The ITCZ and Monsoons!

Until recent decades, Monsoons were considered to be regional cycles of wet/dry, probably driven by rising air over mountains sucking moist air from the oceans into the flatlands. They just happened.

Cambodia January, 2023 - farm the land in dry season, fish when it rains…

This enormous lake rises perhaps 30 feet.

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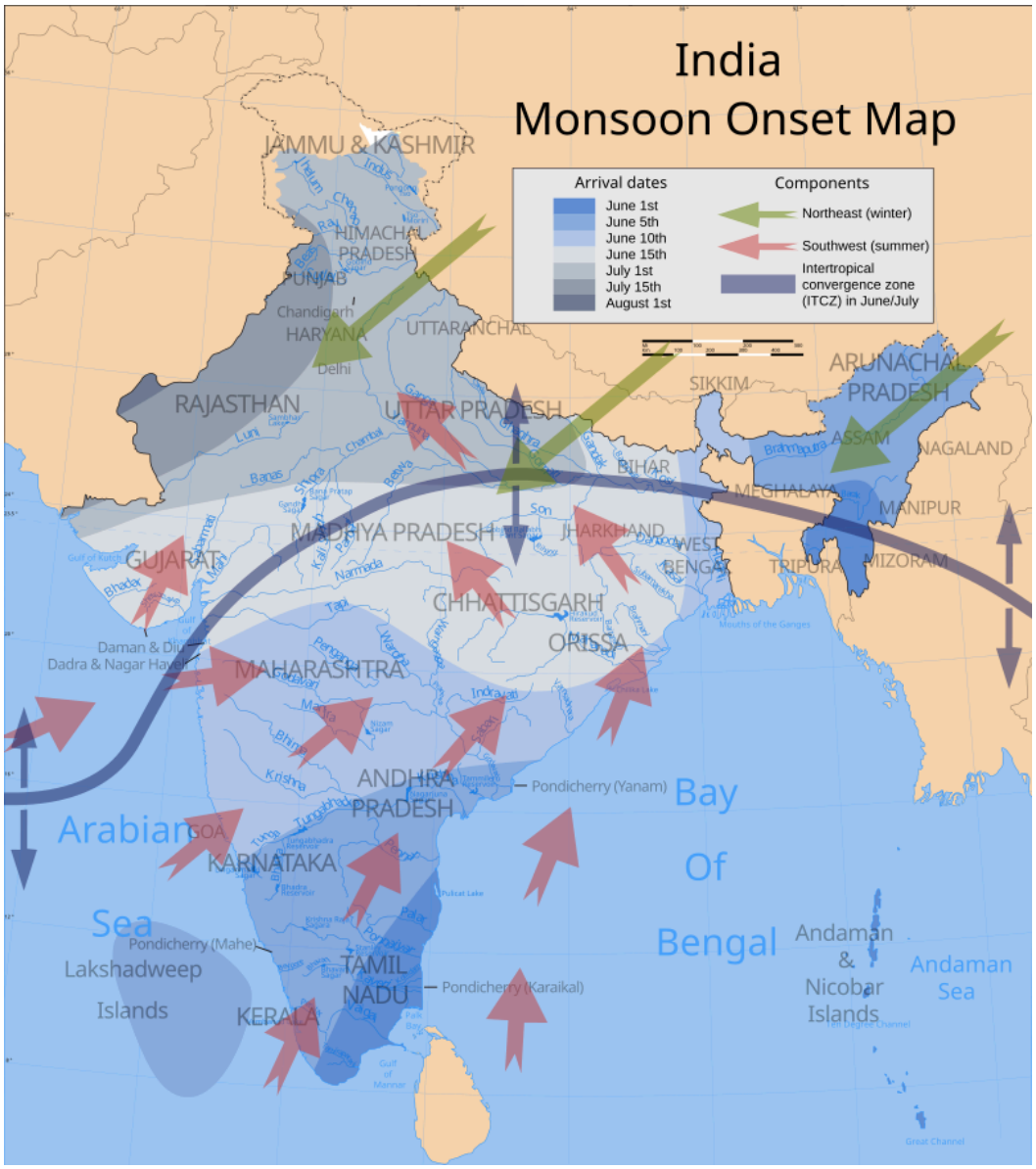


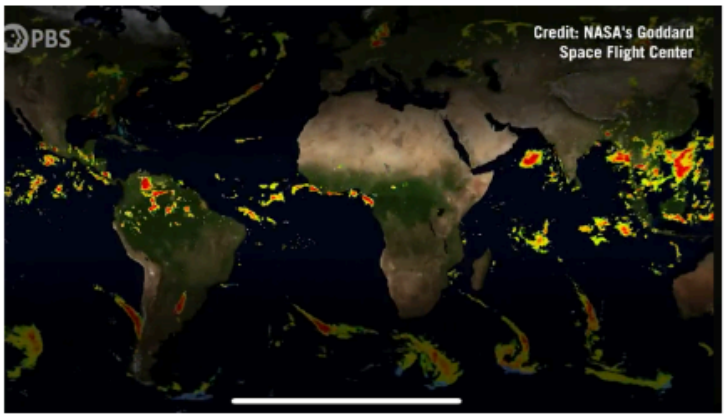
The massive monsoon cycle in India - It just happens….

The Monsoons are now cited as one of the **possible near-term tipping points**. See my **Timing and Impacts Study** at [Timing and Impacts Study - Latest Update](#) **page 19.** We now understand that the major monsoons are part of the global system

Tipping Point #3
Global Monsoons

(Could tip as soon as 2-3 ^{O}C)
Possible by Midcentury ±

Already experiencing regional disruptions of crop monsoons. Will have **major impacts on productivity and human wellbeing**.



The Elements of a Monsoon from Wikipedia https://en.wikipedia.org/wiki/Monsoon

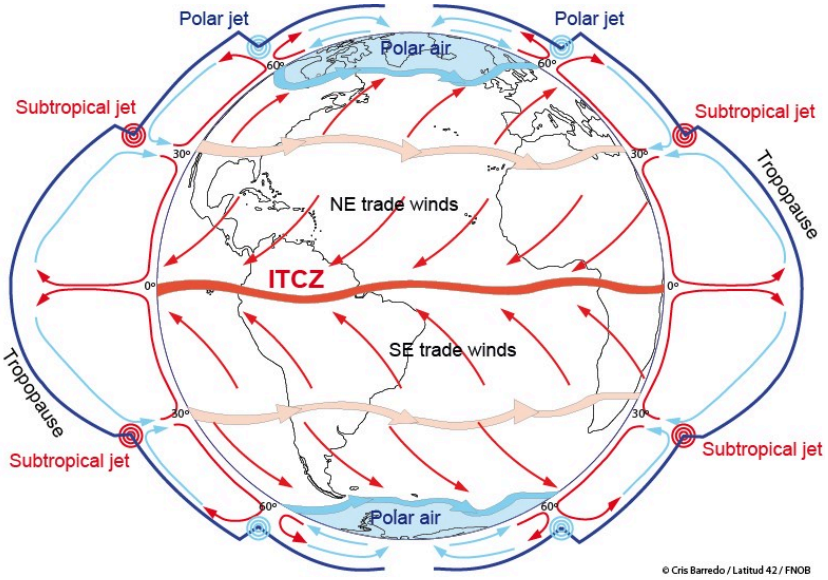
A **monsoon** (/mɒnˈsuːn/) is traditionally a seasonal reversing wind accompanied by corresponding changes in precipitation[1] but is now used to describe seasonal changes in atmospheric circulation and precipitation associated with annual latitudinal oscillation of the **Intertropical Convergence Zone** (ITCZ) between its limits to the north and south of the equator. Usually, the term monsoon is used to refer to the rainy phase of a seasonally changing pattern, although technically there is also a dry phase. The term is also sometimes used to describe locally heavy but short-term rains.[2][3]

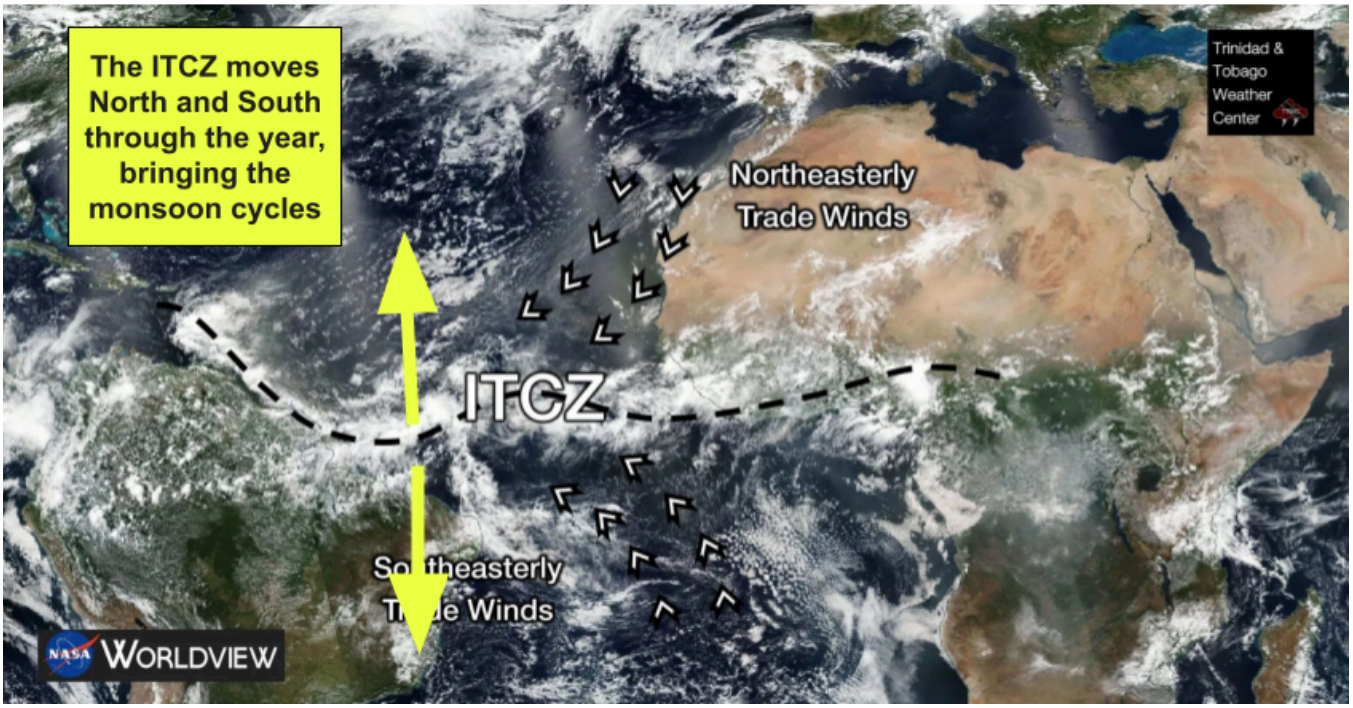
Let's look at the fundamental science behind the major monsoons. Until a global picture was developed, they were discussed regionally, e.g., Indian Monsoon. With modern measurements, **the global picture around the ITCZ was developed.**

The Inter-Tropical Convergence Zone (ITCZ) appears as a band of clouds consisting of showers and occasional thunderstorms that encircles the globe near the equator. The solid band of clouds may extend for many hundreds of miles and is sometimes broken into smaller line segments.

Its existence is due to the convergence of the trade winds: winds in the tropics that move predominantly from the east and curve towards the equator. When: the northeast trade winds from the Northern Hemisphere and the southeast winds from the Southern Hemisphere come together, it forces the air up into the atmosphere, forming the ITCZ.

Monsoons were once considered as a large-scale sea breeze[32] caused by higher temperature over land than in the ocean. This is no longer considered as the cause and the monsoon is now considered a planetary-scale phenomenon involving the annual migration of the Intertropical Convergence Zone between its northern and southern limits.

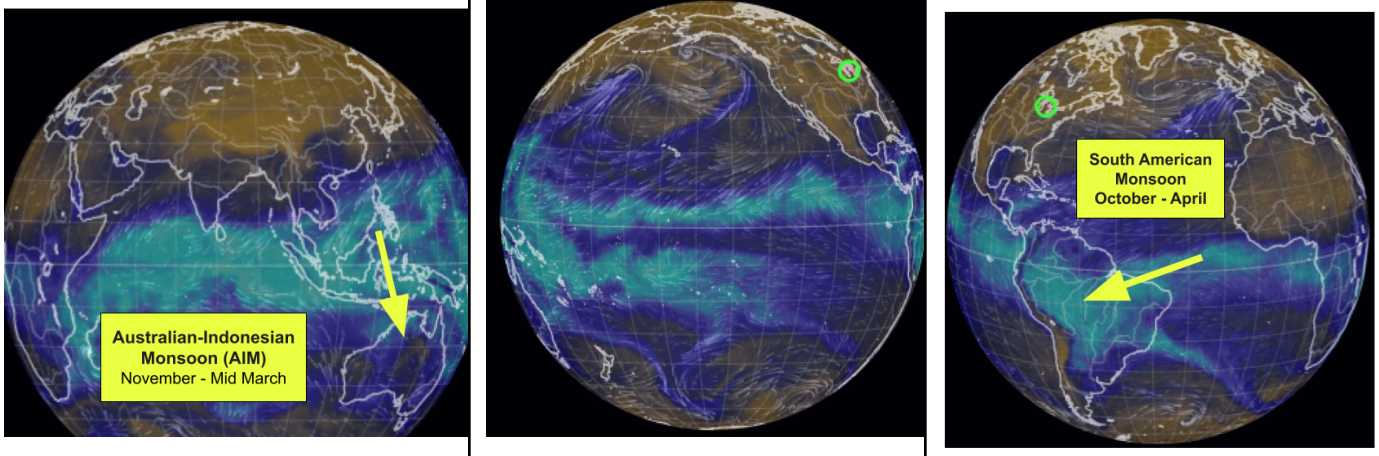




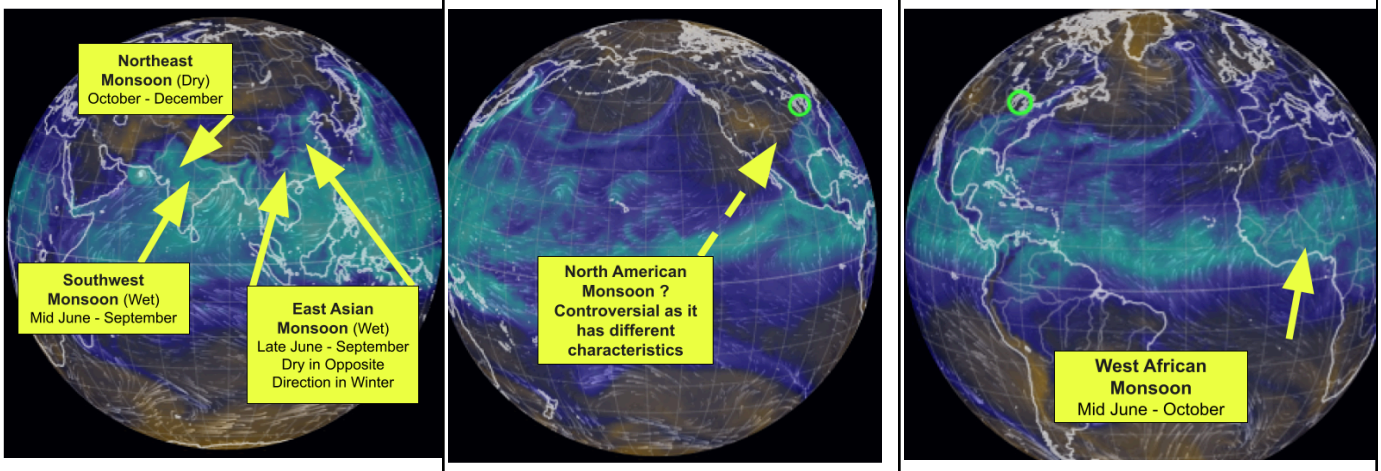
Look at Total Precipitable Water (TPW) on Earth Nullschool [Earth Nullschool]

The key is to notice **the green zone (Total Precipitable Water - TPW) moves up and down**. In the NH Summer, the InterTropical Convergence Zone centers around 10^0 NORTH. In the NH Winter, it rests around the equator. [More land in the NH means more summer heating, so the zone moves North.] The ITCZ is WET and RAINY! **This is the origin of the "real" monsoons**.

InterTropical Convergence Zone (ITCZ) - **NH WINTER** 1/1/24



InterTropical Convergence Zone (ITCZ) - **NH SUMMER** 8/31/24



Here's some other useful references:

Where the major monsoons occur around the planet
https://upload.wikimedia.org/wikipedia/commons/transcoded/0/0c/Monsoons_Wet%2C_Dry%2C_Repeat.webm/Monsoons_Wet%2C_Dry%2C_Repeat.webm.720p.vp9.webm

Monsoon - Wikipedia

This Video is short and very helpful.

PUNCHLINE

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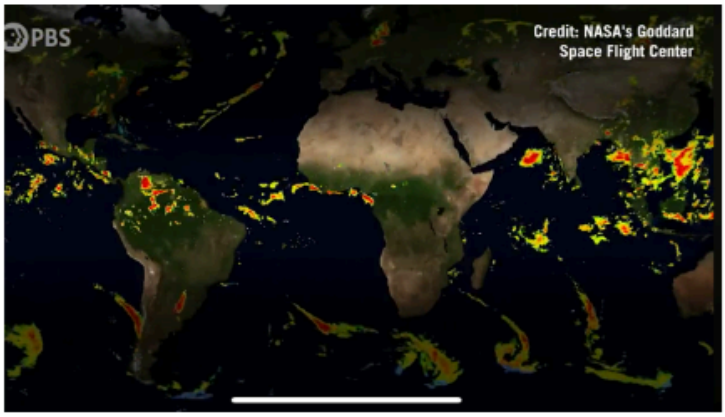


Warming will cause at least two critical changes:

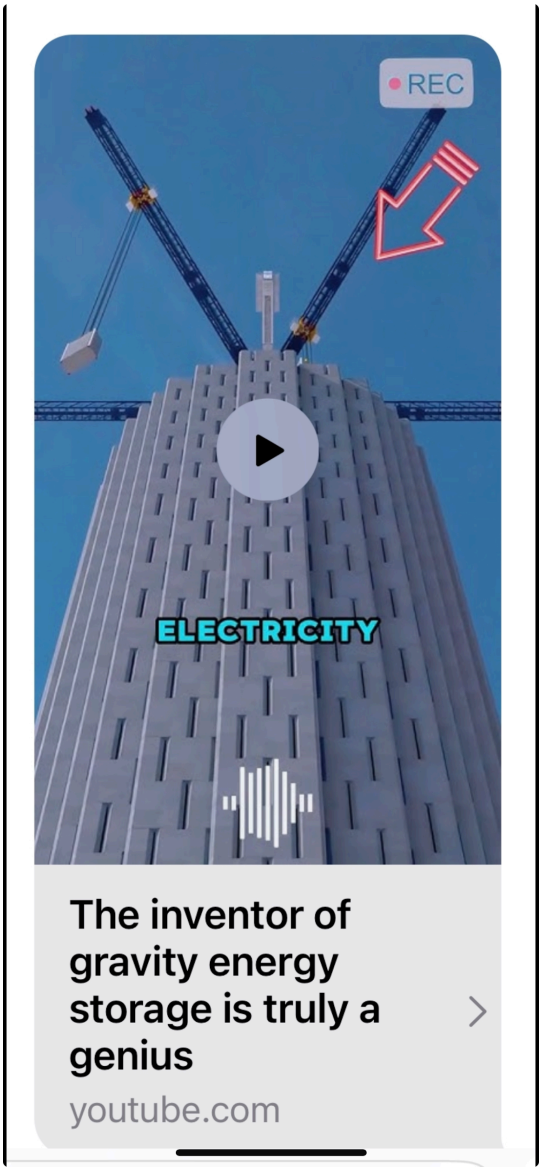
- The position and timing of the monsoon cycles, on which global agriculture is designed, may change in very disruptive ways
- The moisture content will increase (7% per ^{0}C) which will result in more rain and more intense rains → flooding and destruction of crops.

The timing of possible tipping point (irreversible changes) could be around mid-century, if emissions are not stopped.

Approximate "Cheat Sheet":

1 meter → 3 feet **1 degree Celsius (°C)** → 2 degree Fahrenheit (°F)
ppm = parts per million CO_2 = Carbon Dioxide
1 tonne = 1000 kilograms = 2205 pounds **1 gigatonne (1 Gt)** = 1 billion tonnes
1 trillion tonnes (1Tt) = 1000 gigatons

GOOD NEWS CORNER



[The inventor of gravity energy storage is truly a genius - YouTube]

Our Natural World

Marmoset monkeys call each other by name, study suggests

Marmoset monkeys use a high-pitched "phee call" to name other monkeys, one of a short list of animals known to deploy names.

▶ **Listen to article**

Researchers analyzed the "phee calls" between pairs of marmoset monkeys and found that they give each other names. This mother and daughter marmoset were given the names Bhumi and Belle by humans. (David Omer)

By Carolyn Y. Johnson