MARINE BOUNDARY-LAYER VARIABILITY OVER THE INDIAN OCEAN DURING INDOEX (1998)

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Abstract. The variability in boundary-layer structure over the Indian Ocean during a north-east monsoon and the factors influencing it are investigated. This study was made possible as a component of the Indian Ocean Experiment (INDOEX), conducted from February 19 to March 30, 1998. The data used are, surface-layer mean and turbulence measurements of temperature, humidity and wind, and vertical soundings of temperature and humidity. Significant spatio-temporal variability was observed in the boundary-layer structure throughout the cruise. The ITCZ was characterized as the region with strongest winds and maximum surface turbulent fluxes of momentum and heat. One of the important findings from this study was a strong influence of continental air masses on the boundary-layer structure in the Northern Hemisphere, even at a distance of 600 km off the Indian coast. This was generally evident in the form of an elevated plume of dry continental air between altitudes of 1500 m and 2700 m. Advection of continental aerosols in this layer presents potential for significant entrainment into shallow clouds in this region, which eventually feed deeper clouds at the ITCZ. This finding provides an explanation for anomalous higher aerosol concentrations found during previous studies. The structure of the marine boundary layer was influenced by various factors such as proximity to land, an anomalous warm pool in the ocean and the ITCZ. In the southern hemisphere, the boundary-layer height was primarily governed by surface-layer sensible heat flux and was found to be highest in the vicinity of the ITCZ. North of the equator it was strongly influenced by land-air-sea interactions. In addition to this synoptic modulation, there was also a significant diurnal variability in the boundary-layer height.

Keywords: Indian Ocean, INDOEX, ITCZ, Marine boundary layer, North-east monsoon.

1. Introduction

One of the primary objectives of the Indian Ocean Experiment (INDOEX) is to understand the extent to which the continental aerosols, both natural and anthropogenic, are transported over clean ocean regions thousands of kilometres away from the sources and to characterize the meteorological processes responsible for this transport. The transport of aerosols from source regions on the continents to remote oceans could play a significant direct as well as indirect role in global radiative

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