

Behavior of the days with SLS reports in the cuban regions and its relationship with the phases of ENSO events in the period 1990-2020

AUTHORS: Claudia Espinosa Valdés
Alis Valera de La Rosa
Evelio García Valdés

MAIL: claudiaespinosa545@Gmail.com
alis.Valera@insmet.cu
evelio.garcia@insmet.cu

Cuban Institute of Meteorology



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SEVERE LOCAL STORMS (SLS)



Variations in Weather



Very Low Frequency Oscillations or Cycles

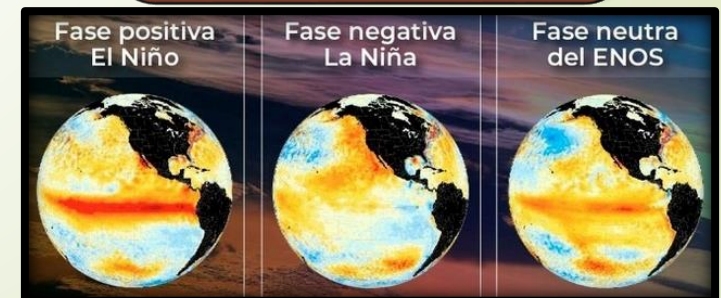


The El Niño-Southern Oscillation event (ENSO)

OBJECTIVES

To find the monthly distribution of TLS in Cuba, as well as its relationship with the ENSO phases.

To analyze the relationship between the days with TLS reports and the intensity of the ENSO phases in the rainy and dry season.



ABSTRACT

Severe Local Storms affect the Cuban territory at any time of the year and constitute one of the main variations in the climate. These variations seem to be associated with very low frequency oscillations or cycles, such as the El Niño – Southern Oscillation event. In this research, the objectives are: to find the monthly distribution of Severe Local Storms in Cuba, finding the months of greatest severity, as well as their relationship with the phases of the El Niño - Southern Oscillation event and to analyze the relationship between the days with reports of severity and intensity of the El Niño-Southern Oscillation phases in the rainy and dry seasons. It was shown that the months with the highest occurrence of severe activity coincide with the rainy period of the year, resulting in the months of May to August as the most frequent, with July standing out as the month of maximum severe activity for the west and center, while which, in the eastern region, is June. In addition, it was observed that the phase that most favored the occurrence of severity was the Neutral phase of the El Niño - Southern Oscillation event, followed by the warm phase and, to a lesser extent, the cold phase. On the other hand, it was evidenced that in the rainy and dry season the greatest number of reports of severe phenomena occurs when the values of the El Niño Index – Southern Oscillation are weak during the La Niña and El Niño phases.

Keywords:

El Niño, La Niña, SLS, rainy season, dry season

INTRODUCTION



1970

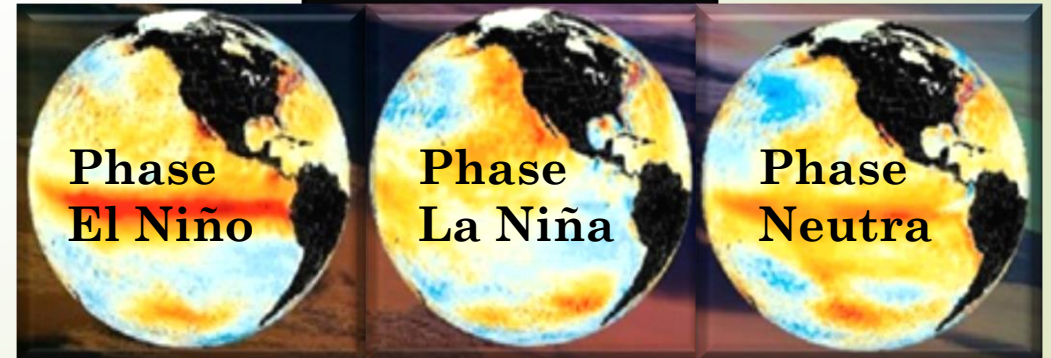


Significant change in the Climate of the largest of the Antilles

Changes in circulation patterns over the Caribbean region and the Gulf of Mexico

ENSO

The observed changes seem to be associated with very low-frequency oscillations or cycles in the background climatic conditions, within processes of natural climate variability



VARIATION IN THE WEATHER



Increase in the
Frequency of
Affection of
Extreme
Meteorological
Events



Severe Local Storms



Hail



Aeroavalanches



Tornadoes



Waterspouts

MATERIALS AND METHODS

STUDY REGION

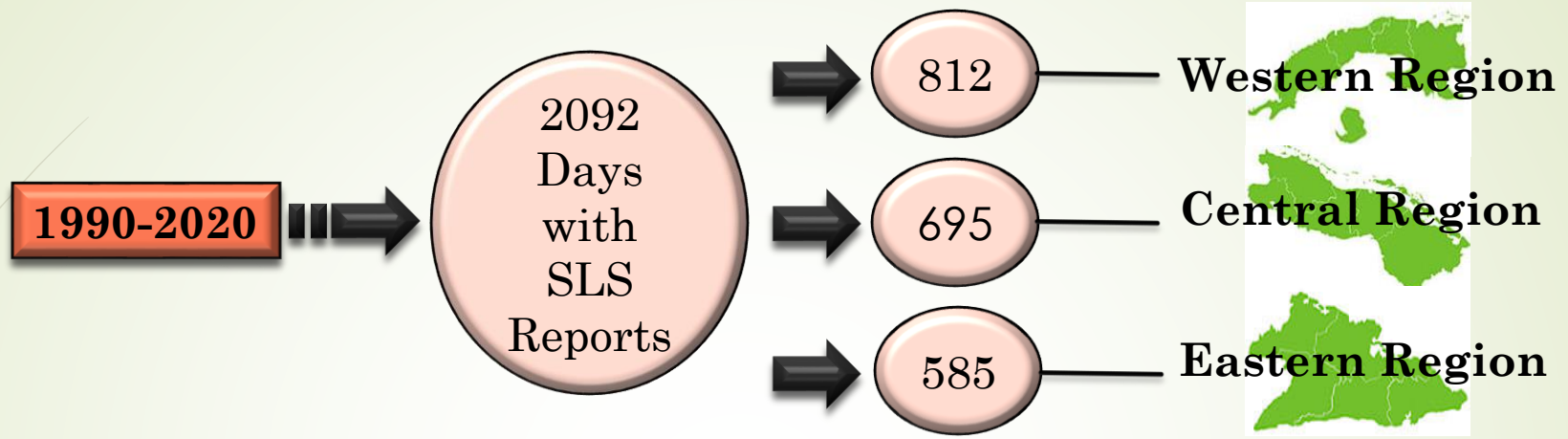


DATABASE

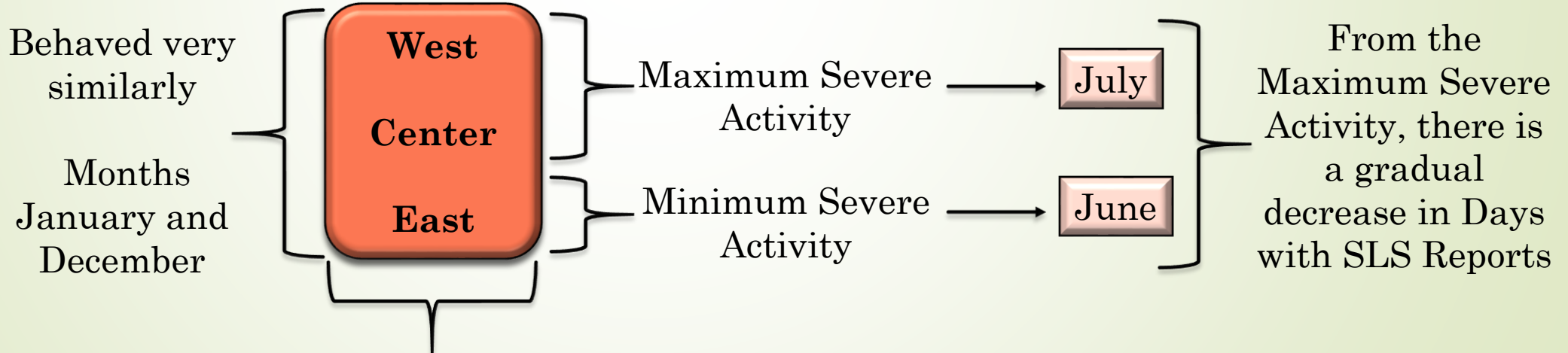
- SLS Reports ↔ INSMET Forecast Center
- ENSO Index (EI) ↔ INSMET Climatology Center

- ❖ Firstly, the days with SLS reports for each of the Cuban regions in the study period are examined, describing the annual and monthly distribution of severe phenomena
- ❖ Subsequently, the relationship between the intensity of the phases of the ENSO event and the behavior of days with severity in Cuba in the rainy and dry season is analyzed.

RESULTS AND DISCUSSION



❖ Monthly Distribution of Days with SLS Reports



As of February, a sustained increase in Days with SLS Reports can be seen

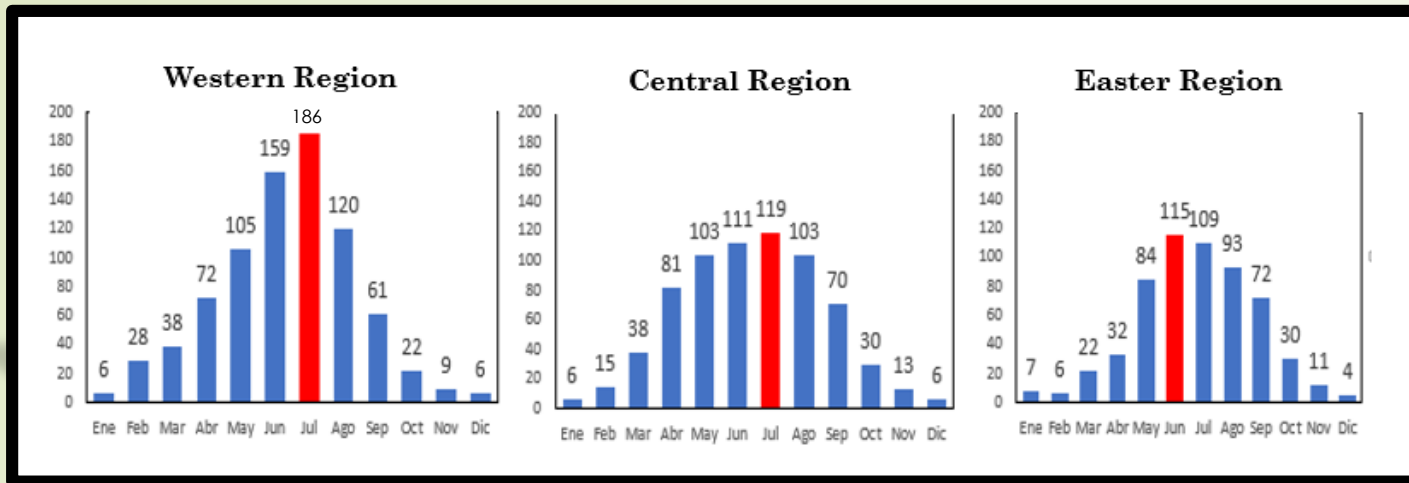


Figure 1: Monthly distribution of the days with SLS reports in the Cuban regions in the period 1990 - 2020.

Highest number of Days with SLS Reports



- May
- June
- July
- August

Rainy Season in Cuba (May - Oct)



Least number of Days with SLS Reports




- January
- February
- November
- December

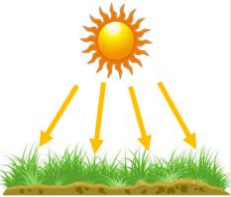
Dry Season in Cuba (Nov - Apr)

Meteorological Conditions

Vertical Wind Shear



Day Warming



Supposes favorable conditions for the development of SLS

Table 1: EI of the months with the highest number of days with SLS reports in the period 1990-2020

Years	May	Jun	Jul	Aug
1990	1.69	13.44	12.27	0.71
1991	94.47	109.33	72.84	36.98
1992	178.93	67.02	13.33	-0.44
1993	133.47	111.60	49.94	39.56
1994	15.40	13.98	-2.88	-7.50
1995	-11.02	-10.00	-3.67	0.00
1996	-15.24	-21.34	-12.47	-9.78
1997	100.33	226.67	341.91	461.07
1998	325.07	37.89	26.37	-14.00
1999	-28.27	-22.40	-7.72	-10.33
2000	-2.67	-1.60	-6.04	-6.67
2001	3.16	5.78	3.47	-0.50
2002	29.72	40.38	57.49	66.27
2003	-8.22	-28.47	-13.83	-0.13
2004	1.93	0.00	-0.73	8.70
2005	34.67	40.37	20.41	10.19
2006	-3.98	2.74	18.68	35.35
2007	-9.20	-6.84	-12.34	-4.79
2008	-2.32	3.05	2.61	23.89
2009	0.67	0.00	16.88	23.36
2010	11.93	10.10	-42.16	-104.89
2011	-24.03	12.55	15.33	4.05
2012	3.53	40.76	37.38	48.17
2013	0.69	-24.24	-49.18	-30.95
2014	7.26	22.75	13.03	24.46
2015	43.25	60.93	149.65	227.23
2016	31.91	3.17	0.03	-12.21
2017	27.00	21.57	12.79	7.97
2018	-14.67	4.44	6.40	2.89
2019	18.60	20.89	23.54	8.56
2020	7.44	0.58	-3.91	-15.28

* The red color represents the El Niño phase, the blue the La Niña phase and the rest of the values represent the Neutral phase.

Neutral Conditions prevail

The Sea Surface Temperature (SST) oscillates between -0.5°C and 0.5°C with respect to the average in the Equatorial Pacific, which resembles normal weather patterns

El Niño Phase

1991 1993 1998 2015
1992 1997 2002

La Niña Phase

2010 → July and August
2013 → Julio

Table 2: Number of days with SLS reports in the months of greatest severe activity in Cuba.

Years/Months	Number of Days with SLS Reports											
	Western Region				Central Region				Eastern Region			
	May	Jun	Jul	Aug	May	Jun	Jul	Aug	May	Jun	Jul	Aug
1990	4	2	9	1	2	6	5	7	0	0	0	0
1991	8	5	10	4	0	3	6	6	0	1	0	3
1992	3	5	9	0	3	6	8	8	1	3	0	1
1993	5	6	3	4	4	5	2	0	0	0	0	1
1994	1	5	1	7	3	2	4	1	1	3	2	2
1995	2	1	5	4	2	2	1	0	4	9	4	1
1996	5	5	3	1	2	1	2	0	2	3	1	3
1997	3	4	4	4	3	3	1	4	0	0	2	1
1998	5	1	1	0	1	2	0	5	1	7	3	3
1999	10	4	5	2	5	3	2	0	5	5	4	4
2000	3	8	7	11	2	5	6	5	1	3	4	2
2001	0	6	6	1	4	4	8	2	5	5	3	2
2002	1	4	8	3	0	3	2	5	4	4	2	7
2003	5	7	3	3	2	4	5	5	9	7	2	2
2004	0	11	7	7	1	6	4	6	0	0	5	3
2005	1	10	10	9	4	2	2	2	1	1	0	3
2006	7	3	5	7	3	2	4	1	0	4	2	2
2007	6	5	8	2	3	4	0	3	3	4	7	4
2008	3	10	4	2	3	1	9	1	2	4	6	6
2009	2	7	2	5	3	3	5	2	7	3	2	1
2010	1	2	4	6	2	1	4	4	3	4	7	3
2011	5	3	5	4	8	2	2	2	4	4	6	4
2012	2	1	10	4	4	5	2	2	3	9	5	2
2013	6	7	6	6	3	3	7	2	2	3	4	4
2014	3	9	7	1	2	5	5	1	4	5	2	6
2015	3	4	8	6	6	11	4	6	6	6	8	1
2016	3	2	7	5	8	8	1	5	6	2	8	6
2017	1	3	9	2	0	0	7	9	1	3	5	7
2018	0	7	10	7	4	1	3	2	2	5	4	4
2019	4	5	5	2	9	4	4	7	0	7	8	5
2020	3	7	5	0	7	4	4	0	7	1	3	0
Total	105	159	186	120	103	111	119	103	84	115	109	93

570
(40.5 %)

436
(31 %)

401
(29 %)

May

In the years that there were a greater number of severe events, the Neutral phase of the ENSO event was present

June

There was no homogeneity in terms of the phases, since the maximum values occurred both in the warm phase and in the neutral phase in the three regions of Cuba

July

August

The phases that most favored severe activity in the archipelago were Neutral and El Niño

Total Days with SLS Reports

1407

❖ Intensity of the ENSO phases in the distribution of days with SLS reports in the Rainy Season (May - Oct)

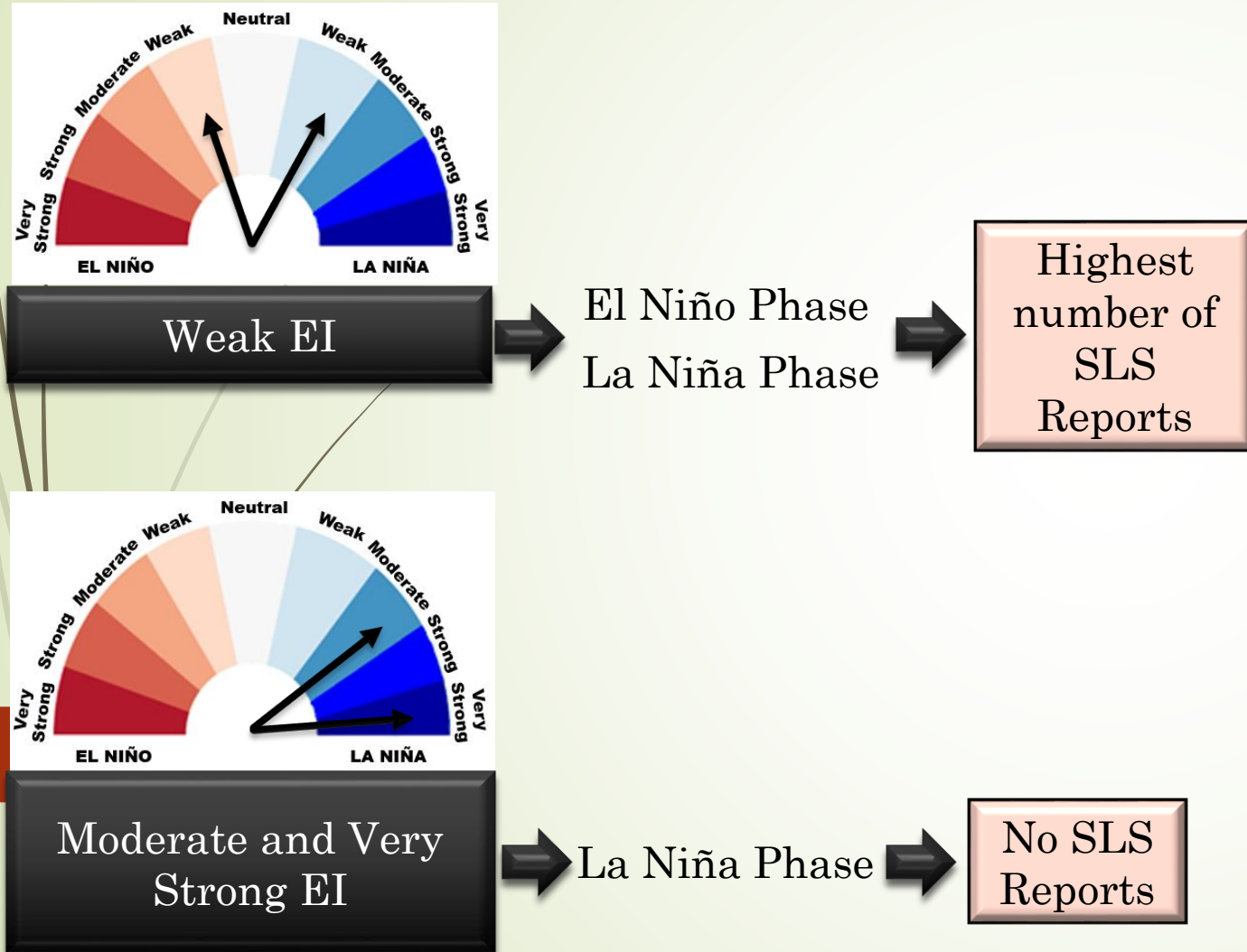


Table 3: Number of months and days with SLS reports in the rainy season in Cuba between the years 1990 - 2020

		Day with SLS Reports			
	Index	Months	Western Region	Central Region	Eastern Region
El Niño Phase	Weak EI (50 - 150)	21	107	85	57
	Moderate EI (150 - 300)	3	15	15	8
	Strong EI (300 - 400)	3	10	6	8
	Very Strong EI (over 400)	4	6	10	8
La Niña Phase	Weak EI (-35 to -150)	4	12	10	12
	Moderate EI (-150 to -190)	0	0	0	0
	Strong EI (-190 to -290)	2	3	1	4
	Very Strong EI (less than -290)	0	0	0	0

❖ Intensity of the ENSO phases in the distribution of days with SLS reports in the Dry Season (Nov - Apr)

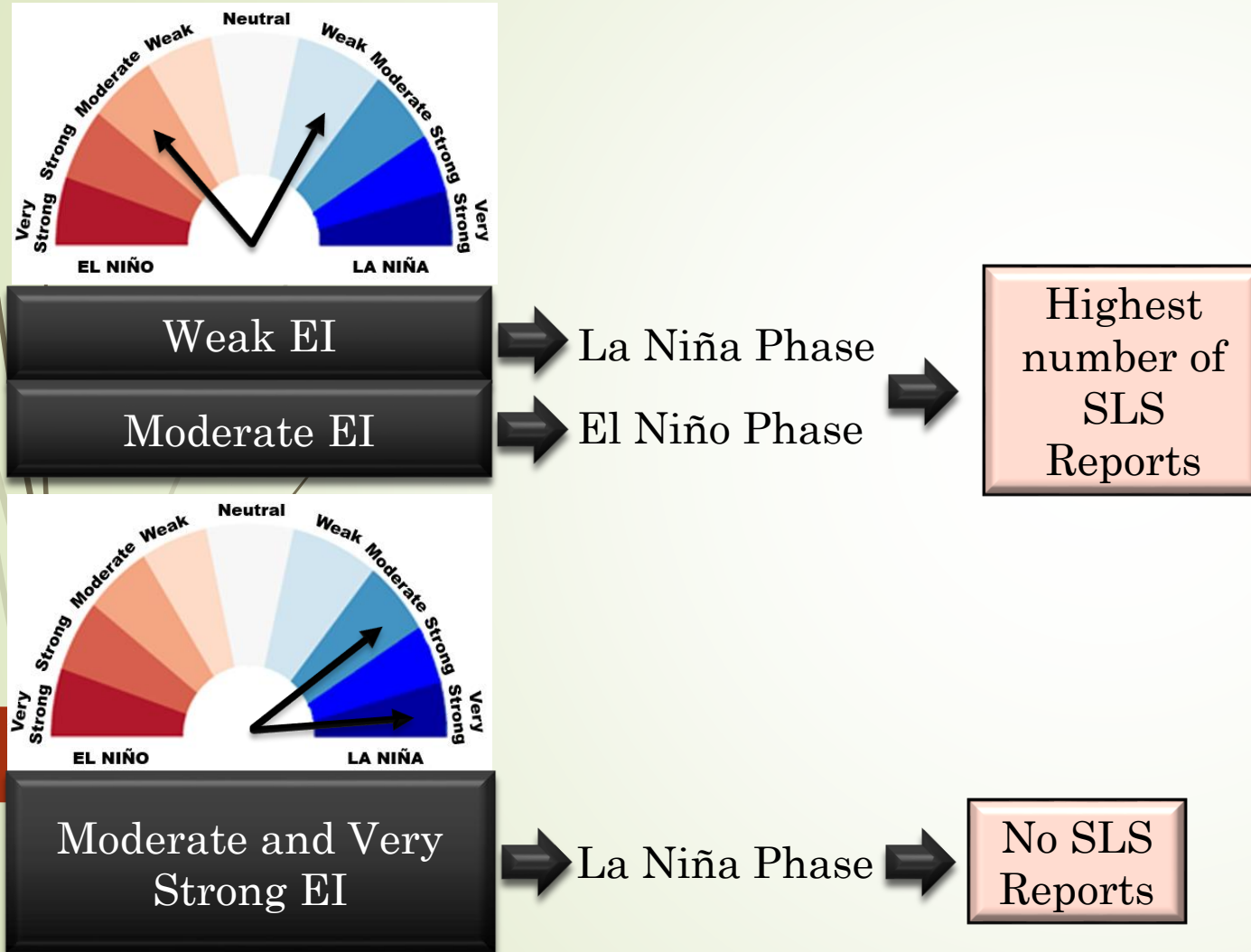


Table 4: Number of months and days with SLS reports in the dry season in Cuba between the years 1990 - 2020

	Index	Months	Day with SLS Reports		
			Western Region	Central Region	Eastern Region
El Niño Phase	Weak EI (50 - 150)	16	13	9	5
	Moderate EI (150 - 300)	10	17	8	6
	Strong EI (300 - 400)	5	6	4	5
	Very Strong EI (over 400)	6	4	0	1
La Niña Phase	Weak EI (-35 to -150)	25	16	24	14
	Moderate EI (-150 to -190)	3	1	0	0
	Strong EI (-190 to -290)	4	4	5	1
	Very Strong EI (less than -290)	4	2	1	0

CONCLUSIONS

- In the study period, a total of 2092 days with SLS reports were recorded, of which 812 corresponded to the western region, 695 to the central region and 585 to the eastern zone.
- The months with the highest number of days with SLS reports were May, June, July and August, which coincide with the rainy period of the year, highlighting July as the month of maximum severe activity for western and central Cuba, and the month of June for the eastern zone.
- The months of greatest involvement of SLS in the western zone represented more than 70% of the cases, registering a total of 570, while in the central zone it is equivalent to 62.7% and 68.3% in the eastern region, with 436 and 401 cases. respectively.
- The phase that most favored the occurrence of SLS was the Neutral phase of the ENSO event, followed by the warm phase and to a lesser extent the cold phase.
- In the rainy season, the greatest number of reports of severe phenomena occur when weak EI values occur during the El Niño and La Niña phases.
- In the dry season, the greatest number of severe phenomena occurs when the La Niña phase is weak. In addition, a greater number of SLS reports were reported when the El Niño EI presents moderate values in the western and eastern region, while in the center of the country they occur when El Niño is weak.



END

END



MUA

