**In September twenty-twenty an oceanic and atmospheric phenomenon known as La Niña developed in the Pacific Ocean between South America and Indonesia.**

**There’s nothing unusual in that, of course. La Niña is the meteorological sister of El Niño, which you’ve no doubt heard of, and together they form what’s known as the ‘El Niño Southern Oscillation’ or ENSO system. Over time, the system moves through different phases of La Niña, El Niño or neutrality, with a new phase typically developing between late Summer and early Autumn and lasting until late Spring of the following year.**

**What made the twenty-twenty La Niña phase unusual was that it didn’t last for three seasons. It lasted for three years, prompting scientists to refer to it as a ‘Triple Dip La Niña’. And for reasons that we’ll get into a bit later in this video, that ‘triple dip’ had the effect of reducing the amount of additional warming in the Earth’s atmosphere. But even with that unusual duration of temperature suppression, our planet still experienced three of the warmest years ever recorded in twenty-twenty, twenty-one and twenty-two.**

**That’s all changed now though. At the time of making this video, which is April twenty-twenty-three, the ENSO system has moved away from La Niña and is currently in a neutral phase. According to the US National Oceanic and Atmospheric Administration, or NOAA, all the signs are now pointing to a strong El Niño system brewing up for this summer and into twenty twenty-four. I’m sure you’re well ahead of me here folks…yes, you’ve guessed it – El Niño does the opposite of La Niña. It tends to put ADDITIONAL warming into our ALREADY rapidly warming global atmosphere. And early indications suggest we’re heading for a major bounce back from three years of oceanic heat absorption during La Niña. So…you know…brace yourselves!**

**Hello and welcome to Just Have a Think,**

**In a normal, unremarkable year across the southern Pacific Ocean, warm moist air rises very high on the Asian side during late summer, causing the unsettled weather and heavy rainfall patterns that are typical of that region at that time of year. The high-level warm air then returns across the Pacific back down to the lower, cooler east side, perpetuating the phenomenon we call the trade winds.**

**Occasionally though, those winds weaken significantly, and the warmer waters flow back to the South American side, usually reaching their strongest point along the coast of Peru around Christmas time, which is why Peruvian fishermen nicknamed this phenomenon the ‘Christ-Child’, or El Niño, which literally translates as the son, or little boy.**

**During an El Niño phase, it’s the rising air in the EASTERN part of the Pacific that causes more stormy and rainy conditions over here. Meanwhile the air over in the western Pacific is DESCENDING, which tends to causeconditions that are more stable than average.**

**Eventually those pressure changes influence global atmospheric circulation, which means the phase and intensity of the ENSO system can ultimately affect seasonal weather patterns in both the northern and southern hemispheres.**

**There’s another lesser-known driver of ENSO conditions though.**

**It’s a difference in air pressure from East to West, as measured between stations in Darwin Australia, and Tahita, slap bang in the middle of the Pacific. It’s known as the Southern Oscillation Index or SOI**

**A positive SOI represents higher air pressure over Tahiti, which tends to cause the stronger easterly trade winds that are typical of a La Niña phase. What we’ve got at the moment though, is higher pressure at the Darwin end, which is weakening the trade winds and allowing the warm water to drift back towards the eastern side, as this NOAA animation from the start of this year demonstrates.**

**It’s this that has prompted NOAA’s climate prediction centre to issue an official El Nino watch for twenty-twenty-three. They’ve already got their beady eye on two hotspots–one off the coast of South America and the other one up in the northern Pacific.**

**These two boxes represent what meteorologists call regions 1 and 2 of the ENSO system, and if we look at them in graph form from May twenty-twenty-two to April twenty-twenty-three, you can clearly see a dramatic jump up in temperature in that region over the last couple of months. That matters because regions 1 and 2 are regarded as the best indicators of the potential strength of any incoming El Niño, and if we compare this year’s changes to the changes experienced immediately prior to the eight strongest El Niño phases in recorded history, you can see that current sea surface temperatures are right up there in the thick of it.**

 **The result is that both the European and North American forecasting agencies all agree that we’re looking at a strong El Niño stretching right across the Southern Pacific Ocean. So, that’s all very dramatic and colourful isn’t it. But what does it mean for weather patterns in various parts of the world?**

**Well, one likely piece of good news for you folks over in the States, is that stronger wind sheer, and higher pressure over the ATLANTIC caused by El Niño events, tends to reduce the overall number of Hurricanes and tropical systems welling up in that region and rolling into the Gulf of Mexico. That doesn’t mean North America is off the hook though. Far from it in fact!**

**During the winter, low-pressure in the North Pacific pushes the polar jet stream further north, bringing warmer-than-normal temperatures to the northern states and western Canada.**

**But El Niño also amplifies the southerly Pacific Jet Stream, bringing lower temperatures and extreme storms to the southern states. This overlay shows the average winter pressure patterns for all the El Niño events since nineteen eighty-three. You can see the very low-pressure air over the North Pacific pushing high pressure into Canada. That Pacific low pressure flows right across the lower half of the US creating a potentially devastating storm track across the southern states. And here’s how that looks in terms of temperature anomalies for the same time periods, with far warmer than average conditions over Canada and much cold than normal weather down south.**

**Weather changes in further flung parts of the world are less predictable, largely because local weather systems and other global weather drivers tend to muddy the forecasts significantly, especially at this early stage of the El Niño phase. But make no mistake, El Niño’s effects are definitely felt in every corner of the planet. Especially during a strong event like the one we’re possibly heading towards now. We can get a fairly good idea of the potential by having a look back at previous strong El Niño years.**

**Twenty sixteen is, so far, the warmest year on record, driven largely by a strong El Niño, but the strongest El Niño on record actually happened almost two decades earlier, back in nineteen-ninety-seven. The amount of energy transferred across the ocean during that event was equivalent to one hundred times the total energy consumption of the entire human species over a whole year, which for those of you who like their data in cold, hard numbers, equates to 35 million-million-billion joules of energy. Which is a lot! And that changed the world’s weather systems profoundly. California suffered extreme rain and mudslides. Dozens of people were killed during extreme weather events in Peru, with thousands more left homeless. There was freak rainfall in Kenya that year as well - about a hundred centimetres, or more than three feet, above average. And hurricane Pauline delivered ninety centimetres of rain to western Mexico in one day. Meanwhile over on the other side of the Pacific, Indonesia experienced extreme drought conditions. It’s not just these massively impactful weather events that are a cause for concern though. The real biggy is the fact that when all that pent up oceanic energy gets liberated up to the surface, it can really turbocharge the warming of our atmosphere. And we really need that, don’t we?**

**So, what about that El Niño -fuelled record hot year in twenty sixteen then? Well, this model shows the Pacific temperature changes as El Niño developed during the course of that year. According to the United Nations the twenty sixteen El Niño impacted around a hundred million people worldwide. It also caused permanent damage to coral reefs and a significant upsurge in carbon dioxide emissions from all the forest fires that happened as a result of extreme heat in many parts of the northern hemisphere. Ethiopia suffered two consecutive failed rainy seasons in Spring and Summer, causing the worst drought the country had suffered for decades. More than ten million people were in need of emergency food. Two million needed emergency water, sanitation and hygiene, and one-point-three million were made homeless. And millions of other vulnerable people were adversely affected across Africa, Central America, South East Asia and the Pacific Islands.**

**Average global ocean surface temperatures in twenty-sixteen hit twenty-one degrees Celsius. That was the highest average temperature since satellite records began back in the nineteen seventies. And here’s a bit of bad news for you… NOAA tells us that average global ocean surface temperatures in twenty-twenty-three have already between that record. They now sit at twenty-one-point-one degrees Celsius, or seventy degrees Fahrenheit.**

**The three years of the tiple-dip** [**La Niña**](https://www.theguardian.com/environment/la-nina)**that we’ve just experienced suppressed the atmospheric warming effect of rising greenhouse gas emissions. Our climate scientists tell us that more than ninety percent of the extra heat caused by cumulative emissions since the industrial revolution has been taken up by our oceans.** [**Measurements from the top two thousand metres of the ocean**](https://www.ncei.noaa.gov/access/global-ocean-heat-content/)**show rapid accumulation of heat in the upper layers, especially since the nineteen eighties. Heat absorbed into the tropical Pacific is now extending down to a depth of more than 100 metres and, according to Dr Kevin Trenberth from the US National Center for Atmospheric Research, in this recent Guardian interview, that increased absorption will cause more extreme and long-lasting marine heatwaves, which are classified as an area of the ocean where temperatures are in the top ten percent ever recorded for that time of year for at least five straight days. heatwaves have devastating effects on marine wildlife and cause coral bleaching on tropical reefs. Experiments have also suggested that warming oceans could be promoting a greater proliferation of algae blooms, causing damage to marine ecosystems. And of course hotter oceans provide more energy for storms, jeopardise ice sheets and push up global sea levels.**

**So, it looks like we could be set for a record breaking year. Unfortunately, it’s a record that our planet could really do without.**

**That’s it for this week. Thanks, as always to the channel’s fantastic Patreon supporters, who keep me on the straight and narrow and help keep ads and sponsorship messages out of these videos. You can get early access to every one of my videos, plus other exclusive content, and the chance to vote for future topics by JOINING those folks, over at Patreon dot com forward slash just have a think. And of course you can hugely support the channel absolutely for free by subscribing and hitting that like button. We’re getting tantalisingly close to the half million subscriber mark, so if you can help us get there then you’d having my undying gratitude! It’s dead easy to do if you’re on a PC, laptop or mobile device. You just need to click down there, or on that icon there.**

**As always, thanks very much for watching, have a great week, and remember to just have a think. See you next week.**

**Before I go…Amend the Fully Charged video to just Harrogate**