# AMAZONIAN RAINFOREST PALEOFIRES AND TITICACA LEVEL VARIATIONS INDICATORS OF SHORT DRY PERIODS IN RELATION WITH EL NIÑO-LIKE CONDITIONS DURING THE LAST 7000 YEARS

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Sedimentological studies, as well as thin section observations of 3 cores collected in three lakes of Carajas region (Southeastern Amazonia) bring a better knowledge of the frequency of fires occurrences and of the paleoclimatic conditions during the fire occurrence periods. Data of Carajas lakes indicate that, if forest element pollen are always present during the last 7000 yr, they are badly represented between 7000 and 4000 yr BP. Moreover, at that time, the arboreal pollen is dominated by *Piper*, a pioneer element of the rain forest. Its dominance during 3000 yr BP appears abnormal and needs special environmental conditions. It seems that the regeneration cycle of the forest has been continuously interrupted by repeated incidentes. The higher sediment content in microcharcoal during the same period point to fires as the most obvious event explaining the repetitive interruption of rainforest regeneration. After 4000 yr BP, the charcoal content in the sediment, and therefore the frequency of fire occurrences, is lower. Notwithstanding the presence of rainforest elements and the absence of savanna pollen indicators show that the average climatic conditions were favorable to rainforest development which was only limited by the repeated occurrences of fires in connection with short dry climate events.

The last 7000 years of water-level fluctuations of the Lake Titicaca were reconstructed using a transfer function based on modern ostracod fauna. The data indicate that the lake Titicaca, which had rapidly reached its lowest level around 7500 yr BP, did not rise regularly afterwards. Prior to 3900 yr BP, water levels fluctuated around a position considerably lower that the present one. Because lake levels remained around the same mean position, it is lekely that the climate was not permanently dry, but instead there was a succesision of droughts. After 3900 yr BP, the water level rose markedly as a consequence of a wetter climate. After 3000 yr BP, the water level remained lower than at present, with 4 to 5 episodes of abrupt water level drop, corresonding to drier episodes. One is dated about 2300 yr BP and another about 1300 yr BP.

The eastern margin of the Pacific ocean, in the southern tropic, is characterized by relatively cold sea-surface temperature. These cold waters strongly influence the tropical continental climate. This climatic back-ground pattern is drastically altered in the low phase of the Southern Oscillation. In the low SO phase, El Niño events may occur and the equatorial Pacific waters are warmer than usual. This situation leads to large rainfall anomalies and changes in wind patterns in South America (Figure).

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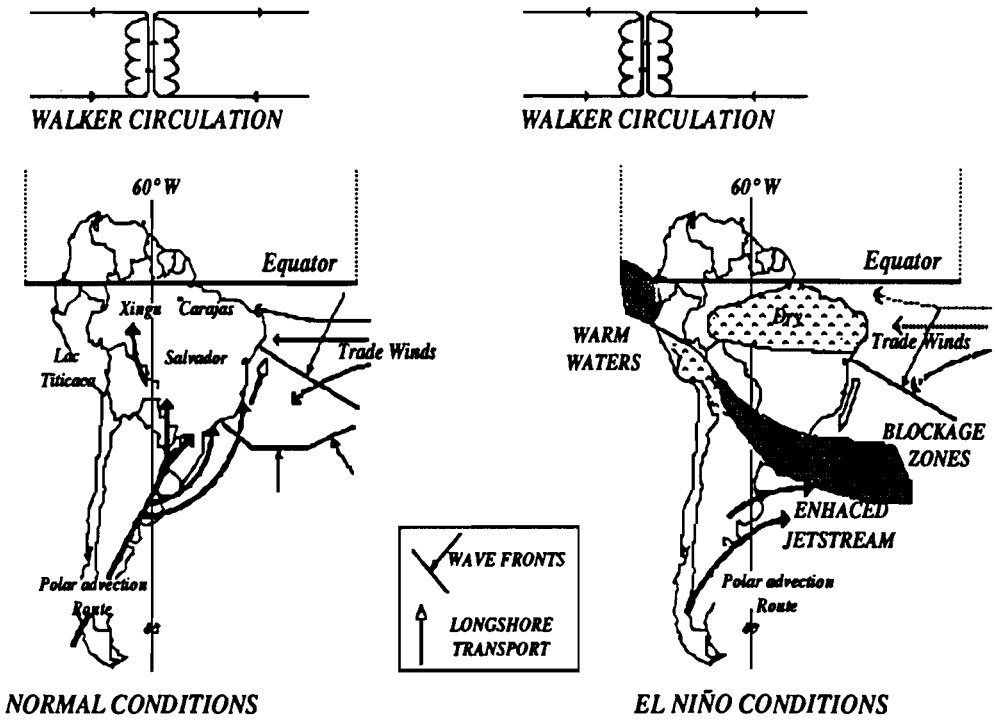


**Figure:** Disturbances caused by strong El Niño events in several areas of South America

During the 1983 El Niño year, annual rainfall in the Carajas region decreases, lengthening the dry season from 3 to 5 months.

During a normal year, the water level of Lake Titicaca drops to *ca* 75 cm during the dry season and rises to a similar amount during the rainy season. During El Niño events or more generaly during low SO phases, precipitaiton is greatly reduced and during the rainy season the rise is markedly weaker or the water level may even drop, as during the 1983 El Niño event.

The dry periods recorded in the Amazonia and the Bolivian Altiplano are similar to dryness caused by present-day strong El Niño events, but the paleo-data indicate that the past climate anomalies should have longer durations (tens to hundreds of years) than the present-day El Niño events. For those reasons, they have been denominated "El Niño-like" conditions. These conditions probably correspond to long-duration low phases of the Southern Oscillation.