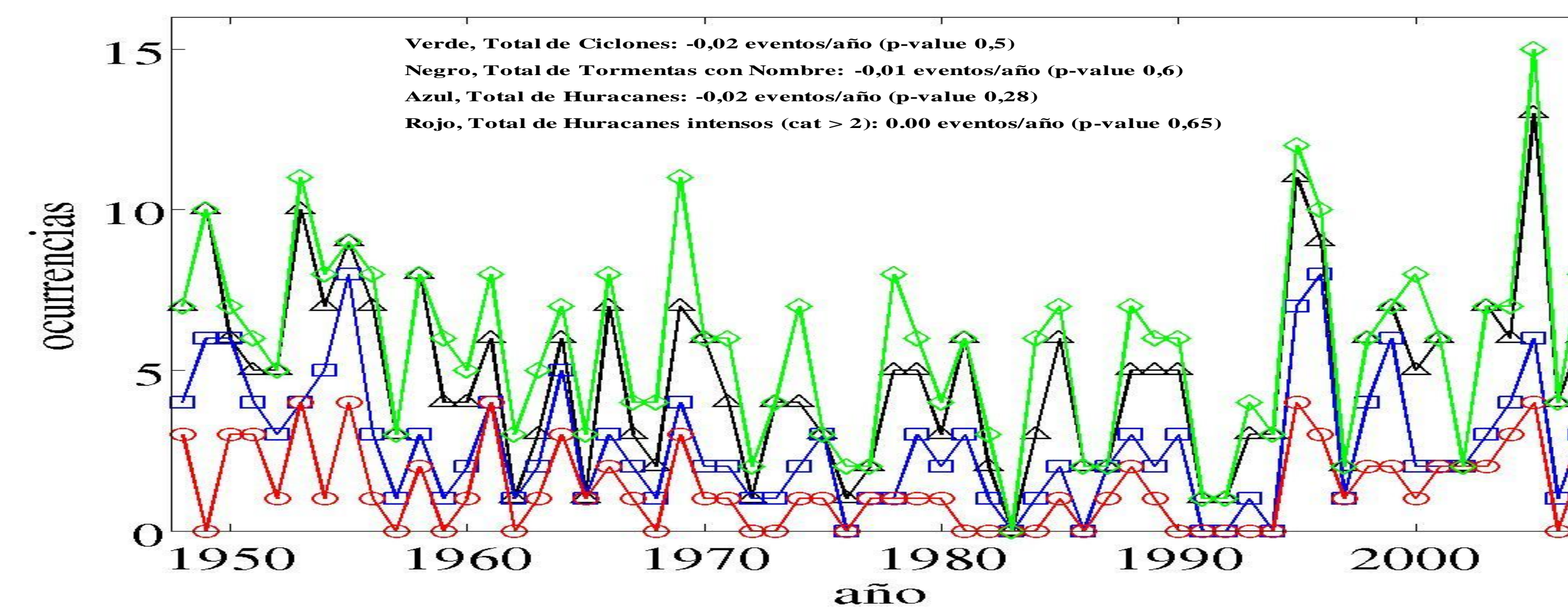


Abstract: The study of the tropical cyclones activity in the Caribbean (Figs. 1 & 2), and their historic characterization in the Central American region, is a basic element to mitigate their impact over different regions of the isthmus. As a part of the project *Paleotempestology of the Caribbean Region: A Multi-proxy, Multi-site Study of the Spatial and Temporal Variability of Caribbean Hurricane Activity* (IAI-CRN2-050), were defined years with high and low tropical cyclone impacts in Central America (Fig. 3), considering variables like trajectory, maximum wind velocity and the annual occurrence of cyclones in the basin, according with the HURDAT data base (<http://www.aoml.noaa.gov/hrd/hurdat/>). The analysis showed that tropical cyclones are more likely to occur near Central America during the August-September-October (ASO, Fig. 4a). Positive (Negative) SST (SLP) anomalies at the Tropical North Atlantic are observed for the years that showed high occurrences of tropical cyclones near Central America (Fig. 4b). Additionally, Costa Rica has a good natural disasters data base, related with events that affected specific locations and several socioeconomic sectors like agriculture, energy and transport. This data base, called DesInventar, allowed the study of disasters in Costa Rica related with tropical cyclones during the last four decades (Fig. 5a). Other disaster data bases like EM-DAT (Fig. 5c) and one produced in the project *Assessment of Impacts and Adaptation Measures for the Water Resources Sector Due to Extreme Events under Climate Change Conditions in Central America* (LA06, AIACC-UCR-CRRH, Fig. 5b) supported this result and extended the analysis for 1950-2007. The analysis showed a trend in the annual number of impacts related with hydrometeorology causes (Fig. 5) that can not be explained by climate trends only (Figs. 2 & 3a). That means that socioeconomic variables should be included in the analysis (Fig. 6) to explain this variability and their associated impacts.



Fig. 1 – The analysis considered the positions of Tropical Cyclones in the Caribbean Sea basin (latitudes $\leq 24^\circ$ N & longitudes $\geq 60^\circ$ W).



Altas ocurrencias: 2005 (15), 1995 (12), 1969-1953 (11), 1996-1949 (10), 1955 (9)
Bajas ocurrencias: 1983 (0), 1991-92 (1), 1972-76-77-86-87-97-2002 (2)

Fig. 2 – Annual Time series for the Tropical Cyclones occurrences in the Caribbean Sea (Fig. 1). All trends have p-values > 0.1 . Lines are: **Total tropical cyclones, green, Named Storms, black, Hurricanes, blue, Strong Hurricanes, red.**

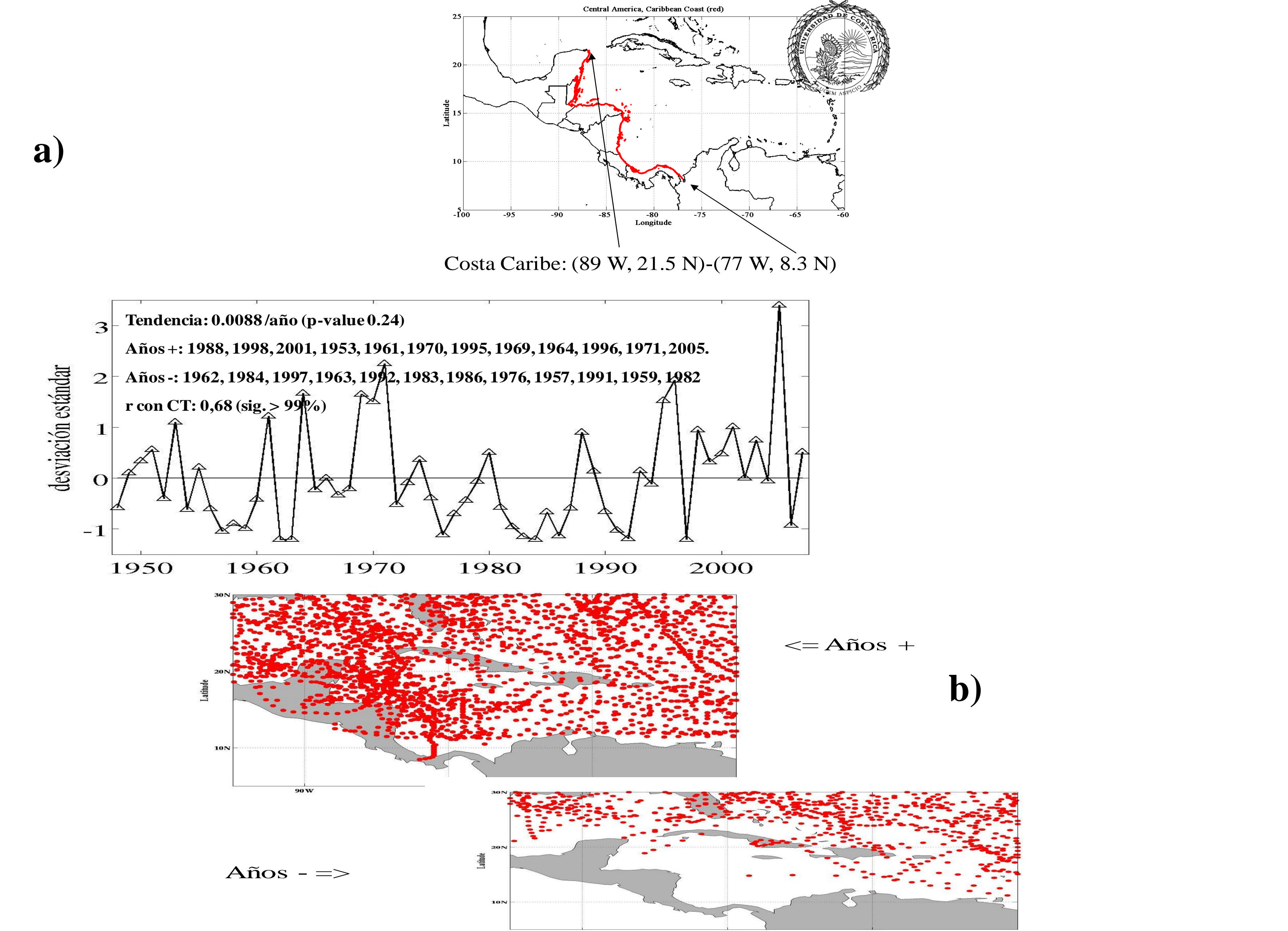
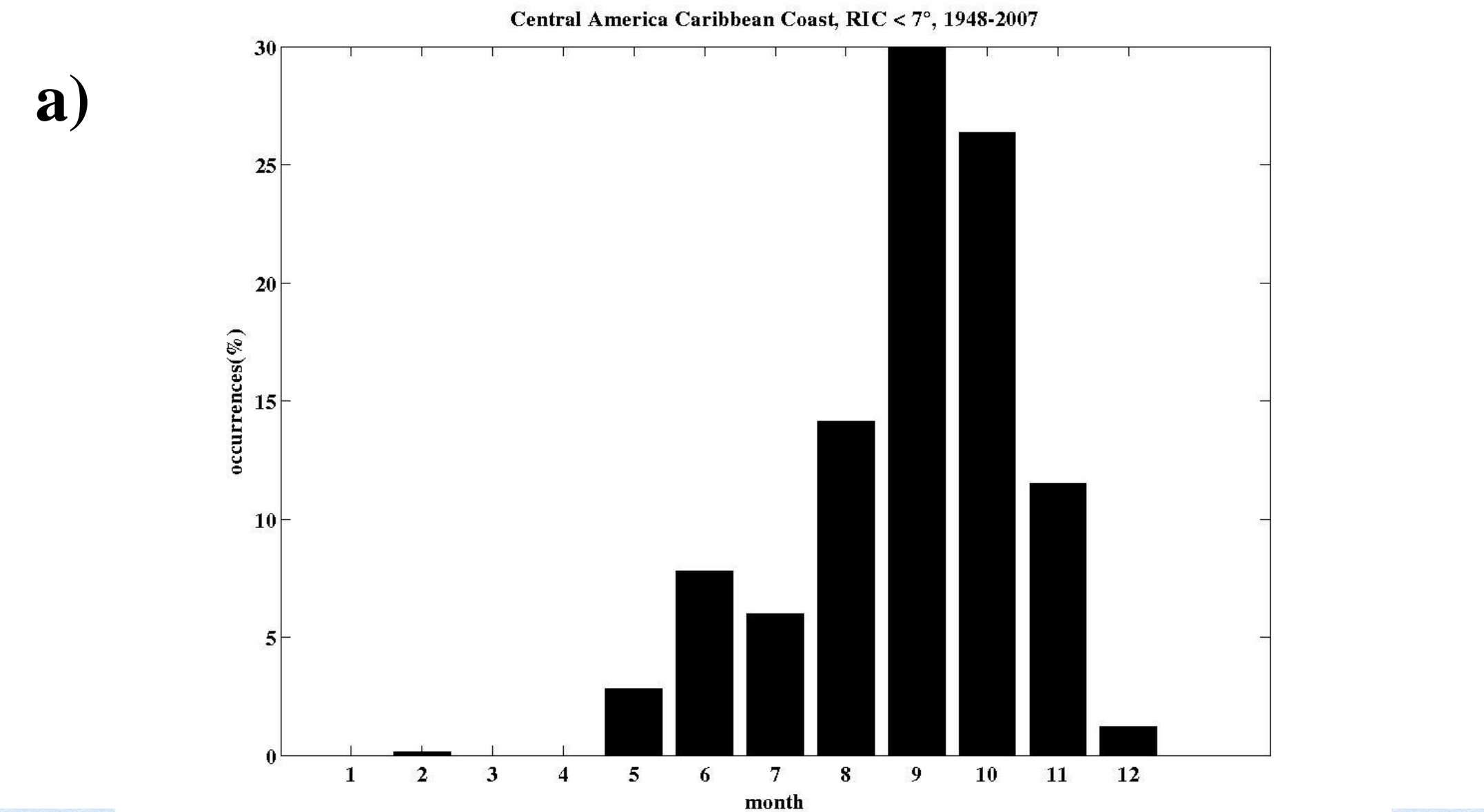


Fig. 3 – a) The Tropical Cyclone occurrence index for Central America counts the number of Central American Caribbean Coast points equal or closer than 7° from any tropical cyclone position recorded in HURDAT. In spite that its trend is positive, its p-value > 0.1 . It has a positive correlation with the annual occurrence of Tropical Cyclones in the Caribbean Basin (green line, Fig. 2, approx. 46% of the variance). b) This index allows the identification of years with more and few impacts over Central America, notice that these years (Fig. 3a) not necessarily coincide with years of high and low occurrences in the Caribbean Basin (Fig. 2).



ASO, (years+)-(years-)

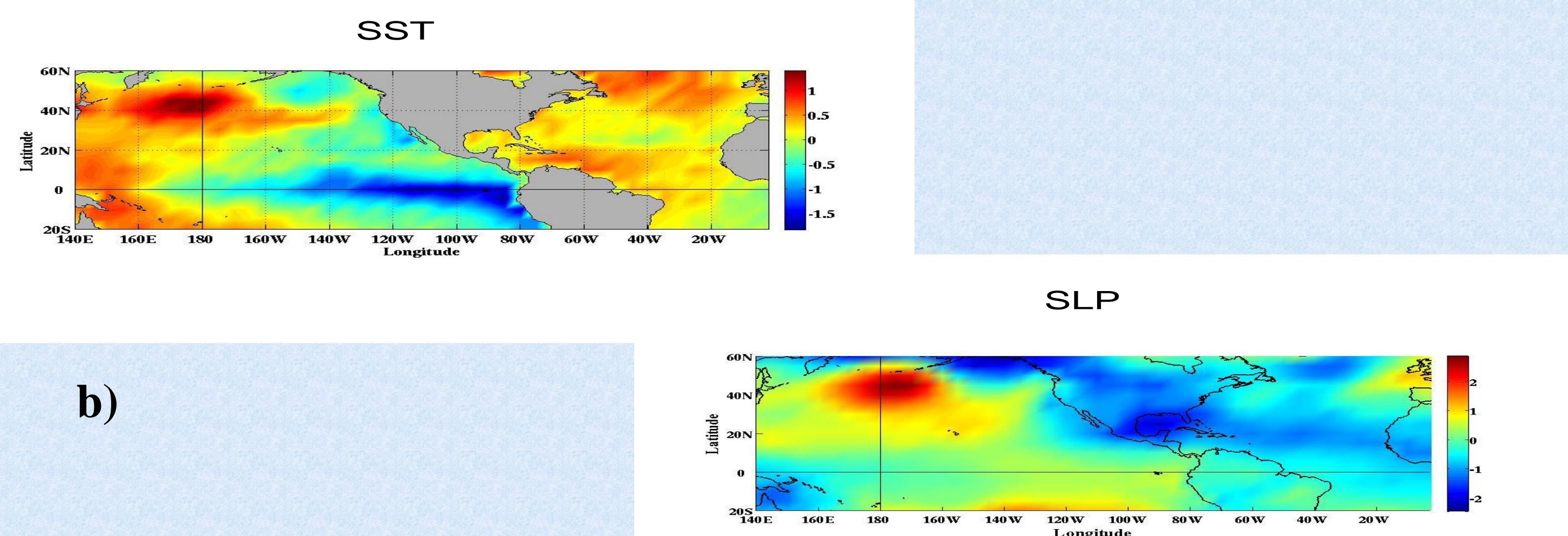


Fig. 4 – a) The annual distribution of the occurrence index (Fig. 3a) showed that tropical cyclones are more likely to occur near Central America during ASO. b) Positive SST anomalies at the Tropical North Atlantic are observed for the (years+)-(years-) composites (1968-2007 period). Notice also the negative SLP over the Tropical North Atlantic.

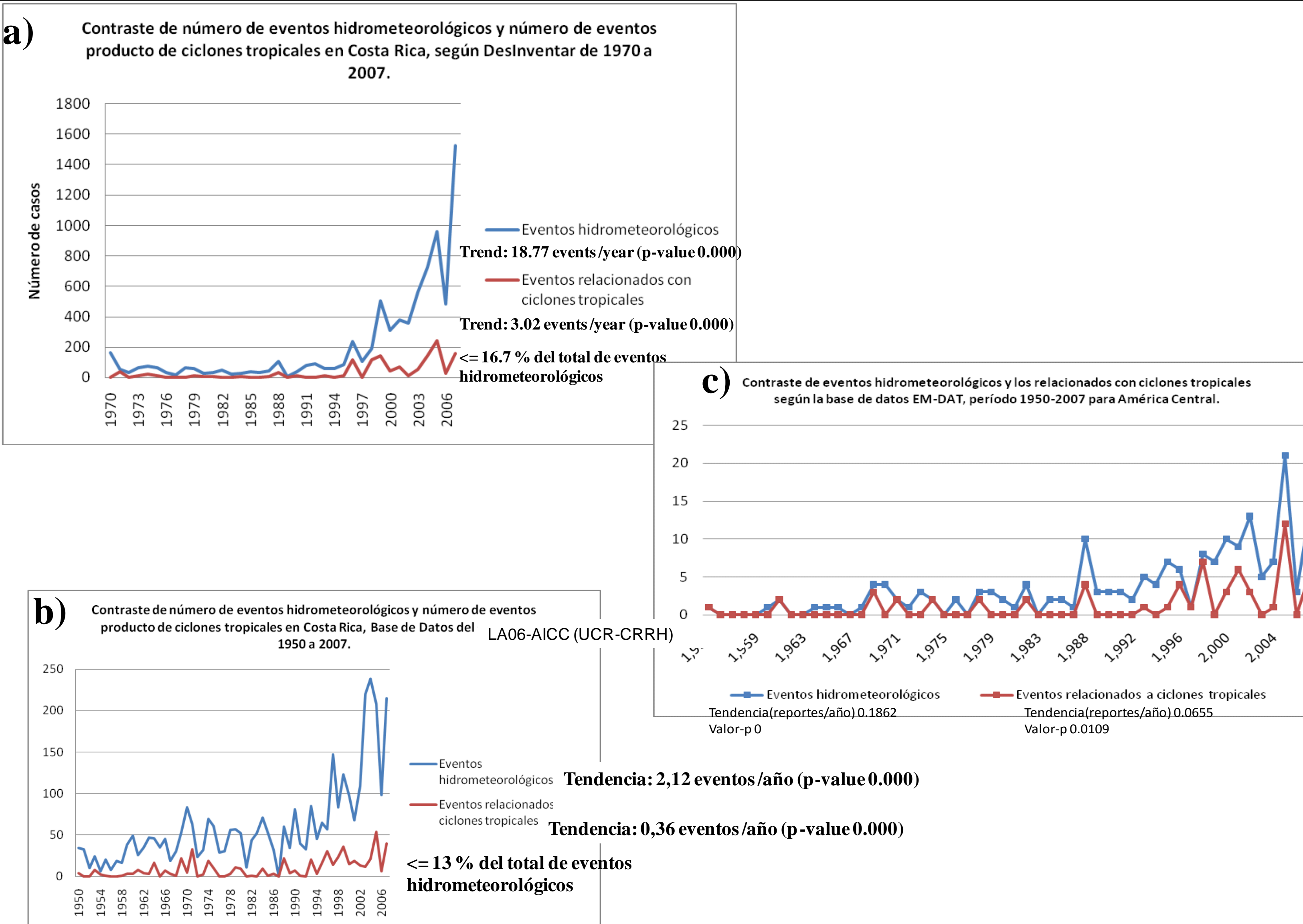


Fig. 5 – Annual number of disaster reports found in a) DesInventar, b) LA06-AICC project and c) EM-DAT Data Base associated with hydro meteorological events (blue line) and with Tropical Cyclones events (red line). All have positive trends, p-values < 0.05 . Series associated with tropical cyclones have positive correlations with both, the Total Tropical Cyclones category (green line, Fig. 2) and the index shown in Fig. 3a.

Contraste del estudio de la variable del desastre natural con un Índice Social

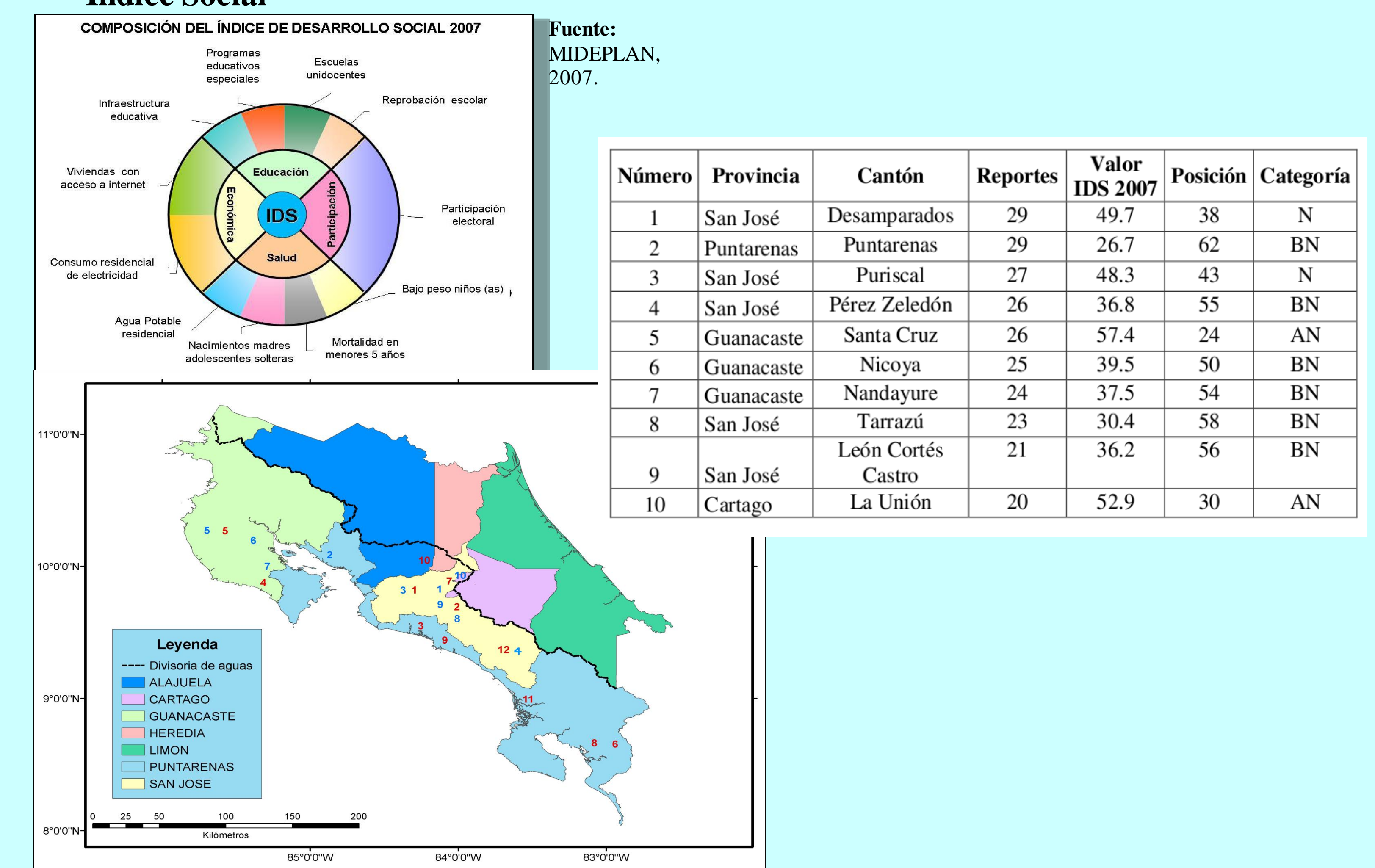


Fig. 6 – In the table are the number of disaster reports associated with Tropical Cyclone events during 1970-2007 by county in Costa Rica. All the administrative divisions shown in the map in blue numbers, according to the table, are located at the Costa Rican Pacific slope. Notice that six of this ten counties had a Social Development Index (IDS in Spanish) in the below normal (BN) category during 2007. Costa Rica has 81 counties. Black line in the map is the Pacific - Caribbean slope division.

Acknowledgments. Projects CRN2050 – IAI, “Paleotempestology of the Caribbean Region: a Multiproxy, Multi-site Study of the Spatial and Temporal Variability of Caribbean Hurricane Activity” and VI-805-A7-002, UCR, “Estudio y comparación histórica del impacto de ciclones tropicales en Centroamérica y el Caribe”.