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Convective Organization in the Pacific ITCZ: Merging OLR, TOVS, and SSM/I Information

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1. INTRODUCTION.

One of the most striking features of the planet's long--time average cloudiness is the zonal band of concentrated convection lying near the equator. Large--scale variability of the Intertropical Convergence Zone (ITCZ) has been well--documented in studies of the planetary spatial scales and seasonal/annual/interannual temporal cycles of convection.

Smaller--scale variability is difficult to study over the tropical oceans for several reasons. Conventional surface and upper--air data are virtually non--existent in some regions; diurnal and annual signals overwhelm fluctuations on other time scales; and analyses of variables such as geopotential and moisture are generally less reliable in the tropics. These problems make the use of satellite data an attractive alternative and the preferred means to study variability of tropical weather systems.

2. PROCEDURE

The hypothesis tested is: active convection in the ITCZ would produce one signal in the OLR data and somewhat different signals in TOVS infrared and microwave soundings and SSM/I moisture and precipitation data. The synthesis of these three signals would yield information describing the four--dimensional (spatial and temporal) organization of sub--planetary scale convective episodes. The eastern Pacific ITCZ is examined from these three satellite platforms.

The different sensors revealed unique structures in the meteorological fields associated with convective episodes of the ITCZ. Preliminary results from OLR (Hayes, 1988) reveal at least two convective modes of the cool--season ITCZ: a mean zonal convective mode throughout the Pacific basin and a meridionally--oriented eddy mode.

Fig. 1 is GOES-W IR imagery of the ITCZ across a portion of the eastern Pacific on 1 August 1987. The ITCZ is easily recognized as the curved, zonal band of cloudiness stretching across the bottom of the image. The ITCZ is active in the western part of the image and inactive in the east. Figs. 2 and 3 show OLR and TOVS MSU data observed over the same part of the Pacific on the same day. The ITCZ appears as cold cloudtop temperatures in OLR, and as warm brightness temperatures in MSU data. As expected, the different instruments, observing different parts of the spectrum, see different signatures in the atmosphere.

Cool and warm centers appear roughly correlated between OLR and TOVS MSU 1 (respectively). The warm (moist) centers in the MSU data are located slightly poleward of the coldest high clouds in the OLR.

When these two modes are active simultaneously features appear that are not present when either mode is active alone. TOVS and SSM/I observations will link moisture and precipitation structures within these modes.

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3. REFERENCE.

Hayes, P.M., 1988: Active Modes of the Pacific ITCZ. M.S. thesis, Texas A&M University, 90 pp. [Available from Department of Meteorology, TAMU, College Station, TX 77843].

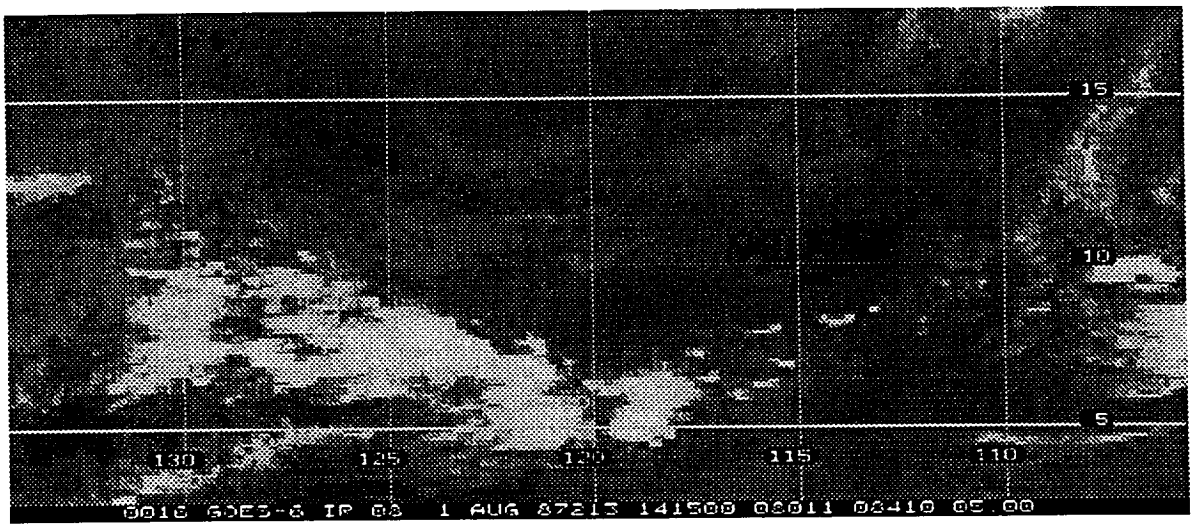

Fig. 1. GOES-W IR image of ITCZ on 1 Aug 87.

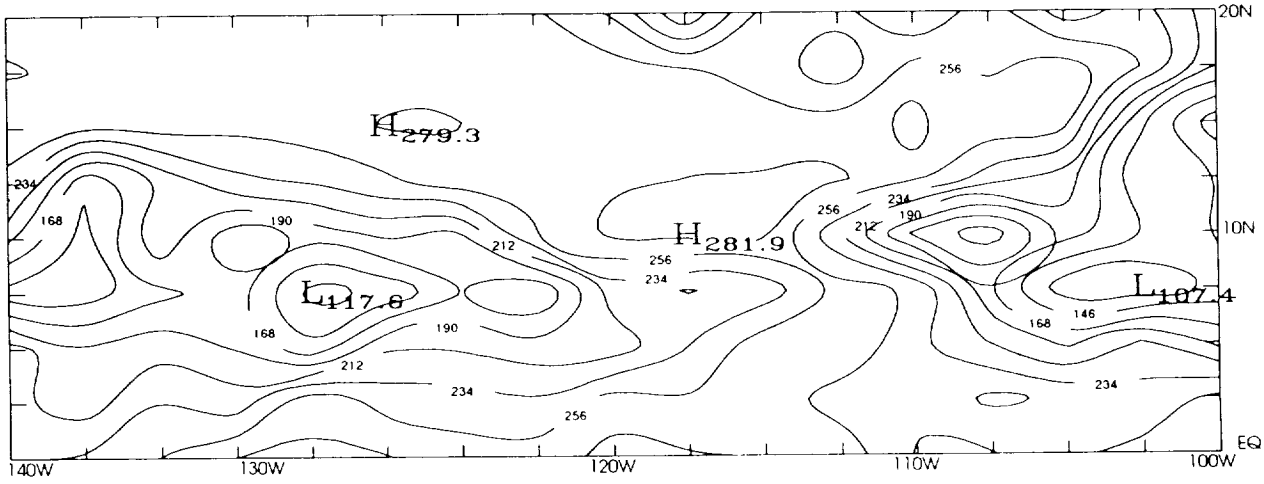

Fig. 2. OLR over same area as Fig. 1 on 1 Aug 87.

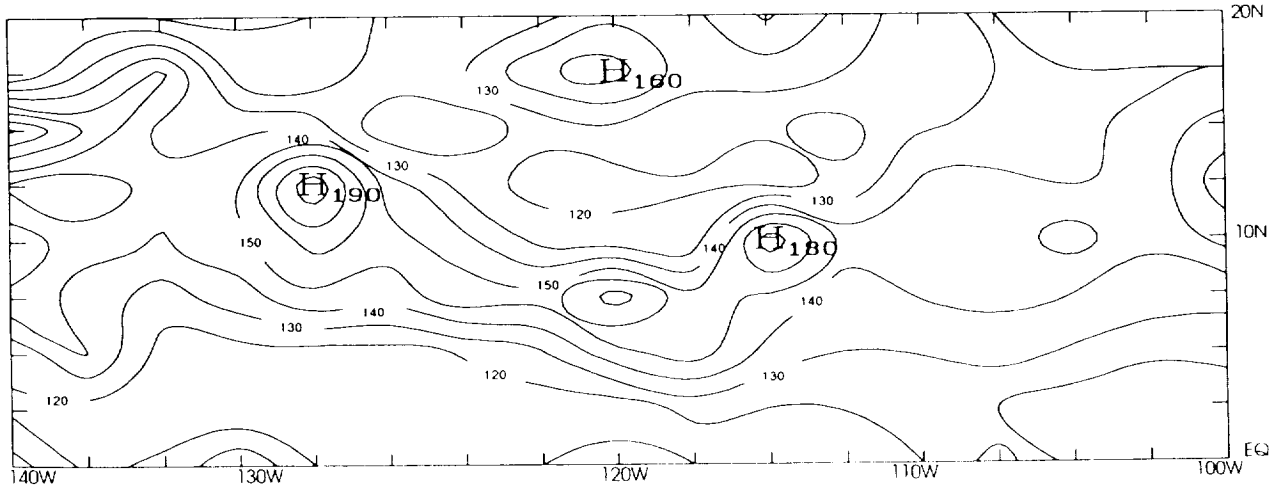

Fig. 3. TOVS MSU Channel 1 on 1 Aug 87.