Applications of

LIDAR: Light Detection and Ranging

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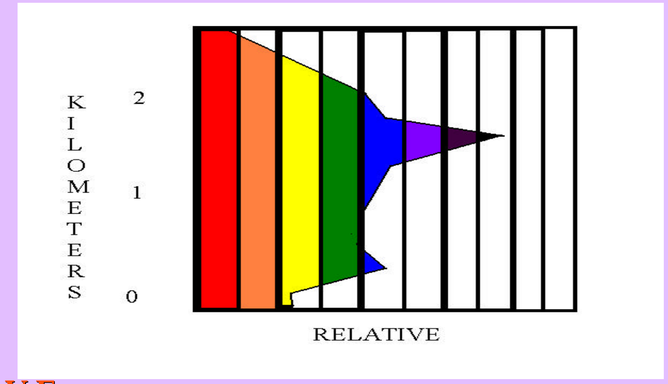
BACKGROUND INFORMATION

Light scattering and attenuation can be used to investigate the atmosphere using a remote-sensing instrument called a lidar. A lidar system uses lasers pulses to measure atmospheric constituents such as aerosol particles, ice crystals, water vapor, or trace gases. Profiles of these atmospheric components as a function of altitude or location are necessary for weather forecasting, climate modeling, and environmental monitoring.

Colors in a lidar graph vary with intensity. Darker colors denote a greater amount of interference while lighter colors denote a lesser amount of interference. =======>

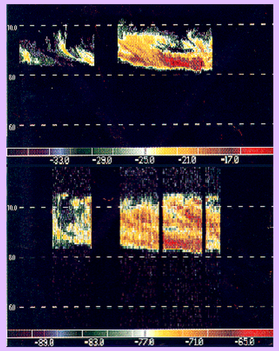


OBJECTIVE

The CAU Mobile Atmospheric Observatory includes a lidar system capable of observing vertical profiles of aerosol cross sections from heights that begin near the surface and extend beyond the boundary layer to altitudes of some 4 to 5 km in the daytime and into the stratosphere at night. The current data display makes use of a standard display program provided by the manufacturer of the computer board that digitizes the lidar echoes (Gage Applied Sciences).

The goal of the project is to develop a Visual C++ program that modifies an existing DOS- based C program that has the desired features and software drivers purchased from Gage to read their A/D board. This will result in a customized data system for the lidar in the mobile lab. After the lidar incorporates the new data system, the analysis of the data obtained with the system will be used to gather a series of daytime aerosol profiles at the CAU/Aiken field site to demonstrate temporal variations in the height of the urban boundary layer.

DATA



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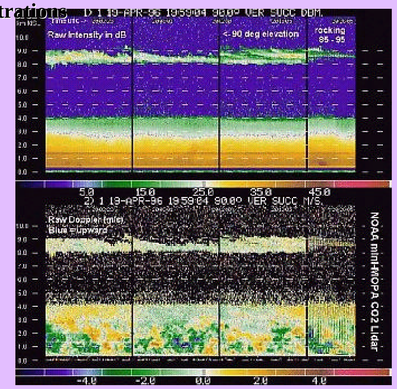
Lidar analysis of cloud content

THE IMPORTANCE OF CLOUDS & AEROSOLS

Clouds are important to climate because they strongly modulate incoming solar and outgoing thermal radiation. Clouds, as the source of precipitation, are also a key element in the hydrologic cycle. Clouds are currently under intense scrutiny by researchers to gain a better understanding of their role in our environment. This knowledge is needed for better predictions of climate change, to guide policy in improvements, and to provide better management of our depleting water resources. Aerosol particles are also important to climate, directly by scattering light and indirectly by serving as cloud condensation nuclei. Aerosol particles in high concentrations are health-endangering pollutants, and in lower concentrations



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Lidar analysis of carbon dioxide content in atmosphere

also aid air quality observations as indicators of the movement and dilution of other pollutants.

Lidar can reveal many characterstics of cloud and aerosol particles using light backscattered from them.

CONCLUSION & FUTURE PLANS

Unfortunately, due to an unavoidable software malfunction, completion of the Visual C++ program could not be completed.

However, work is underway to create a new lidar program that includes an ability to produce real-time two-dimensional time versus height displays of the lidar echoes and an efficient procedure for storing data for further analysis.

The lidar program will then be used in urban boundary studies.