

The effects of el niño and la niña on the earth's climate

[Environment](#), [Climate Change](#)



Introduction

El Niño and La Niña are Spanish words that can be translated to little boy and little girl in English, however, that is not the only meaning and is not the only thing they stand for. Both these events are weather anomalies that are the reoccurring abnormal warming and cooling of the eastern Pacific Ocean waters. Both these atmospheric phenomena have a global impact on Earth in a variety of ways. Their effects differ and are complete opposite of each other, seeing as El Niño is the abnormal warming of the eastern Pacific Ocean, that occurs irregularly between two to eight years and lasts around twelve to eighteen months. La Niña, however, is the opposite, it is an abnormal cooling of the eastern Pacific Ocean waters and it usually occurs right after the El Niño events (Clark 114). According to Lutgens, El Niño is responsible for the dramatic changes in the catastrophic weather impacts and changes of different areas, such as Chile, Peru, Indonesia, Australia, for example, and many others. Meanwhile La Niña has affected areas such as East Asia and more. Both El Niño and La Niña have an effect and influence various countries around all around the planet. Some of the impacts that they are responsible for and have effects on include the variations in precipitation, rainfall, temperature, sea levels, along with the probabilities of hurricanes.

Changes of Precipitation and Rainfall

Studies and research have shown that both El Niño and La Niña events have had an affect towards the variations of precipitation and rainfall throughout the years and around the globe. With an increase in rainfall in some areas

causing flooding and lack of rain in others causing droughts. According to Clayton Clark, " The effects of El Niño and La Niña on changes in precipitation and streamflow pattern and their associated flood and drought events have been documented globally." (114). In Clark's research he also states that the El Niño and La Niña events account for forty percent of annual precipitation and thirty percent of river discharges in Florida. (Clark 114). The amount of precipitation that is accounted for in Florida is mainly from the rivers. The amount there is of precipitation reflects the amount of rainfall that there will be. El Niño is mainly formed by warmer waters, those warmer waters cause air filled with moisture to rise which in turn creates rainstorms. La Niña usually causes drier temperatures and weather in the south but is the opposite towards the north causing also bigger quantities of rainfall.

With higher amounts of precipitation there will be higher amounts of rainfall. Clark however is not the only one that has done this research and has found the same results, in Lutgens text he also mentions that El Niño and La Niña events have an effect on rainfall and precipitation, he stated, " The most obvious impacts of El Niño are flooding along the west coast of South America and drought in Indonesia and Australia."(Lutgens 198). From the rivers of Florida to the west of South America to Indonesia to Australia, the percentage of precipitation and rainfall vary from an excess amount to very little rainfall, the higher percentage of precipitation leads to rainfall, excess rainfall leads to flooding in some areas of the Earth and the lack of rain causing droughts in other areas, and these situations all can occur

simultaneously at the same time. Liu's research also concurred that, " Hill et al. (2011) found the highest rainfall occurred during El Niño periods in South America due to the strengthening of the South American low-level jet, based on an atmospheric general circulation model." (Liu 4295). During El Niño periods in South America there was an increase in rainfall, this also occurred in other areas of the world, according to Lutgens, " This unusually warm water and associated low pressure in the equatorial Pacific causes normally arid areas of Ecuador, Peru, and Chile to receive above-average rain fall. The result can be major flooding in the affected areas" (Lutgens 196). From South America to Chile there were increases of heavy rainfall causing damages because the excess of water causing floods all because of the atmospheric pressures of El Niño causing fluctuations of rainfall percentage. Lui states in his research," The profiles of 20- and 40-dBZ area during El Niño and La Niña periods suggest that ENSO has a significant influence on the intensity, heights, and size of convection systems over the GM and ARGEN. A larger size of 20 dBZ at low levels is observed over the AUS is consistent with the higher population fraction of large-size precipitation systems during La Niña periods." (Lui 4293). Lui's research shows how both the La Niña and El Niño periods had an influence in the increase of precipitation. This can become a problem, having too much rain is not a good thing. Having too much rain is bad and is not the main problem. Having great amount of rain can be good for crops and other resources, but having an excess amount of rain can cause enormous amounts of flooding and the floods can cause greater damage to the areas that are receiving it. The floods can cause catastrophic damages to buildings, houses, highways and even cause death.

Same goes for the droughts, without the the necessary amount of rain that is needed to grow crops and for other survival needs, the people suffer with out water, they can dehydrate and also as a result eventually die.

The Affect on Temperature

As a result of these anomalies, where there is a sudden bringing of warmer and cooler waters and breezes, the temperatures can vary and are affected. From being colder in some areas of the world to being warmer in others. For example, Xuehi Bai stated that in the winter of 2012, as a result of La Niña events, the Great Lakes had mild temperatures and new record-breaking low ice cover. (Bai 1209). These La Niña events caused an abnormal cooling pressure to push towards the Eastern Pacific, meaning there were warmer temperatures in the Atlantic causing the weather temperature to reach a record breaking low of ice cover, because of this there was a sudden change in temperature where it got warmer, which was an abnormal occurrence in the area. According to Clark, “ The interaction between atmosphere and sea surface in the equatorial Pacific Ocean causes an oscillation of temperature and pressure between the eastern and western equatorial Pacific Ocean (Hongsheng, 2000).” (Clark 113-114). This oscillation of temperature refers to the warm breezes and waters that El Niño pushes towards and brings into the eastern Pacific Ocean and the cooler breezes and water temperature brought are because of La Niña.

Atmospheric Pressure and Temperature Changes

El Niño is associated with the Southern Oscillation which is an inter annual fluctuation of pressure in the Pacific. The Southern Oscillation of El Niño is

the variations of winds and water temperatures above the Pacific Ocean, it has an impact around the world including areas such as the North Atlantic to Europe. (Ayarzagüena 8861). These atmospheric pressures influence the temperature all around the Earth. Basically, it affects the climate over the tropics and subtropics. Ji-Won Kim's article explains that the long-lasting high pressures and warm water temperatures occur during the fall and winter and during spring over the western North Pacific. This leads to a weakened winter of East Asia seeing as the warm and wet temperatures brought into East Asia are because of the southerly winds with high pressures, and the opposite occurs with La Niña the southerly winds bring cold temperatures. (Kim 957). Basically, the temperatures are changing as a result of these anomalies. The temperature changes can cause an effect on the Earth. Sudden changes in the Earth's temperatures can be dangerous and cause more catastrophic natural disasters.

These occurrences happen not only in East Asia, but they also happen in other areas, for example North America and Mexico. According to Lutgens, "Typical La Niña winter weather includes cooler and wetter conditions over the northwestern United States and especially cold winter temperatures in the Northern Plains States, while unusually warm conditions occurs in the southwest and southeast." (Lutgens 198). Since La Niña events are bringing the cooler waters and temperatures into the northern areas of the United states, all the warmer temperature and waters are moving towards the southern areas of the country causing even colder winters in the North and warmer weathers in the south. Kim states, " In other words, when El Niño (La

Niña) occurs with positive (negative) PDO phase during the boreal winter, anomalous warm (cold) temperatures over the East Asian continent are dominant.” (Kim 968). Basically, when El Niño events are occurring, they are pushing the warmer temperatures towards the eastern Pacific causing East Asia to become warmer, and as La Niña is occurring the East Asian continent receives colder and cooler temperatures during the winter.

Sea Levels

Another one of the effects as a result of these anomalies of the weather are the impacts that they have on the sea levels. According to research, sea levels have fluctuated and have decreased in some areas whereas in other areas they have increased over the years, due to El Niño and La Niña events. In Hui Wang’s research he states, “ The results showed that the SLAs in the China Sea decreased during El Niño years, with positive SLAs associated with negative SST anomalies. During La Niña years, the opposite occurred.” (Wang 493). In China, the sea levels have changed over periods of time. The sea levels were affected due to El Niño, where they happened to decrease, and La Niña years, where the sea levels increased. These levels fluctuated positively and negatively, they deviated above and below what the sea levels normally happen to be. Wang also states, “ In conclusion, the sea levels in the China Sea, at basin-wide scales and near the coast, showed significant inter-annual and decadal variabilities.” (Wang 493). Wang’s research is mainly about how the sea levels increased during La Niña and decreased during El Niño in the China Sea. If these anomalies affected the sea levels of the China Sea what is to say that it isn’t happening also

somewhere else. The sea levels can also be increasing and decreasing for example in the Pacific Ocean or the Atlantic Ocean, or anywhere else around earth.

We often hear about the weather on the news, and there are times that it is mentioned that there is storm ahead. One of Earth's most violent storms are the hurricanes. These tropical cyclones are caused by warm moist air that is above the ocean. As long the hurricane is above warm waters it is continually getting bigger and stronger and keeps going until it comes across cold waters or it hits land and continues until it loses its fire and momentum. When coming onto land hurricanes cause catastrophic damages to anything that comes across its path, buildings, streets, people. Pielke states, " The 1997-98 El Niño event depressed activity of the 1997 hurricane season and losses were minimal (\$100 million.) However, this is not always the case. Two El Niño years resulted in large losses: in 1965 Betsy resulted in more than \$13 billion in normalized losses, and in 1972 Agnes had more than \$11 billion." (Pielke 2031). In the years 1997 to 1998 El Niño caused a decrease in hurricanes and damages were minimal but there were still damages. As Pielke also states, " El Niño does not mean no hurricanes, as several El Niño years have seen large impacts." (Pielke 2031). There have been several large hurricanes that have cost billions in damage. As stated before, Pielke mentions that hurricane Betsy of 1965 and hurricane Agnes of 1972 caused damage worth billions. All together with the \$13 billion of Betsy and \$11 billion of Agnes, summed up to 24 billion dollars in damage all because of the effects of El Niño.

Hurricanes

The hurricanes can occur at different times throughout the years. They can form during El Niño and La Niña years. Mark Boye stated that, " There are 63 major U. S. hurricanes in the past 98 years, 5 during El Niño, 37 during neutral conditions, and 22 during La Niña." (Boye 2481). According to Boye's research the majority of the hurricanes that happened in the United States happened during normal and neutral weather conditions and temperatures where there were no abnormalities of any kind. The number of hurricanes that occurred during El Niño were not big in quantity, however, on the other hand another big majority of hurricanes that occurred happened during La Niña events. According to Donnelly, " Studies relying on recent climatology indicate that North Atlantic hurricane activity is greater during La Niña years and suppressed during El Niño years, due primarily to increased vertical wind shear in strong El Niño years hindering hurricane development." (Donnelly 467). In the Atlantic Ocean the majority of the hurricanes happening are because of the strong winds that prevent the development of a hurricane during El Niño.

Typically, during the first stage of development of a hurricane it needs only a slight wind circulation, having strong winds prevent it from forming.

Therefore, most of the hurricanes that are occurring in the North Atlantic is because of La Niña. In Lutgens research and text he also concurs with this idea. He states, " Another La Niña impact is more frequent hurricane activity in the Atlantic. A recent study concluded that the cost of hurricane damages in the United States is 20 times greater in La Niña years than in El Niño

years.” (Lutgens 198). Lutgens and Boye both state that there is a greater amount of hurricane occurrences during La Niña events than El Niño. These hurricanes happen in the Atlantic Ocean, it may vary in other oceans. Since most of the hurricanes occur when La Niña is happening there is one benefit of El Niño years. Lutgens said, “ One major benefit of El Niño is a lower-than-average number of Atlantic hurricanes.” (Lutgens 198). When it is El Niño years the only benefit about them is that there is less hurricane activity in the Atlantic. However, that is not always a huge benefit seeing as stated before that even though there have been few hurricanes during El Niño, out of those few, some have caused catastrophic damages worth billions of dollars, for example, Hurricane Betsy, Agnes, Sandy, Katrina and many more.

Conclusion

El Niño and La Niña have been occurring for many years and will continue to happen in the future. They both are weather anomalies that can not be stopped or changed. They are the sudden warming of sea temperatures and cooling of sea temperatures. These anomalies have various effects on the planet. From the fluctuation of precipitation which can affect the amount of rainfall that Earth is receiving. That rainfall then can cause flooding in some areas because of excess amounts and droughts for lack of rain in others. Temperatures are also changing, getting warmer and colder. In some areas for example in the Great Lakes there was a change in their temperatures, rather than having the average amount of ice coverage, in 2012 there was a below normal ice coverage due to the temperature change as a result of La Niña. Sea levels are also an effect of these anomalies. Sea levels have been

recorded to have increased and decreased depending on whether El Niño or la Niña is occurring. Hurricane are also influenced by these abnormalities of the weather. There were less amounts of hurricanes formed during El Niño than La Niña where a majority of the hurricanes recorded occurred in the United States. Even though these anomalies can not be changed it is important to know the effects they have on the planet that we live in, even if nothing can be done and least it is important to know what is to come in the future with the changes.