International Journal Semiarid

NATURAL DISASTERS IN THE STATE OFALAGOAS NORTHEAST REGION OF BRAZIL - ARISING FROM THE CLIMATE EVENTS IN LA NIÑA

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ABSTRACT:
We live in an interconnected world, like a butterfly effect what happens in certain areas of the world reflects in others. These (inter)connections go beyond a globalization for capitalist ends, the world goes beyond the correlations between society. The present work aims to demonstrate an analysis derived from studies on the effects of climatic events and anomalies in the Equatorial Pacific Ocean on ENSO, which causes socio-environmental disasters in La Niña years, in the State of Alagoas, Northeast Brazil – NEB; through data obtained through the Center for Weather Forecasting and Climatic Studies - CPTEC, from the National Institute for Space Research - INEP, as well as through Weather Spark reports and data from the Brazilian Institute of Geography and Statistics - IBGE, among others. Research warns that in years of La Niña and/or El Niño, the Northeast region of Brazil is susceptible to the occurrence of environmental disasters, whether caused by strong rainfall levels that cause flooding, inundation, and landslides of masses called hydrometeoric. Drought and/or drought are defined as climatic effects. In Alagoas, natural disasters occur either due to hydrometeoric or climatic effects. The same, leave hundreds of people homeless, homeless, sick and even in deaths always from the occurrence of natural disasters. With this, two years were analyzed, 2000 and 2010, for the disasters arising from extreme hydrometeoric effects in the state of Alagoas. According to data analyzed from specialized meteorological agencies, we identified the year 2000 and 2010 as the La Niña period, that is, responsible for part of the events in socio-environmental disasters arising from the high rainfall that occurred, causing overflows in the main rivers in Alagoas.

Keywords: Vulnerable areas; Climate anomalies; Public calamity

DESASTRES NATURAIS NO ESTADO DE ALAGOAS, REGIÃO NORDESTE DO BRASIL - ADVINDOS DOS EVENTOS CLIMÁTICOS DE LA NIÑA

RESUMO:

Vivemos em um mundo interligado, como um efeito borboleta o que acontece em determinadas áreas do mundo refletem em outras. Essas (inter)conecções, vão além de uma globalização para fins capitalistas, o mundo vai além das correlações entre a sociedade. O presente trabalho tem como finalidade de demonstrar uma análise derivada de estudos sobre os efeitos de eventos climáticos e anomalias no Oceano Pacífico Equatorial em ENOS, que acarreta desastres socioambientais em anos de La Niña, no Estado de Alagoas, Nordeste Brasileiro – NEB; por meio de dados obtidos através do Centro de Previsão do Tempo e Estudos Climáticos – CPTEC, do Instituto Nacional de Pesquisas Espaciais – INEP, bem ainda por meios dos relatórios da *Weather Spark* e dados do Instituto Brasileiro de Geografia e Estatísticas – IBGE, dentre outros. Pesquisas advertem que em anos de La Niña e ou El Niño, a região Nordeste do Brasil são susceptíveis a ocorrência de desastres ambientais seja ocasionada por fortes níveis pluviométricos que

acarretam enchentes, inundações, alagamentos e desmoronamentos de massas denominados hidrometeóricos. Já a seca e/ou estiagem se definem como efeitos climáticos. Em Alagoas, os desastres naturais coorem seja por efeitos hidrometeóricos ou climáticos. Os mesmos, deixam centenas de pessoas desabrigadas, desalojadas, enfermas e até em óbitos sempre da ocorrência de desatres naturais. Com isso, foram analisados o intervalo entre a década de 2000 a 2010, para os desastres advindos de efeitos extremos hidrometeóricos no estado alagoano. Conforme dados analisados de órgãos especializados em meteorologia entre a década de 2000 e 2010, o fenômeno de La Niña, foi responsável por parte dos acontecimentos em desastres socioambiental advindo dos altos níveis pluviométricos ocorridos, fazendo com que aja transbordamentos nos principais rios em Alagoas.

Palavras-chave: Áreas vulneráveis; Anomalias climáticas; Calamidade pública.

INTRODUCTION

Located in South America, with 8,510,295,914 km², Brazil is a country of continental dimensions. In the globalizing media, disasters such as hurricanes, typhoons, tsunamis and earthquakes have always been and are in the world spotlight. However, in recent years, rains, droughts and drought are getting a different look.

In Brazil, a country known as "the country of the tropics", which the media disseminates to the whole world, is not free of natural disasters, on the contrary, landslides, floods, floods, lightning, droughts and droughts demonstrate that these types of disasters, has been occurring frequently in Brazilian lands. In the country's media. Landslides in Petrópolis in Rio de Janeiro and Ouro Preto; floods in Bahia, Minas Gerais, Ceará and Santa Catarina; Rays in São Paulo; drought in south-central Europe etc.

According to the Atmospheric Electricity Group - ELAT/INPE, 78 million rays fall annually in Brazil; in 2018, 71 lightning deaths were recorded, and in 2019 there were 67 deaths nationwide. According to the United Nations – UN, Brazilians appear among the 15 countries in the world with the highest number of inhabitants exposed to risks of flooding of river water flows; between the years 2000 and 2019 in Brazil there were 70 disasters caused by the climate that injured an average of 70 million inhabitants in Brazil. Therefore, further studies of natural disasters provided by hydrometheoretical and climatic events around the globe are needed.

In 2010, 872 municipalities, about 8 million people lived in areas with potential risk of floods and landslides in the country, according to the Brazilian Institute of Geography and Statistics - IBGE. According to these data, in the Northeast region of Brazil, by 2010, more than 1,800 million inhabitants living in areas of risk from disasters arising from extreme events were recorded. Therefore, in Alagoas it is no different, to analyze these vulnerable areas that are suffering from these disasters and their impacts in the state of Alagoas, is to understand that these environments are contextualizing themselves in the context of socio-environmental vulnerability.

> The conditions of vulnerability result from social processes and environmental changes that are called socio-environmental vulnerability, because they combine: 1) the social processes related to the precariousness of living conditions and social protection (work, income, health and education, as well as aspects related to infrastructure, such as healthy and safe housing, roads, sanitation, for example) that make certain population groups (e.g., women and children), especially among the poorest, vulnerable to disasters; 2) environmental changes resulting from environmental degradation (occupied environmental protection areas, deforestation of slopes and river beds, pollution

> of water, soil and atmosphere, for example) that make certain areas more vulnerable when a threat occurs and its subsequent events (FREITAS, C.; CARVALHO, M.; XIMENES, E. et al. 2012, p. 1578-1579).

In Alagoas, the history of disasters, floods, floods and mass slips, mainly in the Middle and Low Course of the Mundaú River Basin that extends from Mata´s zone to the Coast are impressive. Cities such as União dos Palmares, São José da Laje, Santana do Mundaú, Branquinha, Murici, Rio Largo, Maceió, among others, have faced major socio-environmental problems caused by disasters from the extreme hydro climatic effects, with emphasis on the times of the La Niña phenomenon.

Thus, the research is of paramount importance to catalog these periods of La Niña, and what disasters and impacts that occurred in rainy times of this phenomenon considered abnormal in the Equatorial Pacific Ocean that has been causing socio-environmental disasters in northeastern Brazil and consequently in Alagoas, where studies in disasters by the force of heavy rainwater were concentrated.

The research also provides quantitative data showing a more accurate analysis of disasters resulting from floods and high rainfall levels in the years of La Niña weather events between the 2000s and 2010s, but not ruling out other natural disasters in other decades, and in other states. The aforementioned events in natural disasters cause a situation of socio-environmental vulnerability in the country and in Alagoas, it would be no different.

METHODOLOGICAL PROCEDURES

The methodological script was used to analyze different factors (climatic, geomorphological, soils, watersheds, etc.), to have a good result on why natural disasters. The literature review with research in scientific database, internet research of scientific works with the theme was crucial to understand the relationship of physical-natural and social components of areas of occupation suffering from natural disasters. Another methodological stage was the historical study of the climatic events under analysis, satellite images with data obtained by CPTEC/INEP, as well as the National Centers for Environmental Information (NCEI) and Weather Spark that provide climate reports of places around the globe. For a better understanding of territorial studies, data were consulted to the Brazilian Institute of Geography and Statistics - IBGE, by the Brazilian Agricultural Research Company - EMBRAPA, the National Water Agency - ANA, among others. However, one of the research activities, which were essential for this article, was the fieldwork. In it, the dialogue with the population living in the study areas was gratifying to know their concerns. And to finalize the methodological steps, the use of thematic cartography in the making of maps by qgis software, to better understand the proposal presented here was important for a better visualization of the analyzed areas.

RESULTS AND DISCUSSIONS

With the data collection and the study of the problem, the cut out chosen in the Northeast region was Alagoas, with its history of floods and floods. Present in the development and vulnerability of the process of urban evolution of municipalities throughout the state, with different impacts and different reactions in planning to health the population's need and establish a new quality of life after the intervention in social daily life.

Alagoas is understood as an area that needs further studies due to this process of disasters, as well as renovation in its anthropic landscape. Before we understand what is developed with the impacts of the forces of nature, we must understand the region as a whole. Thus, an analysis of the area of study is necessary.

ANALYSIS OF THE STUDY AREA

The Northeast of Brazil is the second most populous region of the country, behind only the Southeast Region, and being one of the largest regions in territorial extension; among its 9 states, Alagoas has a territorial area of 27,830,656 km², with an estimated population of 3,351,543 inhabitants, and a population density of 112.33 inhabitants per square kilometer according to IBGE (figure 1).

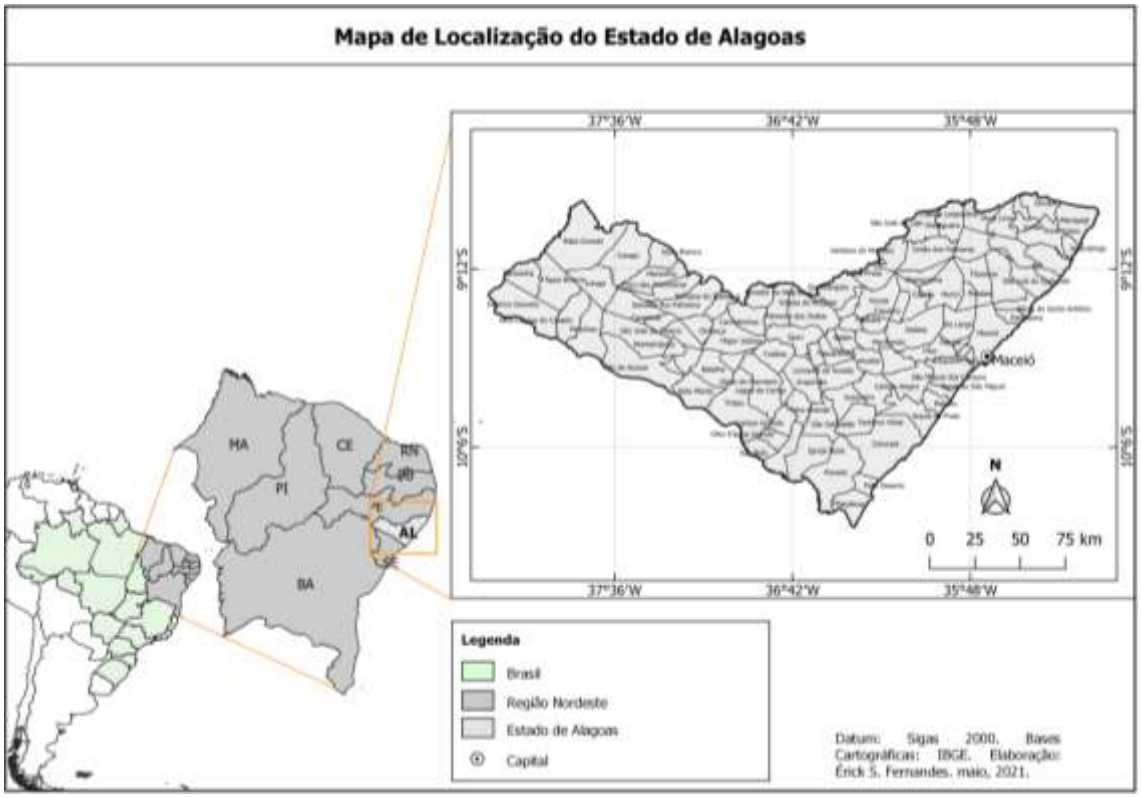

Figure 1. Map of the area of study. Political Location of the State of Alagoas / Northeast Region. Source: Prepared by the author.

On the physical composition of Alagoas, according to the analysis of the "National Atlas of Brazil Milton Santos" (2002), made available by IBGE, at the macro level, the state has its climate varied between the predominance of Semi humid, Humid and Semiarid (Figure 2a), with the predominance of crystalline relief and in some sedimentary environments, also having in the composition soils: Yellow Latosol (LA), Red-Yellow Clay (PVA), Litholic Neosol (RL), Ferrilúvic Skewer (ES) (Figure 2b), and other soils with fine, clayey sand, this according to EMBRAPA, therefore has in this state clay soils that, together with the crystalline relief, facilitate the flow of river waters to overflow. It is still in the state, a vegetation of biomes of the Atlantic Forest and Caatinga (Figure 2c) that carry a great variation of fauna and flora. However, it is already largely devastated by the anthropic action of centuries, since the monuculture of sugarcane is still strong.

Alagoas is still bathed by two hydrographic regions, the São Francisco and East Northeast Atlantic according to data from ANA (Figure 2d).

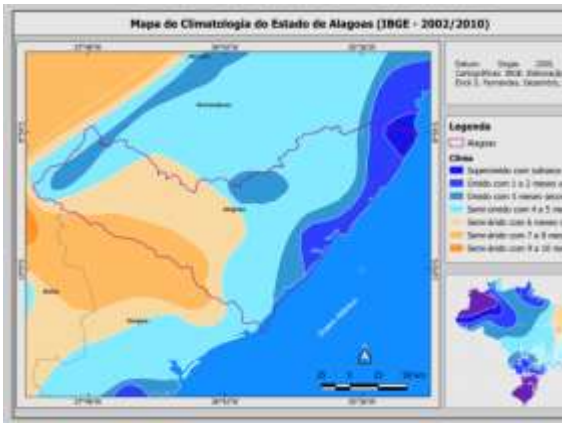

Figure 2a: Map of Climatology of Alagoas, data: IBGE. Source: Prepared by the author.

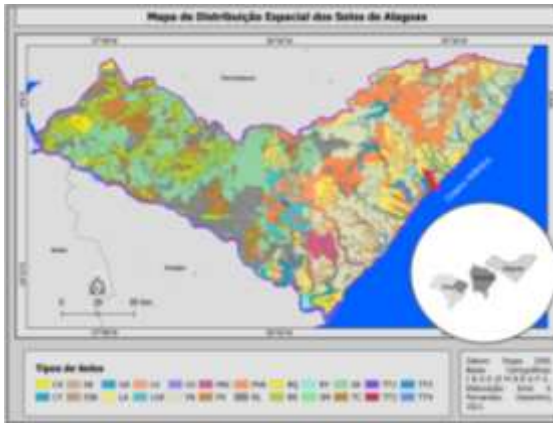

Figure 2b: Soil Map of Alagoas, data: EMBRAPA/IBGE. Source: Prepared by the author.

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Figure 2c: Map of Location of Biomes in Alagoas, data: IBGE. Source: Prepared by the author.

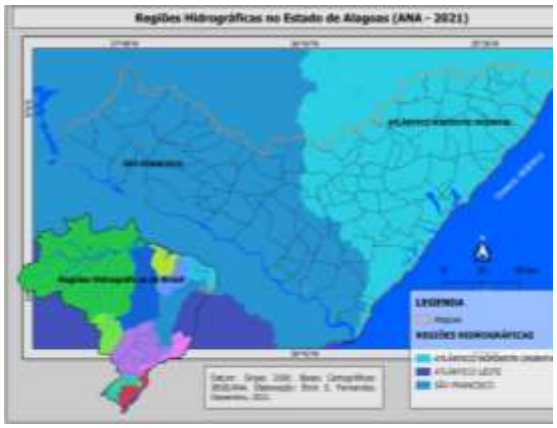


Figure 2c: Location Map of Hydrographic Regions in Alagoas, data: IBGE/ANA. Source: Prepared by the author.

All this combination of climate, vegetation, relief and soil, suffering the constant anthropic action contribute to natural disasters, since the tropical climate varying in Humid and Semi humid, with the predominantly clay soil, and the banks of rivers without the ciliary forests, crystalline relief, being a state with watersheds and basins scattered throughout the territory; Alagoas becomes an environment conducive to occurrences of disasters causing floods and drought, due to lack or excess of rains.

Another variable that facilitates hydro meteorological catastrophes is urbanization. Cities are poorly designed without a larger study of vulnerable areas. We are not here to blame populations that settle in vulnerable environments (riverbanks and hills). There are cities, which neighborhoods are not properly designed, and consequently will be the most affected by a disaster of hydrometeor events. Next we will observe the consequences of abnormal events in warming and cooling of the waters of the aforementioned Equatorial

Pacific Ocean, along with the conceptualizations of these phenomena that form the years of La Niña and El Niño.

CLIMATE EVENTS IN THE EQUATORIAL PACIFIC OCEAN IN ENO

The abnormal phenomena that occur in the Equatorial Pacific Ocean are known as El Niño and La Niña (ENOS) which according to the Center for Weather Forecasting and Climate Studies (CPTEC) of the National Institute of Space Research (INEP) "are part of the same atmospheric-oceanic phenomenon that occurs in the Equatorial Pacific Ocean." These phenomena cause climate change throughout the globe, causing periods of severe droughts in northeastern Brazil in Times of El Niño and extreme rains in Times of La Niña leaving part of neb residents in a state of socio-environmental vulnerability (not limited only to these climatic events).

> A component of the earth's climate system is represented by the interaction between the surface of the oceans and the low atmosphere adjacent to it. The processes of energy and humidity exchange between them determine the behavior of the climate, and changes in these processes can affect the regional and global climate. El Niño represents the abnormal warming of surface and subsurface waters of the Equatorial Pacific Ocean. The word El Niño is derived from Spanish, and refers to the presence of warm waters that every year appears on the northern coast of Peru at Christmas time. The fishermen of Peru and Ecuador called this presence of warmer waters of Corrientes de El Niño in reference to the Niño Jesus or Child Jesus. At present, climate system anomalies that are known worldwide as El Niño and La Niña represent a change in the ocean-atmosphere system in the tropical Pacific Ocean, and which has consequences on weather and climate across the planet. (OLIVEIRA, Galvan, 2001, CPTEC/INPE, 2016, p. 01).

In Times of El Niño there is an abnormal warming by the temperature of the sun's rays in the surface waters of the Equatorial Pacific Ocean on the West Coast of the Americas, with emphasis on South America to the Coast of Asia (Figure 3). This anomaly happens in years of weakening winds that are responsible for bringing the cloud masses around the globe between the tropics of Cancer and Capricorn to the Equator, these winds are called Alísios (atmospheric low altitude winds).

With the Trade winds being low altitude that passes from the American coast to Asia, the high-altitude winds that blow in the opposite direction are called "Counter-Trade winds", with this circulation of air mass is formed what we can call walker's circulation cell, understanding the conceptualization of this cell, it is important to analyze why the occurrences of these anomalies.

This phenomenon cited causes an interruption in the events of the upsurge of low temperature waters off the coast of South America, with the weakened Trade Winds the Walker Cell loses its strength and there is no effective transport of the waters and cloud mass of the American coast, which causes the interruption of the phenomenon of upsurge; the entire American coast is warming in Times of El Niño and there is a weakening of the masses of rain clouds in the globe, in this time happens droughts in northeastern Brazil.

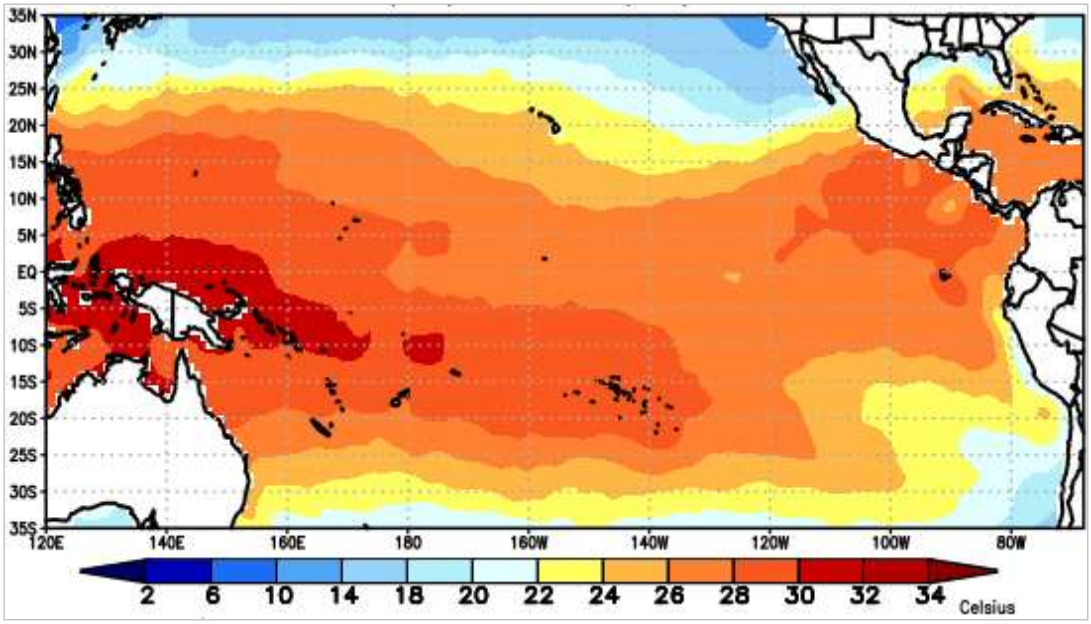


Figure 3.Warming Sea Surface Temperature, 22 to 32 Degrees Celsius, 15/03/2021 - 22/03/2021. Source: NCEP/NOAA - USA. CPTEC/INEP.

In times of La Niña (figure 4) occurs a contrary anomaly in the Equatorial Ocean, as cited is what give the name of this climatic event, since its conceptualization is understood as opposite of El Niño hence the name La Niña. Therefore, la niña events happen with the strengthening and stretching of the aforementioned Walker Cell and with this strengthening there is an increase in the phenomenon of upsurge in the waters of the American coast.

In the period of occurrence of La Niña, there is an increase in low temperature waters, since with the strengthening of trade winds there is a greater amount of cloud masses and ocean water being transported towards Asia through the tropics. With this, the high temperature in Celsius is concentrated in the waters of the Asian region causing increased rain clouds in that region, which in turn are transported with greater efficiency to the Northeast of Brazil. In times of La Niña, a greater predominance of rain in the North and Northeast regions of Brazil.

> La Niña is a phenomenon that is characterized by being opposed to El Niño, which is, it is the cooling of the waters of the Equatorial Pacific Ocean, for this reason it is known as cold episode (Oliveira, 2001). During its performance, there is a strengthening of the Subtropical High of the South Pacific, transporting cold surface ocean waters more efficiently to the Central-West Equatorial Pacific, thus strengthening the Walker cell. El Niño and La Niña events have a tendency to alternate between periods ranging in average from 2 to 7 years, but there is evidence that La Niña has occurred in a smaller amount in recent decades. The frequency of occurrence between one event and another can change from 1 to 10 years and its intensities vary greatly in each case. (Freire, J.; Lima, J.; Cavalcante, E.; 2011, p. 430).

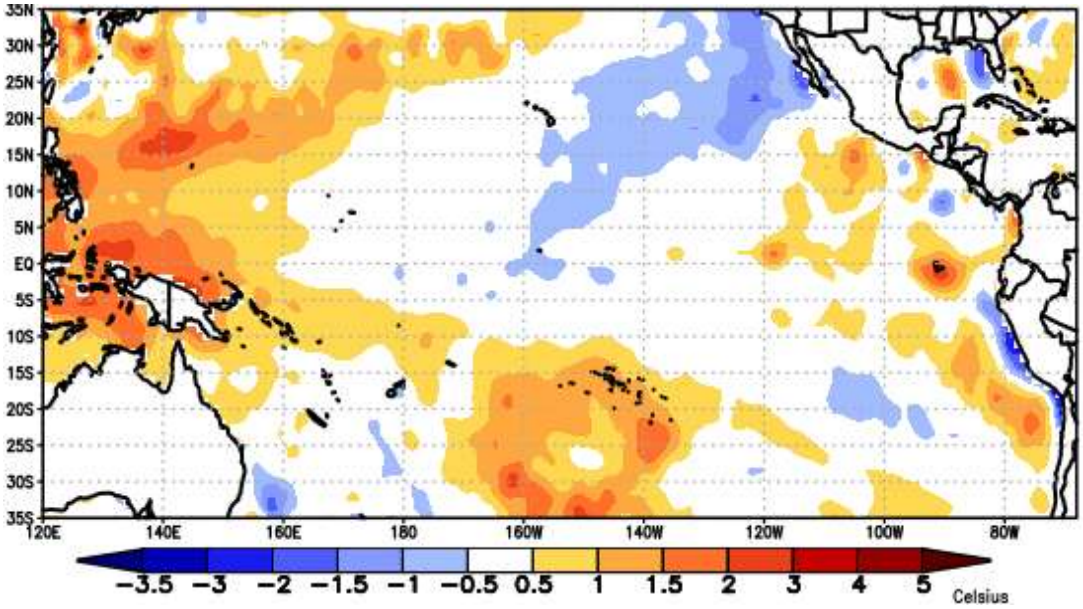


Figure 4.Anomaly of the Cooling Sea Surface Temperature on the U.S. Coast, with 0.5 to -2 Degrees Negative, 15/03/2021 - 22/03/2021.
Source:NCEP/NOAA - USA. CPTEC/INEP.

CLIMATE EVENTS AND NATURAL DISASTERS IN ALAGOAS/NEB.

La Niña's climatic events, as cited, cause heavy rains in the North "The authors suggest that the influence of the North Tropical Atlantic (TA) (ATN) on climate variability in the Amazon region may be comparable to the best known teleconnections with the Pacific Ocean ENOS[...]" ARAÚJO et al. (2013, p. 470) and in northeastern Brazil, causing landslides, floods, in phase dwellers in municipalities with their cities on the margins of water courses. These ENOS events have variations of 7 to 10 years currently.

> The El Niño-Southern Oscillation Phenomenon (ENOS) has two phases: La Niña (Cold Phase), and El Niño (Hot Phase). According to Vianello et al (2001), the occurrence of el Niño and La Niña phenomena is associated with neb droughts and floods. Affecting mainly the semi-arid region where the population depends exclusively on the rains for its livelihood. (FREIRE, J; LIMA, J; CAVALCANT, E. 2011, p. 430).

Therefore, the study, it cuts the clipping of la niña events with the interval of a decade (2000 to 2010), where heavy rains and flooding of entire neighborhoods in Alagoas cities are recorded, comparing the years of floods and disasters, we can observe that they match the Years of La Niña recorded by CPTEC/INPE in 2019, thus, we can associate the events of the Equatorial Pacific Ocean in ENOS, with the socio-environmental disasters caused by heavy rains and floods in northeastern Brazil and the state of Alagoas. We will now see in the table below (Table 1) the years of La Niña in the red marking. In the decades of 2000 to 2010 equivalent to the year of heavy rains and floods in Alagoas.

Table 1: Years of occurrence of La Niña in the Globe between 1970 – 2018

Anos de Ocorrência		
1970-1971	1988-1989	2007-2008
1973-1974	1998-1999	2010-2011
1975-1976	1999-2000	2017-2018

Source: CPTEC/INPE, 2019.

These disasters at high rainfall levels are recorded by Weather Spark, which, with a partnership with countries among others in Latin America, recorded in rainfall the rainfall rate on flood dates by the Airport of Recife capital of Pernambuco, which borders the State of Alagoas, in this way, we can have a better sense of the climatic events of this region since the Hydrographic basins of Alagoas cross municipalities and state borders, like the Mundaú River which starts in Pernambuco and goes to the neighboring state, Alagoas. This aforementioned river causes floods and disasters in the states of Pernambuco and Alagoas for decades, being one of the main rivers responsible for flood disasters in the municipality of União dos Palmares, Alagoas, according to Fernandes (2021, p. 41) "With an area of 4,457.87 km2 the Mundaú river basin covers an area that supplies 36 municipalities that runs from the state of Pernambuco to Alagoas, it is in this Hydrographic Basin that the studies of the floods of União dos Palmares are found[...]".

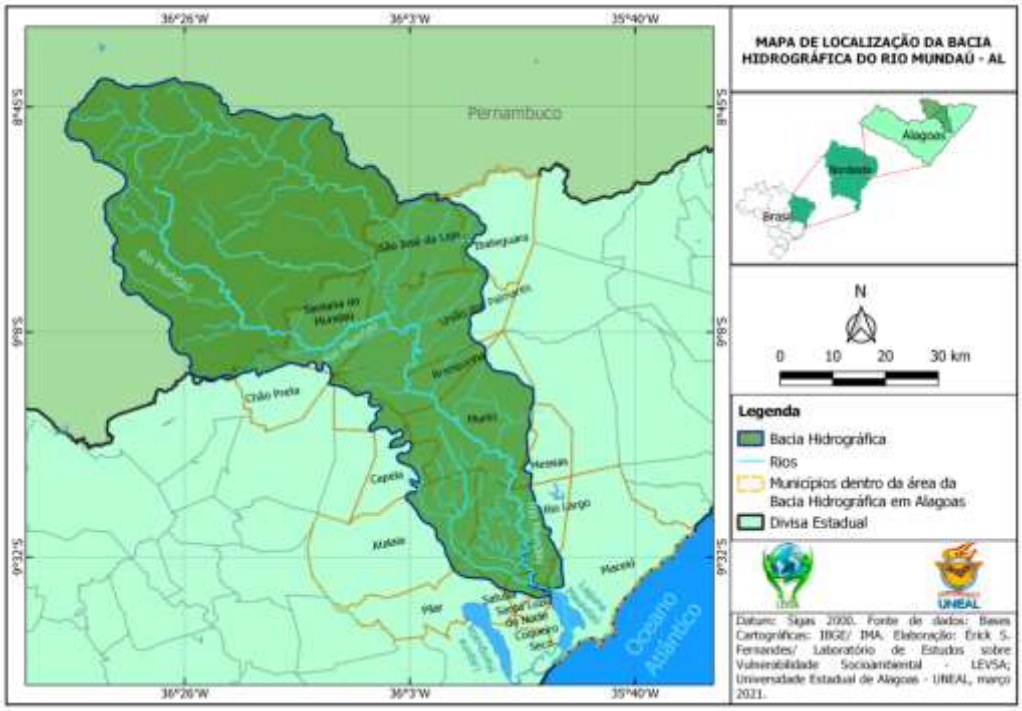
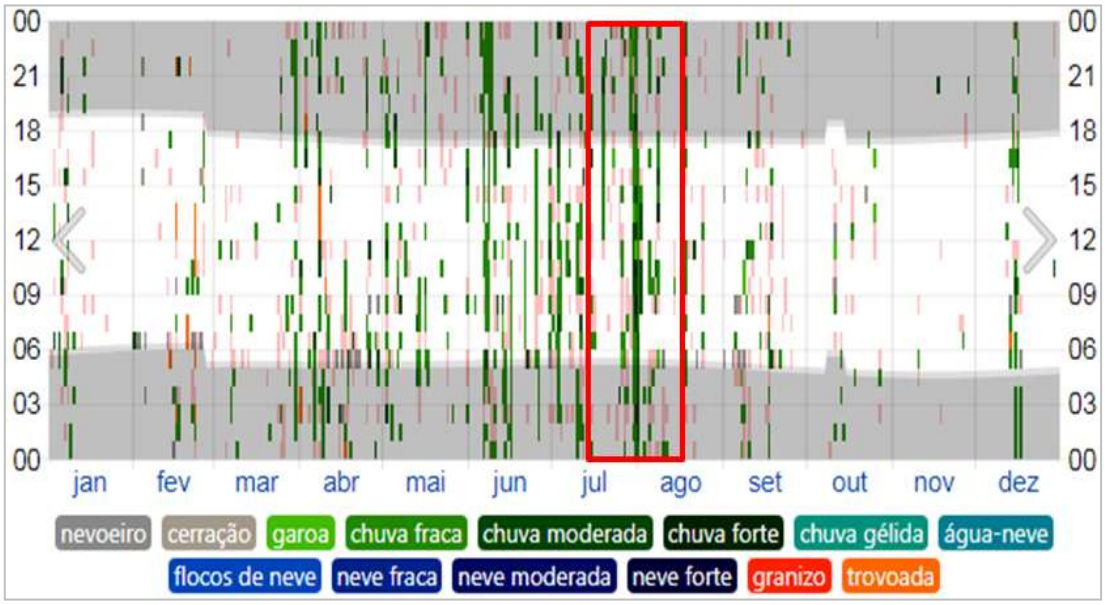


Figure 5: Location of bhrm. Data: IBGE/ IMA. Source: Prepared by the Author.

Therefore, in an account of the analysis of the disasters cited, beginning in 2000, after heavy rains in 1989 that also caused floods in the region, on August 2nd 2000, heavy rains are recorded in the Brazilian Northeast Region. Rainfall 1 below shows that between

the end of July and the beginning of August 2000, the highest rainfall concentration occurred, about 143 mm.



Rain graph 1. Weather conditions observed in 2000. Modifications of their own. Source:Weatherspark.com.Modified by The Author.

The extreme rains that occurred during the last days of July, with the first days of August were so strong, that the rivers overflowed. The floods were so intense that municipalities declared a state of public calamity (PCE) and other emergency situations (SE). During this period, the Civil Defense of Alagoas counted 70,000 homeless and 36 dead until the next day after the floods took over the municipalities, on August 3, this news is propagated by various media at the regional to national level; between radio and television, this news is also found in newspapers, being the main articles of the Gazeta de Alagoas Newspaper (Figure 6).

> The Civil Defense reported, early last night, that 70,000 homeless and 36 dead the numbers of victims of the rains in the state. The Government, which begins to distribute today, basic baskets for flagellates, has already decreed a state of calamity in 25 municipalities, so that they can receive federal aid. Camaragibe headquarters recorded 15 deaths, São Luiz do Quitunde, Passo do Camaragibe and Rio Largo had five, each. The other fatalities are from Maceió, two from União dos Palmares, one from Satuba and one from Santa Luzia do Norte. (Gazeta de Alagoas, August 3, 2000, p. 01).

A Defesa Civil informou, no início da noite de ontem, que chegam a 70 mil desabrigados e 36 mortos os números de vítimas das chuvas no Estado. O governo, que começa a distribuir, hoje, cestas básicas para os flagelados, já decretou estado de calamidade em 25 municípios, para que possam receber ajuda federal. Murici do Camaragibe registrou 15 mortes. São Luiz do Quitunde, Passo do Camaragibe e Rio Largo morreram cinco, cada um. As outras vítimas fatais são de Maceió, duas de União dos Palmares, uma de Satuba e uma de Santa Luzia do Norte. AS

FHC promete operação de guerra em AL

Acompanhado do governador Ronaldo Lessa, o presidente Fernando Henrique Cardoso sobrevoou, ontem, as áreas mais castigadas pelas chuvas em Alagoas. FHC garantiu que vai ser montada uma operação de guerra, até com o uso de navios da Marinha, para levar alimentos e remédios para os desabrigados alagoanos. AS

O presidente Cardoso sobrevoa, com o governador Ronaldo Lessa, as áreas mais castigadas pelas últimas chuvas em Alagoas

Carreta desaba com uma ponte, próximo a Paripueira, e fica submersa

Em Bebedouro, moradores usam canoa para atravessar trecho de avenida

OAM promove Caravana da Solidariedade

A *Organização Arnon de Mello* (OAM) está convocando a população alagoana a participar da Caravana da Solidariedade, em favor dos desabrigados das chuvas no Estado. Muitas doações já estão sendo entregues nas empresas da OAM, que, partir das 8 horas de hoje, estará com 10 veículos nas ruas, recolhendo donativos em Maceió, Arapiraca e Pão de Açúcar. AJO

Figure 6.Image clipping and news of the flood in Alagoas in the year 2000 by jornal Gazeta de Alagoas. Modified by the Author.Source: Gazeta de Alagoas edition: 03/08/2000.

NCEI /GIBBS service also made records on Satellite images and reports sampled shortly thereafter. With this, we can see the concentration of mass of rain clouds in the state of Alagoas on the day of the events in tragedy, coming through the Intertropical Convergence Zone – ZCIT in Atlantic Ocean, going towards the Equatorial Pacific through the tropics. As a result of the hydrometheoretical disasters, the population was answered to new areas, where new houses were built and, consequently, new neighborhoods were emerging in several municipalities in Alagoas.

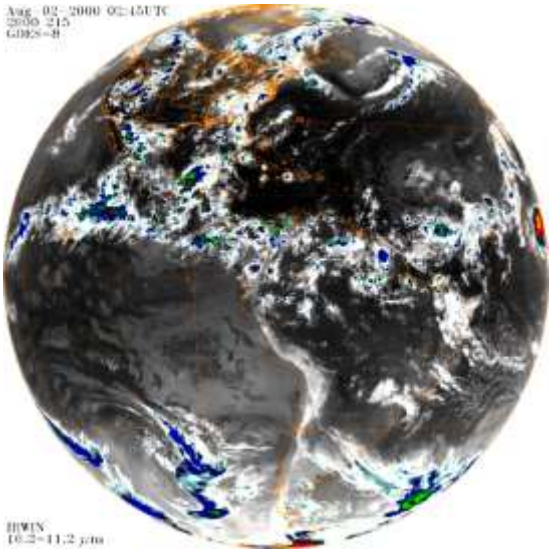


Figure 7a: 02/August/2000. South America's weather record. Source: NCEP /GIBBS service.

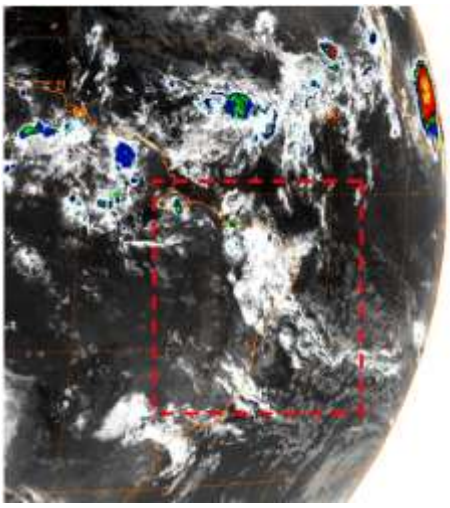
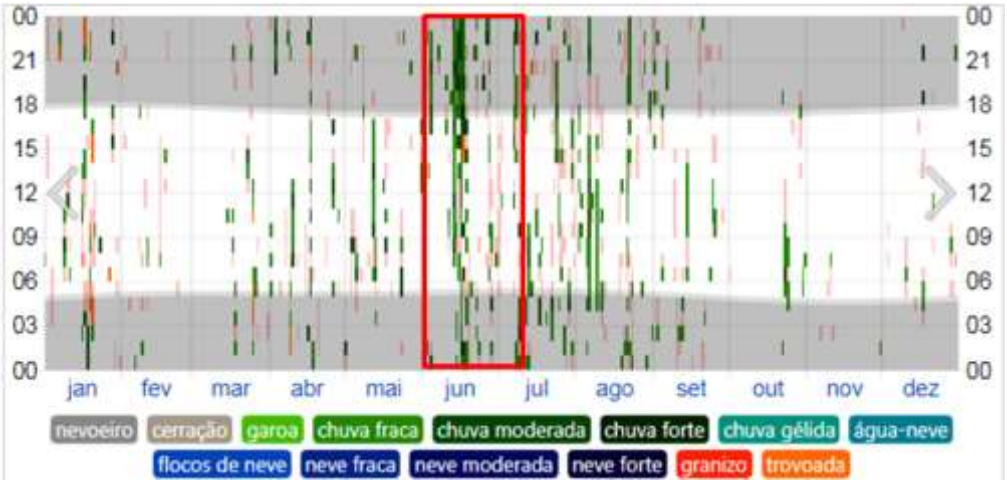


Figure 7b: Clipping of August 2, 2000. South America's weather record. Source: NCEI /GIBBS service. Modified by the author.

In June 2010, strong rainfall rates are also recorded in eastern Alagoas and Pernambuco. Such precipitation caused flooding in the NEB, and in Alagoas the concentration of rains contracted to increase the flow of Mundaú Rivers and their sub tributaries. We can see from the weather conditions observed in 2010 (Rain2), from the data obtained by Weather Spark from January to December that the concentration of green spectra once again shows the month that rained the most in the year, in the case of June 2010. The floods of the rivers occurred on the 18th of the month, causing more tragedies, leaving 26 dead and 47,897,000 homeless throughout the state.



Rain graph 2. Weather conditions observed in 2010. Modified by the Author. Source: Weatherspark.com.

> In 2010, on June 18 and 19, the region was again devastated by the floods of the Paraíba and Mundaú rivers. The initial reports, especially those made by the residents of the affected cities, indicate that this is the largest historical flood in these basins. The State Civil Defense continues to account for the damage caused by the flood in the State of Alagoas. In the bulletin issued on June 23, 2010, the numbers of homeless and displaced were 26,618 and 47,897,000 people, respectively. Twenty-six deaths and 22 missing were reported, as well as 7,669 damaged homes and 9,732 homes destroyed. (JUNIOR, C.; PEDROSA, V.; SOUZA, V. 2010, p.6).

We observed in the following image the reflection of the destruction of the aforementioned flood in the municipality of União dos Palmares in Alagoas (figure 8). The change in the landscape depicted before and after by images taken at the time reflect the strength of nature in La Niña times in relation to the present water flows, showing the evident situation of vulnerability of residents who are in areas of risk, and often without financial conditions to dwell safe places suffer problems such as floods. In this case, we observed that the population inhabited the banks of the Mundaú.

Figure 8.Cidade de União dos Palmares/Alagoas before and after the flood of 18/06/2010 . Source: Prepared by the author, images of Clezivaldo Mizael (Personal Archive).

> The flood event of June 2010 should be analyzed considering its occurrence throughout the month of June and not only in the two days of disasters caused in the cities of Alagoas and Pernambuco. Rainfall records for the month of June show a period of rainfall much higher than the average (as shown in the isoietas in Figure 3). To illustrate, the Garanhus post recorded 283.6 mm of rain between

> June 1 and 19, for a historical monthly average of 120 mm. The first 5 days of the month were quite rainy, followed by a less humid period and, from the 12th, again a very rainy period. (JUNIOR, C.; PEDROSA, V.; SOUZA, V. 2010, p.9).

Satellite images and meteorological records taken from cptec/inpe reports from Brazil show the approach of clouds called Eastern Wave Disturbances (DOE) known as Eastern Waves (OL). Clouds loaded with humidity, and with the increase of The HSCIT, were the major contributors of heavy rains in eastern Alagoas and Pernambuco. In Alagoas, on June 17 (Figure 9a), and on the 18th (Figure 9b) entire cities suffered from flood and flood disasters.

According to JÚNIOR et al. (2010, p. 9) historical figures are recorded in rain gauges in 2010.

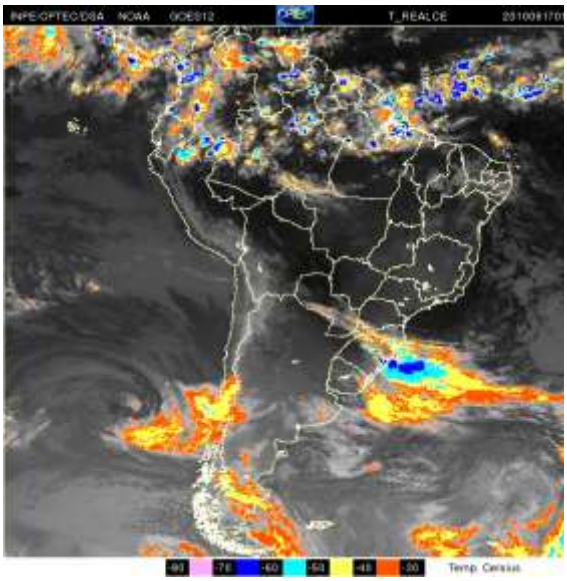


Figure 9a: Synoptic Analysis: 17/06/2010-00Z. Source: cptec.inpe.br/ Satellite: GOES12.

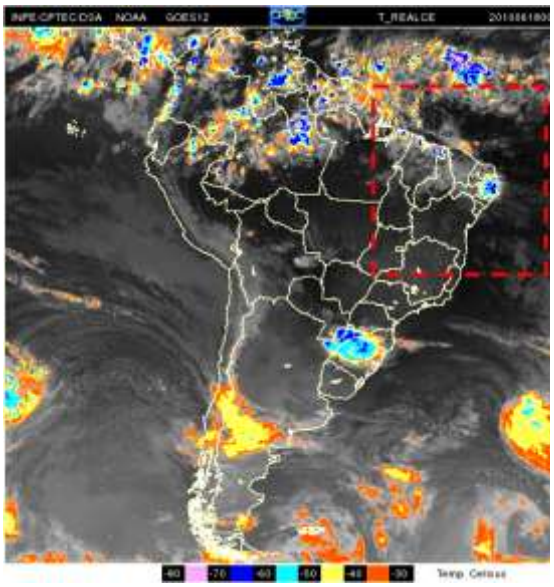


Figure 9b: Sinotic Analysis: 18/06/2010-00Z. Source: cptec.inpe.br/ Satellite: GOES12. Modified by the Author.

After these disasters of 2010, the urban spot of many cities in Alagoas changed, interiors neighborhoods were destroyed and others erected with new housing, such as the municipality of São José da Laje, the Residential Councilman Armando Lira; in Santana do Mundaú, the Residential Santana do Mundaú; in União dos Palmaresos housing estates (Newton Pereira Gonçaves, Nova Esperança, Conceição Lira I and II and José Carrilho Pedroza; in Branquinha, 3 housing sets were built on Plateau I, II and III; in Murici the Olavo Calheiros Housing Complex was built; in Rio Largo, the Demorisvaldo Targino housing complex was built for the displaced and homeless from the flood that occurred in the Mundaú River Hydrographic Basin.

FINAL CONSIDERATIONS

With this, we consider that the Brazilian Northeast, in the decade of 2000 to 2010, went through hydrometheoretical events often arising from the ENOS of the Equatorial Pacific

Ocean region, these events at intervals not fixed by established, but that can occur between 7 and 10 years, cause disasters in the socio-environmental context of the State of Alagoas.

The NEB due to heavy rains at this time of year was one of the areas with the highest occurrence of natural disasters, such as floods. During this period, hundreds of people lose their homes and lives. The physical components such as the predominantly clayey soil, and the predominantly crystalline relief, as well as deforestation of the ripiary forests, also completed for the promotion of these disasters. Man when building residence in irregular places and without any infrastructure, urbanization with paved roads are also promoters for the triggering of these socio-environmental problems. A greater executively of public policies, example of reforestation of riprica forests, supervision against deforestation is an option for a diminutive to the problematic esplanade in the present work.

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