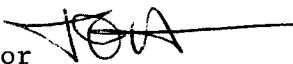


1225 West Dayton Street
Madison, Wisconsin 53706

THE UNIVERSITY OF WISCONSIN

10 April 1973

TO: Contracting Officer, Code 245, NASA/GSFC
Technical Officer, Code 651, NASA/GSFC

FROM: Thomas O. Haig 
Executive Director

REFERENCE: Contract NAS5-21798

SUBJECT: Monthly Progress Report for "Studies of Soundings and Imaging
Measurements from Geostationary Satellites"

Task A Investigation of Meteorological Data Processing Techniques

Activity on this task during the past month has concentrated on two areas:

- 1) Development of techniques for detecting the right hand earth limb, and
- 2) Exploitation of techniques developed to correct line start timing errors to process ATS III digital images for day 204, 1969 and day 203, 1969.

Software for detecting the right hand earth edge and rewriting digital tapes with line start corrections has been developed and tested. We now have 16 corrected images for day 204, ten based on left hand limb detection and six based on right hand limb detection. Wind sets have now been obtained for both types of correction. They show east west residuals which are comparable to, or less than those obtained from raw data with low timing errors. We thus have verification that the data processing techniques developed to correct line start timing errors do result in significant data improvement. In order to describe our progress on day 203, 1969, processing it is usefull to list the basic operations of the correction technique:

- a) image navigation,
- b) threshold detection of earth edge position for each line,
- c) calculation of expected earth edge position for each line based on results of a), and
- d) rewrite digital tapes with line shifts equal to the difference between results of b) and c).

Task A Investigation of Meteorological Data Processing Techniques Continued

After d) is completed, images can be processed for wind sets using standard techniques. For day 203, 1969 step a) is complete for 10 of 16 images, step b) is complete for 7 of 16 images, steps c) and d) remain to be completed.

We are also working at a reduced rate on improving our theoretical understanding of the limb radiance profile, specifically the sun angle dependence of the detection altitude. Activity in this area should increase next month as processing for day 203, 1969 is completed.

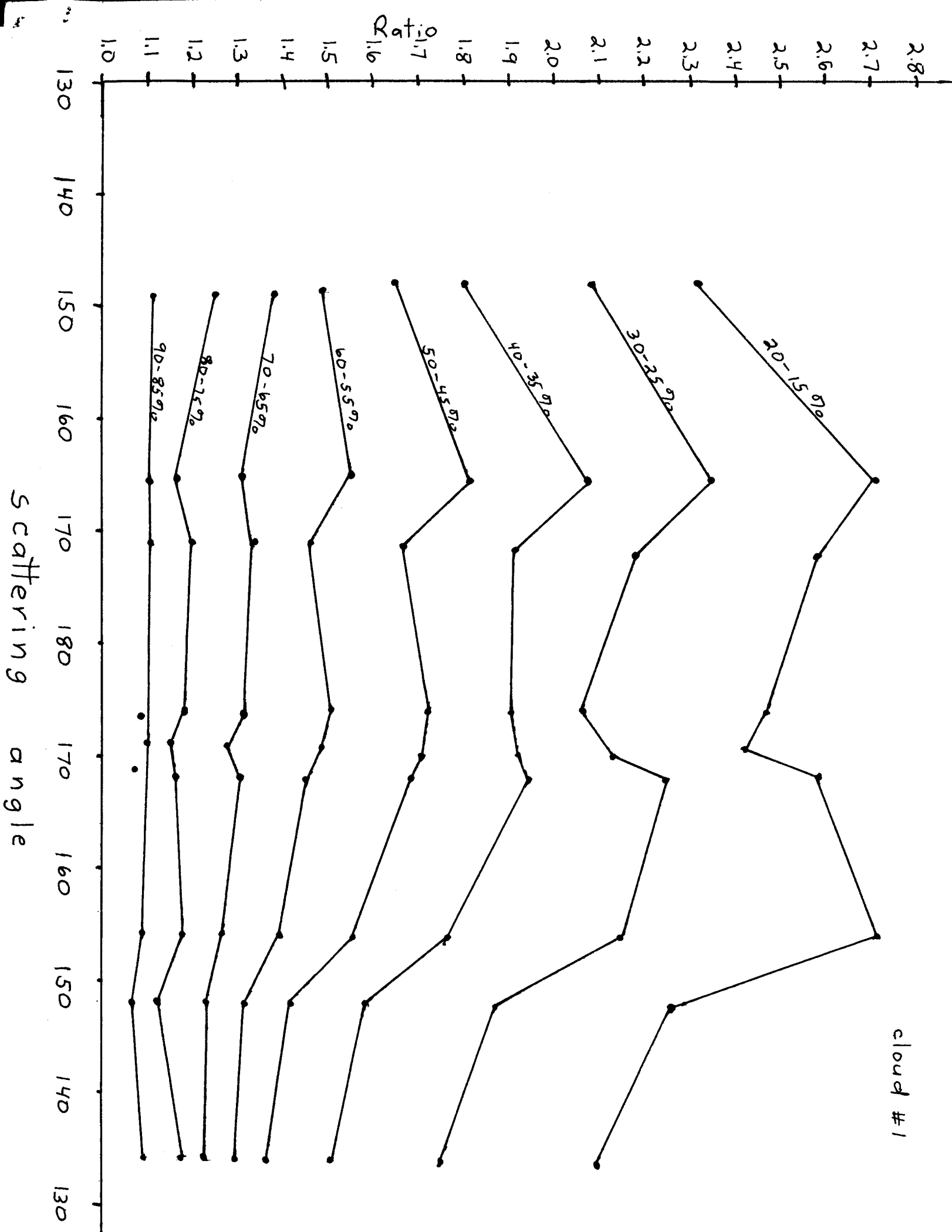
Task B Sun Glitter

No significant progress during the past month.

Task D Cloud Growth Rate

A graduate student working in this program has completed a review of literature covering the following: a) theoretical studies of single scattering from ice cylinders, as well as from water droplets; b) theoretical studies of multiple scattering effects including the effects of droplet distribution, phase function shape and cloud thickness on reflected light as a function of sun-satellite-cloud geometry; c) experimental studies of scattering in the laboratory and from real clouds; d) available brightness normalization procedures.

In normalization procedures developed so far, the effect of varying cloud thickness on the anisotropic scattering patterns has been neglected. Analysis of our data of brightness gradient fields for convective regions obtained by using McIDAS has shown the contrast ratio to be a function of scattering angle. In analyzing the ATS data, first a brightness histogram is made of each cloud sample grouped into 20 even class intervals. The intervals are labeled according to their relative brightness values via 95-100% as the highest, followed by the next interval 90-95% and so on. This grouping was done with the hypothesis that while any one area in the convection might change its thickness, the relative distribution of thickness over the sample will remain constant for a steady state convective system. The ratio of the brightest interval to each brightness interval obtained of a cloud sample is shown in Figure 1. If the brightness contrast had remained constant, each line would remain straight. As can be seen, they do not. This means, the contrast is a function of scattering geometry. So, any brightness normalization scheme must consider the effect of varying thickness on anisotropic scattering.



Task D Cloud Growth Rate (Continued)

The type of phase function which is actually in clouds has also been included in our analysis. The phase function of water droplets has a peak for back scattering while the phase function for ice cylinders has a dip at back scatter angles. The thick parts of clouds display quasi-Lambertian reflection characteristics both in theory and from experiments. Hence, the ratio of the bright to the dim parts of the cloud at back scatter angles can tell something about the phase function. In Figure 1, notice there is a dip in the graph at back scatter angles. This indicates a water droplet phase function. The peak of the phase function causes that thickness to appear brighter and, hence, the ratio to the brightest parts of the cloud will be less resulting in the dip in the graph. Analysis of other clouds has shown indication of droplet type phase function, ice cylinder phase functions, and a combination of the two. Work in this area of analysis is continuing.

Task E Comparative Studies in Satellite Stability

Computer coding of the model is proceeding on schedule. Approximately 50% has been completed, debugged, and tested.

Task F. High Resolution Optics Study

Both student and staff efforts are progressing nicely. A large volume of rough draft material has been generated. Now we must carefully sort and coordinate to start assembling the final report draft, as well as continue specific area studies.

TOH/jz