equatorial Pacific Ocean during the developing El Niño event it can be inferred that it had an impact on the atmospheric circulation. The deep atmospheric convection and ascending air of the Walker Circulation was no longer over the longitudes of the warm pool of the western Pacific Ocean but over the central and eastern equatorial Pacific Ocean. Surface winds over the western Pacific Ocean reversed in response to the eastward shift in convection and in a positive feedback process, further heat and moisture were fed into the convection zone. Thus, as the convection moved eastward the Walker Circulation contracted and a reverse circulation was established over the western equatorial Pacific Ocean with subsiding air in the west.

Prior conditions

Early in 1997 some computer models predicted the development of an El Niño event. However, overall the different computer models provided conflicting advice and none indicated the development of a very intense event. There remains fundamental scientific debate about what are the necessary conditions to initiate an El Niño event. A major issue is the relative importance of internal processes within the ocean and of westerly wind bursts over the western equatorial Pacific Ocean to initiate and intensify eastward propagating equatorial Kelvin waves. The early onset and rapid intensification of the 1997–98 event were not anticipated but once identified several computer models described the evolution well.

A precondition for an El Niño event had developed during the latter half of 1996 as an extensive warm pool became established in the surface layers of the western Pacific Ocean. By January 1997 sea level over the region was up to 20 cm above normal and sea surface temperatures were slightly warmer than normal west of the Date Line. The global map of sea surface temperature anomaly for January 1997 (see Figure II.4) shows an area of slightly warmer than normal temperatures over the western equatorial Pacific Ocean and slightly cooler temperatures over the eastern equatorial Pacific Ocean.

The equatorial depth-section of temperature and temperature anomaly is shown in Figure II.5. The thermocline associated with the pool of warm water was deeper than normal over the western Pacific Ocean. To the north of Papua New Guinea the temperature was nearly 2°C warmer than normal at a depth of near 100 metres, and near the Date Line the temperature was about 4°C above normal at a depth of 150 metres.

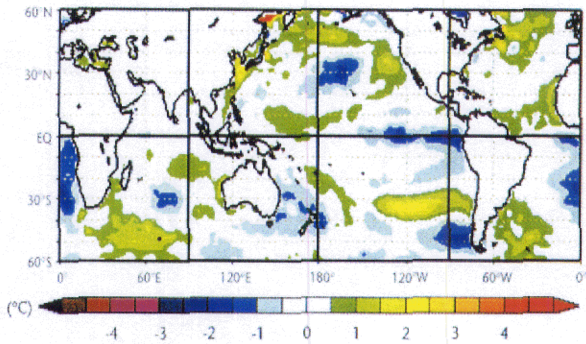

Figure II.4
Sea surface temperature anomaly for January 1997 during the commencement of the El Niño event. Temperatures are warmer than normal in the western Pacific Ocean and cooler than normal in the east.
(NOAA/CDC, USA)

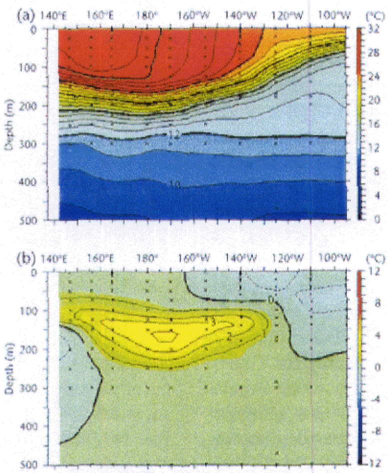

Figure II.5
(a) Monthly mean temperature and (b) temperature anomaly during January 1997 at the commencement of the El Niño event along the equator. The thermocline is deeper than normal under the warm surface layer in the western and central Pacific Ocean, but slightly elevated with colder than normal water at the surface over the eastern Pacific Ocean.
(NOAA/PMEL (TAO Project), USA)

Commencement

During the Southern Hemisphere summer of 1996–97 there were periods of sustained westerly wind bursts in the western equatorial Pacific Ocean that may have been significant in the initiation and subsequent evolution of the 1997–98 El Niño event. The first period of westerly winds was in December 1996, when there was a pair of tropical cyclones in the western Pacific Ocean, one north and the other south of the equator. The longitudinal extent and duration of this westerly wind burst were limited.

A major westerly wind burst over the western equatorial Pacific Ocean occurred