TITLE: Morphology and development of organized convection in the boundary layer

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SIGNIFICANT ACCOMPLISHMENTS, FY-84

Further progress has been made in the analysis of the data obtained during the FY-81 flight program. That program produced vector windspeed measurements in a horizontal plane derived from an airborne Doppler lidar. Gradual improvement in the understanding of the various error sources in the measurements has allowed error correction to the point where continuity in the scalar measurements is measured in tenths of 1 m/s in the boundary layer. The systematic errors which remain do not affect local flow analysis.

The removal of much of the short-term error in the data fields has produced dramatic measurements of wave structures in and near the boundary layer. Deep boundary layer measurements in CCOPE (to 3000 m altitude) show pronounced interacting wave structures with periods on the order of 2 km. Observations of similar waves in California at altitudes down to 300 m demonstrate that the lidar system is sufficiently stable to detect structures with amplitudes of only 1 m/s. Wave structures have also been observed to result from obstacle flow.

FOCUS OF FY-85 RESEARCH:

These clear-air measurements demonstrate the potential of the system for the measurement of complex structures, and are of considerable meteorological interest. The lidar system is uniquely capable of such measurements: sensitive microwave radars are capable of clear-air measurements to a certain extent, but clutter and a large averaging volume are limiting factors. However, the lidar system has been limited to scanning in a single horizontal plane. Current work will change the lidar scan pattern to allow essentially simultaneous data acquisition from several different measurement planes. This will allow 3-dimensional data to be obtained, and will provide the vertical context necessary for interpretation of wave structures. This scan pattern will produce horizontal flow fields at several altitudes throughout the boundary layer, and will allow observation of convection from the surface upward.

RECOMMENDATIONS FOR FUTURE RESEARCH:

Since high vertical resolution and vertical context are so important in boundary-layer studies, the three-dimensional capability of the system should be fully exploited during the coming flight tests.

PUBLICATIONS IN FY-84:

Boundary layer observations with an airborne Doppler lidar, 21st Conference on Radar Meteorology, American Meteorological Society, Sept. 1983