

Supplementary Figures for

“ENSO’s Impact on the Gap Wind Regions of the Eastern Tropical Pacific Ocean”

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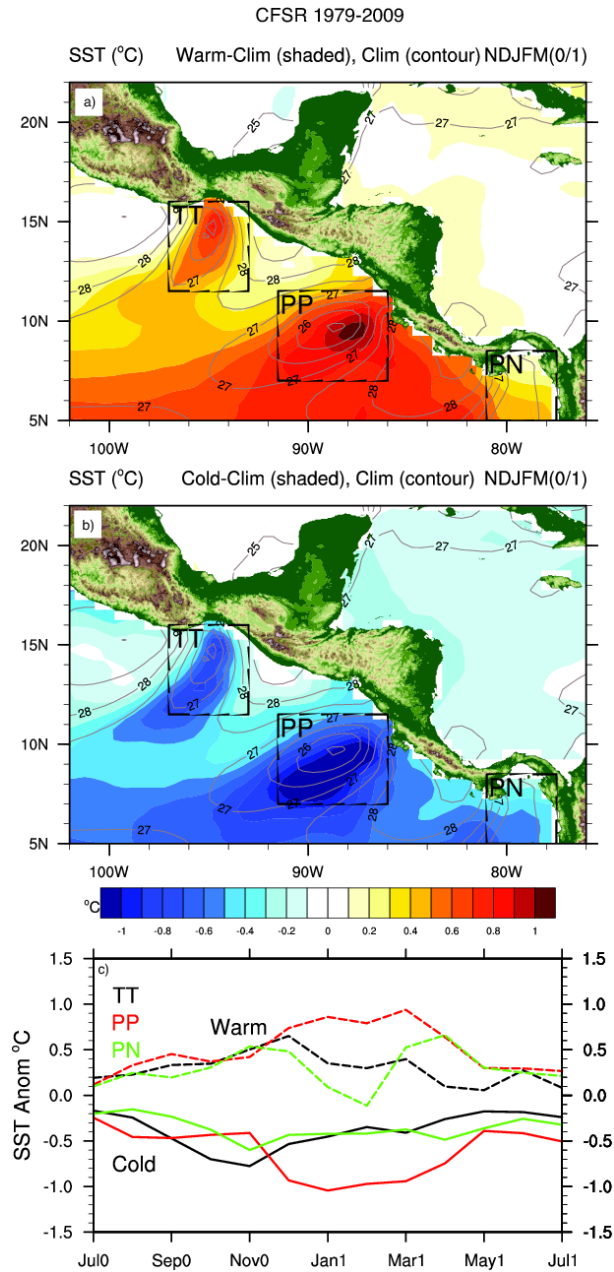


Fig. S1. (a) El Niño and (b) La Niña composite (shading) SST anomalies during NDJFM. Climatological mean (contours) are shown in both (a) and (b) The contour/shading is 0.5/0.1°C. Boxes denote the Tuahantepec (TT), Papagayo (PP), and Panama (PN) regions. (c) SST evolution of El Niño (dashed lines) and the La Niña (solid lines) from July(0) to July(1) in the TT (black), PP (red) and PN (green) regions shown in (a). The data are from CFSR.

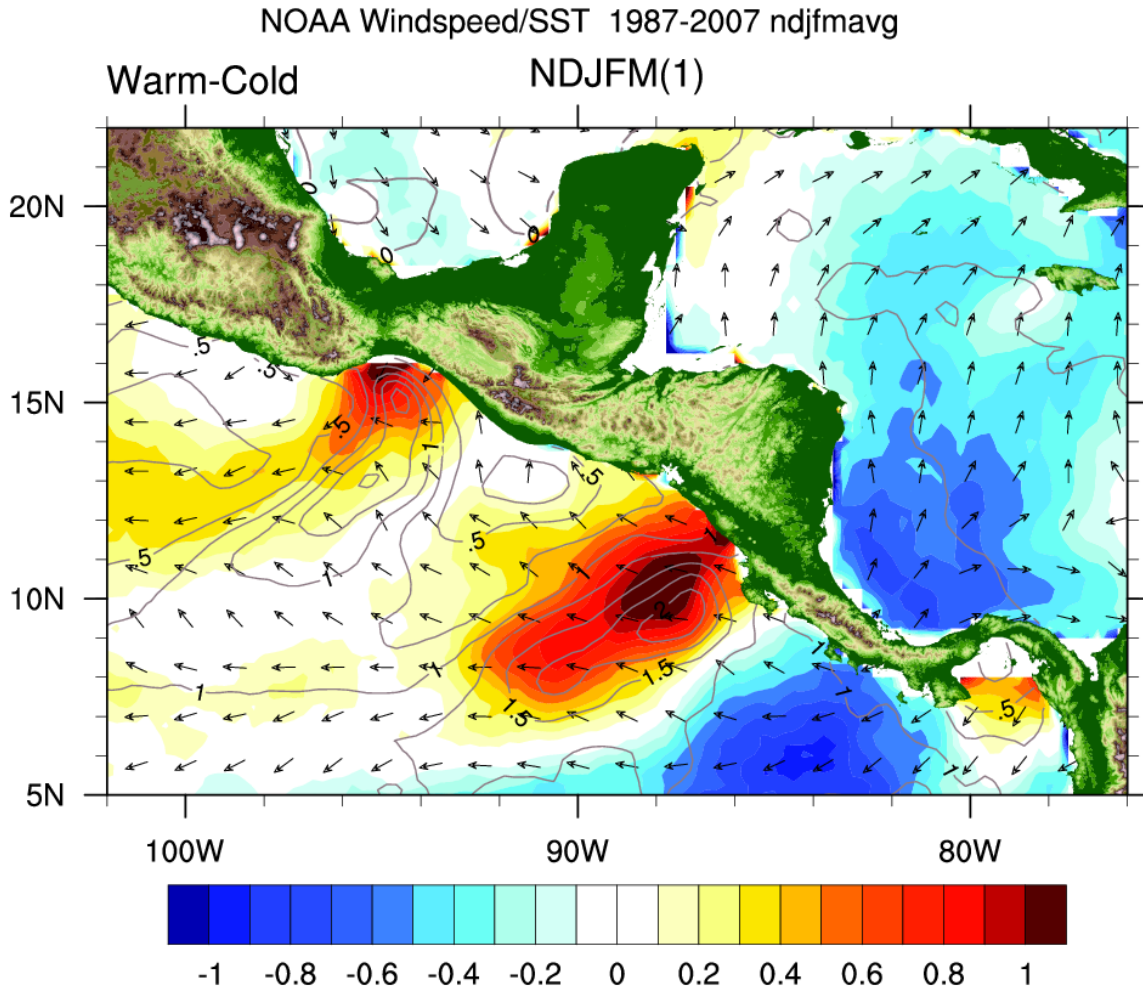


Fig. S2. El Niño – La Niña composite SST (contours), vector wind direction and wind speed (shaded), during NDJFM, as in Fig. 4b but here based on the NOAA high-resolution SST (Reynolds et al. 2007) and wind (Zhang et al. 2007) datasets. The ENSO events are drawn from the period of record: 1982-2007 for SSTs and 1987-2007 for the winds. The contour/shading interval is  $0.25^{\circ}\text{C}/0.1 \text{ m s}^{-1}$ .

The surface winds may also be influenced by local conditions. The wind speed may increase over the large positive SST anomalies during El Niño especially in the TT and PP regions due to the decrease stability of the atmospheric boundary layer and the enhanced downward vertical mixing of higher momentum air over warm mesoscale SSTs (e.g. see Xie 2004; Chelton and Xie 2010). Likewise, vertical mixing would decrease over cold SST anomalies during La Niña.

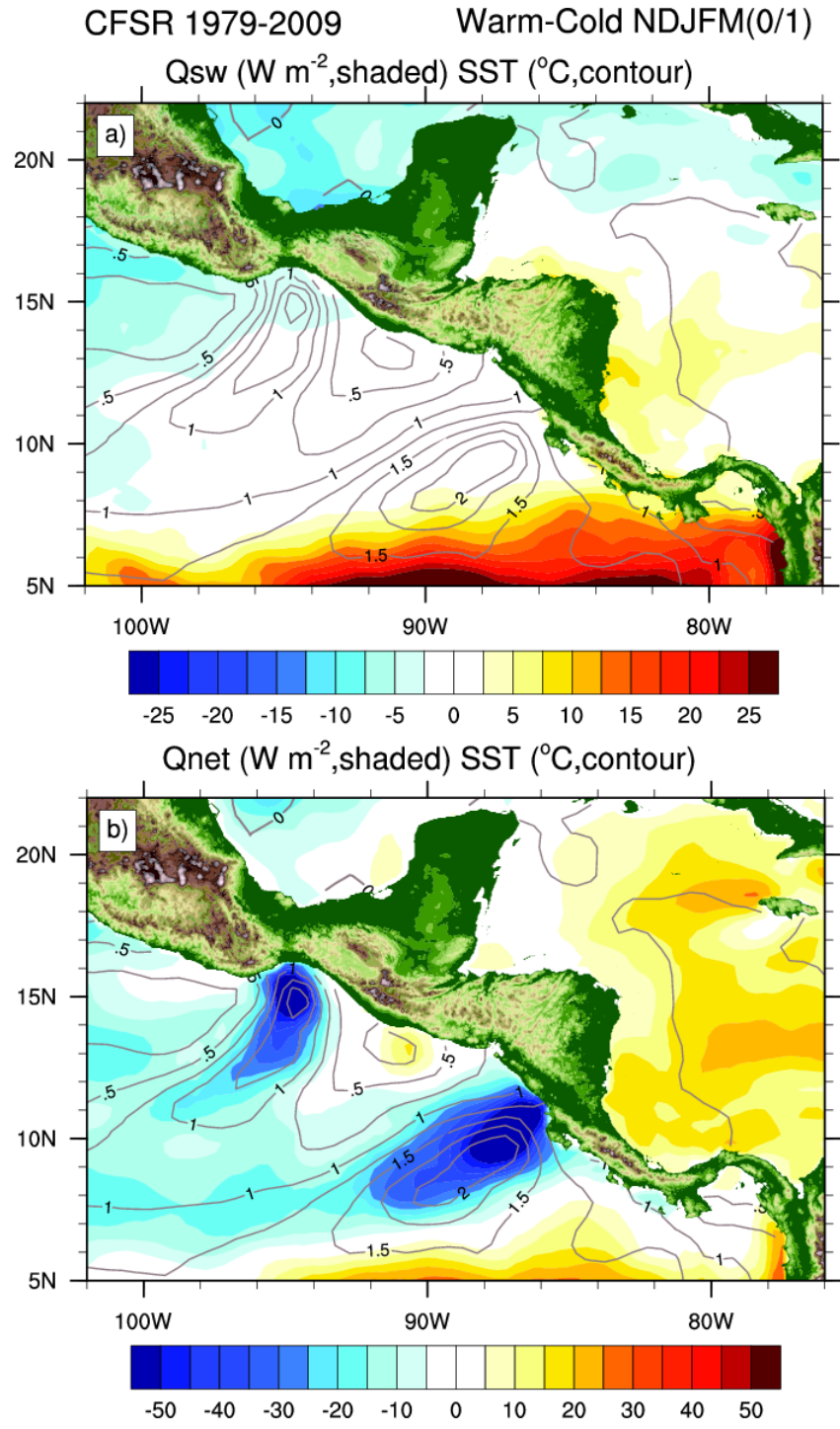


Fig. S3. El Niño – La Niña composite SST (contours) and (a) shortwave radiation and (b) net surface heat flux into the ocean (shading) during NDJFM. The contour/shading interval is (a)  $0.25^{\circ}\text{C}/2.5 \text{ W m}^{-2}$  and (b)  $0.25^{\circ}\text{C}/5 \text{ W m}^{-2}$ . Data are from CFSR.

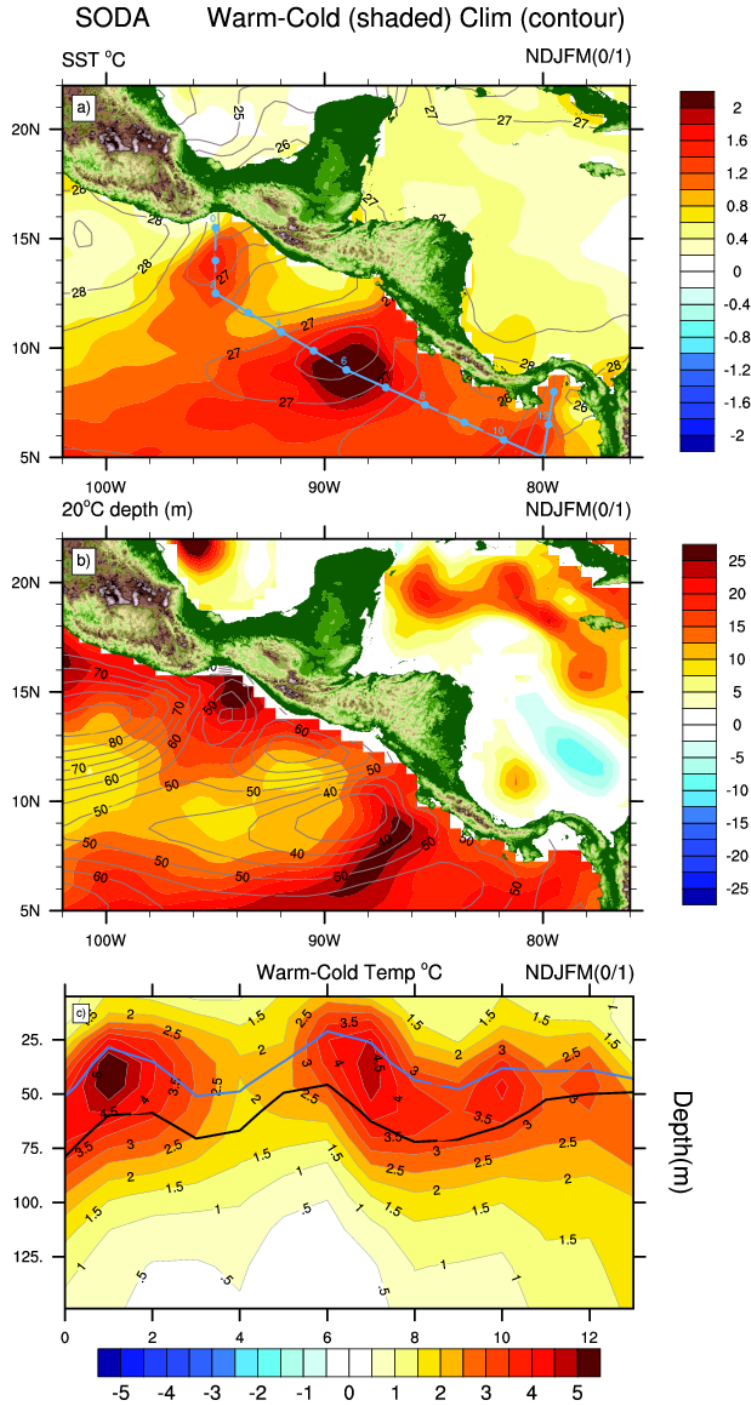


Fig. S4. Fields from the Simple Ocean Data Analysis (SODA). (a) SST Mean (contours) and El Niño – La Niña (shading), (b) Z20 Mean (contours) and El Niño – La Niña (shading). The contour/shading interval is (a) 0.5C/0.2C and (b) 5m/2.5 m. (c) Temperature anomalies as a function of depth along the transect shown in (a), black (blue) line is the depth of the Z20 surface in El Niño (La Niña). The climatology is for 1958-2007 and the ENSO events are from 1979-2007, the same as for CFSR except for the 2007-2008 La Niña.

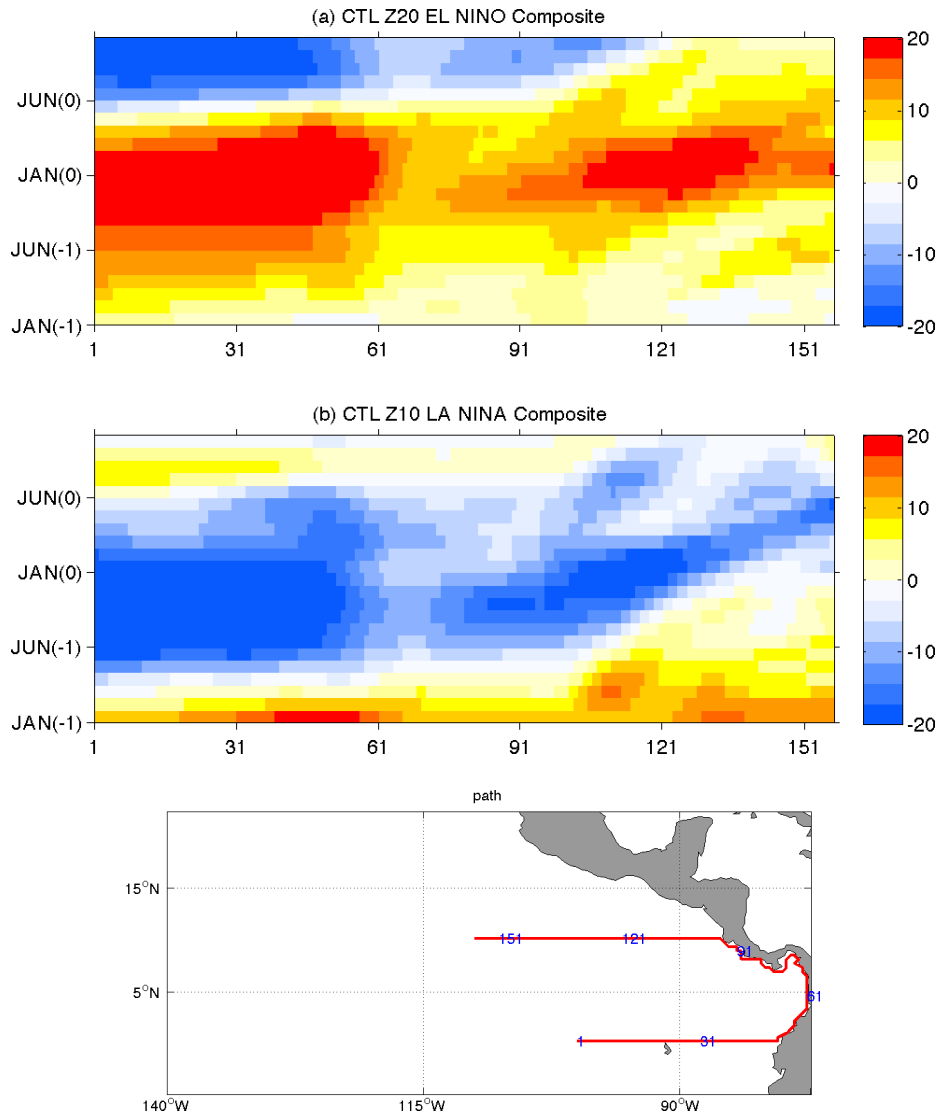
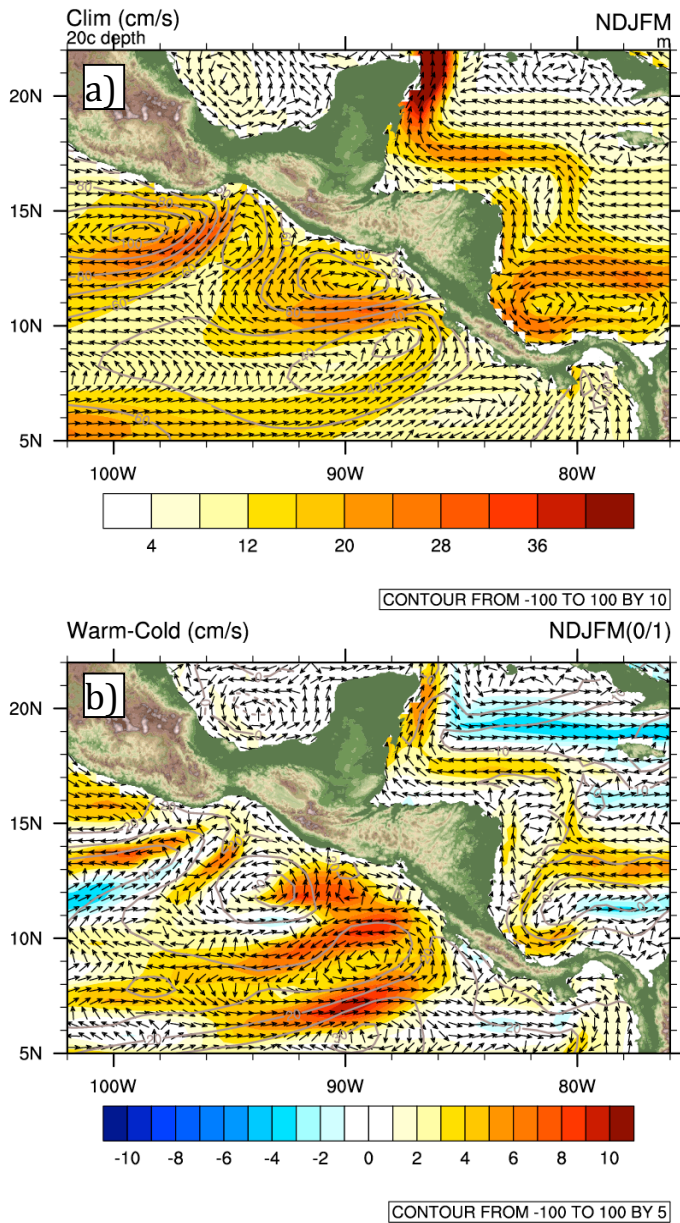


Fig. S5. Hovmöller (time-distance) diagram of the composite Z20 depth for (a) El Nino events and (b) La Nina events for the transect shown in bottom panel. The path has three segments: i) east from 100°W to the South American Coast along the equator (points 0-40); ii) north from the equator to 10°N along the South American coast (point 41-95) and iii) west from the coast to 112°W along 10°N. The time coordinate spans 24 months from the Jan of Yr(-1) before an event peaks to Dec of Yr(0) based on month values from the CTL ROMS simulation. The values along the equator and 10°N are the average of 3 points, one to either side of the transect line, while the values in the second segment are from single vales right along the coast.

The results show the relatively rapid propagation along the equator and the coast are consistent with downwelling Kelvin waves during EL Nino and upwelling waves during La Nina. The slower westward propagation at 9°N is consistent with Rossby wave speeds. Note this figure differs from Fig. 8 in that monthly values were used here and a much longer period of the ENSO cycle is shown.

### CFSR OCN Current (5-100m) 1979-2009



### CFSR Ocn Current (cm/s) Clim(contour)

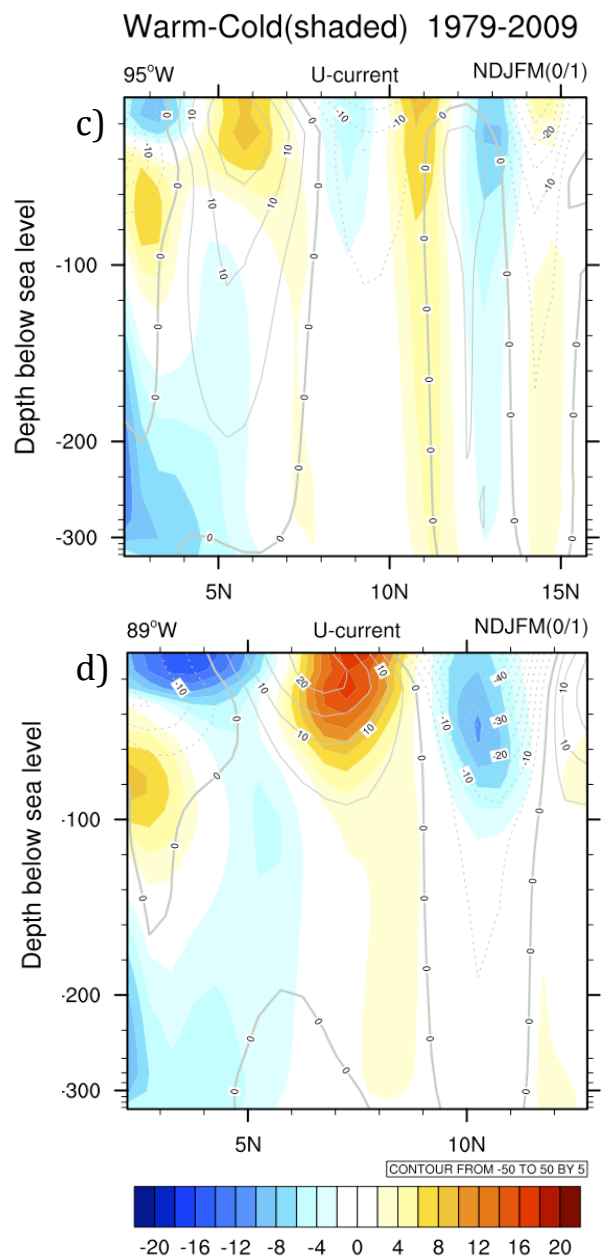


Fig. S6. (a) Mean and (b) El Niño – La Niña currents averaged over the upper 100 m in the ocean. The current direction and shading are denoted by vectors and shading, respectively. The Z20 depth (m), (as shown Fig. 8) is contoured. The contour interval is (a) 10 m and (b) 5m and the shading interval is (a) 4 cm s<sup>-1</sup> and (b) 1 cm s<sup>-1</sup>. The mean (contour) and El Niño – La Niña (shaded) zonal current as a function of depth at (c) 95°W and (d) 89°W which pass through the TT and PN regions, respectively. In both (c) and (d) the contour interval is 5 cm s<sup>-1</sup> and shading interval is 2 cm s<sup>-1</sup>.

# CFSR Ocn Temp

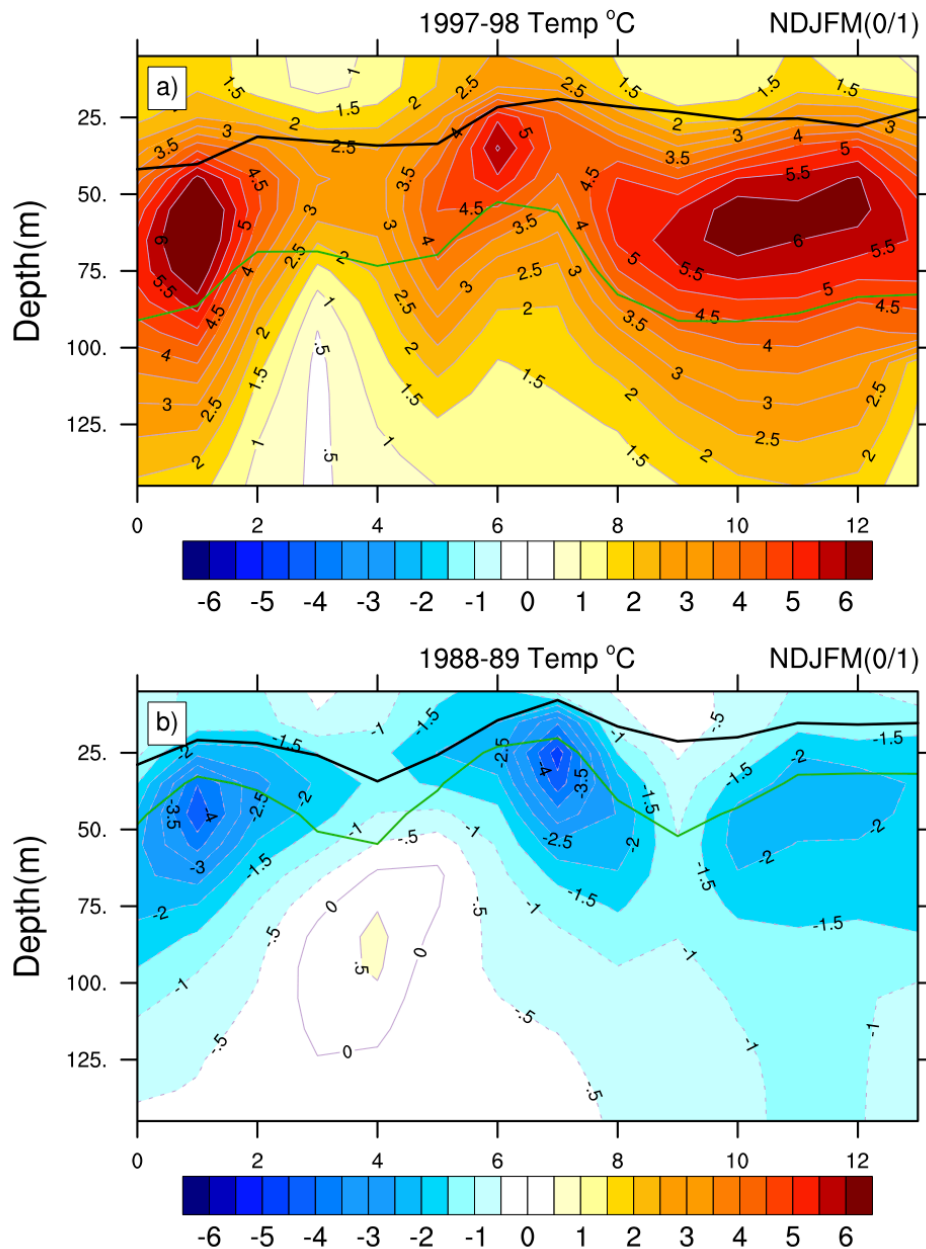


Fig. S7. Cross section along the transect shown in Fig. 8 beginning in the Gulf of Tehuantepec (0), passing through the Costa Rica Dome (6) and ending at the Gulf of Panama (13) of the temperature departures from the 1979-2010 mean (contours and shading, interval 0.5°C), the mixed layer depth (black line) and Z20 depth (green line). The data are from CFSR for (a) 1997-98 El Niño and (b) 1988-89 La Niña



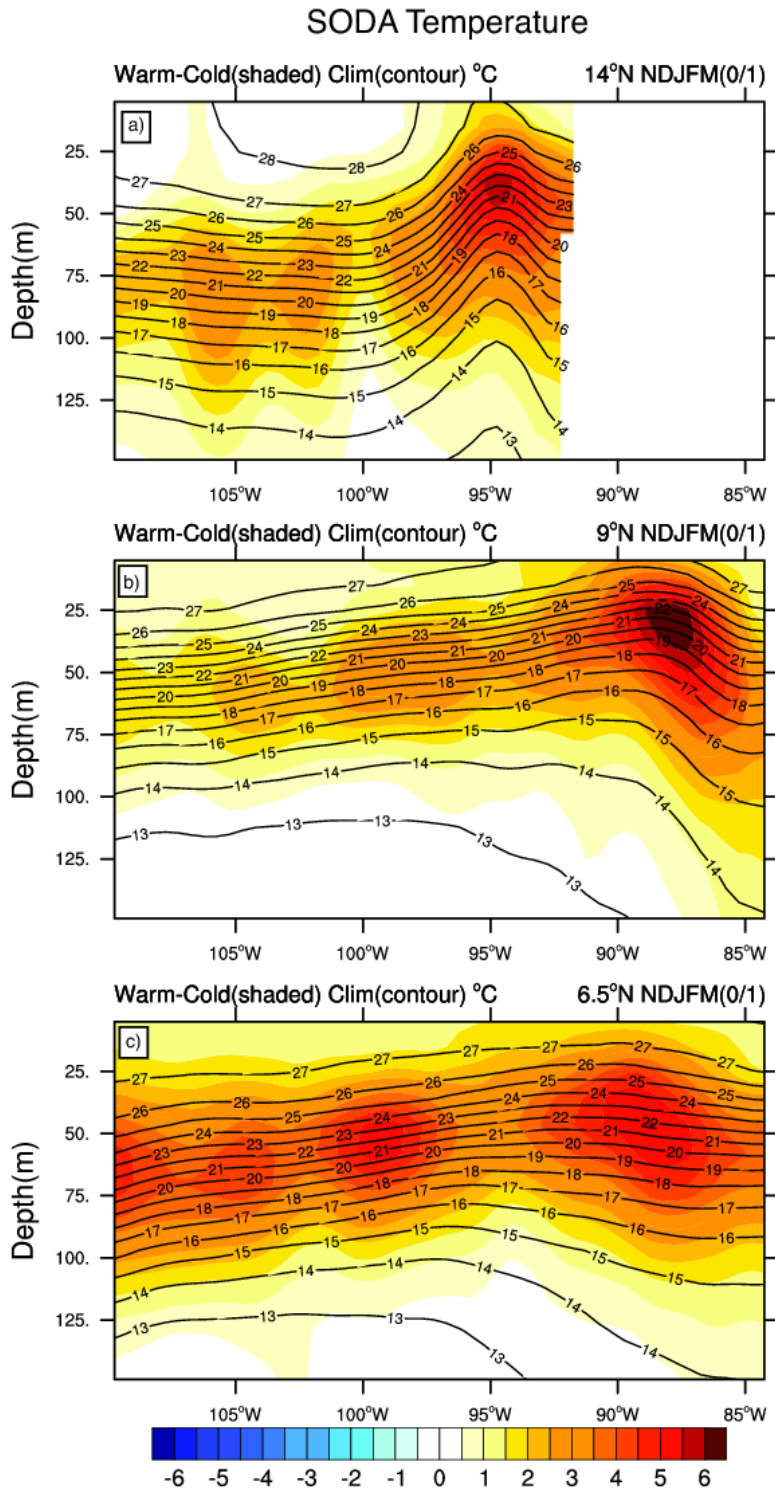


Fig. S8. Cross section of the mean temperature (contours) and El Niño – La Niña composite temperature (shading) at 14°N, 9°N and 6.5°N. The contour/shading interval is 1°C/0.5°C. Data are from SODA for the same periods as in Fig. S4.

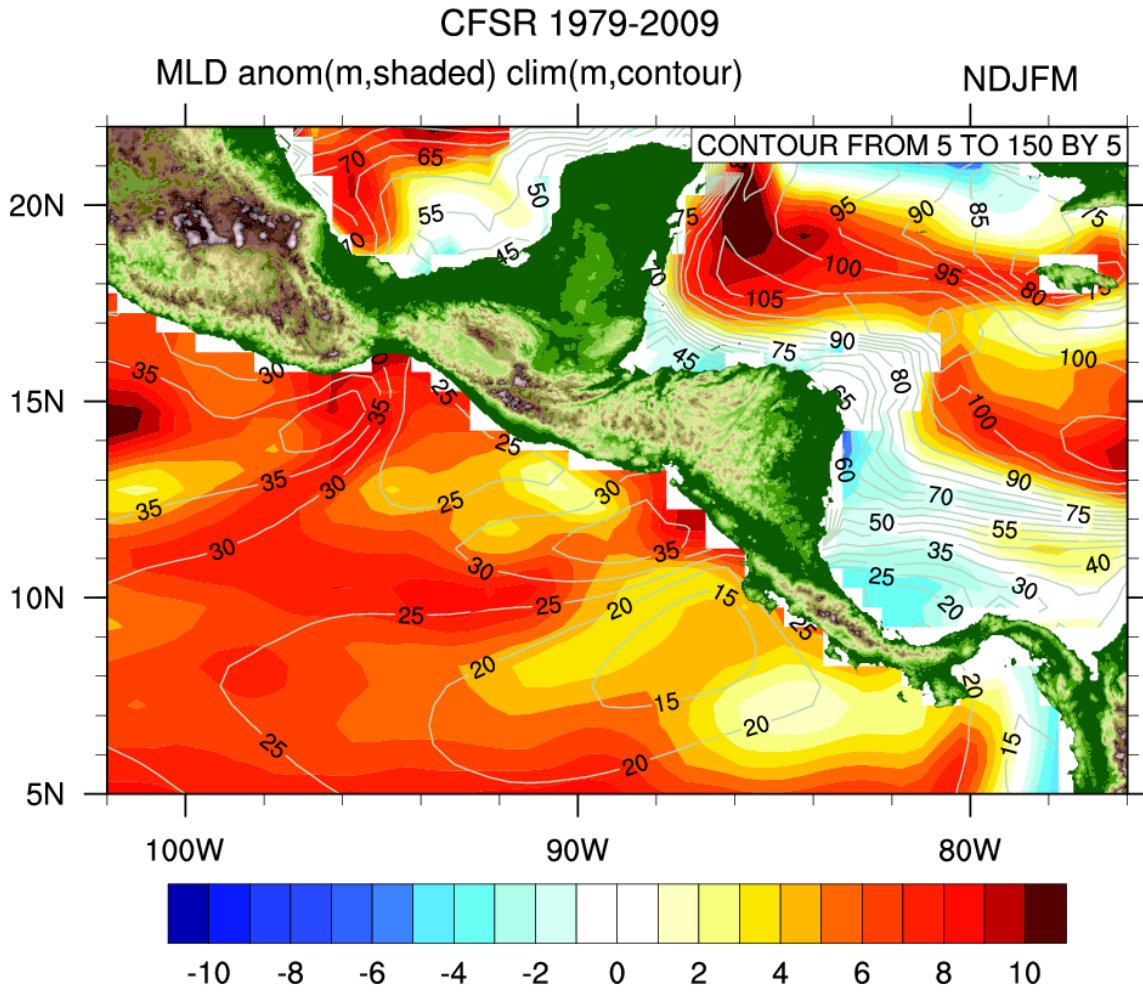


Fig. S9. Mean and El Niño – La Niña composite mixed layer depth (MLD) (during NDJFM). The contour/shading interval is (a) 5 m/1 m. Data are from CFSR.