ABSTRACT

A MODULAR ATMOSPHERIC PROPAGATION PROGRAM (MAPP)

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A computer model of the atmosphere has been developed that will solve a wide variety of lidar and atmospheric propagation problems. The lidar system calculations involve the prediction of path loss and lidar signal return for a variety of atmospheric conditions and lidar system configurations. The program contains a very large data base of absorption and attenuation coefficients for all of the naturally occurring gases and several gaseous pollutants such as SO_2, NO_2, NO, N_2O, O_3, HCL, etc. The spectral range of this data base extends from the ultra-violet(1200 Å) through the infra-red. Several aerosol models are included in the program to account for the effects of this important scattering mechanism.

The program incorporates a maximum of flexibility in accepting input data and providing output data in an easily used form. Profiles for the standard atmosphere and for various polluted atmosphere and cloud models are stored in the machine. These stored models can be used singly or in combination, or be supplemented or replaced by additional profiles provided as input data to the program. A variety of output options are available involving either numerical data or graphical data; the output quantities can be attenuation, power returned or power differences, as functions of range or path position.

Path loss is computed by dividing the distance into increments, calculating the absorption for each increment and summing up the loss over the desired path. The absorption for each increment is calculated by multiplying the material concentration times the absorption coefficient for that material. The absorption coefficient for a particular wavelength and material is determined by either table look-up or calculating the coefficient from spectral line data. The line profile is calculated as a function of temperature and pressure. The concentration of the gas as a function of range is either taken from a stored model or an input quantity.

By appropriate selection of a peak absorption and a peak transmission wavelength, the program will calculate a range-resolved return for the differential-absorption lidar (DIAL) measurement technique. Multiple computer runs may be made to determine the optimum pair of wavelengths in using the DIAL technique to monitor the constituent of interest in the presence of other interfering gases.