

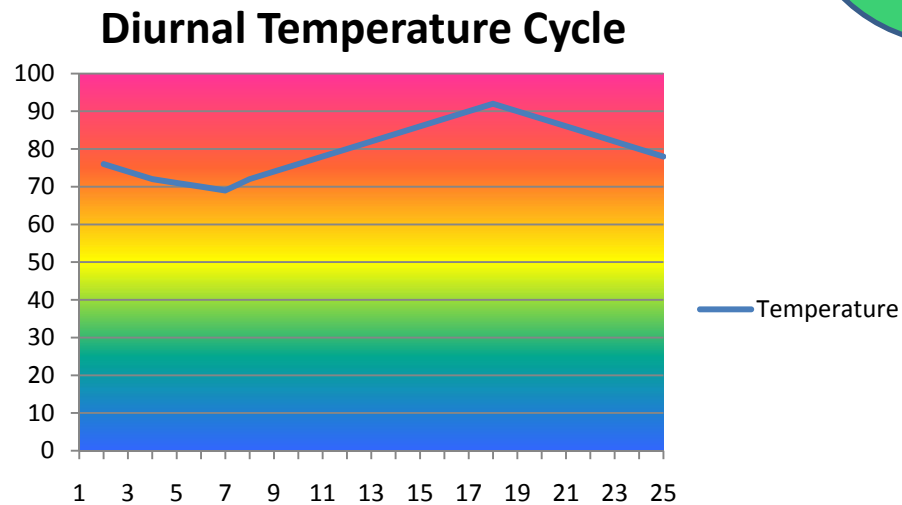
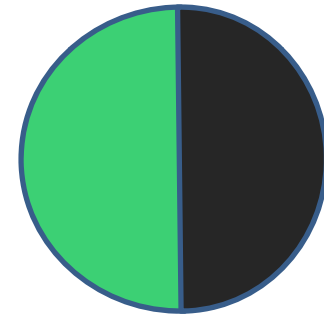
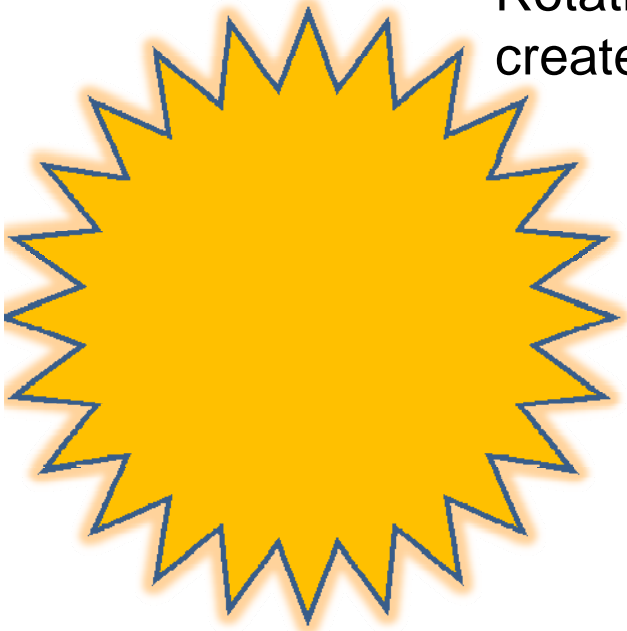
# Consequences of the Earth's Rotation

The earth rotates on its axis taking approximately 24 hours to complete one rotation. This has important environmental consequences.

1. Rotation creates a **diurnal cycle** of light and darkness, temperature, and humidity changes.
2. Rotation requires the creation of standardized **time zones**. There are 24, one for each hour of the earth's rotation.
3. Rotation causes the **tides**- the twice daily rise and fall of sea level. Tides are complicated because they are the result of both the gravity of the moon and the gravity of the sun. Sometimes the sun and the moon are lined up with the earth, but most of the time they are not. Tides are highest when the earth, sun and moon are in a straight line.
4. The **Coriolis Force**. Rotation causes a deflection of ocean and air currents. The earth rotates much faster than the winds or currents move. This causes a large deflection in the direction that winds move and ultimately results in rotation around low pressure cells and high pressure cells. It also causes large rotating pools of water in the oceans called **gyres**. The Coriolis force only operates on large features.

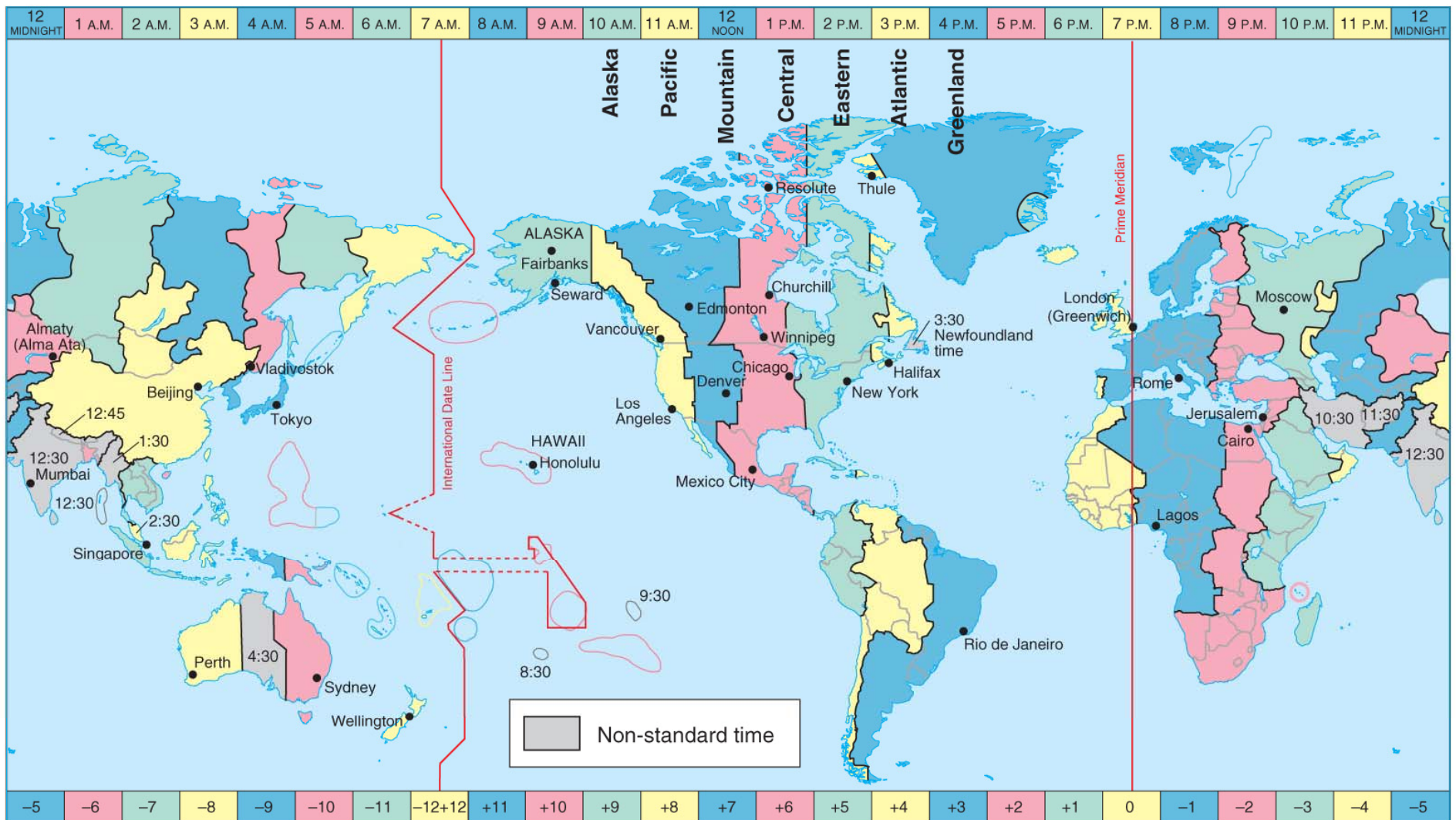
# Diurnal Cycle

Half the earth is illuminated while half is dark.  
Rotation causes the day-night cycle which also creates a corresponding cycle of temperature and humidity.

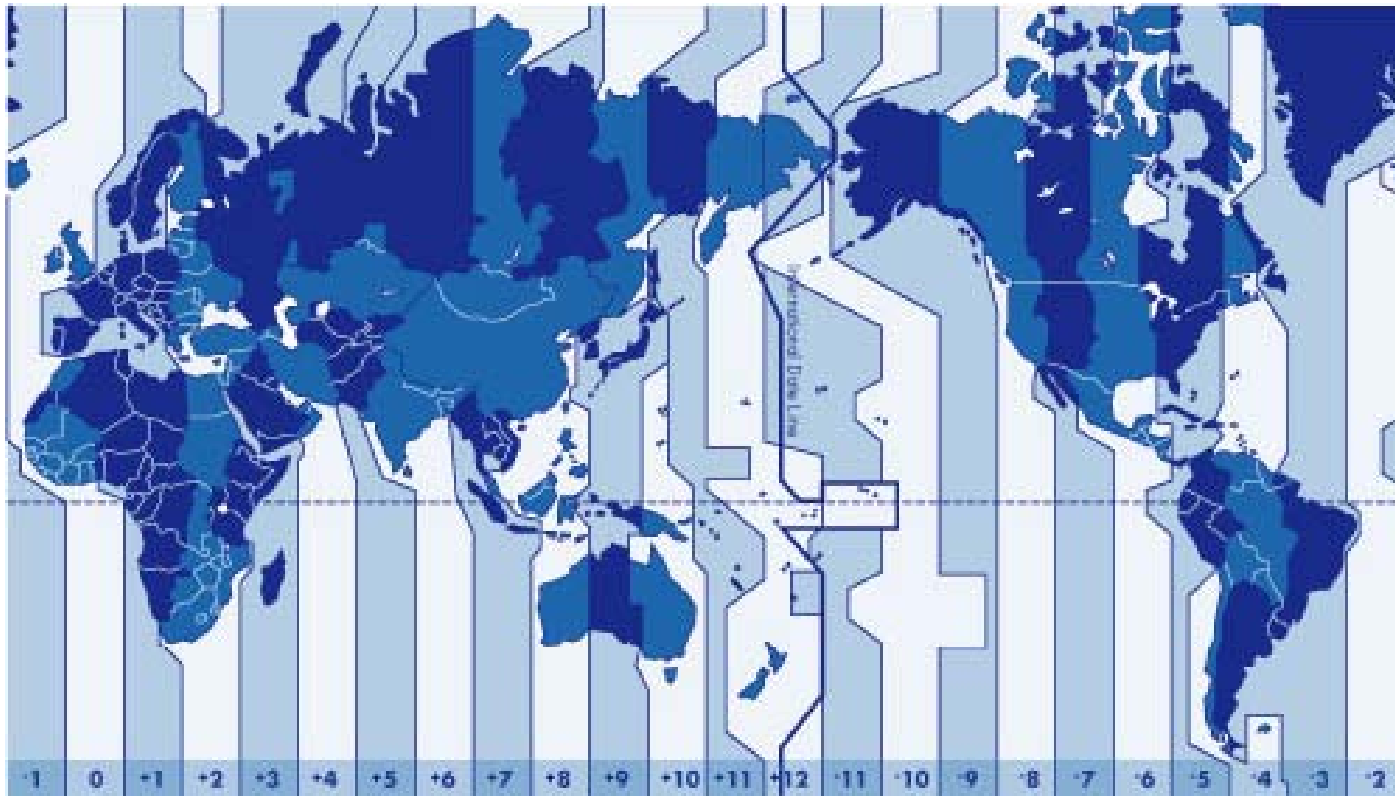


# Standard Time Zones

Each Time Zone Covers 15° of Longitude  
or one hour of Earth's rotation



# Time Zones More or Less Follow Lines of Longitude Across the Ocean



# High Tide



(a)

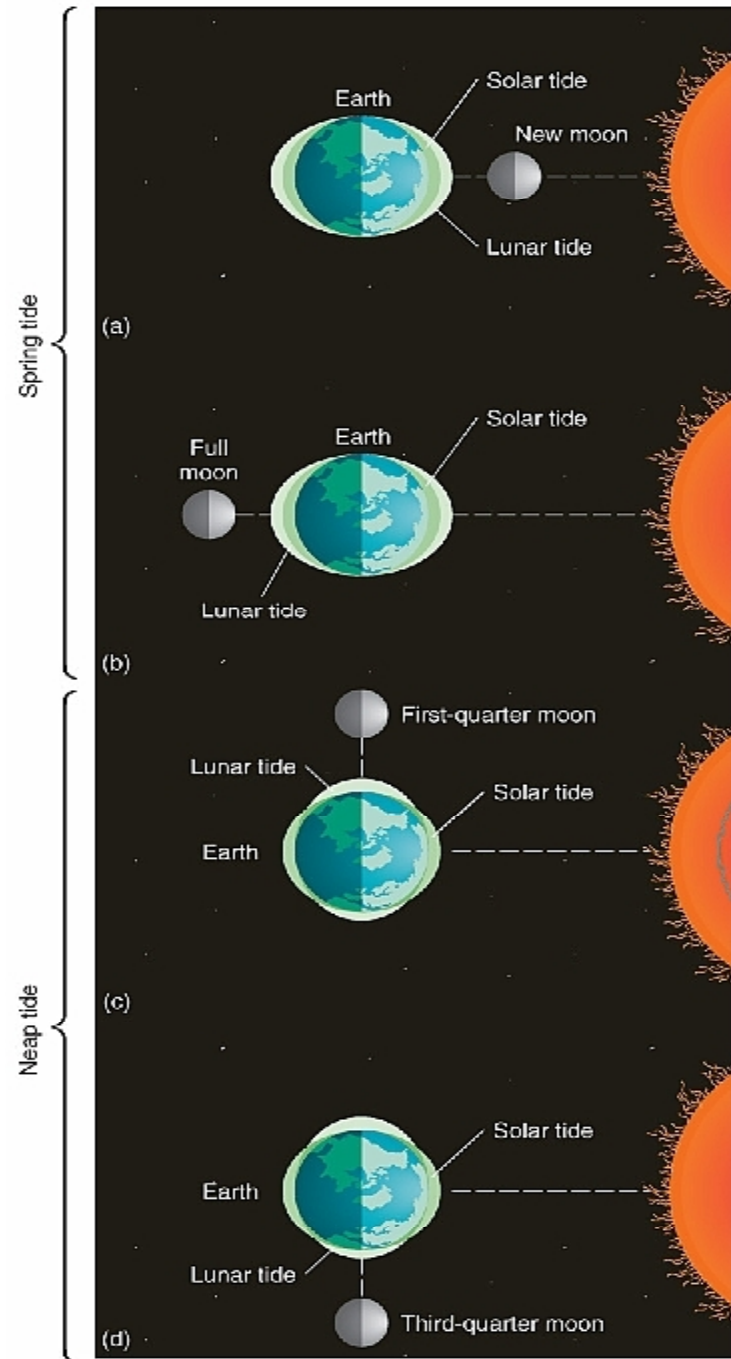
# Low Tide



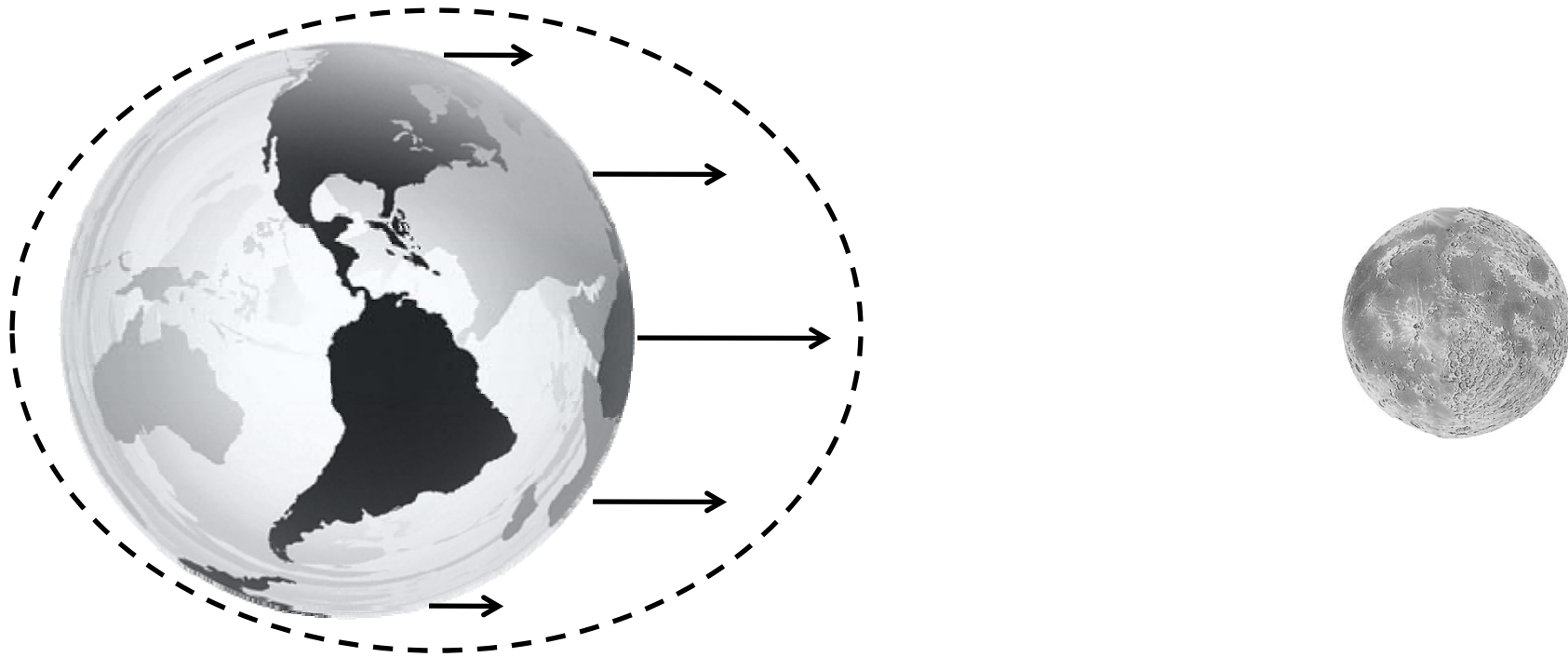
(b)

# Tides

Sea level rises and falls twice a day as the earth rotates. The tidal range is determined by the combined gravitational pull of the sun and moon.

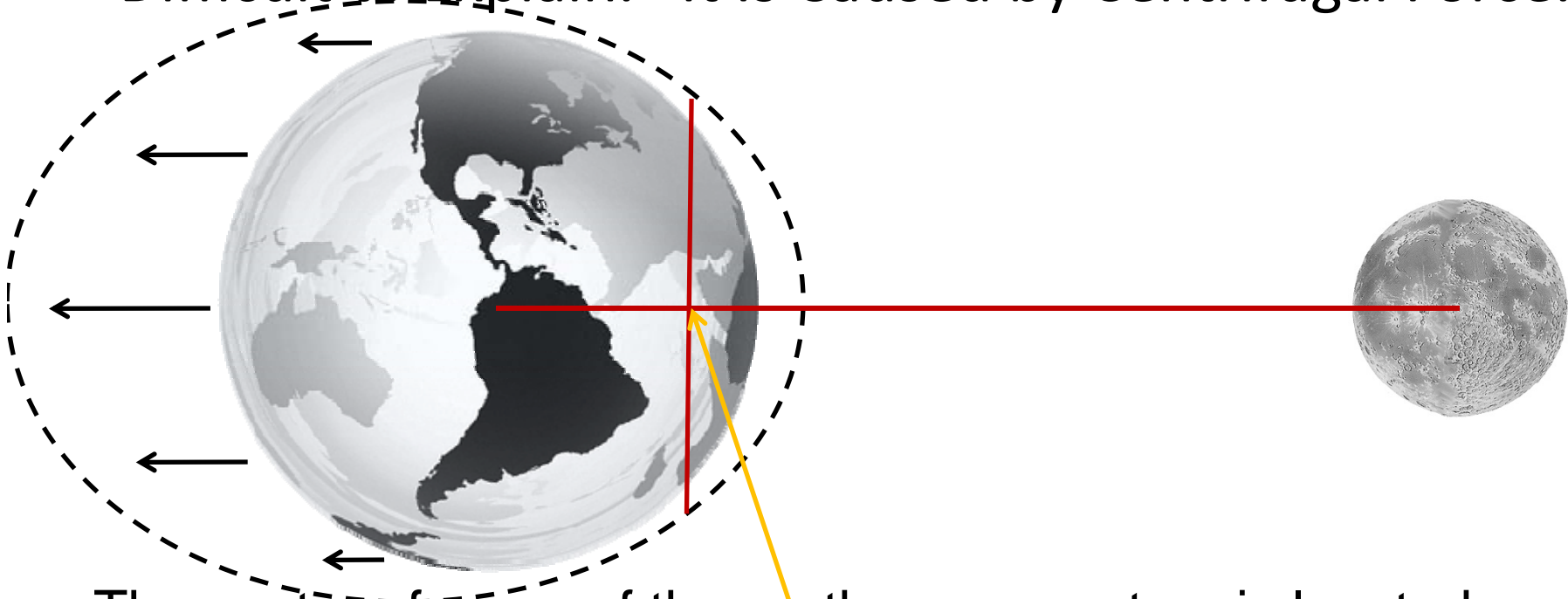


The Moons Gravity Pulls on the Ocean. The Rise in Sea Level Is Called a Tide(s).





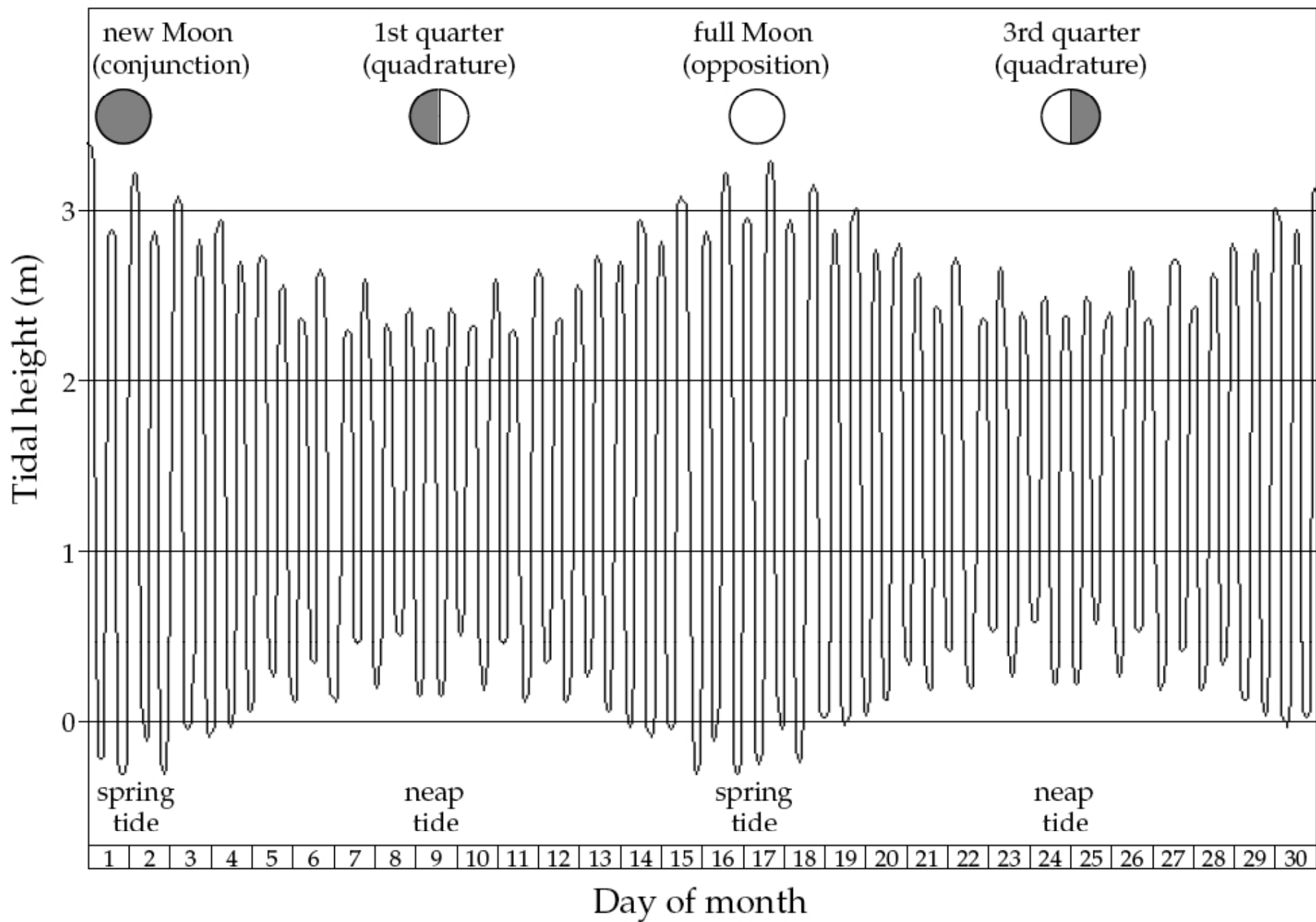
This Causes a Bulge on the Side of the Earth Facing the Moon, But There Is Also a Bulge on the Opposite Side Away From the Moon. This Is Much More Difficult to Explain. It Is Caused by Centrifugal Force.



The center of mass of the earth-moon system is located beneath the surface of the earth, not at the center of the earth. As the earth-moon system rotate about this center of mass, centrifugal force throws water on the opposite side of the earth outward creating a tide there.

The Result of the Moon's Gravity and the Centrifugal Force Create Nearly Equal Tides on Opposite Sides of the Earth, So Sea Level Rises and Falls Twice a Day.





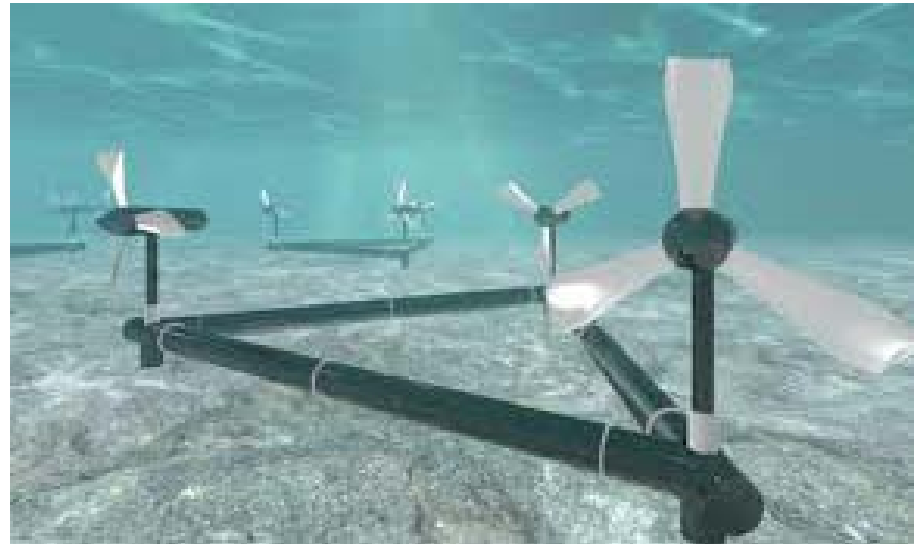
The Rise and Fall in Sea Level Means that Rivers Near the Ocean Flow in Opposite Directions as the Tides Rise and Fall.



Sailing Ships Often Sail into Port as the Tide Flows in (upstream) and Sail out to Sea as the Tide Flows out (down stream)

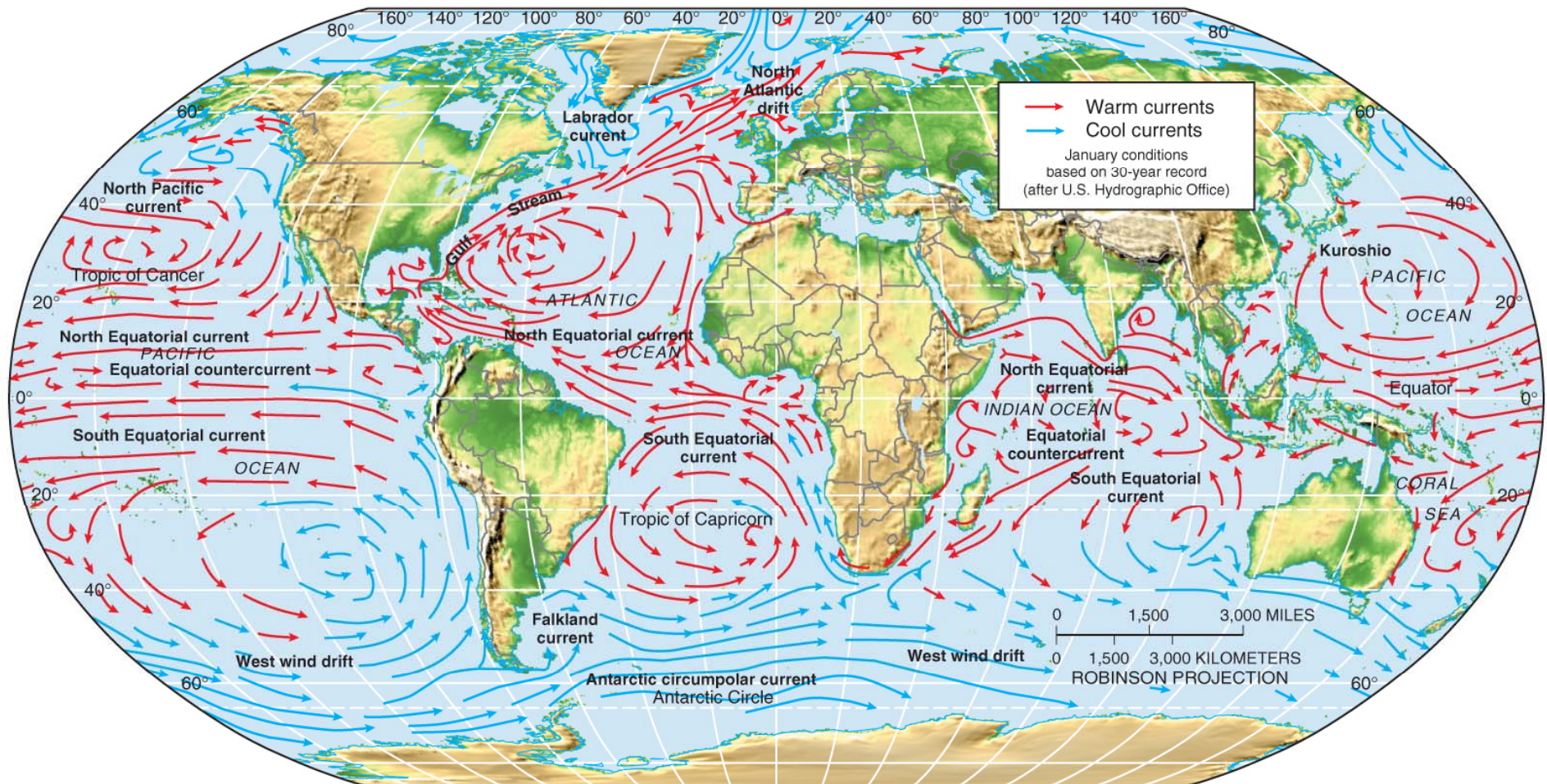


# Artists Conception of Tides Used to Generate Electricity.



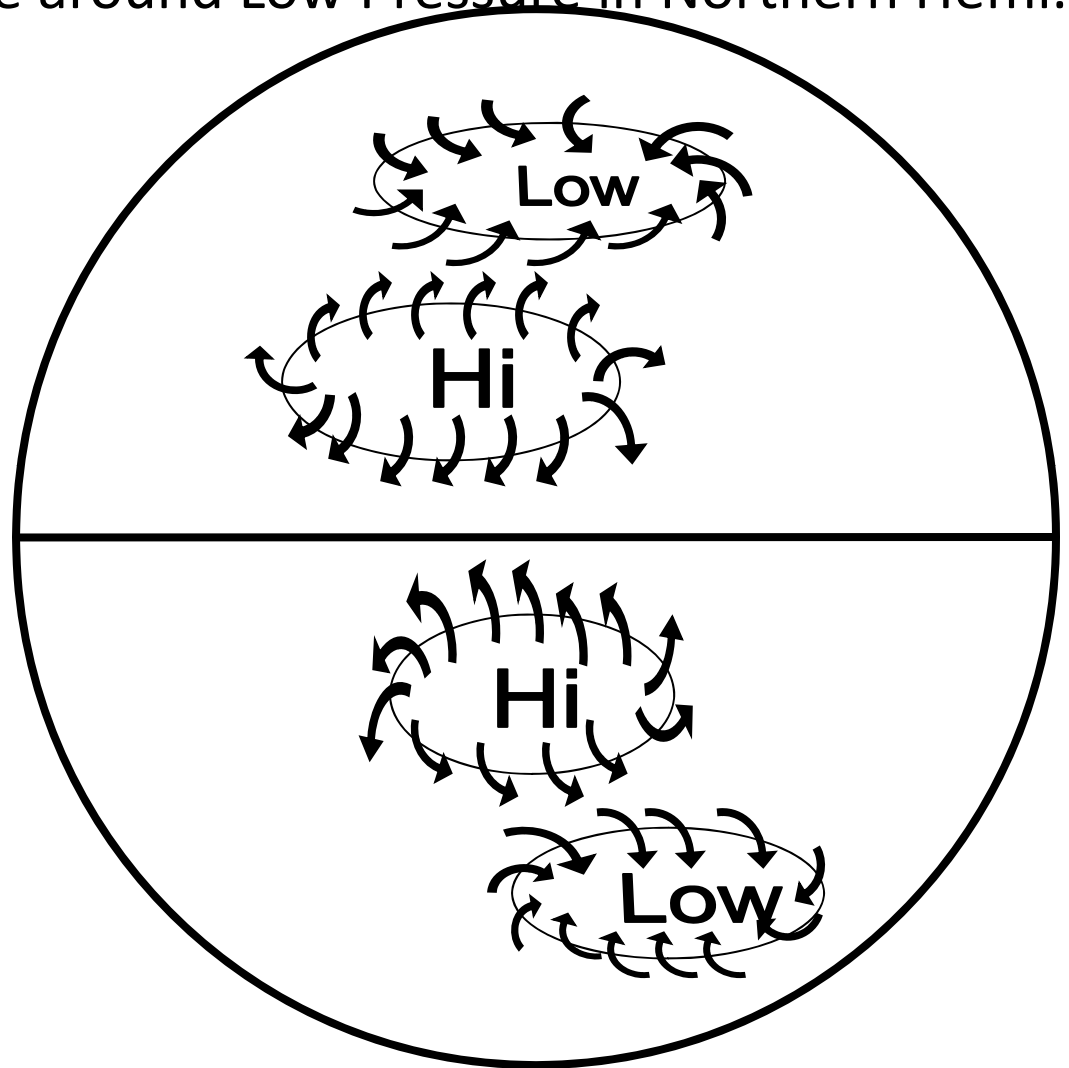
# The Coriolis Force Creates Large Circulation Cells in the Ocean Called Gyres.

## They Have the Same Circulation Pattern As Winds in High Pressure Cells in the Atmosphere



Winds Rotate Clockwise around High Pressure in Northern Hemisphere  
Winds Rotate Counterclockwise around Low Pressure in Northern Hemi.

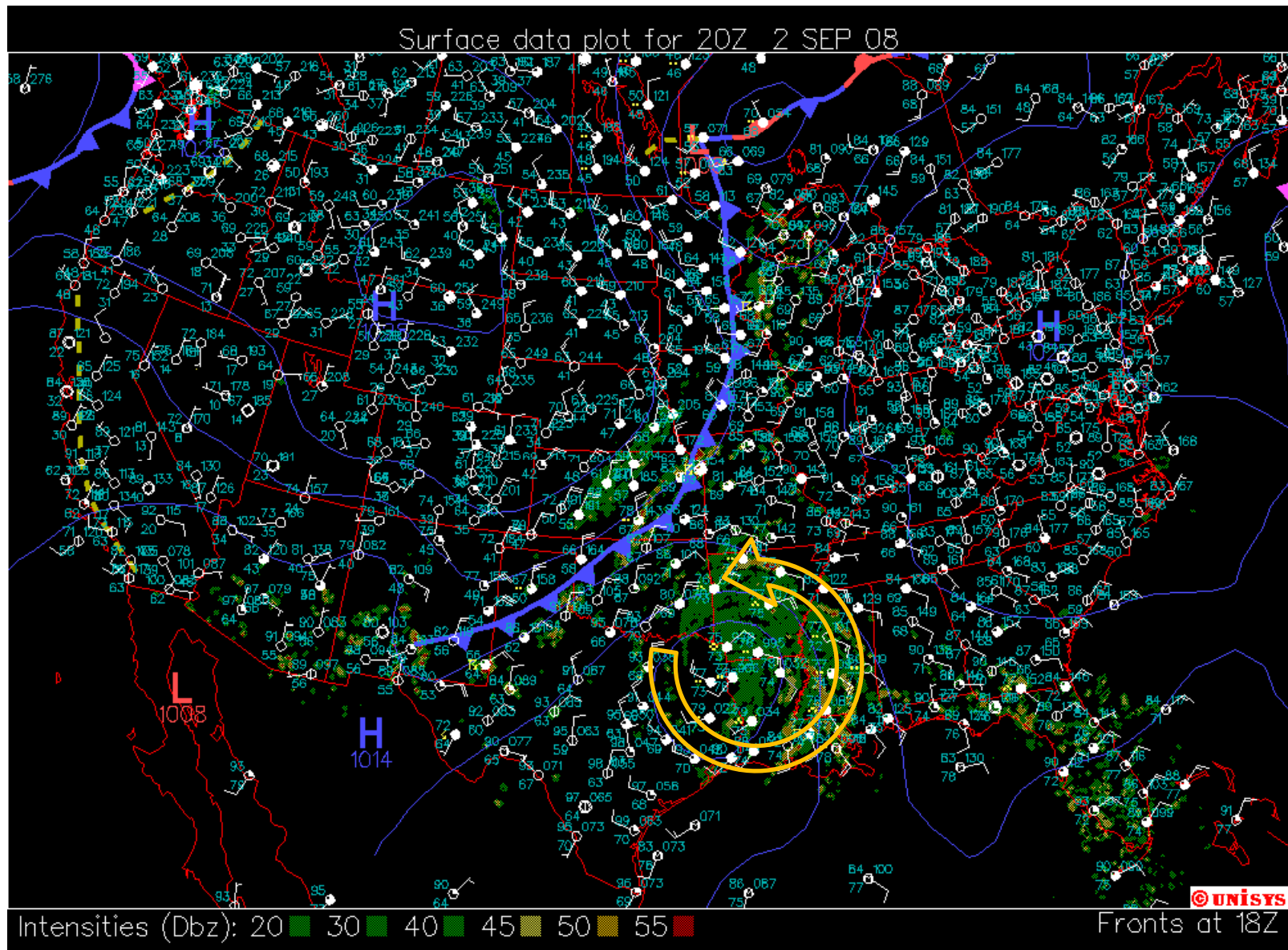
The Coriolis Force  
Causes Winds to  
Rotate Around  
Pressure Cells



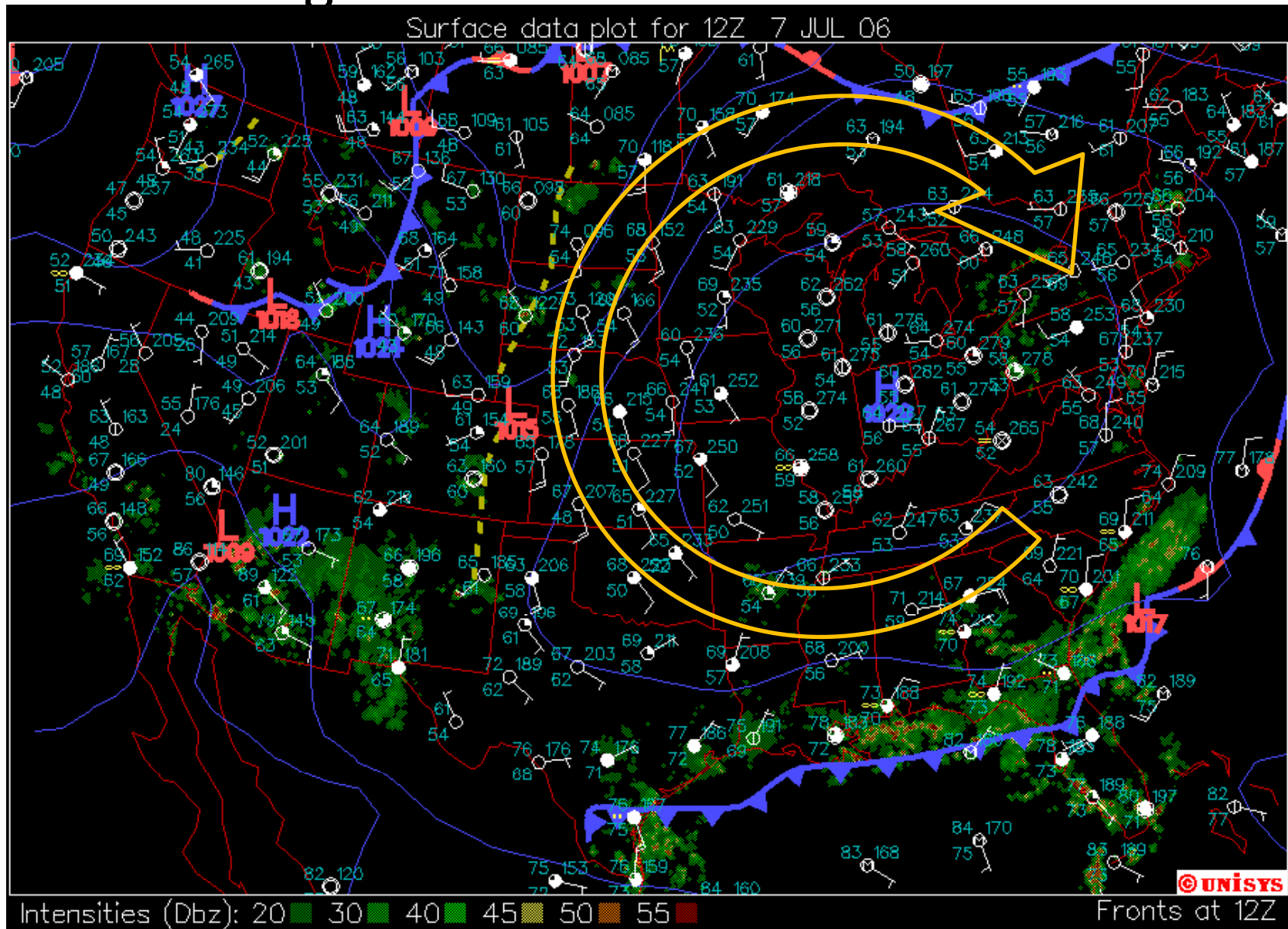
Winds Rotate Counterclockwise around High Pressure in Southern Hemi.  
Winds Rotate Clockwise around Low Pressure in South Hemisphere



# Note the Counterclockwise Rotation of Winds Around Hurricane Gustav in LA, MS, AR & TX



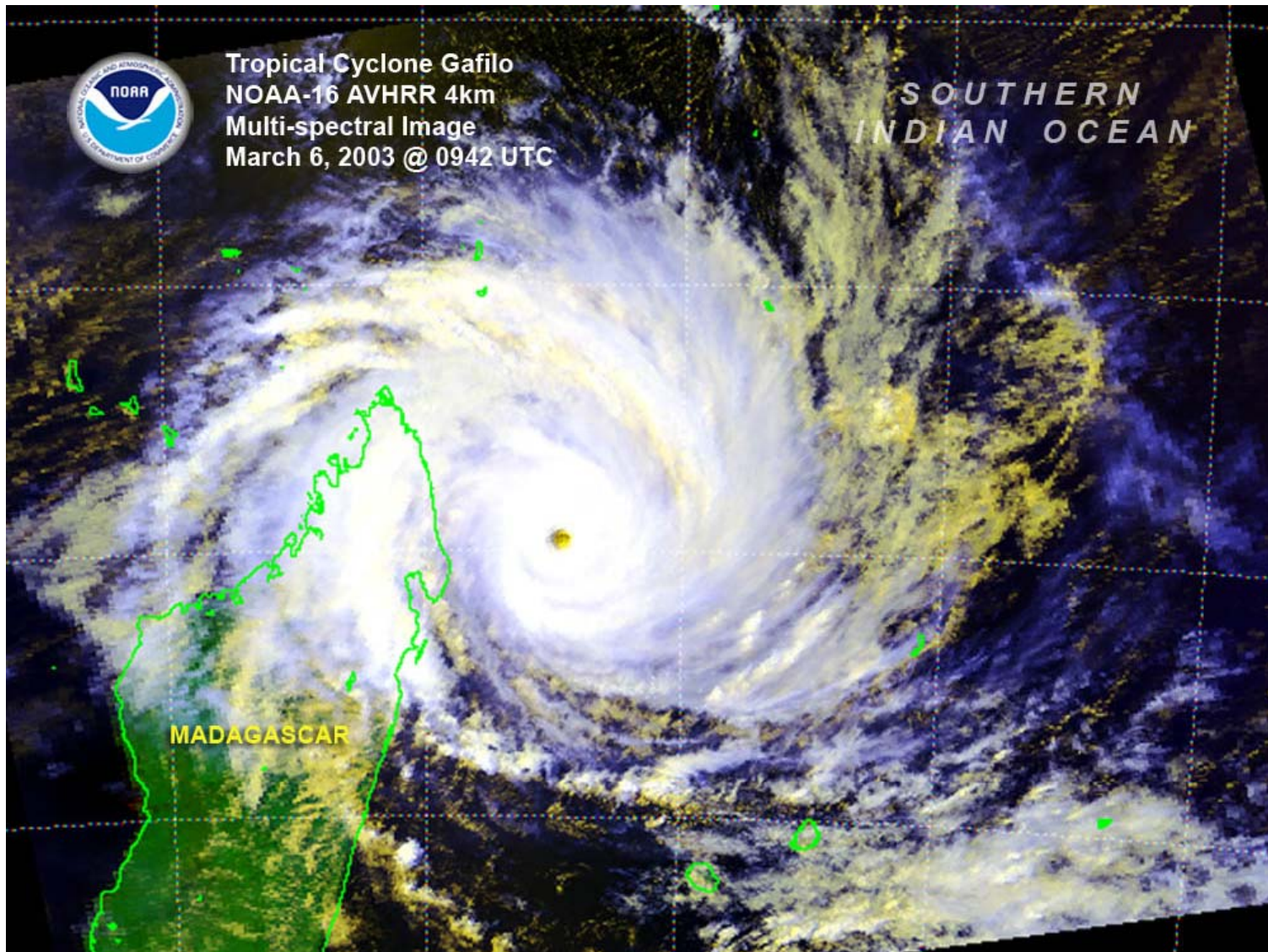
# Note Clockwise Rotation of Winds around High Pressure Centered over Indiana



# Polar Low in Barents Sea, Northern Hemisphere, Counterclockwise Rotation



# Hurricane Gafilo, Southern Hemisphere, Clockwise Rotation



# Hurricane Catarina in South Atlantic, Clockwise Rotation



The Coriolis Force Only Operates on Things that Move a Considerable Distance, Generally greater than 300 Miles.



Whirlpools and Tornadoes Spin But They are too Small to be Affected by the Coriolis Force.