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(E75-10306) ANALYSIS PROBLEMS OF MULTISPECTRAL SCANNER DATA Monthly Report, Apr. - May 1975 (Boeing Co., Kent, Wash.) 5 p HC $3.25 CSCL 09D G3/43 N75-25253 Unclas 00306

Enclosed you will find copies of the NASA product description and shipping list which identifies those materials received since we last reported. CR142850

During our visit to Houston in April we discussed some of our analysis problems with S192 data. In summary, to date we have developed techniques to closely fit the data with analytical functions; we employ several smoothing techniques including convolution, Kalman, and Fourier filters; and we scale the data as a function of altitude through comparison with physical models of the brightness profile (limb view of the atmosphere). The data is calibrated beginning with the NASA-provided calibration function which is further scaled by a multiplicative factor; this factor accounts for unknown physical constants and errors in calibration. After reviewing results of the above processes we remained dissatisfied with the results; the data would not satisfactorily represent the general structure of the stratosphere as has been reasonably well determined. In an attempt to reconcile the problem the following actions were taken.

1. From discussions with personnel at NASA, JSC, Lockheed Electronics Company and the Jet Propulsion Laboratory we learned of others' experience with the S192 noise. As a result of our composite experience we are experimenting with a calibration bias constant, variable from scan to scan but sinusoidal over several scans. We have found that use of a convenient bias value we select reconciles measured values with modeled values very closely. We hope to identify the exact amplitude and frequency of the sensor low frequency noise and adjust the data values accordingly. By plotting the bias value for several scans we hope to identify its correct value as a function of scan rather than our arbitrary selection of a convenient value. We expect to be able to report on these results next month.

2. We have modified the existing software routines to incorporate the effect of overlap between succesive instantaneous field of view of the sensor. The effect is small and has been neglected to date, but with the problems of scaling with which we are not afflicted, we are attempting to account for any known effect.

3. We performed a short sensor sensitivity study to determine if the sensor as represented by the data we have received is capable of identifying the aerosol component. The enclosed Figure 1 is useful in illustrating the results. Two curves are shown representing two of the models being used. One is the pure Rayleigh model and the other is the model for Rayleigh plus Mie scattering as modeled by Elterman in 1968 ("UV, Visible, and IR Attenuation for Altitudes to 50 Km, 1968", Air Force Cambridge Research Laboratories). Also shown is the sensitivity for band 1 (channel 22). It is seen that the sensitivity is sufficient to reliably detect an aerosol component similar to that represented by the 1968 Elterman model up to an altitude of approximately 30 Km.

Also shown on Figure 1 is data from pass 47 scaled to match the Elterman model, represented by X marks. The data matches the model very well. Also shown by O marks is the same data scaled to match the Rayleigh model.

The data also matches this model very well. Our problem then is not a matter of sensitivity but rather it is the problem of properly scaling the data. This is the area in which we are working presently.

Figure 1 is the brightness as would be recorded by the sensor system. Characteristics such as band pass filters, sensitivites, and observation angle are included. We have also enclosed Figure 2 and Figure 3 for comparison. Figure 2 illustrates the Rayleigh model and the Rayleigh + 1968 Elterman model for 180° backscatter and $\lambda = .34\mu$. The differences between Figure 1 and Figure 2 are the scattering angle and the integrated wavelength band versus a single wavelength. Figure 2 is the common representation of the stratosphere, but Figure 1 is the stratosphere as recorded by the sensor.

Figure 3 is included to illustrate the capability of a portion of the analysis system. Shown are the Elterman profile of attenuation coefficients and the profile as derived by inversion of the modeled limb brightness. The close approximation gives us confidence that we will be able to produce significant results to good accuracy when we have adequately solved our noise and scaling problems.

At this point in the investigation we conclude that the S192 data even with its noise problems appears to contain valuable information which we can extract. We recommend that we proceed with the analysis of the S192 data in addition to the S190 and the S191 data.

FIGURE 2: LIMB BRIGHTNESS MODELS

λ = 34μ
SCATTERING ANGLE = 180°

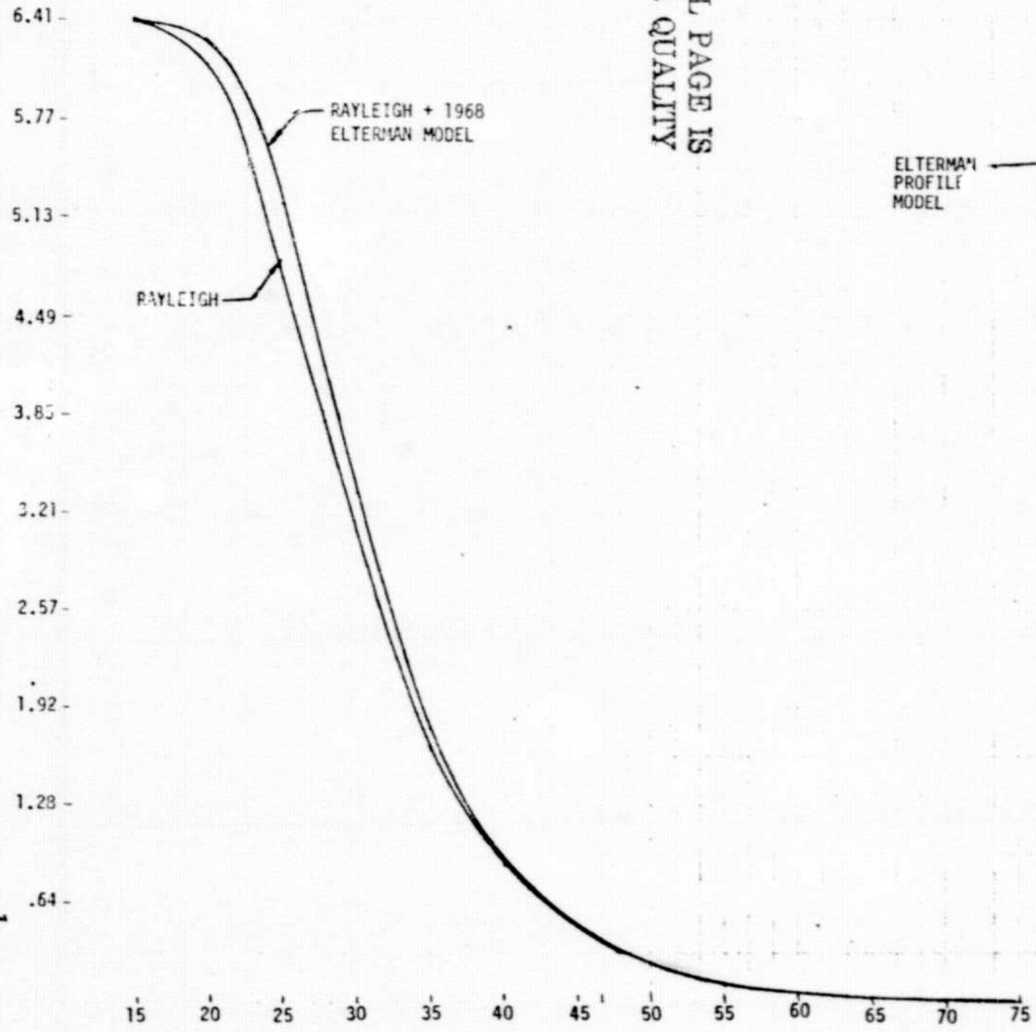

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FIGURE 3: ATTENUATION COEFFICIENTS RAYLEIGH + 1968 ELTERMAN MODEL

λ = .34μ
SCATTERING ANGLE = 180°

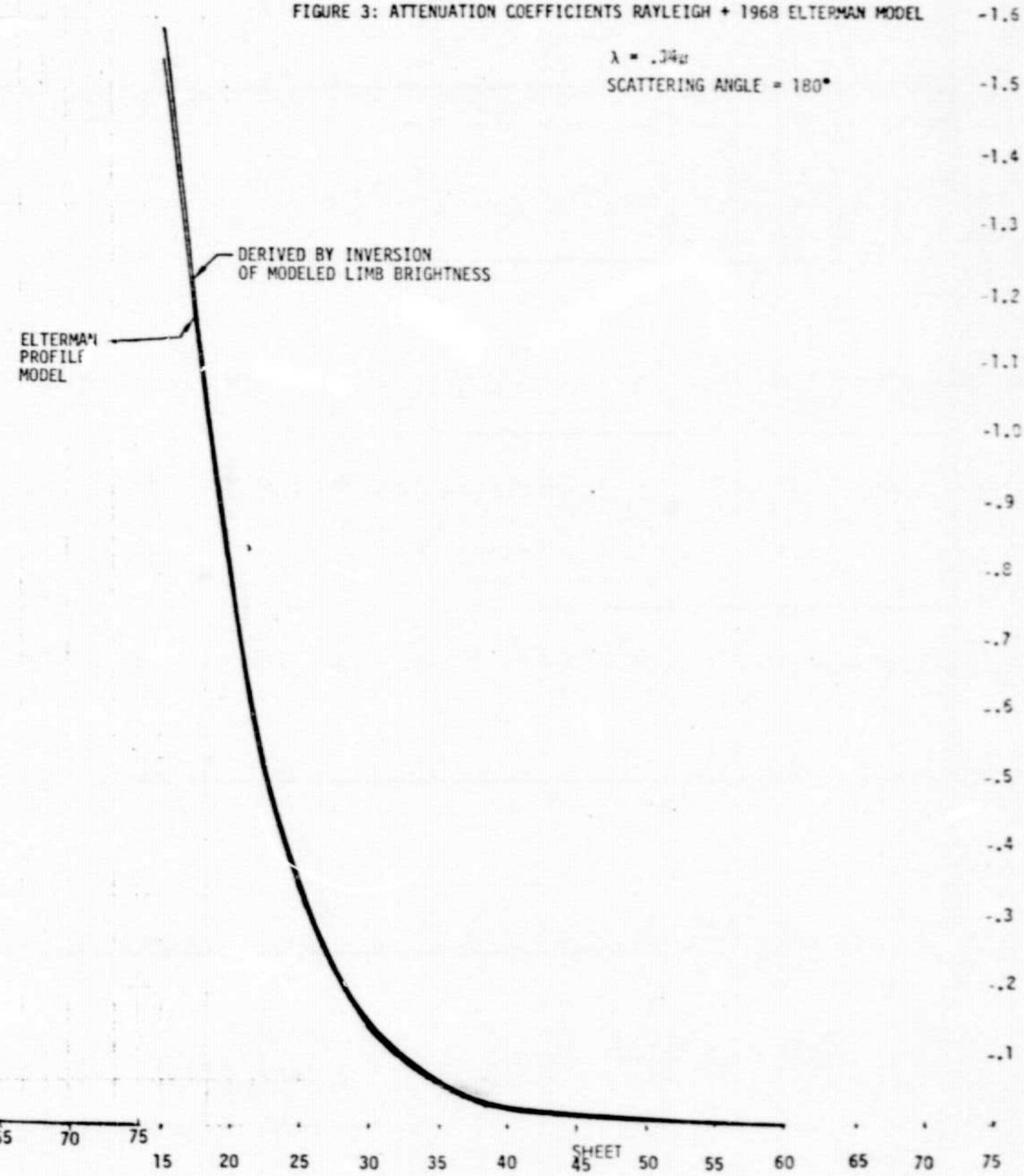

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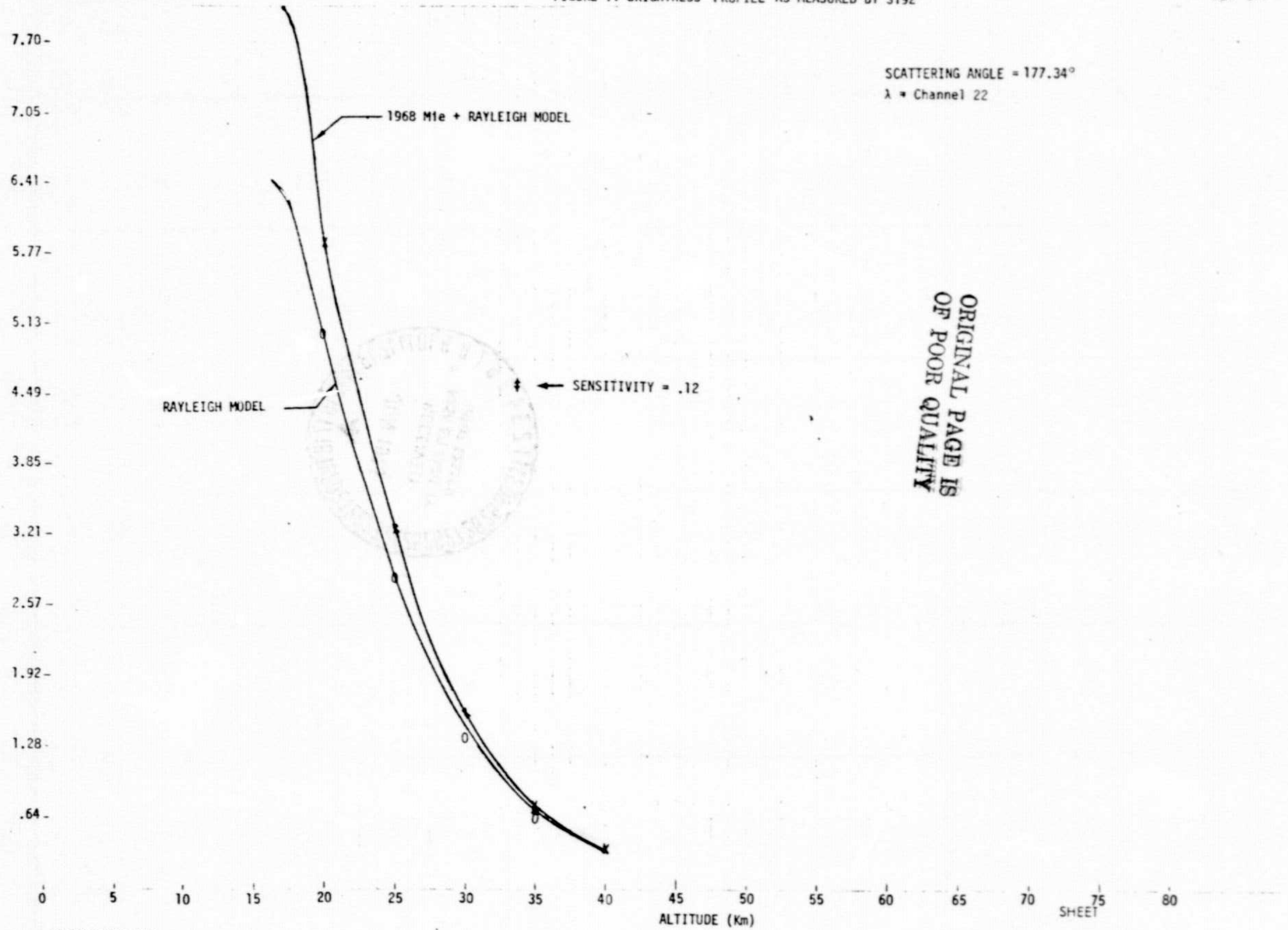
FIGURE 1: BRIGHTNESS PROFILE AS MEASURED BY S192



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