

Influence of the El Niño and La Niña on tropical cyclones over the South China Sea

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Abstract. The present paper investigates the influence of El Niño and La Niña event year over the South China Sea (SCS) on tropical cyclones (TCs) activity moving on to Thailand. Base on the storm tracking for a period of 69 years (1951–2019) from the Thai Meteorological Department (TMD) was applied to analyse. The results show that during this period the number of 27 El Niño event year and 22 La Niña event year, the intention of the tropical cyclones are a stronger and frequent occurrence during La Niña event year (14 TS and 3 TY) more than El Niño event year (9 TS and 2 TY) which nearly matches of total the tropical cyclones in each event year (30 TCs for El Niño and 33 TCs for La Niña). Furthermore, analysis using the genesis location of tropical cyclones indicates that the tropical cyclones are significantly influenced in the La Niña event year seems to be related mostly located in the central of the South China Sea (111° – 117° E, 7° – 18° N) and the genesis location more near the mainland of Thailand than the El Niño event year, different from tropical cyclones in El Niño event year it's scattered throughout this area (SCS).

1. Introduction

Tropical cyclones (TCs) influencing the weather and can cause disasters as well such as heavy rain and the strong winds [1-4]. Which is divided into the severity of the storm according to an international agreement by using the wind speed near the storm center as follows Depression (D), Tropical Storm (TS), and Typhoon (TY). The tropical cyclones have different names for their origin, such as those that originate in the North Atlantic Ocean, the Caribbean Sea, the Gulf of Mexico and the Western part of Mexico known as the Hurricane (HR), were genesis in the Western North Pacific Ocean, the South Pacific Ocean and the South China Sea called the Typhoon (TY), and were born in the Bay of Bengal and the Indian Ocean is called the Cyclone (CY). Thailand is located between the sources of the tropical cyclone on both sides, on the east side is the Pacific Ocean and the South China Sea and on the west side is the Indian Ocean. The storms are more likely to move from the east side than the west. Thailand normally has an average of 3-4 TCs per year [5].

One of the factors of a tropical cyclone occurrence due to the water in the sea or the ocean is heated, the water temperature rises. The El Niño–Southern Oscillation (ENSO), El Niño and La Niña events have a direct effect on the change in seawater temperature [2-4, 6-10]. El Niño was the warm phase of ENSO and participatory the warm ocean water that develops in the central and east-central of equatorial the Pacific, however the La Niña was warm seawater that moves to the western. Considered the La Niña was to be the cold phase of the broader ENSO weather phenomenon, as the opposite of El Niño.

This research investigated the influence of El Niño and La Niña event year over the South China Sea (SCS) on tropical cyclones (TCs) moving into Thailand monthly period of 69 years (1951–2019). The variety of TCs activity was explained in terms of the genesis locations [1-2, 6-8].

2. Methodology

2.1. El Niño and La Niña years data.

In terms of the El Niño and La Niña years have been retrieved from the data information of Historical El Niño/La Niña episodes (1950-present) from the National Oceanic and Atmospheric Administration (NOAA) [11]. The event years that appropriate for this research period with selected for the weak and strong year events, we found that 27 events (10 weak and 17 strong) for the El Niño years (red) and 22 events (13 weak and 9 strong) for the La Niña years (blue), shown in figure 1.

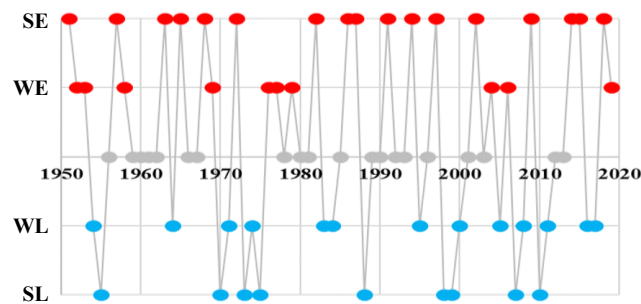


Figure 1. Weak and Strong El Niño/La Niña years (1951-2019).

2.2. Tropical cyclone in the South China Sea data.

Base on the tropical cyclone moving into Thailand monthly period of 69 years (1951–2019) from the Thai Meteorological Department [5]. We obtained the classifications, the number and the genesis locations of the tropical cyclone in the South China Sea with matching in this period for the weak and strong of the El Niño and La Niña years respectively.

Table 1. The number of tropical cyclones during the weak and strong* of the El Niño / La Niña years.

YR (EN)	D	TS	TY	YR (LN)	D	TS	TY
1953	1			1955*	1*		
1957*	1*			1964	4		1
1958	3			1970*	3*		
1963*	3*			1973*	1*	1*	1*
1965*	1*	2*		1974	1		
1968*	1*	1*		1975*	1*		
1969	2			1983		3	
1972*	1*		1*	1984		2	
1979	2	1		1988*	1*		
1982*		1*		1995		1	
1986*	1*		1*	1998*		2*	
1991*	1*			1999*	2*		
1997*	1*	2*		2000		1	1
2015*		1*		2005	1		
2018*	1*	1*		2007*	1*		
				2008		1	
				2010*		1*	
				2017		2	

* Strong El Niño / La Niña years.

3. Result and discussion

In this period 1951-2019 was assessed base on a nearby number, 15 selected of El Niño and 18 selected of La Niña event years with the appearance of the tropical cyclones. The total number of TCs for each

event year was not too much different in value (30 TCs for El Niño and 33 TCs for La Niña) were shown in table 1. The intensities of the tropical cyclones are stronger (>D) and the frequent occurrence during the La Niña event year was higher than the El Niño event year with the number of 14 TS, 3 TY for La Niña and 9 TS, 2 TY for El Niño [2, 4, 9]. In terms of the weak and strong years, the number of TCs in both La Niña years was equally (18/15*) but was less in the weak El Niño (9/21*).

The genesis locations of the tropical cyclones in the weak and strong years of El Niño event were spread around the border of the South China Sea, especially for storms TS and TY shown in figure 2a-2b. While TCs in the La Niña years mostly appears more intensely in the centric of this area (111°– 117° E, 7°– 18° N), it is noticeably the denser and large powerful storms (TS and TY) genesis locations were more moving westward approach to Thailand shown in figure 2c-2d [1-3, 8-10]. This phenomenon was related to the warm water in the equatorial part of the Pacific Ocean moves across from the East towards the West (SCS) in the La Niña years. The tropical cyclones typically form relate to the warm water, they derive the primary energy source. The central region of the SCS has a greater depth and volume of seawater than that of the rim. Therefore, it has a concentration of higher temperature value and better retention.

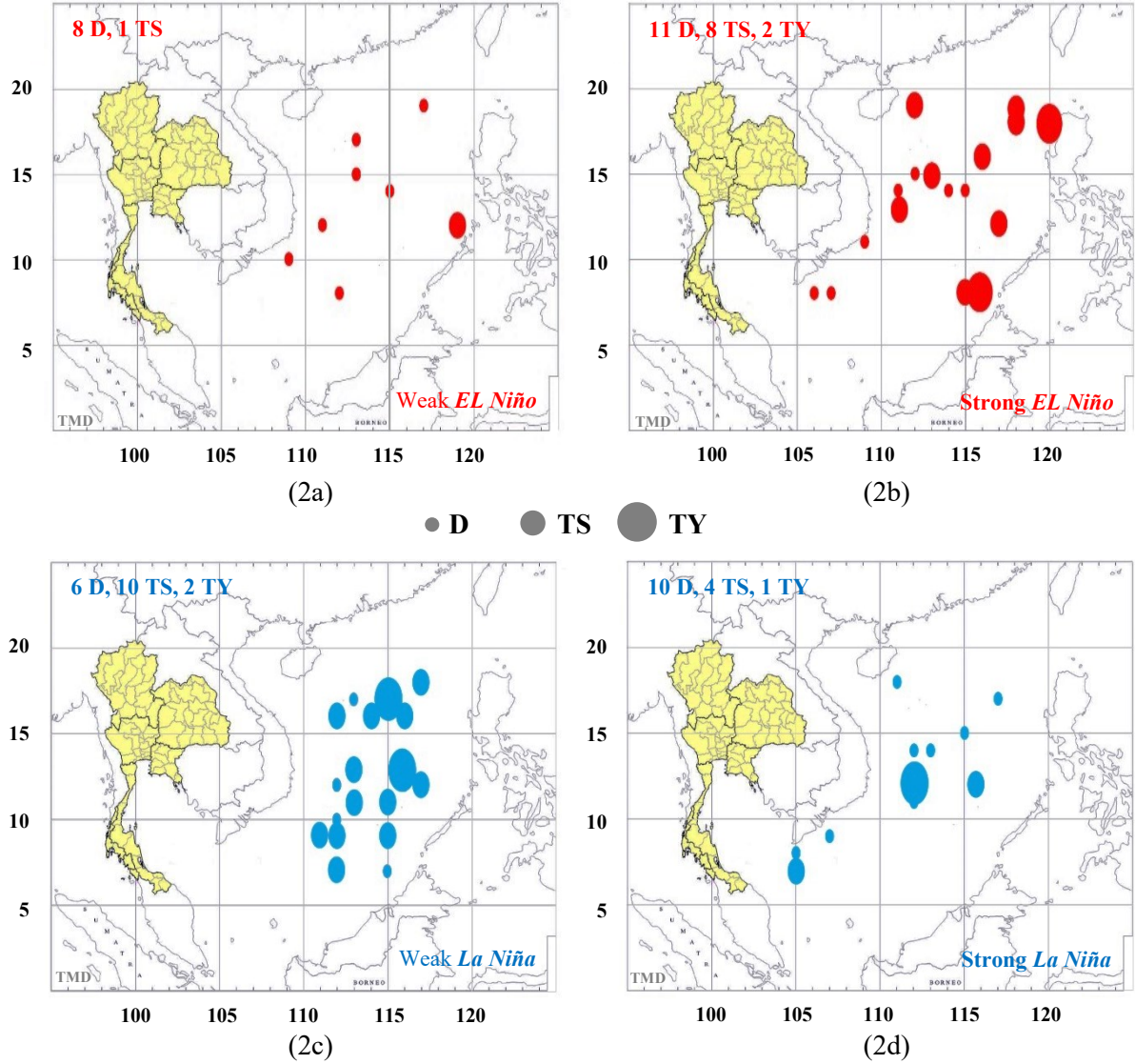


Figure 2. Tropical cyclones genesis locations over the South China Sea, (2a-2b) Weak and Strong El Niño years, and (2c-2d) Weak and Strong La Niña years. (Some TCs location may overlap)

4. Conclusion

This paper analyses the influence of the El Niño and La Niña on Tropical cyclones over the South China Sea. The relation between the El Niño and La Niña on Tropical cyclones as the mechanism of ENSO affecting the TCs activity are also investigated. One of the main factors required for the formation genesis and development intensity of tropical cyclones is the sufficiently warm sea surface temperature (SST). In the La Niña years, warm water at the Pacific Ocean's surface moves to the west influenced the sea surface temperature in the South China Sea was warmer and creep in farther than the El Niño years. Causing a higher in the number (TCs) and the intensity (TS and TY) of the tropical storms in La Niña years of this area. In terms of the genesis location, La Niña events make TCs mostly was developed on the centric of the South China Sea and them close to Thailand.

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