Geophysical Research Abstracts
Vol. 14, EGU2012-8867, 2012
EGU General Assembly 2012

A see-saw of pre-Columbian boom regions in southern Peru, determined by large-scale circulation changes

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Environmental changes and cultural transitions during several periods of Peruvian history show a strong coincidence between humid and dry climatic oscillations and the rise and decline of cultures. It is noteworthy, that alternating periods of geo-ecological fragility and stability occurred in time and space between the coastal Nasca region (14.5° S) and the high Andean northern Titicaca basin, just a few hundred kilometers to the east.
Based on a multi-proxy palynological and sedimentological approach to reconstruct palaeoenvironmental changes, we found that the Nasca region received a maximum of precipitation during the archaeological boom times of the Early Horizon and the Early Intermediate Period (800 BC – 650 AD, Paracas and Nasca cultures) as well as during the late intermediate period (1150-1450 AD), whereas, in contrast, the Titicaca region further to the south-east experienced drought and cultural depression during that times. During the Middle Horizon (650 – 1150 AD), the Tiwanaku agronomy and culture boomed in the Titicaca region and expanded to the west, contemporaneous with a raised lake level and more humid conditions. In the Nasca region, runoff for irrigation purposes was reduced and less reliable due to drought.
Considering a coincidence between environmental and cultural changes, we state that success and decline of civilizations were controlled by hydrological oscillations, triggering fertility as well as a critical loss of natural resources. In response to spatial changing resources, cultural foci were shifted. Therefore, the success of pre-Columbian civilizations was closely coupled to areas of geo-ecological favorability, which were directly controlled by distinct regional impacts of large-scale circulation mechanisms, including El Niño – Southern Oscillation (ENSO). Changes in the position of the intertropical convergence zone (ITCZ) and the Bolivian anticyclone determined meridional shifts in moisture transport across the Andes, which directly triggered human migration to the respective granaries.