shown in Figure 9.10, which also includes the area where the salinity is above 36 at 200 m depth. It is seen that the high salinities reach much further west in the thermocline than at the sea surface. The origin of these high thermocline salinities must be at the sea surface, since the highest salinity reached in the Subtropical Convergence and therefore found in Central Water does not reach 35.8. This leads to the conclusion that convective sinking through evaporation occurs in the Polynesian region, at sea surface temperatures of 26°C and above. Maximum temperatures and salinities are reduced during sinking and spreading by mixing; but even in the Coral Sea where maximum salinities have fallen off to 35.8 and less, SPEW can still be clearly identified at temperatures above 20°C by its higher salinity when compared with WSPCW (Figure 9.11). Below 20°C SPEW appears to be a mixture of WSPCW and ESPCW.

Although the differences in T-S values between SPEW and WSPCW are small, the boundary between the two water masses along 20°S in the central Pacific Ocean and about 15°S in the Coral Sea is quite distinct. This is borne out in Figure 9.11 which shows the small salinity differences between the two groups of stations as being well outside the standard deviation, i.e. the natural variability, of salinity in each water mass. Steric height and salinity distributions indicate that south of 15°S WSPCW is advected from the south-east, while north of 15°S SPEW enters the region from the east. It is worth noting also that at the upper level (where the temperature is well above 20°C) the presence of SPEW is indicated by a salinity maximum (Figure 9.12c), while at the lower level (where temperatures are close to 17°C) SPEW salinity is lower than WSPCW salinity (Figure 9.12d).

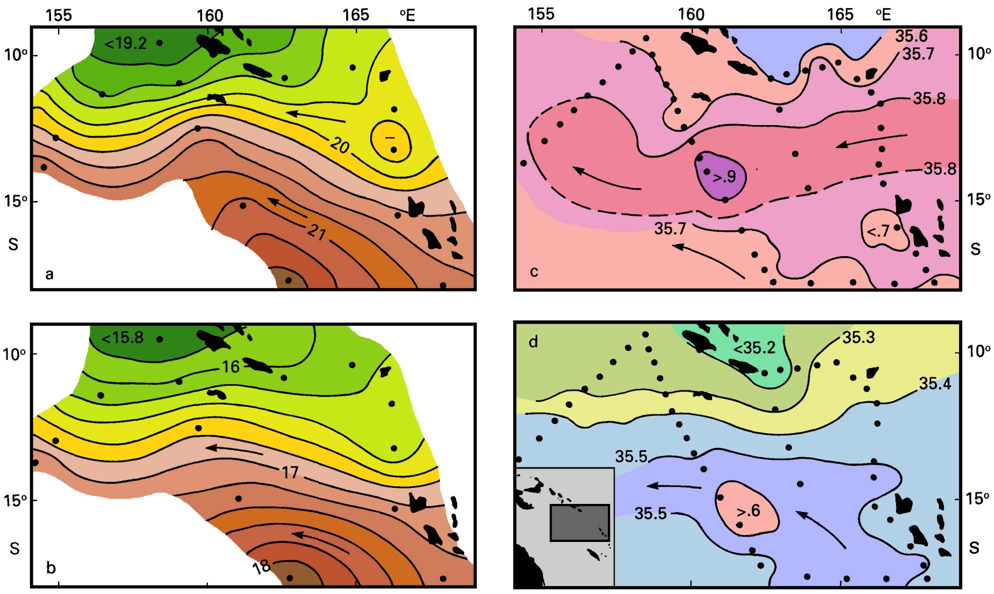

Fig. 9.12. Manifestation of the boundary between SPEW and WSPCW in the eastern Coral Sea. Dynamic height, or steric height multiplied by gravity, relative to an assumed level of no motion of 1200 m, at 148 m (a) and 248 m depth (b), and salinity at 148 m (c) and 248 m depth (d). Arrows give the inferred flow direction. Dots indicate station positions used in

drawing the maps; the inset shows the location of the region. From Tomczak and Hao (1989).

western Pacific Ocean the mechanism that creates and maintains the barrier layer is freshening of the surface layer by local rainfall. Figure 9.15 gives an example of the resulting temperature and salinity structure.

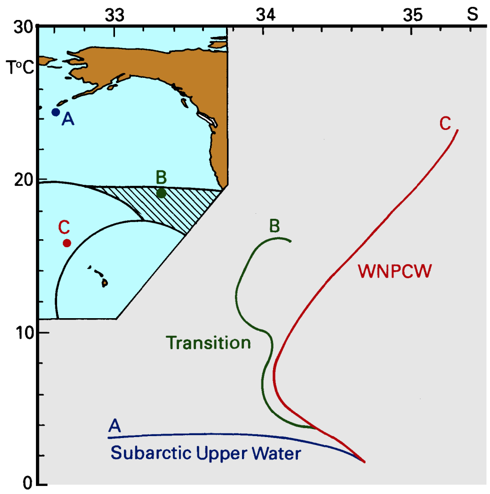

Fig. 9.14. T-S diagrams of Central and Subpolar Upper Water and from the "transition region" of Fig. 9.10. Data from Osborne *et al*. (1991).

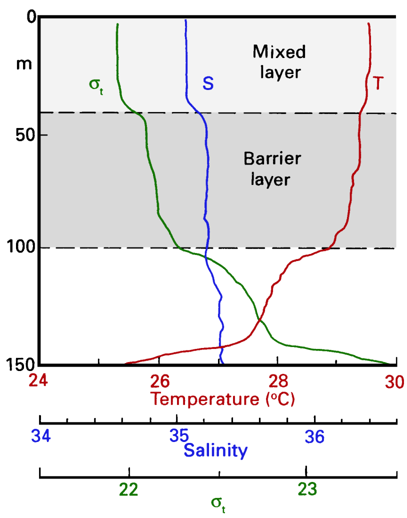

Fig. 9.15. An observation of the barrier layer in the western equatorial Pacific Ocean; *T*: temperature (°C), *S*: salinity. The halocline is above the tropical thermocline, the depth of the mixed layer indicated by the shallower of the two. From Lukas and Lindstrom (1991).

The existence of the barrier layer has only been noted recently and has caused oceanographers and meteorologists to revise some of their ideas about ocean-atmosphere coupling mechanisms. What happens between the ocean and the atmosphere in the western equatorial Pacific Ocean is of utmost importance for the dynamics of the ENSO phenomenon, a major fluctuation of climatic conditions over one half of the globe. The dynamics of ENSO will be discussed in Chapter 19; in the context of barrier layer