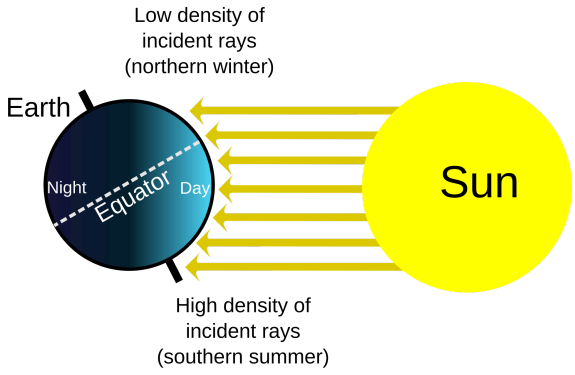
Some Heartbeats of the Planet

Last week's treatment of the InterTropical Convergence Zone (the ITCZ) was a breakthrough of sorts. Monsoons, which have been mysterious for millenia, have been revealed by modern satellites and science to be a global "Heartbeat" (my term).

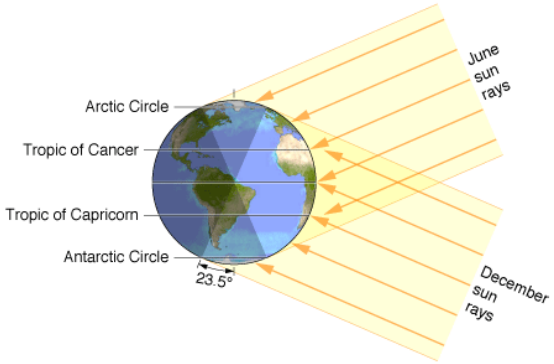
This week we'll look at several of these Heartbeats.

The pulse rate is not one beat per second, but one per year. The driver is the SUN. Its energy is centered on the equator, but this varies seasonally.

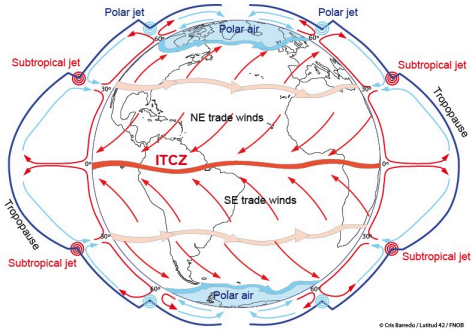
Because the globe axis is tilted with respect to the sun, the equator is only the center of average heating over the year

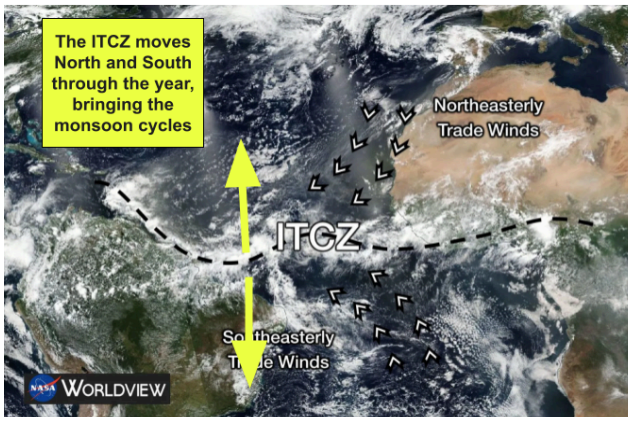


Seasonally, the incoming energy shifts north and southwards from the equator



The Inter Tropical Convergence Zone is where the winds and weather intersect from the hemispheres, based on their relative warming





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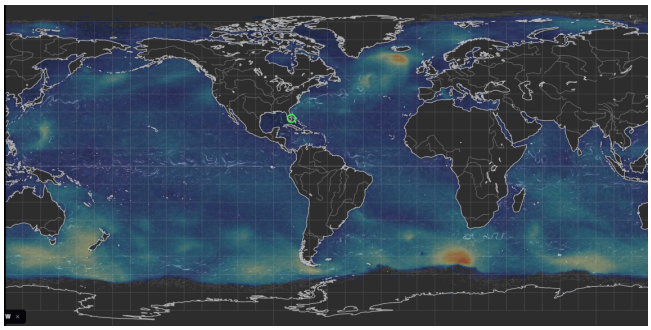
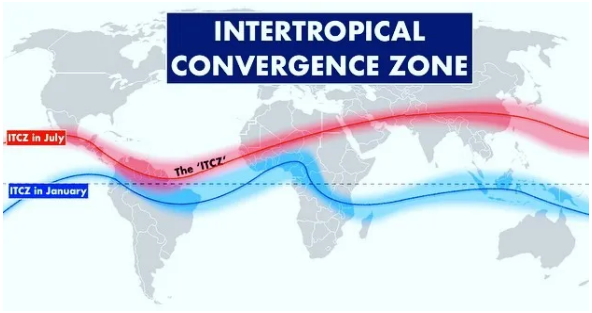
Notice that MOST of the land is in the Northern Hemisphere

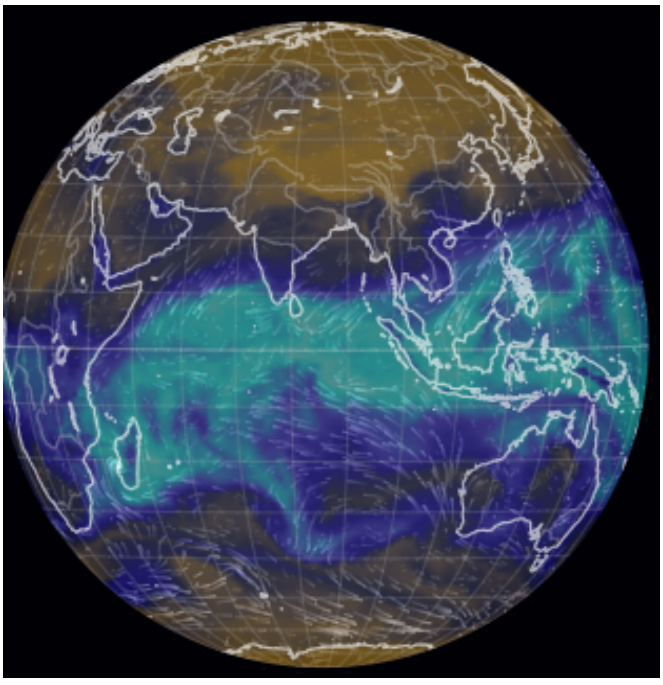


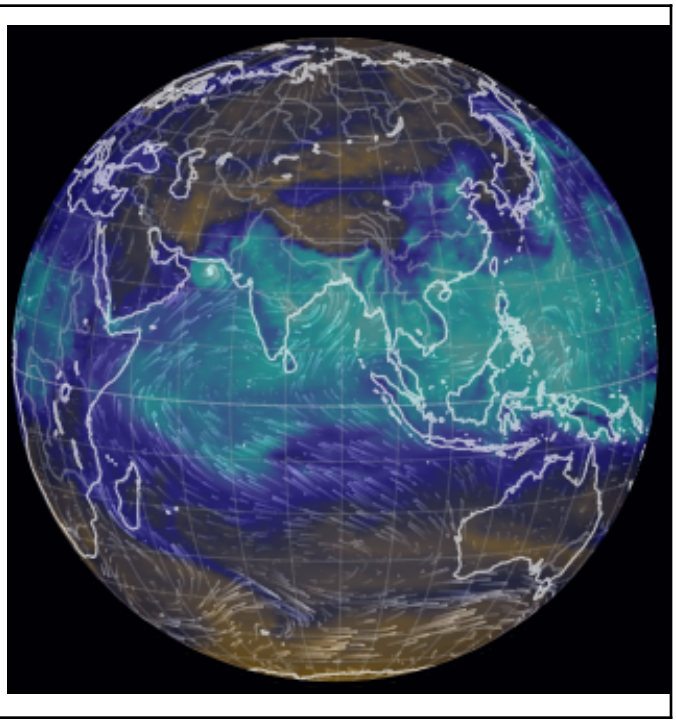
Since land heats up much more quickly than the ocean, **The ITCZ and energy-related planetary pulses can cycle globally** and respond to more heat in the northern hemisphere



MONSOONS

In CSSG-2.39 we got our first look from Earth Nullschool of moisture shifting N←->S annually with the ITCZ. Focus on India to see how dramatic the shifting ITCZ can have on moisture:



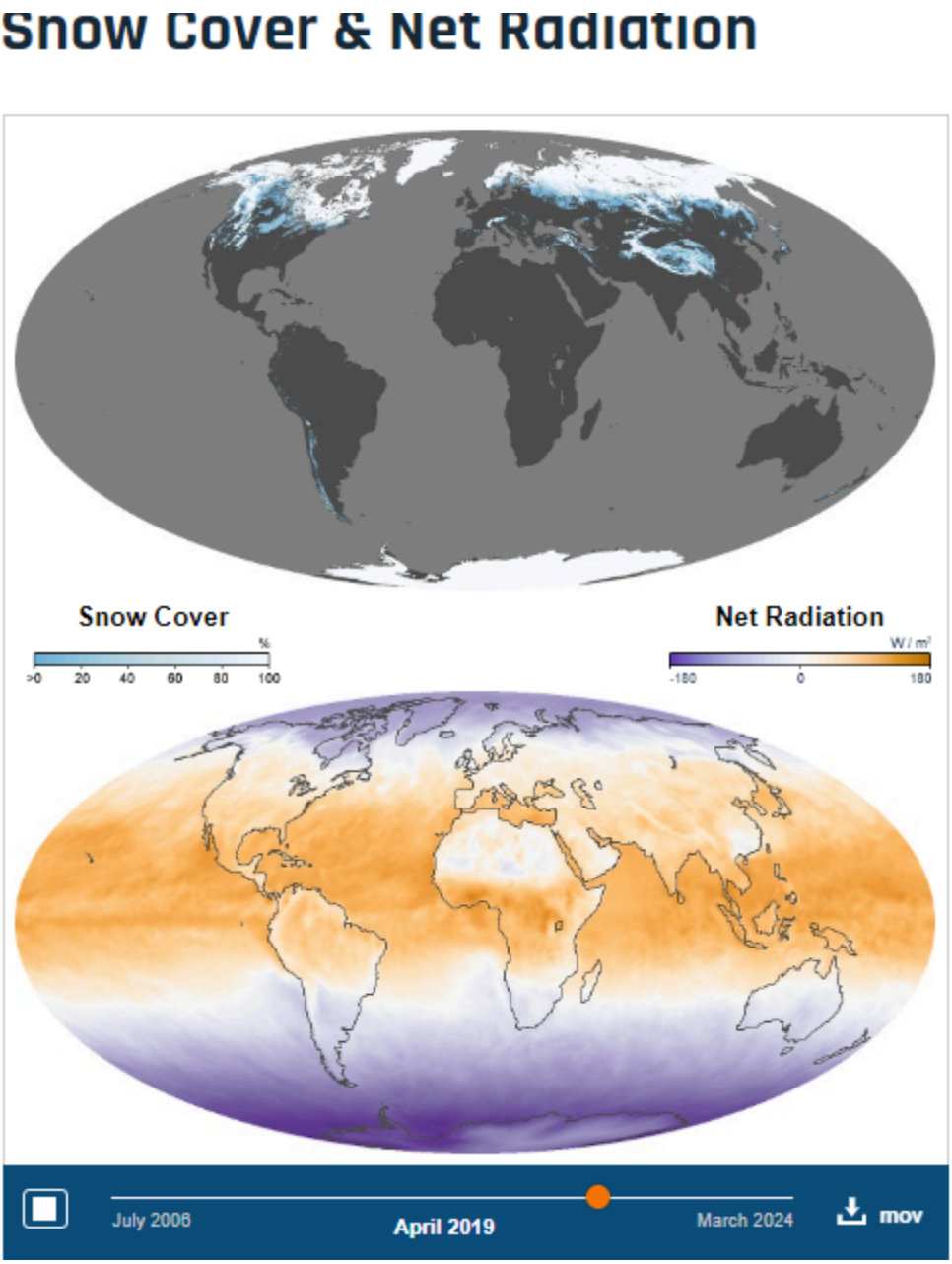


While Earth Nullschool is fantastic for looking at real-time and specific date information, this week I discovered a site which shows the **Heartbeats in animations** from the data.

Global Maps from NASA

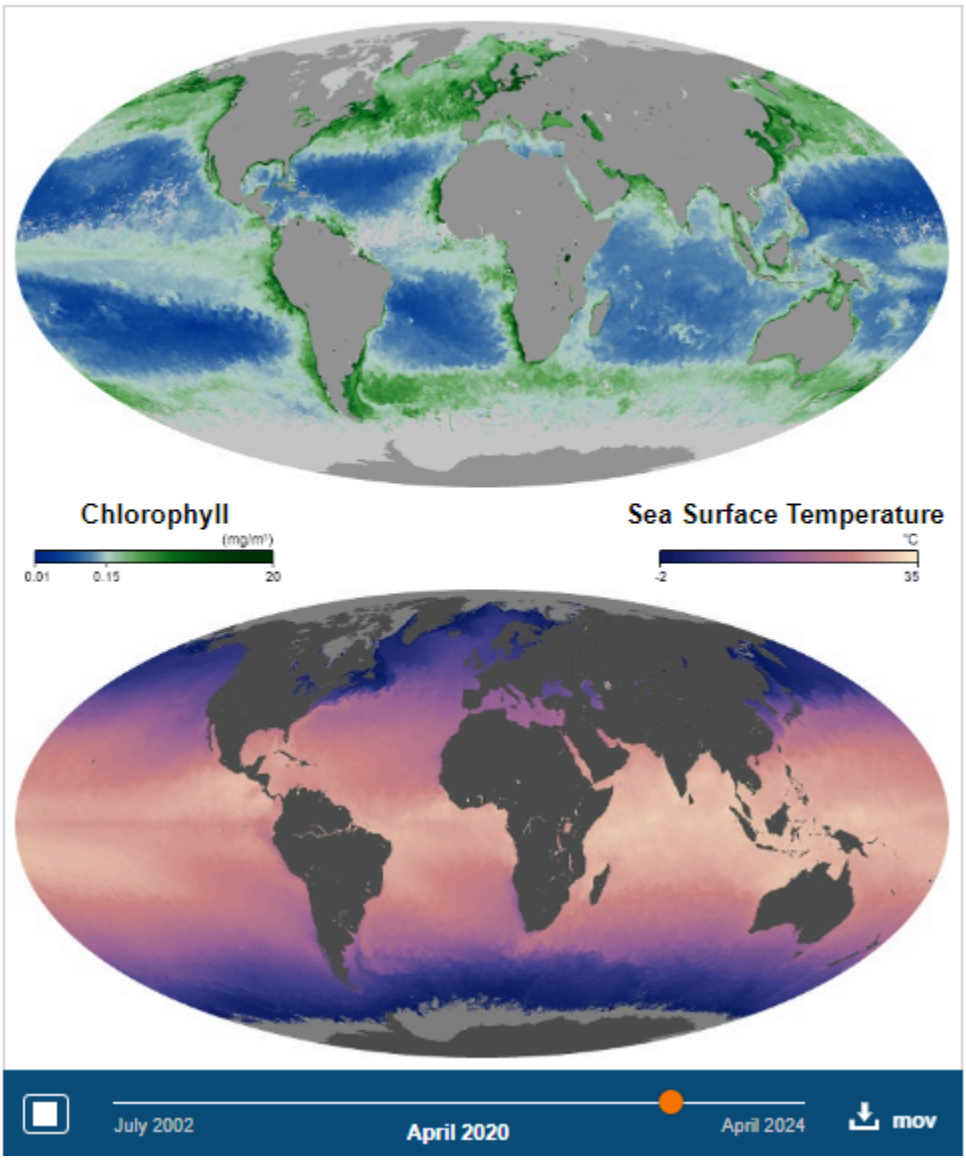
A large number of “Maps” are provided and I encourage everyone to spend a little time playing with this site. Here’s a sample:

We'll take some time to play a few… Let's start with probably the most obvious visual impact of the changes in incoming sunlight - Snow cover. The site allows us to look simultaneously at the net radiation over the years.



Snow Cover & Net Radiation

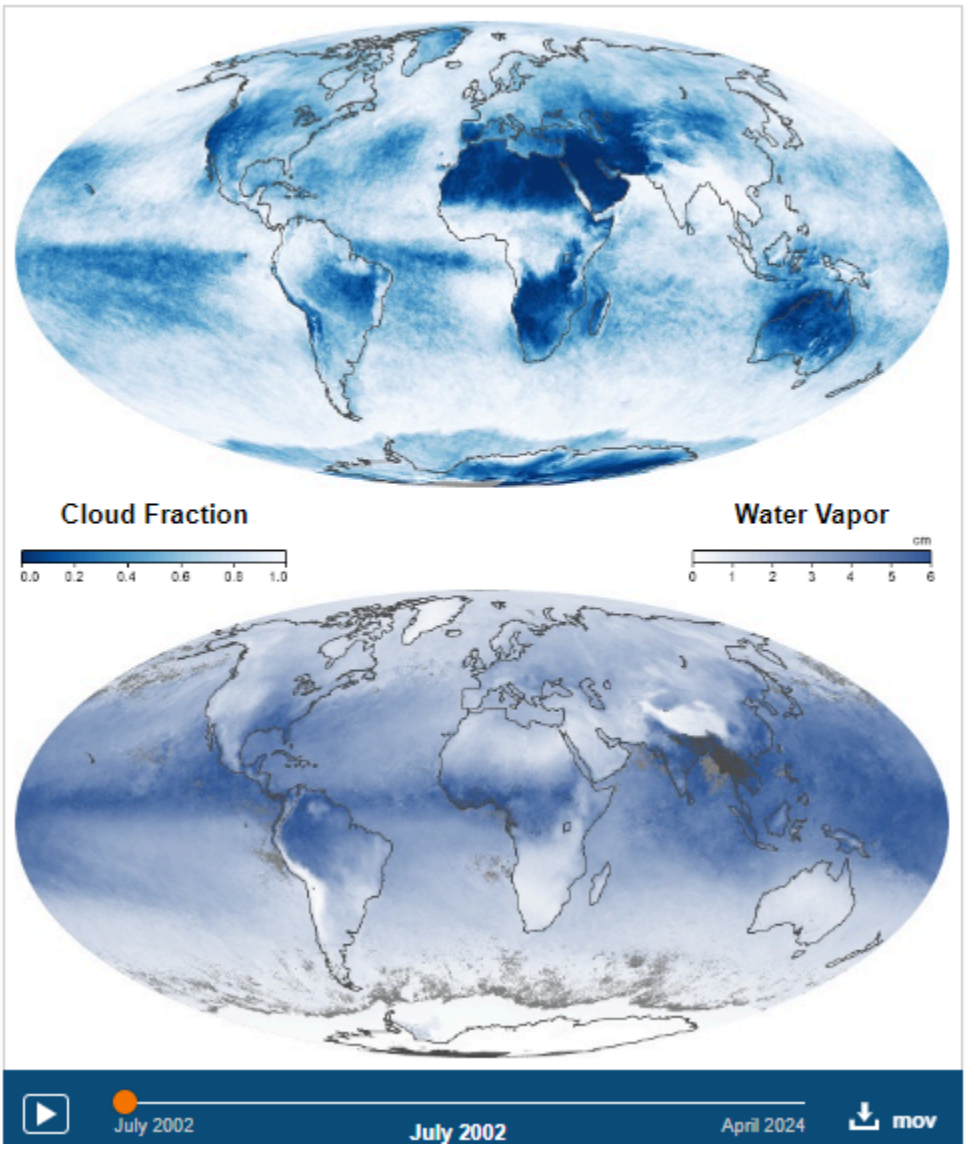
Chlorophyll & Sea Surface Temperature



[Chlorophyll & Sea Surface Temperature]

At the base of the ocean food web are single-celled algae and other plant-like organisms known as phytoplankton. Like plants on land, phytoplankton use chlorophyll and other light-harvesting pigments to carry out photosynthesis, absorbing atmospheric carbon dioxide to produce sugars for fuel. Chlorophyll in the water changes the way it reflects and absorbs sunlight, allowing scientists to map the amount and location of phytoplankton. These measurements give scientists valuable insights into the health of the ocean environment, and help scientists study the ocean carbon cycle.

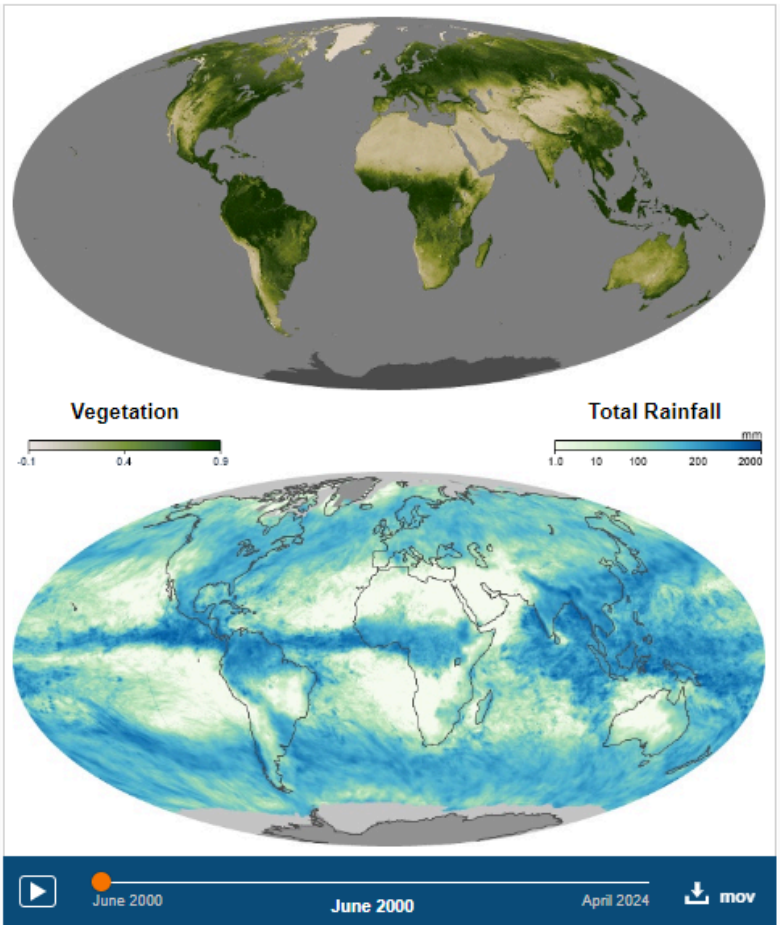
Cloud Fraction & Water Vapor



[Cloud Fraction & Water Vapor]

The comparison of global cloudiness and water vapor shows that year-round, the tropics are both the cloudiest and the most humid zone. This pattern makes sense because tropical latitudes receive the Sun's most direct rays for more of the year than higher latitudes, and the steady sunlight and warmth fuel evaporation from the ocean. On land, tropical forests release water vapor during photosynthesis. Because of this steady heating and evaporation, air over the tropics is usually warm, moist, and buoyant. It rises high into the atmosphere, where it cools, and clouds form.

Vegetation & Total Rainfall

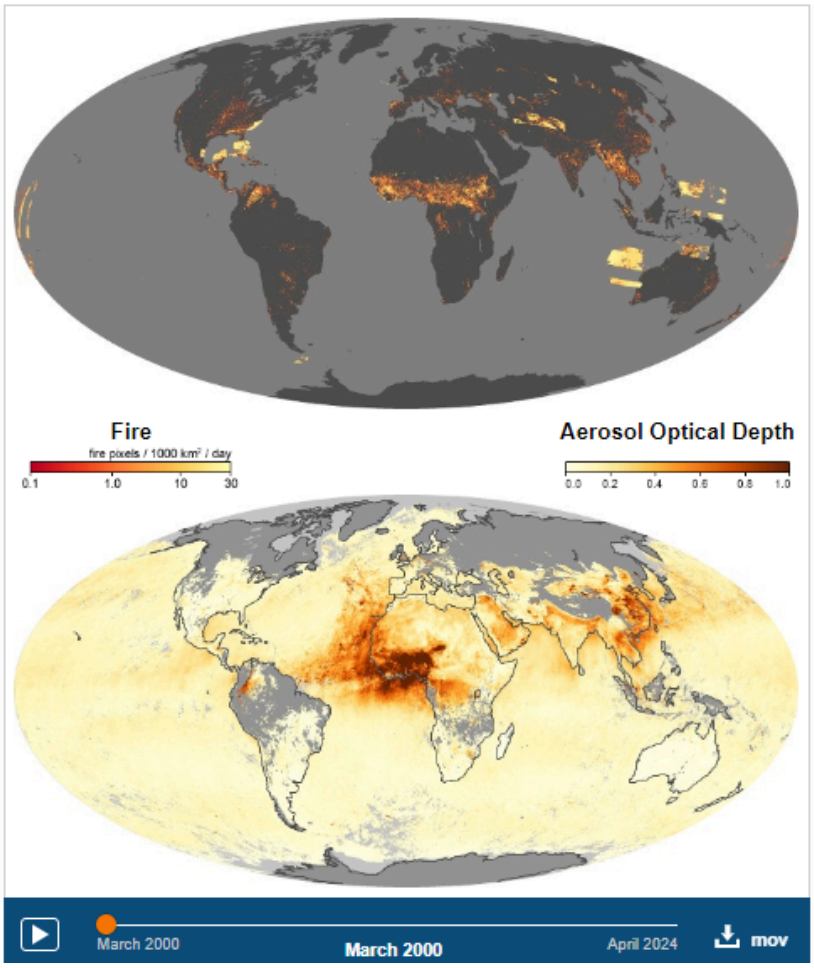


Vegetation & Total Rainfall

The relationship between rainfall and vegetation is pronounced in southern Africa and southern Asia. A belt of seasonal rains encircles the globe near the Equator. In, June, July, and August, when the rains move north of the equator, Africa's Sahel region (a grassland-savanna landscape south of the Sahara Desert) is dark green, alive with growing plants. As the rains move south in September, the vegetation follows. The plants that had been growing in the Sahel fade, while southern Africa comes to life. Likewise, the Asian monsoon controls plant growth in India and Southeast Asia. The seasonal rains and accompanying green-up begin first in Southeast Asia in April or May, and extend westward into India by June or July. Rains and vegetation begin to fade in late autumn.

In other ecosystems the connection between rain and plant growth seems counterintuitive. In South America, savannas and grasslands of the southern part of the continent are greener when it rains. But in the heart of the continent, the Amazon Rainforest is greenest during the driest months (June-September). This pattern is because the forest has a steady supply of groundwater all year, so it grows best when the rain clouds are thin enough to let sunlight through.

Fire & Aerosol Optical Depth



[Fire & Aerosol Optical Depth]

The comparison shows the places and times of year in which fires play a major role in aerosols. For example, fire counts and aerosols increase in tandem across South America from July through September, and taper off in tandem in October. This pattern is due to land clearing and agricultural fires that are widespread across the Amazon Basin and Cerrado regions during the dry season. A similar relationship is apparent in Central America (March-May), central and southern Africa (June-September, and Southeast Asia (January-April).

In other cases, however, aerosol concentrations rise in the absence of significant fire activity. For example, from May through August each year, aerosol amounts rise dramatically around the Arabian Peninsula and nearby oceans, even though there is no significant fire activity in the vicinity. Here, dust storms are the likely source of the aerosols. An arc of elevated aerosol amounts at the foothills of the Himalaya Mountains in northern India in some months when fire activity is minimal (for example, November 2006) is an indication that urban or industrial air pollution is playing a role.

PUNCHLINES

I think the most serious idea from this is that **regional climates are not just isolated things**. The deeper picture is that there is a **global climate - the Heartbeats of the Planet.**

Perhaps the system needs to understood in parts:

- **Earth's Energy Imbalance and what can impact it**
- **The Heartbeats**
- **The Circulatory systems moving the energy around**
  - **The global conveyor belt, including the AMOC**
  - **The atmospheric cells**
  - **the jet streams and atmospheric rivers**
  - **The vertical construction of the atmosphere**

Etc.

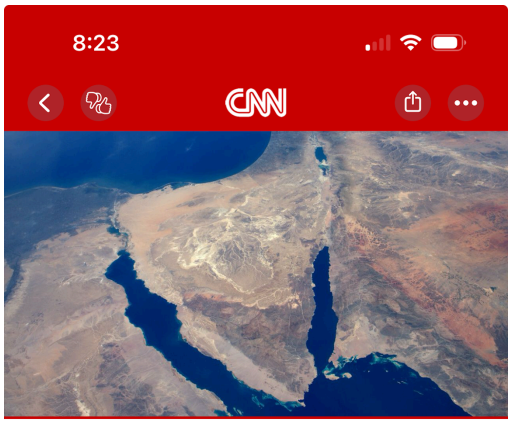
Worth thinking through…..

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

https://apple.news/AbHIzdEulTIutZb9s9xz7cA



The controversial plan to turn a desert green

Laura Paddison, CNN

9:00 AM EDT September 8, 2024

Ties van der Hoeven's ambitions are nothing if not grand. The Dutch engineer wants to transform a huge stretch of inhospitable desert

Our Natural World