A VHF BOUNDARY-LAYER RADAR

By

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Contents

Abstract

This thesis is concerned with the development of a VHF wind profiler capable of measuring from a height of 300 metres up to 4 kilometres. This region of the troposphere contains the mixed-layer, which is more commonly known as the convective boundary layer region.

The different types of atmospheric detection equipment used to measure the boundary layer region of the atmosphere are reviewed, along with wind profiling observation techniques.

The factors considered during the development of the antenna arrays are described, which includes the beam patterns of antenna arrays, and the technical aspects of impedance matching from the individual antennas through to the transmission and acquisition system to minimise the effect of antenna ringing. The effects of scattering and ground clutter on the performance of boundary-layer VHF wind profilers are also discussed.

Results from initial tests of a single module of Yagi antennas of the system are shown, demonstrating the ability of the radar during the developmental stages for probing the boundary layer. A comparison of radar reflectivities with values calculated using radiosonde data from the Adelaide airport is also performed. An examination of pattern scales in the boundary layer is then carried out to determine the optimum configuration of the antenna arrays for spaced antenna mode operation.

This thesis then concludes with the the first results of the boundary layer radar in its optimum configuration. A study of pattern scales and the angular spectrum of scatterers in the lower troposphere was performed, and the comparison of results of campaigns of co-located high resolution GPS radiosondes and Omega Navaid radiosondes with the Adelaide Boundary Layer Radar are shown completing this research.

Altogether this thesis examines the potential of VHF radars in the application of boundary layer monitoring. These radars will not only have research applications due to their high spatial and temporal resolution for investigating the lower troposphere, but are potentially an important tool for meteorologists for continuous monitoring of the atmosphere in all weather conditions, even in remote locations.

Originality Declaration

This work contains no material which has been accepted for the award of any other degree or diploma in any university or other tertiary institution and, to the best of my knowledge and belief, contains no material previously published or written by another person, except where due reference has been made in the text.

I give consent to this copy of my thesis, when deposited in the University Library, being available for loan and photocopying.

Signed: . ..... dated: 14 January 1999

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