13B.5 DEVELOPMENT OF NEW CONVECTIVE CELLS IN THE EAST PACIFIC WARM POOL

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The convection in the east Pacific ITCZ occurs over a pool of warm ocean water (the east Pacific warm pool) which extends roughly from 5° N to the Mexican coast. The water south of this region is typically $5-8$ K cooler than the $28-30°$ C water to the north, resulting in a strong north-south SST gradient. This gradient forces a strong southerly flow at low levels, which may form the primary feed to the ITCZ in this region.

In spite of the strong SST forcing, the convection over the east Pacific warm pool is highly variable, with variations apparently related to the passage of easterly waves in the process of intensifying into tropical storms.

The EPIC2001 project observed the coupled ocean-atmosphere system in the east Pacific warm pool during its field phase of 1 September to 15 October 2001. Two aircraft, the NCAR C-130 and a NOAA P-3, were deployed from Huatulco, Mexico during this period, and two ships, NOAA's Ron Brown and NSF's RV New Horizon were stationed in the warm pool. Observations were made on and near the 95° W TAO mooring line.

The P-3 was deployed in the unvarying pattern shown in figure 1, at an elevation of 2 km. Dropsondes and various types of expendable ocean probes were dropped from the P-3, with the dropsonde locations shown in this figure. We used the dropsonde data and data from the tail radar of the P-3 to explore the relationship between surface winds,

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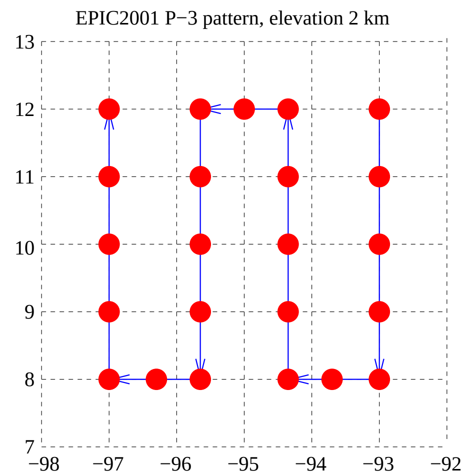

Figure 1: Flight pattern for NOAA P-3. The circles indicate dropsonde locations.

convective inhibition (CIN), and the location and intensity of convective cells.

Figure 2 shows the radar reflectivity at 2 km, the dropsonde winds at the surface, and contours of convective inhibition, defined as

$$CIN = \theta_{est} - \theta_{eb}$$

where θ_{est} is the saturated equivalent potential temperature at 850 mb and θ_{eb} is the average equivalent potential temperature between 980 mb and 1000 mb. This is a day with relatively strong convection associated with the spinup of tropical storm Ivo. Notice that the inflow and the initial convection are in a region of negative CIN, which means that convection is relatively uninhibited by stable layers at low levels. However, northeast of this region is an area of strongly positive CIN. This is a mesoscale cold pool.

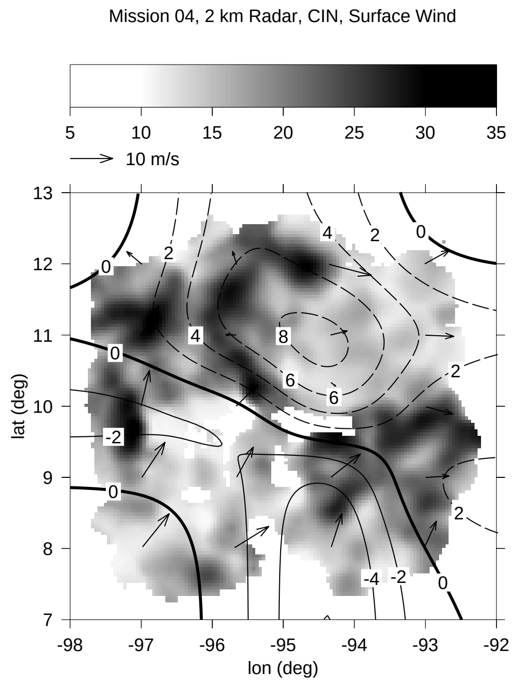

Figure 2: Reflectivity at 2 km along with contours of CIN and dropsonde winds at the surface for a day (9 Sept) with widespread convection.

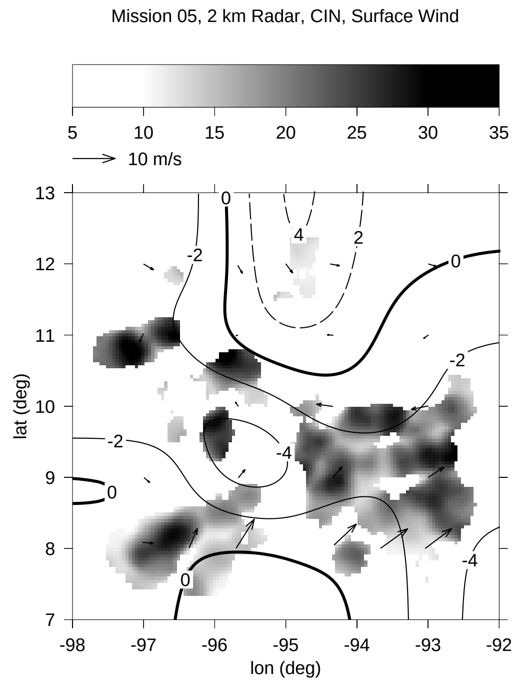

Figure 3: As in figure 2 except for a day (13 Sept) with convection covering a smaller area.

However, significant convective precipitation is still found in this area, which means either that the convective cells which produced the cold pool have not yet died, or that unstable air is overriding the cold pool from the southwest.

Figure 3 shows a day with much less widespread convection. Virtually all of the convection occurs in regions of negative CIN in this case, indicating that the convection is not strong or widespread enough to produce a significant cold pool. The convection in the southeast corner has moderately strong inflow from the southwest, but the rest of the region has relatively light winds.

From the examination of 10 case studies, we infer that:

- Convection tends to form in regions of negative CIN except where it extends from such a region into a presumably self-generated cold pool region with positive CIN. Significant CIN exists in this region, and it plays an important role in preventing convective development.

- Days with extensive convection are always fed by an inflow exhibiting relatively strong winds (of order 10 m s^{-1}), suggesting that surface heat fluxes are an important factor in driving the convection.

Acknowledgments. EPIC2001 could not have been executed without the wholehearted support of UCAR/JOSS, NOAA/AOC, NCAR/RAF, and Universidad Nacional Autónoma de México (UNAM). Special thanks go to Jay Fein (NSF), Michael Patterson (NOAA/OGP), and Graciela Raga (UNAM). This work was supported by NOAA and NSF (USA) and CONACYT (Mexico). The second author is on sabbatical leave at UNAM for 2001-2002.