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RADIOMETRIC AND LIDAR PROBING OF THE TROPOSPHERE

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Dr Platt of the CSIRO Division of Atmospheric Physics described the results of simultaneous lidar and radiometric measurements of cloud during two series of experiments at Adelaide in South Australia. The lidar was built by the University of Adelaide and operated at a wave-length of 0.694 μm in the visible region of the spectrum and had a height resolution of 75 m. The radiometer was developed by Dr Platt and was a passive detector of the long-wave radiation at 11 μm (*ie* in the centre of the atmospheric window) with a beam width of 6' of arc. Both instruments were pointed vertically upwards and therefore "looked" at the same "piece" of sky.

Dr Platt showed results from the lidar and the radiometer which indicated both enhanced short-wave scatter and enhanced long-wave emission in *clear sky* regions adjacent to visible cumulus clouds. The most likely explanation for this phenomenon is the swelling of natural aerosols in an atmosphere where the relative humidity approaches 100%, as would be the case close to growing cloud. It was established that "dry" aerosol layers observed by the lidar gave no significant increase in long-wave emission. The physics of aerosol swelling is well established, and a similar phenomenon has been observed in the atmosphere itself in a recent analysis of photographs from the Apollo series of satellites. The phenomenon has a bearing on photographic and radiometric remote sensing of the atmosphere in general.

He then showed results relating the short-wave scatter of cirrus and alto-cumulus clouds to the long-wave emissivity of the cloud. There was, in general, only a slight correlation between cloud thickness and emissivity but a good correlation between short-wave backscatter and emissivity. Changes in the emissivity of cirrus appear to reflect changes in *density* rather than *thickness* of the cloud. It appeared also from Dr Platt's measurements that the emissivity of cirrus may be much less than the 0.5 normally assumed in numerical modelling work; and that in turn, alto-cumulus may be of much lower emissivity than the 1.0 normally assumed. With regard to alto-cumulus it appears that significant differences occur between ice and water clouds but the subject is still under investigation.

In the discussion of his talk, questions from the audience centred on the meaning of cloud emissivity as interpreted by numerical modellers, the practical value of the results and the possible application of the lidar-radiometer combination to the study of fogs. In reply to this last question Dr Platt suggested that perhaps the attenuation of the visible lidar beam would be too great in fog but that the 10.6 μm lidar might be useful.

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