A METHOD OF MONITORING NON-RESONANT RAMAN LIDAR RETURNS DURING DAYLIGHT HOURS

by

John Cooney

Drexel University

Physics and Atmospheric Science Department

ABSTRACT

A method for using non-resonant Raman lidar during daytime hours is presented.

A dual (or quadruple) arrangement of electro-optical channels is set up in the lidar receiver. Each channel contains its own optical spectral response as determined by an appropriate set of interference filters. The incoming signal is split and fed into two channels, filtered (simultaneously) and then inserted into the input terminals of an operational amplifier. The difference signal is selected and amplified whereas the common portion of the signal is highly attenuated (Common Mode Rejection Ratio = 75-80db). For the present hardware, daylight intensities 10^2-10^3 times Raman signals are received simultaneously. Mean values of intensities of daylight signals which give rise to a constant differences merely shift the value of the measured variable at the ground. These mean value signals have their common part highly attenuated.

The differences of the fluctuation portions of the daylight signal represents a noise signal. Identical (space-time) optical paths for each component of the daylight signal produce the same fluctuational spectra in each channel. Hence noise levels, much less than signal levels, are anticipated.

First a N_2-H_2) signal pair is differenced. Then an N_2-O_2 pair is differenced and used for instrumental normalization purposes.

Signal levels to be encountered are quite well known as a result of prior field work.

Improved optical design of laser system can reduce mean value of daylight intensities by 10^2. Thus the mean daylight intensity can be set equal to the expected signal levels by more advanced optical design.

Performance characteristics of photomultiplier pairs are discussed in this connection.