N91-10515

Cloud and Boundary Layer Structure Over San Nicolas Island During FIRE

Bruce A. Albrecht, Christopher W. Fairall, William J. Syrett

Penn State University
Department of Meteorology
University Park, PA 16802

Wayne H. Schubert

Department of Atmospheric Science
Colorado State University
Fort Collins, CO 80523

Jack B. Snider

NOAA/ERL/WPL
Boulder, CO 80303

The temporal evolution of the structure of the marine boundary layer and of the associated low-level clouds observed in the vicinity of San Nicolas Island (SNI) is defined from data collected during the FIRE Marine Stratocumulus IFO (July 1-19). Surface, radiosonde, and remote-sensing measurements are used for this analysis. Soundings from the Island and from the ship Point Sur, which was located approximately 100 km northwest of SNI, are used to define variations in the thermodynamic structure of the lower-troposphere on time scales of 12 hours and longer. Time-height sections of potential temperature and equivalent potential temperature clearly define large-scale variations in the height and the strength of the inversion and periods where the conditions for cloud-top entrainment instability (CTEI) are met. Well-defined variations in the height and the strength of the inversion were associated with a Catalina Eddy that was present at various times during the experiment and with the passage of the remnants of a tropical cyclone on July 18 (Fig. 1). The large-scale variations in the mean thermodynamic structure at SNI correlate well with those observed from the Point Sur.

Cloud characteristics are defined for 19 days of the experiment using data from a microwave radiometer, a cloud ceilometer, a sodar, and longwave and shortwave radiometers. The depth of the cloud layer is estimated by defining inversion heights from the sodar reflectivity and cloud-base heights from a laser ceilometer. The integrated liquid water obtained from NOAA's microwave radiometer is compared with the adiabatic liquid water content that is calculated by lifting a parcel adiabatically from cloud base. In addition, the cloud structure is characterized by the variability in cloud-base height and in the integrated liquid water. The laser ceilometer is used to estimate the relative fraction of clear and cloudy periods during the experiment. Mean and variances of the solar and longwave fluxes are computed from pyranometer and pyrgeometer measurements.

The time-height sections of equivalent potential temperature are used to identify times during the experiment when conditions for CTEI exist for a day or longer. Our initial analysis shows that CTEI conditions are met over SNI from July 1-4 and over both SNI and the Point Sur July 10-13. From July 6-9 and from July 13-16 the the conditions at the inversion are very unfavorable for CTEI. The cloud characteristics for these different periods will be studied in detail to evaluate the effects of CTEI on cloud structure.

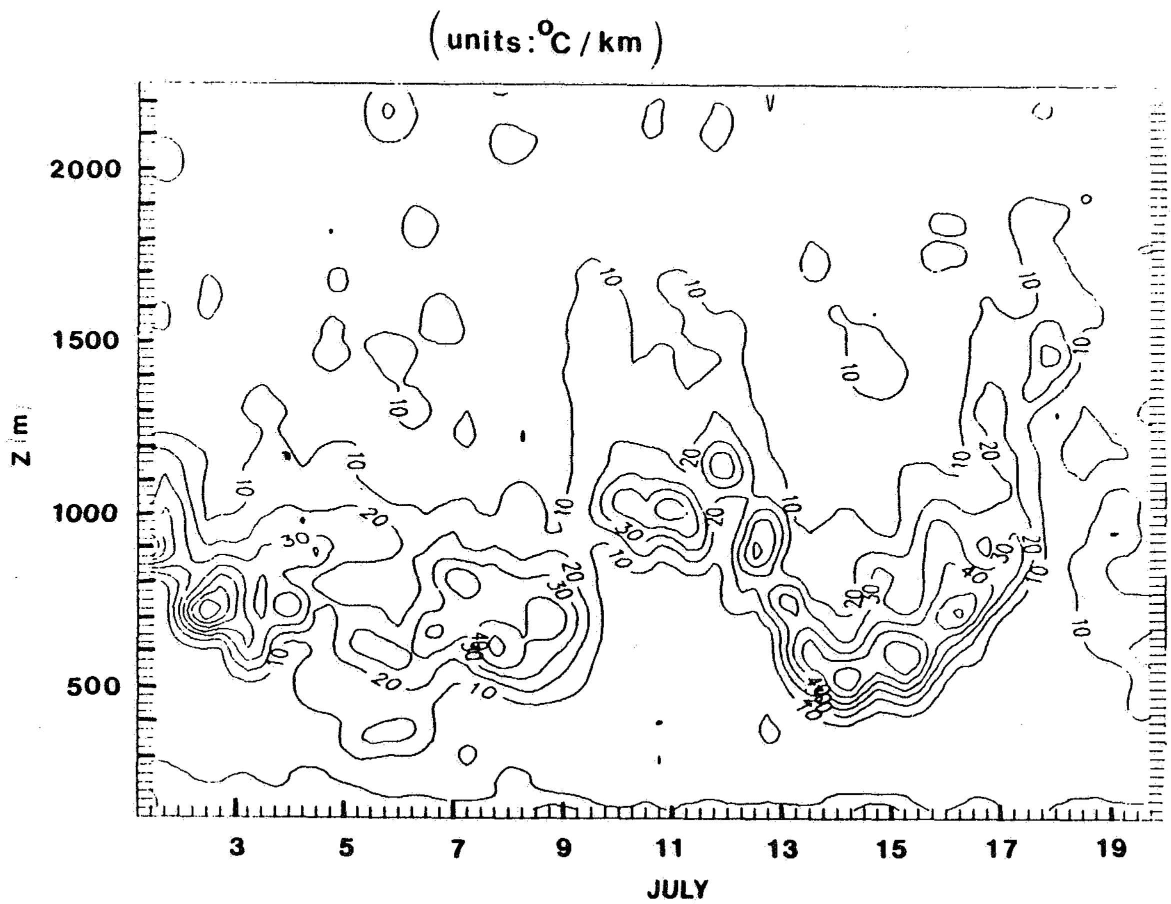

Figure 1. Time height section of $\partial\theta_e/\partial z$ calculated from CLASS soundings made from San Nicolas Island during FIRE.