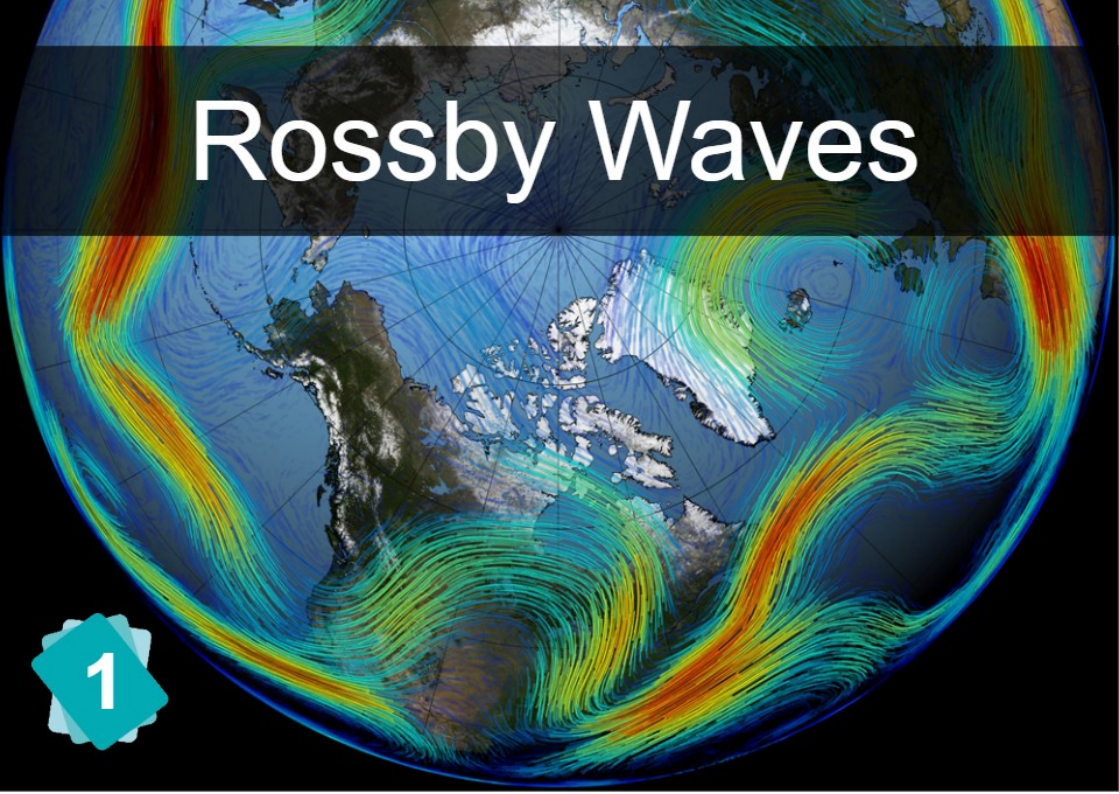
# Rossby Waves



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**Each meander within a Jet Stream is a Rossby Wave.**

**Rossby Waves form primarily as a result of Earth's geography and the effect of Coriolis force. Their eastward slow motion often results in long persistent weather patterns.**

# Jet Streams


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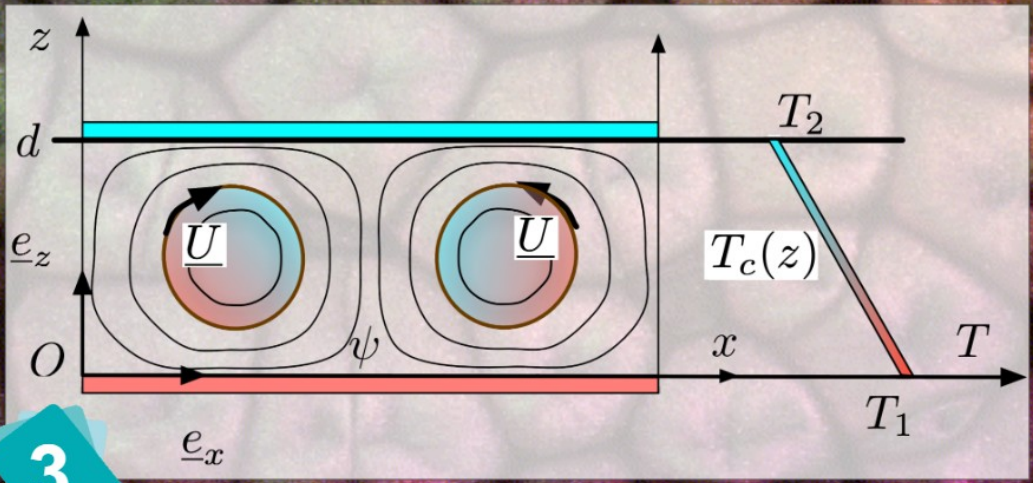
Jet Streams are large-scale, fast flowing and meandering air currents located at an altitude of 9 to 16 kilometers. They are produced by two factors : the coexistence of Polar, Hadley and Ferrel cells and the effect of Coriolis force.

Each hemisphere has a Polar Jet Stream and a Subtropical Jet Stream.

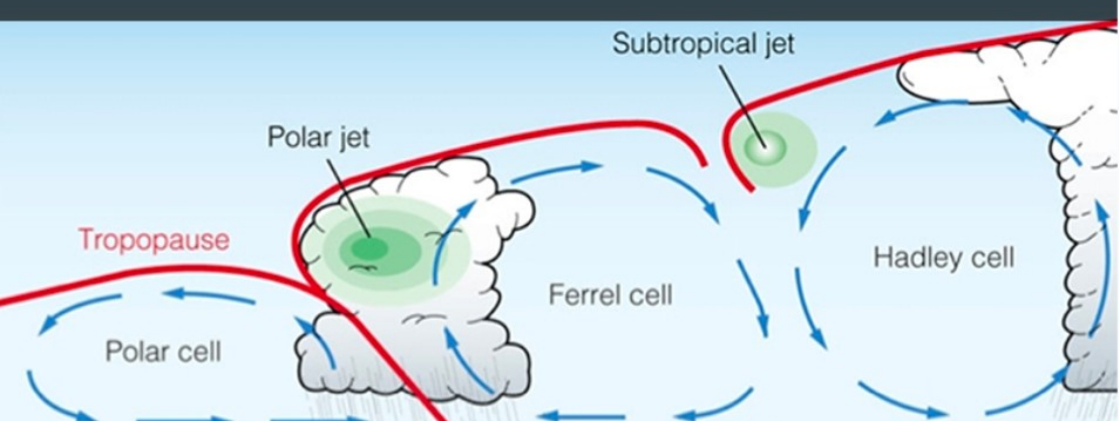
# Rayleigh-Bénard Instabilities




**Rayleigh-Bénard is a thermo-convective instability, occurring when a fluid is in a medium undergoing a temperature gradient between a warm bottom layer and a top cooler one (T1>T2).**

**This pattern of particles movements contribute to create convection cells.**

# Atmospheric Convection Cells

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Hadley cells above the equator and Polar cells above the poles are the result of Rayleigh-Bénard instabilities in the troposphere where air temperature decreases with altitude.

Ferrel cells between them are due to the appearance of the other two. Jet streams are formed at the border of these cells.

# Air Traffic Optimization


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**Air traffic depends on jet streams as they are rapid air currents 8-16 km high, the altitude where planes circulate. It can allow to gain time travel or thrift fuel to use or avoid them.**

**Their modifications could then affect the air traffic as the increase of meridional winds implies more turbulences and then flight perturbations.**

# Persistent Extreme Events

**Meridional Stream**
**Zonal Stream**

6

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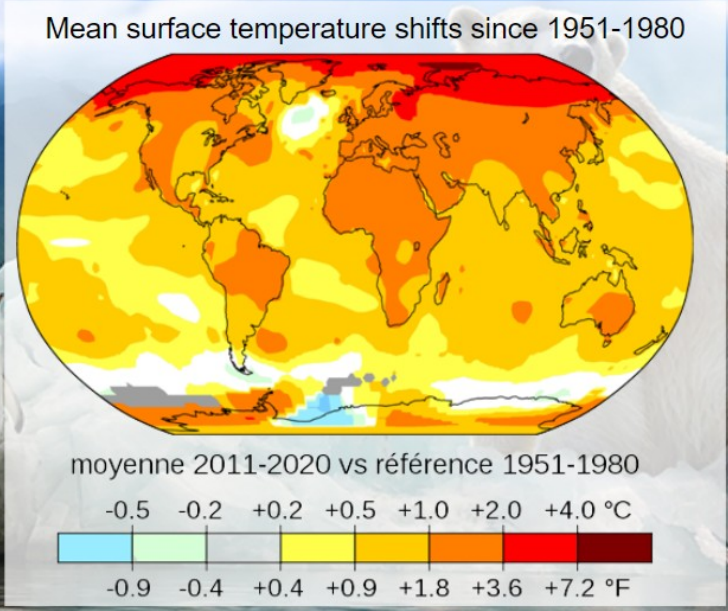
As the Jet Streams weaken, the polar vortex is more likely to leak towards the equator. This leads to strong vertical flows that reinforce the Rossby Waves of the Jet Streams.

As a result, this could lead to prolonged and persistent extreme weather conditions.

# Polar Amplification



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**Any change in the net radiation balance tends to induce a bigger change in the surface temperature near the poles than in the planetary average.**

# Weakened Jet Streams


**Global Warming and Polar Amplification will make the vertical temperature gradient decrease. In reaction to that, the Jets Streams may flow slower and slower.**

# Jet Streams Migration

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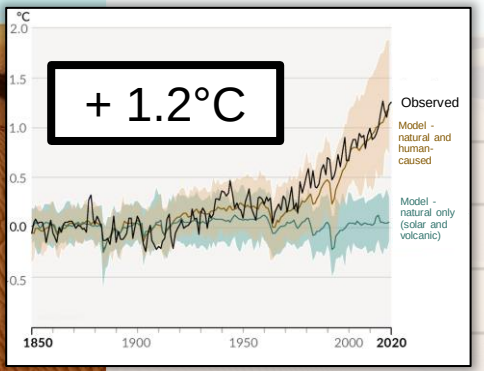
**Jet Streams will be gradually pushed poleward due to global warming.**

**For instance, the Northern Jet Stream moved northward at a rate of 2.01 km per year from 1979 to 2001.**

# Rising Air Temperatures



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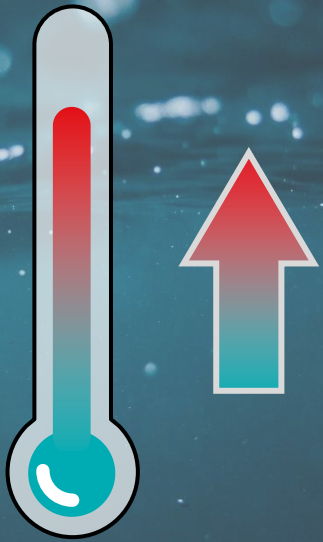
The average air temperature at the surface of the Earth has increased by 1.2°C since 1900. Future emission scenarios predict that this increase will reach between 2 and 5°C by 2100.
During the last ice age 20,000 years ago, the average air temperature was only 5°C lower than today and warming up took 10,000 years.

Set 1

# Rising Water Temperatures



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Oceans absorb 91% of the energy accumulated on Earth. The water temperature has therefore increased, especially close to the surface. Water expands as it warms.

Set 3

# River Flooding

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The disruption of the water cycle can both increase and decrease rainfall. More rain can lead to river flooding. If the soil is very dry, it makes matters worse because the water runs off it.

Set 4

# Cyclones

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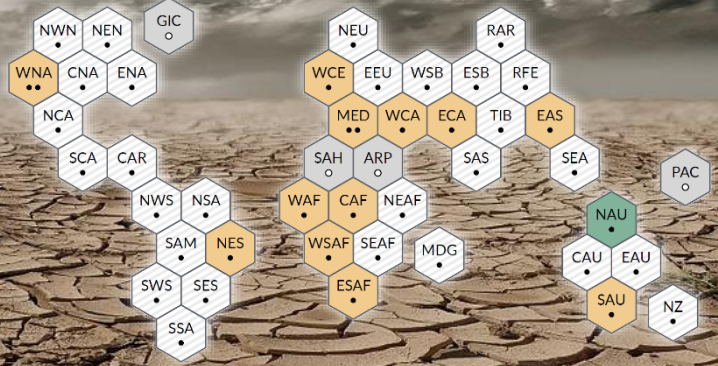
Cyclones draw their energy from warm water at the surface of the ocean. They are getting stronger because of global warming.

Set 4

# Droughts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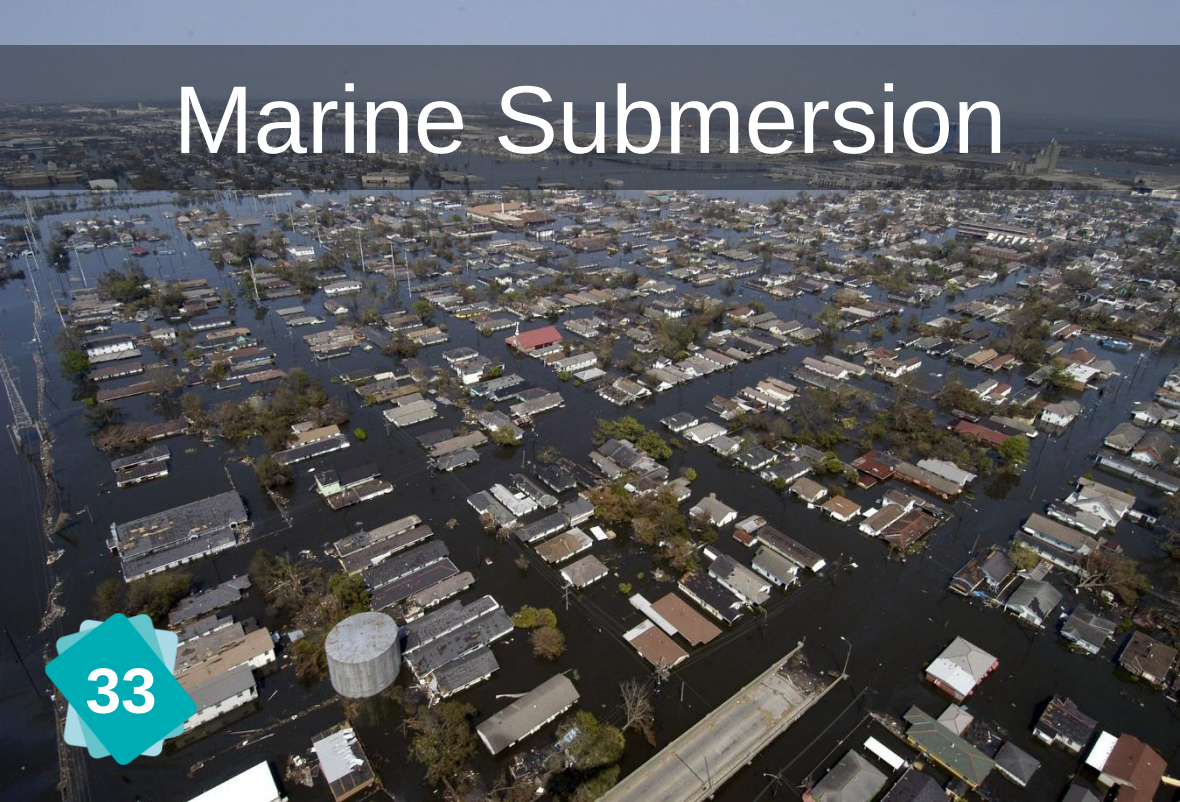
The disruption of the water cycle can both increase and decrease rainfall. A lack of rain can cause drought. Droughts are likely to become more frequent in the future.

Set 4

# Marine Submersion



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Cyclones and other extreme weather events bring strong winds, waves and low pressure conditions. A 1-hPa (hectopascal) drop in atmospheric pressure causes a 1-cm sea level rise. Therefore cyclones can cause marine submersions (coastal flooding), on top of the sea level rise already caused by global warming.

Set 4

# Heatwaves


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One consequence of higher temperatures is more frequent heatwaves.

Set 5