CLIMATE EXPERIMENT IN THE AMERICAS WARM POOLS

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Introduction

Climate variability over Mexico, Central America and the Caribbean is modulated to a large extent by warm pools, one off the Mexican Pacific coast and one over the Intra Americas Seas (IAS). Summer precipitation over this region exhibits a relative minimum during the middle of summer (Fig. 1). Magaña, et al. (1999) have proposed that air sea interaction processes over the Mexican warm pool result in such relative minimum in the middle of the rainy season.

On the other hand, Amador and Magaña (2000) suggested that the low level jet over the Caribbean Sea acts as a link between the eastern Pacific and the Caribbean on interannual time scales and even on shorter time scales. The impacts of variations of this low-level jet (LLJ) on summer precipitation, easterly waves and even hurricane activity are just beginning to be discovered.

The region of SSTs larger than 28C over the Americas constitutes two warm pools, given the climate dyanmics of the Caribbean Sea and the eastern Pacific off the coast of Mexico and Central America. The existence of continental barrier (the Central American Isthmus), the Inter Tropical Convergence Zone (ITCZ) and weak low level winds in the eastern Pacific and weak tropical convective activity and an intense low level jet in the Caribbean results in two different climate regimes separated by the Central American Isthmus.

Until recently, only a few field experiments had taken place in the region during summer. The study of warm pools in the Americas had focused on the genesis of hurricanes or on the thermal structure of the Caribbean Sea. None had addressed the issue of two warm pools connected through the dynamics of the low level flow. In order to test the proposed hypothesis on the MSD or on the role of the low – level jet in the Caribbean as a dynamical link between the eastern Pacific warm pool and the Caribbean Sea required a special experiment.

Objectives

The main objective of the experiment was to improve our understanding of the elements that control regional climate in the Mexico, Central America and Caribbean region, in order to provide more accurate climate predictions that adequate meet the needs of some socioeconomic sectors.

The Field Experiment had the following objectives:

1. To document the atmospheric and oceanic processes related to the Mid Summer Drought (MSD), over the Mexican Pacific and the Caribbean Sea.
2. To examine the air-sea interaction processes over the Mexican warm pool that modulate the rainy season over Mexico and Central America

Specifically, the campaigns were designed to:

i) Determine the conditions prior to the onset of the rainy season over southern Mexico

ii) Examine the characteristics of the ocean circulation around the Mexican warm pool
iii) Document the connections between the Caribbean sea and the northeastern Pacific

Field Campaign:

Observations of atmospheric and oceanic conditions over the Mexican warm pool during May-June, August and September, and the western Caribbean Sea during July-August, were measured through the use of:

- Atmospheric radiosondes
- Oceanic state profiles (CTD)
- Weather station over ships
- Radiation measurements

The trajectories followed during the campaigns are presented in Figure 1.

Preliminary results

Satellite estimates of convective activity show that precipitation over the warm pool exhibited a bimodal structure corresponding to the MSD.

One of the important objectives of the experiment was to determine month by month fluctuations in the sea surface temperature in relation to the MSD. It was found that the warm pool over the eastern Pacific is well over 30C most of summer.

As determined by Magaña et al (1999), the low level jet over the Caribbean reached maximum intensity during July. Observed values were over 15 m/s, frequently resulting in perturbations over the eastern Pacific. As a matter of fact, a couple of tropical cyclones formed as a result of the intense flow crossing the Papagayo gap in Central America.

Additional analyses on radiation balances, surface fluxes, thermal structure of the warm pool, etc. are currently being prepared by members of the Collaborative Research Network 73, financially supported by the Inter American Institute (IAI) for Global Change Research.

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References

Magaña, V., J. A. Amador y S. Medina, 1999. The mid-summer drought over Mexico and Central America. J. Climate, 12, 1577-1588

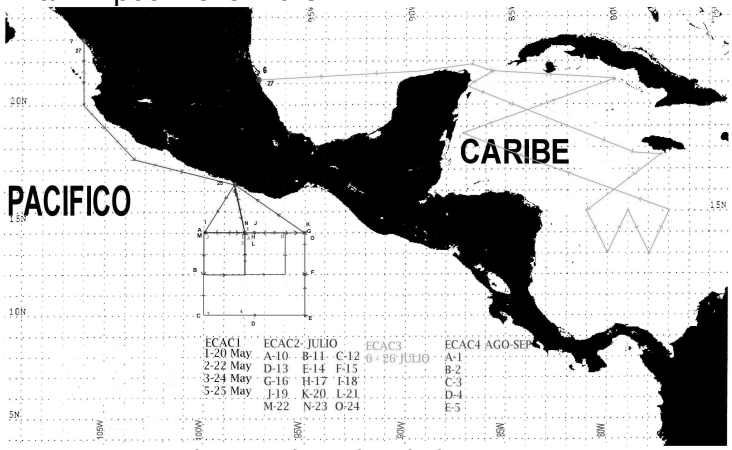

Fig. 1 Trajectories during ECAC