



The Vertical Circulation Anomalies in the Tropical Atmosphere above the Pacific during the Extreme El-Nino and La-Nina Events

E.V. Sokolikhina (1), E.K. Semenov (2), N.N. Sokolikhina (2)

(1) P.P. Shirshov Institute of Oceanology of RAS, (2) Moscow State University by M.V. Lomonosov

The schemes of the large-scale changes of the vertical cells of the circulation in tropics (the meridional Hadley cells and the zonal Walker circulation) during the extreme El-Nino and La Nina events are studied. The both cells are thermal and appear as the result of the ascending air motion forming above the warmer parts of the ocean and as the result of the descending air flow forming above the cooled water surface. The Hadley and Walker cells reflect fully the whole mechanism of the atmospheric circulation in low latitudes. We used the re-analysis NCEP/NCAR average monthly data for the zonal and meridional wind and the vertical wind analogue on the main isobaric surfaces from 1958 to 1998. Taking into account that the circulating Hadley and Walker cells are connected directly with the divergence and convergence, the divergent wind velocity potential was calculated. Further the divergent wind velocity potential values were differentiated along x and y and the values of the zonal and meridional velocity analogues were obtained accordingly. All the calculated data were restored in the layer from 850 to 100 hPa using the cubic spline-interpolation. The composition maps of the vertical motions were plotted separately for the El-Nino and La-Nina events. These maps showed that the most significant changes in the vertical circulation schemes were observed during the Southern Hemisphere summer above the tropical Pacific and the adjacent continental parts. The changes of the vertical circulation above the other tropical regions and during the other seasons were not so bright and scaled. During the warm ENSO phase above the tropical Pacific the unexampled displacement of the ascending branch of the Walker circulation from the Indonesia “marine continent” to the central and eastern parts of the Pacific virtually up to the Southern America coast is observed. In this situation the Northern Australia and Indonesia are

found in the zone of the large-scale air mass subsidence that leads to the catastrophic droughts and fires. On the contrary, during the cold ENSO phase the strong intensification of the ascending motions in the summer monsoon region above the Northern Australia is observed, that causes the abundant precipitation and floods. The changes of the meridional vertical circulation during the warm ENSO phase was shown, first of all, in practically full disappearance of the classical Hadley circulation above the central Pacific, which is typical for the trade inter-tropical convergence zone, and in appearance of the latitudinal monsoon circulation above the central Pacific, which is typical for the monsoon ITCZ above the Indian Ocean. During the cold ENSO phase the Hadley circulation above the central Pacific was not only restored, but also the considerable intensification was observed.