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LIDAR OBSERVATION OF PBL-CLOUDS: IN PART OF ECLIPS PHASE II

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The clouds play a significant role in the atmosphere particularly in steadying the radiant balance. Since their type, structure and height considerably influence the transmission, absorption and re-radiation of the IR radiation they are of great importance for the local meteorology and global climatology. In the small spatial scales (micro- and meso- ones) the clouds considerably change in space and time. Therefore certain difficulties exist when determining the parameters which most complex characterize them or should be introduced in the models for analyses and prediction of various atmospheric processes.

The ECLIPS (Experimental Cloud Lidar Pilot Study) program, in which our lidar group also takes part, is well described. In general, the main purpose is to perform a ground-based lidar observations of the clouds simultaneously with the NOAA 10 and NOAA 11 meteorological satellites overpassing the same areas.

Essential lidar data are the recorded profiles from which the information about the clouds height, optical depth and vertical extinction can be derived.

The presented experiment was conducted using triple-beam aerosol meteorological lidar, developed at the Institute of Electronics of Bulgarian Academy of Sciences, which is well described previously [1].

The experimental data required for the ECLIPS Phase II measurements were recorded during the period from 21 May to 09 July, 1991 at 30 observations by 3 hours each i.e. 1 hour before and 1 hour after the NOAA 10 and NOAA 11 satellites overpasses. The lidar data are completed with the vertical profiles of the atmospheric thermodynamic parameters obtained by conventional means (tethered and pilot balloons and standard radiosounding).

Trough the strong backscattered signal the clouds are the first investigation objects for the most of the lidar groups. Due to the reliable lidar return we used different algorithms to determine the clouds base height, namely, the signal maximum, the slope change of the derivative and one based on the statistical characteristics of the time series recorded at close volumes (strobes) along the sounding paths; the first two are well known. The third one is based on the mode structure of the lidar returns' amplitude distributions at each distance (strobe) [2]. The extinction coefficient profiles were determined and its value at the end of sounding paths was estimated using the method and algorithms proposed by Klett [3]. The integrating is being performed in the limits of a section at the end of the path where the constancy of the extinction coefficient is assumable. The computations are done presuming a constant lidar ratio along the sounding path. Under these conditions, with no other assumptions about the lidar ratio behaviour, and without comparison of the extinction coefficient profiles to values determined by different methods (e.g. meteorological soundings, etc.), the calculated profiles can be accepted as a good first approximation of the real ones. The lidar is in close vicinity to the Institute of Hydrology and Meteorology and we can use their surface measure measurements of the temperature, wind velocity, pressure and humidity as well as the data from the standard radiosoundings carried out at 08 a.m., 02 and 08 p.m. SLT. Soon a satellite photographs receiving system will be put into operation.

On the grounds of a field experiment conducted during the ECLIPS '91 (Sofia) it is concluded that the cloud base heights reported by the operational weather services, based on the lifting condensation levels (LCL), are inaccurate for the fair-weather cumulus clouds. LCLs also vary with a diurnal cycle, starting low in the morning and reaching a peak at about three hours before the local sunset.

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