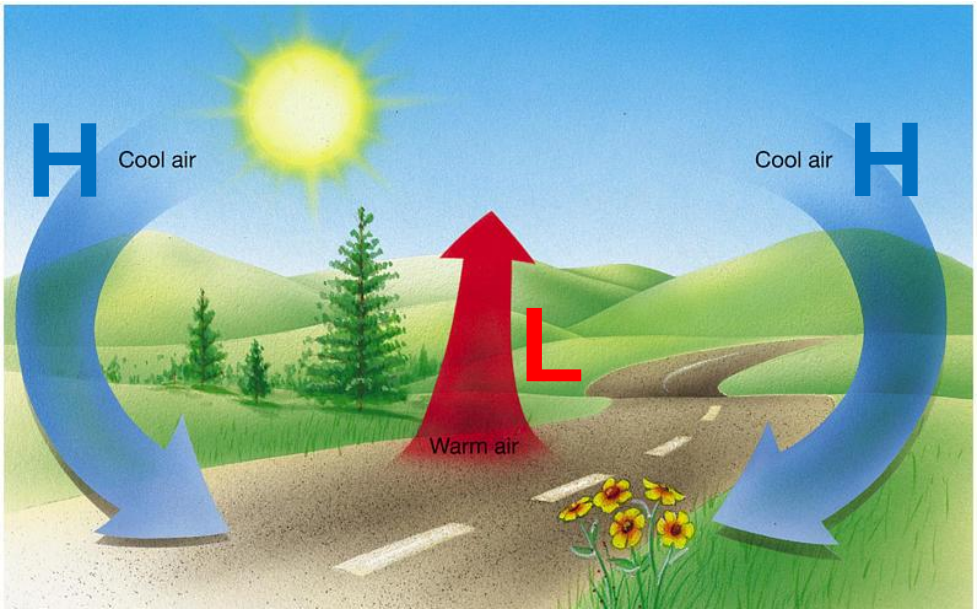
Local and Global Winds

Wind is the horizontal movement of air.

All wind is caused by air pressure differences due to the uneven heating of Earth's surface, which sets convection currents in motion: warm air rises and cool air falls.



- **Convection currents on a small scale (over short distances) cause local winds - felt on the ground, often seasonal.**
- **Convection currents on a large scale (resulting from the difference in absorption of solar energy between the equatorial and polar zones on Earth) cause global winds.**

Local Winds

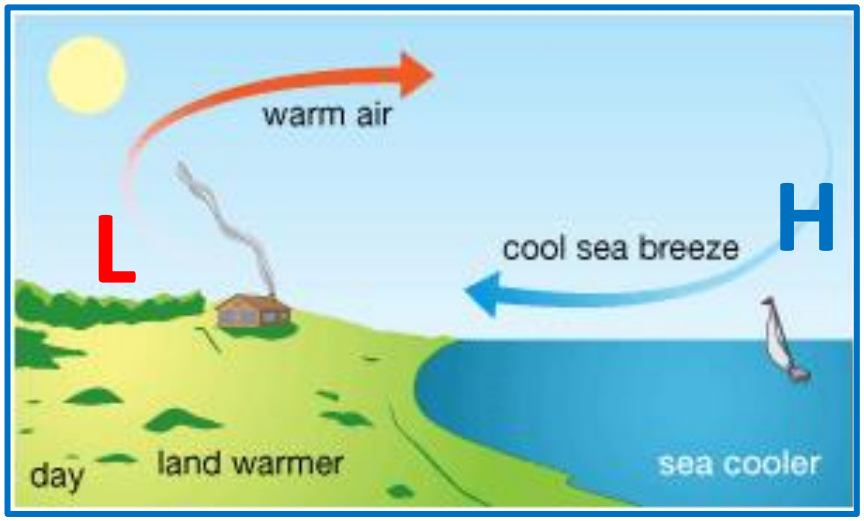
- cover short distances
- blow from any direction

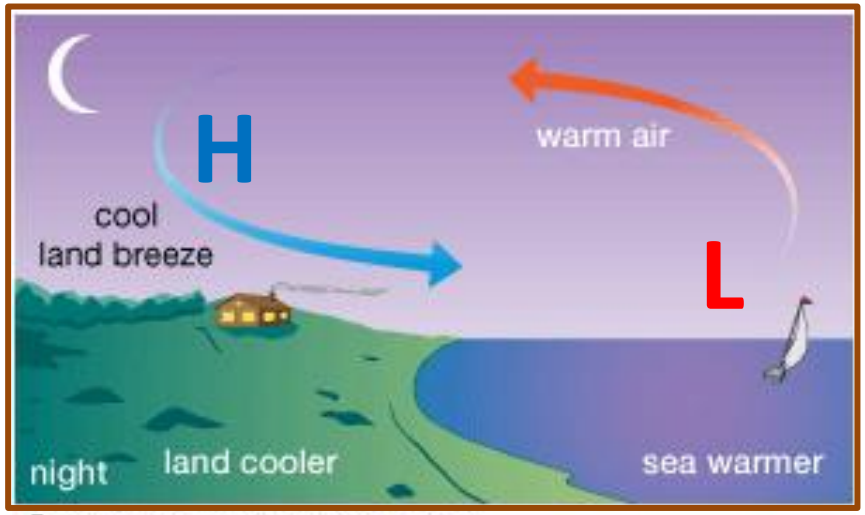
- created and influenced by local conditions, local temperature variations, and local topography.

Types of Local Winds

Sea and land breezes are formed by varying temperature differences between the land and water.

- **During the day the land heats up faster than the water:**
  - **the air above the land warms up and rises, forming a low pressure area;**
  - **the wind will blow from the sea to the land, called a sea breeze.**
- **At night, land cools off faster than the sea:**
  - **the air above the sea surface warms up and rises;**
  - **and the wind will now blow from the land to the sea, called a land breeze.**

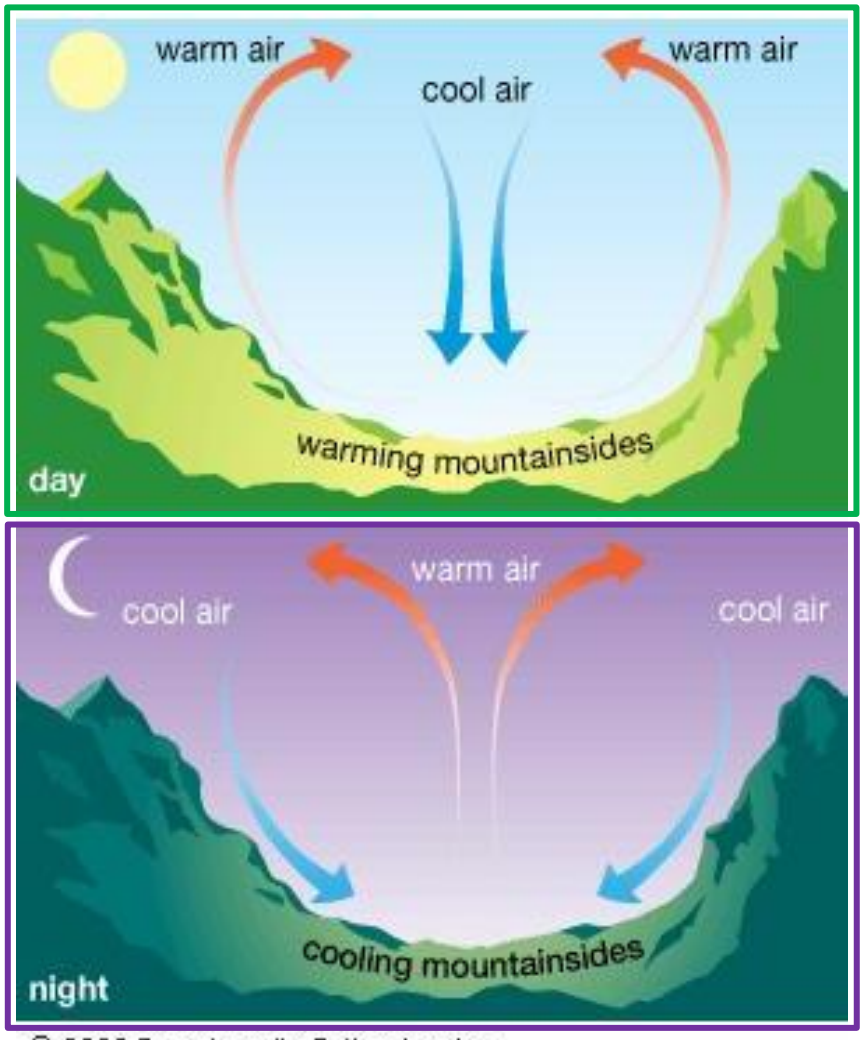




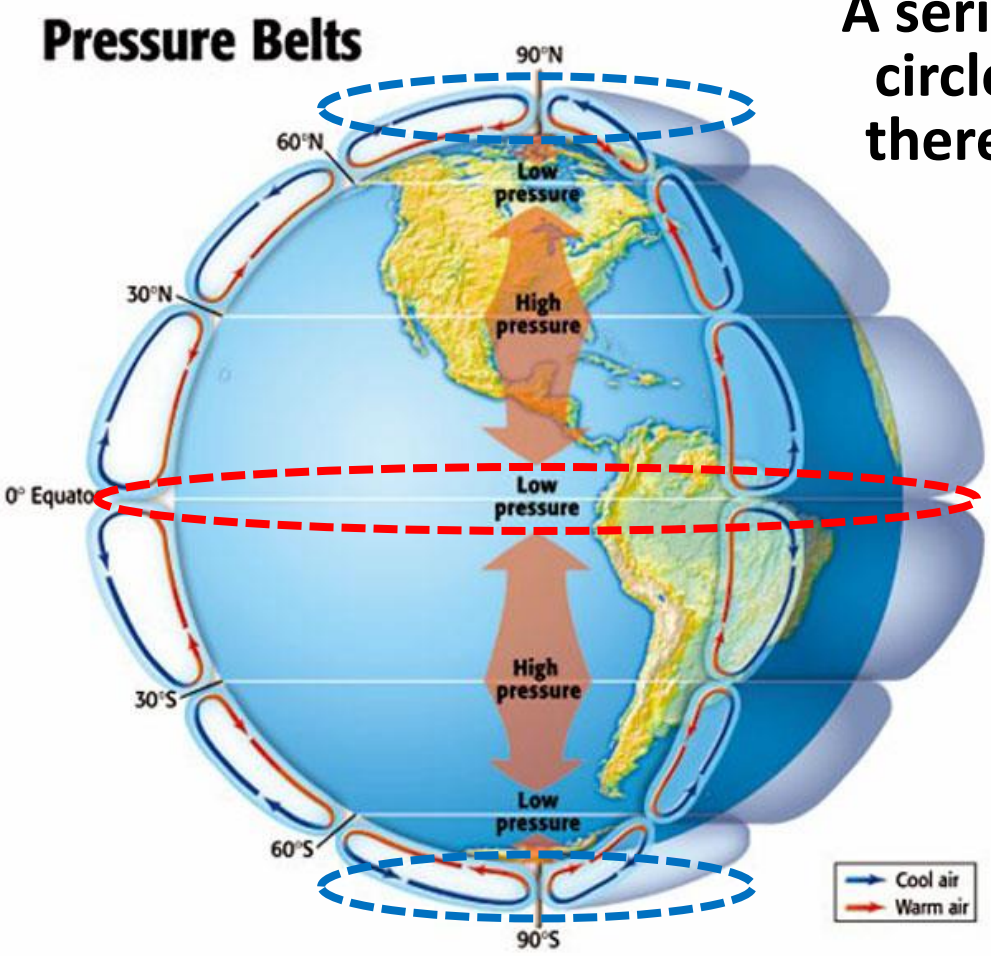
Types of Local Winds

Mountain and valley breezes are examples of local winds caused by the topography of an area.

- **During the day the mountain slopes heat up:**
  - **the warm less dense air flows up the mountain;**
  - **this is called a valley breeze.**
- **At night, the mountain will cool off faster than the valley:**
  - **the cool mountain air descends;**
  - **this is called a mountain breeze.**



Global Winds Formation



A series of pressure/wind belts circles the Earth; between them there are calm areas where air is rising or falling.

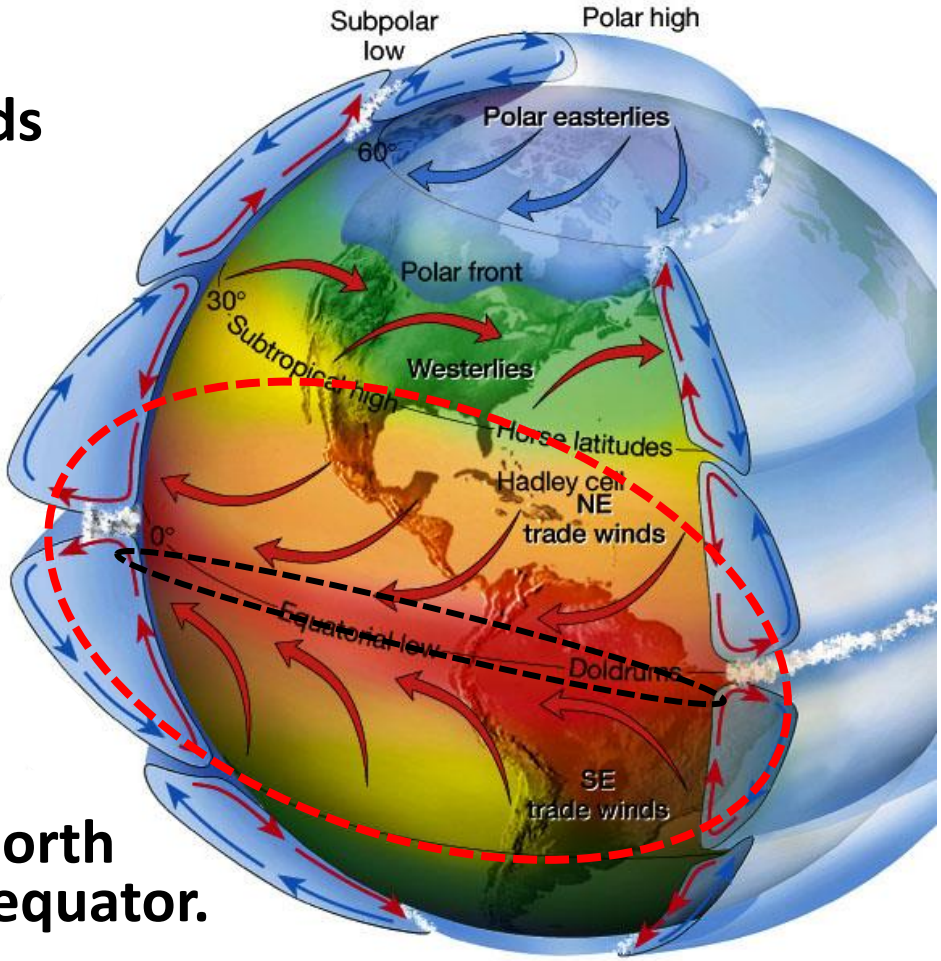
- **Example:**
  - since the warm air **near the equator** is less dense, it rises forming areas of **low pressure**
  - the cold air **near the poles** sinks because it is more dense, forming areas of **high pressure**

The air moves in large <u>circular patterns</u> called convection cells.

Types of Global Winds

Doldrums:

- Calm and weak surface winds located at the equator.
- *Name origin:* early sailors found that there were no winds near the equator for considerable periods of time (these *calm periods* were called *doldrums*) - the ships were essentially stuck in one place, not being able to move forward.



Trade Winds:

- Found between about 30˚ (north and south) latitude and the equator.
- Steady and strong, blow about 11 to 13 mph.
- *Name origin:* from their ability to propel *trading ships* across the ocean.

Voyages of Christopher Columbus

1492-1504

Types of Global Winds

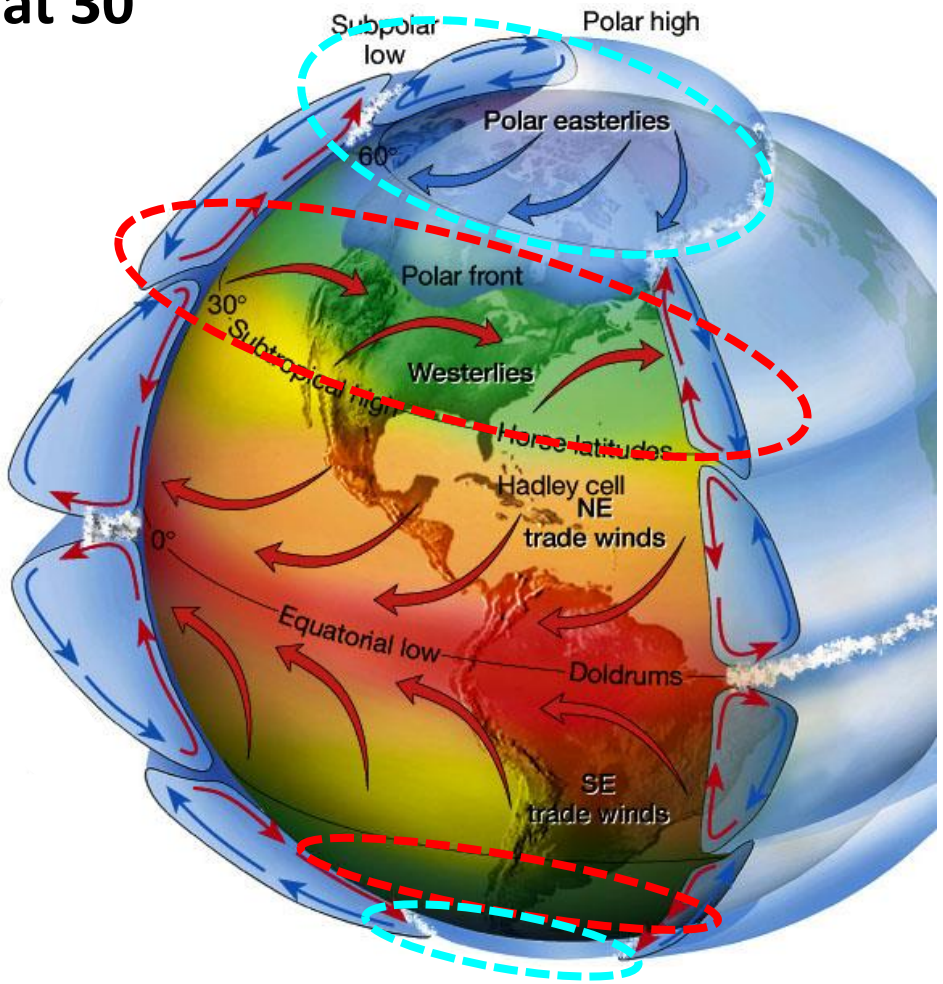
Horse latitudes: calm areas at 30˚

Prevailing Westerlies:

- **Strong winds located in the belt from 30-60˚latitude in both hemispheres.**
- **Originate in horse latitudes.**
- **Blow *from west*, tend towards the poles.**

Polar Easterlies:

- **Cold, dry, weak, irregular.**
- **Found near the North and South Poles reaching to 60˚ latitude.**

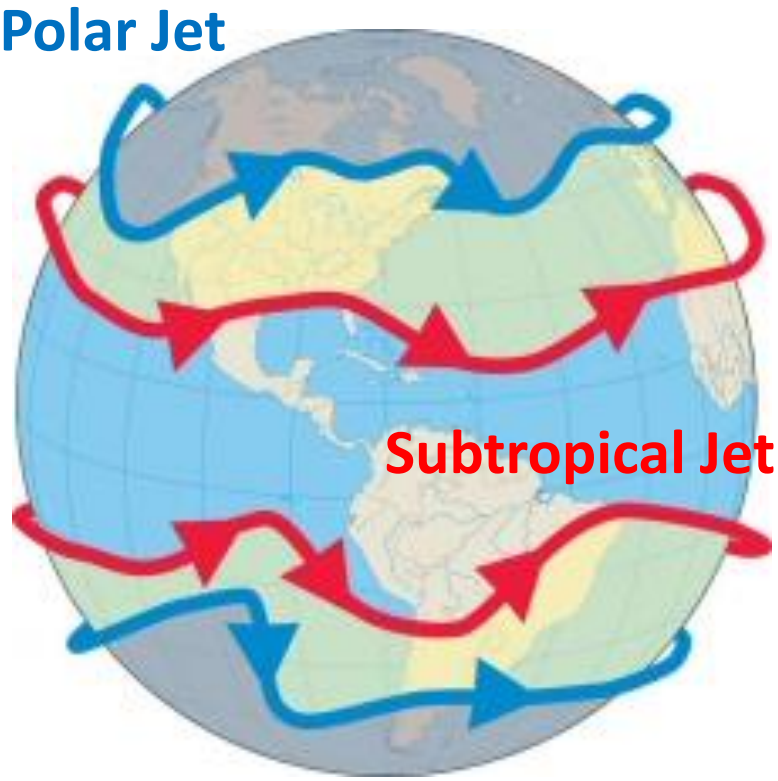


Both of these have a strong impact on the US weather.

Jet Streams

Jet streams are fast flowing, relatively narrow air currents found in the atmosphere of some planets, including Earth.

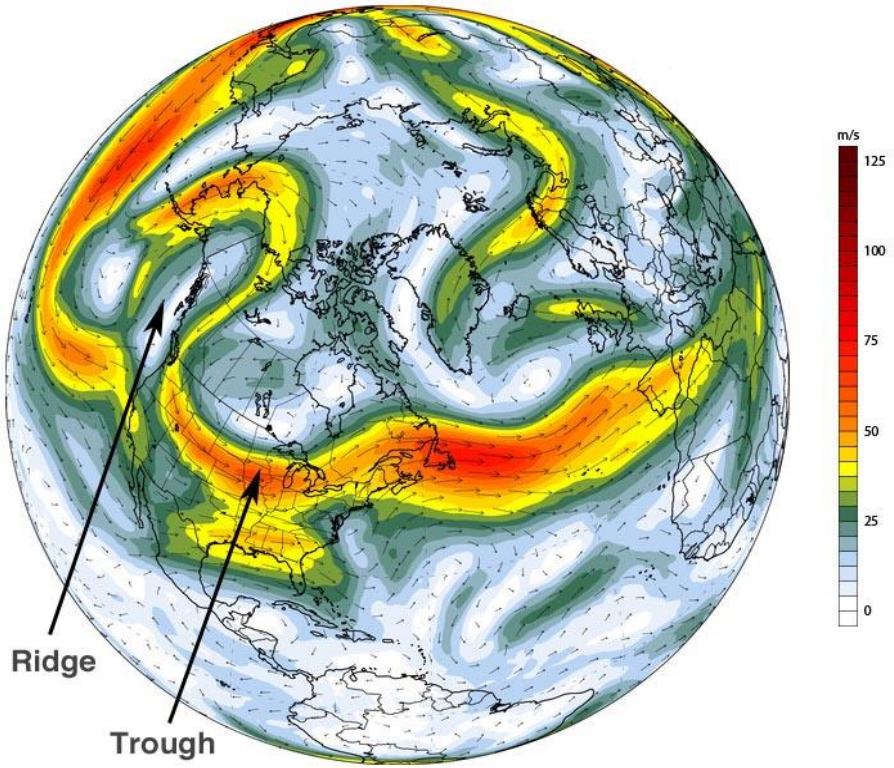
- **Discovered in 1940s.**
- **Can be found in the upper troposphere at ~10-15 km altitude.**
- **Caused by a combination of the Earth's rotation on its axis and uneven atmospheric heating.**
- **Strong, high speed (~50-100 mph).**
- **Major jets move west to east:**
  - **Polar (strongest)**
  - **Subtropical**



- **The polar and subtropical jets merge at some locations and times, while at other times they are well separated.**

Jet Streams Role

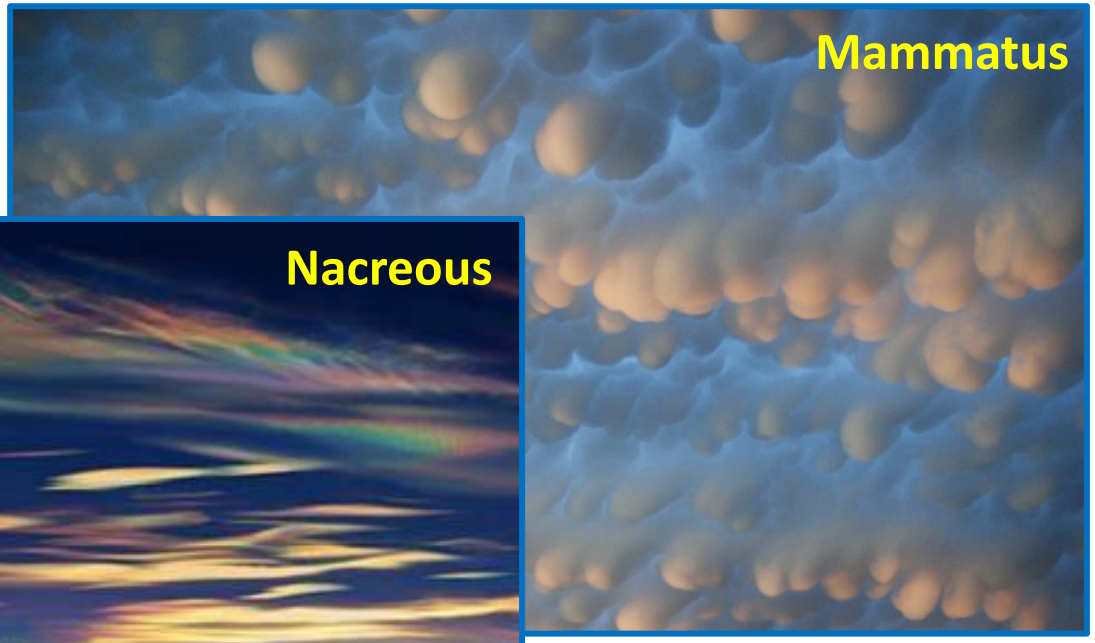
The path of jet streams steers cyclonic storm systems at lower levels in the atmosphere.



- **Jet streams develop meanders, that eventually cut off, detaching and moving air masses.**

- **In air travel, flight time can be dramatically affected by either flying with the flow or against the flow of a jet stream.**


Roll


Mammatus

Nacreous


Lenticular


Kelvin-Helmholtz