What El Nino Will Do to Earth in 2024
https://www.youtube.com/watch?v=mggRl80WzbE
Transcript: https://dontveter.com/ec/enso.pdf

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Life on Earth is full of cyclical variations. We have day and night, the changing of the seasons and the ebb and flow of the tides.

Many of these changes happen over relatively short periods and can be predicted with precision.

But other cycles affect our planet over larger intervals and can be trickier to forecast.

In a previous video, I discussed the role Milankovitch Cycles play in the occurrence of Ice Ages interrupted by warming intervals, but given the vast timescale, it's unlikely our own lives will be very much affected by them.

Yet there is one climate cycle that definitely will affect you – the El Niño Southern Oscillation, better known as El Niño and La Niña.

While El Niño and La Niña originate in the Pacific Ocean, their impacts are felt nearly everywhere on Earth, and by some accounts, the strongest effects are getting more common.

In the last few decades, some of the destructive consequences have included flooding, drought, famine and mass-die offs of marine life.

Indeed, a severe El Niño in 1998 caused an estimated 16% of the world's coral reefs to die, kicking off a cataclysmic mass-bleaching event that persists to this day.

The ENSO is global and will, without a doubt, impact you. So, what are El Niño and La Niña?

Why are they linked? And what are their global impacts?

I'm Alex McColgan, and you are watching Astrum. Join me today as we look at a fascinating climate cycle that became the stuff of legend centuries before we had the science to explain it.

If you think the name El Niño sounds more like a folk story than a scientific phenomenon, you're onto something.

During the 17th century, fishermen noticed periods of warmer water and poor fishing that would peak around Christmastime.

They called it, "El Niño de la Navidad," which means "The Boy of the Nativity," or "The Christmas Child."

It wasn't until the late 19th and early 20th centuries that scientists began to connect a variety of seemingly disconnected regional events scattered across the planet.

By the mid-20th century, they found that these weren't regional occurrences, but phases of a global cyclical phenomenon called the El Niño Southern Oscillation.

The ENSO fluctuates with an average interval of 5 years, although the cycle can take anywhere between 2 and 7 years.

We've now been tracking these cycles for decades, but they've been around for much longer than that.

To understand why the El Niño Southern Oscillation occurs, let's first look at what happens in the Pacific Ocean under "normal" conditions. Winds blow along the equator from east to west.

This is a product of the Coriolis Effect, caused by the Earth's rotation.

Here's a fun fact: if the Earth didn't rotate, air would circulate north/south, from the high-pressure poles to the warmer, low-pressure region at the equator.

As it happens, air does circulate off the poles, but it bends as it approaches the equator.

In a circumferential band that extends 30 degrees north and south of the equator, sometimes known as the horse latitudes, air in the Northern Hemisphere deflects to the southwest, and air in the Southern Hemisphere deflects to the northwest.

This channel of westward-moving air is called the trade winds.

It turns out they're not just important if you're a pirate living in the 18th Century.

As the trade winds blow westerly across the Pacific Ocean, they drag warm water from coastal South America toward Asia.

And as this warm water moves west, colder water rises to replace it, a phenomenon called upwelling.

This cold water is rich in nutrients that feed phytoplankton, which, in turn, support ecosystems of fish and everything that feed off them.

So, as you can imagine, a shock to this system would have major domino effects on marine life.

If this is what normal conditions look like in the Pacific Ocean, think of El Niño as a disruption of "normal."

During El Niño, the trade winds weaken. As they slow down, warm water that would be flowing toward Asia builds up instead near the coastal Americas, resulting in less upwelling cold water.

This, in turn, creates a zone of warm air and water further East in the Pacific.

With less upwelling, the fish that feed off the phytoplankton migrate or die.

The Pacific Jet Stream that crosses North America moves south from where it normally occurs.

As a result, the northern United States and Canada tend to become warmer and dryer, whereas the Gulf Coast and large parts of Coastal South America become wetter.

Peru and Ecuador receive their wettest months from April to October, and during more severe El Niño years, rain and flooding in those regions can be catastrophic.

In the severe El Niño of 1997-98, devastating floods bombarded Peru, collapsing bridges and burying entire shantytowns under a meter-thick layer of mud.

In total, a quarter of a million people were displaced from their homes.

The region of Tumbes, which is normally arid, received an unbelievable 16 times its average annual rainfall.

Outside the Americas, El Niño sets off a series of domino effects that significantly alters weather worldwide.

The increased rainfall in South America typically coincides with a pronounced period of drought in South Asia and Australia.

Severe famines have been recorded in India, and a delay in Australia's monsoon season can lead to massively destructive bushfires.

Due to its vast expanses of grassland, Australia's bushfires are some of the most destructive on Earth, and there are already concerns about an event that could occur later in 2023.

Leaders are understandably worried, given recent warming trends.

You may remember that in 2020, in a non-El Niño year, bushfires wrought nightmarishly apocalyptic scenes that left 50 million acres of land charred to a crisp.

Australia is a literal tinderbox over which El Niño looms like a proverbial flamethrower, so local officials are wise to prepare for the worst.

On a global scale, the average surface temperature during El Niño rises .1 degree Celsius.

But not all El Niño events are severe, and some can be rather mild – something to keep in mind before you hit the panic button.

The average El Niño lasts from 9 to 12 months, but on rare occasions, they have lasted for years.

The world's climate is a pretty complex system responding to a number of inputs.

So, the effects of El Niño are best understood as relative to what the baseline would be, which is why no two El Niño years are alike.

La Niña is the opposite side of the El Niño Southern Oscillation.

If El Niño is a hot event, then La Niña is a cool one (although some regions do experience warming).

As I mentioned earlier, El Niño occurs when the equatorial trade winds slacken, but during La Niña, the trade winds become even stronger.

Think of El Niño as a disruption of normal and La Niña as normal-plus.

The trade winds blow even more warm water from Coastal South America toward Asia, resulting in more upwelling of cold, nutrient-rich water near the Americas.

For fisheries, this can produce a feeding frenzy. And if you like salmon, well, you're in luck.

During La Niña, cold-water species, like salmon, will venture into typically warmer waters where they can't ordinarily survive. (The same is also true of squid, in case you prefer calamari.)

Meanwhile in Asia, the influx of warm equatorial water produces wet conditions – the opposite of the drought experienced during El Niño – causing a spike in tropical cyclones.

In North America, the Jet Stream is pushed further North.

This causes drought in the Southwestern United States and rains in the Pacific Northwest.

In 2022, La Niña exacerbated a megadrought in the Southwest United States, making it the worst in 1,200 years.

Just look at this image of Lake Mead, where the Hoover Dam is located.

That light area is the so-called “bathtub ring,” ordinarily covered by water.

Now, with all this talk of trade winds and Jet Streams, you might be wondering how La Niña effects hurricane season.

Well, depending on where you live, the news is either good or bad.

The Atlantic often experiences a much more severe Hurricane season during La Niña, because the shift in the Jet Stream produces greater atmospheric instability in the South Atlantic.

But the Pacific Basin actually sees fewer hurricanes – a sign of how drastically different these regional effects can be.

Just don’t get too complacent, Pacific dwellers. El Niño has the opposite effect as La Niña.

Meanwhile, in Pacific Coastal South America, you won’t see the warm Christmastime waters that once prompted fishermen to dub it “El Niño de la Navidad.”

Indeed, there’s a reason that fishermen once called “La Niña” “El Viejo,” or “The Old Man.”

During La Niña, the weather in Peru and Chile turns colder and dryer, sometimes producing severe periods of drought.

Brazil’s North, on the other hand, becomes wetter during the months from December to February, and the lowlands of Bolivia can receive catastrophic flooding.

In Africa, the conditions in La Niña years are basically the reverse of what they are during El Niño.

East Africa tends to experience drier than average conditions, whereas the south tends to be wetter than average.

So, where are we now in the ENSO cycle? As of the making of this video, the National Oceanic and Atmospheric Administration, or NOAA, has declared an end to a lengthy one and a half year La Niña.

They concluded this based on measuring the difference in surface atmospheric pressure in the Western and Eastern Pacific – a metric known as the Equatorial Southern Oscillation Index, or (EQSOI).

The last reading of the EQSOI was just .1, down from 1 a year ago, meaning conditions have returned pretty much to normal.

It’s still early to say anything definitive, but there are already indications that an El Niño will occur later in 2023.

Currently, the NOAA is forecasting a 60% chance that El Niño sets in by autumn.

This would have major ramifications, and India is already warning its citizens of potential drought conditions.

There’s another reason to expect an El Niño in 2023, albeit based purely on past experience.

Since we started tracking in the 1950s, there has never been more than a 4-year period without an El Niño event, so if there isn’t one in 2023, it would mark the first 5-year gap without one.

For me, this is an excellent example of how studying climate cycles can help us prepare and foster human survival - not just on this world, but potentially on other worlds too.

Because one of the fascinating aspects of the ENSO is the level of insight we gain from it into Earth’s complex climate systems.

Understanding the interconnectivity of our own planet’s climate will be crucial if we ever want to settle on other planets or even terraform.

If humans eventually undertake the huge task of terraforming Mars, Mercury, Venus or the Moon (or perhaps even an exoplanet in some other part of the Milky Way Galaxy), our success will likely depend on our ability to understand the various inputs and feedback loops that intricately interlink climate systems and biospheres.

That day may seem far off, but it isn’t too early to start dreaming!

So, there we have it, an in-depth primer on the El Niño Southern Oscillation.

The ENSO can be a very destructive cycle for our planet’s animal and human populations, but life is nothing if not adaptable...

Likelier than not, 2023 will add another piece to the growing body of documentation about these events.

How has El Niño or La Niña affected you? Have you noticed any interesting changes in your part of the world? I’d love to hear about it in the comments.

As I was researching for this video, it seemed like a good idea to me to brush up on my knowledge of weather systems.

I went over to Brilliant.org, the sponsor for today's video, and sure enough they have a lesson on weather systems as part of their course "Physics of the Everyday," which included visual aids and questions that gave me insight into how winds and weather fronts worked.

But Brilliant didn't just have interactive lessons about weather.

Physics of the Everyday covered the home, infrastructure, energy, crime and more.

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