

CORRELATION OF HISTORICAL RECORDS OF EL NIÑO EVENTS BETWEEN CHILE, PERU AND ECUADOR (GALAPAGOS).

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The study of the present and future climate evolution in southwestern South America cannot be envisaged without taking into consideration the occurrences of the ENSO phenomenon and their interactions with the interannual/decadal variability of the climate in the course of the last few centuries. The growing interest for the evolution of the global and regional climate, and for the mechanisms involved (e.g. natural versus anthropogenic causes of the global warming), justifies that some emphasis be given to the reconstruction of interannual climate variations during the past centuries, in an area for which written archives are relatively abundant. Besides, the Pacific coastal region of South America is without contest one of the key-areas for the study of long-term variations of the ENSO system. Considering the impacts of the El Niño phenomenon in Ecuador, Peru and Chile in modern times, the region appears as a privileged area for the elaboration of a historical sequence of ENSO events. It should be an appropriate area to try to determine, for instance, whether warmer episodes of the past were characterized by stronger and/or more frequent El Niño manifestations, or if the ENSO regime varied during the longer-term climate variations of the last centuries (Little Ice Age vs. XXth century).

On-going work of the PVC group of Orstom, in collaboration with a series of South American scientists, aims to produce a consolidated chronology of the regional El Niño events as they can be recorded by written documents concerning heavy rains and river floods in Peru and central Chile in the last few centuries. The present contribution addresses the problems of the correlation between the documentary records from these two « teleconnected » areas (northern Peru coast and central Chile) and between these two records with a third proxy record based on the oxygen isotope variations measured in Galapagos Islands coral, obtained by Dunbar et al. (1994).

The reconstructed Peruvian sequence of El Niño events corresponds to a revised version of the famous Quinn et al. (1987) series of historical events of the last four and a half centuries (Hocquenghem & Ortlieb, 1992; Ortlieb et al., 1995; Ortlieb et al., in prep.). The central Chile sequence combines a recent revision of the documentary historical data available for the period 1535-1900 (Ortlieb, 1994) and the time series relating ENSO with measured precipitation excess during the last 150 years (Ruttlant & Fuenzalida, 1991). As nowadays there is a good correlation between the manifestations of the El Niño phenomenon, and their intensities, in northern Peru and central Chile, it was expected that the record of past events may show the same kind of teleconnection. But this is not the case for a number of years between 1535 and 1850. The numerous discrepancies between these two historical sequences, particularly during the centuries XVI–XIX, thus lead to arise some questions about the methodological approach for documentary reconstructions, and pose the problem of a possible difference in the teleconnection system within the ENSO regime, during the Little Ice Age as referred to the present time.

In their study on the oxygen isotope composition of annual growth increments of coral reef from Galapagos, Dunbar et al. (1994) produced another kind of record of El Niño events, based on ocean paleotemperature variations during the period 1587-1953. In this proxy record, the warm events are associated to El Niño conditions. Dunbar et al. noted that there is a fair correlation with the Quinn et al. (1987) sequence, particularly if are included all the years that preceded or followed those identified by Quinn et al. as El Niño years. Actually, the calendar calibration of the coral sequence is a crucial point that may explain that the precise year-to-year correlation is not so satisfactory, especially if the revised series of El Niño events from Peru is taken as reference. Another puzzling problem comes from the fact that the intensity of the temperature anomalies is poorly correlated with the strength of the historical events as recorded onshore, either in Peru or in Chile.

The difficulties met in the tentative correlation of the three reconstructed sequences confirm the author's view that too much confidence has been put, up to now, in the chronology of ENSO events as proposed by Quinn et al: 10 years ago. The historical ENSO record from the Pacific coast of South America still needs to be worked out and there is an urgent need for intensified investigations on the documentary records of climatic anomalies in southwestern America.

If the discrepancies observed in the three areas concerned in this work, during the Little Ice Age centuries, were confirmed, it may be concluded that the decadal/secular variability of the El Niño system is higher than previously thought and that significant variations did occur in the regional climate regime during the last few centuries.

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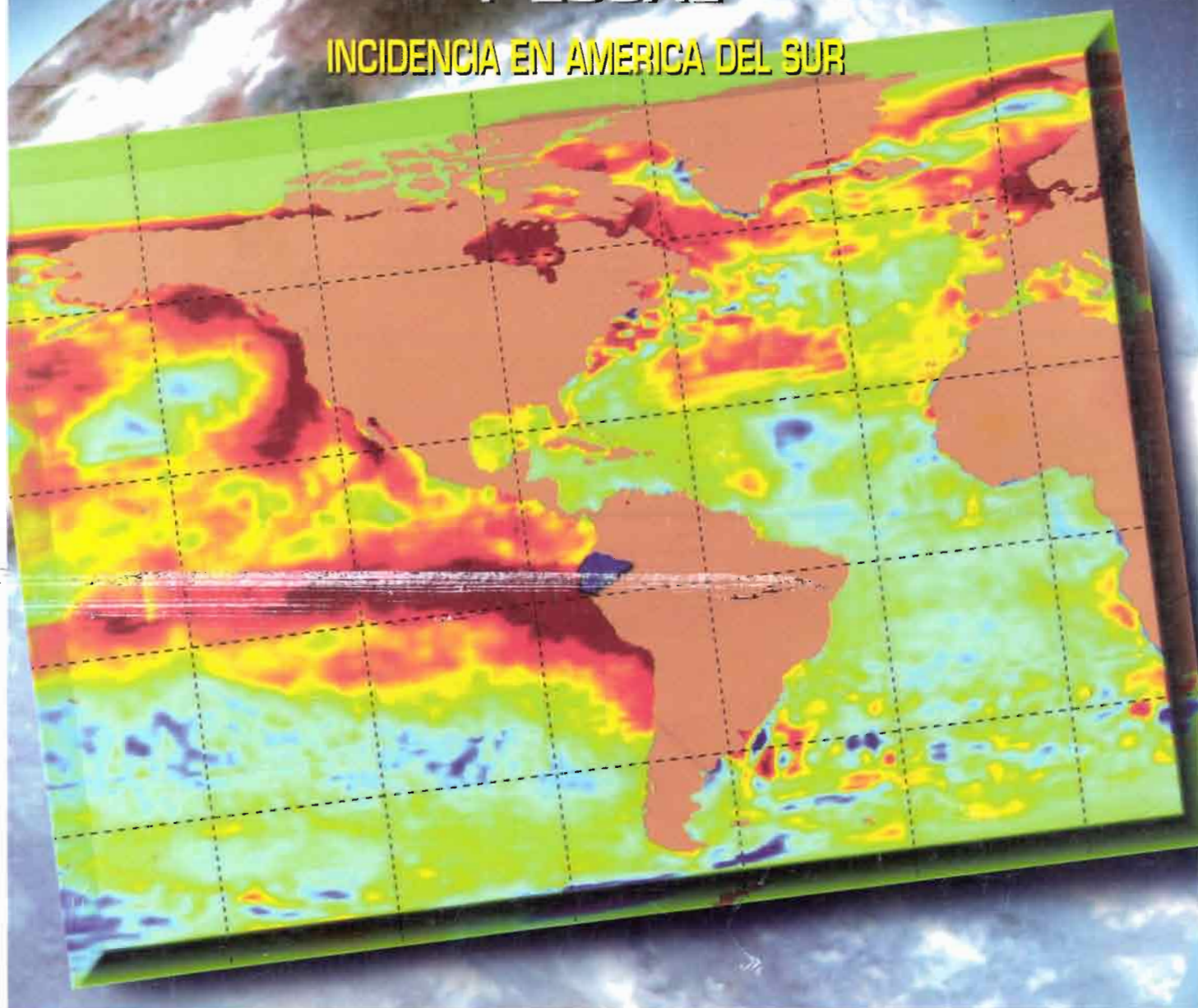
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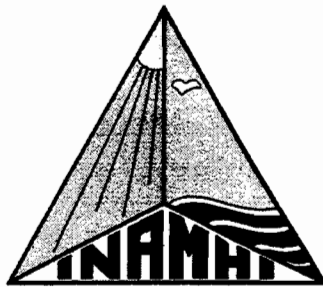
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