J5.2 A CASE STUDY OF THE INTERTROPICAL CONVERGENCE ZONE AT THE OCEAN SURFACE WITH HIGH RESOLUTION SATELLITE DATA

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1. INTRODUCTION

A fine-resolution analysis of the Intertropical Convergence Zone (ITCZ) is essential for understanding the interactions between surface convergence, wind, sea level pressure, and sea surface temperature (SST) within this low-latitude climatological feature (Hastenrath, 1991). The ITCZ is the primary source of convection in the equatorial East Pacific and Atlantic Oceans, and the progression of the ITCZ with the annual cycle brings distinct rainy seasons to Northeast Brazil and other regions of Pan-America. It has been shown that during Pacific warm events the tropical North Atlantic meridional pressure gradient weakens, which leads to diminished northeast trades, driving the anomalous interhemispheric SST gradient, and northward shift of the ITCZ (Curtis and Hastenrath 1995). Whether changes in ITCZ rainfall have their own remote forcing is unclear. Convection within the eastern Pacific ITCZ also deserves further study, especially its role in the development and strength of the North American Monsoon.

2. DATA

It has been shown that important features of the ITCZ are not resolved by coarse resolution data (for example 2.5° NCEP/NCAR reanalysis, Hastenrath 2002). Ship observations on a 1° grid probably still provide the best climatologies of the ITCZ at the ocean surface (Hastenrath and Lamb 1978). However, gridded satellite data at 0.25° resolution are now available for the summer of 2002 via the Tropical Rainfall Measuring Mission (TRMM) for SST and rainfall and QuikScat for surface wind. This paper is one of the first attempts to combine these three products in a climate study. The focus is on the eastern Pacific ITCZ, as the results provide a test case for a proposed "field campaign from space" to take place during the North American Monsoon Experiment in 2004.

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3. DISCUSSION

Here the climatological evolution of SST, wind, and precipitation in the eastern North Pacific (ENP) is given from May to July. Initially, the ENP warm pool (Wang and Enfield 2001), defined by the 28.5°C isotherm, is quite large extending beyond 120° W (Fig. 1a). The band of heaviest rains is to the south of the meridional wind confluence which bends upward at 92°W and follows the west coast of Central America. The evolution from May to July is characterized by a southward (northward) migration of the eastern (western) portion of the confluence line (Fig. 1). At the same time the warm pool and precipitation migrate northward as the North American Monsoon evolves. Finally, the ENP warm pool retracts eastward and the rainfall associated with the ITCZ intensifies, suggesting a transfer of energy from the ocean to the atmosphere (Fig. 1). The July maximum in precipitation (Fig. 1c) may be related to the local SST or may be related to the interhemispheric SST gradient (Lindzen and Nigam 1987). It should be noted that in May as compared to June, there is a large separation between the northern border of the ENP warm pool and the band of heaviest rainfall (Fig. 1a,b, > 4 mm d^{-1}). Further work is needed to determine if the extent of the ENP warm pool in conjunction with the northern extent of the ITCZ plays a role in the strength and/or timing of the North American Monsoon. In July (and August) the confluence line sits at about 10° S (Fig. 1c), before returning northward in September (Hastenrath 2002). Finally, there is a strong bimodal signal in climatological summertime precipitation off the coast of Central America, known as the mid-summer drought (MSD). This feature, which appears to be modified by El Niño/La Niña (Curtis 2002) may be forced by local air-sea interactions (Magaña et al. 1999), or result from the annual march of the ITCZ (Hastenrath 2002). Satellite data from 2002 will be compared with the present climatologies, and help answer lingering questions about the structure and evolution of the ITCZ.

4. REFERENCES

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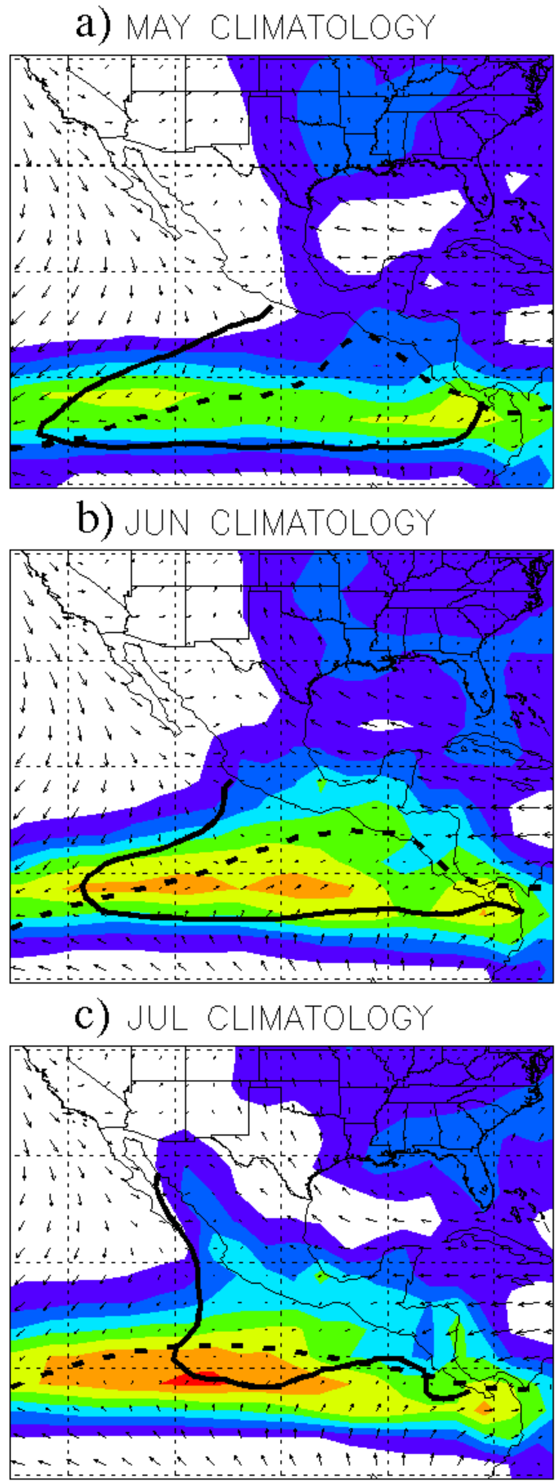

Figure 1. (a) May, (b) June, and (c) July climatologies of the eastern North Pacific warm pool (1982-2000), 1000mb winds (1979-2000), and precipitation (1979-1998). Thick solid line represents the 28.5 °C isotherm. Dashed line denotes the wind confluence. Colors denote rainfall rates every 2 mm day^{-1} from 2 mm day^{-1} (purple) to 14 mm day^{-1} (red).