

# Climate Change:

## The Point of No Return



**❄️ Cryosphere Entities**

**🌊 Circulation Patterns**

**🌿 Biosphere Components**

Köppen Climate Classification

Af 
  Am 
  Aw 
  As 
  BS 
  BW 
  Cf 
  Cs 
  Cw 
  Co 
  Df 
  Ds 
  Eo 
  Et 
  FT 
  FI

*By: Hannah Cravedi, Vasia Fotopoulos,  
Luke Pepin, Marino Tatafiore*

# SHUT DOWN OF THE ATLANTIC MERIDIONAL OVERTURNING CIRCULATION

It is the system of currents in the Atlantic Ocean that brings warm water up to Europe from the tropics. The climate change effects this process by deluding the salty sea water with fresh water in warming it up.

The Atlantic Meridional Overturning Circulation (AMOC) is crucial to the world's climate. It moderates the intensity of Atlantic hurricanes and lessens the droughts in North America. Because of climate change the AMOC conveyor belt will eventually stop. The stop of the conveyor belt will result in an increase of drought in North America and an increase of hurricanes and their intensity.

Hannah



This image shows the current in the Atlantic Ocean today. The red line shows salty water in the upper layers of the ocean northwards from the Gulf of Mexico. The blue line shows denser water that sinks and returns southwards towards the equator at much deeper depths.

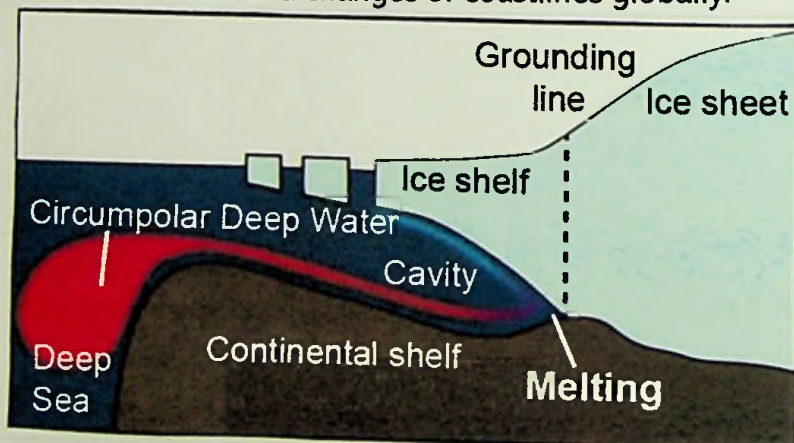
Hannah



# WEST ANTARCTIC ICE SHEET INTEGRATION

Hannah

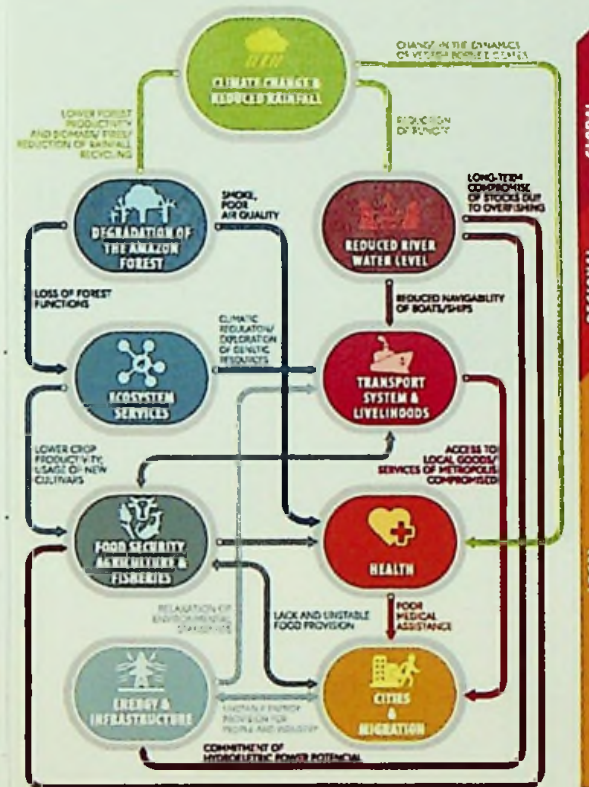
This area makes up one third of the regions in Antarctica. Even a small loss of the ice that makes up the West Antarctic Region, would drastically change the coastlines around the world. Around the world sea levels would rise about 3.3 meters. Due to climate change in the last quarter century the loss of ice has tripled, there has already been a change in coastlines around the world due to this loss. This problem is too far gone that no solution will save us from inevitable rise in sea levels and changes of coastlines globally.



# AMAZON RAINFOREST DIEBACK

Hannah

The Amazon Rainforest is the largest rainforest in the world. In being the largest rainforest in the world it



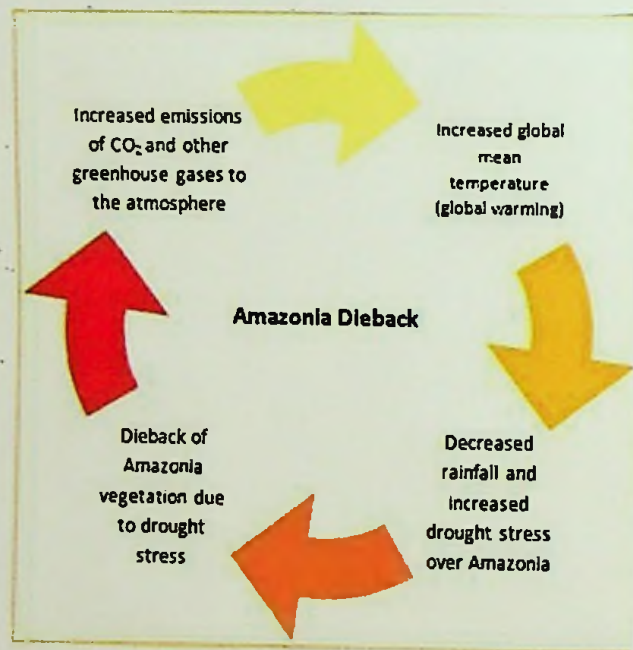
helps the regulate the moisture of the atmosphere. The Amazon rainforest doesn't only regulate the locale climate but plays a huge role in the global climate. The effects that

climate change has on the Amazon Rainforest has a domino effect. Climate change has already affected the



amount of rainfall that the Amazon has received, this has reduced the river water level which in the long term will affect food security, agriculture, and fisheries.

Another example of the domino effect is the degradation of the Amazon Forest, causes a loss of forest functions that affects the ecosystem, then the loss of forest function affects the transport system and livelihoods. Since the access to local goods will be compromised the migration of the cities surrounding the forest will be affected.



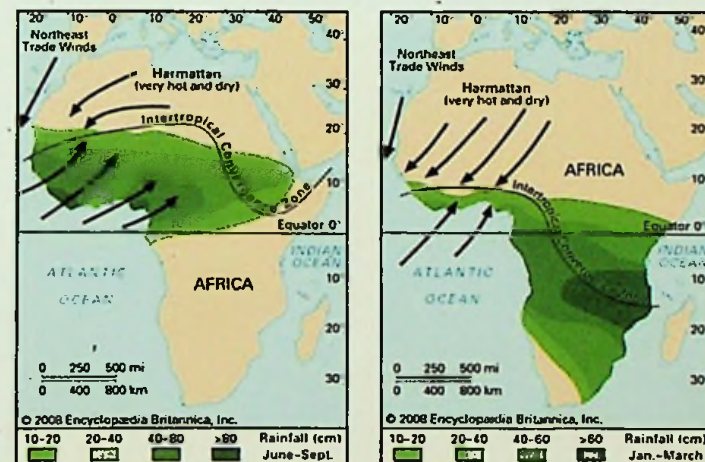
Hannah

### West African Monsoon Shift

West African monsoon is a major wind system that affects West African regions and is identified by winds that are blown in from the south west regions during warmer months and then from the north east during cooler months of the year.

West African monsoon's are notably unreliable. Between the late 1960s and 1980s, a lack of rain hit most of the Sahel, and average rainfall was declining by more than 30% over the region compared to in the 1950s. This resulted to the region to experience a drought, causing to a famine that killed tens of thousands of people.

Warm ocean temperatures reduced the temperature contrast between the continent experiencing a hot summer and the cooler surrounding waters. It was soon realized that the monsoon rains shift southwards away from the Sahel, causing the drought. This effect was assisted by the "climate-vegetation feedback", where the drier conditions caused low vegetation growth, a reduction in evapotranspiration and even less rainfall.



Vasia



The theory suggests that a warming climate could probably bring more rainfall to the Sahel. As the land heats up faster than the tropical waters, rising global temperatures could actually strengthen the land and sea contrast that helps drive the WAM northwards each year. This could bring more rainfall to the Sahel and hopefully bring the growth and reproduction of vegetation to some southern parts of the Sahara.

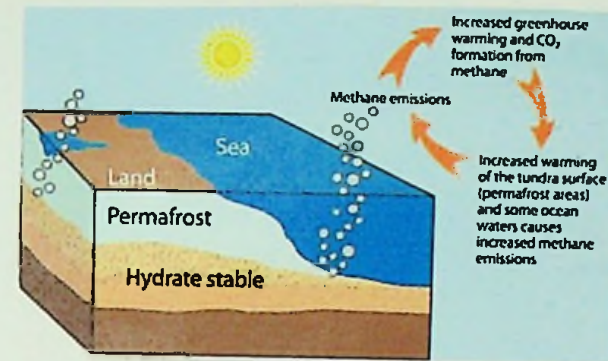
Some more research has suggested that the WAM could be affected by another tipping point – a significant slowdown of the “Atlantic Meridional Overturning Circulation (AMOC). Evidence comes from paleoclimate data from the end of the last ice age, says Prof John Chiang, who runs a climate dynamics research group at the University of California, Berkeley. “In particular for the Younger Dryas event when the AMOC was thought to slow down dramatically because of the influx of freshwater into the North Atlantic,” he tells Carbon Brief. “West African monsoon rainfall weakened during this period.”

Its still unknown why the slowdown of AMOC is causing weakness for Western African Monsoons.

The main two components of the African Monsoons are the West African Monsoon, which prevails during the Northern Hemisphere Summer (June through September), and the East African Monsoon with rains during spring (MAM) and autumn (OND).



Permafrost and methane hydrates



Permafrost is the name given to ground, soil, or rock that contains ice or frozen organic material that has remained at or below 0C for at least two years. It covers around a quarter of the non-glaciated land in the northern hemisphere – including large swaths of Siberia, Alaska, northern Canada and the Tibetan plateau – and can be as much as a kilometer thick. In the southern hemisphere, permafrost is found in parts of Patagonia, Antarctica and New Zealand’s Southern Alps. Submarine permafrost also occurs in shallow parts of the Arctic and Southern oceans.

As the temperature starts getting higher, there is a very high risk that permafrost will thaw. This brings microbes in the soil outside, allowing them to break down the organic carbon in the soil. This process releases CO2 and methane. The thawing of permafrost has the potential to cause further climate warming.

Permafrost thawing is irreversible, Wiltshire notes. The carbon in the soils has built up over incredibly long periods of time. Once its in the atmosphere, there is no getting it back.

Related to permafrost are methane hydrates, or “clathrates”. It’s an ice-like substance formed when methane and water combine at low temperatures and moderate pressure. It’s found under the seafloor on continental shelves where the water is shallow.

Methane hydrates have been called a potential “methane bomb” in the Arctic. It suggests that ocean warming could melt these ice crystals, releasing vast amounts of methane into the atmosphere.



# INDIAN MONSOON SHIFT

- India receives around 70% of its annual rainfall during the monsoon season.

- The contrast in heating between the land and ocean causes a pressure gradient that drives southwesterly winds across India.

- The monsoon rains are crucial for India's farm sector, which makes up about a sixth of India's economy and employs about half of the country's 1.3 billion population.



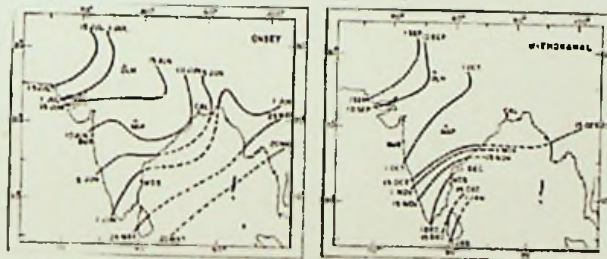
Marino

# INDIAN MONSOON SHIFT

- While the observed record for the strength of the Indian monsoon shows a lot of variability, it does suggest a negative trend since 1950. This amounts to a rainfall decline of around 10% in central India

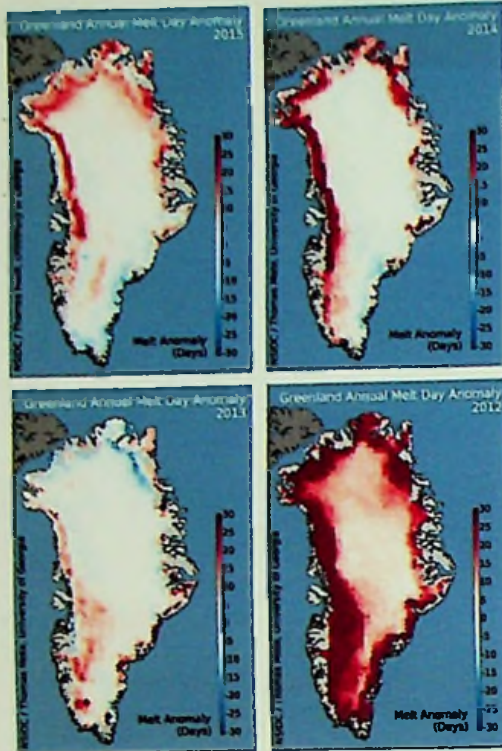
- A potential cause could be air pollution - from India itself and the wider region

- The maps below show the average monsoon onset (left) and withdrawal (right) dates across India.



Marino





## GREEN Land ice melt

Greenland's ice sheet is the 2<sup>nd</sup> largest ice sheet on earth. It holds enough water to rise the sea level by almost 24ft if it all melted, that would affect the coast lines around the world dramatically. Each year the sea level raises 0.7mm. Most of the ice melt comes from the surfaces because of warmer weather and the sun's energy.

Luke

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My biggest concern with climate change is the rising sea levels with this picture of Florida all of Miami would be under water with the sea level rising 6 meters or 20 feet. If this were to happen this would put a spot where a grew up and live completely under water.

## If Sea Levels Rise

60 m sea level rise: North America



If the sea level were to rise 60m this would put our city that most of us call home under water

Luke

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## The boreal forest shift

The boreal forest makes up about 30% of the world's forest and is the world's biggest ecosystem. It is in the northern hemisphere where it is extremely cold but with climate change it is rapidly rising in temperature. The boreal forest is now being threatened by fires droughts pests and diseases. Many specialists think with the climate rapidly changing the boreal forest could turn into woodlands and grasslands turning the world's largest carbon producers into nothing but fire hazards

Luke

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## Our Final Thoughts

If we don't act soon to change the damage that we have done, it will be too late!

