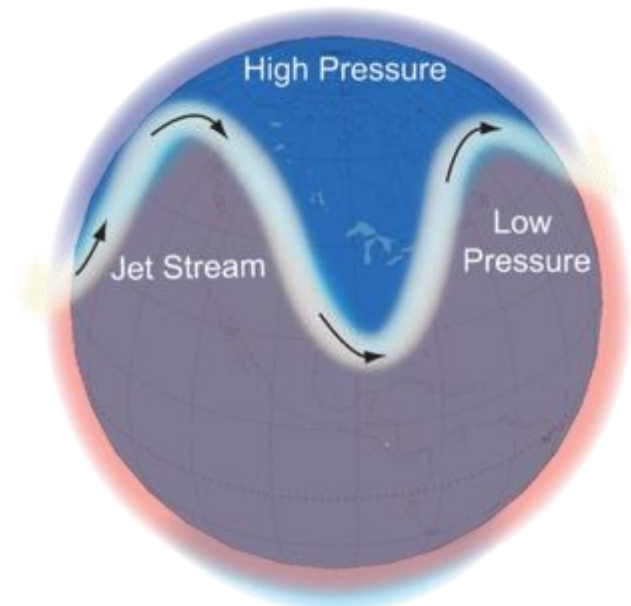
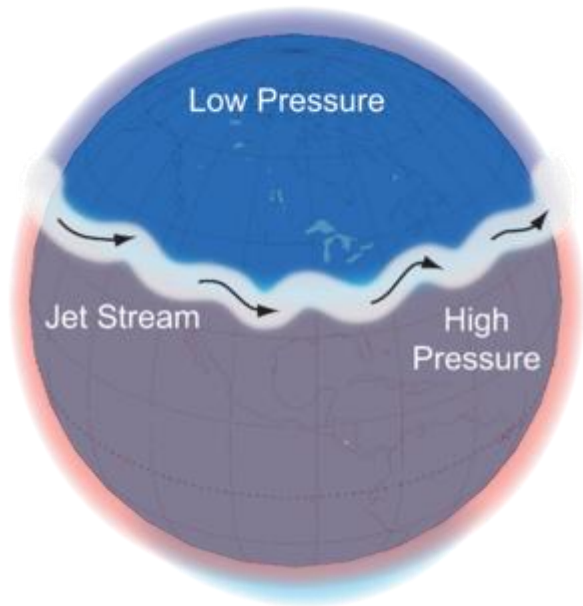
Coriolis Effect

- Magnitude: $2v\omega \sin \varphi$
 - v = velocity of object
 - ω = angular velocity of Earth
 - φ = latitude

Jet Streams

- Strong air currents high in troposphere
 - Typical speed: 129-255 km/hr (80-140 mi/hr)
 - Maximum speed: >443 km/hr (275 mi/hr)

•



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Jet Streams

- Flow is wave-shaped due to:

- _____

- _____

- _____

-
.....

- _____

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Jet Streams



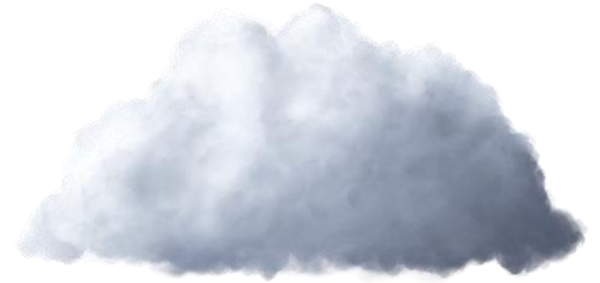
Jet Streams

- _____
 - Keep them moving
 -
- Polar jet stream shifts change surface temperature
- _____
- _____

End of Day 1

Cloud Formation

- Three basic cloud types
 - _____ – “heap” in Latin
 - _____ – “layer” in Latin
 - _____ – “curl of hair” in Latin



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Cloud Formation

- Stratus

- _____

- Low altitude: _____

- _____

- _____

-

- Water vapor condenses into droplets, which form a cloud



Cloud Formation



- Cirrus

- _____

- Horizontal and vertical fall streaks from snow and ice falling out of clouds and evaporating

- _____

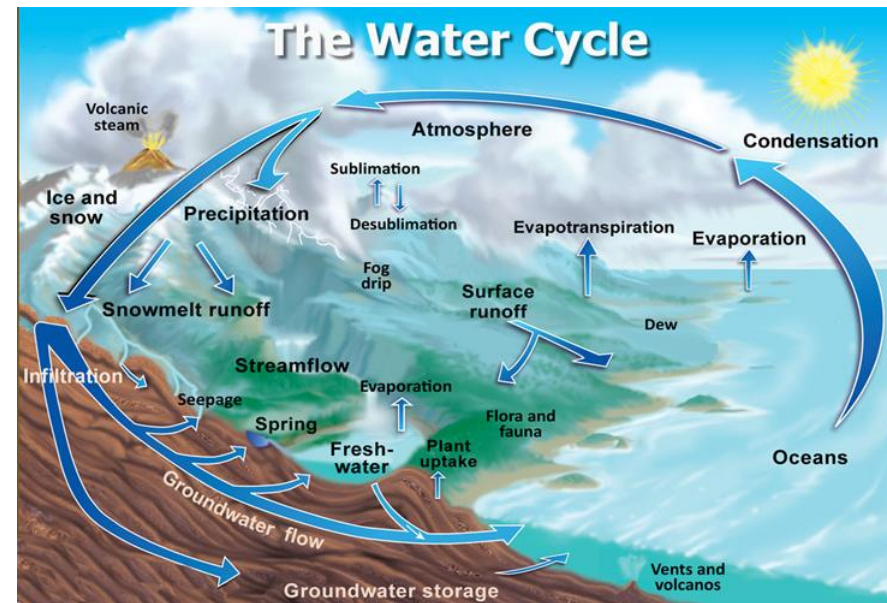
- High altitude: _____

- Glaciation: _____

-

Precipitation

- Water (hydrologic) cycle
 - As ocean water heats up, it evaporates, rises into the air, and condenses as clouds
 -



Precipitation

- Rain: _____
- Snow: _____
- Freezing rain: _____
- Hail: _____
 - Hail built up by additional droplets carried upward
 - Hailstones typically between $\frac{1}{4}$ inch to over 4 inches in diameter

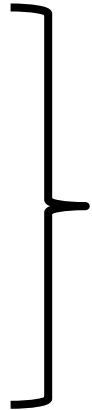
Ten Fundamental Cloud Types

-

-

-

-

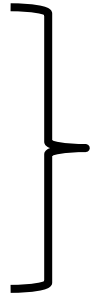


Low Atmosphere:
<6,500 ft (2,000 m)

-

-

-

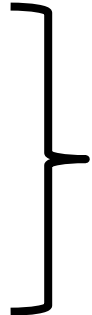


Middle Atmosphere:
6,500 to 23,000 ft (2,000 to 7,000 m)

-

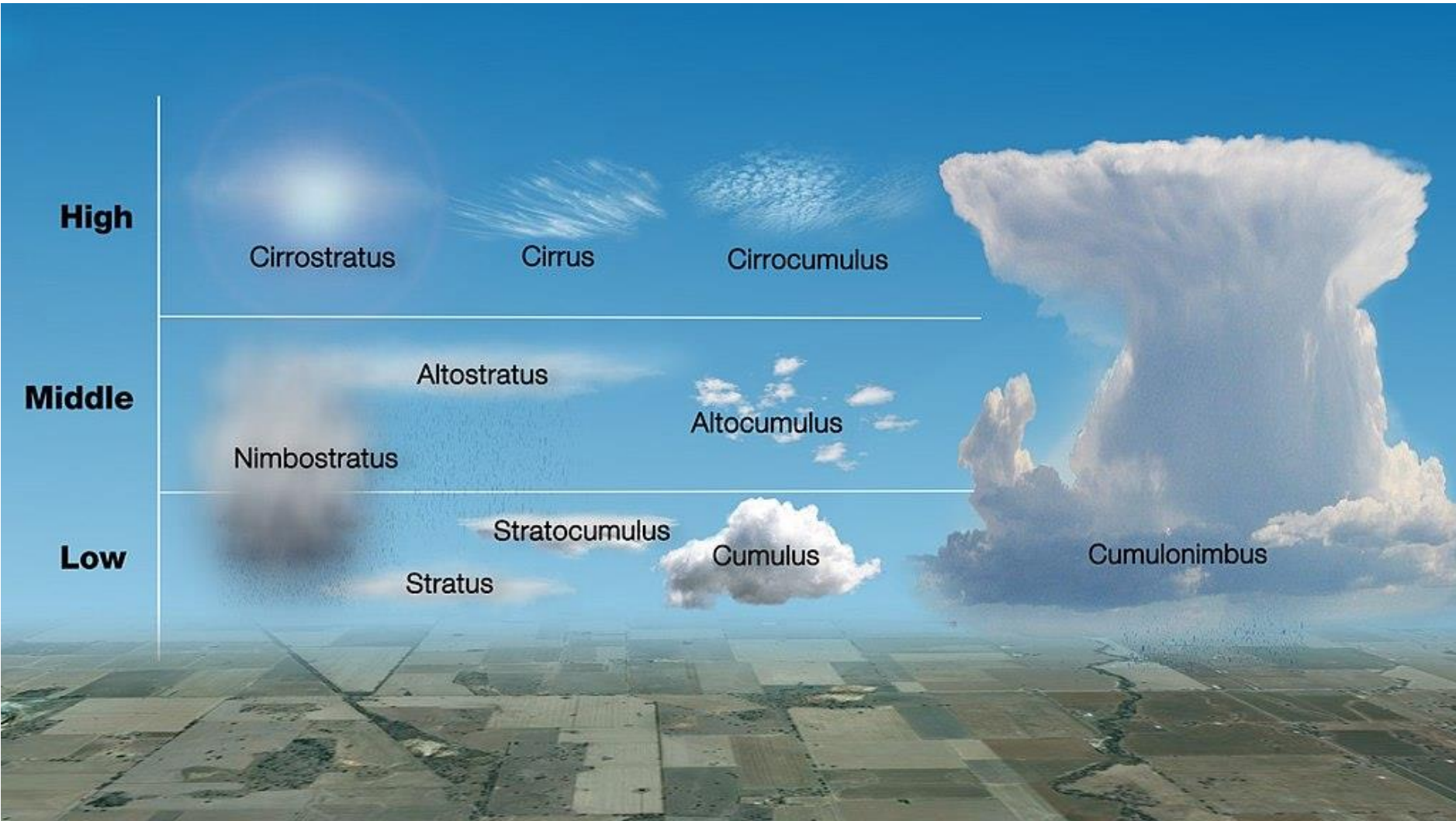
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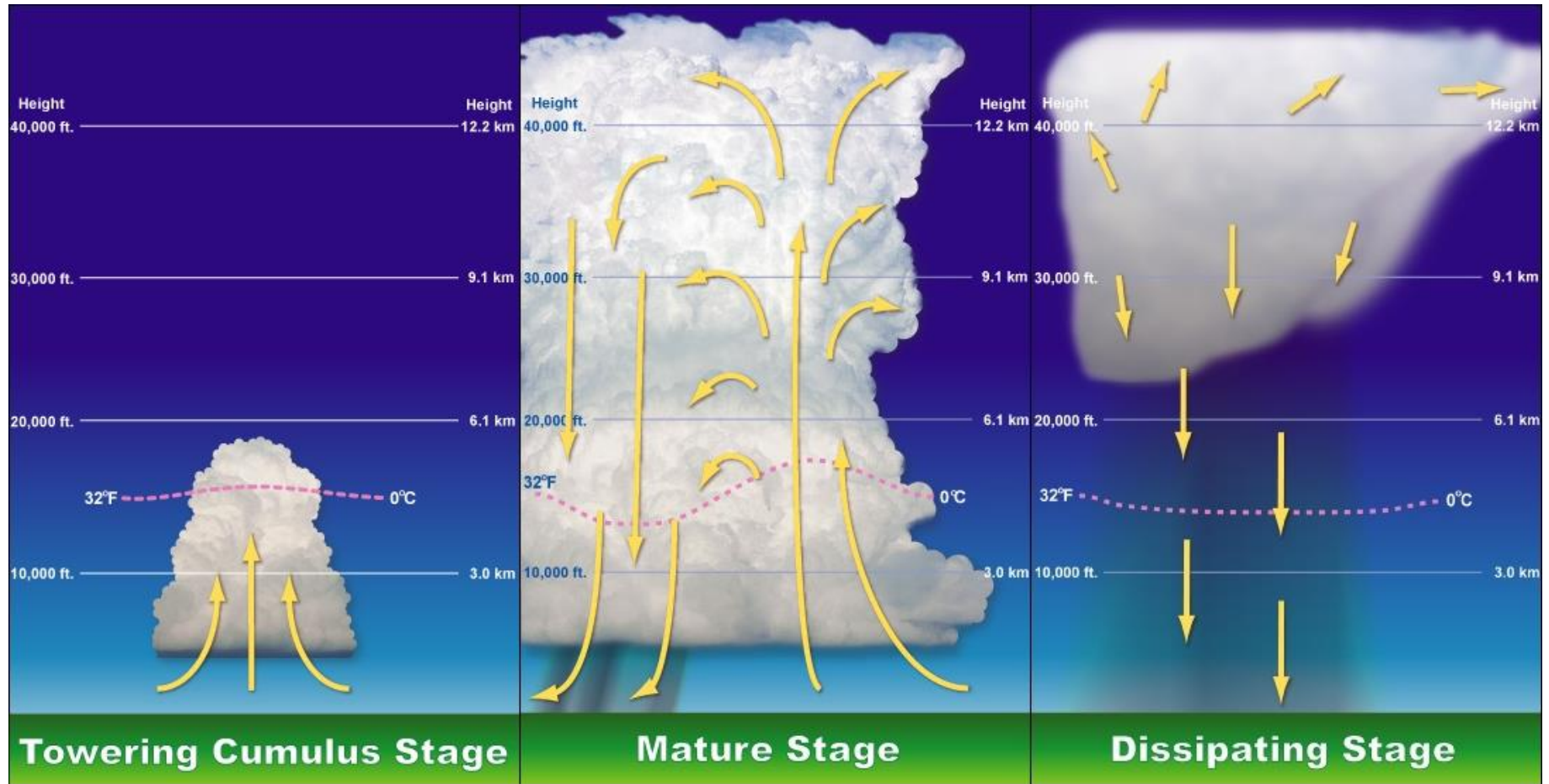
High Atmosphere:
16,500 to 45,000 ft (5,000 to 14,000 m)

Ten Fundamental Cloud Types



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Storms



Storms

- As precipitation falls through the cloud, it brings air along with it

— _____



Storms

- Lightning

- _____
- _____
-
- _____
- _____

– Cloud needs to neutralize → electrons flow quickly from bottom to top → lightning

Storms



Storms

- Lightning
 - Like an electric shock from a doorknob
 - Cloud-to-ground lightning
 - _____
 -

Storms

- Thunder

- _____

-

- _____ → vibration

- Vibration makes the loud thunderclap sound

- Vibrations continue, become smaller and smaller → _____

Storms

-

-
- Destructive, spinning vortexes of air
 - Very low-pressure centers



-

-
-
 - Form in tropical seas
 - Pull surface winds into themselves
 - Winds rise in a tube shape, with warm air falling in the center



Storms

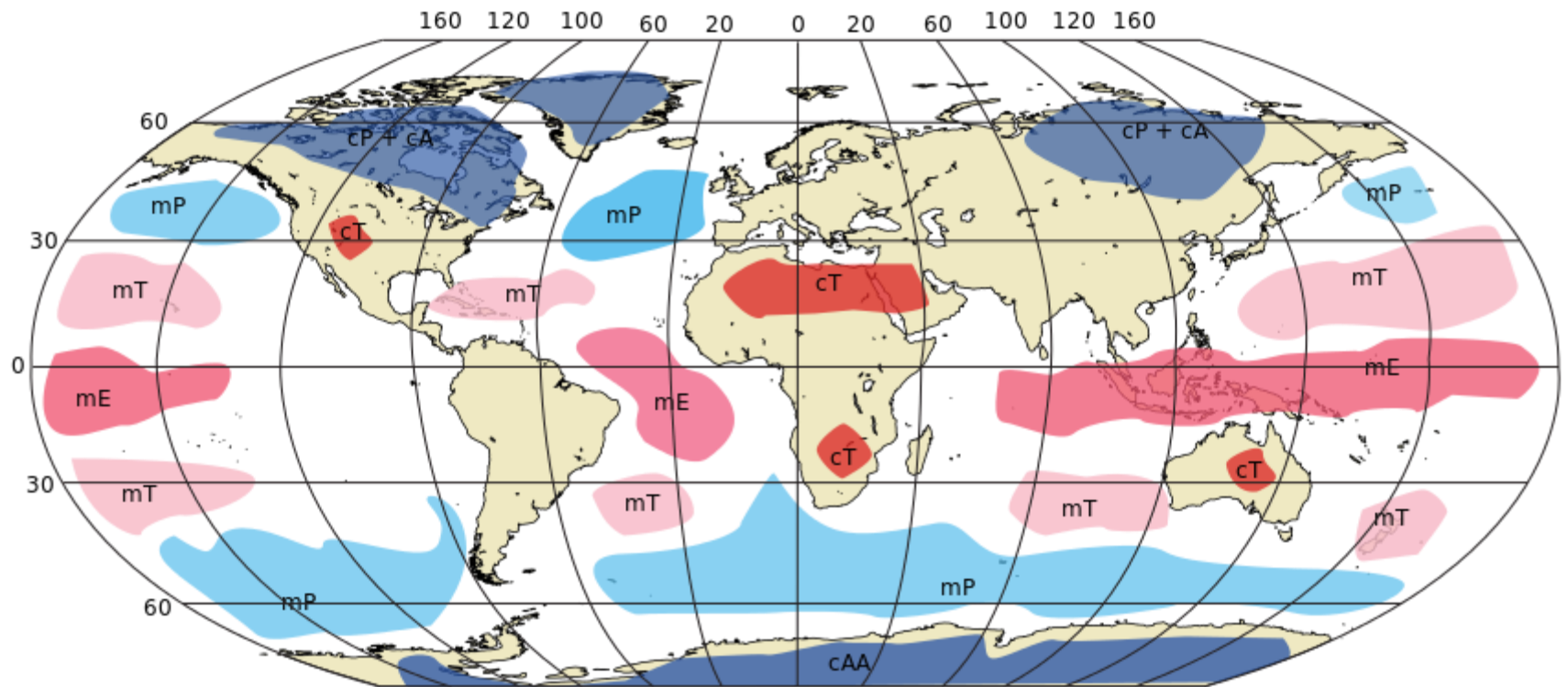
- _____
- Intense snowstorms with strong winds
- _____
- Freezing rain falls through a layer of subfreezing air → ice
- Ice accumulation can be treacherous
- _____



Air Masses

- Defined by uniform weather conditions
 - E.g., _____
- Can be large
 - Up to millions of square kilometers wide and reaching high altitude
- _____
- Usually named by location of origin
 - _____

Air Masses



Air Masses

- Responsible for weather phenomena

— _____

— _____

— _____

— _____

Air Masses

- Orographic lifting

- _____

-

- _____

- Windward side of the mountain: _____

- Leeward side: _____

Air Masses

- Orographic lifting



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Air Masses

- Localized convective lifting
 - _____
 - Small pockets of air warm up faster than surrounding air (localized)
 - _____

Air Masses

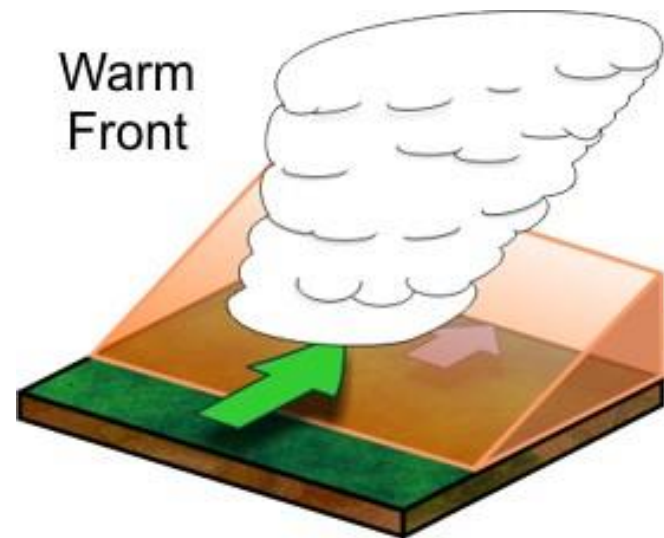
- Fronts
 - _____
 - Cold front: _____
 -



Cold Front

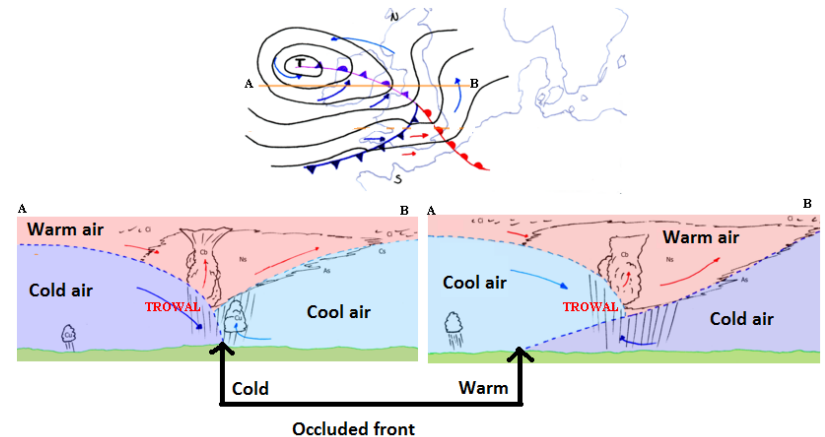
Air Masses

- Fronts
 - Warm front: _____
 -
 - At bottom of wedge, rain clouds form
 - At top, where edge of warm air is advancing, thin clouds form



Air Masses

- Fronts
 - Occluded front: _____
 -
 - Warm air hidden (occluded) above the cold air
 - Usually result in heavy rains



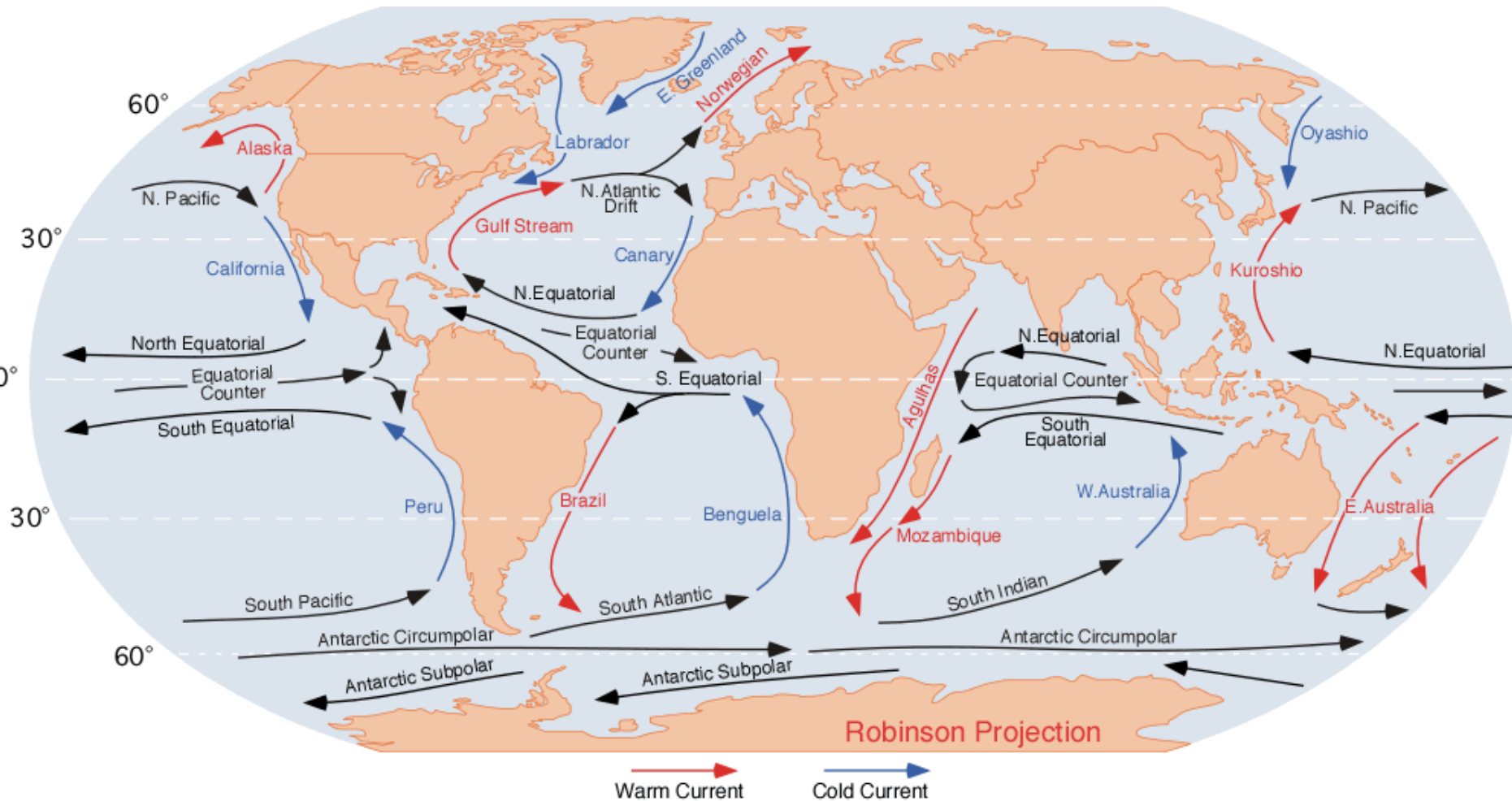
Air Masses

- Fronts
 - Stationary front: _____
 -
 - Accompanied by rain
 - If one mass begins to move, becomes a warm or cold front

Ocean Currents

- Continuous movement of ocean water due to:
 - _____
 - _____
 - _____
 - _____
 - _____
- Drive weather patterns

Ocean Currents

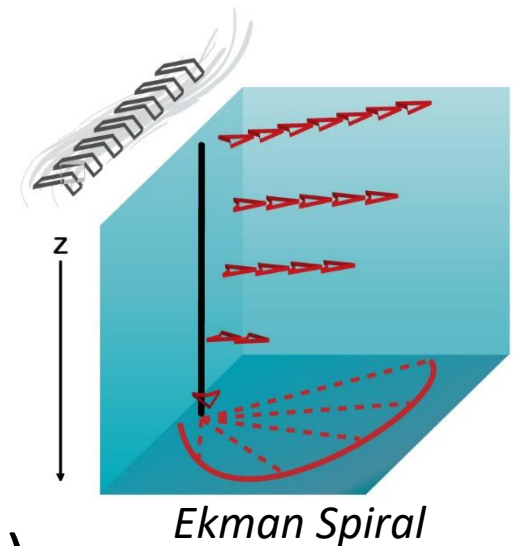


Ocean Currents

-
- Thermohaline circulation: conveyor belt
 - _____
 - _____
- Currents moderate extremes of temperature and precipitation

Gyres

- _____
- Formation
 - _____
 - Wind pulls ocean water, moving it in the direction of windflow
 - _____
 - Deflects wind-driven currents
 - _____ : Coriolis deflects surface waters by $\sim 45^\circ$; each layer down in the water column is deflected by a smaller angle $\rightarrow$ descending spiral to ~ 100 m (330 ft)



Gyres

-

- Formation

-

- Limit gyre size
 - South Pacific Gyre: mainly open ocean, only bordered by Australia and South America
 - Indian Ocean Gyre: much smaller, bordered by Horn of Africa, Sri Lanka, India, and Indonesia

Gyres

- Three major types

-

- _____

- Form close to equator
 -
 - More east-west than circular

-

- _____

- Majority of world's gyres
 -
 - Form under high pressure areas
 - Calm, relatively stable
 - Currents circle around ocean water

Gyres

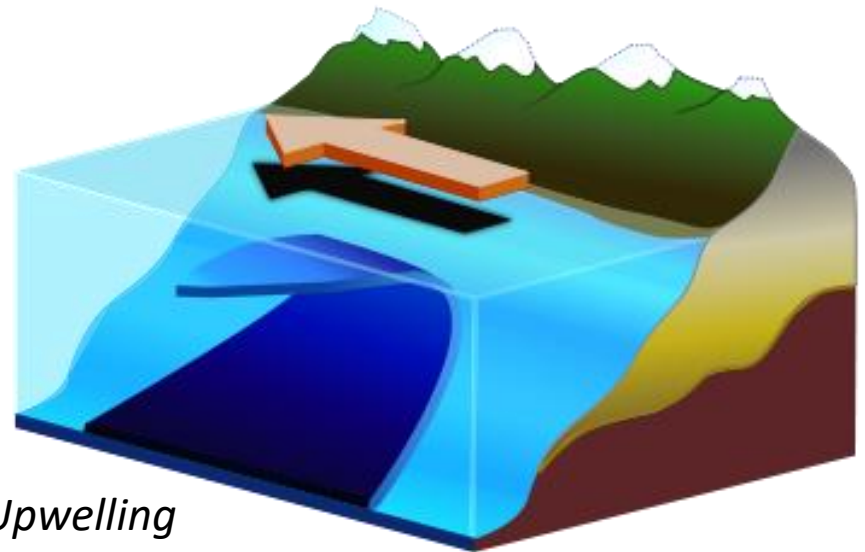
- Three major types

- _____

-

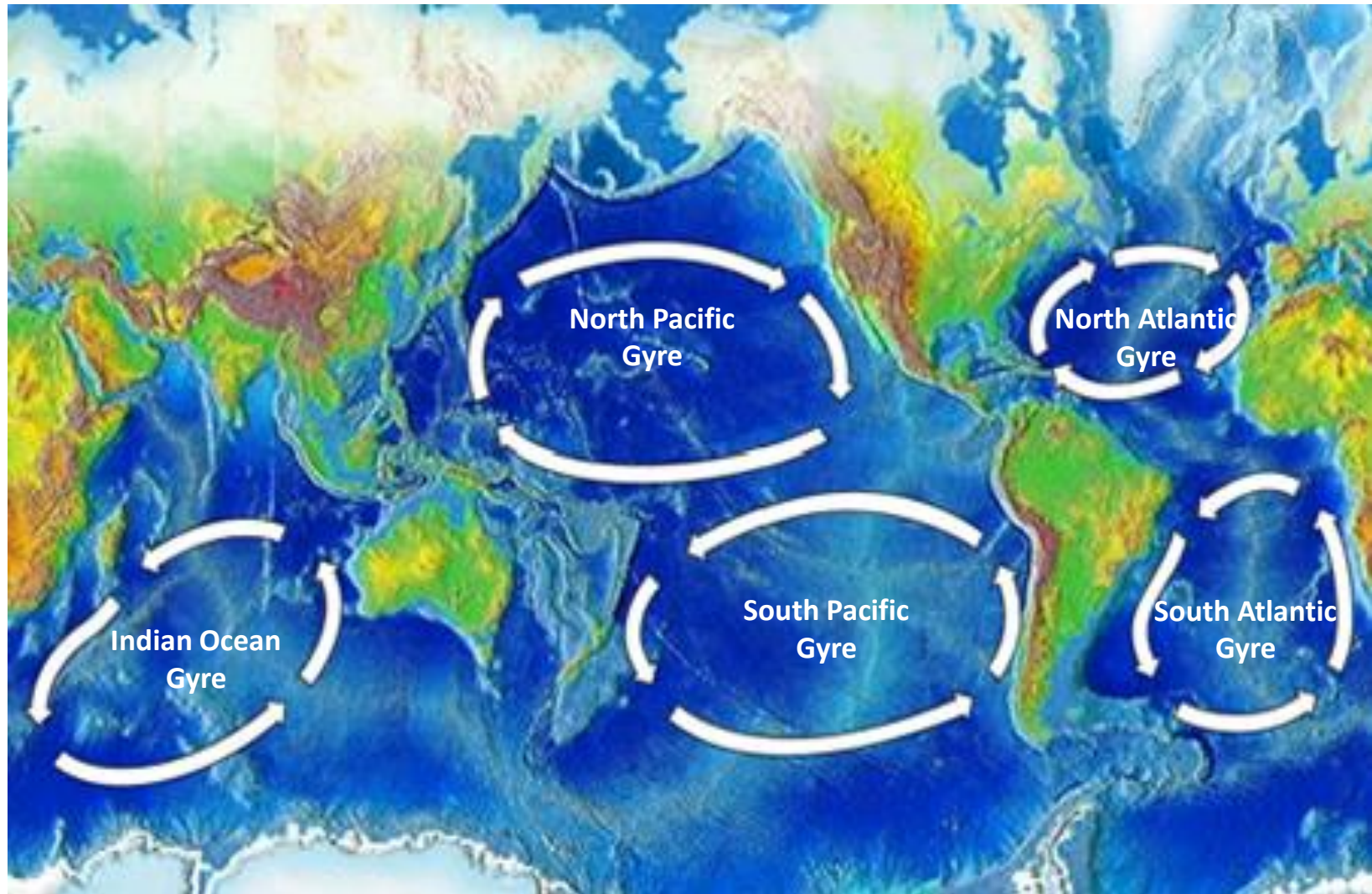
- Wind pushes currents away from coastlines to be replaced by cold, nutrient-rich deep water

- _____



Upwelling

Gyres



Gyres

- Currents follow coastlines
- _____
- _____
- Most stable and predictable
-
- Some gather debris that gets stuck within the stationary water at the center of the gyre → _____

Synthesis

- With so many factors contributing to weather, it's no wonder weather forecasts can be wrong

