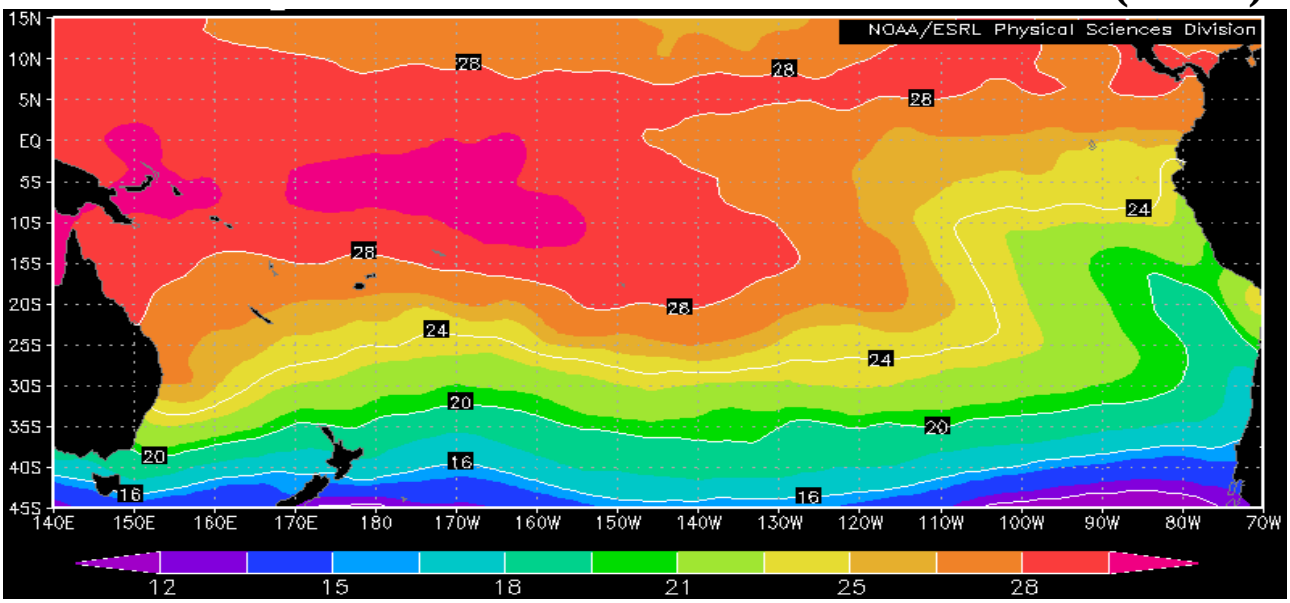
COMISIÓN PERMANENTE DEL PACÍFICO SUR (CPPS)



Sea Surface Temperature Mar, December 2009, NOAA-CIRES/Climate Diagnostic Center

DECEMBER 2009 **BAC No 231**

ERFEN

(Estudio Regional del Fenómeno El Niño)

BOLETÍN DE ALERTA CLIMÁTICO

CLIMATE ALERT BULLETIN

OMM **CPPS** **COI**

COLOMBIA	ECUADOR	PERÚ	CHILE
CCCP	INOCAR	DHN	SHOA

COMISIÓN PERMANENTE DEL PACÍFICO SUR
SECRETARÍA GENERAL
GUAYAQUIL, ECUADOR

The Boletín de Alerta Climático (BAC) is a monthly publication of the CPPS in which the oceanic and atmospheric conditions of the region of the Southeastern Pacific within the Regional Study of El Niño (ERFEN) are analyzed. The digital version of the BAC is available from the 15 of every month in the pages Web of the CPPS: http://www.cpps-int.org and of the INOCAR: http://www.inocar.mil.ec

The suggestions, commentaries or scientific information will be welcome to the electronic mails: dircient@cpps-int.org; nino@inocar.mil.ec, (Group BAC ECUADOR), or by means of written communication directed to the seat of the Permanent Commission for the South Pacific, General Secretariat, Complex Albán Borja, Building CLASSIC, 2nd floor, Guayaquil-Ecuador, FAX: (593)4-2221201.

Figure 1.- Shore stations locations in the Southeast Pacific region.

EXECUTIVE SUMMARY

During December the Sea Surface Temperature in the equatorial Pacific basin stayed with positive anomalies included between 1, 0 and 2, 0ºC as a result of the presence of "El Niño". The western coast of South America as of the first days of the month felt the arrival of a wave Kelvin, which caused a slight increase of the Sea Surface Temperature and increase of the mean sea level. These anomalies were not of great magnitude (< 1ºC), and may be that the intensification of the subtropical anticyclone of the South Pacific has slowed down the increase of the temperatures in surface. Also, this anticyclone has slowed down the reduction of the Convergence zone of the South, so the rain deficit in the region prevailed. The anomaly of the Sea Surface Temperature corresponding to the four areas of monitoring of "El Niño" were: at the Western Pacific ("El Niño" Region 4) of 1, 4ºC; in the Central Pacific ("El Niño 3.4" and "El Niño" 3 Regions) of 1, 8 and 1, 4º C respectively, and in the Eastern Pacific ("El Niño" Region 1+2) of 0, 7ºC. At subsurface level the positive anomalies of the temperature of the sea continued present. The warm nucleus of anomalies projected towards the Eastern edge of the Pacific, with positive values of until 5, 0ºC, being located between 50 and 150 ms of depth. Next to the western coast of South America positive anomalies and conditions of neutrality appeared.

The mean sea level in the South east Pacific maintained the tendency observed in previous months and showed values above its normal patterns against the coasts of Ecuador (around 15, 0 cm) and of Peru (between 12, 0 and 29, 0 cm). The Index of the Southern oscillation for the month continued in the negative phase with a value of -1, 0.

The intertropical convergence zone appeared like a thin band on the Central Pacific until the Eastern Pacific. Cells of weak convective activity were observed with its average central axis located in 5° N. In the region of the South east Pacific the surface winds had a South and South-east direction; with respect to the speed, the anomalies were positive between 0, 5 and 2.0 m/s.

Taking into account the present thermal behavior of the Equatorial Pacific, as well as some numerical models, likely in January the present heating of the Tropical Pacific Ocean persists and that in the Eastern side of the Pacific Ocean the Sea Surface Temperature (SST), tends to increase. The models of numerical simulation indicate the presence of "El Niño" of moderate intensity in the central sector of the Equatorial Pacific, which will continue its advance towards the Eastern of the Pacific during the next months. The present condition, in the region of the South east Pacific, are associate with the occurrence of "El Niño". In Colombia and Chile the SST presented values of neutrality, whereas in Ecuador and Peru the positive anomalies of SST persist. In relation to Sea Level in Ecuador and Peru the anomalies of Sea Level were increased and in Chile it stayed in its normal values.

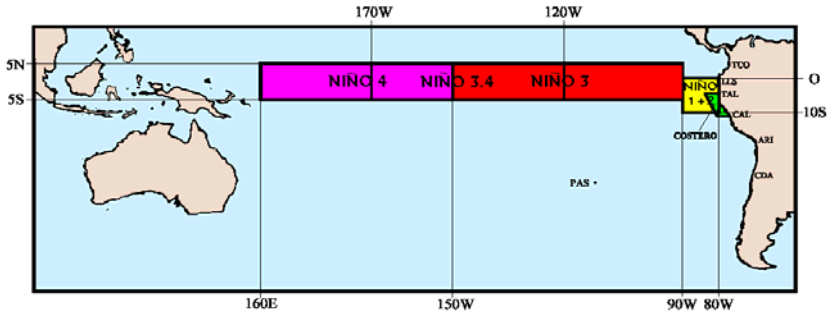


Figure 2.- Map indicating locations and codes of series. Rectangles show the average area of Sea Surface Temperature (SST °C)

INSTITUCIÓN	Dirección electrónica
CCCP - Centro Control de Contaminación del Pacífico (Colombia);	cccp@cccp.org.co
IDEAM – Instituto de Estudios Ambientales (Colombia);	meteorologia@ideam.gov.co
INOCAR - Instituto Oceanográfico de la Armada (Ecuador);	nino@inocar.mil.ec
DHN - Dirección de Hidrografía y Navegación (Perú);	oceanografia@dhn.mil.pe
SHOA - Servicio Hidrográfico y Oceanográfico de la Armada (Chile)	shoa@shoa.cl
DMCh - Dirección de Meteorología (Chile)	metapli@meteochile.cl
NOAA - AOML Miami (USA)	JHARRIS@aoml.noaa.gov

Permanent Commission
for the South Pacific (CPPS)

CLIMATE ALERT BULLETIN
BAC Nº 231, DECEMBER 2009

I. GLOBAL AND REGIONAL IMAGE

The equatorial Pacific during December continued with high sea temperature, whose anomalies are between 1, 0 and 2, 0ºC as a result of the presence of "El Niño". On the other hand the Western coast of South America, during the first days of the month, felt the arrival of a wave Kelvin, which caused the generalized increase of the Sea Level in the coasts of the South east Pacific; as far as those of the temperature of the sea next to the coast. The increase of temperature were not of great magnitude due to driving of the Anticyclone of the South Pacific that intensified the coastal and equatorial upwelling, causing the diminution of the temperatures by mixture processes; in addition, this activity of the Anticyclone has contributed with the reduction of the Convergence zone of the South, having prevailed the rain deficit in the region.

The anomaly of Sea Surface Temperature in the "El Niño" regions during the last week of December, presented the following values; in the region of the Western Pacific ("El Niño" Region 4) it was of 1, 4ºC; in the Central Pacific ("El Niño" Regions 3. 4 and 3) of 1, 8 and 1, 4º C respectively, and in the Eastern Pacific ("El Niño" Region 1+2) of 0, 7ºC.

At subsurface level, the positive anomalies of the temperature of the sea continued present, the warm nucleus stayed in the sector of the Central – Eastern Pacific (150ºW-90ºW), with positive values of until 5, 0ºC, located between 50 and 150 ms of depth. Next to the western coast of South America positive anomalies were observed (between 0º and 4º of South latitude) and neutral conditions towards the north and the south of this strip.

During December The Mean Sea Level continues increasing above its normal. In front of the coasts of Ecuador the sea level was 15, 0 cm higher, whereas throughout the Peruvian coast positive anomalies of consideration appeared, the minimum anomaly was in the southern station of Matarani (12, 0 cm) and the maximum anomaly in the station of Chimbote (29, 0 cm).

In this month the value of the Index of Southern Oscillation (ISO) was of -1, 0.

The Intertropical Convergence Zone during most of the month looked like a thin band extended from the Central Pacific to the Eastern Pacific, where cells of weak convective activity were observed; its central axis average was located in 5° of North latitude. In the region of the South east Pacific the surface winds had a South and Southeast direction with positive anomalies of speed between 0, 5 and 2, 0 m/s.

II. NATIONAL IMAGE

A. CONDITIONS IN THE COLOMBIAN COAST

The Institute of Hydrology, Meteorology and Environmental Studies (IDEAM) reports that during the first fortnight of December the dry season of end of the year with a diminution of rains. The fortification of the Anticyclone of the North Atlantic and the little activity of the Intertropical Convergence Zone generated conditions propitious of low precipitation, nevertheless, in the third week of the month the passage of two cold fronts on the Atlantic that descended a little in terms of

latitude, interacted with the Intertropical Convergence Zone generating some days rainy. From the 27 of December the Anticyclone of the Atlantic intensifies and amplifies again, generating strong winds on the Colombian Caribbean and conditions of good weather in most of the country.

The first fortnight of the month was deficit, whereas in second the precipitations associated to the passage of the fronts caused that at the end of the month amounts over the normal thing in very precise zones were totalized. However, the deficits at national level predominated. Rain with "Total Deficit" superior to 40% showed in the most of Orinoquía and the central zone of the Caribbean region.

In the Andean zone, volumes of precipitation slightly below the usual thing for the month prevailed, although in precise areas some excesses appeared. In the Amazonia, the humidity entrance from Brazilian earth observed during several days of the month was a determining factor so that amounts of rain slightly over the normal thing in most of the region were registered.

The Pollution Control Center for the Pacific (CCCP) indicates that during the monitoring of December 2009 made by the Area of Operational Oceanography of the CCCP to the fixed coastal station Nº 5 located to 10 miles of the bay of Tumaco in the coordinates 78, 51º W and 2º N, can be observed that the registries of Sea Surface Temperature (TSM -SST) for December, were of 27, 2 ºC and 27, 0 ºC during the first and second fortnight respectively. Anomalies with respect to the historical average did not appear.

The thermocline during December presented a reduction of 9 meters, with respect to the last registry of November, being located to 42 meters of depth. During the second fortnight the thermocline descended 10 meters, being located to 50 meters of depth. The superficial value of salinity for the first fortnight of December was of 31, 5 UPS, while in the second fortnight it was of 31, 03 UPS. At surface level a negative anomaly of 0, 55 UPS appeared, in relation to the historical average.

B. CONDITIONS IN THE ECUADORIAN COAST

The Oceanographic Institute of the Navy of Ecuador (INOCAR) informs that during December persisted throughout the Central Equatorial Pacific positive anomalies of the SST in rank of 1, 0 and 2, 0ºC.

As far as Sea Level, it has been observed that the advance of the positive anomalies towards the Eastern edge of the Pacific, related to the presence of a wave Kelvin, has exerted influence in the coast of Ecuador, where stay the positive anomalies.

The event "El Niño", which is developing in the Central Pacific of moderate intensity, until the moment does not exert major influences in the Ecuadorian coast; one hopes that the warm conditions increase in national waters during the first trimester of the present year. At sub-surface level the highest anomalies of temperature throughout the Equatorial Pacific are between 50m and 100m, with values between 2, 0 and 5, 0ºC.

In Ecuador the SST is on and underneath their normal averages, with values that vary between 24, 1 and 28, 0ºC. In the central part of the country, negative anomalies of SST of until -1, 1ºC were demonstrated. Contrary the greater positive anomaly registered of SST was of 1, 4 ºC towards the north of the country. The Air Surface Temperature registered temperature rise in all the coastal stations with the greater temperature of 27, 5ºC, registered in the North coast of the country.

The present wind pattern on the Ecuadorian coastal region has a South-Southwestern direction, with

speed average of 3 m/s. In this month, they have arrived at the coasts of Ecuador waves of the north of the Pacific, which in the open sea have presented heights between 1 and 3 m.

C. CONDITIONS IN THE PERUVIAN COAST

The Direction of Hydrography and Navigation of Peru (DHN) declares that in the North zone of the coast was registered an increase of 1, 6º (average) in the anomalies of the SST with respect to the previous month; whereas, in central and South zones, they fell around 0, 4 ºC. Predominated the positive anomalies; with the exception of San Juan that presented an anomaly of -0, 3ºC, whereas ILO presented a behavior similar to normal values. The anomalies fluctuated between 0, 1° C (Mollendo) and 2, 2º C (Paita).

The Mean Sea Level throughout the Peruvian coast presented positive anomalies of consideration, registering an increase of its values around 12 cm in the North zone and 3 cm in Central and South zones, with respect to the previous month. The minimum anomaly appeared in the southern station of Matarani (12 cm) and the maximum anomaly in the station of Chimbote (29 cm).

Throughout the Peruvian coast, the Air Temperature (AT) has registered an increase average of 0, 6° C, with respect to the previous month, prevailing the positive anomalies in the North zone and negative anomalies in the Central and South zones. The anomalies of the AT fluctuated between -1, 1º C (San Juan) and 0, 7º C (Chimbote).

Intermittent drizzles in some coastal zones appeared during days 5, 17 and 22 of the month, with accumulated values of 1, 1, 5 and 0, 2 mm respectively. Throughout the Peruvian coast winds of South direction appeared; nevertheless, the station of Lobos de Afuera presented South-east component. In relation to the wind speed, the positive anomalies predominated; with the exception of Paita and Chimbote that presented anomalies of -2, 2 and -0, 4 m/s, respectively; whereas San Juan presented a behavior similar to the normal value.

D. CONDITIONS IN THE CHILEAN COAST

The Hydrographic and Oceanographic Service of the Navy of Chile (SHOA) maintains throughout the coast a network of stations of level of the sea to monitor a series of oceanic and atmospheric variables. This is a description of the Sea Surface Temperature (SST) and the Sea Level (SL) between Arica (18º29'S) and Talcahuano (36º41'S) for December 2009.

Like the observed thing in November, during December the negative anomalies of variable SST in all the stations of the North and Center zone of Chile stay. Between Antofagasta and Talcahuano the anomalies presented values that fluctuated of -1, 0 to -2, 0°C. It is possible to emphasize that the station of Arica reestablished its cold condition with anomalies of -0, 1°C in November to -0, 7°C in December. The Sea Level is concordant with the SST and also it presented negative anomalies. In particular, the stations of the Center-North zone (Caldera and Coquimbo) registered negative anomalies of -2, 7 and -4, 2 cm respectively. On the other hand, the station of Talcahuano presented a value very near to the historical average of -0, 3 cm. It is possible to emphasize that the data of SST and SL described previously for the North and Center-South zone of Chile still reflect conditions of neutrality, not being observed until the moment any type of heating of the surface of the sea related to event ENSO.

The Meteorological Direction of Chile (DMC) declares that the average temperature of the air during December presented, generally, negative anomalies that dominated the region Center-South, South and Austral of the country, between Chillán and Coyhaique, with anomalies near to-1, 0ºC.

The coastal region of the north of Chile, between Iquique and La Serena, also presented cooling with anomalies of -0, 8 and -1, 3ºC. Only Arica, in the North end of the country, registered a heating with a positive anomaly of 0, 8ºC.

The average maximum temperature in December characterized by the presence of cooling in the North coast, between Iquique and La Serena and from Chillán to Balmaceda with the biggest negative anomalies in Iquique (- 2, 1ºC) and Temuco (- 1, 7ºC). Only the Central region of the country, between Valparaiso and Curicó, and the South end of Magallanes (Punta Arenas) registered anomalies between +0, 4 and +1, 2ºC.

The minimum temperature average in December presented a cooling between La Serena and Punta Arenas reaching the biggest negative anomalies by on -1, 0ºC between Puerto Montt and Balmaceda. The North region of the coast, between Arica and Antofagasta, maintained positive anomalies between +0, 2 and +1, 6ºC.

The atmospheric circulation on the South Pacific during December was dominated by positive anomalies of the pressure at Sea Level and "Geopotential" height in the middle troposphere (500 hPa) that affected the region of the South East Pacific and coasts of Central Chile, South Chile and Austral Chile. The biggest positive anomalies of pressure were observed in the South end (Balmaceda and Punta Arenas) with +1,6hPa. In the others localities of the Central and North zone, the anomalies fluctuated between +/- 0, 9 hPa. The precipitation in December was by on the normal value and affected the South region between Temuco and Balmaceda. The biggest positive anomalies of "fallen water" appeared in Osorno and Coyahique, by on 40 mm with respect to the normal value. The Astral region (Punta Arenas) reached a slight rain deficit and was of -27 mm.

III. PERSPECTIVE

A. GLOBAL

Taking into account the predictions from several numerical and statistical models, as well as the behavior of the main oceanic and atmospheric indicators, it is anticipated that the conditions ocean-atmospheric of the development of an event "El Niño" continue. This event "El Niño" would reach their maximum development during the first trimester of the present year. Consequently the positive anomalies of the SST will be present and of equal way at subsurface level the heating of the sea will persist, mainly in the region of the Central Equatorial Pacific; being highly recommendable to maintain a careful pursuit of the evolution as well as its future repercussions on the climate of the region of the South East Pacific.

A. REGIONAL

In agreement with the pursuit of the ocean-atmospheric conditions in the South East Pacific Ocean, executed by Program ERFEN (integrated by National Committees ERFEN of Colombia, Chile, Ecuador and Peru) and coordinated by the CPPS it is anticipated that during the next months, in the sector of the Pacific South East, the values as much of the Sea Surface Temperature as the Air Surface Temperature increased slightly over the normal one.

TABLE 1

LARGE SCALE DATA: From left to right, monthly median for the last three months of the zonal wind component at lower levels (U3, U2, U1 in the Equatorial Pacific central western, central and central eastern, respectively in m/s with positive values from East to West). SST (T4,T3.4,T3,T1+2,Tc corresponding to the Equatorial Pacific central western, central and central eastern, close to the coast and the coastal area, Talara-Callao, respectively: in °C), atmospheric pressures in Tahiti (Tht) and Darwin (Dwn), expressed in an excess over 1000 Hpa and South Oscillation Index (SOI).

	ZONAL WIND			NIÑO REGION SST					ATMOSPHERIC PRESSURE		
MONTH	WEST.	CENT.	EAST.	T4	T3.4	T3	T1+2	Tc	Tht	Dwn	IOS
OCT 09	-0.3	4.3	5.2	29.6	27.6	25.7	20.9	18.3	11.9	11.4	-1.7
NOV 09	1.6	6.8	7.1	29.9	28.2	26.2	22.1	20.1	10.8	8.9	-0.8
DEC 09	-0.6	5.7	7.1	29.7	28.3	26.7	23.1	21.6	10.0	7.9	-1.0

Source: NCEP/NWS/NOAA/USA.

TABLE 2

COASTAL OCEAN DATA OF THE ERFEN REGION: Monthly medians of the last three Months for Sea Surface Temperatures (SST) in degrees °C. Stations: Tumaco (TCO), La Libertad-Salinas (LLS), Callao (CAL), Arica (ARI), Antofagasta (ANT), Caldera (CDA), Coquimbo (COQ) and Valparaíso (VAL).

	Sea Surface Temperature (SST)							
MONTH	**TCO**	**LLS**	**CAL**	**ARI**	**ANT**	**CDA**	**COQ**	**VAL**
OCT 09	27.8	23.5	15.1	16.2	16.0	15.0	15.0	12.8
NOV 09	27.4	23.6	16.1	17.6	16.4	15.5	15.8	12.4
DEC 09	27.1	24.1	16.4	18.2	17.1	15.6	16.3	13.3

Source: CCCP (Colombia), INOCAR (Ecuador), DHN (Perú), SHOA (Chile).

TABLE 3

COASTAL OCEAN DATA OF THE ERFEN REGION: Monthly medians of the last three Months for the Mean Sea Level (MSL) in mm. Stations: Tumaco (TCO), La Libertad-Salinas (LLS), Callao (CAL), Arica (ARI), Caldera (CDA), Coquimbo (COQ) and Valparaíso (VAL).

	Mean Sea Level (MSL)							
MONTH	**TCO**	**LLS**	**CAL**	**ARI**	**ANT**	**CDA**	**COQ**	**VAL**
OCT 09	***	2715	1060	***	***	***	***	***
NOV 09	***	2766*	1110	***	744	1188	839	***
DEC 09	***	261.3	114.0	***	***	123.3	89.8	***

Source: CCCP (Colombia), INOCAR (Ecuador), DHN (Perú), SHOA (Chile).

TABLE 4

COAST OCEANIC DATA OF THE ERFEN REGION: Five–day averages (Pentads) of SST (ºC) and MSL (mm).

	Temperatura Superficial del Mar (TSM)			Nivel Medio del Mar (NMM)		
PENTADS	**BALTRA**	**TALARA**	**CALLAO**	**BALTRA**	**LLS (INOCAR)**	**CALLAO**
NOV 04	***	17.9	15.9	***	274.0	107.3
09	***	18.4	15.5	***	274.8	106.8
14	***	18.4	16.6	***	271.9	113.2
19	***	17.7	16.9	***	277.7	109.1
24	***	17.4	15.9	***	277.5	116.3
29	***	17.2	15.6	***	285.3	114.8
DEC 04	***	20.4	15.4	***	293.3	117.0
09	***	21.5	15.9	***	290.9	113.8
14	***	21.2	16.0	***	284.2	117.2
19	***	21.0	16.2	***	285.3	115.6
24	***	21.3	17.3	***	282.5	119.7
29	***	21.3	18.6	***	277.9	118.9

Source: NOAA/Atlantic Oceanographic and Meteorological Laboratory – Miami.
Note.
* Values revised
***. Information not received

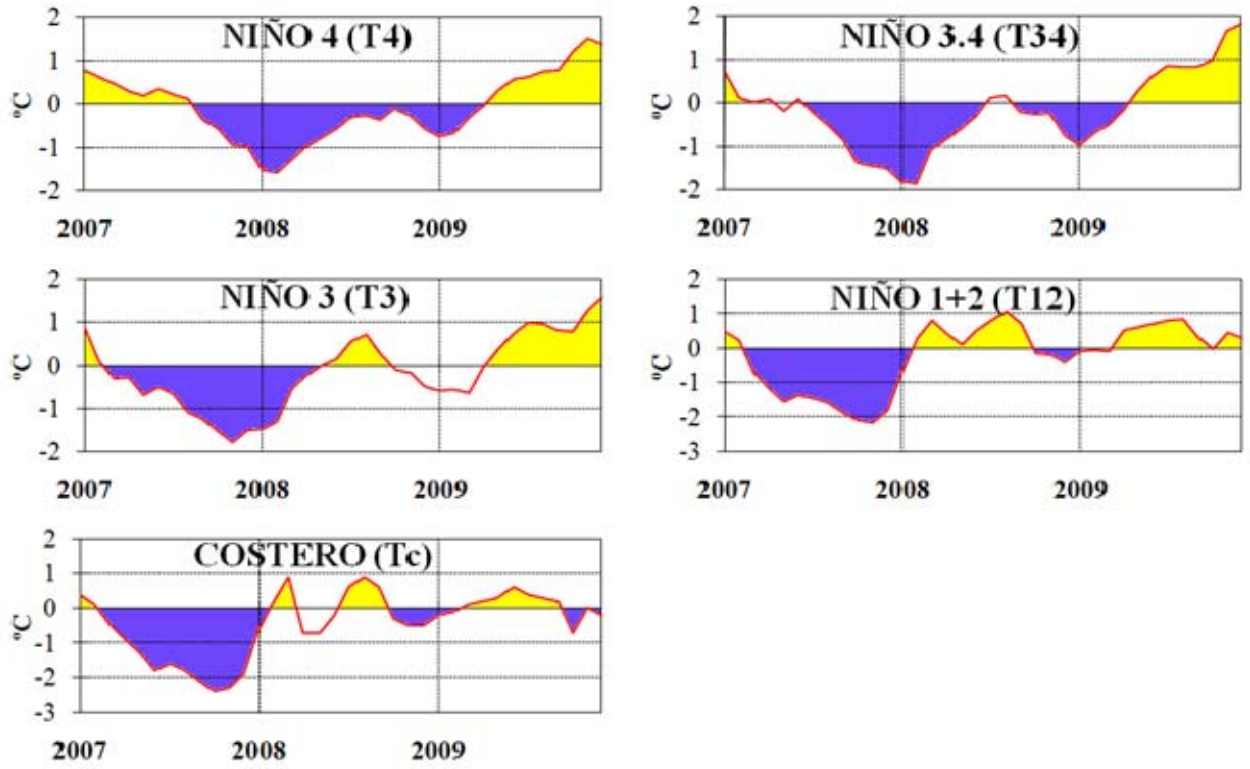


Figure 3.- Oceanic anomalies indices (Niño 4, Niño 3.4, Niño 3, Niño 1+2 and Tc). The location of the oceanic indices appears in figure 2.
(Source: NCEP/NWS/NOAA/USA).

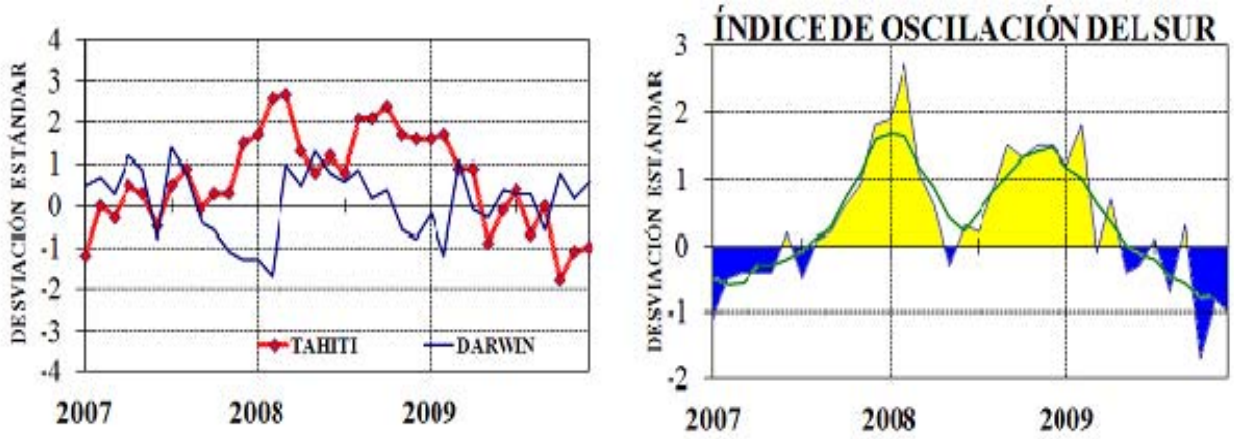


Figure 4.- Left Panel: Five-months running mean for atmospheric pressure anomalies in Tahiti and Darwin (mb). Right Panel: Southern Oscillation Index. (SOI) with monthly values and five-months running mean graphed as a green line. The SOI is based on the difference between standardized pressure values: Tahiti minus Darwin. The differences are also standardized for standard deviation of yearly values.
(Source: NCEP/NWS/NOAA/USA).

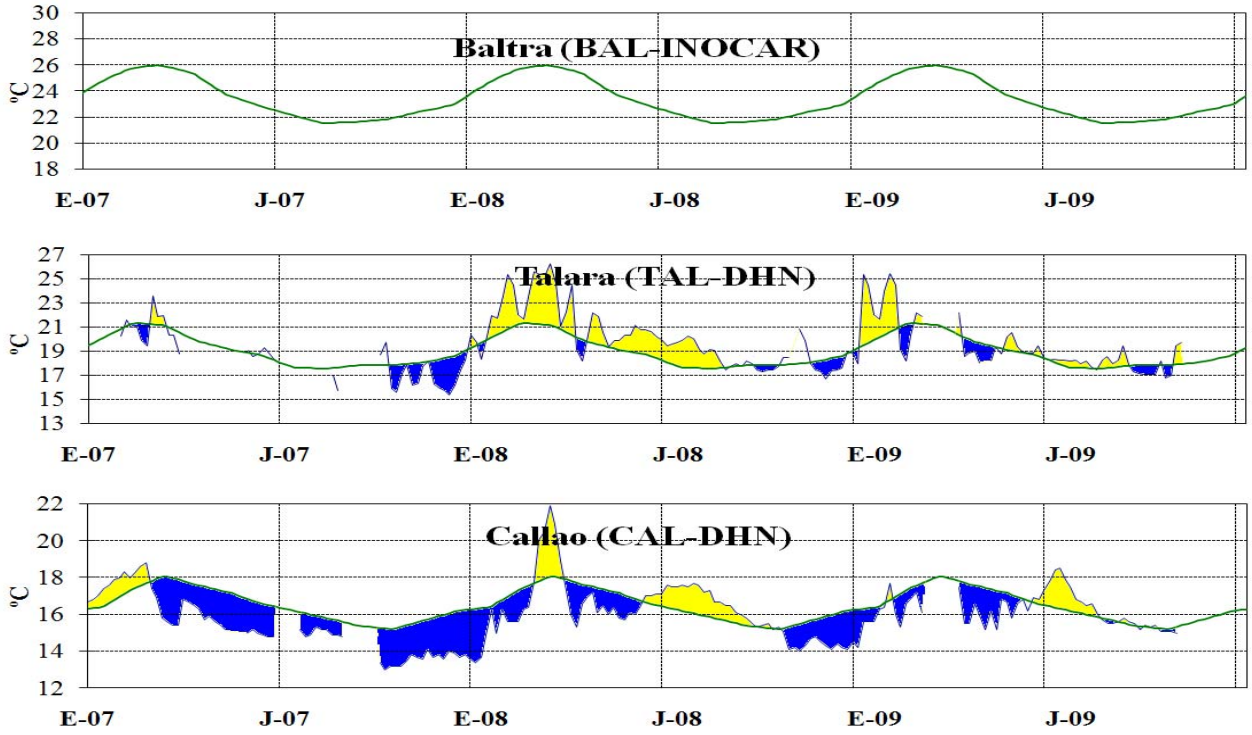


Figure 5.- Series and moving averages of five months of zonal wind standardized anomalies (m/s) averaged between 5°N and 5°S for three Equatorial zones: western (U3), central (U2) and eastern (U1). (Source: NCEP/NWS/NOAA/USA).

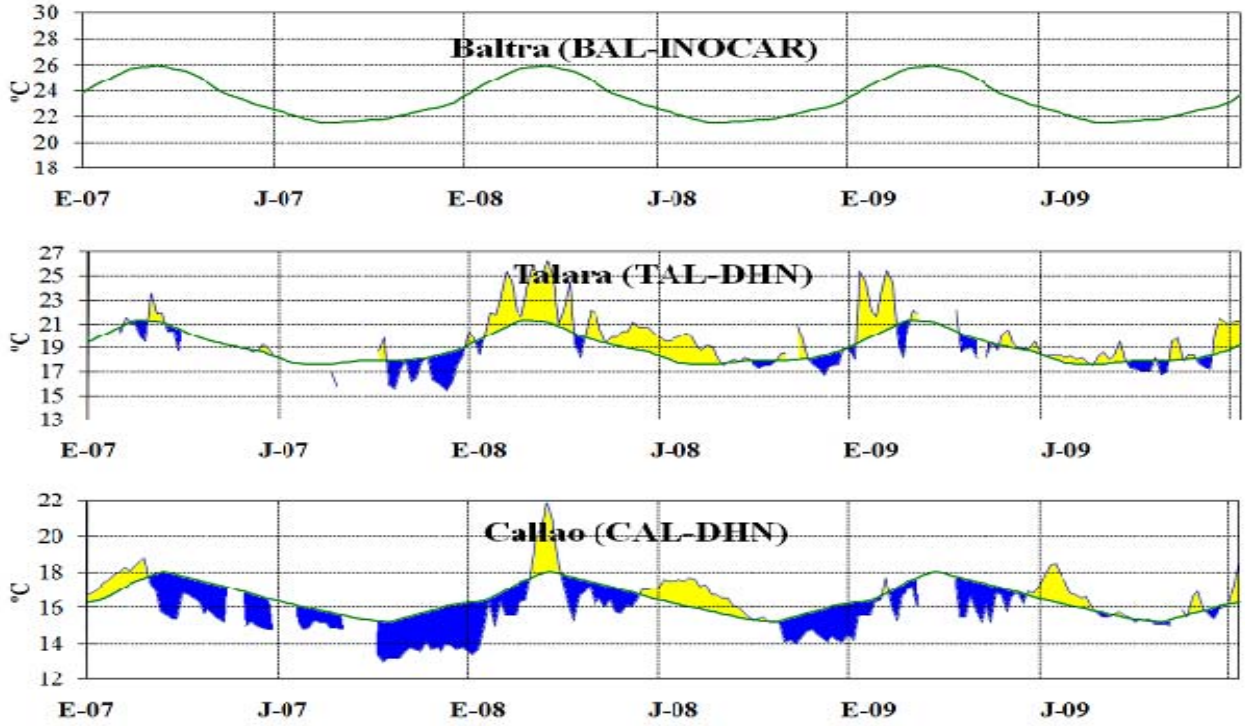


Figure 6.- Five day averages (pentads) of SST (°C) in Ports of Peru and Ecuador. The green curve indicates climatology. The location of oceanic indices appears in figure 1.
(Source: NOAA/Atlantic Oceanographic and Meteorological Laboratory – Miami.)

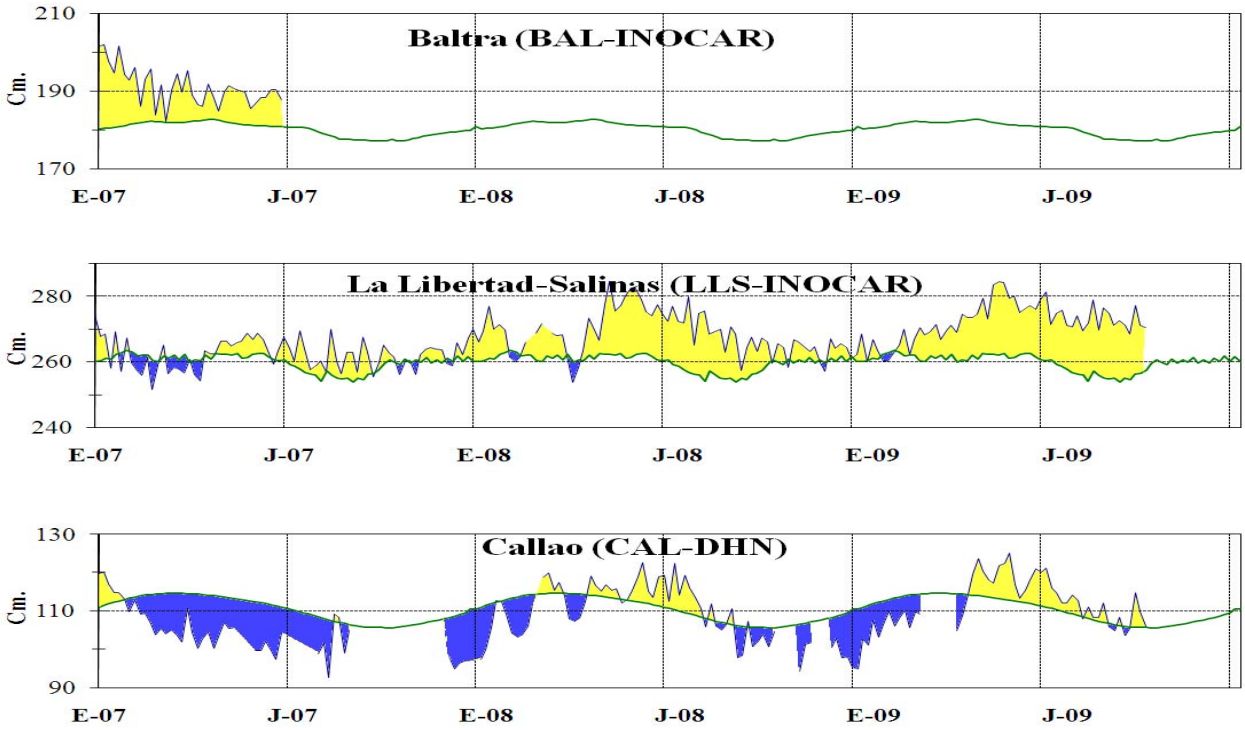


Figure 7.- Five-day running mean (pentads) of MSL (cm) in Ports of Peru and Ecuador. The green curve indicates climatology. The location of oceanic indices appears in figure 1.
(Sources: NOAA/Atlantic Oceanographic and Meteorological Laboratory – Miami, e INOCAR).

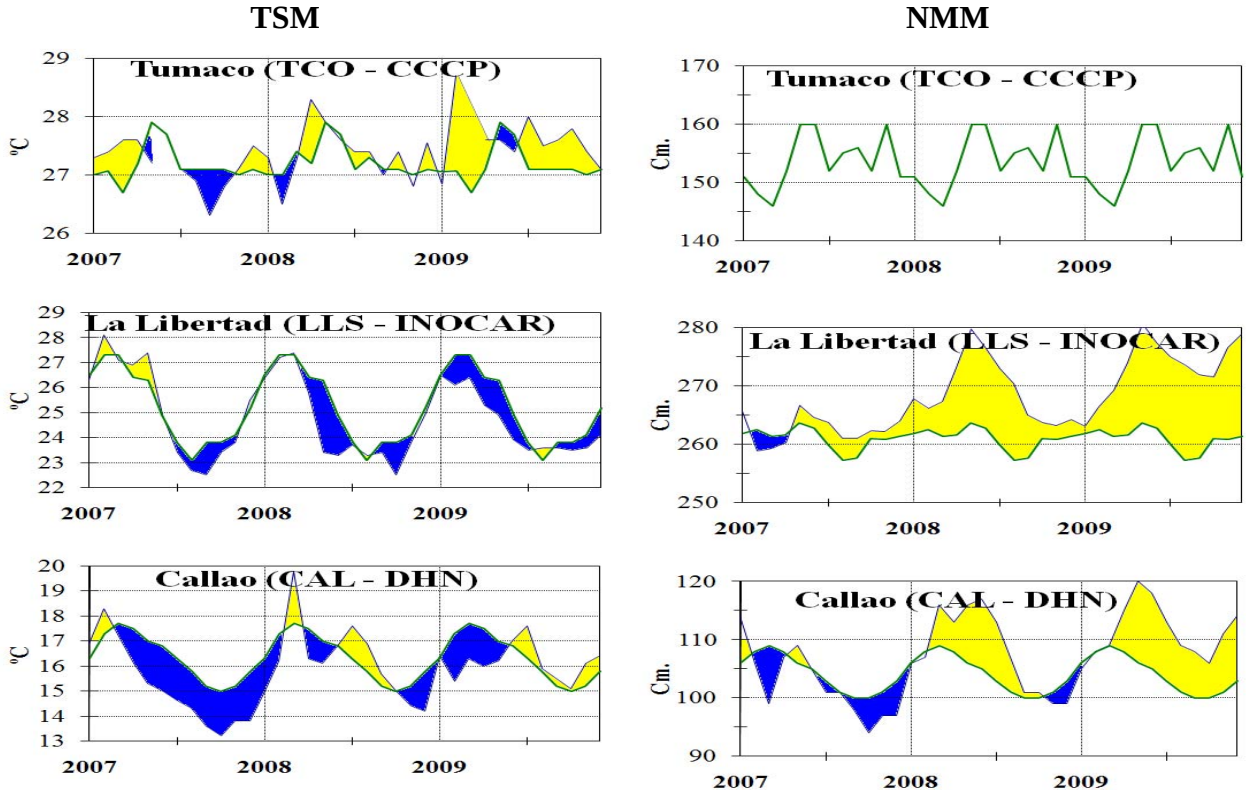


Figure 8a.- Monthly means of the SST (ºC) and MSL (cm) in five stations of the ERFEN region. Green curve indicates historic monthly mean. The location of the stations appears in Figure 1.
(Sources: CCCP, INOCAR y DHN).

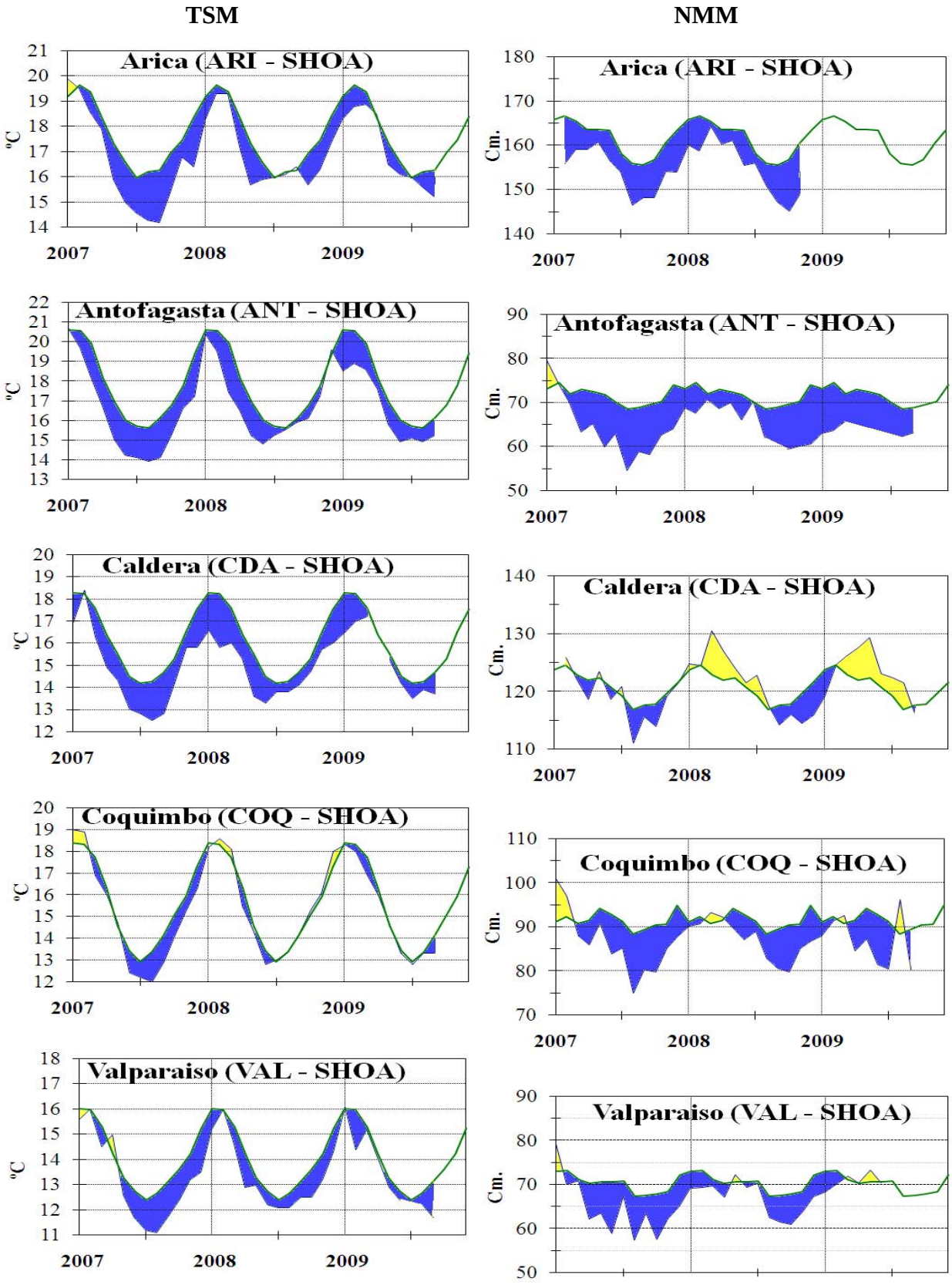


Figure 8b.- Monthly means of the SST (ºC) and MSL (cm) in five stations of the ERFEN region. Green curve indicates historic monthly mean. The location of the stations appears in Figure 1. (Source: SHOA).

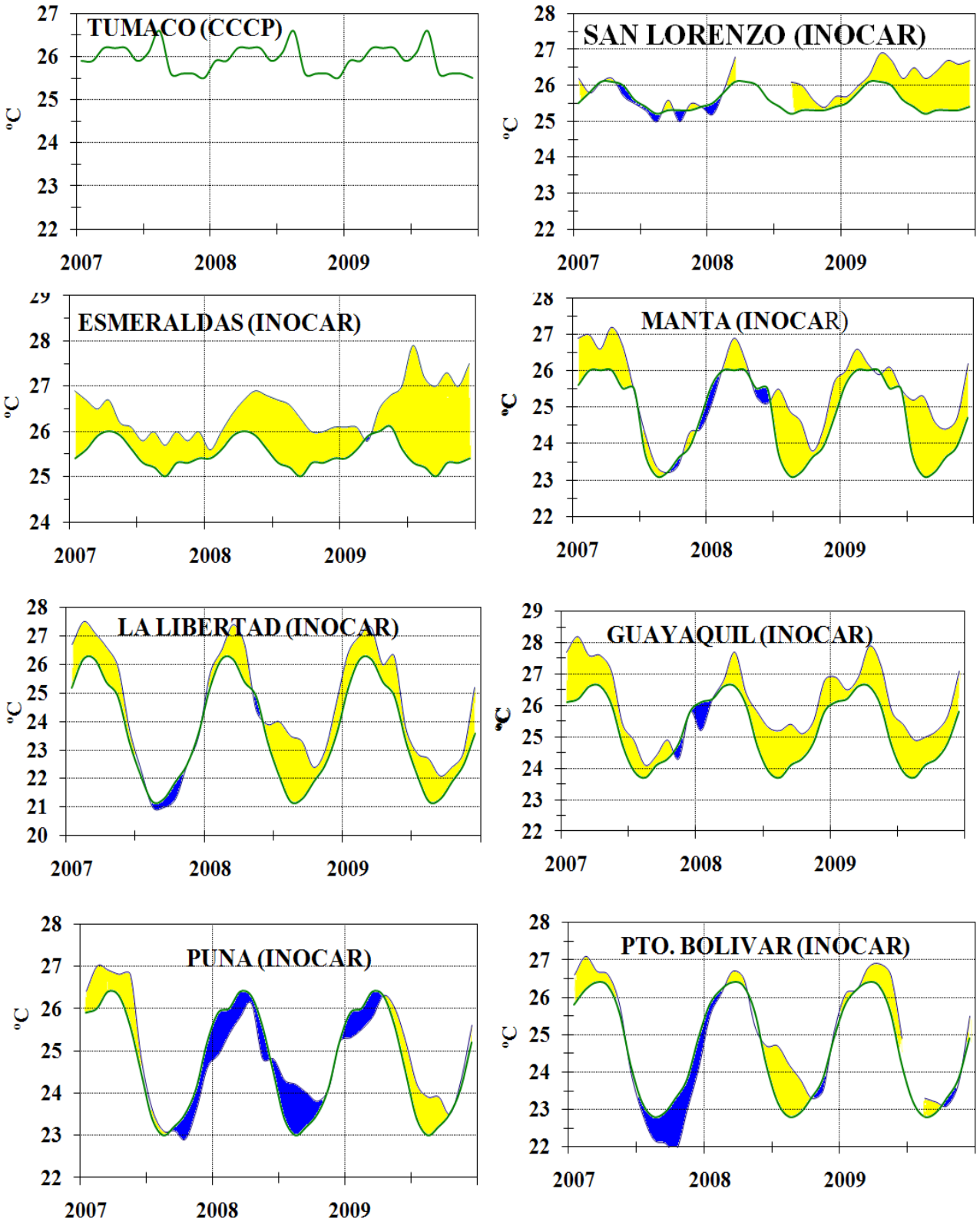


Figure 9a.- Monthly means of the air temperature (ºC) in 8 stations of the ERFEN region. Green curve indicates historic monthly mean. The location of the stations appears in Figure 1. (Sources: CCCP & INOCAR).

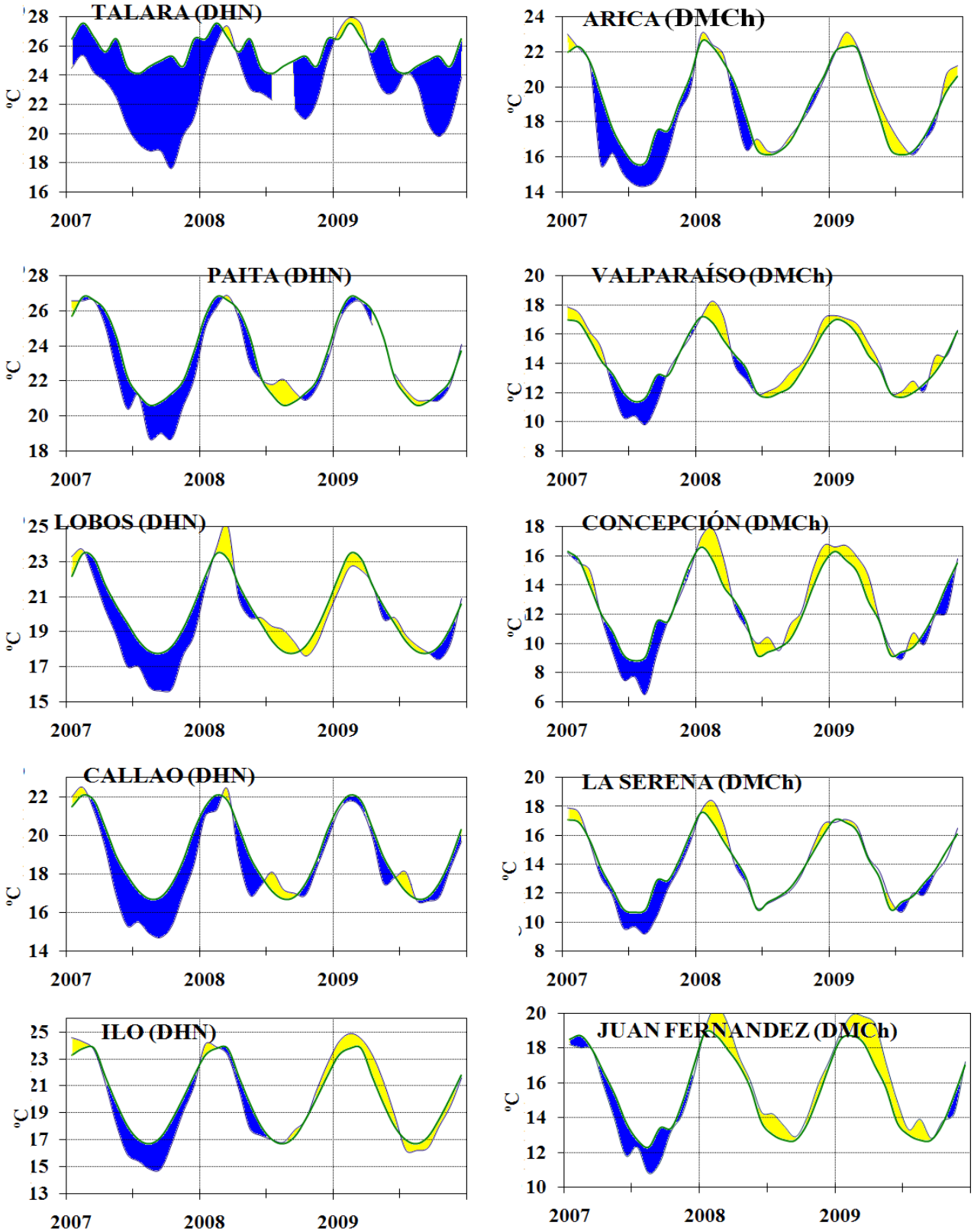


Figure 9b.- Monthly means of the AT (ºC) in 10 stations of the ERFEN region. Green curve indicates historic monthly mean. The location of the stations appears in Figure 1.
(Sources: DHN & DMCh).

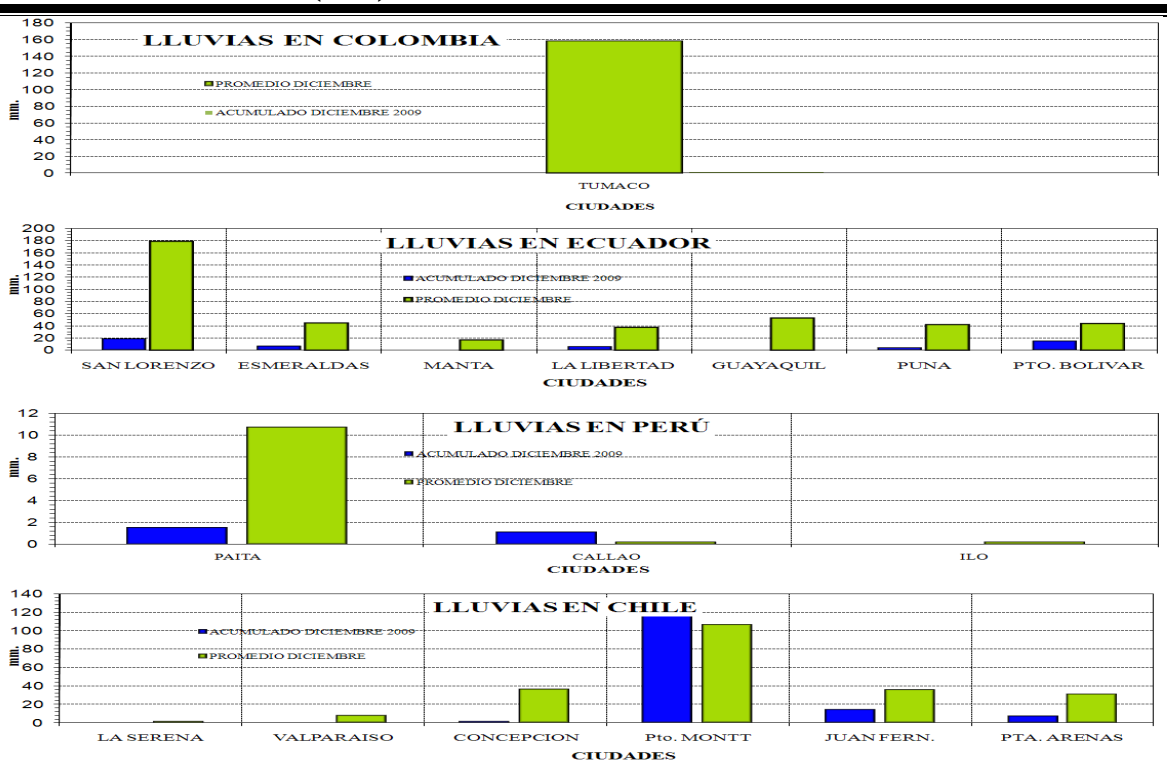


Figure 10.- Rains during November in the coastal stations of Colombia, Ecuador, Peru and Chile. Location of the stations appears in Figure 1.
(Sources: CCCP, INOCAR, DHN & DMCh).

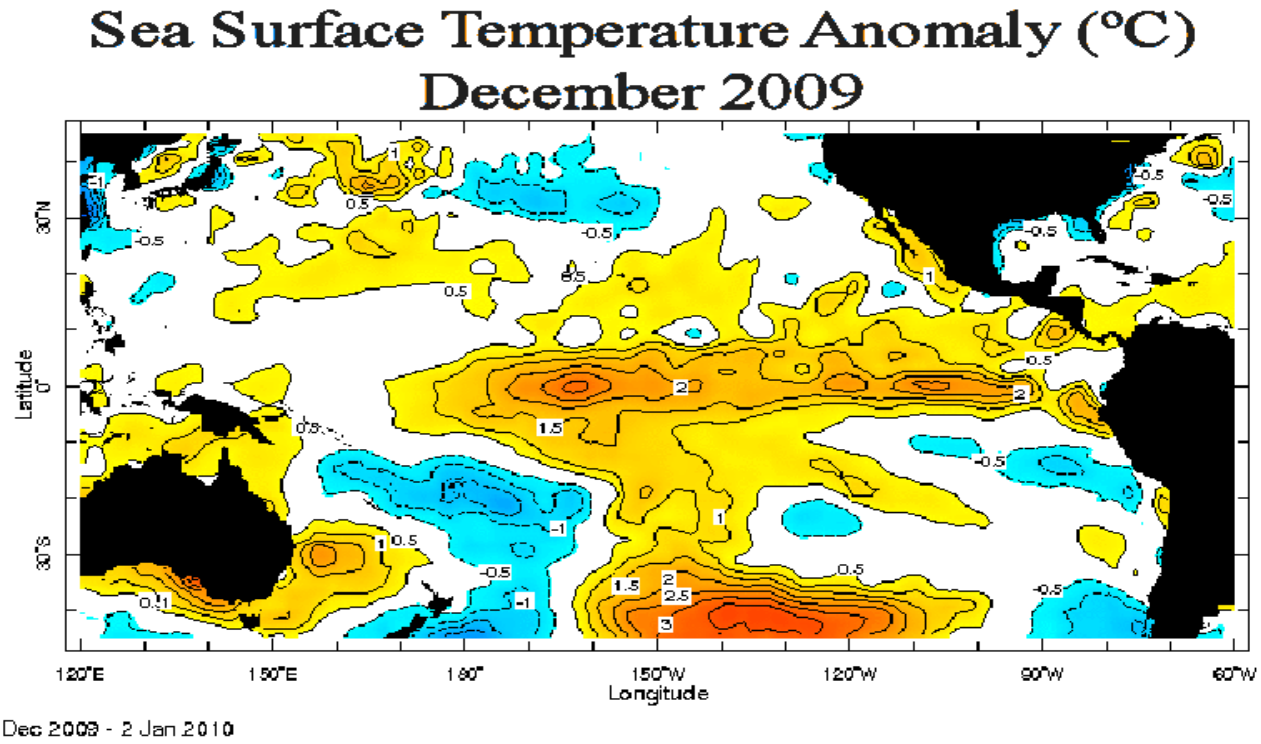


Figure 11.- Sea Surface Temperature Anomalies (ºC) December 2009.
(Source: International Research Institute for Climate and Society)

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