AEROSOL SOUNDING BY LIDAR IN THE LOWER ATMOSPHERE COMPARED TO SIMULTANEOUS SODAR SOUNDING

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ABSTRACT

The vertical distribution of aerosol particles in the lower atmosphere is strongly influenced by the temperature field and turbulence. When a temperature inversion layer is present it acts as a barrier for the vertical transport of particles and a concentration of particles is generated below the inversion layer. The strong turbulence, which is connected to an inversion layer, may be detected by **sodar** (so̲und d̲etection a̲nd r̲anging). In a joint experiment we measured vertical aerosol density profiles by lidar and simultaneously from a continuously operating sodar obtained a picture of the vertical thermal turbulence structure.

The lidar which was originally designed for slant visibility measurement, has a q-switched ruby laser as transmitter. The receiver has time variable gain which corrects for the geometrical range dependence of the lidar signal. The signal was displayed on oscilloscope and photographed on polaroid film. The recording method has several drawbacks and especially the dynamic range is low. We therefore now develop a real time digital recording system with much higher dynamic range. The principle will be described.

The sodar which was designed and operated by another FOA group is a vertically sounding monostatic acoustic sounder. Short pulses of audible sound is transmitted and backscatter returns from heights between 40 and 1 000 m are displayed as intensity modulation on a time-height chart on a facsimile recorder.

The lidar profiles have been evaluated and the heights of sharp discontinuities in the lidar returns have been plotted and superposed on the sodar recordings. A very good correlation between the height of aerosol layers

detected by lidar and of inversion layers from sodar was obtained even when the heights fluctuated rapidly with time. The results show clearly how the vertical distribution of aerosol is influenced by the thermal structure of the lower atmosphere.