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U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Environmental Satellite Service

Satellite Infrared Soundings From NOAA Spacecraft

WASHINGTON, D.C.
SEPTEMBER 1973

NOAA TECHNICAL REPORTS

National Environmental Satellite Service Series

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SATELLITE INFRARED SOUNDINGS FROM NOAA SPACECRAFT

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P. G. Abel, A. Werbowetzki, L. A. Lauritson,
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F. E. Bittner and C. M. Hayden
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Washington, D.C.

ABSTRACT. Data are currently being received from a Vertical Temperature Profile Radiometer (VTPR) aboard the NOAA 2 spacecraft to produce operational atmospheric soundings of temperature and humidity on a global scale. This report describes the VTPR instrument, its calibration, the procedure to obtain "clear radiances" from cloud-contaminated radiance measurements, retrieval techniques used to obtain temperature and humidity profiles from "clear radiances", the quality checks performed on these profiles, and the various forms in which data are available to potential users.

1. INTRODUCTION

Beginning with the NOAA 2 satellite, launched 15 October 1972, satellites of this series will carry instruments to make routine observations from which atmospheric temperature soundings are derived. This is an operational system designed to provide global upper air data to weather services. The purpose of this report is to describe the means by which the operational product is derived from satellite measurements. Subsequent chapters describe the instruments, ground support equipment, data systems, mathematical developments, and the forms of final products.

Basic concepts of indirect soundings from satellites have been tested on the Nimbus 3 and 4 satellites. A Satellite Infra-Red Spectrometer (SIRS) (Wark 1970, Wark and Hilleary 1969, and Wark et al. 1970) and an Infra-Red Interferometer Spectrometer (IRIS) (Conrath et al. 1970, Hanel and Conrath 1969, and Hanel et al. 1972) were carried on each of these satellites. Output signals from these instruments provided measurements of the thermal radiation emitted by the earth's atmosphere and surface. These measurements can be related to the vertical structure of temperature and humidity. A full description of the principles of measurement and data reduction is given by Fritz et al. (1972).

Following initial verification of the reliability with which temperature profiles can be reproduced, the results from SIRS data were provided on a timely basis to the U.S. National Weather Service and were sent through normal telecommunications to other weather services (Smith et al. 1972). This quasi-operational procedure was commenced in May 1969 and continued with occasional interruptions until the implementation of the fully operational product from NOAA 2.

In anticipation of the increasing demand for quantitative weather observations from satellites, the NASA and the NOAA have planned and produced a system to obtain operational soundings covering most areas of the globe twice daily. Plans have specifically dealt with the main deterrent to accurate soundings - clouds. As will be shown, the effect of clouds can be overcome by conducting many measurements within the area from which a single sounding is derived. Soundings are obtained from a number of sets of measurements; SIRS instruments obtained only single sets of measurements from which soundings were derived. A statistical technique (Smith et al. 1972) permits one to deduce the emitted radiation from cloud-free areas.

Each satellite in the NOAA series beginning with NOAA 2 will carry Vertical Temperature Profile Radiometers (VTPR's). Duplication of instruments on each spacecraft will assure continued operation in the event one fails. The spacecraft are described by Schwalb (1972).

NOAA satellites orbit the earth in 78.3^{o} retrograde orbits each 115 minutes at an altitude of 1464 km. Figure 1 shows the earth projection of seven orbits during a 13-hour period. Solid lines indicate the north to south, or "descending", portions of the orbits, which occur over mostly sunlit areas; dashed lines are the nighttime "ascending" portions of the same orbits. Equator crossings of NOAA 2 occur at 9 a.m. (descending node) and 9 p.m. (ascending node) local solar time.

VTPR instruments scan perpendicular to the satellite motion, from left to right while facing the direction of travel, in 23 discrete steps. Fields of view, scanning times, and apparent motion on the earth provide "spots" which are contiguous both across and along the orbital track. In figure 1 the shaded areas indicate the areal coverage during two orbits. Darker shading indicates areas where data are redundant during the two orbits.

Coverage of the earth by VTPR is not complete equatorward of 49° because the instrument scans only $\pm$ 30.3° from the local nadir. At low latitudes as little as two-thirds of the area is observed, but within a 24-hour period the combined ascending and descending portions of the orbits provide nearly complete coverage.

A VTPR instrument observes each spot in eight spectral intervals 4 cm^{-1} to 16 cm^{-1} (.09 μm to .56 μm) wide. One interval is in the window at 12 μm, six are located in the 15 μm band of carbon dioxide, and one is the 19 μm region where water vapor absorption dominates. After a set of eight spectral measurements has been obtained, the scan mirror is stepped to the next spot. When the 23 spots have been observed, the mirror returns to the original position. The pattern resulting from the scanning is depicted in figure 2, which is an enlargement of the small outlined area in figure 1. Observations within this area are obtained in about five minutes.

Analysis of the data first requires their reduction to "clear radiances," which are spectral radiances that one would find with completely clear skies. As described in a later section, data are separated into boxes of adjacent spots, from which a statistical analysis produces a single group of eight radiances for each box. Results are used to retrieve atmospheric profiles.

The scheme initially applied to the VTPR data is shown in figure 2. Eight scan lines are divided into three boxes of 8 x 8, 8 x 7 and 8 x 8 spots. Clear radiances are deduced for three boxes indicated by X's in the figure. A retrieval is made for each box. The dimensions of the boxes are 500 by 600 km and 700 by 600 km for the center and side boxes, respectively. New procedures will be instituted to locate retrievals at the centroids of clear areas.

Although there are potentially about 200 soundings per orbit (2,600 daily), several factors limit the number that can be provided to users. These include excessive cloudiness, which makes it impossible to obtain satisfactory soundings in the troposphere; multi-layered clouds, which reduce the reliability of clear radiances; high and varied terrain, which produces a similar effect; and redundance over polar regions.

The National Environmental Satellite Service will continue to improve the scope and quality of soundings through an active development program. Occasional changes in the methods of deducing soundings will be made, and ancillary data, such as those from the Scanning Radiometer and from statistical regressions,

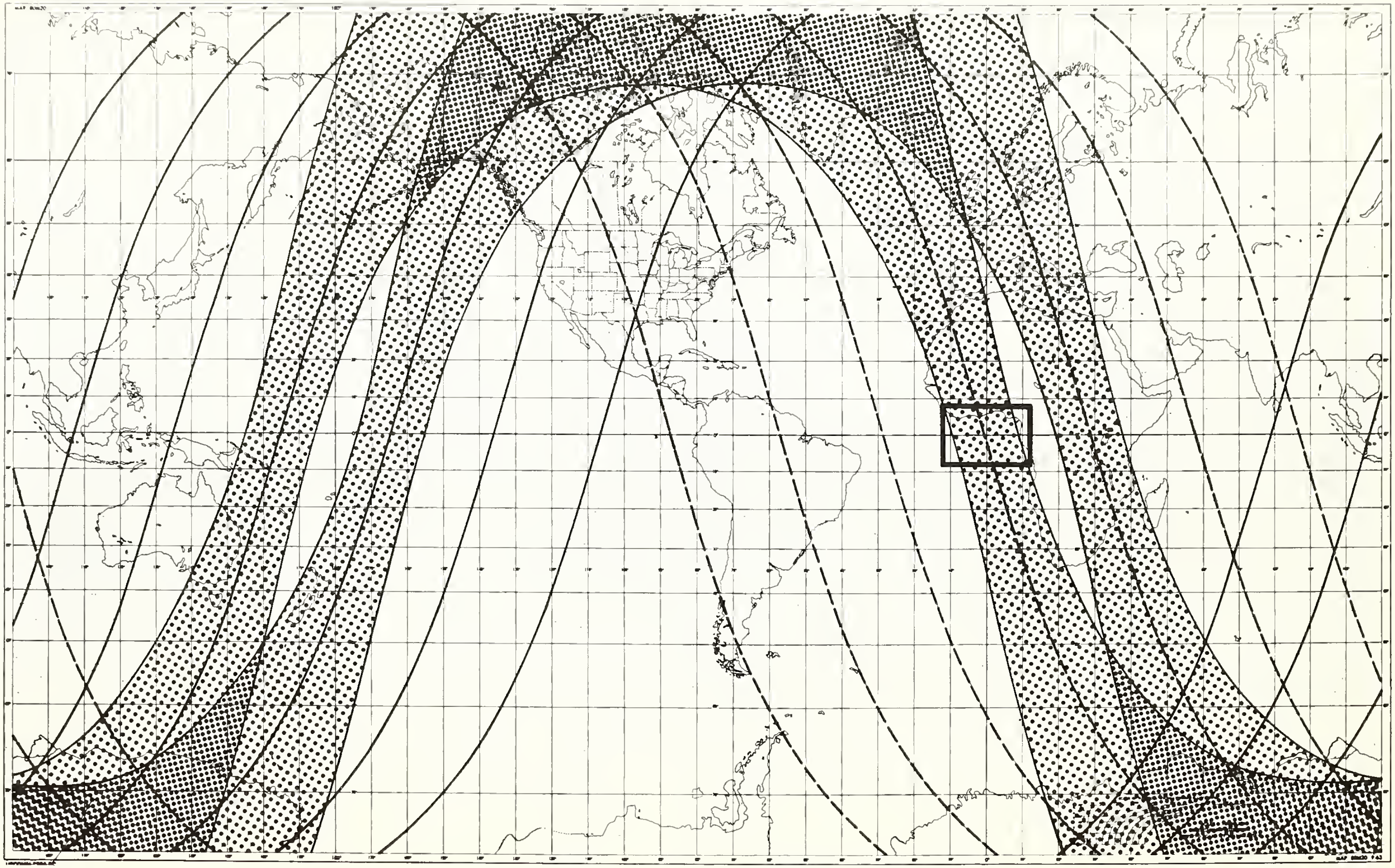


Figure 1.--Satellite tracks for NOAA 2
VTPR coverage

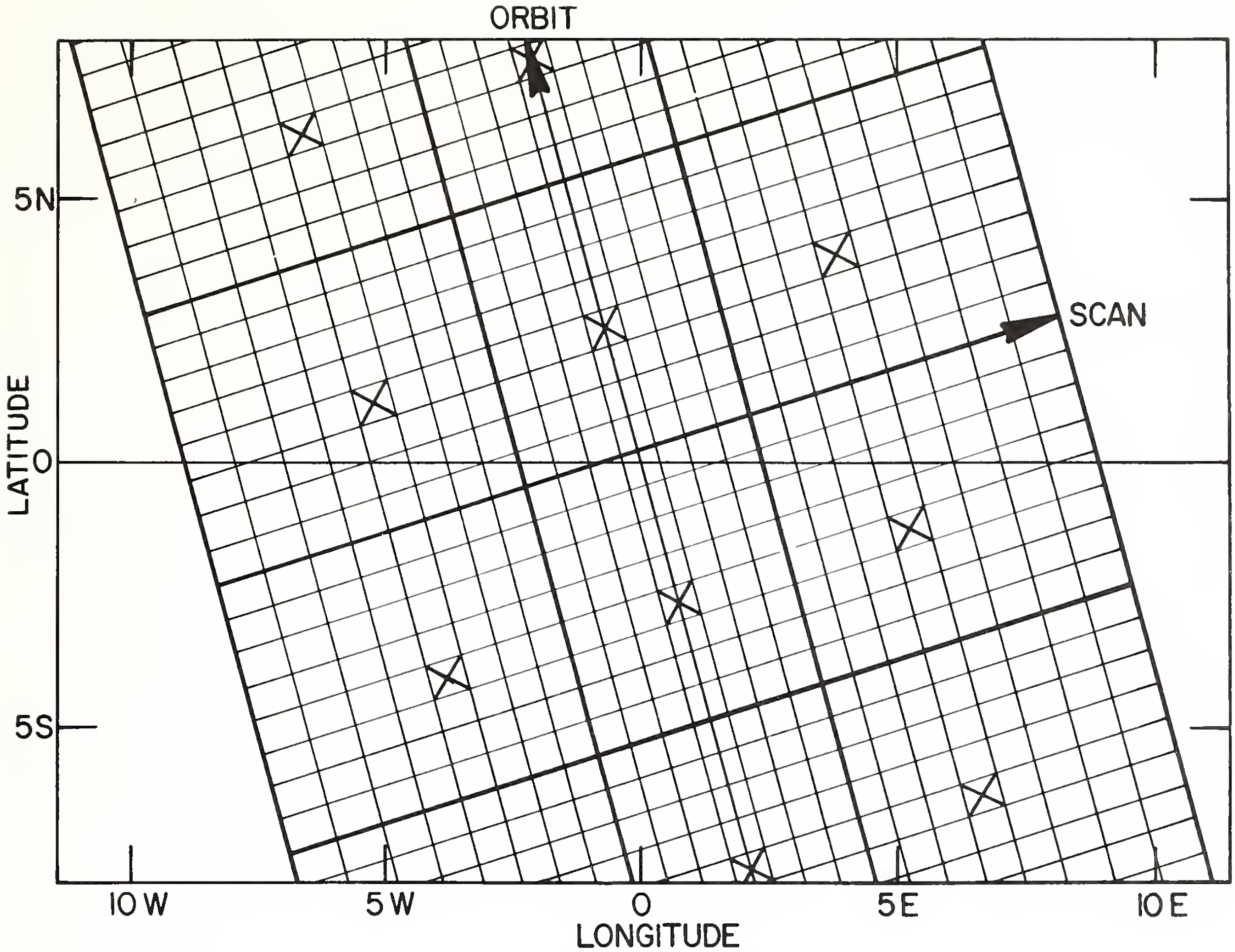


Figure 2.--VTPR scan pattern and data analysis array for box in Figure 1

will be incorporated. As significant alterations are made, and as parameters of newly launched instruments are needed, supplements to this report will be issued.

Parts of this report were prepared by the following personnel of the National Environmental Satellite Service.

Section 1 - Introduction (D.Q.Wark)
Section 2 - Spacecraft (J.M. Siomkajlo and P.G. Abel) and Ground Equipment (L.M. McMillin)
Section 3 - Data Reduction and Analysis
- A. Overall Data Flow (A. Werbowetzki)
- B. Geographical Location of Data (L.A. Lauritson)
- C. Calibration Procedure (J.A. Pritchard, D.S. Crosby, D.Q. Wark and A. Werbowetzki)
- D. First Guess Fields for VTPR Data Processing (H.M. Woolf)
- E. Procedure for Obtaining Clear Radiances (R. Luebbe, L. A. Lauritson, and L.M. McMillin)
- F. Retrieval (M.P. Weinreb and H.E. Fleming)

Section 4 - Quality Tests and Rejection Procedures (F.E. Bittner and C.M. Hayden)
Section 5 - Data Outputs and Archives (L.M. McMillin)

2. SPACECRAFT AND GROUND EQUIPMENT

A. Spacecraft

The Improved TIROS Operational Satellite (ITOS) is a 1.02 x 1.02 x 1.25 m, 336 kg spacecraft designed to operate in a sun-synchronous polar orbit at 1464 km. Power is supplied by three 1.65 x .91 m solar panels, which are extended in space. The Digital Data Processor (DDP) receives data from the VTPR sensor and forwards them to the magnetic tape recorders. A flywheel is used to restrict satellite attitude errors about the pitch axis to $\pm$ 0.5°, and electrical coils are used to correct roll and yaw errors (Schwalb 1972).

B. Vertical Temperature Profile Radiometer (VTPR)

(1) Description of the Instrument

The VTPR is a continuous day-night eight-channel sounding system. Six of the eight channels are used to deduce radiances in the 15 μm carbon dioxide band. Two other channels are used to deduce radiances at 535 cm^{-1} (in a water vapor absorption band) and at 835 cm^{-1} (in an atmospheric window region); these two radiances are used respectively to determine the atmospheric humidity and to act as a control in the determination of clear radiances for the other seven channels (see Section 3.B). The system is designed to permit calculation of the vertical temperature profile from the earth's surface to about 30 km, and to obtain an estimate of the moisture in the lower troposphere.

The optical system of the VTPR instrument consists of a scanning mirror, a 73.5 mm Cassegrainian telescope, a chopper, and a filter wheel (all shown in fig. 3); and a detector assembly (not shown) which consists of an Irtran 4 lens, a wide band anti-reflection-coated germanium window, and an uncooled pyroelectric detector. Broad areal coverage is obtained by scanning $\pm$ 30.3° (center of the center scan spot to the center of the outer scan spot) from the nadir direction in 23 incremental steps of approximately 2.7° (fig. 4). At each scan spot, measurements are obtained for all eight channels as the filter wheel completes one revolution. In order to provide image motion compensation, so that the measurements for all eight channels cover the same geographical area, the filters on the filter wheel are arranged in a spiral (fig. 5).

A black temperature-controlled chopper provides a reference. Radiation from the alternating signal resulting from successive views of the chopper and the scene is passed through one of the filters on the filter wheel and through an Irtran 4 lens to the detector. A mask between the lens and the detector limits the field of view to a 2.136° by 2.236° rectangular scan spot. The projection of the scan spot on the earth's surface is approximately a square 55 km on a side when the satellite is viewing in the nadir direction. Scan spot size increases at larger viewing angles because of the increased distance from the earth's surface to the satellite and the curvature of the earth (fig. 4).

Measurements of spectral radiance must be accurate if they are to be used to obtain atmospheric temperature profiles. The VTPR instrument provides calibrated radiance measurements ranging from zero to 204.8 mW/(m^2 sr cm^{-1}), enabling the instrument to measure equivalent source temperatures up to 340 K. Maximum allowable relative error between any two channels other than the nominal 668.5 cm^{-1} channel is 0.25 mW/(m^2 sr cm^{-1}). Maximum allowable relative error between the nominal 668.5 cm^{-1} channel and any other channel is 0.75 mW/(m^2 sr cm^{-1}) or less. In order to avoid certain problems which can occur when analog data are digitized on the spacecraft. One digital count corresponds to approximately 0.3 mW/(m^2 sr cm^{-1}).

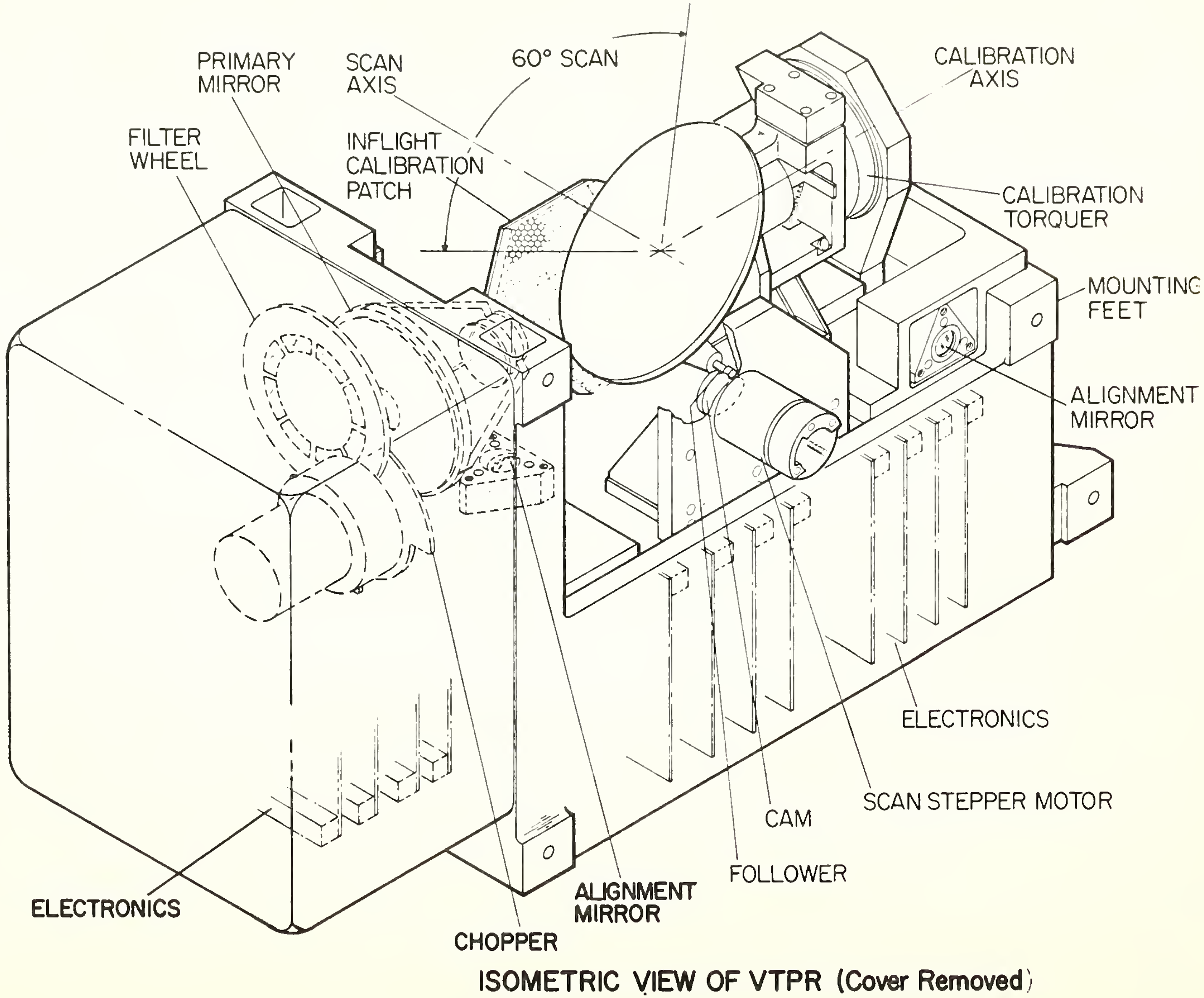


Figure 3.--View of a VTPR instrument (courtesy of RCA)

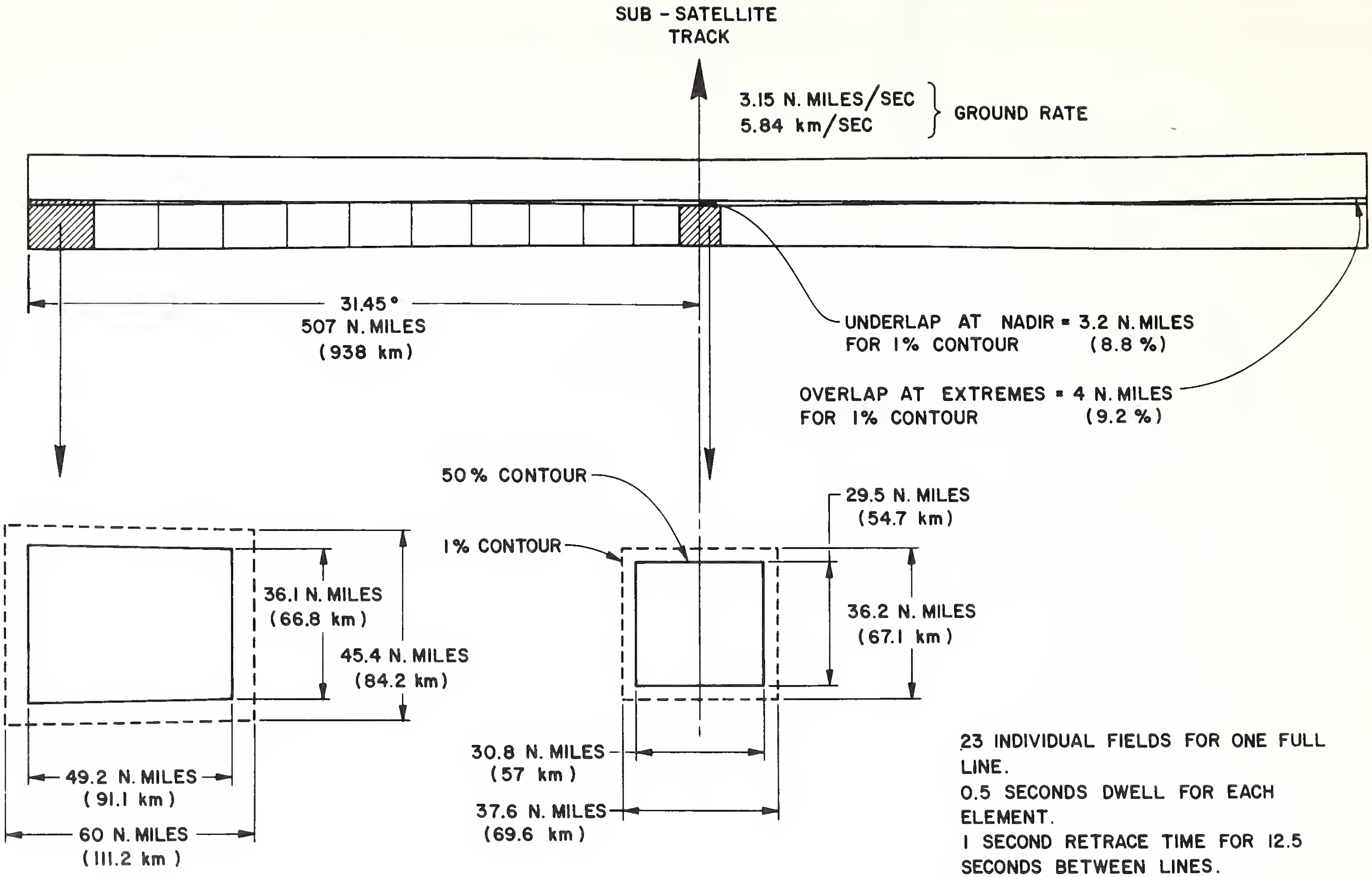


Figure 4.--VTPR scan spot geometry (courtesy of RCA)

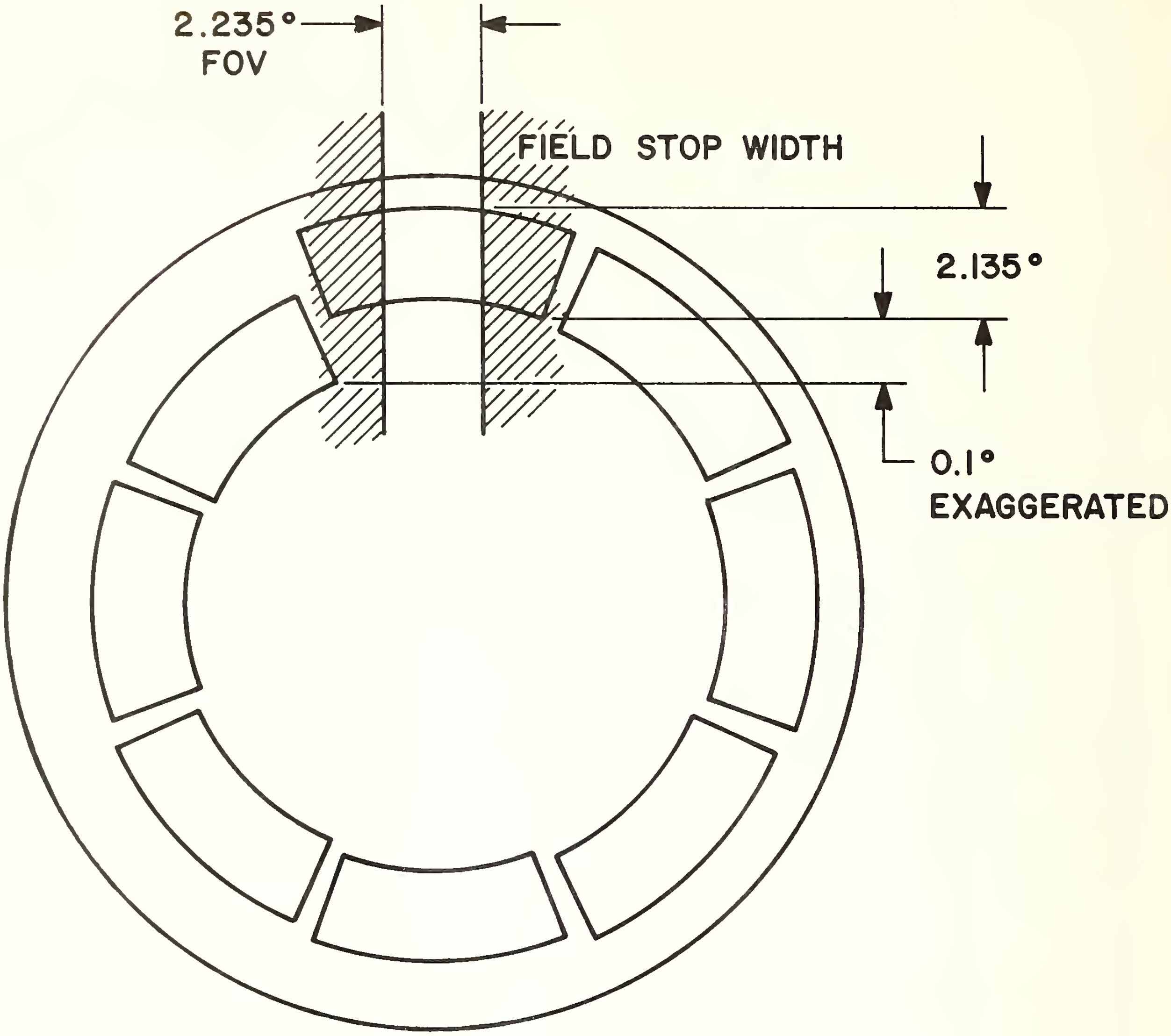


Figure 5.--VTPR filter wheel showing image motion compensation mask (courtesy of RCA)

Analog output from the detector is digitized into 10 bits of binary data. Scan spot location is identified by a five-bit binary code, which is combined with the radiometric data and a parity bit to form a 16-bit word. The resulting digitized data from the VTPR are stored in an output register, transferred to the spacecraft Digital Data Processor, and stored on tape. Digital data from the VTPR and other spacecraft components are transmitted on one of four channels of the S-band link to the ground.

A single scan of the VTPR instrument takes 12.5 s, of which 11.5 s are used to sample the 23 scan spots. Measurements for all eight channels are obtained during the 0.5-s interval allowed for each scan spot. One second is required for the mirror to return to its original position; during this time measurements of various components needed for calibration are recorded in place of the 16 radiance measurements. Output data for a normal scan line are summarized in table 1 of appendix I. When the instrument is operated in its automatic calibration mode, a 37.5-s calibration sequence is recorded (replacing 3 scans of normal data) every seven minutes. Data from this calibration sequence are used in the calibration procedure described in Section 3 C. During this sequence, measurements of electrical voltage calibration, space calibration, housing calibration, and housekeeping telemetry are digitized and inserted into the data stream. During regular operations, the calibration sequence is initiated only once per orbit by direct command from the ground.

Table 1 shows the nominal characteristics of the eight filters in the VTPR instruments. In column 1, filters 1-6 are numbered according to the opaqueness of the atmosphere in the respective spectral intervals, so increasing numbers correspond to decreasing atmospheric opaqueness. This means that the lower numbered filters pass radiation containing information about the upper atmosphere and the higher numbered filters are used to measure the atmospheric temperature near the surface. The numbering system shown in column 1 is used in this report. Numbers in column 2 show the order in which the filters are mounted on the filter wheel. This sequence was chosen to minimize changes in signal level between adjacent filters, thereby minimizing the effects of any memory errors present in the instrument.

A summary of the VTPR parameters is given in table 2.

Table 1.--Nominal spectral intervals for VTPR filters

Filter number	Filter wheel position	Center wavelength (μm)	Center wavelength (cm^{-1})	Filter band pass Half-width (cm^{-1})	Filter band pass Tenth-width (cm^{-1})
1	1	14.96	668.5	3.5	10.5
2	8	14.77	677.5	10	20
3	2	14.38	695.0	10	20
4	7	14.12	708.0	10	20
5	3	13.79	725.0	10	20
6	6	13.38	747.0	10	20
7	4	18.69	535.0	18	20
8	5	11.97	833.0	10	16

Table 2.--Summary of VTPR parameters

Parameter	Nominal value
Spectral range	12-19 μm
Line rate	4.8 lines /min
Field of view	2.136^{o} by 2.236^{o}
Dynamic range	0 to 210 mW/(m^2 sr cm^{-1})
Sensitivity*	0.25 mW/(m^2 sr cm^{-1}) or less
Digital signal output	16 bits
Data rate	256 bits /s
Primary f/number	f/3
Effective f/number	f/0.6 at the detector
Spectral resolution	See table 1
Scan-mirror aperture	3 in.

*Q-Branch 0.75 m^{W}/(m^2 sr cm^{-1})

(2) Spectral Transmission Functions of VTPR Filters

All VTPR filters, with the exception of the Q-branch filters at 668.5 cm^{-1}, were manufactured by the Optical Coating Laboratory, Inc. (OCLI). Q-branch filters were made by Grubb-Parsons, Ltd. (GPL), and by Spectrum Systems, Inc. (SSI). Table 2 of appendix I gives the serial numbers assigned to the VTPR instruments on NOAA 2, as well as the corresponding best estimates of filter spectral characterisitcs.

The importance of obtaining accurate spectral data and the difficulty of doing so implies that the manufacturer's original data should be verified whenever possible. Data for all instrument 1 filters, except the nominal 677.5 cm^{-1} filter, were obtained at the NESS Satellite Experiment Laboratory (SEL). This was, unfortunately, not possible for those in other instruments, for which data on only the 535 cm^{-1} filters were obtained at SEL.

In the SEL verification procedure each of the VTPR filters was mounted in a special holder at 7.5^{o} away from the normal to the f/10 beam in a Beckman IR-7 spectrometer. The holder was rigidly mounted to the spectrometer so that the 7.5^{o} angle was accurate to better than $\pm$ 0.3^{o}. Filter temperature was set near 35C, typically within $\pm$ 0.5C, and the instrument was purged continuously with pure dry nitrogen. Single beam mode, with a spectral resolution of between 0.8 and 1.0 cm^{-1}, was chosen for all the runs. This resolution causes a small but significant convolution distortion in the case of the Q-branch filter only. However, this did not seriously affect the comparison with the manufacturer's data, which were similarly distorted. The distortion is always in the direction of a less desirable filter profile. Thus, filters whose measured profiles meet the specifications are acceptable.

Spectral calibration of the spectrometer was achieved using known carbon dioxide absorption line positions between 577 and 959 cm^{-1}. For the latter region of weak absorption, a White cell with an optical path length of 10 m was used. The calibration runs were made as closely as possible in time to the data runs, but sometimes there was an overnight delay.

The spectrometer output was recorded in analog form on a chart recorder and in digital form on a tape recorder. The tape record was processed to provide a computer-drawn plot of transmission as a function of indicated (uncalibrated) wavenumber.

Table 3 of appendix I presents comparative figures on spectral characteristics obtained from all sources of data. Agreement is always within the noise level of the measurements except for the 535 cm^{-1} filter. In this case, there is a significant disagreement in center wavenumber, most probably caused by an unadvoidably incomplete calibration of the SEL spectrometer. The OCLI figures have therefore been accepted for the center wavenumber of that filter. In addition to using CO_2 line positions near 690 cm^{-1}, the OCLI spectrometer was also calibrated with the water rotation line at 525.97 cm^{-1} (vacuum).

Appendix II contains the best estimates of the filter spectral characteristics in instruments 1 through 4. They are uncorrected for convolution distortion. The curves were calculated solely from the OCLI chart traces. Points were taken from the curves about every 0.4 cm^{-1} and smooth curves were fitted to the points by means of spline functions.

C. Other Spacecraft Equipment

The NOAA 2 satellite carries a two-channel Scanning Radiometer (SR), a Very High Resolution two-channel scanning Radiometer (VHRR), and a Solar Proton Monitor (SPM) in addition to the VTPR instrument (Schwalb 1972). Sea-surface temperatures, which are used in the VTPR data processing, are derived from SR measurements covering the 10.4-12.5 μm spectral interval. The SR instrument views a smaller area than the VTPR instrument and thus has a better chance of receiving radiation from a cloud-free area. Statistical techniques are used to identify the measurements that are cloud-free, and the cloud-free radiances are used to deduce the ocean surface temperature.

D. Ground Equipment

Ground equipment required for the VTPR data processing consists of two readout stations (Wallops, Virginia and Gilmore, Alaska); communication lines connecting the readout stations to the NOAA/NESS data processing and analysis facility in Suitland, Maryland; and the following types of processing equipment and computers at Suitland:

RCA Modulator - Demodulator (MODEM) 2270678-501
EMR 2721 - signal conditioner
EMR 2731 - PCM frame synchronizer
EMR 6130 - computer
CDC 6600 - computer.

3. Data Reduction and Analysis

A. Overall Data Flow

The VTPR data flow and software system consists of six major computer programs. Figure 6 shows the individual program modules and their relationship within the flow system from the spacecraft to data users.

While the NOAA 2 satellite is above the horizon of either of the two readout stations, the digital data are played back from an onboard Scanning Radiometer Recorder (SRR) and immediately forwarded via communication lines to the NOAA/NESS data processing and analysis facility in Suitland, where they are demodulated by the MODEM and passed on to the EMR computers for initial processing. The VTPR data are separated from the other spacecraft data and finally written on an output digital magnetic tape by the Ingest Program in the EMR 6130 computer. Normally, one orbit of data is processed for each readout. However, once each day the satellite does not appear above the horizon at either of the two readout stations during one or two orbits, and it is necessary to store these orbits of data on the spacecraft until the next readout. In these cases, up to 209 minutes of VTPR data may be recorded on one output tape, and two tapes may be required to record all the data.

A sequence of programs is executed on each output tape from the EMR 6130. The first program computes the geographical location of each vertical sounding to be produced. Data concerning the instrument status and condition are then analyzed, and parameters such as electrical gain and standard deviations are checked and verified to be within acceptable limits. Following the procedures described in section 3.B, radiance values are computed and passed, together with appropriate earth location and time information, to the next program. An archive tape containing the earth-located radiances also is generated.

The Clear Radiance Program operates next to eliminate the effects of clouds. It statistically computes an equivalent clear radiance for an area by comparisons of adjacent scan spots, utilizing knowledge of sea-surface temperature (obtained independently from the Scanning Radiometer data) and an approximate first guess vertical temperature structure (obtained from climatology and a recent forecast or analysis). Earth-located clear radiances are generated and added to the archive tape. The data are then used to retrieve temperature profiles.

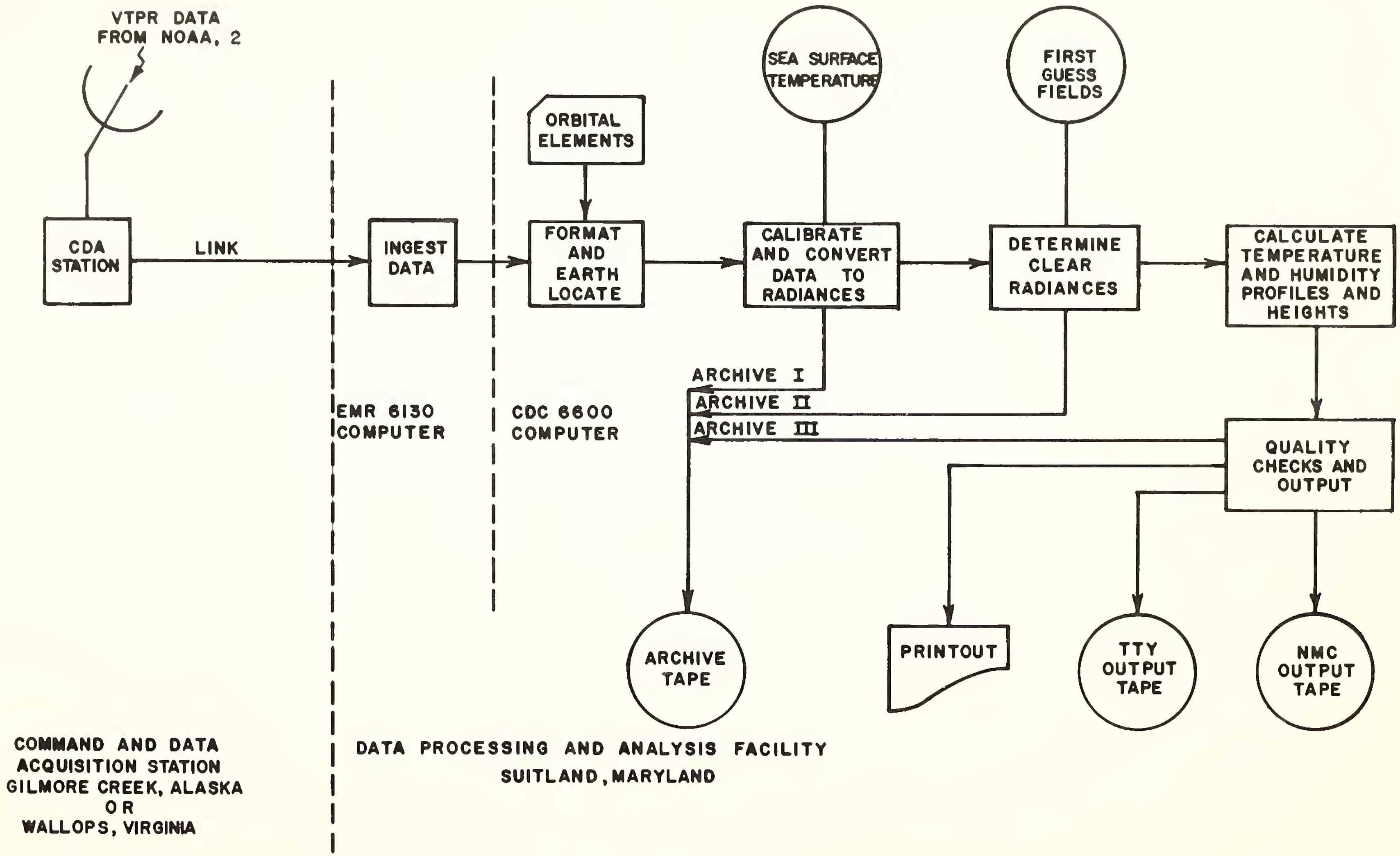


Figure 6.--VTPR software system

The Retrieval Program uses the first guess temperature profile, a first guess humidity value, and atmospheric transmittance values to compute the vertical atmospheric profiles from the input of clear radiances.

The final output data are quality checked and reformatted onto three magnetic tapes. One tape is forwarded to the National Meteorological Center (NMC) for input to their numerical analysis and primitive equation (PE) forecast model. The second tape is given to the National Weather Service communications center for transmission to users. Data that pass the quality check are added to the archive tape, which is then transmitted to other users (Goddard Institute for Space Studies, for example) and to the permanent archive of the NOAA Environmental Data Service.

B. Geographical Location of Data

Earth location of the data is performed in two steps. The first step is performed in an Earth Location Program, which calculates latitudes and longitudes for centers of the areas for which VTPR temperature and humidity profiles are to be calculated. The second step is performed as a subroutine of the calibration program. This subroutine calculates the locations of the VTPR scan spots in the grid on which the sea-surface temperatures are provided.

The location of a scan spot is determined by a point called the sensor principal point. This point is the center of a scan spot on a plane surface perpendicular to the viewing angle of the instrument. Because of the curvature of the earth, this point is the exact center of a scan spot only when the instrument is viewing along the local nadir. In the earth location procedure, principal points are calculated for spots 5, 12, and 19 of the fourth of eight scan lines (fig. 9). To locate these principal points, the satellite position, the satellite attitude, the sensor mounting position, and the mirror position must be known. Attitude information in the form of Φmax and λ (RCA 1972) is supplied by the Satellite Operations Control Center (SOCC); Φ_{max} is the maximum roll angle during an orbit; and λ is the angle from the ascending node to the point of maximum yaw. Values of Φ_{max} and λ are easily converted to roll and yaw angles. The SOCC attempts to control Φ_{max} to within 0.5^{o} tolerance, with a maximum error of about 1^{o}. The pitch tolerance is generally kept to within 0.5^{o}.

Weekly orbital element data are supplied by the NASA. These data and the General Electric orbital predictor package (Brower 1959, and Lyddane (1963) are used to determine satellite position. Once the satellite position is determined, a series of matrix rotation and vector additions are used to compute the principal point latitude and longitude (figs. 7 and 8). These rotations convert the geocentric principal point to a position in a geodetic coordinate system, and include corrections for satellite altitude, satellite position, sensor mounting position, and mirror position.

Sea-surface temperatures from the SR are available for i and j points of a square grid superimposed upon a polar stereographic projection. Positions of the bench marks (fig. 9) are calculated for the VTPR location and converted to positions on the polar grid. Temperatures of intermediate boxes are obtained from the polar grid using coordinates obtained by interpolation from the known bench mark coordinates.

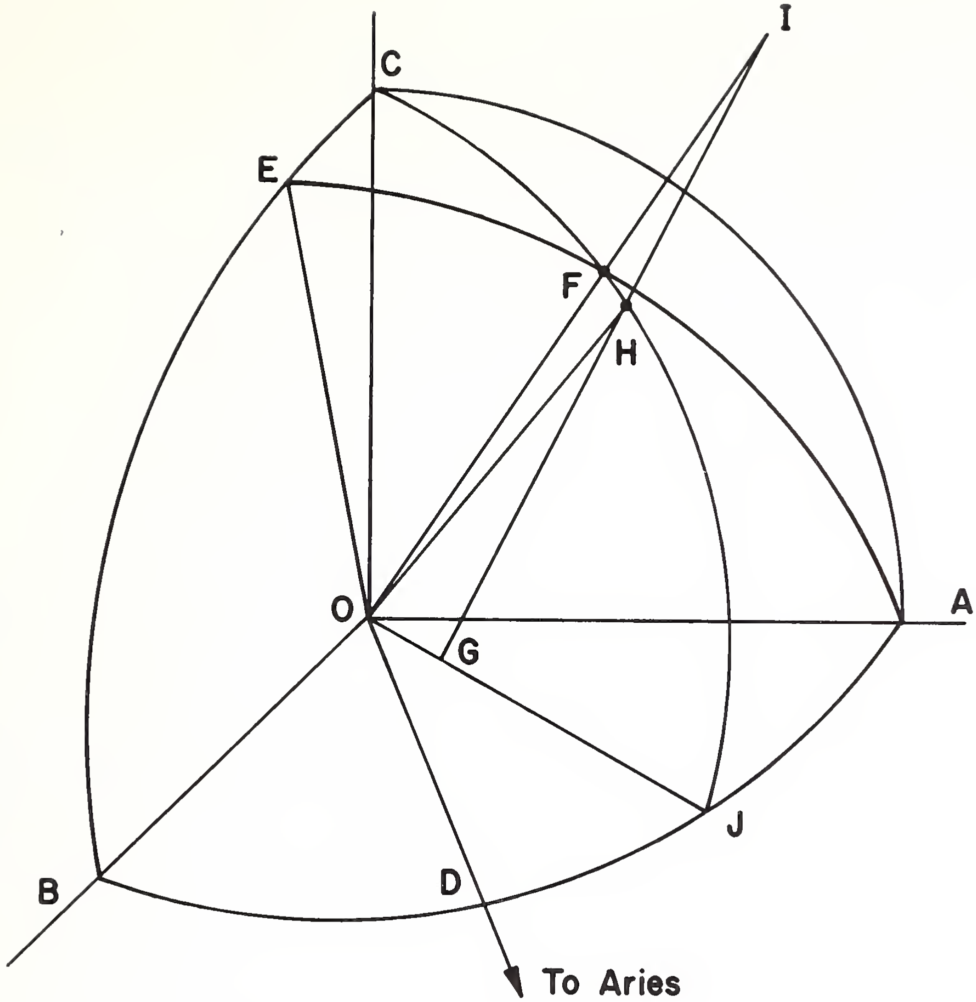
C. Calibration Procedure

Calibration of the VTPR sensor data involves two procedures. The first is a pre-launch ground calibration of the instrument; the second is used after launch to adjust the calibration for changes in the spacecraft operating conditions.

During the first procedure each VTPR instrument is calibrated by being exposed to an external reference source. The internal source is not a standard and must therefore be calibrated against a standard source. This is accomplished by calibrating the internal source with an external source which, in turn, has been checked with a standard.

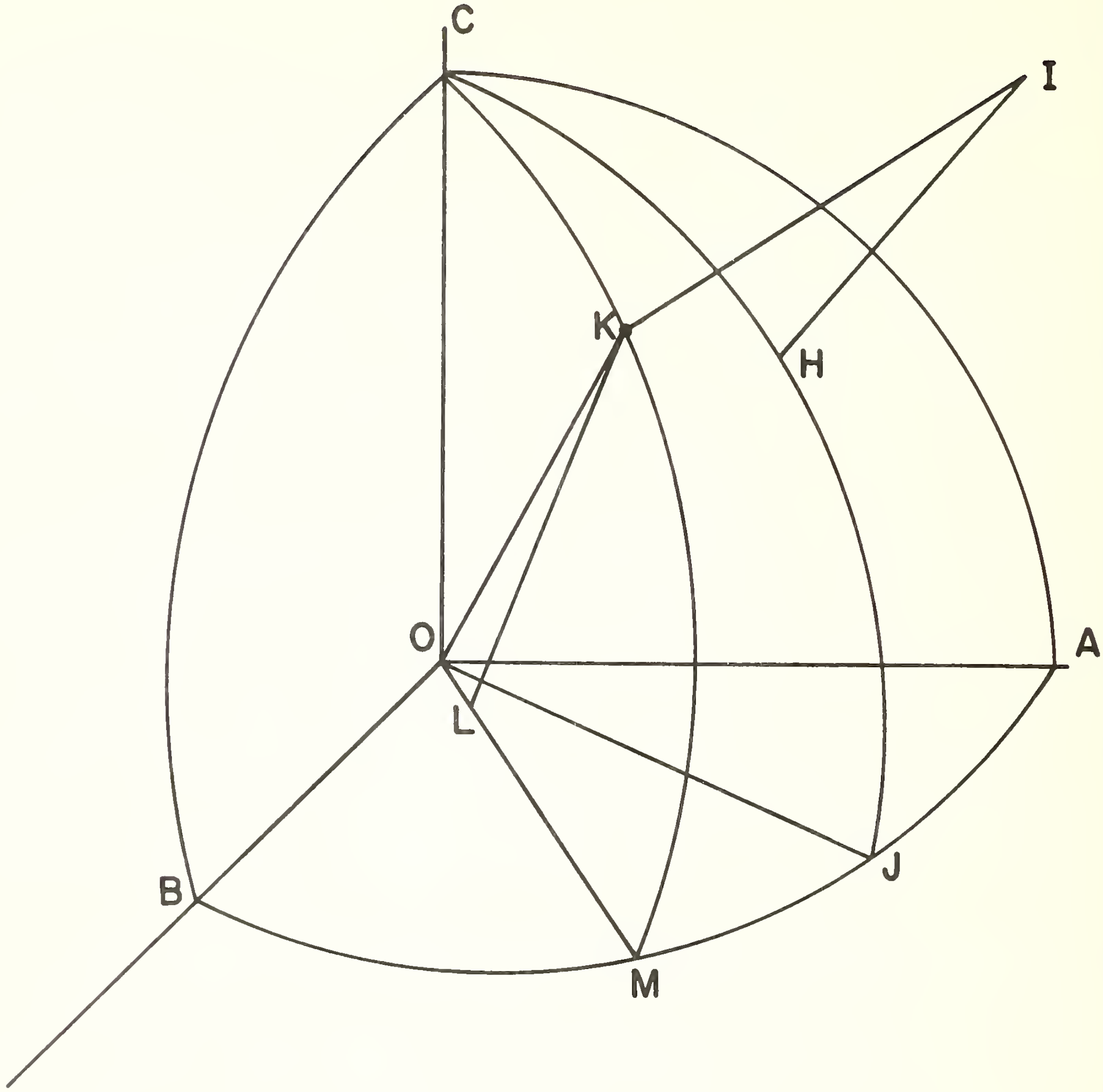
Calibrations of the VTPR are based on the external sources used during thermal-vacuum tests on the ground. The honeycombed external sources used in the calibration have provisions for maintaining any fixed temperature between 180 K and 340 K. Six thermocouples are used to measure the temperature; they indicate that thermal gradients are less than 0.1 K across the surface of the source. These external sources have been compared with the low temperature blackbody reference of the Canadian National Research Council (NRC) (Bedford 1970), using calibrated thermopile detectors as transfer standards (Hilleary et al. 1969). Thermopile output for the VTPR references read 1 $\pm$ 0.5% higher than the output from the NRC reference.

During the calibration of the VTPR internal source, two of the external sources were placed in the "earth" position so that they filled the field of view for scan spots 1 and 23, the extreme mirror positions. With the instrument temperature and the scan position fixed, a calibration was performed by varying the



A = ascending node of orbital plane
C = north pole
F = geocentric subsatellite point
I = satellite position
AFE = geocentric subsatellite point track
JHFC = meridian through F
BOD = right ascension of orbital plane
COE = inclination of orbital plane
AOF = Ω(angle from ascending node to geocentric satellite point
FOH = θ_2 and AFH = θ_1, angles to correct geocentric subsatellite point to geodetic subsatellite point
FOJ = geocentric subsatellite latitude
HGJ = geodetic subsatellite latitude

Figure 7.--Location of satellite position



HIK = roll, pitch, and yaw rotation
K = principal point of a VTPR data spot
KOM = geocentric latitude of principal point
KLM = geodetic latitude of principal point
CKM = mderdian through K

Figure 8.-- Location of principal point showing effect of roll, pitch, and yaw error

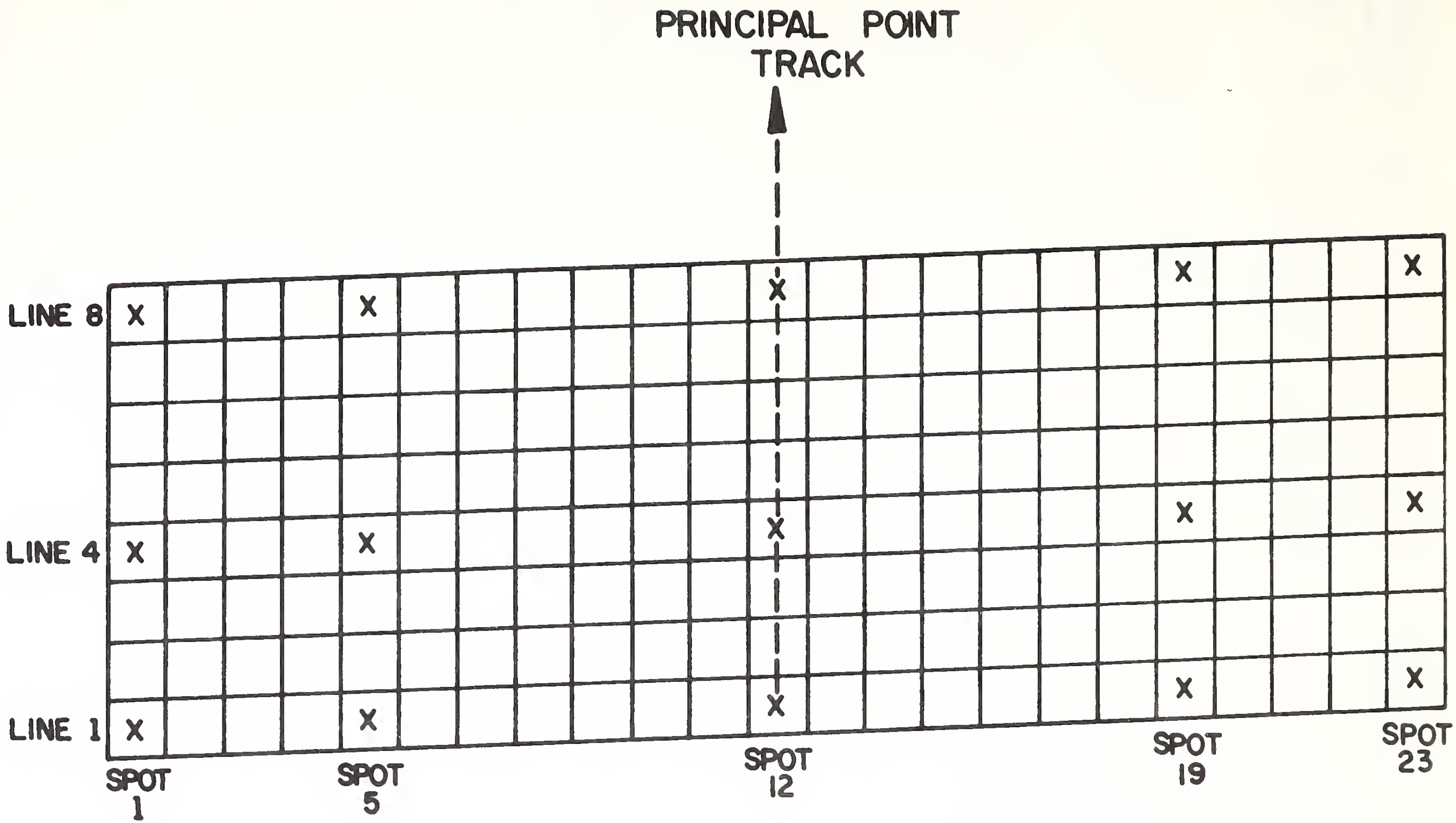


Figure 9.--VTPR scan pattern showing bench marks (X's) used for locating SR data

temperature of one of the external sources in steps between 180 K and 340 K. This procedure was repeated for a series of instrument temperatures. During this calibration process, the VTPR was put into its automatic calibration mode a number of times to allow comparison of the internal source with the external secondary standards.

The second procedure is performed when an instrument is in space. Then, the only radiation references are the internal blackbody source at the nominal temperature of the instrument and a view of space. At the wavelengths used in the VTPR, a space view effectively has zero radiance. For a linear system, two references provide sufficient information to calibrate the output of the instrument in physical units when it is viewing the earth. A relationship between source radiance and the digital output of VTPR is given by

$$I_{ij} = a_i + b_i c_{ij} \quad (1)$$

where I = radiance
a, b = calibration coefficients
c = VTPR output in counts
i = spectral interval
j = source identifier (space or internal).

The linearity of the output implied by eq (1) is an integral part of the instrument design, and has been verified by tests of each instrument.

In the normal earth-directed views, spots 1-23, the coefficients "a" and "b" for the i^{th} channel are determined from

$$a_i = \sum_{k=0}^{3} A_{ik} T_k$$

and (2)

$$b_i = \sum_{k=0}^{3} B_{ik} T_k ,$$

where $T_0 = 1.0$
T_1 = primary optics (counts)
T_2 = secondary optics (counts)
T_3 = shroud (counts).

The last three terms in eq (2) account for the contributions of components of the VTPR to the radiative flux at the detector. Emissions of these components are temperature dependent, but because of the narrow range of operating temperature for these components, their contributions to the flux may be taken to be a linear function of temperature. Values of the coefficients A_{ik} and B_{ik} are determined by regression from data obtained during pre-flight thermal vacuum tests, using output counts from the VTPR and the various thermal probes listed in eq (2). In space, values of T_k for these components are obtained for each scan during the retrace period. Since these temperatures are obtained during each scan, the values of a_i and b_i can change during an orbit to compensate for changing conditions on the satellite.

The values of a_i and b_i given by eq (2) are periodically checked while the instrument is in space. During calibration checks in space, the VTPR views space, identified as spot 27, and the internal source ("patch"), spot 28. These views provide data for the relations:

$$0 = a_i + b_i \overline{C}_{i\ 27}$$

and (3)

$$B(\nu_i, T_{31}) = a_i + b_i \overline{C}_{i\ 28}$$

where $B(\nu_i, T_{31})$ = Planck radiance at ν_i and T_{31}

ν_i = spectral interval

T_{31} = temperature of the "patch"

$\overline{C}_{i\ 27}$ and $\overline{C}_{i\ 28}$ = average counts during the "space" and "patch" views at ν_i.

This procedure provides a check of the values of a_i and b_i. When the values do not check the coefficients in eq (2) are adjusted. As a last resort the instrument may be placed in an automatic calibration mode, values of a_i and b_i will be determined from eq (3), and new coefficients will be generated for eq (2).

Data for the calibration check are provided during a calibration sequence. This sequence (table 4 of appendix I) lasts for 37.5 seconds. In the automatic calibration mode, the instrument obtains calibration data approximately every 7 minutes throughout the orbit. Normally, the VTPR is commanded to obtain calibration data only once per orbit. During a calibration sequence, an electrical calibration is performed using the staircase voltage counts to verify the linearity and stability of the electronic circuitry. Also, means and standard deviations are computed for each phase of the calibration sequence (electrical staircase, space view, and patch view).

Instrument temperature data recorded during the one-second retrace period are identified by a five-bit binary code. Prior to launch, each instrument was arbitrarily assigned identifier code 24 or 25. During the one-second retrace interval of each mirror scan, output counts from the probes measuring the primary optics, secondary optics, and shroud temperatures, a 24-bit time code, and a frame synchronization identifier are recorded.

D. First Guess Fields for VTPR Data Processing

When describing the nature and source of first guess fields utilized in VTPR data processing, it is convenient to divide the earth into three geographical regions: (1) that portion of the Northern Hemisphere north of 18°N (hereafter identified as NH); (2) the area between 18°N and 18°S (hereafter identified as tropics); and (3) the Southern Hemisphere south of 18°S (SH).

(1) Northern Hemisphere

Guess fields for the NH are extracted from the operational forecast of the National Meteorological Center. The fields used and the time intervals at which forecasts are available are listed in table 5 of appendix I.

When forecasts are available for a given field, the forecast nearest in time to that of the satellite observation is used.

The fields are read from system disk (permanent files) and stored in Extended Core Storage (ECS). To construct a guess profile for a particular VTPR observation point, the fields are read into central memory from ECS, and a value for each parameter is interpolated to the VTPR location from the four surrounding grid points. The portion of the guess temperature profile above 10 mb is generated by regression as explained in 3. F.

(2) Tropics

For the tropics, radiosonde data averaged over an appropriate two-month period provides the guess temperature profile; regression estimates are employed to estimate the relative humidity.

(3) Southern Hemisphere

In the Southern Hemisphere, a feedback technique is used to generate guess temperature fields up to 10 mb. The retrieved VTPR profiles for a given day, together with other available upper air data, are used as input to a multi-level objective analysis program, whose output, in the form of grid point data, provides the first guess fields for the subsequent day's VTPR data processing. Humidity information is provided by regression estimates.

E. Procedure for Obtaining Clear Radiances (Program CLRAD)

(1) Mathematical Justification

To eliminate the effect of clouds on the retrieved temperature profiles, a single cloud-free or "clear" radiance is produced from measurements obtained from a number of scan spots. The resulting "clear" radiances are then used to obtain temperature profiles. "Clear" radiances for a 7 x 8 or an 8 x 8 box or subarray are obtained from the measured radiances of the scan spots and the sea-surface temperatures provided by data from the Scanning Radiometer (SR). They are obtained using a technique suggested by Smith in Fritz et al. (1972), and in Smith et al. (1970).

For an area that is partly cloud covered, the radiance can be expressed as

$$I(\nu_i) = N I_{cy}(\nu_i) + (1-N) I_{clr}(\nu_i) \quad (4)$$

where N is the fractional cloud cover, $I_{cy}(\nu_i)$ is the radiance of the cloudy areas, $I_{clr}(\nu_i)$ is the radiance of the clear areas, and ν_i is the central wavenumber of spectral interval i. The term $I_{cy}(\nu_i)$ can be written as

$$I_{cy}(\nu_i) = \varepsilon(\nu_i) I_{cld}(\nu_i) + [1-\varepsilon(\nu_i)]\, I_{clr}(\nu_i) \quad (5)$$

where $\varepsilon(\nu_i)$ is the cloud emissivity and $I_{cld}(\nu_i)$ is the radiance of a completely opaque cloud. Using eq (5) to substitute for $I_{cy}(\nu_i)$ in eq (4) leads to

$$I(\nu_i) = \alpha(\nu_i) I_{cld}(\nu_i) + [1-\alpha(\nu_i)] I_{clr}(\nu_i) \quad (6)$$

where $\alpha(\nu_i)$, the product of the fractional cloud cover and the emissivity, is given by

$$\alpha(\nu_i) = N\varepsilon(\nu_i) . \quad (7)$$

In the spectral region covered by the VTPR, clouds can be assumed to be grey, so α is therefore independent of wavenumber. If there are two adjacent scan areas with different values of α but with the same values of $I_{cld}(\nu_i)$ and $I_{clr}(\nu_i)$, then, for a given spectral interval, a separate equation can be written for each of the two adjacent areas

$$I_1(\nu_i) = \alpha_1(\nu_i)I_{cld}(\nu_i) + [1-\alpha_1(\nu_i)]I_{clr}(\nu_i) \tag{8}$$

and

$$I_2(\nu_i) = \alpha_2(\nu_i)I_{cld}(\nu_i) + [1-\alpha_2(\nu_i)]I_{clr}(\nu_i), \tag{9}$$

where the subscripts 1 and 2 denote two areas. Elimination of $I_{cld}(\nu_i)$ from eqs (8) and (9) gives

$$I_{clr}(\nu_i) = I_1(\nu_i) + [I_2(\nu_i) - I_1(\nu_i)][1-\alpha_2(\nu_i)/\alpha_1(\nu_i)]^{-1}. \tag{10}$$

The atmospheric transmittance for spectral interval 8, which is in an atmospheric window, is close to unity. The radiance for this spectral interval is only slightly affected by the atmosphere so a very good approximation of the value of $I_{clr}(\nu_8)$ can be computed using the first guess atmospheric profiles of temperature and humidity and the surface temperature obtained from the SR data With a value of $I_{clr}(\nu_8)$, the ratio $\alpha_2(\nu_i)/\alpha_1(\nu_i)$ can be obtained from eq (10). Since the ratio is independent of wavenumber, the value of the ratio obtained for ν_8 can be used in eq (10) to obtain values of $I_{clr}(\nu_i)$ for the other spectral intervals. Writing eq (10) for ν_8 and some other ν_i, and eliminating the ratio $\alpha_2(\nu_i)/\alpha_1(\nu_i)$, gives

$$\frac{I_{clr}(\nu_i)-I_2(\nu_i)}{I_{clr}(\nu_8)-I_2(\nu_8)} = \frac{I_{clr}(\nu_i)-I_1(\nu_i)}{I_{clr}(\nu_8)-I_1(\nu_8)} . \tag{11}$$

The right hand side of eq (11) is the slope of a line containing the points $[I_{clr}(\nu_i), I_{clr}(\nu_8)]$ and $[I_1(\nu_i), I_2(\nu_8)]$. Graphically (see fig. 10), the three points $[I_{clr}(\nu_i), I_{clr}(\nu_8)]$, $[I_1(\nu_i), I_1(\nu_8)$ and $[I_2(\nu_i), I_2(\nu_8)]$ lie on a straight line that can be determined from the measured values of $I_1(\nu_i)$, $I_1(\nu_8)$, $I_2(\nu_i)$ and $I_2(\nu_8)$. The value of $I_{clr}(\nu_i)$ can then be found from the known value of $I_{clr}(\nu_8)$. When calculating values of $I_{clr}(\nu_i)$, radiances from adjacent spots with different nadir angles are adjusted to a common nadir angle as described later.

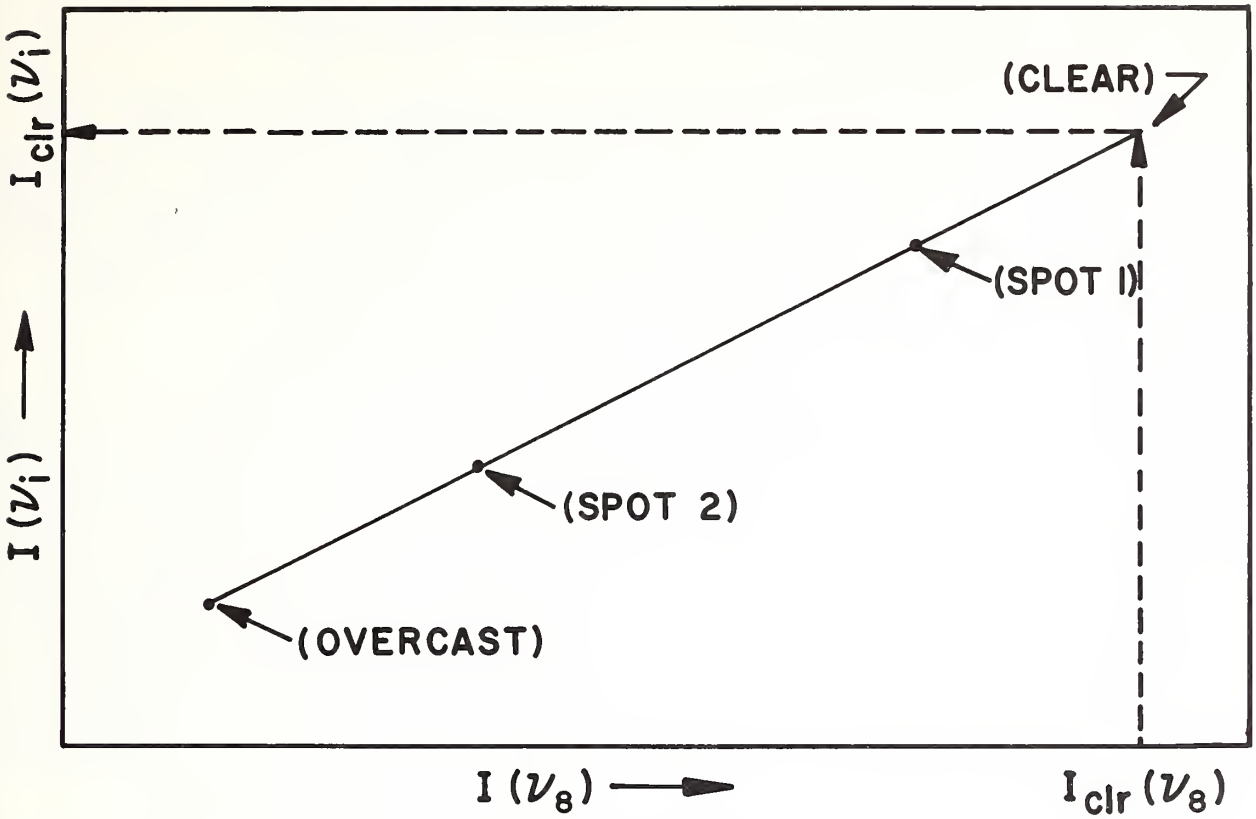


Figure 10.--Procedure for determining clear radiances

(2) Operational Procedures

To reduce the noise level of the deduced clear radiances, $I_{clr}(\nu_i)$, values from a number of adjacent pairs are combined. Figure 2 shows the scanning pattern of the instrument. Data from eight successive scans are used to obtain three temperature profiles. Figure 2 also shows how the 23 x 8 scan spots are divided to form two 8 x 8 subarrays and one 7 x 8 subarray for which three temperature profiles are calculated.

Scan spots are considered to be adjacent if they meet at a corner or an edge. For a given scan spot, pairs are obtained for four adjacent scan spots: the one above and to the right, the one directly above, the one above and to the left, and the one immediately to the left of the given scan spot (fig. 11). In each subarray, there are 49 scan spots for which the four combinations with adjacent spots shown in figure 11 are possible. As a result, 49 x 4 or 196 values of $I_{clr}(\nu_i)$ are obtained for each subarray. Except for scan spots on the edges of the 23 x 8 array, each scan spot has been compared with each of its eight adjacent scan spots when the array is completed.

The 196 values of $I_{clr}(\nu_i)$ are combined to obtain an estimate of the value of $I_{clr}(\nu_i)$ for the area. Several procedures for obtaining a combined value have been tried using simulated data. The best results were obtained by using a mixture of two of these procedures.

When a single cloud layer was simulated, the resulting distribution of values of $I_{clr}(\nu_i)$ was symmetrical, and a weighted average gave the best estimate of the true value of $I_{clr}(\nu_i)$. The weights used are proportional to the inverse of the estimate of the variance of the $I_{clr}(\nu_i)$ for a given scan spot pair and are given by

$$W_m = U_m \Big/ \sum_{m=1}^{M} U_m \tag{12}$$

where

$$U_m = [I_1(\nu_8)-I_2(\nu_8)]^2 \Big/ \Big\{[I_{clr}(\nu_8)-I_1(\nu_8)]^2 + [I_{clr}(\nu_8)-I_2(\nu_8)]^2\Big\} . \tag{13}$$

In eqs (12) and (13), m refers to one of the 196 possible pairs, and M is the number of pairs included in the average.

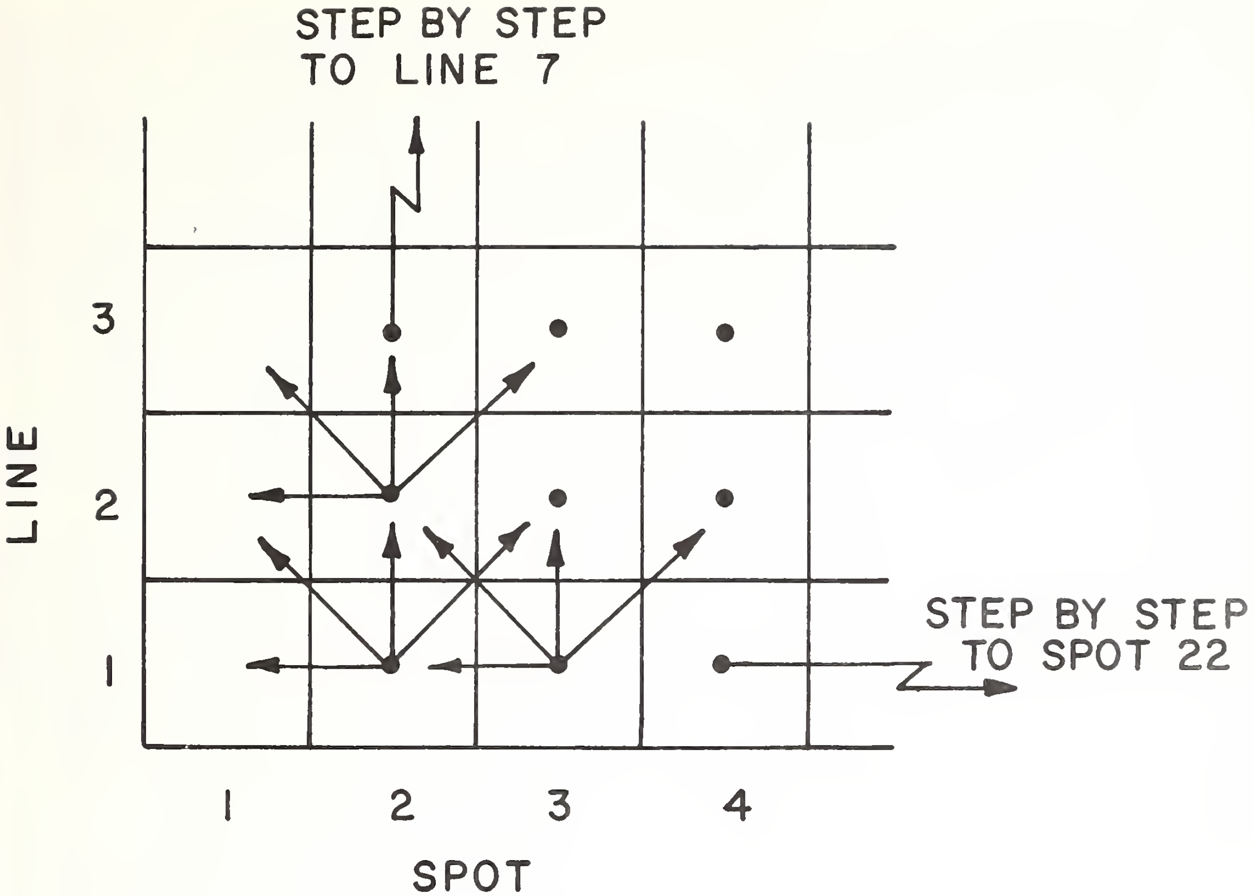


Figure 11.—Scanning pattern showing the pattern used for adjacent pairs and the nominal location of retrievals

When several cloud layers were used in the simulation, the distribution became asymmetrical and the mode gave the best estimate of the true value of $I_{clr}(\nu_i)$. However, when the mode is determined from the number of occurrences in a given class interval, an uncertainty occurs because of the size of the class interval. To avoid this uncertainty, the distribution of values of $I_{clr}(\nu_i)$ was convoluted with a smooth function and the mode was taken at the maximum value of the resulting function. Several smoothing functions were tried, and a fourth degree chi-square distribution was selected. Figure 12 shows typical unsmoothed histograms and the smoothed histograms that result from convoluting the data with a chi-square distribution. Since the effect of clouds (and thus the corrections) are small for channels 1 and 2, the weighted averages are always used and histograms are not produced.

Selection of the value from the weighted average or the mode is determined by comparing the two values. Agreement between the two indicates that the distribution is symmetrical; in such cases the weighted average is selected. Otherwise the mode is selected. At the present time, a difference of 1 mW/(m^2 sr cm^{-1}) or less between the two values is considered to indicate agreement and thus a symmetrical distribution.

During processing of the VTPR data, two checks are made while calculating values of $I_{clr}(\nu_i)$. First, if the measured window (ν_8) radiance "agrees" with the window radiance calculated from the first guess, the spot is assumed to be clear. Window radiances are considered to be in agreement when the measured window radiance equals or exceeds the calculated value. Values of I_{clr} (ν_i) from clear spots are averaged. If one or more clear scan spots is found, the value of $I_{clr}(\nu_i)$ is obtained exclusively from the "clear" areas. As a second check, values of window radiance for adjacent scan spots are compared. When values are too close, the resulting estimate of $I_{clr}(\nu_i)$ is considered to be unreliable unless one or more of the spots is clear. Values of $I_{clr}(\nu_i)$ resulting from adjacent scan spots with differences in value of $I(\nu_8)$ that are less than 1.0 mW/(m^2 sr cm^{-1}) are not used. If no clear areas are found and if fewer than 25 values of $I_{clr}(\nu_i)$ are obtained for a 7 x 7 subarray, a retrieval is not attempted.

Measurements for some adjacent pairs are obtained at different viewing angles of the earth. When these measurements are compared, a correction must be made to compensate for the different atmospheric path lengths. When comparing radiances in adjacent scan spots, and when averaging the results over a 7 x 7 subarray for adjacent scan spots, the first guess temperature profile and

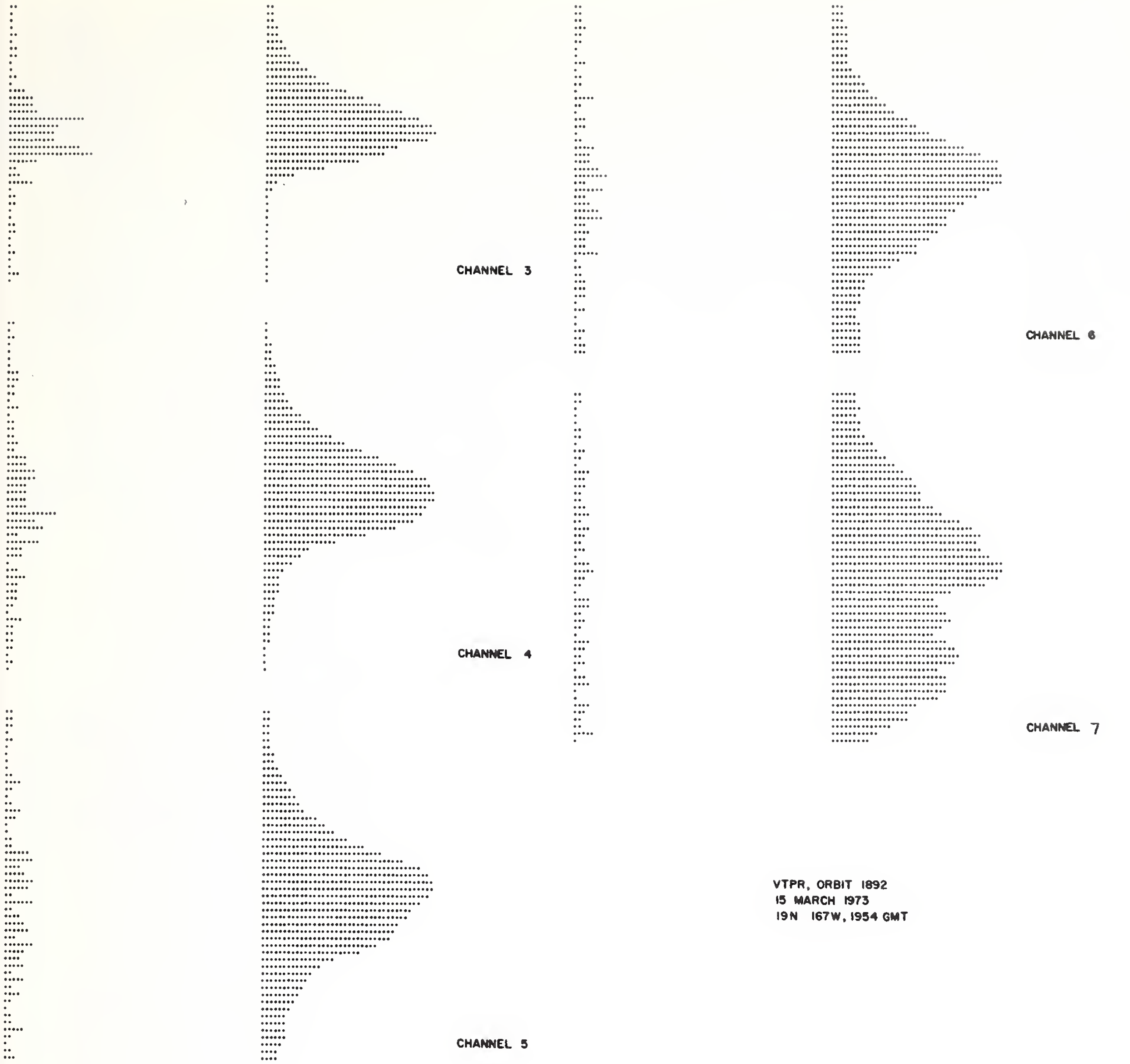


Figure 12.-- Typical histograms and smoothed histrograms of radiances for channels 3 through 7

the sea-surface temperature are used to calculate spectral radiances for the four cases of no clouds and of 50% cloud cover at 700, 470, and 300 mb. Radiances are calculated for several zenith angles, and curves of radiances verses zenith angle are calculated for the four cases (fig. 13). Calculated and measured first guess window radiances are compared to determine which of the four curves gives the best estimate of cloud height (fig. 13a). The corresponding curve is then used to determine zenith angle corrections for the other spectral intervals (fig. 13b). When correcing to the center of the array, the curve for no clouds is used since clear radiances derived in program CLRAD are being adjusted. While the first guess atmosphere is used in making corrections for zenith angles, the zenith angle corrections are small, and the first guess atmosphere has a very minor influence upon the radiances passed on to the retrieval program. One should also note that the value of $I_{clr}(\nu_8)$ resulting from the clear radiance procedure is the value calculated from the first guess.

F. Retrievals

(1) Introduction

The temperature and moisture retrieval program derives atmospheric temperature and humidity profiles from the clear radiances produced by the CLRAD program and can be described as a sequence of five sections called Input, Construction of Transmittances and Weighting Functions, Temperature Retrieval, Moisture Retrieval, and Output.

(2) Input

The retrieval program uses the radiance values for the first seven of the eight spectral intervals listed in table 1. As explained in section 3E., the eighth radiance value is calculated from the first-guess surface temperature and first-guess atmospheric profiles. The retrieval program uses the surface temperature in place of this radiance.

A first-guess temperature and water vapor profile is required by the retrieval program. Below 10 mb, the first-guess profiles are obtained from forecasts, analyses, and climatology as explained in section 3 D. The tropopause temperature, height, and pressure are also provided by the National Meteorological Center (NMC). Above 10 mb, the first-guess temperature profile is obtained by regression on radiances measured in spectral intervals 1 and 2 and the first-guess temperatures at 10, 30, and 50 mb. This technique gives reliable estimates of the temperature above 10 mb because it is based upon a recent sample of rocketsonde and

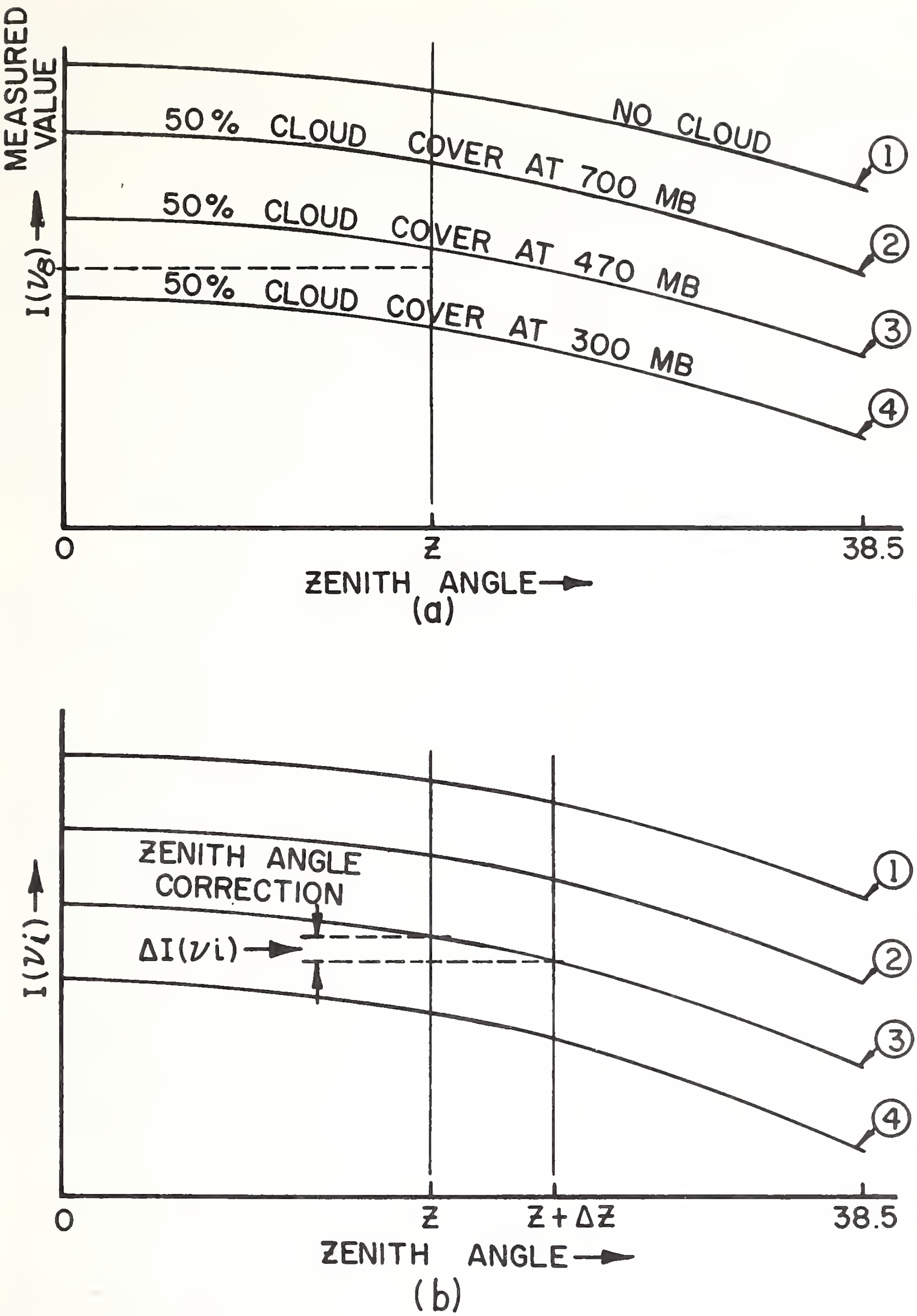


Figure 13.--Calculated window radiance versus zenith angle for 50% cloud cover at four levels showing the zenith angle correction

radiosonde data (Gelman et al., 1972). It is especially valuable in accounting for sudden warming in the stratosphere.

Finally, the guess temperature profile is interpolated to the 100 pressure levels shown in table 6 of appendix I. These levels are distributed between 1000 mb and 0.01 mb in even increments on a scale of pressure raised to the 2/7 power.

A guess for the water vapor mixing ratio profile is also required. In the Northern Hemisphere, NMC provides an average relative humidity for the atmosphere between the surface and a variable level which is near 500 mb. From this single quantity a mixing ratio profile is specified as follows: a saturation mixing ratio profile is calculated from the guess temperature profile between the surface and 500 mb. In this region, the guess mixing ratio profile is constructed as the product of the relative humidity and the saturation mixing ratio. Above the 500 mb level, the mixing ratio profile is constructed to fall off as p^3.

In areas where no moisture information is provided by NMC, such as the Southern Hemisphere, the correlation between temperatures and mixing ratio is utilized through the regression relation

$$W^* - \overline{W} = H\,(T^* - \overline{T}), \tag{14}$$

where W^* is the required guess mixing ratio profile and T^* is the guess temperature profile. The quantities $\overline{T}$, $\overline{W}$, and H are the mean temperature profile, the mean mixing ratio profile, and a matrix of regression coefficients, respectively, which have been compiled in advance from conventional soundings.

(3) Construction of Transmittances and Weighting Functions

Atmospheric transmittances for the eight spectral intervals of table 1 are fundamental to the retrieval and must be constructed accurately. The total transmittance of the atmosphere is assumed to be the product of the individual transmittances of carbon dioxide, ozone, and water vapor,

$$\tau(p) = \tau_{CO_2}(p) \cdot \tau_{O_3}(p) \cdot \tau_{H_2O}(p). \tag{15}$$

Transmittances for CO_2 are based upon calculations made with the point-by-point method of Drayson (1971). His method was used to calculate transmittances for the U. S. Standard Atmosphere, 1962 (COESA 1962) and for atmospheres which differed from the Standard Atmosphere by $\pm$ 10K, $\pm$ 20K, and $\pm$ 30K. Temperature corrections to the transmittances, generated from these calculations, are used in the retrieval program to adjust the transmittances to values appropriate for the first-guess temperature profile.

Appendix II contains the measured filter characteristics of the first four instruments. It includes carbon dioxide transmittances for a typical atmosphere and weighting functions (derivatives of the transmittances with respect to $p^{2/7}$), which indicate the relative contributions of levels of the atmosphere to the radiance received at the satellite. Radiation detected by the VTPR originates from layers which increase in pressure as the channel wavenumber increases.

Ozone transmittances are a minor correction and are applied as a single correction for all latitudes and seasons. The transmittances were calculated for an average profile (McClatchey 1972) from a line-by-line technique for pressures greater than 100 mb, and from a band model for lower pressures.

Water vapor has a marked influence upon atmospheric transmittances in the lower troposphere. The infrared spectrum of water vapor includes both spectral lines and a strong continuum, which are treated separately. The line contribution cannot be calculated by the same procedure used for CO_2 transmittances because the mixing ratio of water vapor is highly variable. Instead, the first step (performed in advance of the retrieval) is to fit a model to line by line calculations of spectral line absorption averaged over the appropriate filter functions. These calculations are performed over homogeneous paths and cover, in increments, the expected atmospheric range of pressure, temperature, and mixing ratio. In the retrieval, the atmosphere is treated as a succession of homogeneous layers (Weinreb and Neuendorffer 1973).

The absorption by the water vapor continuum is observed to vary as the square of the water-vapor concentration and as the inverse fifth or sixth power of temperature (Burch 1970 and Bignell 1970). This behavior, which is consistent with absorption by the water vapor dimer $(H_2O)_2$, is included in the continuum transmittance. A term ascribed to foreign-gas broadening of distant lines, which is proportional to the first power of the moisture concentration, is also included. The overall water-vapor transmittance is finally calculated as the product of the line and continuum transmittances.

(4) Temperature Retrieval

The temperature profile is obtained through a modification of the minimum-rms solution (Rodgers 1970 and Strand and Westwater 1968) of the radiative transfer equation. This solution can be written as

$$B_r(T) = B_r(T^*) + (C)(R_r - R_r^*) \qquad (16)$$

where the matrix C is given by

$$C = SA^T(ASA^T + N)^{-1}. \qquad (17)$$

A description of all terms in these equations follows. Eq (16) and (17) yield $B_r(T)$, which is the 100-element Planck-radiance profile of the solution temperature profile, T, computed at a reference wavenumber of 700 cm^{-1}. The 100 elements correspond to the 100 atmospheric pressure levels shown in table 6 of appendix I. A solution temperature profile is readily obtained from $B_r(T)$. Geopotential thicknesses relative to 1000 mb are computed from the perfect-gas and hydrostatic equations. In the Northern Hemisphere, heights are obtained relative to the NMC forecast 850-mb height.

The term $B_r(T^*)$ is the Planck-function profile computed at 700 cm^{-1} from the guess temperature profile T*. The vector R_r contains six elements, the measured radiances in the first six spectral intervals of table 1. Likewise, R_r^* is a vector of six radiances calculated (by the radiative transfer equation) from the surface temperature, the guess temperature profile, and the transmittances. Both R_r and R_r^* are scaled to the 700 cm^{-1} reference wavenumber through radiance-equivalent temperatures. The 6 x 100-dimensional matrix A consists of the six 100-dimensional weighting functions illustrated in appendix II.

Uncertainties in measurements of the radiances, originating from instrumental noise and calibration errors, quadrature errors, and uncertainties introduced in obtaining clear radiances, reside in N, a 6 x 6 dimensional variance-covariance matrix. Statistics of the atmosphere comprise the 100-dimensional diagonal matrix S, whose elements are variances of the 700 cm^{-1} Planck-radiance profile derived from a set of typical radiosonde measurements. The off-diagonal elements of S, which should contain the correlations among the temperatures at different levels of the atmosphere, are ignored for computational speed and simplicity.

Eq (16) and (17) express the solution as the guess profile plus a linear combination of differences between observed radiances and the radiances calculated from the guess profile. Large errors in the measurements of radiances (large N) will force the solution toward the guess. The solution will also tend toward the guess for layers of the atmosphere with small expected variations in the temperature (small S). Usually one application of eq (16) and (17) will provide a convergent solution in the sense that radiances calculated from the retrieved profile differ from the measured radiances by less than the standard deviation of the errors. Otherwise, eq (16) and (17) are applied again, with T* and R_r^* representing the result of the previous iteration. Since the matrix C is nearly independent of temperature, it is held constant from iteration to iteration, thus minimizing computation time.

Figures 14 and 15 compare operational VTPR retrievals with nearly simultaneous radiosondes for a high latitude (fig. 14) and a tropical (fig. 15) case. It is seen that the VTPR retrievals follow the trend of the radiosondes up to and beyond 50 mb. However, because the weighting functions are broad, the solution does not contain fine-scale structure unless it is introduced via the guess profile.

(5) Moisture Retrieval

The moisture retrieval begins with a measured radiance at 535 cm^{-1} and the retrieved temperature profile. The solution for the mixing ratio profile W is assumed to have the form

$$W = W^* + C\varphi \qquad (18)$$

where W* is the guess mixing ratio profile, C is a constant to be determined, and φ is an empirical orthogonal function (Alishouse et al. 1967) computed in advance of the retrieval from conventional sounding data. If it is impossible to compute φ because of lack of reliable data over certain areas, φ is assumed to be W* itself. The constant C is evaluated in the retrieval through the requirement that 535 cm^{-1} radiance computed from W be equal to the measured radiance within two standard deviations of the measurement errors. Finally the solution W is transformed to dew-point depression. Only one spectral interval is used to measure water vapor. With this single measurement, only one parameter (e.g., the value of C) can be determined. The distribution of the water vapor is determined by the relatively smooth functions W* and φ. Another limitation of any moisture retrieval is the

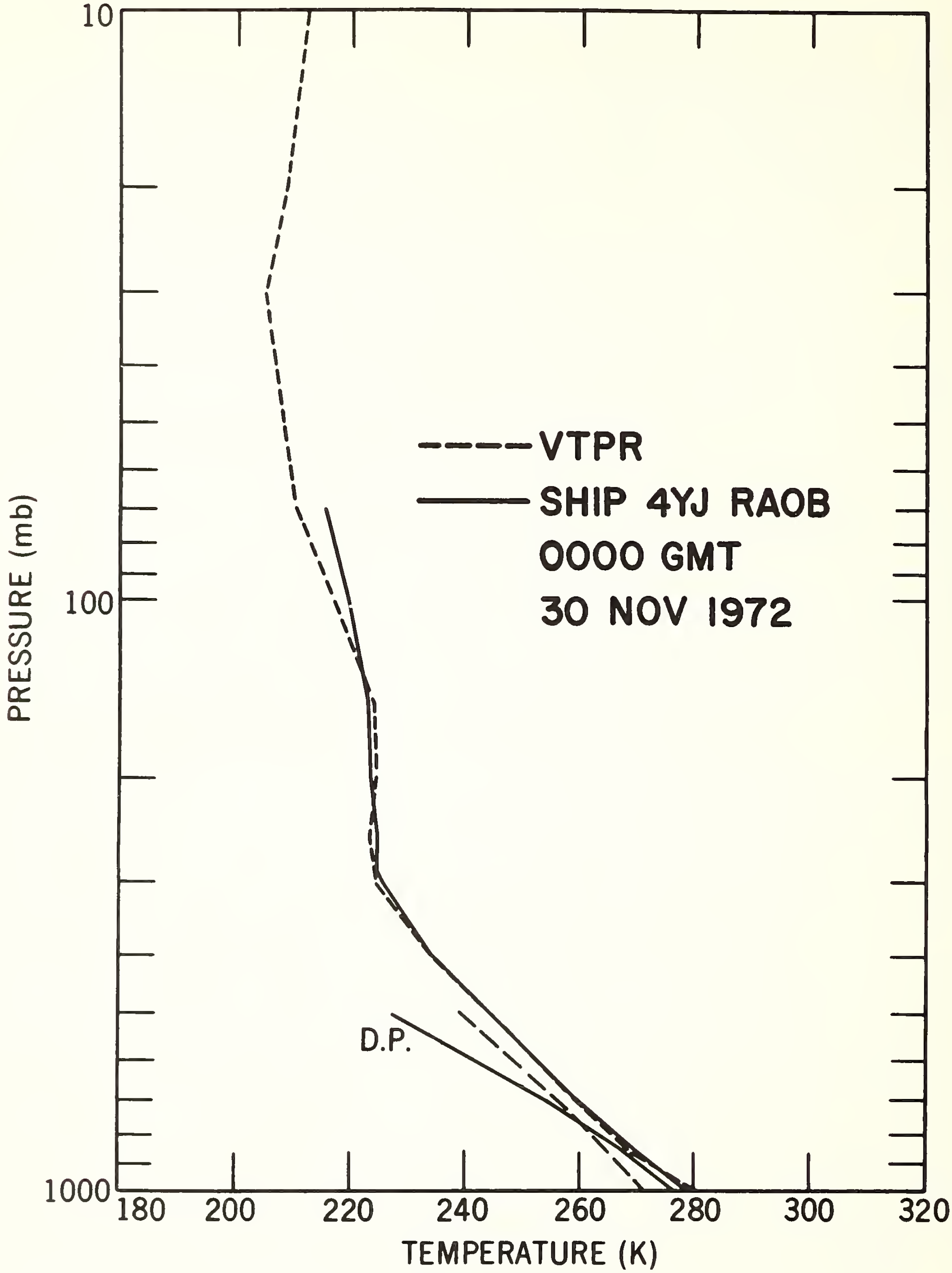


Figure 14.-- Comparison between a VTPR sounding and a radiosonde at 52.5° north, 20° west. D.P. indicates dewpoint.

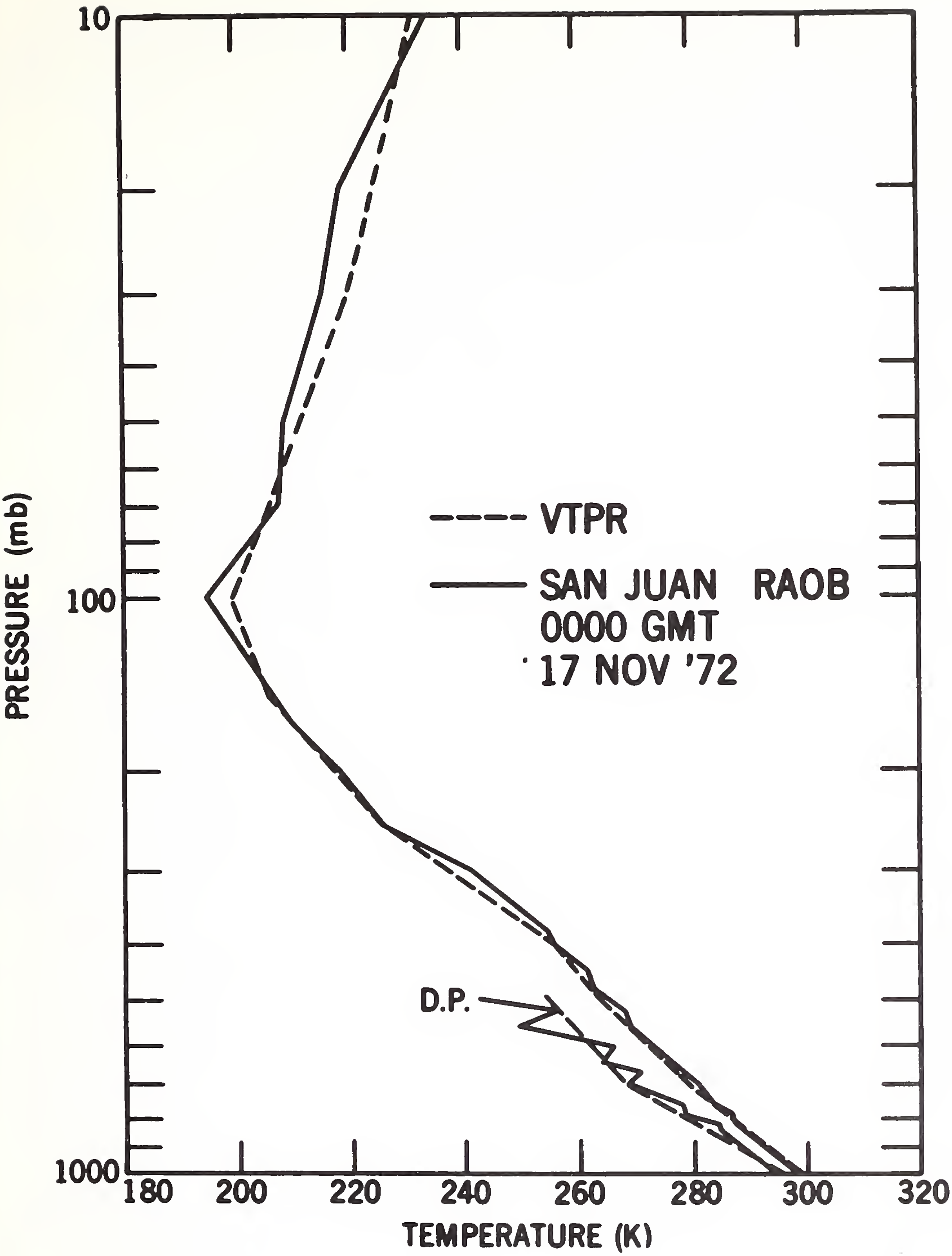


Figure 15.--Comparison between a VTPR sounding and a radiosonde at San Juan (18° north). D.P. indicates dewpoint.

dependence on accurate knowledge of the temperature profile since temperature enters strongly into the computation of radiance. Operational moisture retrievals appear in figures 14 and 15; the lack of detailed structure in the moisture retrievals is apparent.

(6) Output

For each sounding, the following quantities are passed to the quality control program:

a. Retrieved temperatures, heights, and guess temperatures at the 15 standard levels (1000, 850, 700, 500, 400, 300, 250, 200, 150, 100, 70, 50, 30, 20, and 10 mb) and at the tropopause

b. Clear radiances in the eight spectral intervals (table 1)

c. Dewpoint depression at the five standard levels up to the 400 mb level

d. Two coefficients to account for atmospheric attenuation (limb darkening) in the Scanning Radiometer measurements of equivalent temperature which are used to derive surface temperatures.

4. QUALITY TESTS AND REJECTION PROCEDURES

The final output from the VTPR is called the Satellite Infrared Sounding (SIRS); it includes location, heights, temperatures and dewpoint-temperature depressions at the mandatory pressure levels up to 400 mb, height and temperatures up to 10 mb, and temperatures at significant levels. Initially, only data from open water oceanic regions are being released to the user. Before the data are released, several tests are performed. Failure of any one test causes all data up to 100 mb to be deleted. There is no provision for manual adjustment of rejected data; however, operational personnel are provided with orbit-by-orbit summaries from which they are expected to note trends requiring corrective action. The following tests are performed on the data:

a. A superadiabatic temperature lapse rate test is performed on the tropospheric pressure layers bounded by the mandatory and significant pressure levels to insure a stable profile;

b. A gross error or "neighbor" check is performed on the difference between the NMC forecast first guess heights and the retrieved heights for all constant pressure levels. Values of this difference are calculated for all points in the neighborhood (within 500 km). A sounding is required to have at least one neighbor or it is automatically rejected. The value of the height difference for the point is required to agree with the average of the height differences for the other points in the neighborhood to within:

$\pm$ 200 m with one neighbor,

$\pm$ 100 m with two neighbors, or

$\pm$ 75 m with more than two neighbors.

c. When retrievals are extended to land areas on an operational basis, further location tests will be performed to insure that a proper adjustment has been made for the terrain elevation in the field of view.

The above tests are performed on all retrievals; however, the initial criteria used in (b) above for the Southern Hemisphere may be adjusted to the quality of available first guess profiles in this region.

When a retrieval is rejected, the cause is listed for the information of the operational personnel. At the conclusion of each data orbit, the rms temperature difference, E, between the first guess and the retrieval is plotted on a latitude-longitude grid, where the value of E for a retrieval is given by

$$E = (1/10) \left[\sum_{q=1}^{10} (T_q - \hat{T}_q)^2 \right]^{1/2} \tag{20}$$

where $\hat{T}_q$ and T_q are the first guess temperatures and retrieval temperatures, respectively, for the lowest 10 standard pressure levels.

Histograms of the change made to each first guess temperature are tabulated by mandatory level and by location (the Tropics between 18°N and 18°S and Northern Hemisphere and Southern Hemisphere extratropical areas).

At the end of each computer processing, coverage charts are plotted on polar stereographic maps for the Northern and Southern Hemispheres and on a Mercator map for the Tropics. Data rejected during the synoptic period are included but flagged in order to indicate any consistent geographical bias.

Additional checks are generated over selected areas or at selected times to monitor the performance of each VTPR channel, the communication links from the data acquisition stations, and the individual internal programs used to generate a SIRS sounding. Some retrieved soundings are compared with standard radiosonde reports, the NMC analyses, and the Scanning Radiometer (SR) data as a test for meteorological reasonableness. For example, the amount and pressure height of the cloud output are compared with the SR data to check the algorithms used in the clear radiance program. The 1000 to 300 mb thickness and the contoured height fields at 300 mb are also compared with the SR data and the NMC forecast and analyses.

A more complete quality control program is being developed. Further details will be published later in a supplement to this report.

5. DATA OUTPUTS AND ARCHIVES

A. General

Soundings that pass the quality control tests are archived and sent to a number of users. Three tapes are prepared to satisfy requirements of various users. One tape is used to send a teletype message; a second tape is sent to the National Meteorological Center (NMC); and a third tape is prepared as a data archive.

B. Teletype Messages

Teletype messages are formatted to conform to the code used for SIRS A and SIRS B (World Meteorological Organization 1972). Differences in the instrument design and the retrieval procedure require a change in the interpretation of several of the values given.

A number of adjacent measurements are used to obtain "clear" radiances from cloud contaminated values. These "clear" radiances are used in the retrieval, so cloud conditions do not affect the reliability of the data in the way that they affected the SIRS soundings. The cloud indicator is always set at zero to indicate a clear sounding, and no cloud information is transmitted.

This does not, however, indicate that no clouds are present.

When the Nimbus 3 and Nimbus 4 satellites were operational, retrievals were attempted only in the Northern Hemisphere where the NMC forecast was available. The 850-mb forecast height was used as a reference level for the height calculations. This procedure is currently being used with the VTPR data for regions covered by the NMC forecast. When the 850-mb forecast height is not available, the 1000-mb height is set to zero; for these cases, the value given as the 300-mb height is actually the 1000- to 300-mb thickness and the 1000-mb height is zero.

In summary, north of latitude 21°N all heights are referenced to the NMC 850-mb forecast height. South of latitude 18°N, all heights are actually thicknesses between the given level and 1000 mb. Between 18°N and 21°N, either method may be used, and the 1000-mb height must be checked to determine which is used for a given sounding.

To make the SIRS code more compatible with the capability of the VTPR instrument, the code will be modified in the near future, and "clear" radiances will be sent as a separate transmission.

C. Output to NMC

Soundings supplied to NMC are written on two tapes, one for each twelve-hour interval (0600-1800 GMT and 1800-0600 GMT). Data are output as soon as orbits are processed, and NMC uses the tapes as required by their operational schedule. The tapes are not available for general use, but the same soundings appear on the archival tape.

D. Archival Tapes

VTPR data are available in different forms (raw radiances, "clear radiances", and retrieved profiles) at three major points in the data processing. These data are written on tape as three separate files, each of which consists of a header record and a number of data records. The data content and the formats of these files are described in appendix III. This tape is transmitted to the Goddard Institute for Space Studies (GISS) in real time. A copy also is sent to the National Climatic Center at Asheville, North Carolina. Requests for data and questions concerning formats should be sent to the National Climatic Center, Federal Building, Asheville, North Carolina 28801.

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APPENDIX I

Miscellaneous Tables

Information contained in tables 2 and 3 applies to the instruments carried on NOAA 2. Tables 5 and 6 contain information about current operational procedures. These tables will be revised as needed and included in future revisions to this report.

Table 1.--VTPR data sequence and spot identifiers, (normal sequence)

Word no.	No. of words	Position code	Description
1-7	7	24/25	Primary optics
8	1	24/25	Not used
9-16	8	1	Spot 1, filters 1-8
17-24	8	2	Spot 2, filters 1-8
25-32	8	3	Spot 3, filters 1-8
33-40	8	4	Spot 4, filters 1-8
41-48	8	5	Spot 5, filters 1-8
49-56	8	6	Spot 6, filters 1-8
57-64	8	7	Spot 7, filters 1-8
65-72	8	8	Spot 8, filters 1-8
73-80	8	9	Spot 9, filters 1-8
81-88	8	10	Spot 10, filters 1-8
89-96	8	11	Spot 11, filters 1-8
97-104	8	12	Spot 12, filters 1-8
105-112	8	13	Spot 13, filters 1-8
113-120	8	14	Spot 14, filters 1-8
121-128	8	15	Spot 15, filters 1-8
129-136	8	16	Spot 16, filters 1-8
137-144	8	17	Spot 17, filters 1-8
145-152	8	18	Spot 18, filters 1-8
153-160	8	19	Spot 19, filters 1-8
161-168	8	20	Spot 20, filters 1-8
169-176	8	21	Spot 21, filters 1-8
177-184	8	22	Spot 22, filters 1-8
185-192	8	23	Spot 23, filters 1-8
193	1	24/25	Not used
194-195	2	24/25	Shroud
196	1	24/25	Not used
197-199	3	24/25	Secondary optics
- - - - - - - - - - - - - -flyback time -	- - - - - - - - - - - - -		
200	1	24/25	Primary optics
1-7	7	24/25	Primary optics

Table 2.--Spectral characteristics of VTPR filters, instruments 1 and 3

Filter	Instrument Number	Central wave-number	Filter band pass: Half-width	Filter band pass: Tenth-width	Filter band pass: Hundredth-width	Maximum trans-mittance
		(cm^{-1})	(cm^{-1})	(cm^{-1})	(cm^{-1})	
1	1	667.50	3.6	8.9	13.7	.320
	3	668.25	4.3	11.7	20.0	.320
2	1	677.40	11.1	16.6	22.4	.590
	3	677.95	11.1	16.4	23.2	.610
3	1	694.95	12.4	17.9	21.5	.540
	3	695.20	12.3			
4	1	708.25	10.7	15.3	21.2	.610
	3	708.95	10.9	15.3	20.0	.610
5	1	725.35	11.4	15.8	21.5	.740
	3	725.90	10.3	14.4	19.9	.635
6	1	747.40	12.0	16.5	21.6	.715
	3	747.40	11.8	16.7	22.3	.745
7	1	533.65	15.3	25.9	33.6	.495
	3	533.30	17.8	29.3	40.1	.510
8	1	835.25	7.1	15.3	24.6	.665
	3	835.75	6.9	16.2	24.8	.625

Table 3.--Spectral characteristics of instrument number 1, as determined by SEL and manufacturer.

Filter	Laboratory	Central wave-number	Filter band pass			Maximum transmittance
			Half-width	Tenth-width	Hundredth-width	
		(cm^{-1})	(cm^{-1})	(cm^{-1})	(cm^{-1})	
1	SEL	667.5	3.6	8.9	13.7	.32
	BEC	668.0	3.9	10.9	13.4	.30
3	SEL	694.8	12.2	17.9	21.7	.54
	OCLI	695.1	12.5	17.9	21.2	.54
4	SEL	708.3	10.6	15.0	21.8	.61
	OCLI	708.2	10.8	15.5	20.6	.61
5	SEL	725.3	11.3	15.6	20.9	.74
	OCLI	725.4	11.5	16.0	22.0	.74
6	SEL	747.4	12.0	16.1	21.4	.70
	OCLI	747.4	11.9	16.8	21.8	.73
7	SEL	532.80	15.4	26.4	31.3	.49
	OCLI	533.65	15.1	25.3	35.8	.50
8	SEL	835.1	7.0	15.0	22.9	.67
	OCLI	835.4	7.1	15.6	26.2	.66

Table 4.--VTPR data sequence and spot identifiers (calibration sequence)

Word no.	No. of words	Position code	Description
1-7	7	26	Primary optics
8	1	26	Zero Offset level
9	1	26	Not used
10-16	7	26	1st voltage level
17	1	26	Not used
18-24	7	26	2nd voltage level
25	1	26	Not used
26-32	7	26	3rd voltage level
33	1	26	Not used
34-40	7	26	4th voltage level
41	1	26	Not used
42-48	7	26	5th voltage level
49	1	26	Not used
50-56	7	26	6th voltage level
57	1	26	Not used
58-64	7	26	7th voltage level
65-320	256	27	Space look Filters 1-8 cycling
321-352	32	28	Mirror moving, not used
353-559	207	28	Patch look, filters 1-8 cycling
560	1	28	Shroud
561-567	7	29	Shroud
568	1	29	Detector
569-591	23	30	Detector
592	1	30	Patch
593-607	15	31	Patch
608	1	31	Not used

- - - - - - - - - - - - - - End of calibration - - - - - - - - - - -

Normal scan sequence resumes with spot 1, etc.

Table 5.--NMC fields used in VTPR retrievals

Field	Analysis interval	Forecast interval
Pressure:		
Tropopause	12 hr	12 & 18 hr
Temperature:		
Tropopause	12 hr	12 & 18 hr
1000 to 100 mb (10 levels)	12 hr	12 & 18 hr
70 to 10 mb (4 levels)	24 hr	--
Relative humidity:		
Tropopause	12 hr	--
Boundary layer	12 hr	12 & 18 hr
Heights		
850 mb	12 hr	12 & 18 hr

Table 6.--The 100 pressure levels used in VTPR retrievals

Level	Pressure (mb)	Level	Pressure (mb)	Level	Pressure (mb)
1	.010000	35	30.205717	68	271.245360
2	.022509	36	33.093637	69	284.886288
3	.043472	37	36.173585	70	299.010313
4	.075634	38	39.453026	71	313.627558
5	.121989	39	42.939518	72	328.748216
6	.185758	40	46.640713	73	344.382547
7	.270375	41	50.564355	74	360.540883
8	.379474	42	54.718280	75	377.233623
9	.516882	43	59.110411	76	394.471232
10	.686604	44	63.748763	77	412.264246
11	.892818	45	68.641437	78	430.623266
12	1.139871	46	73.796622	79	449.558960
13	1.432267	47	79.222593	80	469.082061
14	1.774667	48	84.927709	81	489.203370
15	2.171881	49	90.920415	82	509.933752
16	2.628863	50	97.209237	83	531.284137
17	3.150709	51	103.802787	84	553.265520
18	3.742652	52	110.709757	85	575.888960
19	4.410059	53	117.938919	86	599.165579
20	5.158426	54	125.499127	87	623.106566
21	5.993379	55	133.399315	88	647.723168
22	6.920666	56	141.648495	89	673.026699
23	7.946158	57	150.255758	90	699.028533
24	9.075845	58	159.230270	91	725.740107
25	10.315836	59	168.581278	92	753.172921
26	11.672352	60	178.318103	93	781.338533
27	13.151729	61	188.450141	94	810.248566
28	14.780413	62	198.986865	95	839.914701
29	16.504959	63	209.937822	96	870.348681
30	18.392029	64	221.312631	97	901.562308
31	20.428391	65	233.120986	98	933.567446
32	22.620917	66	245.372655	99	966.376016
33	24.976580	67	258.077476	100	1000.000000
34	27.502455				

APPENDIX II

Filter Characteristics and CO_2 Transmittances

Filter curves have been obtained for the first four VTPR instruments. These curves were used to calculate CO_2 transmittances and the resulting weighting functions (derivatives of the transmittances with respect to a function of pressure). Table 1 lists the pressures at which numerical values of transmittances and weighting functions are given.

For each instrument (set), twelve pages of data are given in the following order:

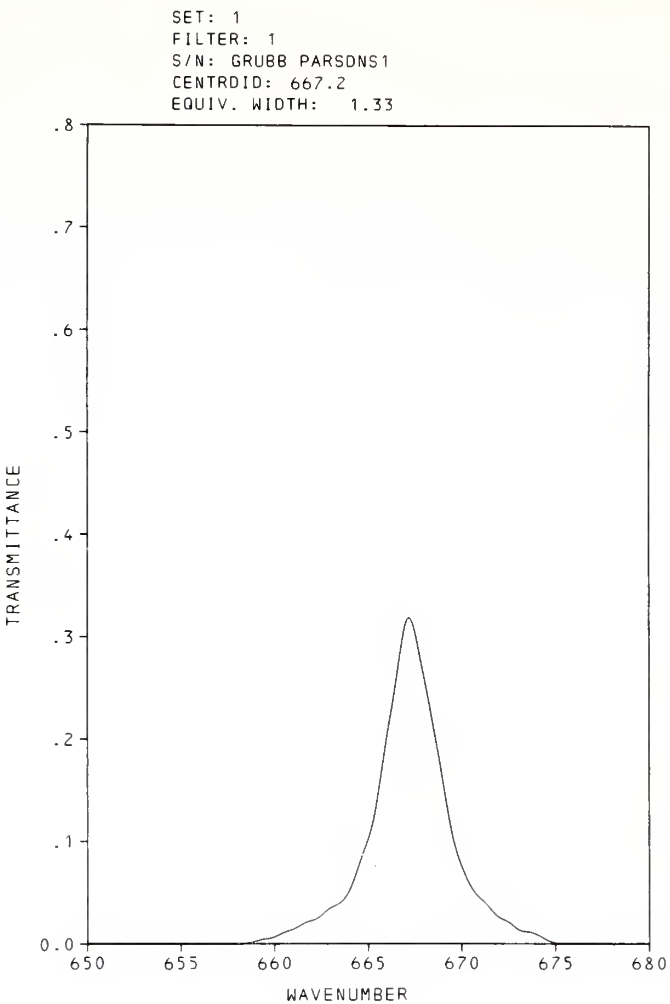
filter curves for channels 1 and 2
filter transmittances for channels 1 and 2
filter curves for channels 3 and 4
filter transmittances for channels 3 and 4
filter curves for channels 5 and 6
filter transmittances for channels 5 and 6
filter curves for channels 7 and 8
filter transmittances for channels 7 and 8
CO_2 transmittances at 0^o zenith angle
CO_2 weighting functions at 0^o zenith angle
CO_2 transmittances at 23.8^o zenith angle
CO_2 weighting functions at 23.8^o zenith angle.

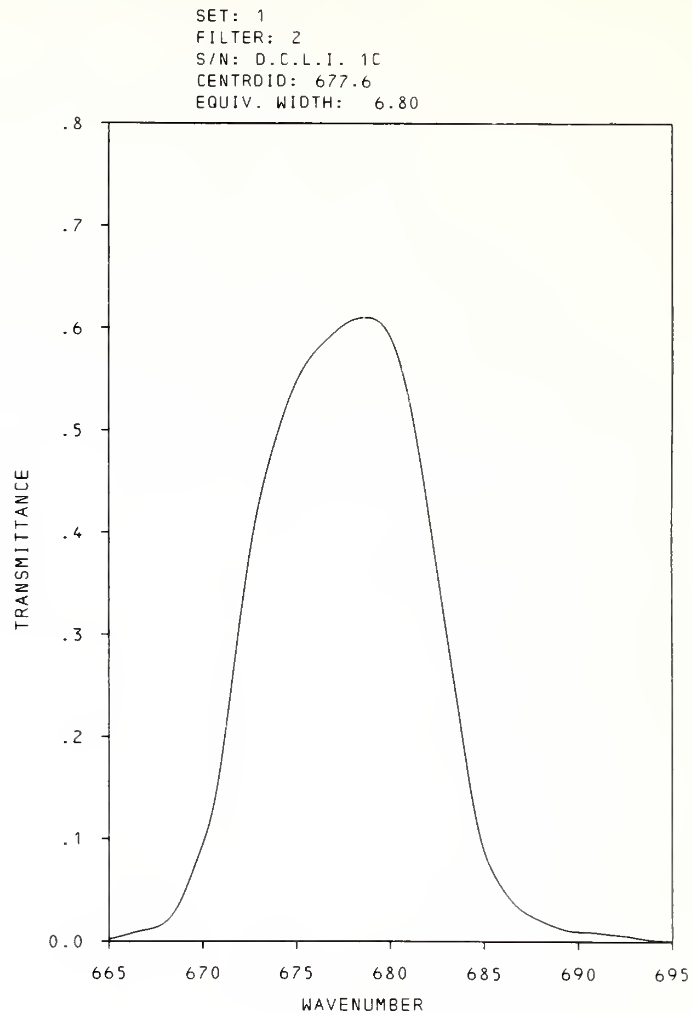
Instruments 1 and 3 were used on NOAA 2.

Table 1.--The 50 pressure levels for which CO_2 transmittances and weighting functions were calculated

Level	Pressure (mb)	Level	Pressure (mb)	Level	Pressure (mb)
2	.022509	36	33.093637	70	299.010313
4	.075634	38	39.453026	72	328.748216
6	.185758	40	46.640713	74	360.540883
8	.379474	42	54.718280	76	394.471232
10	.686604	44	63.748763	78	430.623266
12	1.139871	46	73.796622	80	469.082061
14	1.774667	48	84.927709	82	509.933752
16	2.628863	50	97.209237	84	553.265520
18	3.742652	52	110.709757	86	599.165579
20	5.158426	54	125.499127	88	647.723168
22	6.920666	56	141.648495	90	699.028533
24	9.075845	58	159.230270	92	753.172921
26	11.672352	60	178.318103	94	810.248566
28	14.780413	62	198.986865	96	870.348681
30	18.392029	64	221.312631	98	933.567446
32	22.620917	66	245.372655	100	1000.000000
34	27.502455	68	271.245360		

VTPR

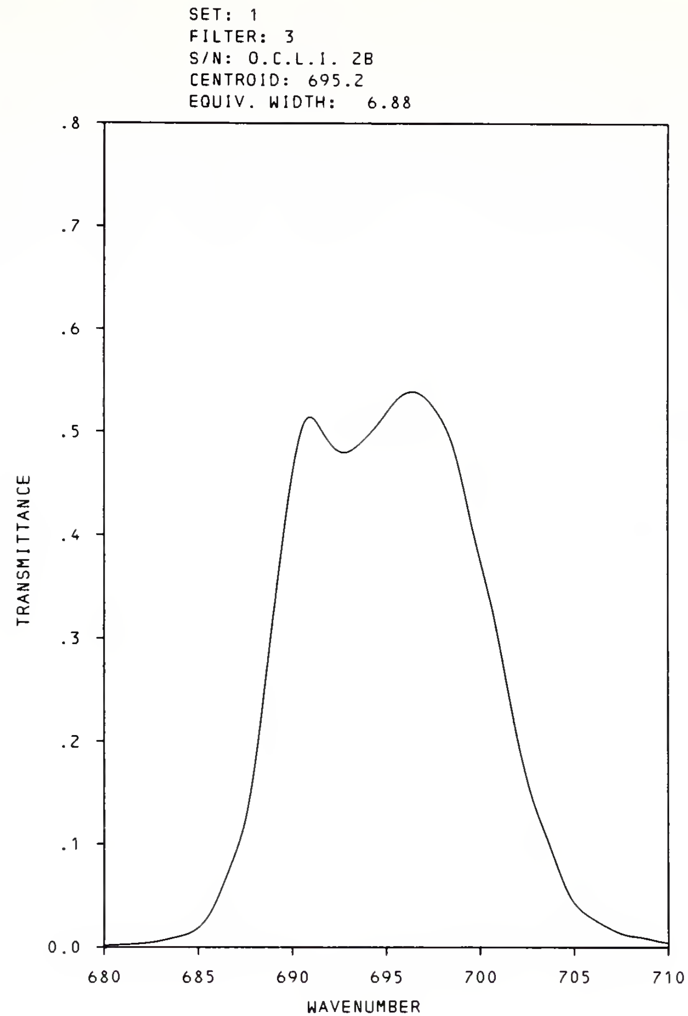

SET: 1
FILTER: 1
S/N: GRUBB PARSONS1
CENTROID: 667.2
EQUIV. WIDTH: 1.33
TRANSMITTANCE
.8
.7
.6
.5
.4
.3
.2
.1
0.0
650
655
660
665
670
675
680
WAVENUMBER

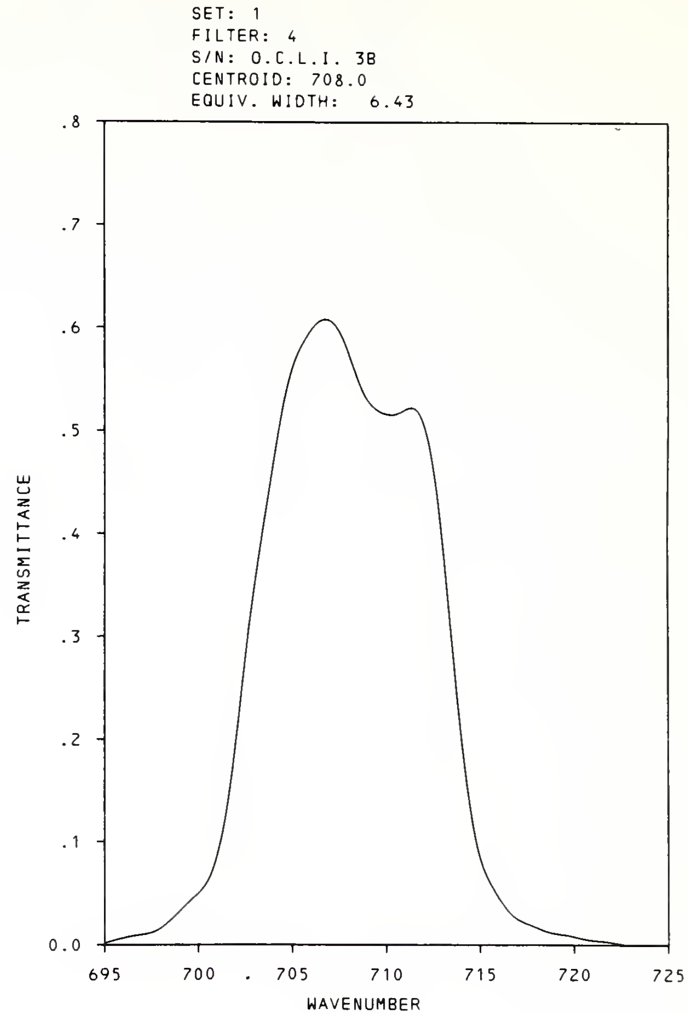

SET: 1
FILTER: 2
S/N: D.C.L.I. 1C
CENTROID: 677.6
EQUIV. WIDTH: 6.80
TRANSMITTANCE
.8
.7
.6
.5
.4
.3
.2
.1
0.0
665
670
675
680
685
690
695
WAVENUMBER

CM^{-1}	TRANS.	CM^{-1}	TRANS.
658.2	.00005	670.8	.04776
658.4	.00025	671.0	.04410
658.6	.00067	671.2	.04079
658.8	.00144	671.4	.03700
659.0	.00251	671.6	.03269
659.2	.00357	671.8	.02865
659.4	.00433	672.0	.02569
659.6	.00484	672.2	.02376
659.8	.00550	672.4	.02205
660.0	.00667	672.6	.01971
660.2	.00838	672.8	.01677
660.4	.01019	673.0	.01403
660.6	.01170	673.2	.01231
660.8	.01291	673.4	.01166
661.0	.01421	673.6	.01131
661.2	.01595	673.8	.01050
661.4	.01809	674.0	.00896
661.6	.02015	674.2	.00703
661.8	.02166	674.4	.00499
662.0	.02271	674.6	.00309
662.2	.02402	674.8	.00157
662.4	.02628	675.0	.00059
662.6	.02940	675.2	.00013
662.8	.03263	675.4	.00001
663.0	.03512		
663.2	.03692		
663.4	.03879		
663.6	.04154		
663.8	.04580		
664.0	.05202		
664.2	.06058		
664.4	.07099		
664.6	.08184		
664.8	.09182		
665.0	.10161		
665.2	.11397		
665.4	.13161		
665.6	.15431		
665.8	.17896		
666.0	.20242		
666.2	.22413		
666.4	.24618		
666.6	.27054		
666.8	.29501		
667.0	.31326		
667.2	.31897		
667.4	.31155		
667.6	.29608		
667.8	.27779		
668.0	.25929		
668.2	.24053		
668.4	.22135		
668.6	.20154		
668.8	.18080		
669.0	.15890		
669.2	.13668		
669.4	.11607		
669.6	.09901		
669.8	.08588		
670.0	.07552		
670.2	.06674		
670.4	.05903		
670.6	.05263		

CM^{-1}	TRANS.	CM^{-1}	TRANS.	CM^{-1}	TRANS.
663.8	.00000	676.4	.58474	689.0	.01306
664.0	.00014	676.6	.58828	689.2	.01197
664.2	.00027	676.8	.59175	689.4	.01102
664.4	.00048	677.0	.59508	689.6	.01027
664.6	.00082	677.2	.59827	689.8	.00979
664.8	.00122	677.4	.60127	690.0	.00952
665.0	.00190	677.6	.60385	690.2	.00932
665.2	.00265	677.8	.60603	690.4	.00925
665.4	.00354	678.0	.60766	690.6	.00911
665.6	.00449	678.2	.60888	690.8	.00884
665.8	.00551	678.4	.60963	691.0	.00850
666.0	.00660	678.6	.60997	691.2	.00809
666.2	.00768	678.8	.60990	691.4	.00768
666.4	.00870	679.0	.60936	691.6	.00721
666.6	.00959	679.2	.60807	691.8	.00680
666.8	.01040	679.4	.60582	692.0	.00646
667.0	.01108	679.6	.60229	692.2	.00605
667.2	.01183	679.8	.59732	692.4	.00571
667.4	.01278	680.0	.59066	692.6	.00524
667.6	.01414	680.2	.58223	692.8	.00469
667.8	.01598	680.4	.57196	693.0	.00408
668.0	.01850	680.6	.55985	693.2	.00340
668.2	.02183	680.8	.54564	693.4	.00279
668.4	.02618	681.0	.52953	693.6	.00224
668.6	.03176	681.2	.51157	693.8	.00184
668.8	.03862	681.4	.49206	694.0	.00150
669.0	.04672	681.6	.47098	694.2	.00129
669.2	.05576	681.8	.44867	694.4	.00116
669.4	.06535	682.0	.42535	694.6	.00109
669.6	.07514	682.2	.40128	694.8	.00095
669.8	.08480	682.4	.37679	695.0	.00075
670.0	.09466	682.6	.35218	695.2	.00054
670.2	.10554	682.8	.32790	695.4	.00034
670.4	.11832	683.0	.30383	695.6	.00014
670.6	.13389	683.2	.27996		
670.8	.15314	683.4	.25616		
671.0	.17599	683.6	.23209		
671.2	.20169	683.8	.20781		
671.4	.22923	684.0	.18354		
671.6	.25766	684.2	.16001		
671.8	.28622	684.4	.13811		
672.0	.31410	684.6	.11859		
672.2	.34089	684.8	.10227		
672.4	.36612	685.0	.08915		
672.6	.38931	685.2	.07868		
672.8	.41005	685.4	.07025		
673.0	.42827	685.6	.06317		
673.2	.44446	685.8	.05692		
673.4	.45908	686.0	.05107		
673.6	.47254	686.2	.04576		
673.8	.48532	686.4	.04100		
674.0	.49756	686.6	.03686		
674.2	.50926	686.8	.03332		
674.4	.52021	687.0	.03040		
674.6	.53027	687.2	.02788		
674.8	.53945	687.4	.02577		
675.0	.54768	687.6	.02387		
675.2	.55503	687.8	.02210		
675.4	.56155	688.0	.02040		
675.6	.56740	688.2	.01877		
675.8	.57250	688.4	.01720		
676.0	.57699	688.6	.01571		
676.2	.58100	688.8	.01435		

VTPR


SET: 1
FILTER: 3
S/N: O.C.L.I. 2B
CENTROID: 695.2
EQUIV. WIDTH: 6.88
TRANSMITTANCE
0.0
.1
.2
.3
.4
.5
.6
.7
.8
680
685
690
695
700
705
710
WAVENUMBER


SET: 1
FILTER: 4
S/N: O.C.L.I. 3B
CENTROID: 708.0
EQUIV. WIDTH: 6.43
TRANSMITTANCE
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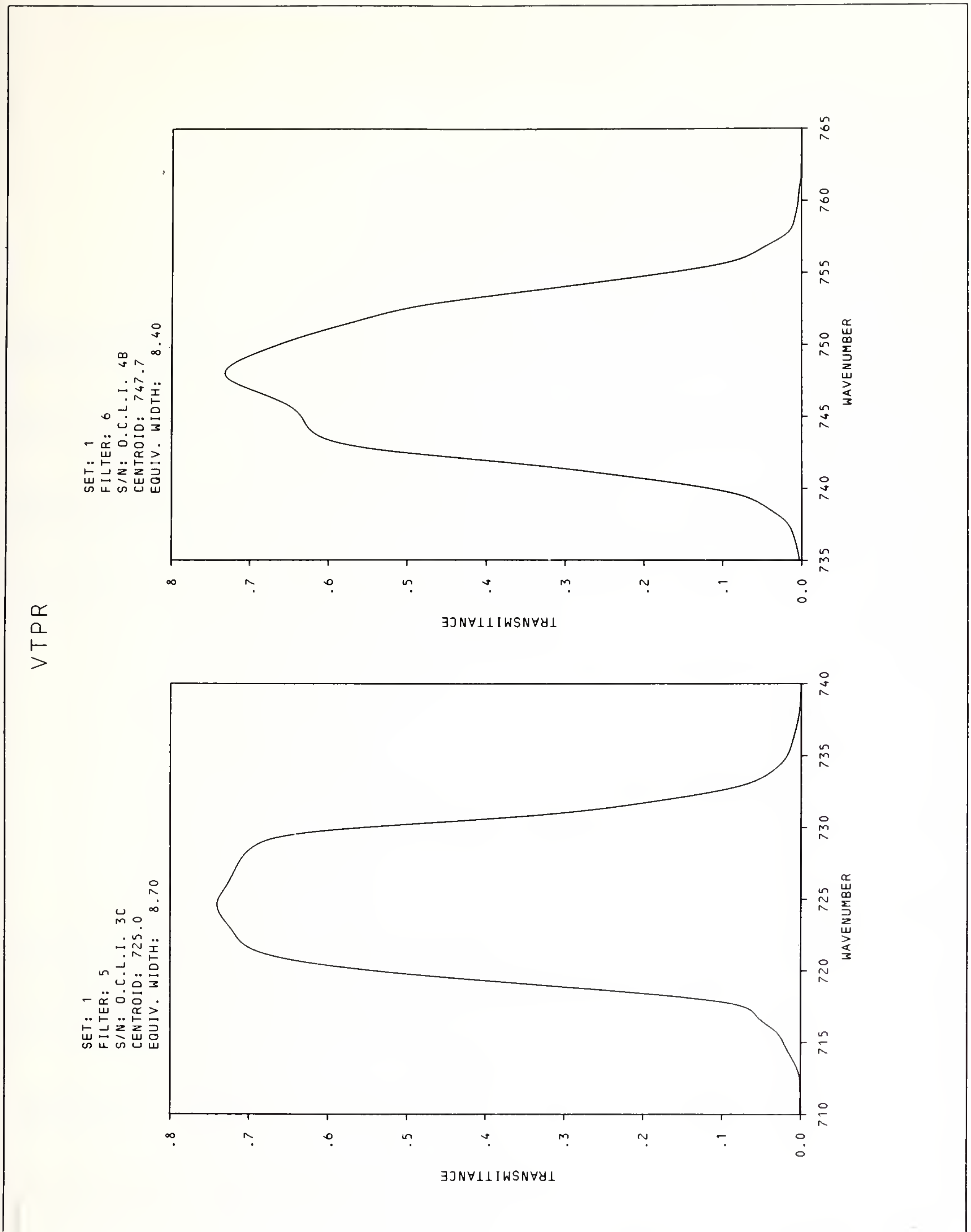
.1
.2
.3
.4
.5
.6
.7
.8
695
700
705
710
715
720
725
WAVENUMBER

CM^{-1}	TRANS.	CM^{-1}	TRANS.	CM^{-1}	TRANS.
678.8	.00007	691.4	.50714	704.0	.08390
679.0	.00028	691.6	.50109	704.2	.07379
679.2	.00048	691.8	.49510	704.4	.06430
679.4	.00069	692.0	.48988	704.6	.05578
679.6	.00089	692.2	.48554	704.8	.04862
679.8	.00110	692.4	.48238	705.0	.04305
680.0	.00131	692.6	.48045	705.2	.03865
680.2	.00151	692.8	.47990	705.4	.03514
680.4	.00172	693.0	.48066	705.6	.03232
680.6	.00193	693.2	.48252	705.8	.02978
680.8	.00206	693.4	.48513	706.0	.02737
681.0	.00227	693.6	.48829	706.2	.02517
681.2	.00248	693.8	.49173	706.4	.02304
681.4	.00268	694.0	.49538	706.6	.02098
681.6	.00289	694.2	.49923	706.8	.01905
681.8	.00309	694.4	.50329	707.0	.01712
682.0	.00344	694.6	.50769	707.2	.01541
682.2	.00378	694.8	.51243	707.4	.01382
682.4	.00420	695.0	.51738	707.6	.01252
682.6	.00468	695.2	.52234	707.8	.01155
682.8	.00530	695.4	.52701	708.0	.01080
683.0	.00605	695.6	.53121	708.2	.01025
683.2	.00688	695.8	.53458	708.4	.00983
683.4	.00770	696.0	.53705	708.6	.00928
683.6	.00860	696.2	.53857	708.8	.00867
683.8	.00942	696.4	.53905	709.0	.00784
684.0	.01025	696.6	.53864	709.2	.00701
684.2	.01128	696.8	.53712	709.4	.00612
684.4	.01245	697.0	.53472	709.6	.00536
684.6	.01403	697.2	.53141	709.8	.00468
684.8	.01609	697.4	.52729	710.0	.00426
685.0	.01871	697.6	.52261	710.2	.00385
685.2	.02215	697.8	.51732	710.4	.00351
685.4	.02641	698.0	.51126	710.6	.00316
685.6	.03184	698.2	.50418	710.8	.00275
685.8	.03851	698.4	.49558	711.0	.00227
686.0	.04628	698.6	.48506	711.2	.00165
686.2	.05488	698.8	.47234	711.4	.00103
686.4	.06403	699.0	.45748	711.6	.00034
686.6	.07338	699.2	.44132		
686.8	.08260	699.4	.42461		
687.0	.09195	699.6	.40797		
687.2	.10247	699.8	.39229		
687.4	.11513	700.0	.37757		
687.6	.13074	700.2	.36319		
687.8	.15034	700.4	.34861		
688.0	.17393	700.6	.33321		
688.2	.20061	700.8	.31636		
688.4	.22950	701.0	.29807		
688.6	.25969	701.2	.27881		
688.8	.29029	701.4	.25914		
689.0	.32069	701.6	.23954		
689.2	.35047	701.8	.22063		
689.4	.37929	702.0	.20274		
689.6	.40680	702.2	.18596		
689.8	.43272	702.4	.17049		
690.0	.45638	702.6	.15646		
690.2	.47701	702.8	.14394		
690.4	.49380	703.0	.13294		
690.6	.50590	703.2	.12283		
690.8	.51264	703.4	.11327		
691.0	.51429	703.6	.10385		
691.2	.51202	703.8	.09401		

CM^{-1}	TRANS.	CM^{-1}	TRANS.	CM^{-1}	TRANS.
694.8	.00051	707.4	.59941	720.0	.00785
695.0	.00154	707.6	.59291	720.2	.00701
695.2	.00251	707.8	.58462	720.4	.00611
695.4	.00354	708.0	.57484	720.6	.00534
695.6	.00450	708.2	.56436	720.8	.00469
695.8	.00547	708.4	.55394	721.0	.00424
696.0	.00643	708.6	.54430	721.2	.00386
696.2	.00727	708.8	.53619	721.4	.00354
696.4	.00804	709.0	.52989	721.6	.00322
696.6	.00868	709.2	.52507	721.8	.00277
696.8	.00926	709.4	.52153	722.0	.00225
697.0	.00971	709.6	.51902	722.2	.00167
697.2	.01029	709.8	.51716	722.4	.00103
697.4	.01106	710.0	.51587	722.6	.00032
697.6	.01222	710.2	.51529		
697.8	.01389	710.4	.51536		
698.0	.01614	710.6	.51626		
698.2	.01884	710.8	.51793		
698.4	.02186	711.0	.52005		
698.6	.02527	711.2	.52166		
698.8	.02881	711.4	.52198		
699.0	.03248	711.6	.52005		
699.2	.03614	711.8	.51510		
699.4	.03981	712.0	.50635		
699.6	.04334	712.2	.49343		
699.8	.04662	712.4	.47594		
700.0	.04997	712.6	.45330		
700.2	.05389	712.8	.42526		
700.4	.05897	713.0	.39234		
700.6	.06579	713.2	.35594		
700.8	.07485	713.4	.31761		
701.0	.08675	713.6	.27896		
701.2	.10173	713.8	.24147		
701.4	.12019	714.0	.20623		
701.6	.14238	714.2	.17389		
701.8	.16868	714.4	.14514		
702.0	.19852	714.6	.12051		
702.2	.23041	714.8	.10070		
702.4	.26302	715.0	.08559		
702.6	.29485	715.2	.07408		
702.8	.32443	715.4	.06534		
703.0	.35150	715.6	.05820		
703.2	.37658	715.8	.05183		
703.4	.40031	716.0	.04579		
703.6	.42346	716.2	.04019		
703.8	.44661	716.4	.03518		
704.0	.46970	716.6	.03087		
704.2	.49208	716.8	.02739		
704.4	.51298	717.0	.02476		
704.6	.53169	717.2	.02276		
704.8	.54751	717.4	.02116		
705.0	.56024	717.6	.01968		
705.2	.57053	717.8	.01826		
705.4	.57889	718.0	.01672		
705.6	.58584	718.2	.01524		
705.8	.59201	718.4	.01376		
706.0	.59741	718.6	.01254		
706.2	.60198	718.8	.01158		
706.4	.60545	719.0	.01087		
706.6	.60751	719.2	.01029		
706.8	.60809	719.4	.00984		
707.0	.60693	719.6	.00932		
707.2	.60404	719.8	.00868		

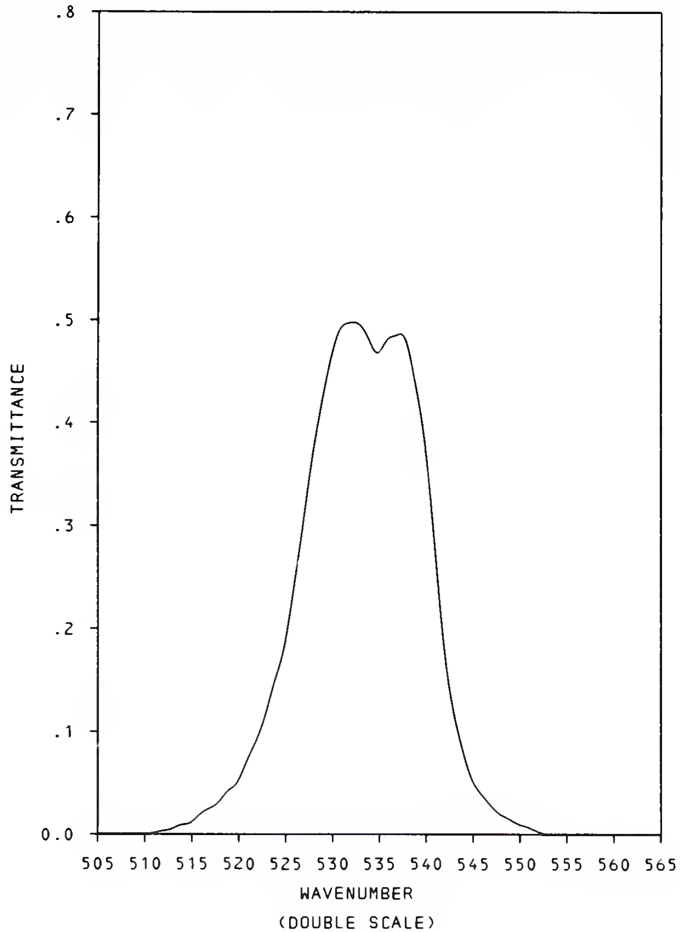

VTPR
SET: 1
FILTER: 5
S/N: O.C.L.I. 3C
CENTROID: 725.0
EQUIV. WIDTH: 8.70
TRANSMITTANCE
0.0 .1 .2 .3 .4 .5 .6 .7 .8
WAVENUMBER
710 715 720 725 730 735 740
SET: 1
FILTER: 6
S/N: O.C.L.I. 4B
CENTROID: 747.7
EQUIV. WIDTH: 8.40
TRANSMITTANCE
0.0 .1 .2 .3 .4 .5 .6 .7 .8
WAVENUMBER
735 740 745 750 755 760 765

CM^{-1}	TRANS.	CM^{-1}	TRANS.	CM^{-1}	TRANS.
711.8	.00009	724.4	.74020	737.0	.00566
712.0	.00017	724.6	.74029	737.2	.00479
712.2	.00044	724.8	.73951	737.4	.00400
712.4	.00087	725.0	.73803	737.6	.00331
712.6	.00157	725.2	.73603	737.8	.00270
712.8	.00252	725.4	.73368	738.0	.00218
713.0	.00383	725.6	.73124	738.2	.00174
713.2	.00531	725.8	.72880	738.4	.00139
713.4	.00714	726.0	.72671	738.6	.00113
713.6	.00896	726.2	.72463	738.8	.00087
713.8	.01105	726.4	.72271	739.0	.00061
714.0	.01305	726.6	.72088	739.2	.00044
714.2	.01514	726.8	.71914	739.4	.00026
714.4	.01714	727.0	.71732	739.6	.00009
714.6	.01906	727.2	.71540		
714.8	.02089	727.4	.71340		
715.0	.02263	727.6	.71122		
715.2	.02463	727.8	.70870		
715.4	.02706	728.0	.70592		
715.6	.03011	728.2	.70244		
715.8	.03411	728.4	.69826		
716.0	.03890	728.6	.69304		
716.2	.04403	728.8	.68660		
716.4	.04891	729.0	.67781		
716.6	.05326	729.2	.66467		
716.8	.05648	729.4	.64526		
717.0	.05944	729.6	.61759		
717.2	.06405	729.8	.57974		
717.4	.07231	730.0	.53257		
717.6	.08624	730.2	.48001		
717.8	.10782	730.4	.42579		
718.0	.13732	730.6	.37384		
718.2	.17309	730.8	.32807		
718.4	.21364	731.0	.28943		
718.6	.25741	731.2	.25663		
718.8	.30283	731.4	.22817		
719.0	.34869	731.6	.20232		
719.2	.39412	731.8	.17778		
719.4	.43824	732.0	.15403		
719.6	.48010	732.2	.13158		
719.8	.51899	732.4	.11104		
720.0	.55441	732.6	.09294		
720.2	.58600	732.8	.07788		
720.4	.61385	733.0	.06588		
720.6	.63760	733.2	.05648		
720.8	.65736	733.4	.04891		
721.0	.67311	733.6	.04273		
721.2	.68547	733.8	.03742		
721.4	.69495	734.0	.03255		
721.6	.70209	734.2	.02828		
721.8	.70748	734.4	.02454		
722.0	.71166	734.6	.02141		
722.2	.71479	734.8	.01880		
722.4	.71740	735.0	.01671		
722.6	.71975	735.2	.01505		
722.8	.72228	735.4	.01366		
723.0	.72515	735.6	.01253		
723.2	.72811	735.8	.01149		
723.4	.73098	736.0	.01044		
723.6	.73376	736.2	.00940		
723.8	.73611	736.4	.00844		
724.0	.73811	736.6	.00748		
724.2	.73951	736.8	.00653		

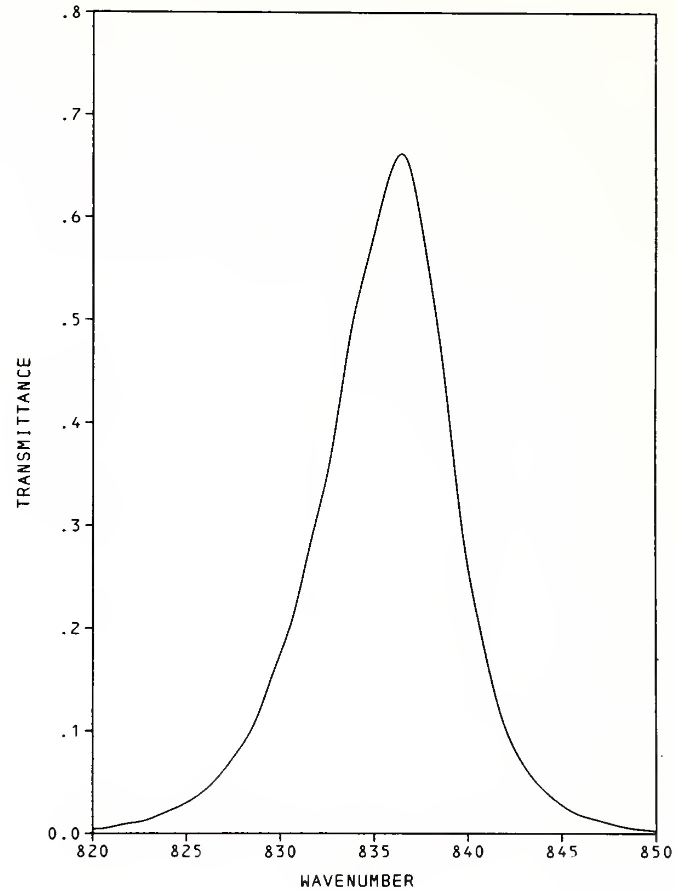
CM^{-1}	TRANS.	CM^{-1}	TRANS.	CM^{-1}	TRANS.
733.8	.00017	746.4	.67774	759.0	.00765
734.0	.00059	746.6	.68715	759.2	.00681
734.2	.00092	746.8	.69681	759.4	.00605
734.4	.00134	747.0	.70622	759.6	.00529
734.6	.00176	747.2	.71496	759.8	.00471
734.8	.00227	747.4	.72236	760.0	.00429
735.0	.00277	747.6	.72799	760.2	.00395
735.2	.00328	747.8	.73135	760.4	.00361
735.4	.00395	748.0	.73228	760.6	.00319
735.6	.00462	748.2	.73093	760.8	.00277
735.8	.00538	748.4	.72774	761.0	.00227
736.0	.00630	748.6	.72295	761.2	.00168
736.2	.00723	748.8	.71673	761.4	.00101
736.4	.00832	749.0	.70942	761.6	.00034
736.6	.00941	749.2	.70118		
736.8	.01059	749.4	.69228		
737.0	.01193	749.6	.68286		
737.2	.01353	749.8	.67312		
737.4	.01563	750.0	.66320		
737.6	.01832	750.2	.65295		
737.8	.02185	750.4	.64219		
738.0	.02622	750.6	.63093		
738.2	.03118	750.8	.61891		
738.4	.03655	751.0	.60622		
738.6	.04219	751.2	.59311		
738.8	.04782	751.4	.57984		
739.0	.05395	751.6	.56656		
739.2	.06126	751.8	.55353		
739.4	.07050	752.0	.54043		
739.6	.08261	752.2	.52648		
739.8	.09832	752.4	.51093		
740.0	.11773	752.6	.49311		
740.2	.14017	752.8	.47211		
740.4	.16496	753.0	.44790		
740.6	.19135	753.2	.42143		
740.8	.21883	753.4	.39336		
741.0	.24715	753.6	.36446		
741.2	.27681	753.8	.33555		
741.4	.30832	754.0	.30706		
741.6	.34210	754.2	.27891		
741.8	.37857	754.4	.25109		
742.0	.41706	754.6	.22362		
742.2	.45563	754.8	.19647		
742.4	.49236	755.0	.17017		
742.6	.52547	755.2	.14530		
742.8	.55295	755.4	.12277		
743.0	.57446	755.6	.10336		
743.2	.59068	755.8	.08773		
743.4	.60278	756.0	.07580		
743.6	.61152	756.2	.06672		
743.8	.61799	756.4	.05950		
744.0	.62269	756.6	.05319		
744.2	.62614	756.8	.04672		
744.4	.62875	757.0	.03992		
744.6	.63093	757.2	.03319		
744.8	.63312	757.4	.02689		
745.0	.63555	757.6	.02134		
745.2	.63858	757.8	.01697		
745.4	.64236	758.0	.01395		
745.6	.64715	758.2	.01185		
745.8	.65320	758.4	.01042		
746.0	.66051	758.6	.00941		
746.2	.66875	758.8	.00857		

VTPR

SET: 1
FILTER: 7
S/N: O.C.L.I. 1-3-B
CENTROID: 533.1
EQUIV. WIDTH: 8.15



SET: 1
FILTER: 8
S/N: O.C.L.I. 1D
CENTROID: 835.5
EQUIV. WIDTH: 5.58



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510.1	.00024	522.7	.11203	535.3	.47246	547.9	.01939
510.3	.00041	522.9	.11814	535.5	.47564	548.1	.01825
510.5	.00057	523.1	.12473	535.7	.47865	548.3	.01727
510.7	.00081	523.3	.13150	535.9	.48110	548.5	.01638
510.9	.00114	523.5	.13834	536.1	.48264	548.7	.01548
511.1	.00155	523.7	.14486	536.3	.48362	548.9	.01450
511.3	.00196	523.9	.15097	536.5	.48419	549.1	.01344
511.5	.00244	524.1	.15675	536.7	.48468	549.3	.01238
511.7	.00285	524.3	.16254	536.9	.48533	549.5	.01132
511.9	.00318	524.5	.16881	537.1	.48598	549.7	.01043
512.1	.00350	524.7	.17598	537.3	.48607	549.9	.00961
512.3	.00375	524.9	.18445	537.5	.48525	550.1	.00896
512.5	.00416	525.1	.19431	537.7	.48289	550.3	.00839
512.7	.00464	525.3	.20515	537.9	.47857	550.5	.00790
512.9	.00538	525.5	.21680	538.1	.47222	550.7	.00733
513.1	.00619	525.7	.22894	538.3	.46431	550.9	.00668
513.3	.00717	525.9	.24108	538.5	.45543	551.1	.00587
513.5	.00798	526.1	.25322	538.7	.44582	551.3	.00505
513.7	.00872	526.3	.26552	538.9	.43612	551.5	.00424
513.9	.00921	526.5	.27790	539.1	.42635	551.7	.00342
514.1	.00945	526.7	.29053	539.3	.41600	551.9	.00261
514.3	.00970	526.9	.30357	539.5	.40468	552.1	.00196
514.5	.01002	527.1	.31685	539.7	.39197	552.3	.00139
514.7	.01059	527.3	.33013	539.9	.37746	552.5	.00081
514.9	.01157	527.5	.34324	540.1	.36109	552.7	.00024
515.1	.01295	527.7	.35587	540.3	.34316		
515.3	.01458	527.9	.36793	540.5	.32385		
515.5	.01638	528.1	.37926	540.7	.30349		
515.7	.01817	528.3	.38993	540.9	.28238		
515.9	.01980	528.5	.40019	541.1	.26096		
516.1	.02118	528.7	.41013	541.3	.23969		
516.3	.02241	528.9	.41983	541.5	.21924		
516.5	.02355	529.1	.42936	541.7	.20002		
516.7	.02452	529.3	.43857	541.9	.18250		
516.9	.02542	529.5	.44753	542.1	.16702		
517.1	.02640	529.7	.45592	542.3	.15317		
517.3	.02737	529.9	.46391	542.5	.14095		
517.5	.02860	530.1	.47124	542.7	.13003		
517.7	.03014	530.3	.47784	542.9	.12025		
517.9	.03202	530.5	.48346	543.1	.11137		
518.1	.03422	530.7	.48810	543.3	.10323		
518.3	.03658	530.9	.49161	543.5	.09565		
518.5	.03894	531.1	.49397	543.7	.08848		
518.7	.04106	531.3	.49544	543.9	.08155		
518.9	.04277	531.5	.49633	544.1	.07479		
519.1	.04416	531.7	.49682	544.3	.06844		
519.3	.04538	531.9	.49715	544.5	.06257		
519.5	.04685	532.1	.49739	544.7	.05736		
519.7	.04872	532.3	.49747	544.9	.05288		
519.9	.05149	532.5	.49723	545.1	.04921		
520.1	.05499	532.7	.49649	545.3	.04611		
520.3	.05899	532.9	.49535	545.5	.04351		
520.5	.06339	533.1	.49348	545.7	.04114		
520.7	.06779	533.3	.49120	545.9	.03886		
520.9	.07210	533.5	.48827	546.1	.03666		
521.1	.07618	533.7	.48484	546.3	.03438		
521.3	.08009	533.9	.48102	546.5	.03218		
521.5	.08400	534.1	.47694	546.7	.03006		
521.7	.08799	534.3	.47311	546.9	.02795		
521.9	.09206	534.5	.47010	547.1	.02591		
522.1	.09655	534.7	.46831	547.3	.02403		
522.3	.10127	534.9	.46822	547.5	.02224		

CM^{-1}	TRANS.	CM^{-1}	TRANS.	CM^{-1}	TRANS.
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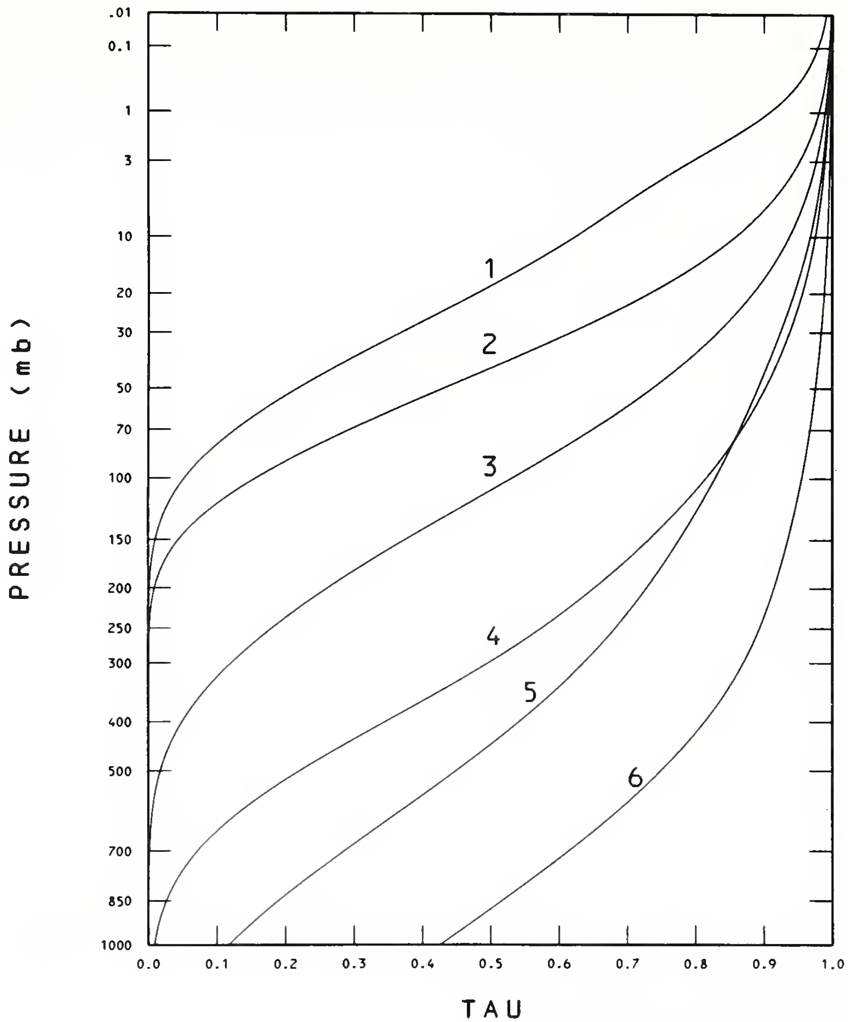
816.0	.00028	828.6	.10593	841.2	.15575
816.2	.00050	828.8	.11436	841.4	.14046
816.4	.00073	829.0	.12384	841.6	.12646
816.6	.00089	829.2	.13405	841.8	.11397
816.8	.00112	829.4	.14459	842.0	.10314
817.0	.00128	829.6	.15497	842.2	.09377
817.2	.00151	829.8	.16490	842.4	.08557
817.4	.00173	830.0	.17438	842.6	.07832
817.6	.00190	830.2	.18392	842.8	.07179
817.8	.00212	830.4	.19418	843.0	.06588
818.0	.00229	830.6	.20562	843.2	.06047
818.2	.00245	830.8	.21884	843.4	.05556
818.4	.00268	831.0	.23373	843.6	.05110
818.6	.00290	831.2	.24969	843.8	.04697
818.8	.00312	831.4	.26603	844.0	.04323
819.0	.00335	831.6	.28221	844.2	.03972
819.2	.00357	831.8	.29755	844.4	.03648
819.4	.00379	832.0	.31211	844.6	.03347
819.6	.00396	832.2	.32684	844.8	.03057
819.8	.00407	832.4	.34257	845.0	.02784
820.0	.00413	832.6	.36020	845.2	.02527
820.2	.00424	832.8	.38056	845.4	.02298
820.4	.00441	833.0	.40343	845.6	.02092
820.6	.00474	833.2	.42753	845.8	.01919
820.8	.00530	833.4	.45168	846.0	.01774
821.0	.00608	833.6	.47450	846.2	.01651
821.2	.00692	833.8	.49475	846.4	.01545
821.4	.00781	834.0	.51226	846.6	.01450
821.6	.00865	834.2	.52771	846.8	.01350
821.8	.00932	834.4	.54199	847.0	.01250
822.0	.00987	834.6	.55594	847.2	.01149
822.2	.01032	834.8	.57028	847.4	.01049
822.4	.01088	835.0	.58517	847.6	.00948
822.6	.01155	835.2	.60018	847.8	.00853
822.8	.01250	835.4	.61479	848.0	.00759
823.0	.01372	835.6	.62857	848.2	.00675
823.2	.01512	835.8	.64101	848.4	.00597
823.4	.01662	836.0	.65139	848.6	.00530
823.6	.01819	836.2	.65875	848.8	.00474
823.8	.01980	836.4	.66221	849.0	.00430
824.0	.02131	836.6	.66081	849.2	.00396
824.2	.02287	836.8	.65367	849.4	.00357
824.4	.02443	837.0	.64101	849.6	.00324
824.6	.02611	837.2	.62400	849.8	.00279
824.8	.02789	837.4	.60397	850.0	.00223
825.0	.02984	837.6	.58216	850.2	.00167
825.2	.03191	837.8	.55984	850.4	.00100
825.4	.03420	838.0	.53736	850.6	.00033
825.6	.03665	838.2	.51410		
825.8	.03938	838.4	.48956		
826.0	.04234	838.6	.46312		
826.2	.04558	838.8	.43422		
826.4	.04909	839.0	.40320		
826.6	.05294	839.2	.37141		
826.8	.05712	839.4	.34011		
827.0	.06164	839.6	.31060		
827.2	.06644	839.8	.28427		
827.4	.07140	840.0	.26135		
827.6	.07642	840.2	.24104		
827.8	.08156	840.4	.22269		
828.0	.08680	840.6	.20545		
828.2	.09243	840.8	.18860		

VTPR

SET: 1

CO_2 TRANSMITTANCES



CO_2 TRANSMITTANCE VALUES

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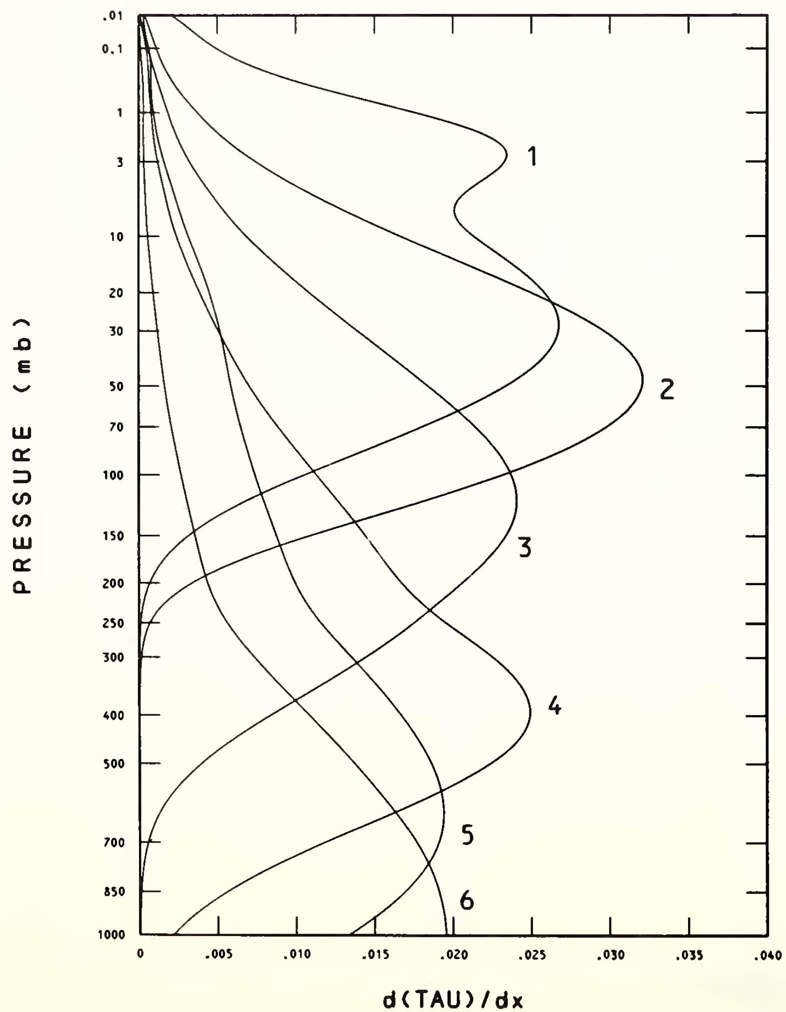
.98878	.99800	.99902	.99981	.99980	.99998
.98147	.99644	.99819	.99924	.99908	.99991
.97051	.99395	.99684	.99822	.99773	.99967
.95468	.99054	.99488	.99704	.99623	.99926
.93071	.98550	.99214	.99569	.99464	.99870
.89774	.97851	.98863	.99415	.99285	.99812
.85654	.96927	.98428	.99241	.99071	.99754
.81044	.95727	.97891	.99037	.98807	.99695
.76418	.94189	.97225	.98790	.98475	.99629
.72081	.92258	.96403	.98489	.98068	.99554
.68006	.89882	.95409	.98133	.97586	.99468
.63937	.87015	.94226	.97717	.97029	.99368
.59631	.83621	.92821	.97223	.96384	.99251
.54997	.79676	.91167	.96638	.95645	.99112
.50054	.75174	.89247	.95955	.94817	.98949
.44870	.70135	.87044	.95165	.93908	.98761
.39545	.64609	.84549	.94265	.92930	.98547
.34201	.58675	.81750	.93244	.91893	.98306
.28965	.52445	.78643	.92098	.90804	.98035
.23963	.46052	.75235	.90821	.89672	.97736
.19311	.39644	.71531	.89401	.88493	.97403
.15103	.33369	.67541	.87822	.87260	.97034
.11411	.27368	.63287	.86070	.85967	.96622
.08285	.21767	.58804	.84133	.84609	.96165
.05747	.16687	.54144	.82006	.83180	.95660
.03790	.12240	.49370	.79687	.81676	.95105
.02358	.08508	.44553	.77174	.80092	.94498
.01374	.05552	.39767	.74468	.78422	.93836
.00742	.03363	.35089	.71577	.76667	.93119
.00365	.01876	.30594	.68512	.74824	.92345
.00161	.00952	.26333	.65263	.72886	.91507
.00061	.00436	.22343	.61810	.70835	.90589
.00021	.00187	.18639	.58101	.68636	.89560
.00006	.00075	.15231	.54082	.66252	.88381
.00001	.00030	.12152	.49740	.63660	.87021
.00000	.00011	.09439	.45097	.60849	.85451
	.00003	.07106	.40240	.57827	.83662
	.00002	.05166	.35276	.54607	.81645
	.00002	.03622	.30314	.51206	.79398
	.00001	.02440	.25483	.47646	.76924
	.00000	.01572	.20923	.43951	.74232
		.00966	.16749	.40152	.71333
		.00566	.13029	.36292	.68236
		.00317	.09824	.32412	.64952
		.00167	.07182	.28558	.61493
		.00084	.05076	.24789	.57887
		.00042	.03457	.21163	.54164
		.00019	.02270	.17743	.50355
		.00008	.01441	.14584	.46485
		.00004	.00893	.11743	.42581

VTPR

SET: 1

CO_2 WEIGHTING FUNCTIONS



CO_2 WEIGHTING FUNCTION VALUES

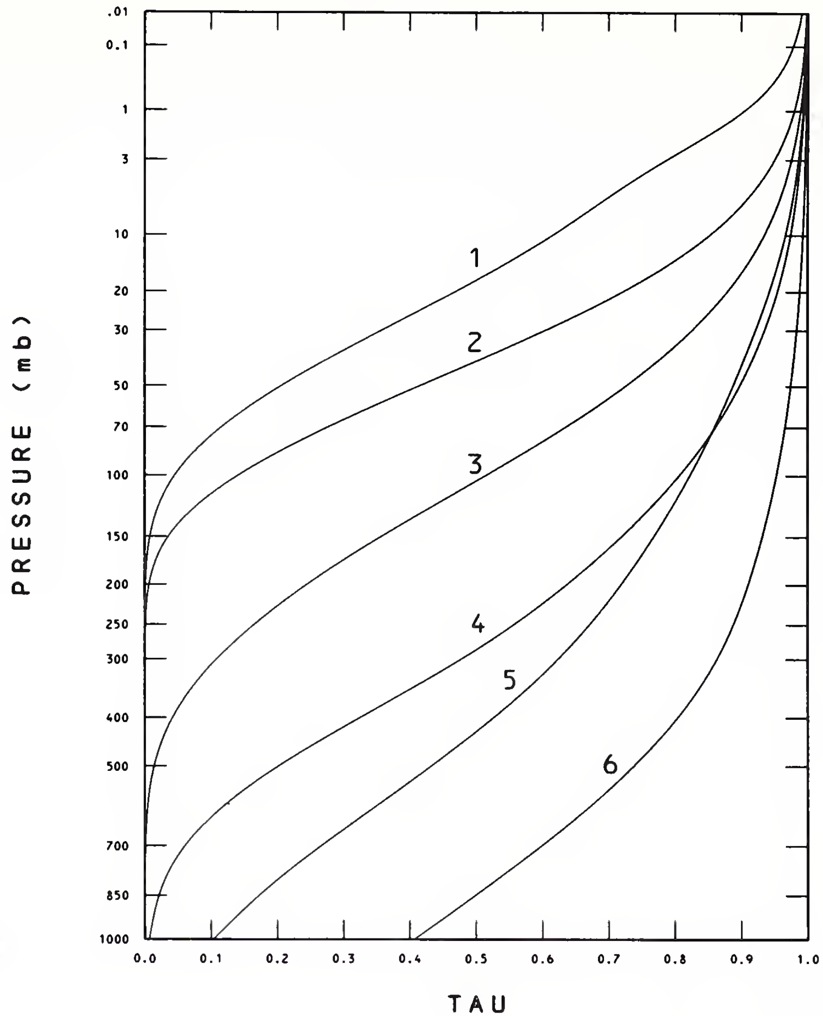
1	2	3	4	5	6
.00256	.00049	.00032	.00013	.00016	.00001
.00475	.00109	.00054	.00045	.00059	.00007
.00639	.00141	.00081	.00055	.00072	.00016
.00975	.00207	.00117	.00063	.00077	.00025
.01423	.00299	.00156	.00072	.00083	.00029
.01871	.00402	.00196	.00082	.00097	.00029
.02221	.00526	.00241	.00093	.00118	.00029
.02346	.00680	.00298	.00112	.00148	.00031
.02255	.00863	.00370	.00137	.00185	.00035
.02087	.01073	.00453	.00164	.00223	.00040
.02011	.01307	.00542	.00192	.00259	.00046
.02079	.01562	.00644	.00226	.00299	.00053
.02233	.01834	.00763	.00269	.00346	.00064
.02399	.02112	.00892	.00317	.00392	.00075
.02539	.02388	.01030	.00368	.00435	.00088
.02636	.02647	.01173	.00422	.00473	.00100
.02678	.02873	.01323	.00479	.00504	.00114
.02656	.03052	.01477	.00541	.00532	.00128
.02570	.03167	.01629	.00605	.00556	.00142
.02422	.03213	.01778	.00673	.00577	.00158
.02222	.03183	.01925	.00748	.00602	.00175
.01981	.03081	.02063	.00832	.00631	.00195
.01708	.02911	.02188	.00922	.00662	.00217
.01416	.02680	.02291	.01016	.00697	.00240
.01122	.02390	.02364	.01112	.00733	.00265
.00841	.02051	.02404	.01208	.00771	.00290
.00597	.01676	.02407	.01305	.00813	.00317
.00395	.01282	.02373	.01400	.00856	.00345
.00245	.00911	.02299	.01489	.00899	.00372
.00139	.00589	.02193	.01577	.00944	.00402
.00071	.00347	.02065	.01673	.00995	.00437
.00032	.00180	.01924	.01785	.01059	.00484
.00011	.00081	.01779	.01929	.01143	.00549
.00004	.00035	.01625	.02091	.01243	.00632
.00001	.00014	.01450	.02250	.01351	.00731
.00000	.00006	.01262	.02384	.01460	.00839
.00000	.00002	.01069	.02464	.01562	.00951
	.00000	.00870	.02491	.01657	.01066
	.00000	.00677	.02460	.01743	.01181
	.00001	.00508	.02359	.01816	.01292
	.00000	.00364	.02190	.01877	.01398
		.00247	.01979	.01918	.01500
		.00158	.01736	.01939	.01596
		.00096	.01463	.01938	.01687
		.00056	.01183	.01911	.01769
		.00029	.00927	.01854	.01835
		.00015	.00696	.01766	.01885
		.00008	.00498	.01650	.01922
		.00003	.00338	.01505	.01946
		.00001	.00217	.01331	.01956

VTPR

[ZENITH ANGLE 23°47']

SET: 1

CO_2 TRANSMITTANCES



CO_2 TRANSMITTANCE VALUES

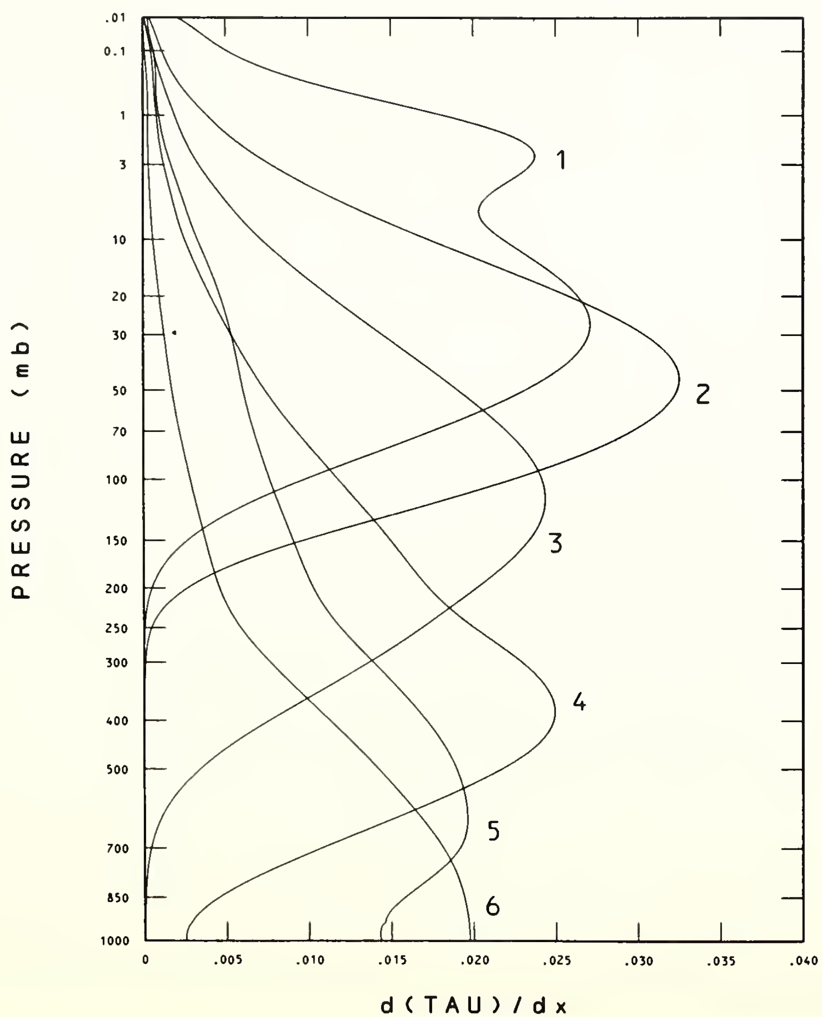
1	2	3	4	5	6
.98851	.99795	.99898	.99980	.99978	.99998
.98094	.99630	.99813	.99919	.99901	.99990
.96961	.99373	.99673	.99814	.99761	.99965
.95313	.99017	.99469	.99694	.99610	.99921
.92813	.98490	.99184	.99554	.99447	.99864
.89390	.97761	.98818	.99394	.99260	.99803
.85147	.96798	.98363	.99211	.99036	.99743
.80452	.95546	.97802	.98997	.98757	.99681
.75792	.93942	.97105	.98737	.98407	.99611
.71445	.91927	.96245	.98421	.97980	.99532
.67339	.89448	.95204	.98047	.97474	.99440
.63196	.86459	.93968	.97611	.96892	.99335
.58783	.82923	.92500	.97094	.96220	.99211
.54031	.78820	.90773	.96481	.95452	.99065
.48971	.74147	.88768	.95764	.94593	.98893
.43683	.68932	.86471	.94938	.93653	.98694
.38277	.63233	.83870	.93994	.92643	.98468
.32881	.57139	.80953	.92925	.91575	.98213
.27629	.50775	.77722	.91725	.90454	.97928
.22649	.44283	.74184	.90387	.89290	.97612
.18055	.37817	.70347	.88901	.88077	.97262
.13939	.31530	.66225	.87249	.86809	.96873
.10370	.25563	.61844	.85416	.85477	.96440
.07392	.20046	.57244	.83391	.84076	.95959
.05019	.15102	.52481	.81170	.82601	.95427
.03228	.10842	.47627	.78749	.81046	.94843
.01952	.07339	.42754	.76131	.79406	.94205
.01099	.04638	.37941	.73315	.77678	.93509
.00569	.02705	.33267	.70312	.75860	.92755
.00266	.01444	.28809	.67133	.73953	.91943
.00111	.00699	.24615	.63772	.71948	.91062
.00039	.00303	.20720	.60207	.69827	.90099
.00012	.00125	.17136	.56390	.67557	.89020
.00003	.00050	.13869	.52268	.65097	.87785
.00000	.00020	.10946	.47834	.62426	.86361
	.00007	.08398	.43115	.59532	.84719
	.00001	.06234	.38208	.56424	.82850
	.00000	.04459	.33227	.53116	.80747
		.03070	.28288	.49625	.78406
		.02027	.23526	.45978	.75835
		.01276	.19084	.42209	.73042
		.00764	.15075	.38353	.70041
		.00435	.11551	.34445	.66842
		.00238	.08557	.30523	.63458
		.00122	.06127	.26637	.59902
		.00060	.04236	.22884	.56205
		.00029	.02843	.19378	.52403
		.00012	.01879	.16173	.48527
		.00004	.01208	.13184	.44604
		.00000	.00683	.10302	.40655

VTPR

(ZENITH ANGLE 23°47')

SET: 1

CO_2 WEIGHTING FUNCTIONS



CO_2 WEIGHTING FUNCTION VALUES

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.00263	.00052	.00033	.00015	.00017	.00001
.00491	.00113	.00057	.00047	.00062	.00008
.00663	.00147	.00084	.00056	.00073	.00017
.01017	.00216	.00121	.00064	.00078	.00026
.01482	.00312	.00162	.00075	.00086	.00030
.01936	.00420	.00205	.00086	.00102	.00030
.02275	.00548	.00252	.00098	.00124	.00030
.02375	.00709	.00312	.00117	.00156	.00033
.02262	.00900	.00388	.00144	.00194	.00037
.02094	.01119	.00474	.00172	.00233	.00043
.02037	.01364	.00567	.00202	.00271	.00049
.02126	.01628	.00673	.00237	.00312	.00057
.02291	.01909	.00797	.00282	.00360	.00067
.02458	.02195	.00932	.00332	.00407	.00080
.02595	.02475	.01074	.00385	.00451	.00092
.02684	.02735	.01224	.00442	.00489	.00106
.02712	.02957	.01378	.00502	.00520	.00120
.02673	.03126	.01538	.00567	.00548	.00135
.02568	.03226	.01693	.00634	.00571	.00150
.02402	.03252	.01844	.00705	.00594	.00166
.02184	.03201	.01991	.00783	.00620	.00184
.01926	.03075	.02128	.00870	.00649	.00205
.01640	.02881	.02249	.00964	.00683	.00228
.01337	.02625	.02346	.01061	.00719	.00253
.01038	.02310	.02410	.01160	.00757	.00279
.00759	.01945	.02438	.01260	.00798	.00305
.00525	.01553	.02428	.01359	.00842	.00333
.00337	.01152	.02379	.01456	.00887	.00363
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.00109	.00487	.02166	.01634	.00977	.00422
.00052	.00273	.02024	.01729	.01029	.00459
.00022	.00133	.01870	.01840	.01094	.00507
.00007	.00055	.01714	.01982	.01180	.00576
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.00001	.00009	.01370	.02293	.01391	.00765
	.00004	.01178	.02416	.01502	.00877
	.00001	.00985	.02482	.01605	.00993
	.00000	.00790	.02490	.01702	.01111
		.00604	.02437	.01787	.01229
		.00444	.02313	.01857	.01342
		.00311	.02118	.01909	.01449
		.00206	.01887	.01944	.01551
		.00127	.01633	.01960	.01647
		.00075	.01356	.01958	.01737
		.00043	.01077	.01919	.01816
		.00021	.00817	.01824	.01877
		.00011	.00579	.01674	.01922
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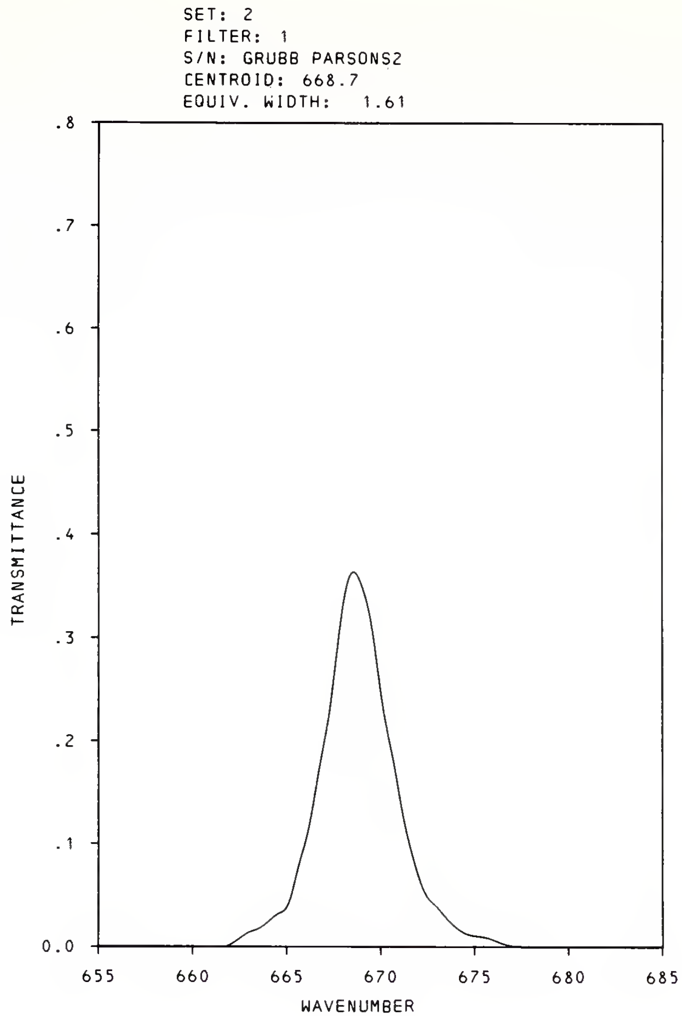
VTPR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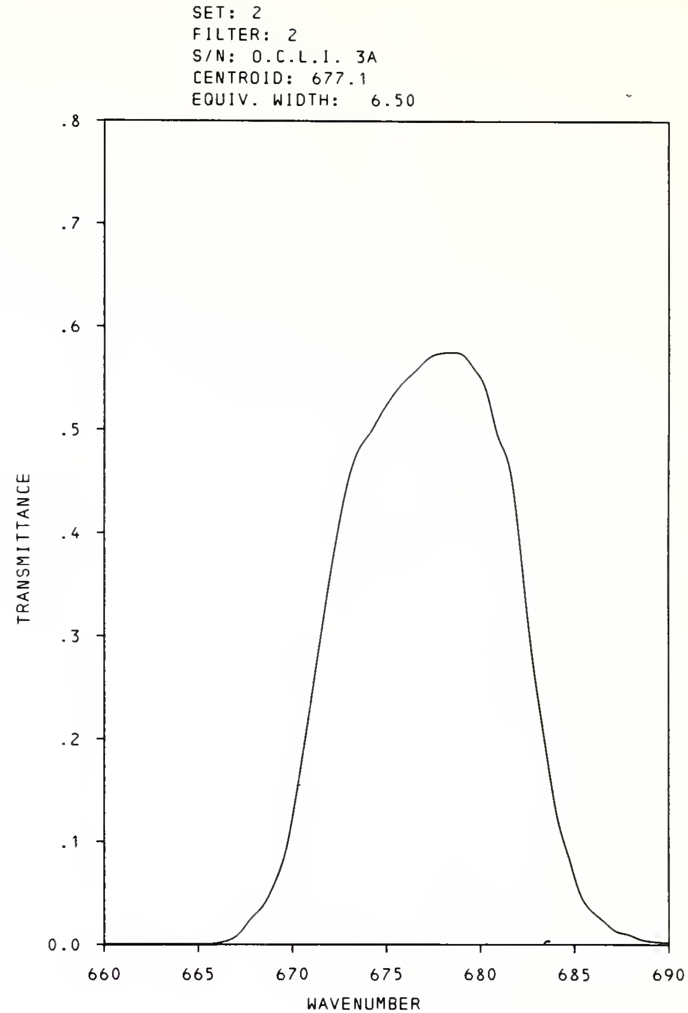
WAVENUMBER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WAVENUMBER

CM^{-1}	TRANS.	CM^{-1}	TRANS.
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662.2	.00537	674.8	.01079
662.4	.00801	675.0	.01024
662.6	.01071	675.2	.00979
662.8	.01301	675.4	.00921
663.0	.01458	675.6	.00841
663.2	.01587	675.8	.00727
663.4	.01745	676.0	.00584
663.6	.01968	676.2	.00436
663.8	.02245	676.4	.00301
664.0	.02563	676.6	.00190
664.2	.02883	676.8	.00106
664.4	.03150	677.0	.00053
664.6	.03325	677.2	.00021
664.8	.03582	677.4	.00006
665.0	.04200	677.6	*00000
665.2	.05356		
665.4	.06822		
665.6	.08274		
665.8	.09559		
666.0	.10917		
666.2	.12630		
666.4	.14714		
666.6	.16879		
666.8	.18854		
667.0	.20753		
667.2	.22949		
667.4	.25721		
667.6	.28784		
667.8	.31667		
668.0	.33976		
668.2	.35568		
668.4	.36341		
668.6	.36297		
668.8	.35659		
669.0	.34682		
669.2	.33405		
669.4	.31649		
669.6	.29263		
669.8	.26498		
670.0	.23841		
670.2	.21680		
670.4	.19851		
670.6	.18005		
670.8	.15926		
671.0	.13791		
671.2	.11853		
671.4	.10236		
671.6	.08845		
671.8	.07575		
672.0	.06417		
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672.4	.04808		
672.6	.04388		
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673.0	.03669		
673.2	.03235		
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673.8	.02058		
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CM^{-1}	TRANS	CM^{-1}	TRANS.	CM^{-1}	TRANS.
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665.9	.00130	678.5	.57499		
666.1	.00195	678.7	.57466		
666.3	.00286	678.9	.57330		
666.5	.00403	679.1	.57024		
666.7	.00553	679.3	.56569		
666.9	.00774	679.5	.56049		
667.1	.01099	679.7	.55567		
667.3	.01541	679.9	.55060		
667.5	.02035	680.1	.54319		
667.7	.02497	680.3	.53155		
667.9	.02887	680.5	.51634		
668.1	.03238	680.7	.50132		
668.3	.03648	680.9	.48994		
668.5	.04194	681.1	.48187		
668.7	.04883	681.3	.47271		
668.9	.05676	681.5	.45801		
669.1	.06535	681.7	.43447		
669.3	.07490	681.9	.40437		
669.5	.08680	682.1	.37101		
669.7	.10221	682.3	.33753		
669.9	.12127	682.5	.30554		
670.1	.14272	682.7	.27602		
670.3	.16548	682.9	.24968		
670.5	.18889	683.1	.22569		
670.7	.21282	683.3	.20261		
670.9	.23726	683.5	.17913		
671.1	.26197	683.7	.15573		
671.3	.28662	683.9	.13427		
671.5	.31100	684.1	.11691		
671.7	.33480	684.3	.10351		
671.9	.35788	684.5	.09188		
672.1	.37999	684.7	.07978		
672.3	.40099	684.9	.06697		
672.5	.42049	685.1	.05507		
672.7	.43799	685.3	.04571		
672.9	.45320	685.5	.03927		
673.1	.46588	685.7	.03479		
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673.5	.48337	686.1	.02815		
673.7	.48877	686.3	.02516		
673.9	.49351	686.5	.02198		
674.1	.49878	686.7	.01866		
674.3	.50509	686.9	.01548		
674.5	.51172	687.1	.01300		
674.7	.51809	687.3	.01157		
674.9	.52394	687.5	.01079		
675.1	.52941	687.7	.01001		
675.3	.53454	687.9	.00871		
675.5	.53948	688.1	.00722		
675.7	.54397	688.3	.00566		
675.9	.54787	688.5	.00449		
676.1	.55132	688.7	.00371		
676.3	.55457	688.9	.00319		
676.5	.55802	689.1	.00280		
676.7	.56185	689.3	.00247		
676.9	.56569	689.5	.00215		
677.1	.56900	689.7	.00182		
677.3	.57141	689.9	.00150		
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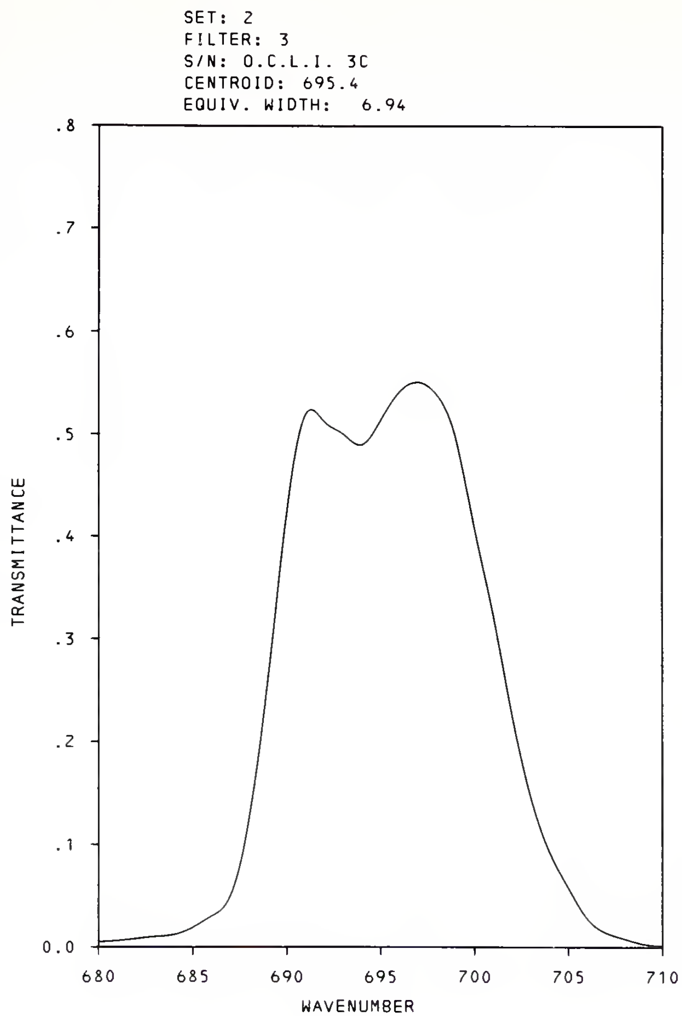
VTPR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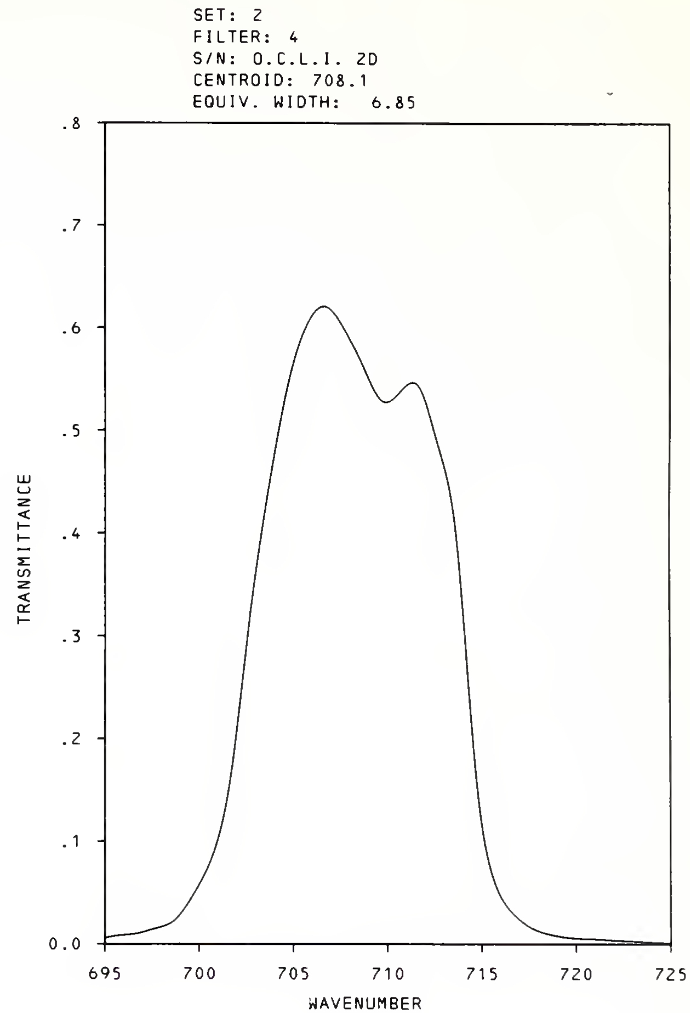
WAVENUMBER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715
720
725
WAVENUMBER

CM^{-1}	TRANS.	CM^{-1}	TRANS.	CM^{-1}	TRANS.	CM^{-1}	TRANS.
672.1	.00014	684.7	.01630	697.3	.54868	709.9	.00111
672.3	.00035	684.9	.01803	697.5	.54667	710.1	.00090
672.5	.00055	685.1	.02004	697.7	.54383	710.3	.00069
672.7	.00076	685.3	.02219	697.9	.54015	710.5	.00049
672.9	.00090	685.5	.02448	698.1	.53564	710.7	.00028
673.1	.00104	685.7	.02677	698.3	.53009	710.9	.00007
673.3	.00118	685.9	.02892	698.5	.52323		
673.5	.00132	686.1	.03100	698.7	.51442		
673.7	.00139	686.3	.03315	698.9	.50346		
673.9	.00146	686.5	.03600	699.1	.48987		
674.1	.00153	686.7	.04016	699.3	.47385		
674.3	.00160	686.9	.04612	699.5	.45616		
674.5	.00173	687.1	.05451	699.7	.43764		
674.7	.00180	687.3	.06568	699.9	.41905		
674.9	.00194	687.5	.07941	700.1	.40123		
675.1	.00208	687.7	.09578	700.3	.38424		
675.3	.00222	687.9	.11465	700.5	.36766		
675.5	.00243	688.1	.13594	700.7	.35108		
675.7	.00264	688.3	.15966	700.9	.33395		
675.9	.00284	688.5	.18553	701.1	.31578		
676.1	.00312	688.7	.21348	701.3	.29664		
676.3	.00340	688.9	.24337	701.5	.27694		
676.5	.00361	689.1	.27500	701.7	.25704		
676.7	.00381	689.3	.30788	701.9	.23755		
676.9	.00395	689.5	.34110	702.1	.21875		
677.1	.00402	689.7	.37383	702.3	.20093		
677.3	.00402	689.9	.40511	702.5	.18414		
677.5	.00395	690.1	.43417	702.7	.16847		
677.7	.00395	690.3	.46018	702.9	.15390		
677.9	.00395	690.5	.48245	703.1	.14038		
678.1	.00409	690.7	.50048	703.3	.12810		
678.3	.00423	690.9	.51352	703.5	.11680		
678.5	.00451	691.1	.52108	703.7	.10653		
678.7	.00472	691.3	.52344	703.9	.09731		
678.9	.00492	691.5	.52212	704.1	.08892		
679.1	.00506	691.7	.51851	704.3	.08136		
679.3	.00506	691.9	.51407	704.5	.07435		
679.5	.00506	692.1	.51019	704.7	.06769		
679.7	.00499	692.3	.50741	704.9	.06124		
679.9	.00499	692.5	.50526	705.1	.05472		
680.1	.00506	692.7	.50332	705.3	.04820		
680.3	.00513	692.9	.50124	705.5	.04175		
680.5	.00534	693.1	.49854	705.7	.03579		
680.7	.00555	693.3	.49535	705.9	.03038		
680.9	.00583	693.5	.49229	706.1	.02580		
681.1	.00617	693.7	.48987	706.3	.02212		
681.3	.00652	693.9	.48883	706.5	.01914		
681.5	.00694	694.1	.48973	706.7	.01678		
681.7	.00735	694.3	.49257	706.9	.01484		
681.9	.00777	694.5	.49708	707.1	.01325		
682.1	.00825	694.7	.50263	707.3	.01186		
682.3	.00867	694.9	.50880	707.5	.01068		
682.5	.00909	695.1	.51518	707.7	.00957		
682.7	.00950	695.3	.52142	707.9	.00853		
682.9	.00985	695.5	.52739	708.1	.00749		
683.1	.01013	695.7	.53294	708.3	.00638		
683.3	.01040	695.9	.53779	708.5	.00527		
683.5	.01068	696.1	.54195	708.7	.00430		
683.7	.01110	696.3	.54528	708.9	.00340		
683.9	.01165	696.5	.54771	709.1	.00264		
684.1	.01241	696.7	.54931	709.3	.00208		
684.3	.01346	696.9	.55000	709.5	.00166		
684.5	.01477	697.1	.54979	709.7	.00139		

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689.2	.00062	701.8	.17824	714.4	.23339
689.4	.00082	702.0	.20756	714.6	.18824
689.6	.00096	702.2	.23941	714.8	.14988
689.8	.00103	702.4	.27230	715.0	.11974
690.0	.00103	702.6	.30456	715.2	.09652
690.2	.00096	702.8	.33477	715.4	.07885
690.4	.00096	703.0	.36231	715.6	.06549
690.6	.00096	703.2	.38772	715.8	.05514
690.8	.00103	703.4	.41142	716.0	.04686
691.0	.00123	703.6	.43403	716.2	.04035
691.2	.00144	703.8	.45588	716.4	.03514
691.4	.00164	704.0	.47718	716.6	.03089
691.6	.00185	704.2	.49760	716.8	.02720
691.8	.00212	704.4	.51685	717.0	.02384
692.0	.00233	704.6	.53473	717.2	.02089
692.2	.00253	704.8	.55082	717.4	.01822
692.4	.00267	705.0	.56514	717.6	.01596
692.6	.00288	705.2	.57768	717.8	.01411
692.8	.00308	705.4	.58857	718.0	.01260
693.0	.00336	705.6	.59789	718.2	.01130
693.2	.00356	705.8	.60576	718.4	.01028
693.4	.00377	706.0	.61213	718.6	.00938
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694.0	.00418	706.6	.62118	719.2	.00726
694.2	.00432	706.8	.62035	719.4	.00664
694.4	.00452	707.0	.61768	719.6	.00617
694.6	.00480	707.2	.61350	719.8	.00582
694.8	.00527	707.4	.60823	720.0	.00555
695.0	.00582	707.6	.60220	720.2	.00534
695.2	.00651	707.8	.59576	720.4	.00521
695.4	.00712	708.0	.58905	720.6	.00507
695.6	.00774	708.2	.58213	720.8	.00493
695.8	.00822	708.4	.57480	721.0	.00473
696.0	.00856	708.6	.56706	721.2	.00452
696.2	.00884	708.8	.55884	721.4	.00432
696.4	.00918	709.0	.55048	721.6	.00411
696.6	.00966	709.2	.54260	721.8	.00390
696.8	.01034	709.4	.53575	722.0	.00370
697.0	.01130	709.6	.53068	722.2	.00349
697.2	.01233	709.8	.52794	722.4	.00329
697.4	.01343	710.0	.52767	722.6	.00308
697.6	.01452	710.2	.52925	722.8	.00288
697.8	.01548	710.4	.53219	723.0	.00267
698.0	.01644	710.6	.53596	723.2	.00253
698.2	.01761	710.8	.54000	723.4	.00233
698.4	.01925	711.0	.54370	723.6	.00212
698.6	.02151	711.2	.54623	723.8	.00192
698.8	.02473	711.4	.54671	724.0	.00171
699.0	.02884	711.6	.54445	724.2	.00151
699.2	.03370	711.8	.53856	724.4	.00130
699.4	.03911	712.0	.52931	724.6	.00110
699.6	.04501	712.2	.51767	724.8	.00089
699.8	.05103	712.4	.50465	725.0	.00069
700.0	.05740	712.6	.49136	725.2	.00048
700.2	.06425	712.8	.47890	725.4	.00027
700.4	.07179	713.0	.46650	725.6	.00007
700.6	.08028	713.2	.45198		
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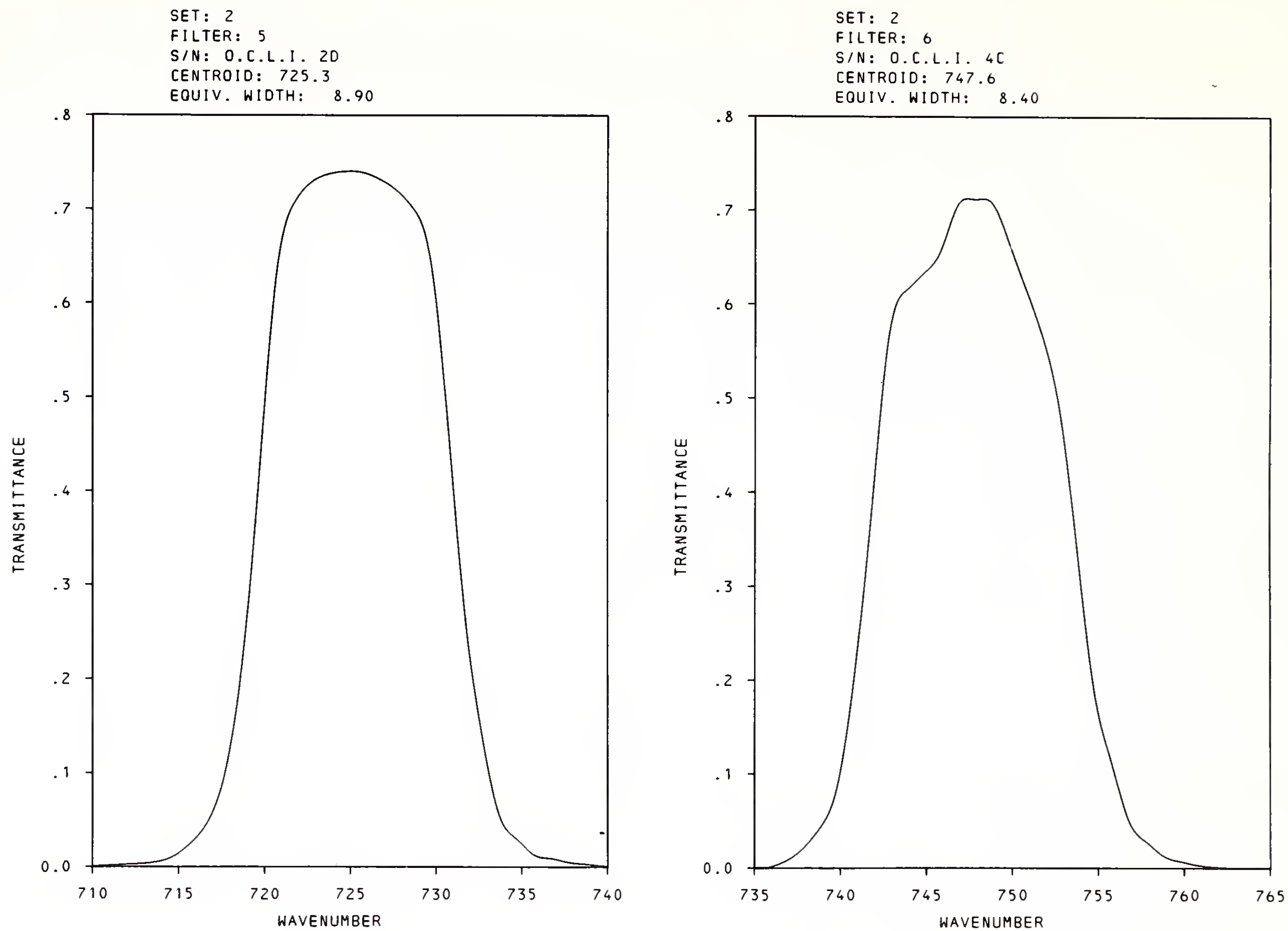
VTPR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725
730
735
740
WAVENUMBER
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FILTER: 6
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WAVENUMBER

CM^{-1}	TRANS.	CM^{-1}	TRANS.	CM^{-1}	TRANS.
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710.0	.00027	722.6	.72644	735.2	.02100
710.2	.00053	722.8	.72938	735.4	.01735
710.4	.00071	723.0	.73178	735.6	.01424
710.6	.00089	723.2	.73365	735.8	.01201
710.8	.00107	723.4	.73525	736.0	.01059
711.0	.00133	723.6	.73650	736.2	.00988
711.2	.00151	723.8	.73748	736.4	.00952
711.4	.00169	724.0	.73828	736.6	.00917
711.6	.00187	724.2	.73899	736.8	.00872
711.8	.00214	724.4	.73952	737.0	.00801
712.0	.00231	724.6	.73988	737.2	.00712
712.2	.00249	724.8	.74015	737.4	.00623
712.4	.00267	725.0	.74024	737.6	.00534
712.6	.00285	725.2	.74015	737.8	.00472
712.8	.00311	725.4	.73988	738.0	.00418
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713.2	.00374	725.8	.73855	738.4	.00347
713.4	.00418	726.0	.73748	738.6	.00320
713.6	.00472	726.2	.73614	738.8	.00285
713.8	.00534	726.4	.73463	739.0	.00240
714.0	.00614	726.6	.73294	739.2	.00196
714.2	.00721	726.8	.73107	739.4	.00160
714.4	.00845	727.0	.72902	739.6	.00116
714.6	.01005	727.2	.72671	739.8	.00080
714.8	.01201	727.4	.72431	740.0	.00062
715.0	.01441	727.6	.72146	740.2	.00036
715.2	.01708	727.8	.71844	740.4	.00018
715.4	.02011	728.0	.71497	740.6	.00009
715.6	.02331	728.2	.71123		
715.8	.02678	728.4	.70705		
716.0	.03043	728.6	.70242		
716.2	.03461	728.8	.69744		
716.4	.03933	729.0	.69139		
716.6	.04485	729.2	.68311		
716.8	.05143	729.4	.67145		
717.0	.05908	729.6	.65517		
717.2	.06834	729.8	.63328		
717.4	.07937	730.0	.60543		
717.6	.09254	730.2	.57260		
717.8	.10811	730.4	.53576		
718.0	.12635	730.6	.49580		
718.2	.14753	730.8	.45372		
718.4	.17191	731.0	.41056		
718.6	.19976	731.2	.36767		
718.8	.23117	731.4	.32629		
719.0	.26623	731.6	.28777		
719.2	.30458	731.8	.25333		
719.4	.34596	732.0	.22325		
719.6	.39009	732.2	.19656		
719.8	.43645	732.4	.17271		
720.0	.48397	732.6	.15065		
720.2	.53042	732.8	.12956		
720.4	.57375	733.0	.10945		
720.6	.61175	733.2	.09094		
720.8	.64218	733.4	.07439		
721.0	.66496	733.6	.06069		
721.2	.68142	733.8	.05019		
721.4	.69308	734.0	.04289		
721.6	.70153	734.2	.03791		
721.8	.70820	734.4	.03444		
722.0	.71399	734.6	.03150		
722.2	.71888	734.8	.02839		

CM^{-1}	TRANS.	CM^{-1}	TRANS.	CM^{-1}	TRANS.
735.8	.00059	748.4	.71211	761.0	.00218
736.0	.00185	748.6	.70993	761.2	.00176
736.2	.00311	748.8	.70548	761.4	.00143
736.4	.00453	749.0	.69876	761.6	.00109
736.6	.00613	749.2	.69020	761.8	.00084
736.8	.00798	749.4	.68054	762.0	.00067
737.0	.00999	749.6	.67022	762.2	.00042
737.2	.01243	749.8	.65981	762.4	.00025
737.4	.01520	750.0	.64965	762.6	.00008
737.6	.01830	750.2	.63966		
737.8	.02183	750.4	.62975		
738.0	.02577	750.6	.61993		
738.2	.03006	750.8	.61011		
738.4	.03467	751.0	.60012		
738.6	.03946	751.2	.58987		
738.8	.04458	751.4	.57921		
739.0	.05021	751.6	.56796		
739.2	.05709	751.8	.55587		
739.4	.06607	752.0	.54261		
739.6	.07783	752.2	.52775		
739.8	.09311	752.4	.51070		
740.0	.11208	752.6	.49097		
740.2	.13450	752.8	.46814		
740.4	.15994	753.0	.44219		
740.6	.18806	753.2	.41365		
740.8	.21854	753.4	.38317		
741.0	.25120	753.6	.35127		
741.2	.28595	753.8	.31861		
741.4	.32281	754.0	.28595		
741.6	.36177	754.2	.25430		
741.8	.40274	754.4	.22483		
742.0	.44455	754.6	.19864		
742.2	.48518	754.8	.17656		
742.4	.52237	755.0	.15868		
742.6	.55394	755.2	.14373		
742.8	.57787	755.4	.13072		
743.0	.59399	755.6	.11829		
743.2	.60406	755.8	.10545		
743.4	.60994	756.0	.09185		
743.6	.61346	756.2	.07841		
743.8	.61657	756.4	.06574		
744.0	.62010	756.6	.05466		
744.2	.62379	756.8	.04601		
744.4	.62757	757.0	.03980		
744.6	.63126	757.2	.03535		
744.8	.63462	757.4	.03207		
745.0	.63798	757.6	.02938		
745.2	.64176	757.8	.02653		
745.4	.64663	758.0	.02342		
745.6	.65301	758.2	.02015		
745.8	.66157	758.4	.01704		
746.0	.67198	758.6	.01419		
746.2	.68298	758.8	.01192		
746.4	.69364	759.0	.01033		
746.6	.70254	759.2	.00907		
746.8	.70867	759.4	.00814		
747.0	.71186	759.6	.00739		
747.2	.71295	759.8	.00663		
747.4	.71270	760.0	.00579		
747.6	.71220	760.2	.00495		
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748.0	.71245	760.6	.00336		
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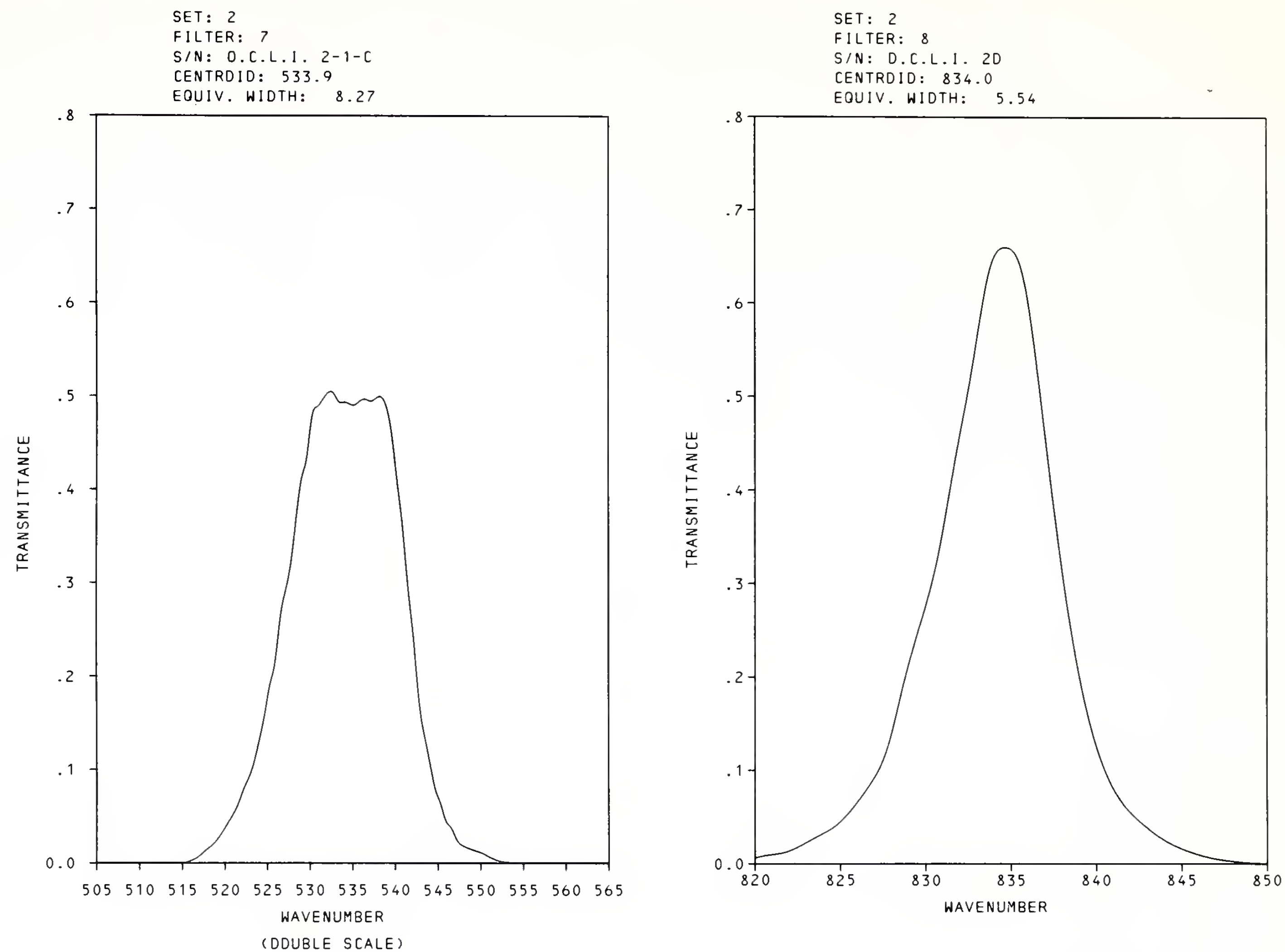
VTPR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FILTER: 7
S/N: O.C.L.I. 2-1-C
CENTROID: 533.9
EQUIV. WIDTH: 8.27
TRANSMITTANCE
.8
.7
.6
.5
.4
.3
.2
.1
0.0
505 510 515 520 525 530 535 540 545 550 555 560 565
WAVENUMBER
(DOUBLE SCALE)
SET: 2
FILTER: 8
S/N: O.C.L.I. 2D
CENTROID: 834.0
EQUIV. WIDTH: 5.54
TRANSMITTANCE
.8
.7
.6
.5
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.3
.2
.1
0.0
820 825 830 835 840 845 850
WAVENUMBER

CM^{-1}	TRANS.	CM^{-1}	TRANS.	CM^{-1}	TRANS.	CM^{-1}	TRANS.
515.3	.00033	527.9	.33353	540.5	.38591	553.1	.00041
515.5	.00099	528.1	.34892	540.7	.37060	553.3	.00017
515.7	.00165	528.3	.36498	540.9	.35256		
515.9	.00240	528.5	.38078	541.1	.33196		
516.1	.00314	528.7	.39534	541.3	.31078		
516.3	.00397	528.9	.40734	541.5	.29100		
516.5	.00496	529.1	.41578	541.7	.27396		
516.7	.00612	529.3	.42182	541.9	.25791		
516.9	.00753	529.5	.42894	542.1	.24003		
517.1	.00902	529.7	.44052	542.3	.21869		
517.3	.01067	529.9	.45599	542.5	.19635		
517.5	.01241	530.1	.47105	542.7	.17599		
517.7	.01398	530.3	.48131	542.9	.16027		
517.9	.01547	530.5	.48594	543.1	.14827		
518.1	.01680	530.7	.48752	543.3	.13851		
518.3	.01820	530.9	.48868	543.5	.12949		
518.5	.01986	531.1	.49066	543.7	.12031		
518.7	.02168	531.3	.49323	543.9	.11087		
518.9	.02383	531.5	.49604	544.1	.10103		
519.1	.02623	531.7	.49869	544.3	.09135		
519.3	.02879	531.9	.50109	544.5	.08266		
519.5	.03152	532.1	.50299	544.7	.07596		
519.7	.03450	532.3	.50415	544.9	.07108		
519.9	.03748	532.5	.50423	545.1	.06652		
520.1	.04046	532.7	.50299	545.3	.06106		
520.3	.04352	532.9	.50026	545.5	.05461		
520.5	.04642	533.1	.49695	545.7	.04849		
520.7	.04948	533.3	.49397	545.9	.04402		
520.9	.05254	533.5	.49248	546.1	.04137		
521.1	.05593	533.7	.49240	546.3	.03947		
521.3	.05966	533.9	.49281	546.5	.03699		
521.5	.06396	534.1	.49298	546.7	.03326		
521.7	.06892	534.3	.49240	546.9	.02896		
521.9	.07414	534.5	.49149	547.1	.02499		
522.1	.07902	534.7	.49058	547.3	.02217		
522.3	.08316	534.9	.48992	547.5	.02027		
522.5	.08704	535.1	.48975	547.7	.01903		
522.7	.09102	535.3	.49041	547.9	.01796		
522.9	.09548	535.5	.49174	548.1	.01713		
523.1	.10070	535.7	.49323	548.3	.01638		
523.3	.10665	535.9	.49463	548.5	.01564		
523.5	.11352	536.1	.49563	548.7	.01498		
523.7	.12105	536.3	.49612	548.9	.01431		
523.9	.12899	536.5	.49604	549.1	.01365		
524.1	.13702	536.7	.49529	549.3	.01299		
524.3	.14513	536.9	.49438	549.5	.01233		
524.5	.15407	537.1	.49397	549.7	.01167		
524.7	.16424	537.3	.49447	549.9	.01109		
524.9	.17533	537.5	.49563	550.1	.01043		
525.1	.18559	537.7	.49703	550.3	.00952		
525.3	.19370	537.9	.49819	550.5	.00852		
525.5	.20032	538.1	.49885	550.7	.00753		
525.7	.20793	538.3	.49860	550.9	.00654		
525.9	.21927	538.5	.49703	551.1	.00563		
526.1	.23424	538.7	.49389	551.3	.00480		
526.3	.25038	538.9	.48909	551.5	.00397		
526.5	.26502	539.1	.48247	551.7	.00323		
526.7	.27611	539.3	.47378	551.9	.00257		
526.9	.28455	539.5	.46261	552.1	.00199		
527.1	.29200	539.7	.44871	552.3	.00157		
527.3	.29977	539.9	.43258	552.5	.00124		
527.5	.30888	540.1	.41594	552.7	.00099		
527.7	.31996	540.3	.40047	552.9	.00074		

CM^{-1}	TRANS.	CM^{-1}	TRANS.	CM^{-1}	TRANS.
817.8	.00011	830.4	.30272	843.0	.03823
818.0	.00044	830.6	.31823	843.2	.03530
818.2	.00083	830.8	.33552	843.4	.03253
818.4	.00122	831.0	.35469	843.6	.02987
818.6	.00166	831.2	.37520	843.8	.02743
818.8	.00211	831.4	.39636	844.0	.02510
819.0	.00260	831.6	.41753	844.2	.02300
819.2	.00316	831.8	.43803	844.4	.02106
819.4	.00377	832.0	.45759	844.6	.01928
819.6	.00443	832.2	.47677	844.8	.01757
819.8	.00521	832.4	.49605	845.0	.01601
820.0	.00604	832.6	.51611	845.2	.01457
820.2	.00693	832.8	.53750	845.4	.01319
820.4	.00776	833.0	.56016	845.6	.01191
820.6	.00853	833.2	.58288	845.8	.01069
820.8	.00914	833.4	.60438	846.0	.00959
821.0	.00964	833.6	.62333	846.2	.00848
821.2	.01014	833.8	.63829	846.4	.00754
821.4	.01064	834.0	.64877	846.6	.00659
821.6	.01130	834.2	.65530	846.8	.00582
821.8	.01225	834.4	.65880	847.0	.00510
822.0	.01352	834.6	.66007	847.2	.00449
822.2	.01502	834.8	.65985	847.4	.00388
822.4	.01668	835.0	.65846	847.6	.00338
822.6	.01856	835.2	.65508	847.8	.00288
822.8	.02050	835.4	.64882	848.0	.00244
823.0	.02250	835.6	.63868	848.2	.00199
823.2	.02449	835.8	.62377	848.4	.00161
823.4	.02654	836.0	.60377	848.6	.00122
823.6	.02854	836.2	.57961	848.8	.00094
823.8	.03048	836.4	.55229	849.0	.00066
824.0	.03242	836.6	.52281	849.2	.00044
824.2	.03441	836.8	.49234	849.4	.00028
824.4	.03652	837.0	.46158	849.6	.00011
824.6	.03895	837.2	.43094		
824.8	.04173	837.4	.40074		
825.0	.04494	837.6	.37132		
825.2	.04854	837.8	.34306		
825.4	.05248	838.0	.31613		
825.6	.05669	838.2	.29058		
825.8	.06112	838.4	.26653		
826.0	.06583	838.6	.24392		
826.2	.07065	838.8	.22287		
826.4	.07575	839.0	.20336		
826.6	.08096	839.2	.18530		
826.8	.08639	839.4	.16873		
827.0	.09210	839.6	.15355		
827.2	.09847	839.8	.13964		
827.4	.10595	840.0	.12706		
827.6	.11498	840.2	.11570		
827.8	.12595	840.4	.10545		
828.0	.13892	840.6	.09625		
828.2	.15333	840.8	.08805		
828.4	.16851	841.0	.08074		
828.6	.18380	841.2	.07431		
828.8	.19860	841.4	.06854		
829.0	.21256	841.6	.06345		
829.2	.22575	841.8	.05890		
829.4	.23838	842.0	.05480		
829.6	.25080	842.2	.05103		
829.8	.26310	842.4	.04760		
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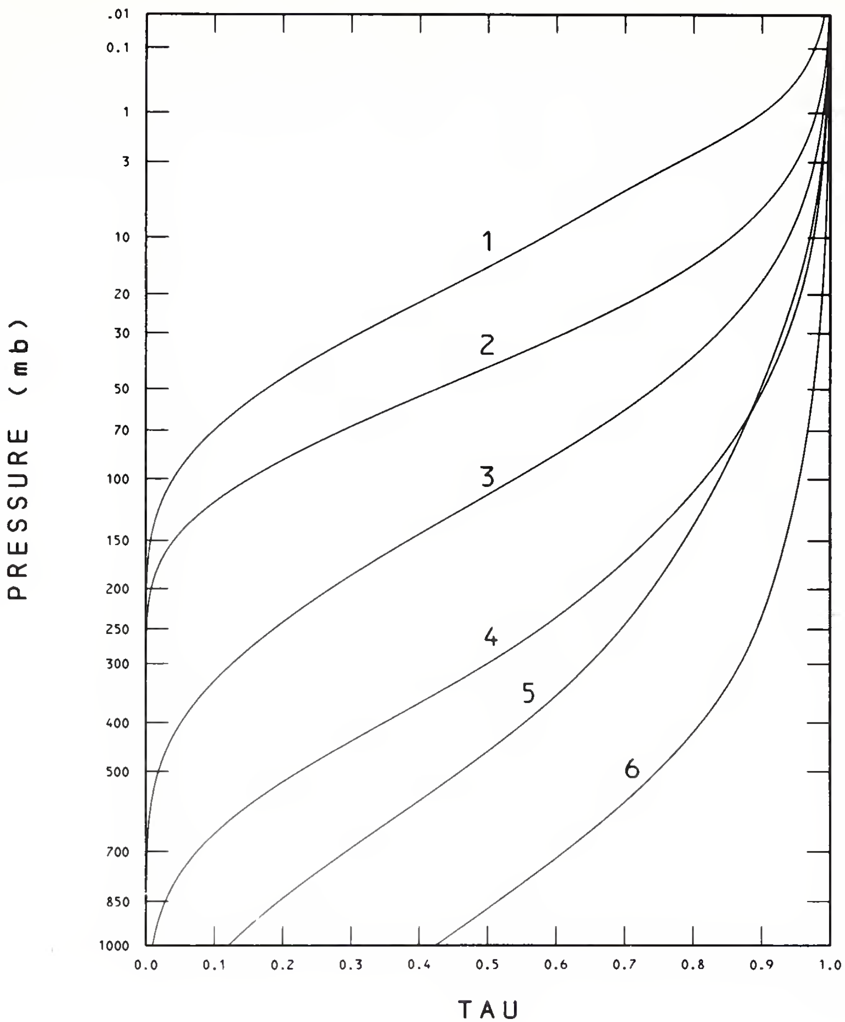
830.2	.28864	842.8	.04123		

VTPR

SET: 2

CO_2 TRANSMITTANCES



CO_2 TRANSMITTANCE VALUES

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.98011	.99624	.99819	.99927	.99913	.99991
.96772	.99361	.99686	.99826	.99788	.99968
.95049	.99000	.99494	.99709	.99649	.99926
.92486	.98470	.99226	.99575	.99503	.99870
.88993	.97739	.98885	.99422	.99337	.99811
.84627	.96778	.98462	.99249	.99137	.99753
.79655	.95537	.97938	.99047	.98889	.99693
.74490	.93958	.97287	.98801	.98578	.99627
.69466	.91987	.96483	.98503	.98197	.99551
.64650	.89573	.95510	.98149	.97745	.99463
.59882	.86670	.94353	.97735	.97222	.99363
.54956	.83238	.92977	.97245	.96617	.99245
.49812	.79254	.91355	.96663	.95925	.99105
.44503	.74712	.89471	.95983	.95149	.98941
.39132	.69633	.87311	.95199	.94297	.98751
.33819	.64067	.84863	.94303	.93380	.98535
.28689	.58097	.82117	.93288	.92406	.98292
.23855	.51835	.79070	.92148	.91382	.98019
.19413	.45419	.75728	.90878	.90315	.97718
.15426	.39000	.72093	.89465	.89201	.97383
.11926	.32727	.68174	.87895	.88032	.97011
.08924	.26744	.63990	.86152	.86801	.96597
.06420	.21179	.59573	.84226	.85503	.96137
.04405	.16151	.54971	.82110	.84131	.95628
.02861	.11769	.50244	.79805	.82682	.95070
.01741	.08111	.45462	.77307	.81149	.94459
.00983	.05233	.40693	.74618	.79527	.93793
.00510	.03120	.36014	.71746	.77815	.93071
.00238	.01700	.31499	.68701	.76011	.92293
.00100	.00832	.27199	.65474	.74107	.91450
.00035	.00358	.23151	.62045	.72084	.90527
.00011	.00138	.19371	.58362	.69909	.89492
.00003	.00047	.15873	.54372	.67543	.88307
.00000	.00014	.12695	.50060	.64962	.86940
	.00001	.09879	.45449	.62153	.85363
		.07448	.40622	.59122	.83565
		.05417	.35683	.55882	.81540
		.03796	.30740	.52446	.79283
		.02553	.25921	.48836	.76799
		.01638	.21361	.45079	.74100
		.00999	.17175	.41206	.71193
		.00579	.13432	.37261	.68090
		.00318	.10195	.33290	.64800
		.00163	.07511	.29340	.61338
		.00079	.05357	.25472	.57730
		.00037	.03688	.21750	.54008
		.00016	.02454	.18236	.50201
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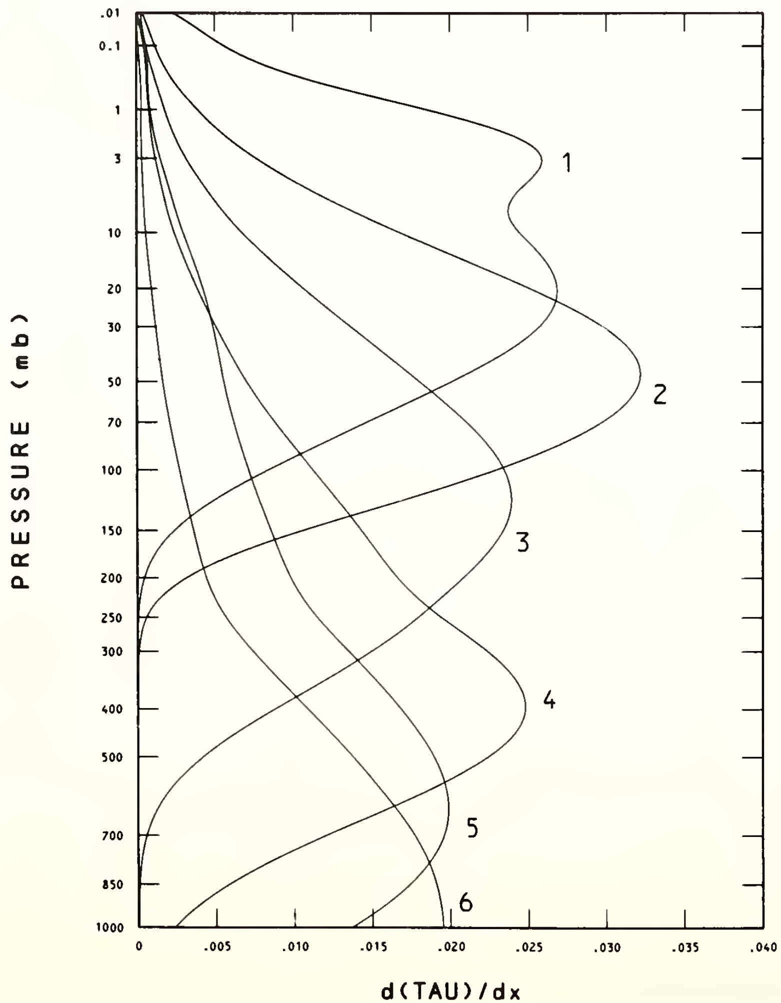
		.00003	.00995	.12070	.42438

SET: 2

CO_2 WEIGHTING FUNCTIONS



CO_2 WEIGHTING FUNCTION VALUES

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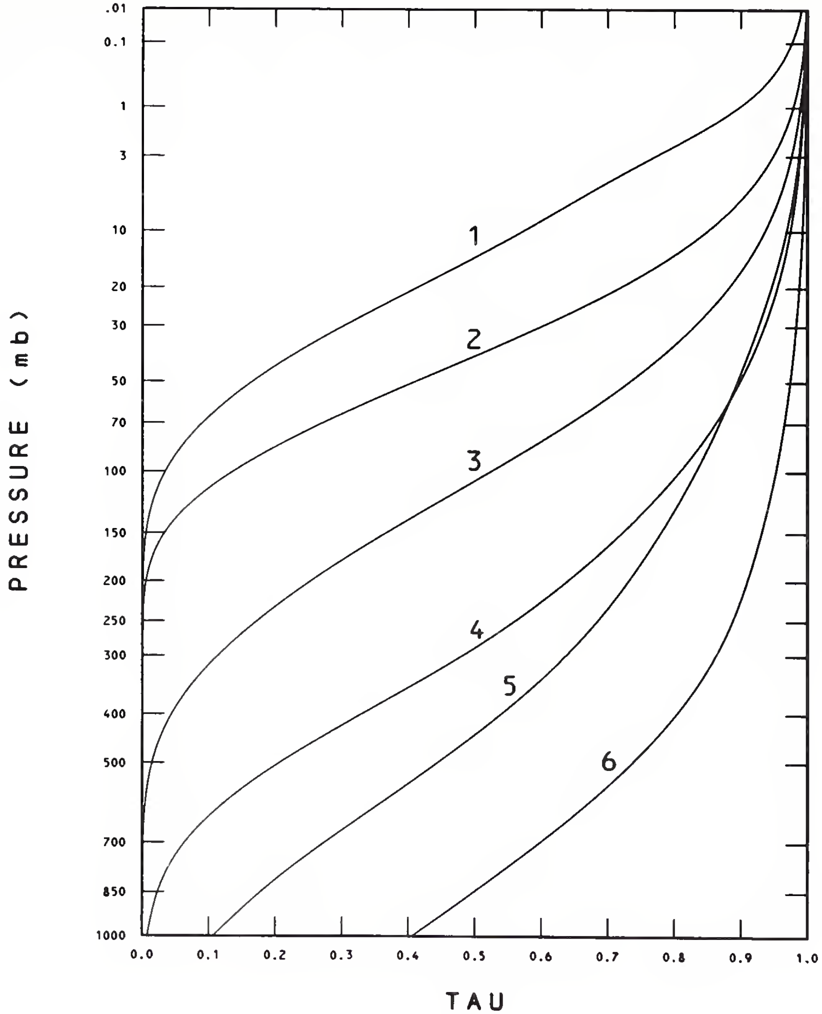
.00548	.00115	.00054	.00044	.00055	.00007
.00707	.00150	.00080	.00054	.00067	.00016
.01051	.00218	.00115	.00063	.00071	.00025
.01513	.00313	.00152	.00072	.00077	.00030
.01979	.00420	.00191	.00081	.00091	.00029
.02365	.00546	.00234	.00092	.00110	.00029
.02569	.00700	.00291	.00111	.00139	.00031
.02567	.00883	.00362	.00136	.00173	.00036
.02453	.01092	.00443	.00163	.00209	.00041
.02376	.01326	.00531	.00191	.00243	.00047
.02410	.01581	.00630	.00224	.00281	.00054
.02519	.01853	.00748	.00267	.00324	.00064
.02621	.02132	.00875	.00315	.00368	.00076
.02679	.02408	.01010	.00366	.00408	.00088
.02682	.02667	.01151	.00420	.00443	.00101
.02621	.02892	.01297	.00477	.00473	.00115
.02500	.03069	.01449	.00539	.00500	.00129
.02326	.03181	.01598	.00602	.00523	.00143
.02111	.03222	.01745	.00669	.00545	.00159
.01873	.03185	.01890	.00744	.00570	.00176
.01626	.03075	.02028	.00827	.00599	.00196
.01376	.02897	.02154	.00917	.00632	.00218
.01129	.02658	.02260	.01010	.00667	.00242
.00888	.02361	.02337	.01105	.00705	.00267
.00661	.02015	.02383	.01201	.00745	.00292
.00464	.01637	.02394	.01297	.00788	.00319
.00301	.01243	.02369	.01391	.00834	.00347
.00180	.00875	.02304	.01479	.00879	.00375
.00097	.00559	.02207	.01567	.00926	.00404
.00047	.00323	.02090	.01661	.00980	.00440
.00020	.00162	.01958	.01773	.01046	.00486
.00006	.00069	.01821	.01915	.01133	.00552
.00002	.00027	.01673	.02076	.01235	.00635
.00001	.00009	.01501	.02235	.01347	.00734
	.00004	.01313	.02368	.01461	.00843
	.00000	.01117	.02450	.01569	.00955
		.00913	.02480	.01670	.01070
		.00712	.02452	.01764	.01186
		.00535	.02356	.01844	.01297
		.00384	.02193	.01911	.01403
		.00260	.01987	.01958	.01503
		.00165	.01750	.01983	.01599
		.00100	.01482	.01985	.01689
		.00058	.01206	.01960	.01770
		.00029	.00952	.01903	.01835
		.00015	.00720	.01814	.01885
		.00007	.00521	.01695	.01920
		.00003	.00358	.01546	.01943
		.00001	.00234	.01368	.01953

V T P R

[ZENITH ANGLE 23°47']

SET: 2

CO_2 TRANSMITTANCES



CO_2 TRANSMITTANCE VALUES

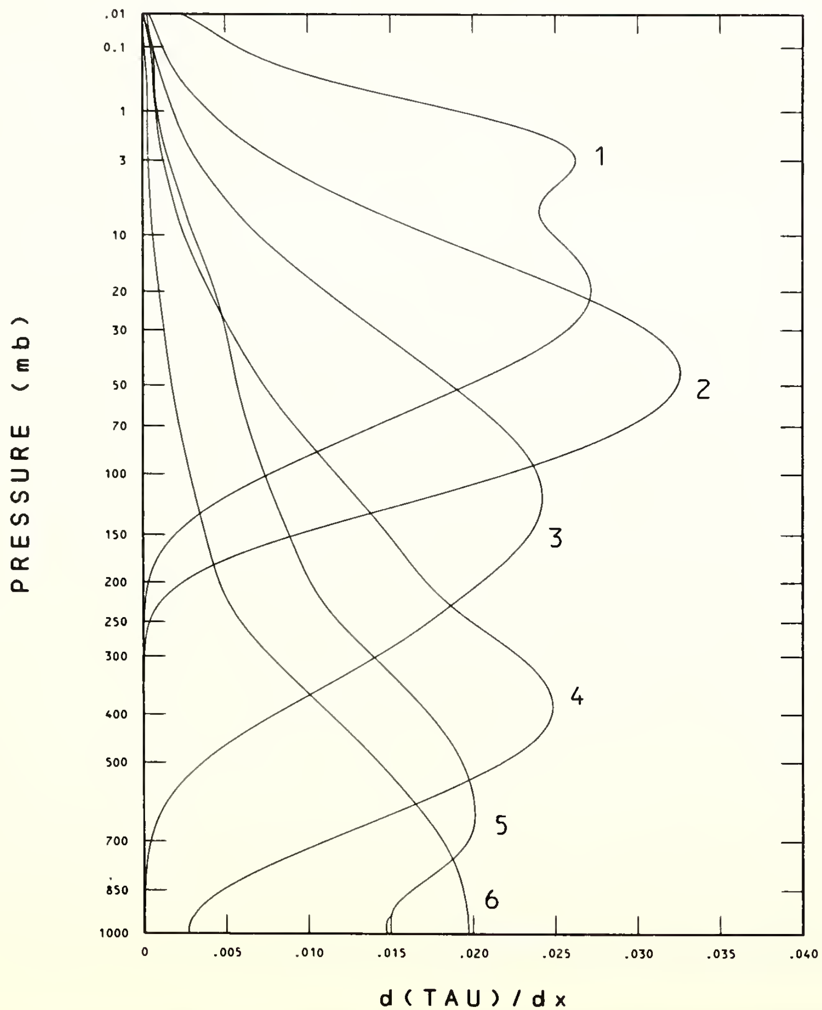
1	2	3	4	5	6
.98818	.99784	.99899	.99982	.99979	.99999
.97951	.99611	.99814	.99922	.99906	.99991
.96672	.99337	.99675	.99818	.99777	.99965
.94883	.98961	.99475	.99698	.99637	.99922
.92213	.98407	.99197	.99560	.99486	.99864
.88584	.97645	.98842	.99401	.99313	.99802
.84077	.96644	.98399	.99220	.99104	.99742
.78992	.95350	.97851	.99008	.98842	.99679
.73761	.93704	.97169	.98749	.98514	.99609
.68700	.91649	.96329	.98436	.98114	.99528
.63842	.89132	.95311	.98064	.97640	.99435
.59001	.86106	.94100	.97630	.97094	.99329
.53980	.82532	.92662	.97116	.96464	.99205
.48737	.78389	.90968	.96506	.95744	.99057
.43344	.73676	.89001	.95794	.94939	.98883
.37911	.68420	.86748	.94972	.94057	.98683
.32565	.62681	.84196	.94034	.93110	.98456
.27436	.56552	.81336	.92971	.92107	.98199
.22637	.50158	.78166	.91776	.91053	.97912
.18260	.43645	.74696	.90446	.89954	.97593
.14362	.37172	.70930	.88967	.88807	.97241
.10967	.30891	.66880	.87324	.87602	.96849
.08083	.24949	.62568	.85501	.86333	.96413
.05707	.19474	.58032	.83488	.84992	.95928
.03828	.14587	.53326	.81279	.83573	.95393
.02420	.10397	.48514	.78873	.82072	.94806
.01426	.06970	.43670	.76270	.80484	.94163
.00775	.04348	.38868	.73472	.78802	.93463
.00384	.02489	.34186	.70488	.77026	.92705
.00170	.01291	.29700	.67331	.75156	.91887
.00067	.00597	.25458	.63992	.73182	.91002
.00021	.00239	.21498	.60453	.71088	.90034
.00002	.00086	.17832	.56663	.68838	.88948
	.00027	.14470	.52569	.66393	.87707
	.00007	.11446	.48165	.63728	.86276
	.00000	.08797	.43477	.60831	.84626
		.06538	.38599	.57709	.82749
		.04677	.33641	.54374	.80637
		.03216	.28717	.50841	.78287
		.02117	.23962	.47139	.75707
		.01326	.19516	.43302	.72906
		.00786	.15490	.39366	.69898
		.00442	.11938	.35369	.66693
		.00236	.08907	.31353	.63304
		.00117	.06432	.27366	.59746
		.00055	.04491	.23514	.56049
		.00025	.03050	.19914	.52249
		.00010	.02043	.16622	.48377
		.00003	.01331	.13549	.44458
		.00000	.00767	.10587	.40516

VTPR

(ZENITH ANGLE 23°47')

SET: 2

CO_2 WEIGHTING FUNCTIONS



CO_2 WEIGHTING FUNCTION VALUES

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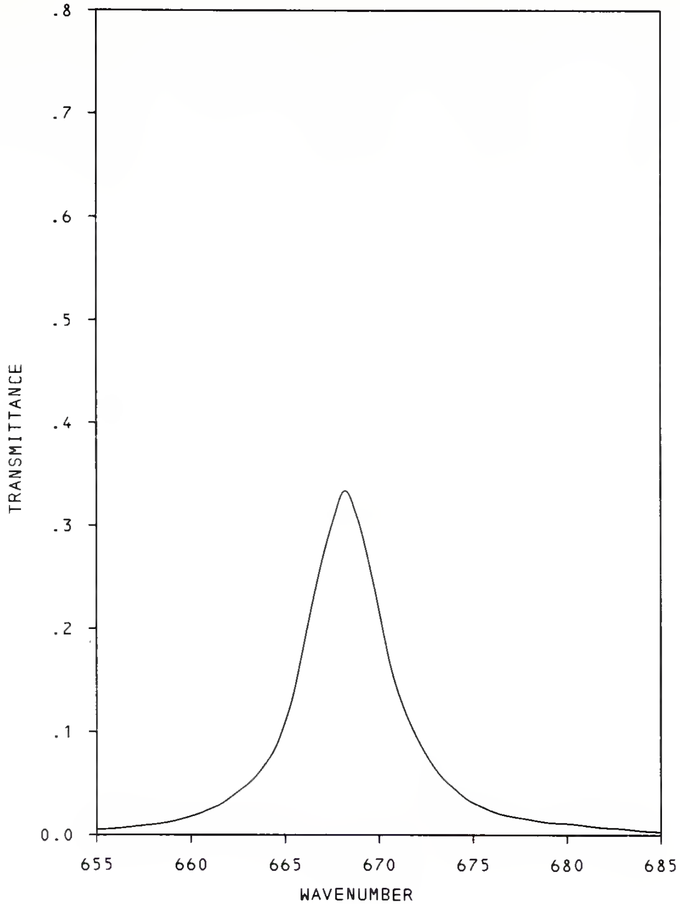
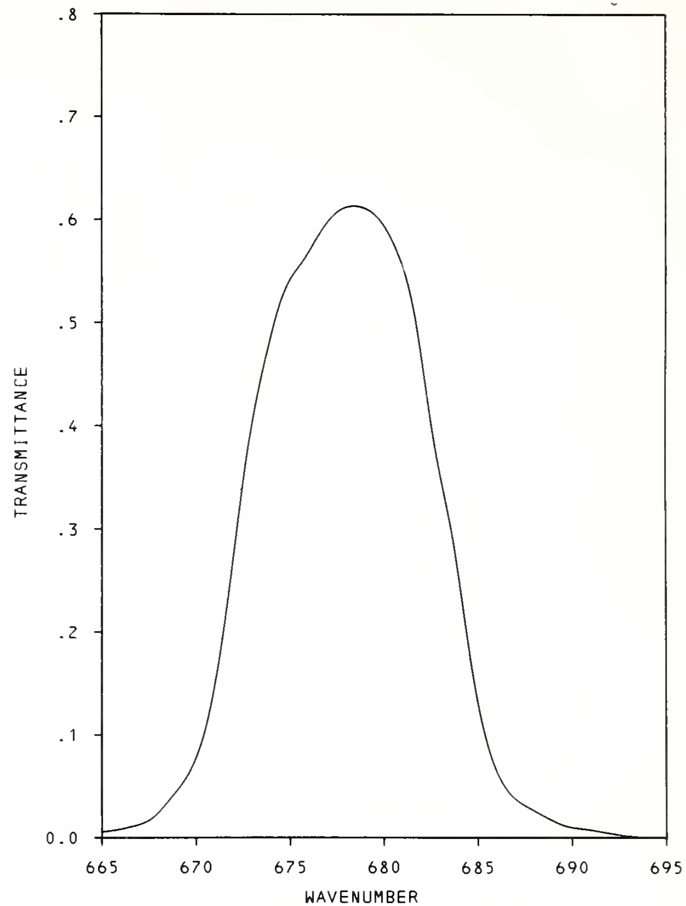
.00732	.00155	.00083	.00056	.00068	.00017
.01093	.00228	.00119	.00064	.00072	.00026
.01576	.00327	.00158	.00074	.00079	.00031
.02051	.00437	.00199	.00085	.00095	.00031
.02431	.00569	.00245	.00097	.00116	.00030
.02614	.00730	.00305	.00117	.00146	.00033
.02590	.00921	.00379	.00143	.00182	.00038
.02470	.01139	.00464	.00171	.00219	.00043
.02405	.01382	.00555	.00200	.00254	.00049
.02454	.01647	.00659	.00235	.00293	.00057
.02569	.01928	.00781	.00280	.00338	.00068
.02667	.02215	.00914	.00330	.00382	.00080
.02717	.02496	.01054	.00383	.00423	.00093
.02706	.02755	.01201	.00440	.00458	.00107
.02629	.02976	.01352	.00499	.00488	.00121
.02490	.03143	.01508	.00564	.00515	.00136
.02301	.03239	.01661	.00631	.00538	.00151
.02072	.03260	.01810	.00701	.00561	.00167
.01824	.03201	.01955	.00779	.00587	.00186
.01570	.03067	.02092	.00865	.00618	.00207
.01315	.02865	.02216	.00958	.00652	.00230
.01062	.02600	.02316	.01055	.00690	.00255
.00819	.02277	.02385	.01154	.00729	.00281
.00595	.01908	.02420	.01252	.00772	.00307
.00405	.01514	.02418	.01350	.00817	.00335
.00253	.01113	.02378	.01447	.00865	.00365
.00145	.00754	.02297	.01536	.00911	.00393
.00074	.00458	.02185	.01623	.00960	.00425
.00034	.00250	.02053	.01717	.01015	.00461
.00014	.00118	.01907	.01827	.01083	.00510
.00006	.00045	.01758	.01968	.01171	.00579
	.00017	.01600	.02125	.01276	.00665
	.00005	.01421	.02278	.01390	.00768
	.00002	.01228	.02401	.01506	.00881
	.00000	.01031	.02468	.01615	.00997
		.00829	.02480	.01719	.01115
		.00635	.02431	.01811	.01233
		.00468	.02312	.01888	.01346
		.00328	.02124	.01947	.01453
		.00216	.01898	.01987	.01554
		.00133	.01650	.02007	.01649
		.00078	.01378	.02007	.01739
		.00043	.01101	.01969	.01817
		.00021	.00842	.01873	.01877
		.00010	.00603	.01719	.01920
		.00005	.00418	.01582	.01950
		.00002	.00306	.01499	.01967
		.00001	.00270	.01472	.01973

VTPR

SET: 3
FILTER: 1
S/N: S.S.13091671-1
CENTROID: 668.5
EQUIV. WIDTH: 2.14



SET: 3
FILTER: 2
S/N: O.C.L.I. 1A
CENTROID: 677.9
EQUIV. WIDTH: 6.95



CM^{-1}	TRANS.	CM^{-1}	TRANS.	CM^{-1}	TRANS.	CM^{-1}	TRANS.
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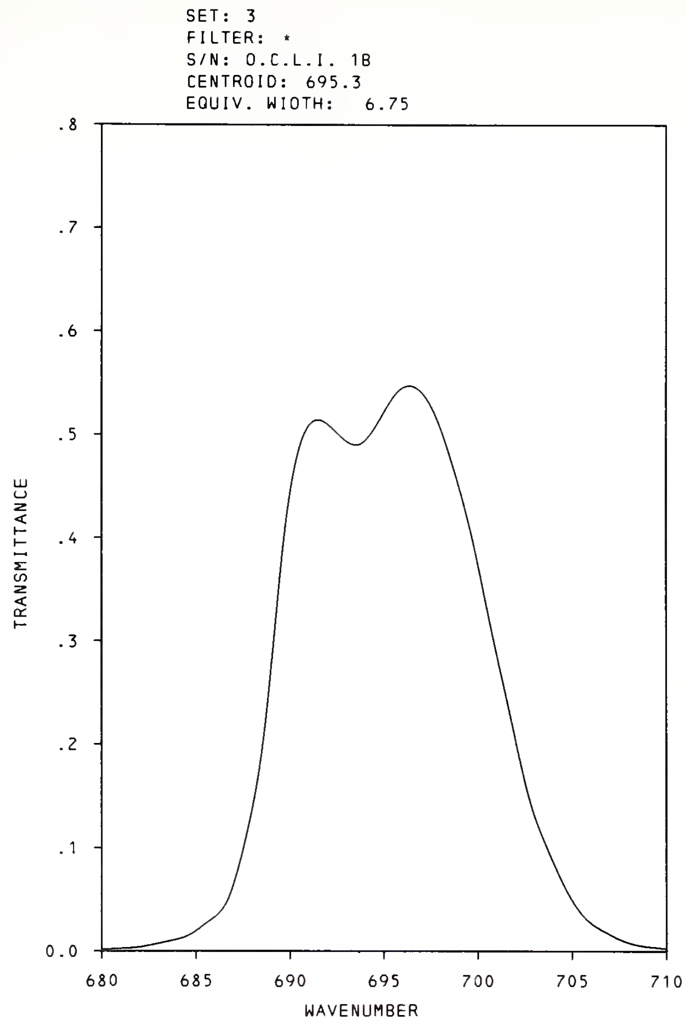
650.3	.00030	662.9	.04752	675.5	.02700		
650.5	.00049	663.1	.05056	675.7	.02538		
650.7	.00071	663.3	.05403	675.9	.02377		
650.9	.00090	663.5	.05799	676.1	.02229		
651.1	.00109	663.7	.06253	676.3	.02105		
651.3	.00131	663.9	.06745	676.5	.02000		
651.5	.00150	664.1	.07257	676.7	.01910		
651.7	.00169	664.3	.07816	676.9	.01835		
651.9	.00191	664.5	.08499	677.1	.01767		
652.1	.00210	664.7	.09367	677.3	.01707		
652.3	.00229	664.9	.10369	677.5	.01647		
652.5	.00251	665.1	.11444	677.7	.01591		
652.7	.00270	665.3	.12615	677.9	.01531		
652.9	.00289	665.5	.14001	678.1	.01467		
653.1	.00311	665.7	.15664	678.3	.01400		
653.3	.00330	665.9	.17487	678.5	.01334		
653.5	.00349	666.1	.19292	678.7	.01272		
653.7	.00368	666.3	.21016	678.9	.01221		
653.9	.00390	666.5	.22699	679.1	.01182		
654.1	.00411	666.7	.24365	679.3	.01159		
654.3	.00430	666.9	.25956	679.5	.01141		
654.5	.00452	667.1	.27401	679.7	.01126		
654.7	.00473	667.3	.28727	679.9	.01111		
654.9	.00490	667.5	.29999	680.1	.01088		
655.1	.00508	667.7	.31198	680.3	.01054		
655.3	.00525	667.9	.32402	680.5	.01015		
655.5	.00542	668.1	.33237	680.7	.00970		
655.7	.00561	668.3	.33361	680.9	.00923		
655.9	.00587	668.5	.32800	681.1	.00876		
656.1	.00617	668.7	.31776	681.3	.00829		
656.3	.00653	668.9	.30684	681.5	.00786		
656.5	.00694	669.1	.29442	681.7	.00747		
656.7	.00737	669.3	.27939	681.9	.00713		
656.9	.00779	669.5	.26301	682.1	.00687		
657.1	.00820	669.7	.24630	682.3	.00670		
657.3	.00859	669.9	.22905	682.5	.00653		
657.5	.00897	670.1	.21065	682.7	.00636		
657.7	.00938	670.3	.19174	682.9	.00615		
657.9	.00979	670.5	.17399	683.1	.00582		
658.1	.01024	670.7	.15879	683.3	.00544		
658.3	.01071	670.9	.14585	683.5	.00501		
658.5	.01126	671.1	.13448	683.7	.00458		
658.7	.01188	671.3	.12424	683.9	.00418		
658.9	.01261	671.5	.11499	684.1	.00385		
659.1	.01343	671.7	.10654	684.3	.00362		
659.3	.01435	671.9	.09872	684.5	.00343		
659.5	.01533	672.1	.09137	684.7	.00325		
659.7	.01638	672.3	.08446	684.9	.00311		
659.9	.01745	672.5	.07799	685.1	.00289		
660.1	.01854	672.7	.07204	685.3	.00266		
660.3	.01968	672.9	.06658	685.5	.00242		
660.5	.02101	673.1	.06154	685.7	.00221		
660.7	.02255	673.3	.05698	685.9	.00203		
660.9	.02420	673.5	.05300	686.1	.00199		
661.1	.02576	673.7	.04962	686.3	.00201		
661.3	.02728	673.9	.04655	686.5	.00206		
661.5	.02899	674.1	.04338	686.7	.00210		
661.7	.03116	674.3	.04013	686.9	.00206		
661.9	.03366	674.5	.03700	687.1	.00191		
662.1	.03638	674.7	.03428	687.3	.00163		
662.3	.03921	674.9	.03199	687.5	.00122		
662.5	.04199	675.1	.03011	687.7	.00077		

CM^{-1}	TRANS.	CM^{-1}	TRANS.	CM^{-1}	TRANS.
659.8	.00007	672.4	.33035	685.0	.13329
660.0	.00028	672.6	.35740	685.2	.11522
660.2	.00049	672.8	.38187	685.4	.09950
660.4	.00070	673.0	.40363	685.6	.08601
660.6	.00090	673.2	.42303	685.8	.07454
660.8	.00111	673.4	.44070	686.0	.06494
661.0	.00132	673.6	.45711	686.2	.05702
661.2	.00153	673.8	.47275	686.4	.05055
661.4	.00167	674.0	.48770	686.6	.04527
661.6	.00188	674.2	.50161	686.8	.04095
661.8	.00209	674.4	.51426	687.0	.03748
662.0	.00229	674.6	.52525	687.2	.03463
662.2	.00250	674.8	.53422	687.4	.03219
662.4	.00271	675.0	.54145	687.6	.03004
662.6	.00292	675.2	.54729	687.8	.02795
662.8	.00313	675.4	.55243	688.0	.02594
663.0	.00334	675.6	.55737	688.2	.02392
663.2	.00348	675.8	.56272	688.4	.02190
663.4	.00369	676.0	.56864	688.6	.01996
663.6	.00389	676.2	.57482	688.8	.01808
663.8	.00410	676.4	.58108	689.0	.01620
664.0	.00424	676.6	.58713	689.2	.01446
664.2	.00445	676.8	.59276	689.4	.01286
664.4	.00466	677.0	.59777	689.6	.01154
664.6	.00487	677.2	.60208	689.8	.01050
664.8	.00515	677.4	.60583	690.0	.00973
665.0	.00542	677.6	.60876	690.2	.00911
665.2	.00577	677.8	.61105	690.4	.00869
665.4	.00619	678.0	.61251	690.6	.00820
665.6	.00674	678.2	.61334	690.8	.00779
665.8	.00730	678.4	.61362	691.0	.00723
666.0	.00800	678.6	.61334	691.2	.00661
666.2	.00876	678.8	.61258	691.4	.00598
666.4	.00966	679.0	.61140	691.6	.00535
666.6	.01057	679.2	.60959	691.8	.00466
666.8	.01147	679.4	.60716	692.0	.00403
667.0	.01252	679.6	.60396	692.2	.00341
667.2	.01377	679.8	.59986	692.4	.00278
667.4	.01544	680.0	.59485	692.6	.00223
667.6	.01766	680.2	.58887	692.8	.00174
667.8	.02051	680.4	.58205	693.0	.00132
668.0	.02399	680.6	.57427	693.2	.00090
668.2	.02802	680.8	.56551	693.4	.00056
668.4	.03233	681.0	.55556	693.6	.00014
668.6	.03678	681.2	.54388		
668.8	.04123	681.4	.52977		
669.0	.04568	681.6	.51280		
669.2	.05041	681.8	.49229		
669.4	.05563	682.0	.46886		
669.6	.06161	682.2	.44369		
669.8	.06863	682.4	.41838		
670.0	.07690	682.6	.39418		
670.2	.08678	682.8	.37255		
670.4	.09846	683.0	.35357		
670.6	.11223	683.2	.33598		
670.8	.12843	683.4	.31832		
671.0	.14706	683.6	.29941		
671.2	.16799	683.8	.27785		
671.4	.19121	684.0	.25365		
671.6	.21659	684.2	.22800		
671.8	.24392	684.4	.20199		
672.0	.27264	684.6	.17689		
672.2	.30177	684.8	.15381		

VTPR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FILTER: *
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CENTROID: 695.3
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TRANSMITTANCE
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.7
.6
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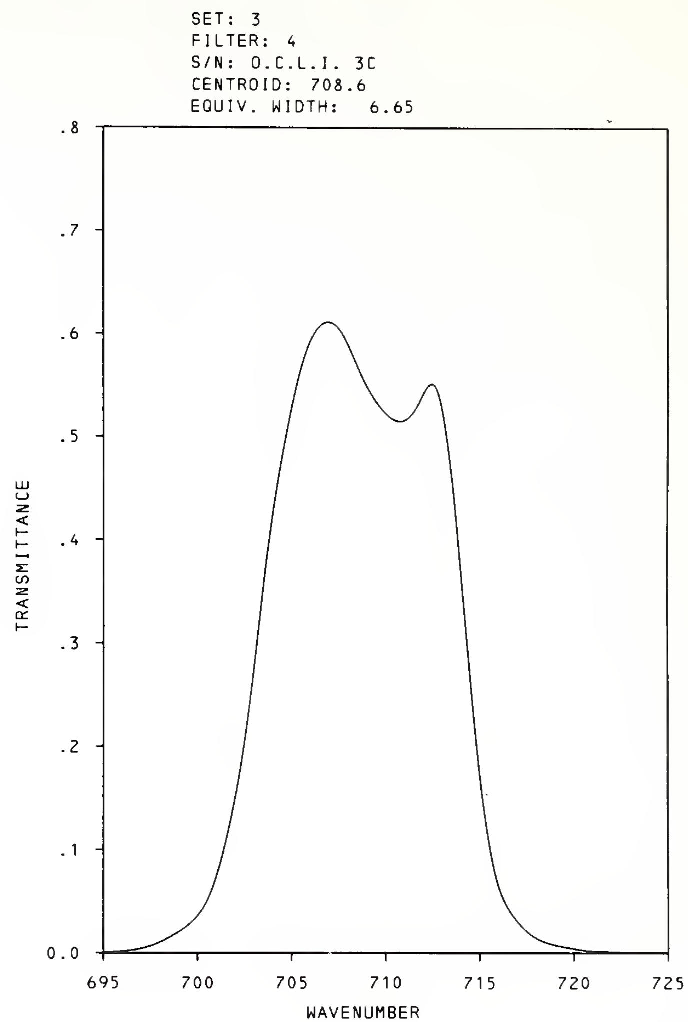
.4
.3
.2
.1
0.0
680
685
690
695
700
705
710
WAVENUMBER


SET: 3
FILTER: 4
S/N: O.C.L.I. 3C
CENTROID: 708.6
EQUIV. WIDTH: 6.65
TRANSMITTANCE
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.7
.6
.5
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.3
.2
.1
0.0
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700
705
710
715
720
725
WAVENUMBER

CM^{-1}	TRANS.	CM^{-1}	TRANS.	CM^{-1}	TRANS.
677.8	.00014	690.4	.47901	703.0	.13191
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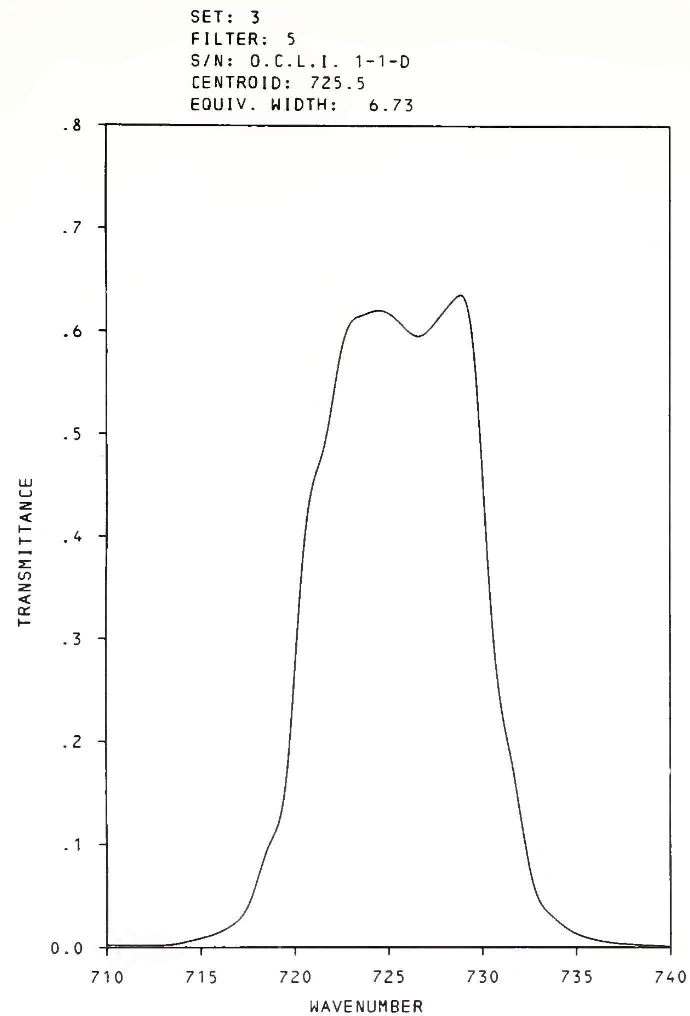
678.2	.00061	690.8	.50136	703.4	.11212
678.4	.00081	691.0	.50785	703.6	.10334
678.6	.00095	691.2	.51176	703.8	.09469
678.8	.00101	691.4	.51352	704.0	.08625
679.0	.00101	691.6	.51352	704.2	.07801
679.2	.00101	691.8	.51217	704.4	.07004
679.4	.00095	692.0	.50987	704.6	.06254
679.6	.00095	692.2	.50677	704.8	.05559
679.8	.00108	692.4	.50332	705.0	.04924
680.0	.00122	692.6	.49974	705.2	.04350
680.2	.00142	692.8	.49636	705.4	.03843
680.4	.00169	693.0	.49332	705.6	.03397
680.6	.00189	693.2	.49110	705.8	.03019
680.8	.00209	693.4	.48974	706.0	.02708
681.0	.00223	693.6	.48954	706.2	.02438
681.2	.00236	693.8	.49083	706.4	.02209
681.4	.00257	694.0	.49353	706.6	.01999
681.6	.00284	694.2	.49744	706.8	.01803
681.8	.00317	694.4	.50231	707.0	.01607
682.0	.00365	694.6	.50798	707.2	.01418
682.2	.00426	694.8	.51413	707.4	.01236
682.4	.00493	695.0	.52054	707.6	.01074
682.6	.00561	695.2	.52683	707.8	.00932
682.8	.00635	695.4	.53270	708.0	.00804
683.0	.00716	695.6	.53783	708.2	.00696
683.2	.00797	695.8	.54189	708.4	.00608
683.4	.00878	696.0	.54472	708.6	.00534
683.6	.00959	696.2	.54628	708.8	.00473
683.8	.01040	696.4	.54668	709.0	.00426
684.0	.01128	696.6	.54587	709.2	.00385
684.2	.01223	696.8	.54385	709.4	.00351
684.4	.01351	697.0	.54067	709.6	.00317
684.6	.01506	697.2	.53628	709.8	.00284
684.8	.01709	697.4	.53068	710.0	.00236
685.0	.01945	697.6	.52385	710.2	.00196
685.2	.02215	697.8	.51582	710.4	.00155
685.4	.02492	698.0	.50663	710.6	.00115
685.6	.02769	698.2	.49650	710.8	.00088
685.8	.03026	698.4	.48556	711.0	.00061
686.0	.03289	698.6	.47394	711.2	.00041
686.2	.03607	698.8	.46192	711.4	.00020
686.4	.04039	699.0	.44949	711.6	.00007
686.6	.04627	699.2	.43645		
686.8	.05430	699.4	.42261		
687.0	.06457	699.6	.40782		
687.2	.07673	699.8	.39188		
687.4	.09044	700.0	.37499		
687.6	.10523	700.2	.35736		
687.8	.12097	700.4	.33953		
688.0	.13779	700.6	.32177		
688.2	.15676	700.8	.30441		
688.4	.17885	701.0	.28766		
688.6	.20506	701.2	.27118		
688.8	.23633	701.4	.25483		
689.0	.27199	701.6	.23835		
689.2	.30995	701.8	.22154		
689.4	.34791	702.0	.20458		
689.6	.38364	702.2	.18783		
689.8	.41498	702.4	.17176		
690.0	.44105	702.6	.15690		
690.2	.46219	702.8	.14359		

CM^{-1}	TRANS.	CM^{-1}	TRANS.	CM^{-1}	TRANS.
694.8	.00007	707.4	.60717	720.0	.00399
695.0	.00027	707.6	.60278	720.2	.00332
695.2	.00047	707.8	.59680	720.4	.00272
695.4	.00066	708.0	.58949	720.6	.00219
695.6	.00086	708.2	.58125	720.8	.00179
695.8	.00113	708.4	.57261	721.0	.00153
696.0	.00140	708.6	.56411	721.2	.00133
696.2	.00173	708.8	.55613	721.4	.00120
696.4	.00219	709.0	.54889	721.6	.00106
696.6	.00272	709.2	.54245	721.8	.00093
696.8	.00332	709.4	.53660	722.0	.00073
697.0	.00412	709.6	.53141	722.2	.00053
697.2	.00498	709.8	.52676	722.4	.00033
697.4	.00605	710.0	.52271	722.6	.00013
697.6	.00731	710.2	.51932		
697.8	.00871	710.4	.51686		
698.0	.01030	710.6	.51533		
698.2	.01209	710.8	.51493		
698.4	.01395	711.0	.51580		
698.6	.01595	711.2	.51799		
698.8	.01807	711.4	.52165		
699.0	.02027	711.6	.52683		
699.2	.02273	711.8	.53361		
699.4	.02538	712.0	.54112		
699.6	.02837	712.2	.54756		
699.8	.03176	712.4	.55108		
700.0	.03568	712.6	.54995		
700.2	.04054	712.8	.54225		
700.4	.04645	713.0	.52749		
700.6	.05376	713.2	.50636		
700.8	.06273	713.4	.47945		
701.0	.07343	713.6	.44762		
701.2	.08572	713.8	.41147		
701.4	.09961	714.0	.37206		
701.6	.11489	714.2	.33093		
701.8	.13144	714.4	.28953		
702.0	.14945	714.6	.24926		
702.2	.16939	714.8	.21158		
702.4	.19158	715.0	.17729		
702.6	.21643	715.2	.14666		
702.8	.24434	715.4	.12001		
703.0	.27498	715.6	.09755		
703.2	.30701	715.8	.07954		
703.4	.33917	716.0	.06559		
703.6	.37027	716.2	.05502		
703.8	.39904	716.4	.04705		
704.0	.42502	716.6	.04073		
704.2	.44862	716.8	.03542		
704.4	.47028	717.0	.03063		
704.6	.49041	717.2	.02638		
704.8	.50935	717.4	.02266		
705.0	.52723	717.6	.01940		
705.2	.54377	717.8	.01668		
705.4	.55886	718.0	.01435		
705.6	.57208	718.2	.01249		
705.8	.58338	718.4	.01090		
706.0	.59255	718.6	.00957		
706.2	.59979	718.8	.00851		
706.4	.60518	719.0	.00758		
706.6	.60883	719.2	.00671		
706.8	.61082	719.4	.00605		
707.0	.61116	719.6	.00532		
707.2	.60996	719.8	.00465		

VTPR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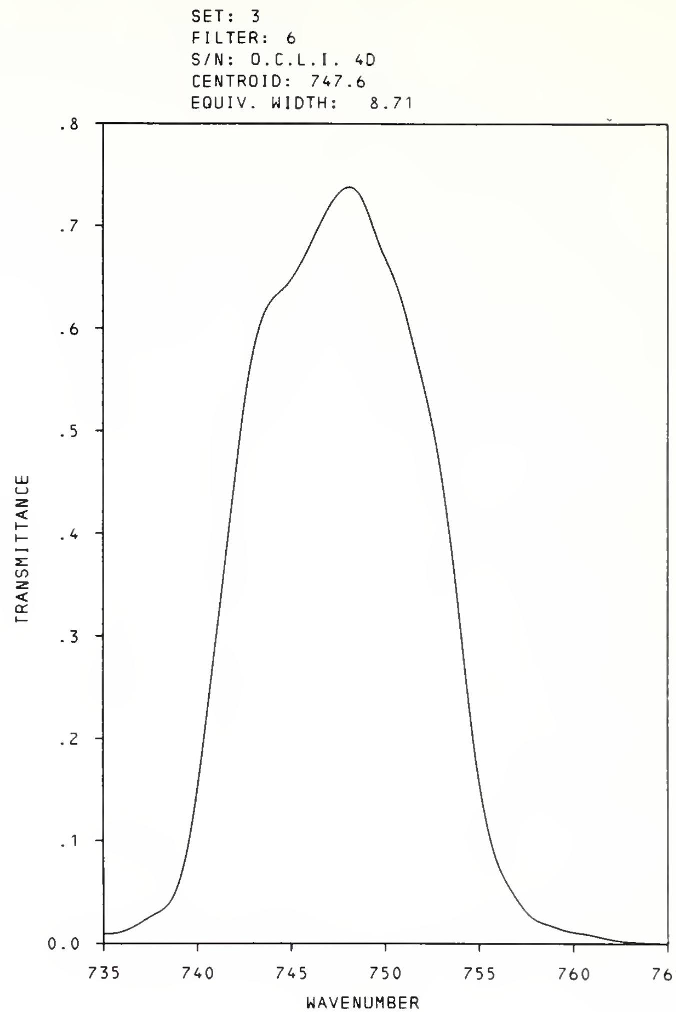
720
725
730
735
740
WAVENUMBER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FILTER: 6
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745
750
755
760
765
WAVENUMBER

CM^{-1}	TRANS.	CM^{-1}	TRANS.	CM^{-1}	TRANS.
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707.1	.00061	719.7	.19212	732.3	.09892
707.3	.00081	719.9	.23774	732.5	.07866
707.5	.00094	720.1	.28882	732.7	.06258
707.7	.00101	720.3	.33976	732.9	.05101
707.9	.00101	720.5	.38511	733.1	.04300
708.1	.00094	720.7	.41963	733.3	.03762
708.3	.00094	720.9	.44258	733.5	.03371
708.5	.00094	721.1	.45772	733.7	.03035
708.7	.00108	721.3	.46889	733.9	.02705
708.9	.00128	721.5	.48013	734.1	.02389
709.1	.00148	721.7	.49520	734.3	.02093
709.3	.00175	721.9	.51485	734.5	.01824
709.5	.00195	722.1	.53692	734.7	.01588
709.7	.00209	722.3	.55899	734.9	.01386
709.9	.00209	722.5	.57878	735.1	.01218
710.1	.00209	722.7	.59385	735.3	.01077
710.3	.00209	722.9	.60381	735.5	.00956
710.5	.00202	723.1	.60967	735.7	.00848
710.7	.00202	723.3	.61283	735.9	.00754
710.9	.00195	723.5	.61438	736.1	.00666
711.1	.00195	723.7	.61565	736.3	.00592
711.3	.00202	723.9	.61707	736.5	.00532
711.5	.00202	724.1	.61848	736.7	.00471
711.7	.00202	724.3	.61956	736.9	.00424
711.9	.00202	724.5	.62003	737.1	.00384
712.1	.00202	724.7	.61976	737.3	.00343
712.3	.00202	724.9	.61855	737.5	.00316
712.5	.00202	725.1	.61660	737.7	.00289
712.7	.00202	725.3	.61397	737.9	.00262
712.9	.00209	725.5	.61074	738.1	.00242
713.1	.00215	725.7	.60711	738.3	.00229
713.3	.00242	725.9	.60334	738.5	.00209
713.5	.00276	726.1	.59977	738.7	.00188
713.7	.00330	726.3	.59695	738.9	.00168
713.9	.00397	726.5	.59526	739.1	.00148
714.1	.00478	726.7	.59520	739.3	.00128
714.3	.00565	726.9	.59668	739.5	.00108
714.5	.00653	727.1	.59950	739.7	.00087
714.7	.00747	727.3	.60334	739.9	.00067
714.9	.00834	727.5	.60771	740.1	.00047
715.1	.00929	727.7	.61236	740.3	.00027
715.3	.01023	727.9	.61700	740.5	.00007
715.5	.01137	728.1	.62158		
715.7	.01265	728.3	.62602		
715.9	.01413	728.5	.63012		
716.1	.01581	728.7	.63376		
716.3	.01770	728.9	.63524		
716.5	.01985	729.1	.63147		
716.7	.02221	729.3	.61922		
716.9	.02503	729.5	.59533		
717.1	.02880	729.7	.55677		
717.3	.03392	729.9	.50496		
717.5	.04078	730.1	.44574		
717.7	.04980	730.3	.38518		
717.9	.06076	730.5	.32926		
718.1	.07254	730.7	.28397		
718.3	.08418	730.9	.25046		
718.5	.09461	731.1	.22556		
718.7	.10282	731.3	.20578		
718.9	.10996	731.5	.18754		
719.1	.11917	731.7	.16762		

CM^{-1}	TRANS.	CM^{-1}	TRANS.	CM^{-1}	TRANS.
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729.0	.00026	741.6	.38921	754.2	.27776
729.2	.00052	741.8	.42090	754.4	.24485
729.4	.00070	742.0	.45251	754.6	.21367
729.6	.00087	742.2	.48325	754.8	.18511
729.8	.00113	742.4	.51207	755.0	.15978
730.0	.00131	742.6	.53819	755.2	.13749
730.2	.00148	742.8	.56074	755.4	.11833
730.4	.00174	743.0	.57946	755.6	.10205
730.6	.00192	743.2	.59470	755.8	.08864
730.8	.00209	743.4	.60680	756.0	.07776
731.0	.00226	743.6	.61621	756.2	.06887
731.2	.00244	743.8	.62326	756.4	.06147
731.4	.00261	744.0	.62848	756.6	.05503
731.6	.00287	744.2	.63240	756.8	.04902
731.8	.00313	744.4	.63580	757.0	.04319
732.0	.00357	744.6	.63911	757.2	.03779
732.2	.00392	744.8	.64311	757.4	.03291
732.4	.00435	745.0	.64790	757.6	.02873
732.6	.00479	745.2	.65339	757.8	.02551
732.8	.00522	745.4	.65966	758.0	.02299
733.0	.00557	745.6	.66645	758.2	.02116
733.2	.00601	745.8	.67367	758.4	.01977
733.4	.00636	746.0	.68125	758.6	.01863
733.6	.00679	746.2	.68909	758.8	.01741
733.8	.00723	746.4	.69675	759.0	.01611
734.0	.00775	746.6	.70432	759.2	.01480
734.2	.00818	746.8	.71155	759.4	.01358
734.4	.00862	747.0	.71817	759.6	.01245
734.6	.00888	747.2	.72418	759.8	.01158
734.8	.00906	747.4	.72931	760.0	.01088
735.0	.00914	747.6	.73341	760.2	.01036
735.2	.00923	747.8	.73628	760.4	.00984
735.4	.00940	748.0	.73785	760.6	.00932
735.6	.00975	748.2	.73776	760.8	.00871
735.8	.01036	748.4	.73584	761.0	.00792
736.0	.01132	748.6	.73184	761.2	.00714
736.2	.01263	748.8	.72557	761.4	.00627
736.4	.01419	749.0	.71712	761.6	.00540
736.6	.01602	749.2	.70737	761.8	.00461
736.8	.01802	749.4	.69701	762.0	.00392
737.0	.02029	749.6	.68682	762.2	.00322
737.2	.02255	749.8	.67742	762.4	.00270
737.4	.02482	750.0	.66897	762.6	.00218
737.6	.02699	750.2	.66087	762.8	.00183
737.8	.02899	750.4	.65252	763.0	.00157
738.0	.03091	750.6	.64320	763.2	.00139
738.2	.03344	750.8	.63240	763.4	.00122
738.4	.03683	751.0	.61995	763.6	.00104
738.6	.04179	751.2	.60637	763.8	.00096
738.8	.04876	751.4	.59209	764.0	.00078
739.0	.05799	751.6	.57737	764.2	.00052
739.2	.06992	751.8	.56266	764.4	.00035
739.4	.08481	752.0	.54803	764.6	.00009
739.6	.10274	752.2	.53288		
739.8	.12416	752.4	.51660		
740.0	.14872	752.6	.49875		
740.2	.17580	752.8	.47872		
740.4	.20471	753.0	.45634		
740.6	.23475	753.2	.43161		
740.8	.26531	753.4	.40462		
741.0	.29596	753.6	.37545		
741.2	.32678	753.8	.34411		

VTPR

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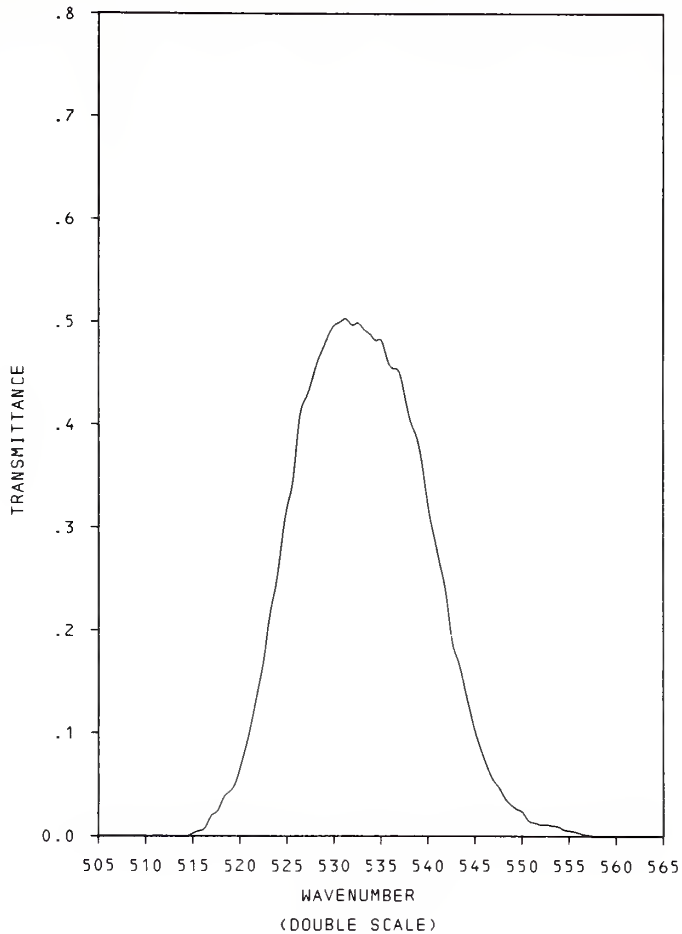
CENTROID: 532.9
EQUIV. WIDTH: 9.11



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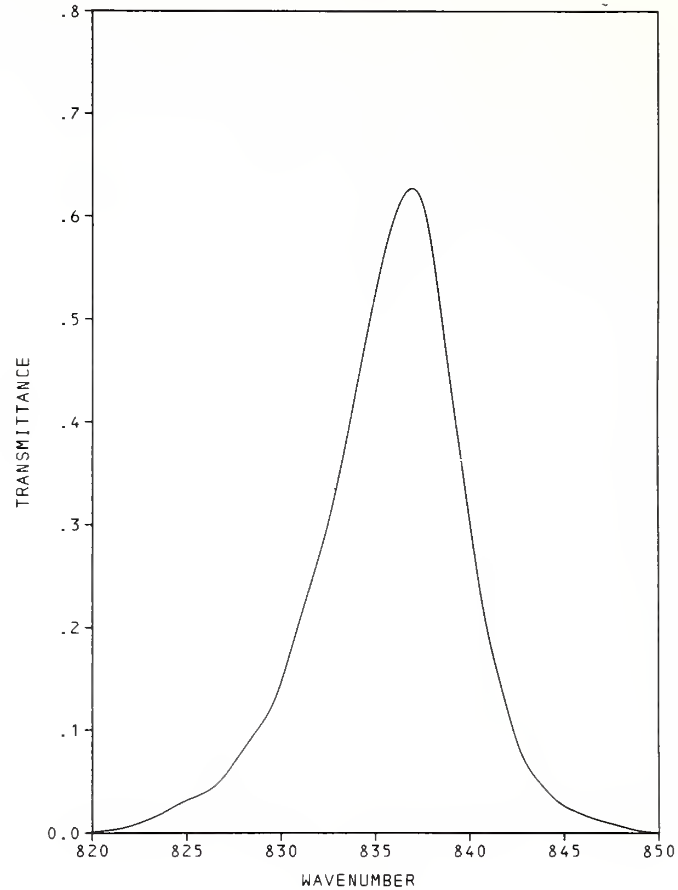

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514.7	.00155	527.3	.43413	539.9	.32394	552.5	.01102
514.9	.00255	527.5	.43996	540.1	.31264	552.7	.01075
515.1	.00346	527.7	.44643	540.3	.30345	552.9	.01038
515.3	.00419	527.9	.45298	540.5	.29516	553.1	.01002
515.5	.00474	528.1	.45899	540.7	.28669	553.3	.00984
515.7	.00519	528.3	.46419	540.9	.27786	553.5	.00965
515.9	.00565	528.5	.46865	541.1	.26911	553.7	.00929
516.1	.00692	528.7	.47293	541.3	.26110	553.9	.00856
516.3	.00947	528.9	.47721	541.5	.25336	554.1	.00747
516.5	.01321	529.1	.48158	541.7	.24443	554.3	.00647
516.7	.01703	529.3	.48595	541.9	.23296	554.5	.00565
516.9	.02004	529.5	.48996	542.1	.21839	554.7	.00528
517.1	.02140	529.7	.49333	542.3	.20300	554.9	.00510
517.3	.02231	529.9	.49606	542.5	.18997	555.1	.00492
517.5	.02404	530.1	.49770	542.7	.18178	555.3	.00464
517.7	.02741	530.3	.49870	542.9	.17659	555.5	.00428
517.9	.03187	530.5	.49943	543.1	.17203	555.7	.00373
518.1	.03597	530.7	.50070	543.3	.16593	555.9	.00310
518.3	.03889	530.9	.50216	543.5	.15837	556.1	.00255
518.5	.04080	531.1	.50307	543.7	.15017	556.3	.00200
518.7	.04226	531.3	.50243	543.9	.14189	556.5	.00164
518.9	.04380	531.5	.50052	544.1	.13378	556.7	.00127
519.1	.04590	531.7	.49825	544.3	.12595	556.9	.00100
519.3	.04900	531.9	.49697	544.5	.11812	557.1	.00073
519.5	.05346	532.1	.49743	544.7	.11056	557.3	.00036
519.7	.05920	532.3	.49861	544.9	.10336	557.5	*00000
519.9	.06566	532.5	.49897	545.1	.09681		
520.1	.07231	532.7	.49770	545.3	.09098		
520.3	.07878	532.9	.49533	545.5	.08561		
520.5	.08551	533.1	.49296	545.7	.08042		
520.7	.09262	533.3	.49142	545.9	.07532		
520.9	.10036	533.5	.49023	546.1	.07040		
521.1	.10865	533.7	.48896	546.3	.06566		
521.3	.11748	533.9	.48686	546.5	.06120		
521.5	.12659	534.1	.48431	546.7	.05719		
521.7	.13588	534.3	.48240	546.9	.05400		
521.9	.14498	534.5	.48213	547.1	.05155		
522.1	.15400	534.7	.48304	547.3	.04945		
522.3	.16374	534.9	.48304	547.5	.04699		
522.5	.17504	535.1	.48003	547.7	.04380		
522.7	.18842	535.3	.47411	547.9	.04025		
522.9	.20245	535.5	.46719	548.1	.03697		
523.1	.21502	535.7	.46136	548.3	.03442		
523.3	.22485	535.9	.45754	548.5	.03242		
523.5	.23314	536.1	.45544	548.7	.03078		
523.7	.24188	536.3	.45480	548.9	.02923		
523.9	.25290	536.5	.45480	549.1	.02778		
524.1	.26638	536.7	.45399	549.3	.02650		
524.3	.28086	536.9	.45098	549.5	.02559		
524.5	.29489	537.1	.44479	549.7	.02495		
524.7	.30727	537.3	.43641	549.9	.02386		
524.9	.31774	537.5	.42703	550.1	.02186		
525.1	.32567	537.7	.41792	550.3	.01894		
525.3	.33250	537.9	.40973	550.5	.01612		
525.5	.34160	538.1	.40299	550.7	.01421		
525.7	.35599	538.3	.39798	550.9	.01339		
525.9	.37503	538.5	.39370	551.1	.01311		
526.1	.39397	538.7	.38896	551.3	.01275		
526.3	.40836	538.9	.38250	551.5	.01211		
526.5	.41674	539.1	.37384	551.7	.01147		
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526.9	.42502	539.5	.35053	552.1	.01093		

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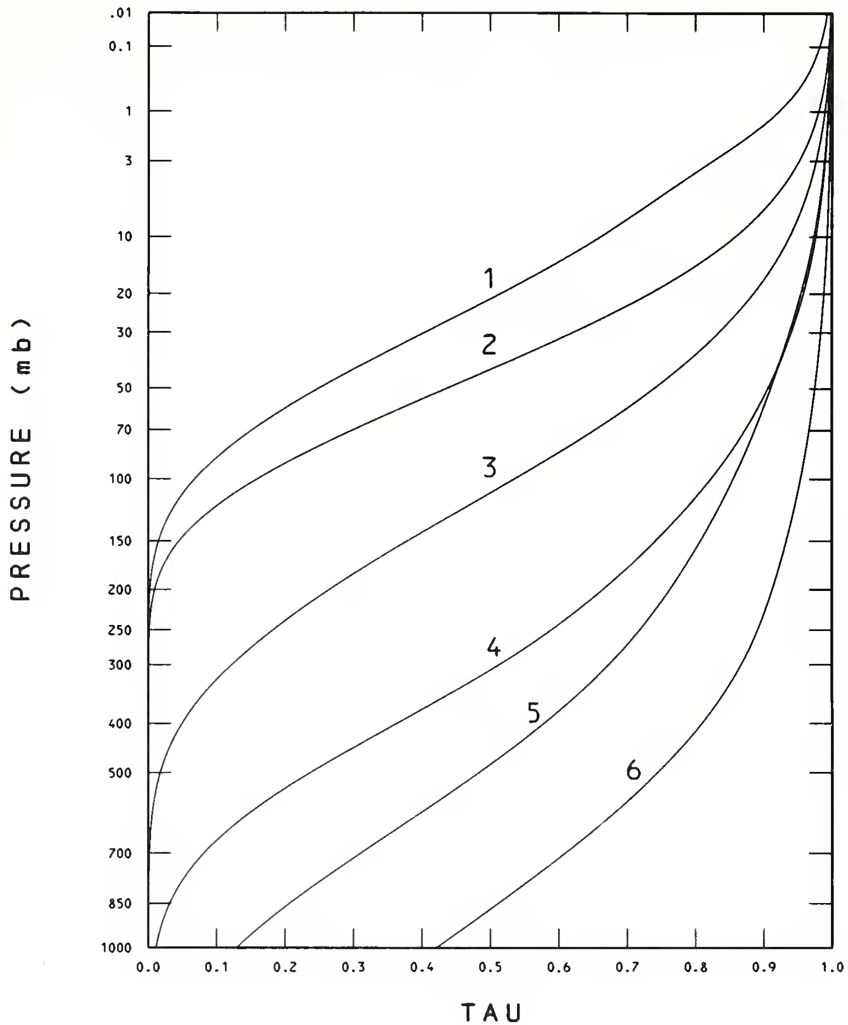
820.2	.00095	832.8	.32489	845.4	.02238
820.4	.00138	833.0	.34144	845.6	.02079
820.6	.00180	833.2	.35889	845.8	.01925
820.8	.00223	833.4	.37698	846.0	.01772
821.0	.00271	833.6	.39560	846.2	.01628
821.2	.00324	833.8	.41448	846.4	.01491
821.4	.00382	834.0	.43347	846.6	.01358
821.6	.00456	834.2	.45246	846.8	.01241
821.8	.00546	834.4	.47129	847.0	.01140
822.0	.00652	834.6	.48986	847.2	.01040
822.2	.00769	834.8	.50800	847.4	.00944
822.4	.00896	835.0	.52561	847.6	.00849
822.6	.01029	835.2	.54242	847.8	.00748
822.8	.01172	835.4	.55834	848.0	.00642
823.0	.01315	835.6	.57308	848.2	.00541
823.2	.01469	835.8	.58656	848.4	.00435
823.4	.01634	836.0	.59849	848.6	.00345
823.6	.01809	836.2	.60862	848.8	.00260
823.8	.01994	836.4	.61684	849.0	.00191
824.0	.02196	836.6	.62289	849.2	.00127
824.2	.02403	836.8	.62650	849.4	.00074
824.4	.02610	837.0	.62724	849.6	.00027
824.6	.02806	837.2	.62459		
824.8	.02986	837.4	.61791		
825.0	.03156	837.6	.60661		
825.2	.03310	837.8	.59006		
825.4	.03464	838.0	.56873		
825.6	.03618	838.2	.54386		
825.8	.03782	838.4	.51680		
826.0	.03962	838.6	.48885		
826.2	.04175	838.8	.46137		
826.4	.04424	839.0	.43490		
826.6	.04726	839.2	.40902		
826.8	.05092	839.4	.38345		
827.0	.05522	839.6	.35789		
827.2	.05999	839.8	.33200		
827.4	.06508	840.0	.30585		
827.6	.07034	840.2	.28018		
827.8	.07564	840.4	.25556		
828.0	.08089	840.6	.23265		
828.2	.08614	840.8	.21202		
828.4	.09129	841.0	.19377		
828.6	.09643	841.2	.17738		
828.8	.10158	841.4	.16226		
829.0	.10678	841.6	.14799		
829.2	.11251	841.8	.13399		
829.4	.11903	842.0	.12025		
829.6	.12667	842.2	.10704		
829.8	.13574	842.4	.09479		
830.0	.14624	842.6	.08386		
830.2	.15786	842.8	.07463		
830.4	.17011	843.0	.06710		
830.6	.18274	843.2	.06095		
830.8	.19525	843.4	.05575		
831.0	.20756	843.6	.05119		
831.2	.21971	843.8	.04684		
831.4	.23180	844.0	.04265		
831.6	.24389	844.2	.03862		
831.8	.25609	844.4	.03485		
832.0	.26856	844.6	.03151		
832.2	.28145	844.8	.02864		

VTPR

SET: 3

CO_2 TRANSMITTANCES



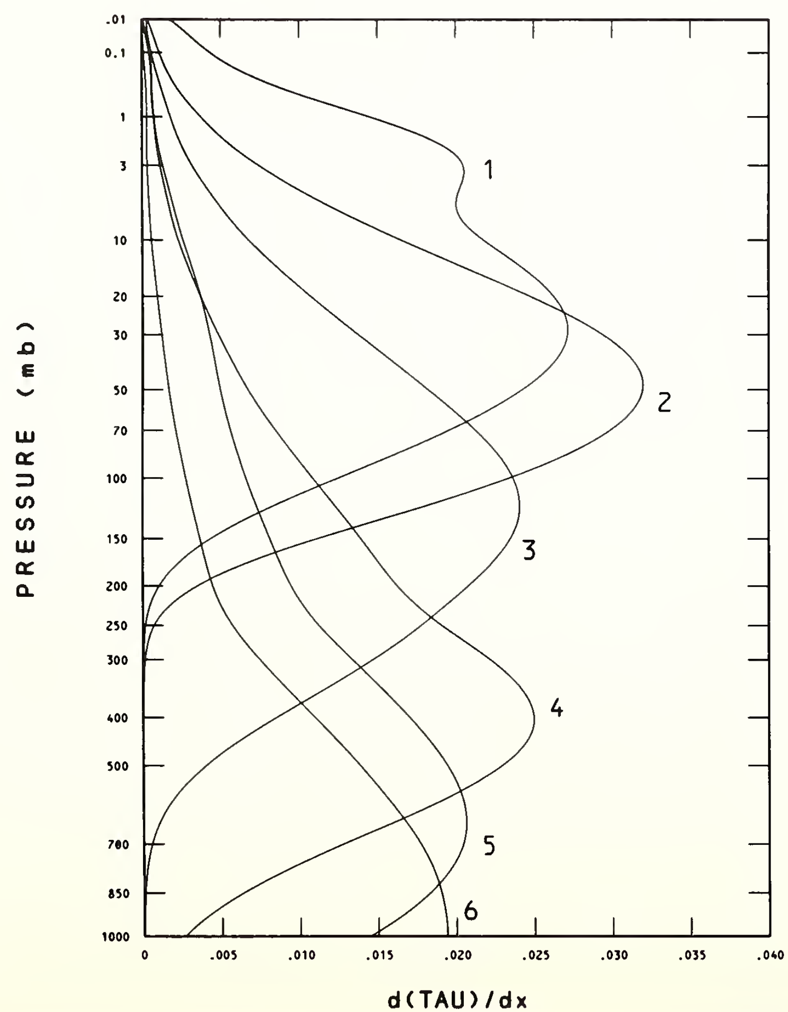
CO_2 TRANSMITTANCE VALUES

1	2	3	4	5	6
.99085	.99799	.99904	.99984	.99984	.99999
.98442	.99643	.99821	.99929	.99924	.99991
.97479	.99396	.99688	.99831	.99817	.99967
.96130	.99054	.99494	.99716	.99698	.99926
.94124	.98549	.99223	.99586	.99572	.99869
.91392	.97848	.98879	.99438	.99428	.99809
.87972	.96919	.98450	.99270	.99253	.99749
.84063	.95714	.97920	.99076	.99037	.99689
.79965	.94175	.97261	.98839	.98764	.99621
.75899	.92247	.96449	.98553	.98430	.99543
.71880	.89880	.95466	.98212	.98033	.99454
.67752	.87028	.94297	.97815	.97575	.99352
.63346	.83654	.92907	.97344	.97045	.99232
.58605	.79735	.91270	.96786	.96438	.99089
.53561	.75264	.89368	.96134	.95757	.98922
.48286	.70260	.87187	.95380	.95009	.98729
.42878	.64773	.84716	.94520	.94201	.98510
.37446	.58878	.81944	.93545	.93342	.98262
.32106	.52685	.78866	.92449	.92435	.97985
.26970	.46322	.75488	.91227	.91485	.97678
.22140	.39934	.71815	.89867	.90487	.97338
.17700	.33666	.67856	.88355	.89434	.96960
.13722	.27656	.63629	.86674	.88317	.96539
.10263	.22035	.59169	.84815	.87129	.96072
.07359	.16925	.54526	.82771	.85865	.95556
.05028	.12440	.49762	.80540	.84519	.94988
.03245	.08668	.44947	.78120	.83085	.94368
.01960	.05671	.40152	.75510	.81556	.93692
.01097	.03444	.35457	.72718	.79931	.92960
.00560	.01925	.30937	.69753	.78207	.92170
.00258	.00977	.26642	.66603	.76374	.91315
.00103	.00445	.22613	.63247	.74414	.90379
.00037	.00187	.18865	.59632	.72293	.89330
.00012	.00072	.15413	.55701	.69973	.88130
.00003	.00026	.12290	.51438	.67426	.86746
.00000	.00007	.09537	.46858	.64636	.85151
	.00000	.07171	.42041	.61606	.83334
		.05203	.37087	.58346	.81289
		.03639	.32099	.54865	.79011
		.02445	.27207	.51187	.76507
		.01569	.22548	.47337	.73788
		.00958	.18240	.43348	.70864
		.00557	.14361	.39268	.67746
		.00309	.10980	.35145	.64445
		.00160	.08154	.31029	.60976
		.00079	.05866	.26986	.57367
		.00038	.04077	.23083	.53648
		.00016	.02740	.19386	.49850
		.00006	.01784	.15962	.46000
		.00003	.01134	.12874	.42124

VTPR

SET: 3

CO_2 WEIGHTING FUNCTIONS



CO_2 WEIGHTING FUNCTION VALUES

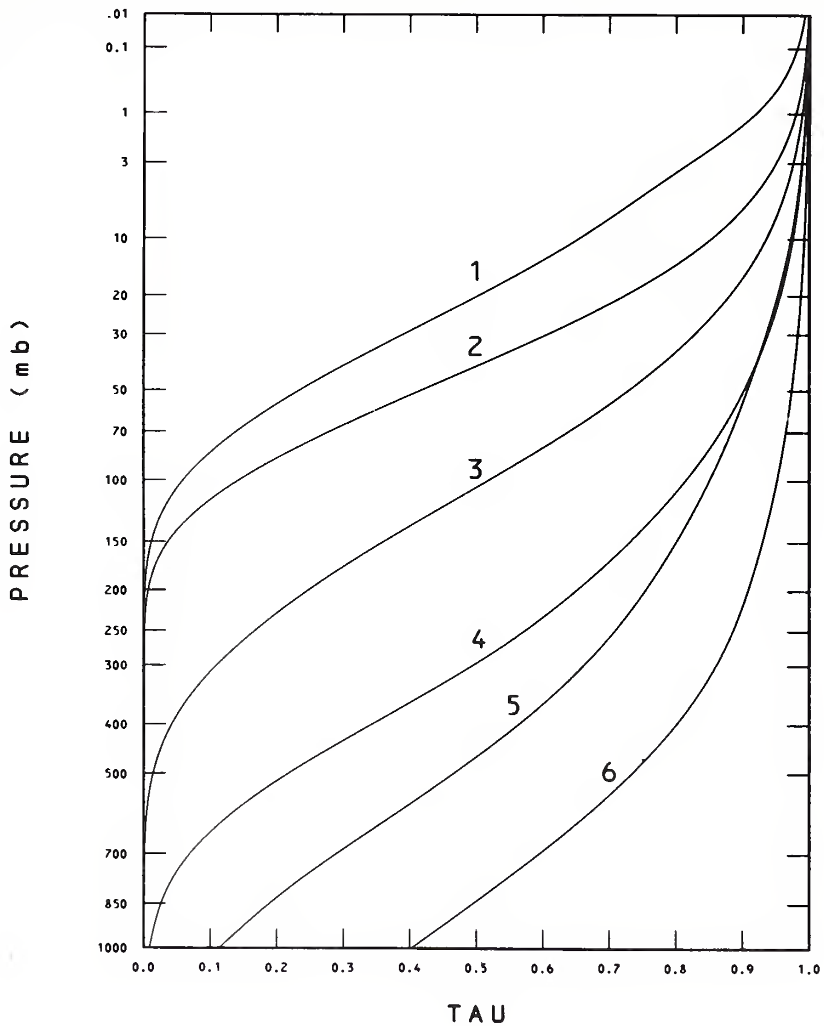
1	2	3	4	5	6
.00223	.00049	.00032	.00012	.00013	.00001
.00422	.00108	.00054	.00043	.00048	.00008
.00553	.00141	.00080	.00053	.00057	.00016
.00823	.00207	.00116	.00061	.00061	.00025
.01183	.00300	.00154	.00070	.00066	.00030
.01548	.00404	.00193	.00079	.00079	.00030
.01855	.00529	.00237	.00089	.00096	.00030
.02027	.00681	.00295	.00107	.00121	.00032
.02053	.00862	.00366	.00130	.00152	.00036
.02013	.01070	.00448	.00157	.00183	.00042
.02020	.01301	.00536	.00183	.00213	.00048
.02123	.01554	.00636	.00215	.00246	.00055
.02287	.01822	.00755	.00257	.00284	.00066
.02451	.02098	.00884	.00302	.00322	.00077
.02587	.02371	.01020	.00351	.00358	.00090
.02679	.02628	.01162	.00403	.00390	.00103
.02720	.02853	.01310	.00458	.00417	.00117
.02702	.03032	.01463	.00518	.00442	.00131
.02628	.03150	.01614	.00579	.00464	.00146
.02500	.03200	.01763	.00644	.00486	.00161
.02324	.03176	.01909	.00717	.00512	.00179
.02110	.03081	.02049	.00797	.00542	.00199
.01863	.02918	.02175	.00884	.00576	.00222
.01593	.02693	.02281	.00976	.00613	.00246
.01309	.02408	.02357	.01069	.00652	.00271
.01025	.02070	.02401	.01163	.00694	.00297
.00762	.01697	.02409	.01257	.00740	.00324
.00529	.01302	.02379	.01351	.00789	.00352
.00342	.00928	.02309	.01439	.00837	.00380
.00202	.00604	.02207	.01528	.00888	.00410
.00108	.00358	.02083	.01623	.00946	.00446
.00051	.00186	.01945	.01738	.01017	.00493
.00019	.00084	.01802	.01883	.01107	.00559
.00007	.00036	.01648	.02048	.01215	.00643
.00002	.00014	.01471	.02215	.01334	.00743
.00001	.00006	.01281	.02358	.01456	.00853
.00000	.00001	.01084	.02451	.01573	.00965
		.00882	.02495	.01687	.01081
		.00685	.02482	.01792	.01196
		.00513	.02399	.01884	.01307
		.00367	.02249	.01963	.01412
		.00248	.02053	.02021	.01512
		.00158	.01821	.02055	.01606
		.00096	.01554	.02064	.01694
		.00055	.01275	.02045	.01772
		.00028	.01016	.01992	.01835
		.00015	.00776	.01905	.01881
		.00007	.00567	.01785	.01914
		.00003	.00395	.01634	.01934
		.00001	.00261	.01450	.01941

V T P R

[ZENITH ANGLE 23°47']

SET: 3

CO_2 TRANSMITTANCES



CO_2 TRANSMITTANCE VALUES

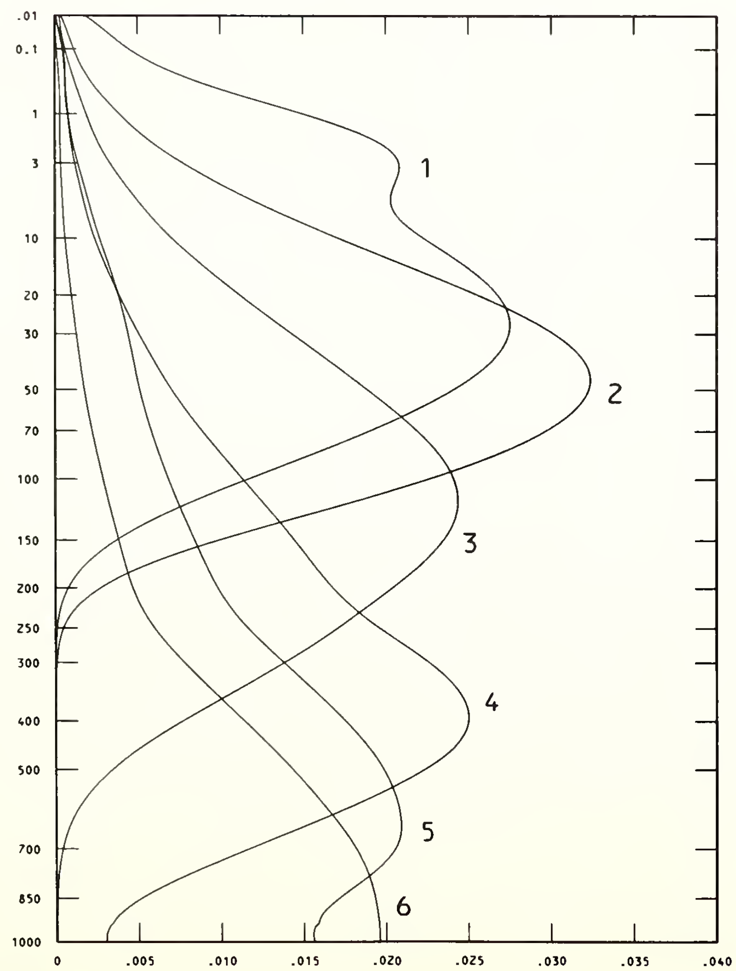
1	2	3	4	5	6
.99062	.99794	.99901	.99982	.99982	.99999
.98395	.99630	.99816	.99925	.99919	.99990
.97400	.99373	.99676	.99823	.99808	.99965
.95997	.99018	.99475	.99706	.99687	.99921
.93907	.98490	.99194	.99571	.99558	.99862
.91069	.97757	.98834	.99417	.99408	.99800
.87540	.96789	.98386	.99242	.99224	.99738
.83540	.95533	.97832	.99037	.98995	.99674
.79383	.93928	.97142	.98788	.98708	.99602
.75275	.91917	.96293	.98487	.98357	.99520
.71198	.89448	.95264	.98130	.97941	.99425
.66983	.86475	.94042	.97713	.97462	.99318
.62466	.82961	.92590	.97220	.96910	.99190
.57606	.78884	.90880	.96635	.96278	.99040
.52446	.74244	.88894	.95951	.95571	.98863
.47068	.69065	.86619	.95162	.94796	.98660
.41578	.63406	.84043	.94260	.93962	.98428
.36091	.57352	.81154	.93238	.93076	.98167
.30728	.51024	.77952	.92090	.92141	.97875
.25602	.44560	.74446	.90810	.91162	.97552
.20814	.38111	.70640	.89386	.90132	.97193
.16449	.31825	.66549	.87803	.89044	.96795
.12577	.25846	.62194	.86044	.87888	.96352
.09250	.20305	.57615	.84100	.86658	.95860
.06502	.15327	.52868	.81964	.85347	.95316
.04339	.11028	.48020	.79635	.83949	.94720
.02722	.07483	.43145	.77112	.82458	.94067
.01589	.04742	.38321	.74394	.80869	.93357
.00853	.02772	.33626	.71491	.79178	.92587
.00414	.01482	.29139	.68413	.77385	.91758
.00180	.00716	.24909	.65150	.75480	.90860
.00067	.00307	.20973	.61682	.73445	.89879
.00022	.00123	.17344	.57957	.71244	.88779
.00006	.00046	.14032	.53919	.68839	.87522
.00000	.00016	.11066	.49557	.66201	.86073
	.00004	.08481	.44892	.63315	.84405
	.00000	.06286	.40013	.60183	.82508
		.04487	.35028	.56817	.80376
		.03080	.30048	.53229	.78005
		.02027	.25207	.49447	.75404
		.01270	.20651	.45506	.72585
		.00755	.16496	.41445	.69560
		.00426	.12803	.37304	.66342
		.00230	.09626	.33127	.62943
		.00116	.07009	.28967	.59380
		.00055	.04938	.24934	.55683
		.00026	.03387	.21152	.51890
		.00010	.02291	.17683	.48033
		.00003	.01507	.14436	.44133
		.00000	.00879	.11301	.40212

VTPR

[ZENITH ANGLE 23°47']

SET: 3

CO_2 WEIGHTING FUNCTIONS



CO_2 WEIGHTING FUNCTION VALUES

1	2	3	4	5	6
.00230	.00052	.00033	.00013	.00015	.00001
.00437	.00113	.00056	.00045	.00050	.00008
.00573	.00146	.00084	.00055	.00058	.00017
.00857	.00216	.00120	.00063	.00062	.00026
.01232	.00313	.00160	.00072	.00069	.00031
.01604	.00421	.00202	.00082	.00083	.00031
.01907	.00551	.00248	.00093	.00102	.00031
.02064	.00711	.00308	.00112	.00128	.00034
.02076	.00899	.00383	.00137	.00160	.00038
.02036	.01116	.00468	.00164	.00192	.00044
.02056	.01357	.00561	.00193	.00223	.00050
.02174	.01619	.00665	.00226	.00257	.00058
.02346	.01897	.00789	.00269	.00296	.00069
.02511	.02180	.00922	.00317	.00335	.00082
.02642	.02458	.01064	.00368	.00371	.00095
.02726	.02716	.01212	.00422	.00403	.00109
.02754	.02937	.01365	.00480	.00431	.00123
.02722	.03107	.01523	.00542	.00456	.00138
.02632	.03210	.01678	.00606	.00479	.00154
.02486	.03241	.01828	.00675	.00502	.00170
.02294	.03196	.01976	.00751	.00529	.00189
.02065	.03078	.02114	.00834	.00560	.00210
.01804	.02890	.02237	.00925	.00596	.00234
.01520	.02640	.02337	.01020	.00635	.00259
.01227	.02328	.02405	.01116	.00677	.00285
.00940	.01966	.02437	.01213	.00722	.00312
.00682	.01574	.02431	.01310	.00770	.00341
.00459	.01171	.02387	.01406	.00820	.00370
.00286	.00805	.02301	.01495	.00870	.00399
.00161	.00500	.02183	.01584	.00923	.00431
.00081	.00281	.02044	.01680	.00983	.00468
.00036	.00138	.01892	.01793	.01055	.00517
.00012	.00057	.01736	.01937	.01149	.00586
.00005	.00024	.01573	.02101	.01259	.00674
.00002	.00009	.01390	.02261	.01380	.00777
	.00004	.01195	.02395	.01505	.00891
	.00001	.00999	.02475	.01625	.01007
		.00800	.02501	.01740	.01126
		.00610	.02467	.01845	.01244
		.00448	.02361	.01934	.01356
		.00313	.02184	.02004	.01462
		.00206	.01967	.02054	.01562
		.00127	.01722	.02083	.01655
		.00074	.01450	.02091	.01743
		.00042	.01170	.02059	.01818
		.00021	.00903	.01964	.01875
		.00010	.00652	.01809	.01915
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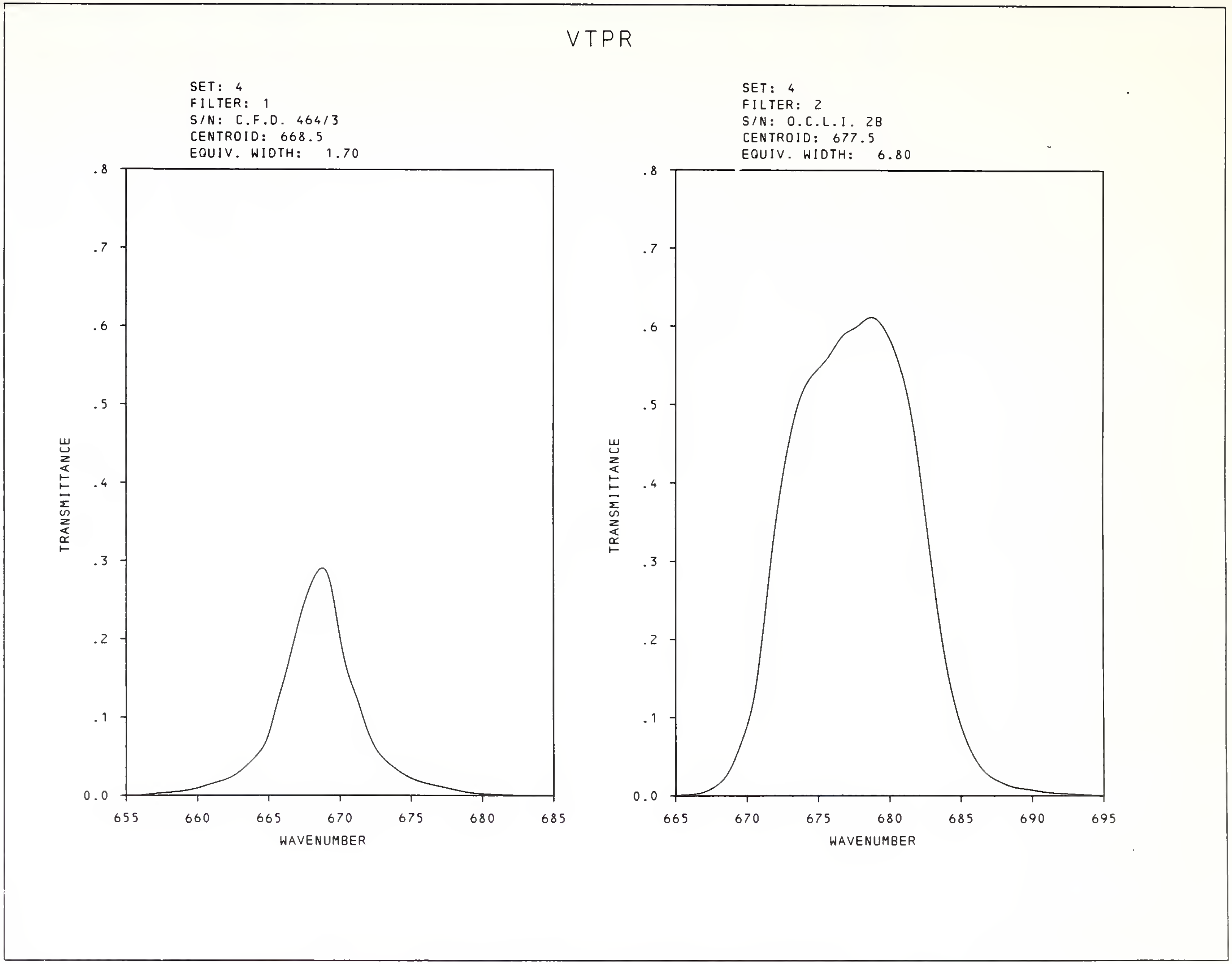
		.00001	.00301	.01558	.01962


VTPR
SET: 4
FILTER: 1
S/N: C.F.D. 464/3
CENTROID: 668.5
EQUIV. WIDTH: 1.70
TRANSMITTANCE
.8
.7
.6
.5
.4
.3
.2
.1
0.0
655
660
665
670
675
680
685
WAVENUMBER
SET: 4
FILTER: 2
S/N: O.C.L.I. 28
CENTROID: 677.5
EQUIV. WIDTH: 6.80
TRANSMITTANCE
.8
.7
.6
.5
.4
.3
.2
.1
0.0
665
670
675
680
685
690
695
WAVENUMBER

CM^{-1}	TRANS.	CM^{-1}	TRANS.	CM^{-1}	TRANS.
656.1	.00024	668.7	.29047	681.3	.00088
656.3	.00070	668.9	.29017	681.5	.00075
656.5	.00115	669.1	.28533	681.7	.00058
656.7	.00160	669.3	.27464	681.9	.00042
656.9	.00202	669.5	.25768	682.1	.00025
657.1	.00243	669.7	.23686	682.3	.00007
657.3	.00278	669.9	.21499		
657.5	.00314	670.1	.19459		
657.7	.00345	670.3	.17653		
657.9	.00373	670.5	.16134		
658.1	.00402	670.7	.14926		
658.3	.00435	670.9	.13919		
658.5	.00468	671.1	.12954		
658.7	.00506	671.3	.11889		
658.9	.00550	671.5	.10739		
659.1	.00601	671.7	.09586		
659.3	.00660	671.9	.08520		
659.5	.00728	672.1	.07577		
659.7	.00806	672.3	.06759		
659.9	.00894	672.5	.06075		
660.1	.00996	672.7	.05509		
660.3	.01105	672.9	.05044		
660.5	.01220	673.1	.04649		
660.7	.01337	673.3	.04308		
660.9	.01455	673.5	.04002		
661.1	.01568	673.7	.03715		
661.3	.01674	673.9	.03440		
661.5	.01775	674.1	.03177		
661.7	.01882	674.3	.02930		
661.9	.01999	674.5	.02697		
662.1	.02135	674.7	.02483		
662.3	.02298	674.9	.02291		
662.5	.02492	675.1	.02120		
662.7	.02721	675.3	.01971		
662.9	.02982	675.5	.01836		
663.1	.03271	675.7	.01719		
663.3	.03585	675.9	.01614		
663.5	.03919	676.1	.01517		
663.7	.04272	676.3	.01429		
663.9	.04640	676.5	.01346		
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664.7	.06511	677.3	.01035		
664.9	.07349	677.5	.00956		
665.1	.08488	677.7	.00872		
665.3	.09822	677.9	.00789		
665.5	.11199	678.1	.00706		
665.7	.12492	678.3	.00626		
665.9	.13722	678.5	.00550		
666.1	.14975	678.7	.00480		
666.3	.16319	678.9	.00416		
666.5	.17750	679.1	.00358		
666.7	.19215	679.3	.00309		
666.9	.20666	679.5	.00265		
667.1	.22066	679.7	.00227		
667.3	.23382	679.9	.00197		
667.5	.24587	680.1	.00173		
667.7	.25668	680.3	.00154		
667.9	.26632	680.5	.00139		
668.1	.27487	680.7	.00126		
668.3	.28212	680.9	.00114		
668.5	.28752	681.1	.00102		

CM^{-1}	TRANS.	CM^{-1}	TRANS.	CM^{-1}	TRANS.
664.8	.00014	677.4	.59677	690.0	.00714
665.0	.00034	677.6	.59882	690.2	.00653
665.2	.00054	677.8	.60140	690.4	.00592
665.4	.00075	678.0	.60446	690.6	.00531
665.6	.00088	678.2	.60752	690.8	.00476
665.8	.00109	678.4	.61011	691.0	.00422
666.0	.00129	678.6	.61174	691.2	.00381
666.2	.00156	678.8	.61188	691.4	.00347
666.4	.00197	679.0	.61045	691.6	.00313
666.6	.00259	679.2	.60752	691.8	.00286
666.8	.00347	679.4	.60337	692.0	.00265
667.0	.00469	679.6	.59800	692.2	.00245
667.2	.00612	679.8	.59174	692.4	.00225
667.4	.00789	680.0	.58453	692.6	.00211
667.6	.00986	680.2	.57636	692.8	.00190
667.8	.01218	680.4	.56704	693.0	.00170
668.0	.01483	680.6	.55664	693.2	.00150
668.2	.01803	680.8	.54500	693.4	.00129
668.4	.02204	681.0	.53194	693.6	.00109
668.6	.02708	681.2	.51711	693.8	.00088
668.8	.03327	681.4	.50017	694.0	.00068
669.0	.04068	681.6	.48071	694.2	.00048
669.2	.04905	681.8	.45853	694.4	.00027
669.4	.05824	682.0	.43370	694.6	.00007
669.6	.06796	682.2	.40690		
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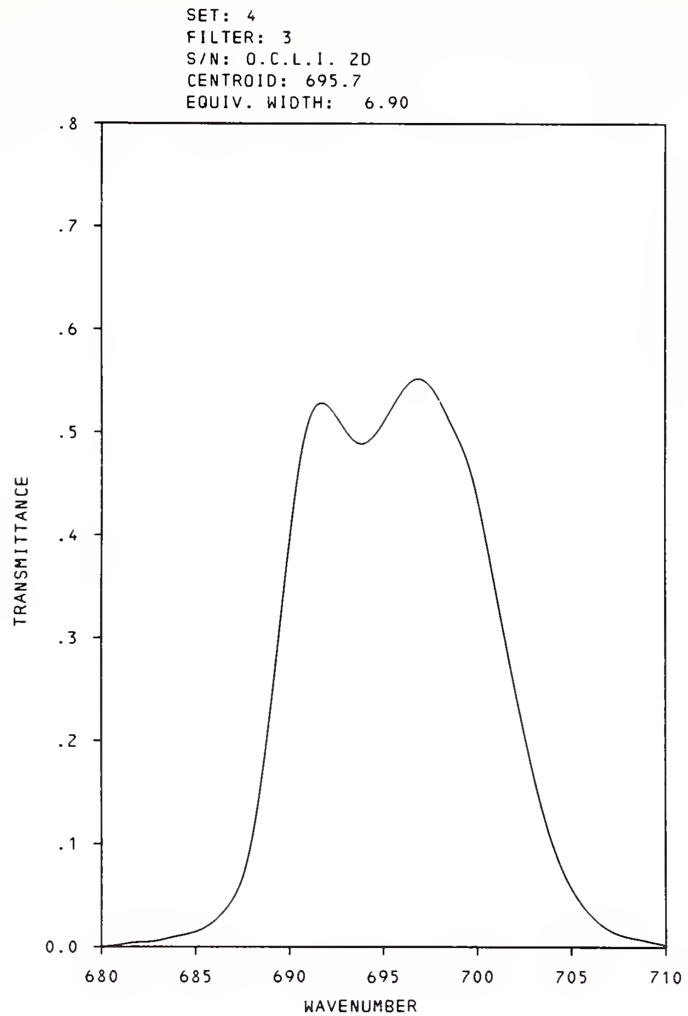
670.6	.13654	683.2	.26369		
670.8	.16076	683.4	.23689		
671.0	.18947	683.6	.21178		
671.2	.22124	683.8	.18879		
671.4	.25430	684.0	.16790		
671.6	.28716	684.2	.14913		
671.8	.31818	684.4	.13219		
672.0	.34669	684.6	.11701		
672.2	.37281	684.8	.10341		
672.4	.39669	685.0	.09116		
672.6	.41867	685.2	.08028		
672.8	.43887	685.4	.07062		
673.0	.45738	685.6	.06198		
673.2	.47404	685.8	.05429		
673.4	.48874	686.0	.04749		
673.6	.50146	686.2	.04150		
673.8	.51201	686.4	.03633		
674.0	.52058	686.6	.03191		
674.2	.52752	686.8	.02823		
674.4	.53316	687.0	.02524		
674.6	.53786	687.2	.02279		
674.8	.54201	687.4	.02068		
675.0	.54595	687.6	.01884		
675.2	.54983	687.8	.01714		
675.4	.55398	688.0	.01551		
675.6	.55847	688.2	.01401		
675.8	.56371	688.4	.01265		
676.0	.56943	688.6	.01150		
676.2	.57528	688.8	.01054		
676.4	.58092	689.0	.00980		
676.6	.58589	689.2	.00925		
676.8	.58983	689.4	.00871		
677.0	.59262	689.6	.00823		
677.2	.59480	689.8	.00776		

VTPR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TRANSMITTANCE
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.2
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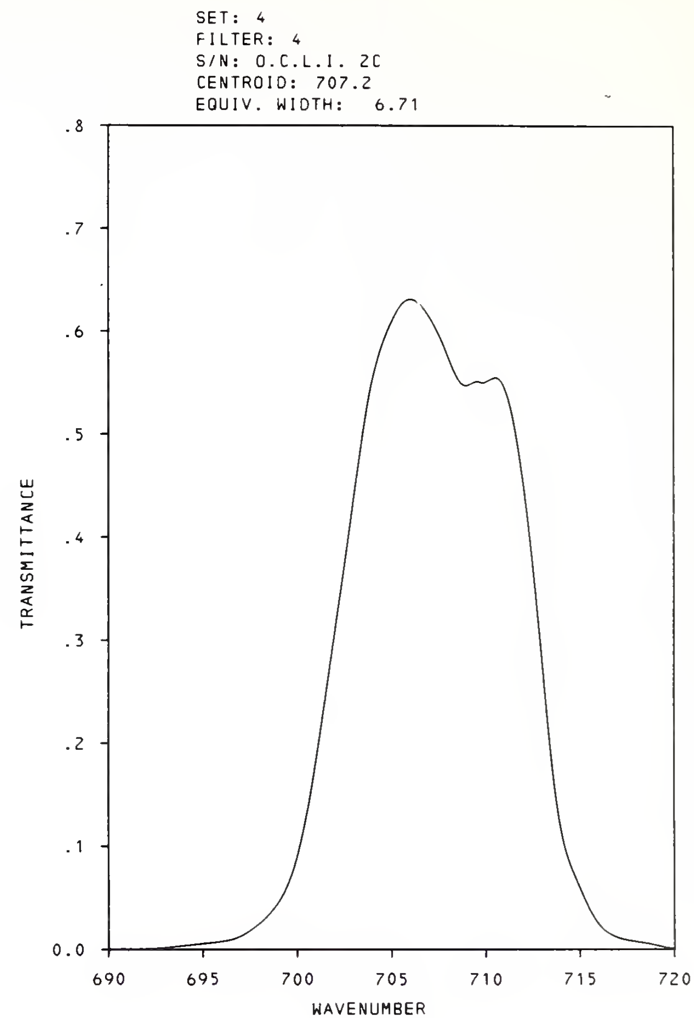
680
685
690
695
700
705
710
WAVENUMBER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CENTROID: 707.2
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TRANSMITTANCE
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.7
.6
.5
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.3
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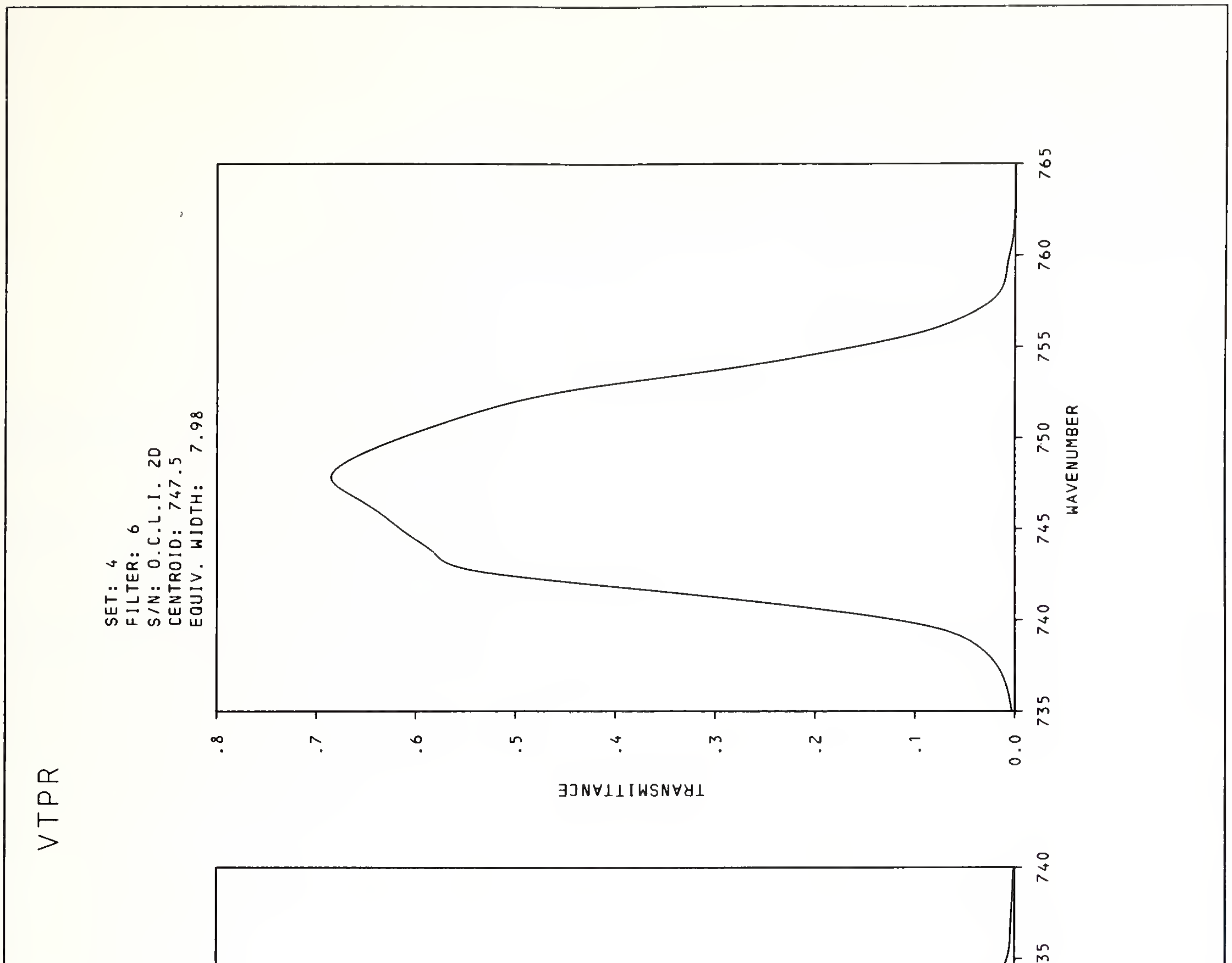
.1
0.0
690
695
700
705
710
715
720
WAVENUMBER

CM^{-1}	TRANS.	CM^{-1}	TRANS.	CM^{-1}	TRANS.
679.8	*00000	692.4	.51823	705.0	.05730
680.0	.00007	692.6	.51284	705.2	.05101
680.2	.00021	692.8	.50718	705.4	.04542
680.4	.00041	693.0	.50173	705.6	.04038
680.6	.00076	693.2	.49683	705.8	.03576
680.8	.00124	693.4	.49275	706.0	.03155
681.0	.00186	693.6	.48985	706.2	.02775
681.2	.00255	693.8	.48854	706.4	.02437
681.4	.00324	694.0	.48882	706.6	.02133
681.6	.00380	694.2	.49054	706.8	.01871
681.8	.00414	694.4	.49358	707.0	.01650
682.0	.00435	694.6	.49765	707.2	.01457
682.2	.00442	694.8	.50256	707.4	.01291
682.4	.00456	695.0	.50822	707.6	.01160
682.6	.00483	695.2	.51429	707.8	.01049
682.8	.00525	695.4	.52064	708.0	.00953
683.0	.00594	695.6	.52692	708.2	.00877
683.2	.00677	695.8	.53300	708.4	.00808
683.4	.00766	696.0	.53859	708.6	.00739
683.6	.00856	696.2	.54349	708.8	.00663
683.8	.00939	696.4	.54743	709.0	.00580
684.0	.01015	696.6	.55012	709.2	.00497
684.2	.01091	696.8	.55150	709.4	.00414
684.4	.01167	697.0	.55129	709.6	.00338
684.6	.01256	697.2	.54971	709.8	.00262
684.8	.01353	697.4	.54674	710.0	.00200
685.0	.01463	697.6	.54253	710.2	.00138
685.2	.01608	697.8	.53721	710.4	.00083
685.4	.01774	698.0	.53086	710.6	.00028
685.6	.01981	698.2	.52382		
685.8	.02230	698.4	.51636		
686.0	.02520	698.6	.50877		
686.2	.02858	698.8	.50131		
686.4	.03238	699.0	.49386		
686.6	.03666	699.2	.48585		
686.8	.04142	699.4	.47681		
687.0	.04701	699.6	.46611		
687.2	.05378	699.8	.45327		
687.4	.06241	700.0	.43829		
687.6	.07345	700.2	.42151		
687.8	.08733	700.4	.40349		
688.0	.10431	700.6	.38458		
688.2	.12412	700.8	.36532		
688.4	.14662	701.0	.34599		
688.6	.17161	701.2	.32666		
688.8	.19888	701.4	.30740		
689.0	.22815	701.6	.28842		
689.2	.25901	701.8	.26971		
689.4	.29090	702.0	.25142		
689.6	.32356	702.2	.23354		
689.8	.35641	702.4	.21614		
690.0	.38886	702.6	.19923		
690.2	.41965	702.8	.18287		
690.4	.44788	703.0	.16713		
690.6	.47246	703.2	.15201		
690.8	.49227	703.4	.13772		
691.0	.50718	703.6	.12433		
691.2	.51761	703.8	.11190		
691.4	.52416	704.0	.10051		
691.6	.52741	704.2	.09009		
691.8	.52796	704.4	.08056		
692.0	.52623	704.6	.07200		
692.2	.52285	704.8	.06420		

CM^{-1}	TRANS.	CM^{-1}	TRANS.	CM^{-1}	TRANS.
691.8	.00007	704.4	.58568	717.0	.01086
692.0	.00020	704.6	.59547	717.2	.00979
692.2	.00040	704.8	.60432	717.4	.00898
692.4	.00060	705.0	.61230	717.6	.00831
692.6	.00087	705.2	.61921	717.8	.00771
692.8	.00114	705.4	.62477	718.0	.00717
693.0	.00154	705.6	.62873	718.2	.00664
693.2	.00194	705.8	.63081	718.4	.00603
693.4	.00235	706.0	.63094	718.6	.00536
693.6	.00282	706.2	.62940	718.8	.00463
693.8	.00322	706.4	.62652	719.0	.00375
694.0	.00362	706.6	.62243	719.2	.00288
694.2	.00402	706.8	.61740	719.4	.00201
694.4	.00443	707.0	.61156	719.6	.00127
694.6	.00483	707.2	.60499	719.8	.00074
694.8	.00516	707.4	.59762	720.0	.00040
695.0	.00557	707.6	.58937	720.2	.00020
695.2	.00597	707.8	.58039	720.4	.00007
695.4	.00637	708.0	.57107	720.6	*00000
695.6	.00677	708.2	.56221		
695.8	.00724	708.4	.55477		
696.0	.00771	708.6	.54948		
696.2	.00838	708.8	.54733		
696.4	.00925	709.0	.54787		
696.6	.01033	709.2	.54961		
696.8	.01173	709.4	.55095		
697.0	.01354	709.6	.55048		
697.2	.01562	709.8	.55001		
697.4	.01804	710.0	.55142		
697.6	.02058	710.2	.55343		
697.8	.02347	710.4	.55471		
698.0	.02648	710.6	.55377		
698.2	.02984	710.8	.54921		
698.4	.03353	711.0	.54049		
698.6	.03775	711.2	.52775		
698.8	.04244	711.4	.51106		
699.0	.04787	711.6	.49061		
699.2	.05431	711.8	.46653		
699.4	.06209	712.0	.43904		
699.6	.07154	712.2	.40840		
699.8	.08294	712.4	.37494		
700.0	.09649	712.6	.33887		
700.2	.11204	712.8	.30059		
700.4	.12974	713.0	.26109		
700.6	.14939	713.2	.22220		
700.8	.17111	713.4	.18586		
701.0	.19451	713.6	.15381		
701.2	.21912	713.8	.12793		
701.4	.24453	714.0	.10829		
701.6	.27021	714.2	.09367		
701.8	.29569	714.4	.08247		
702.0	.32077	714.6	.07329		
702.2	.34584	714.8	.06470		
702.4	.37112	715.0	.05612		
702.6	.39687	715.2	.04781		
702.8	.42335	715.4	.04003		
703.0	.45031	715.6	.03306		
703.2	.47679	715.8	.02722		
703.4	.50187	716.0	.02260		
703.6	.52473	716.2	.01891		
703.8	.54438	716.4	.01609		
704.0	.56074	716.6	.01388		
704.2	.57428	716.8	.01220		



VTPR
SET: 4
FILTER: 5
S/N: O.C.L.I. 1-4-E
CENTROID: 724.7
EQUIV. WIDTH: 6.76
TRANSMITTANCE
WAVENUMBER
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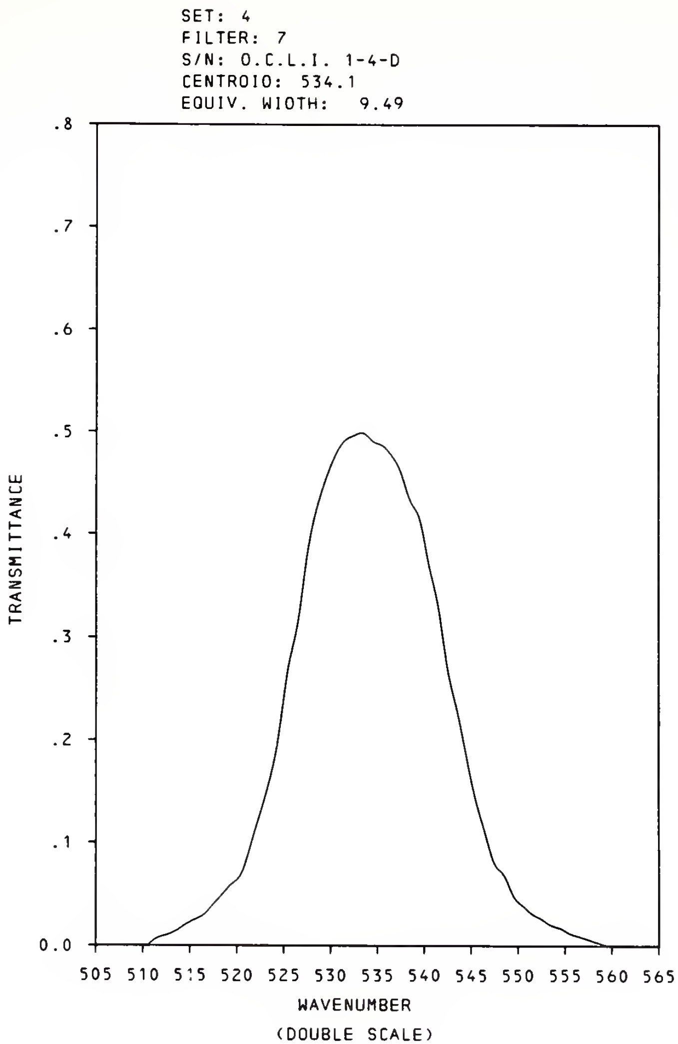
.7
.6
.5
.4
.3
.2
.1
0.0
710
715
720
725
730
735
740
SET: 4
FILTER: 6
S/N: O.C.L.I. 2D
CENTROID: 747.5
EQUIV. WIDTH: 7.98
TRANSMITTANCE
WAVENUMBER
.8
.7
.6
.5
.4
.3
.2
.1
0.0
735
740
745
750
755
760
765

CM^{-1}	TRANS.	CM^{-1}	TRANS.	CM^{-1}	TRANS.
710.7	.00014	723.3	.61755	735.9	.00446
710.9	.00034	723.5	.61728	736.1	.00426
711.1	.00054	723.7	.61660	736.3	.00413
711.3	.00074	723.9	.61558	736.5	.00406
711.5	.00095	724.1	.61416	736.7	.00392
711.7	.00108	724.3	.61241	736.9	.00379
711.9	.00122	724.5	.61024	737.1	.00358
712.1	.00135	724.7	.60767	737.3	.00331
712.3	.00156	724.9	.60483	737.5	.00311
712.5	.00183	725.1	.60206	737.7	.00291
712.7	.00216	725.3	.59956	737.9	.00271
712.9	.00264	725.5	.59766	738.1	.00250
713.1	.00325	725.7	.59658	738.3	.00230
713.3	.00386	725.9	.59665	738.5	.00210
713.5	.00460	726.1	.59780	738.7	.00189
713.7	.00541	726.3	.60016	738.9	.00169
713.9	.00629	726.5	.60375	739.1	.00149
714.1	.00717	726.7	.60862	739.3	.00129
714.3	.00825	726.9	.61437	739.5	.00108
714.5	.00940	727.1	.62032	739.7	.00088
714.7	.01069	727.3	.62546	739.9	.00068
714.9	.01211	727.5	.62904	740.1	.00047
715.1	.01373	727.7	.63026	740.3	.00027
715.3	.01562	727.9	.62816	740.5	.00007
715.5	.01779	728.1	.62194		
715.7	.02029	728.3	.61058		
715.9	.02327	728.5	.59320		
716.1	.02685	728.7	.56899		
716.3	.03131	728.9	.53801		
716.5	.03679	729.1	.50156		
716.7	.04355	729.3	.46098		
716.9	.05154	729.5	.41742		
717.1	.06080	729.7	.37231		
717.3	.07122	729.9	.32693		
717.5	.08278	730.1	.28284		
717.7	.09543	730.3	.24151		
717.9	.10936	730.5	.20445		
718.1	.12505	730.7	.17314		
718.3	.14297	730.9	.14764		
718.5	.16353	731.1	.12701		
718.7	.18727	731.3	.11004		
718.9	.21426	731.5	.09563		
719.1	.24415	731.7	.08265		
719.3	.27675	731.9	.07054		
719.5	.31171	732.1	.05958		
719.7	.34871	732.3	.04984		
719.9	.38679	732.5	.04159		
720.1	.42439	732.7	.03483		
720.3	.45969	732.9	.02962		
720.5	.49121	733.1	.02563		
720.7	.51725	733.3	.02259		
720.9	.53767	733.5	.02009		
721.1	.55343	733.7	.01792		
721.3	.56567	733.9	.01589		
721.5	.57555	734.1	.01407		
721.7	.58420	734.3	.01231		
721.9	.59212	734.5	.01075		
722.1	.59915	734.7	.00933		
722.3	.60517	734.9	.00805		
722.5	.61004	735.1	.00690		
722.7	.61362	735.3	.00602		
722.9	.61592	735.5	.00528		
723.1	.61714	735.7	.00480		

CM^{-1}	TRANS.	CM^{-1}	TRANS.	CM^{-1}	TRANS.
733.8	.00016	746.4	.65078	759.0	.00893
734.0	.00056	746.6	.65684	759.2	.00837
734.2	.00096	746.8	.66322	759.4	.00790
734.4	.00136	747.0	.66960	759.6	.00734
734.6	.00175	747.2	.67558	759.8	.00662
734.8	.00223	747.4	.68053	760.0	.00582
735.0	.00279	747.6	.68396	760.2	.00502
735.2	.00335	747.8	.68547	760.4	.00415
735.4	.00399	748.0	.68483	760.6	.00335
735.6	.00463	748.2	.68236	760.8	.00271
735.8	.00534	748.4	.67829	761.0	.00215
736.0	.00622	748.6	.67303	761.2	.00175
736.2	.00710	748.8	.66673	761.4	.00136
736.4	.00813	749.0	.65971	761.6	.00112
736.6	.00933	749.2	.65197	761.8	.00088
736.8	.01069	749.4	.64352	762.0	.00064
737.0	.01228	749.6	.63467	762.2	.00048
737.2	.01412	749.8	.62526	762.4	.00024
737.4	.01619	750.0	.61553	762.6	.00008
737.6	.01866	750.2	.60540		
737.8	.02145	750.4	.59503		
738.0	.02464	750.6	.58434		
738.2	.02831	750.8	.57358		
738.4	.03254	751.0	.56249		
738.6	.03732	751.2	.55109		
738.8	.04283	751.4	.53921		
739.0	.04937	751.6	.52660		
739.2	.05758	751.8	.51321		
739.4	.06795	752.0	.49869		
739.6	.08119	752.2	.48266		
739.8	.09778	752.4	.46464		
740.0	.11787	752.6	.44422		
740.2	.14100	752.8	.42101		
740.4	.16692	753.0	.39525		
740.6	.19515	753.2	.36806		
740.8	.22530	753.4	.34030		
741.0	.25704	753.6	.31311		
741.2	.29030	753.8	.28743		
741.4	.32483	754.0	.26366		
741.6	.36064	754.2	.24133		
741.8	.39757	754.4	.22028		
742.0	.43449	754.6	.19994		
742.2	.46990	754.8	.18008		
742.4	.50196	755.0	.16070		
742.6	.52892	755.2	.14204		
742.8	.54925	755.4	.12449		
743.0	.56281	755.6	.10838		
743.2	.57127	755.8	.09411		
743.4	.57653	756.0	.08167		
743.6	.58020	756.2	.07090		
743.8	.58403	756.4	.06133		
744.0	.58873	756.6	.05288		
744.2	.59407	756.8	.04522		
744.4	.59966	757.0	.03828		
744.6	.60532	757.2	.03206		
744.8	.61058	757.4	.02656		
745.0	.61553	757.6	.02201		
745.2	.62031	757.8	.01826		
745.4	.62494	758.0	.01539		
745.6	.62956	758.2	.01324		
745.8	.63451	758.4	.01164		
746.0	.63961	758.6	.01045		
746.2	.64504	758.8	.00957		

VTPR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CENTROIO: 534.1
EQUIV. WIOTH: 9.49
TRANSMITTANCE
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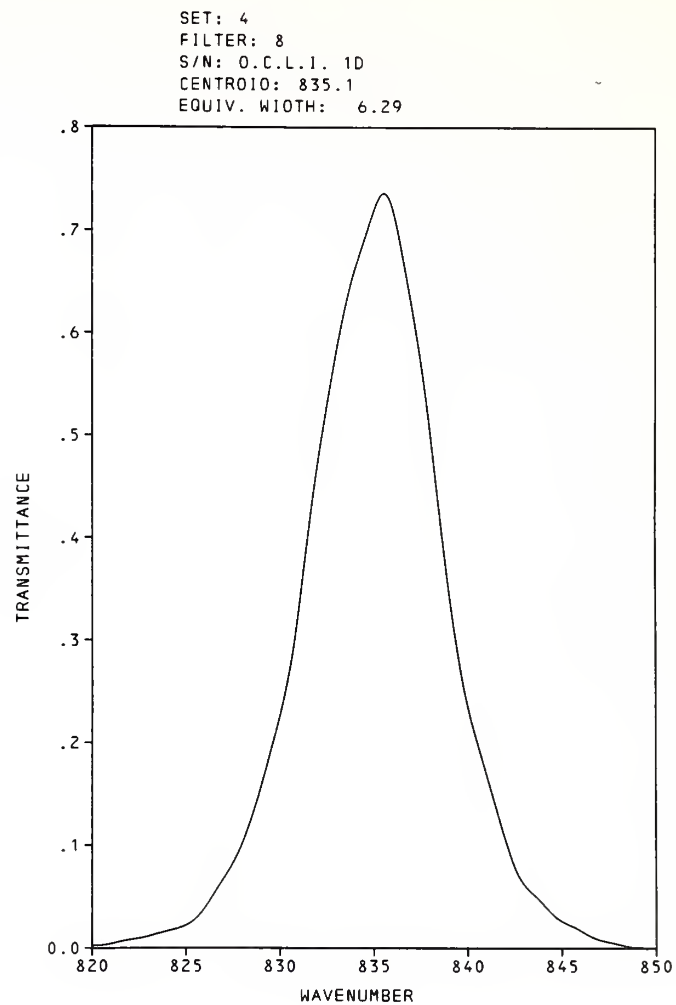
.5
.6
.7
.8
505 510 515 520 525 530 535 540 545 550 555 560 565
WAVENUMBER
(DOUBLE SCALE)


SET: 4
FILTER: 8
S/N: O.C.L.I. 1D
CENTROIO: 835.1
EQUIV. WIOTH: 6.29
TRANSMITTANCE
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.1
.2
.3
.4
.5
.6
.7
.8
820 825 830 835 840 845 850
WAVENUMBER

CM^{-1}	TRANS.	CM^{-1}	TRANS.	CM^{-1}	TRANS.	CM^{-1}	TRANS.
510.6	.00085	523.2	.14981	535.8	.48483	548.4	.07031
510.8	.00237	523.4	.15655	536.0	.48284	548.6	.06746
511.0	.00389	523.6	.16357	536.2	.48066	548.8	.06366
511.2	.00531	523.8	.17107	536.4	.47829	549.0	.05939
511.4	.00645	524.0	.17932	536.6	.47572	549.2	.05494
511.6	.00750	524.2	.18862	536.8	.47307	549.4	.05086
511.8	.00816	524.4	.19915	537.0	.47003	549.6	.04744
512.0	.00873	524.6	.21130	537.2	.46652	549.8	.04478
512.2	.00930	524.8	.22467	537.4	.46235	550.0	.04279
512.4	.00977	525.0	.23853	537.6	.45741	550.2	.04118
512.6	.01025	525.2	.25200	537.8	.45172	550.4	.03975
512.8	.01091	525.4	.26443	538.0	.44584	550.6	.03824
513.0	.01167	525.6	.27496	538.2	.44014	550.8	.03653
513.2	.01252	525.8	.28369	538.4	.43512	551.0	.03482
513.4	.01347	526.0	.29147	538.6	.43113	551.2	.03321
513.6	.01452	526.2	.29925	538.8	.42810	551.4	.03169
513.8	.01575	526.4	.30798	539.0	.42534	551.6	.03036
514.0	.01689	526.6	.31860	539.2	.42212	551.8	.02932
514.2	.01822	526.8	.33113	539.4	.41785	552.0	.02837
514.4	.01945	527.0	.34489	539.6	.41168	552.2	.02751
514.6	.02059	527.2	.35902	539.8	.40371	552.4	.02657
514.8	.02173	527.4	.37259	540.0	.39451	552.6	.02543
515.0	.02268	527.6	.38502	540.2	.38493	552.8	.02419
515.2	.02372	527.8	.39584	540.4	.37544	553.0	.02287
515.4	.02457	528.0	.40542	540.6	.36680	553.2	.02163
515.6	.02543	528.2	.41386	540.8	.35912	553.4	.02049
515.8	.02619	528.4	.42145	541.0	.35162	553.6	.01955
516.0	.02704	528.6	.42847	541.2	.34375	553.8	.01898
516.2	.02808	528.8	.43493	541.4	.33492	554.0	.01841
516.4	.02932	529.0	.44109	541.6	.32458	554.2	.01793
516.6	.03084	529.2	.44688	541.8	.31272	554.4	.01736
516.8	.03264	529.4	.45238	542.0	.30001	554.6	.01660
517.0	.03463	529.6	.45760	542.2	.28739	554.8	.01566
517.2	.03681	529.8	.46263	542.4	.27543	555.0	.01461
517.4	.03890	530.0	.46738	542.6	.26500	555.2	.01347
517.6	.04108	530.2	.47183	542.8	.25608	555.4	.01243
517.8	.04308	530.4	.47601	543.0	.24830	555.6	.01158
518.0	.04497	530.6	.47990	543.2	.24109	555.8	.01091
518.2	.04697	530.8	.48331	543.4	.23378	556.0	.01025
518.4	.04896	531.0	.48635	543.6	.22600	556.2	.00977
518.6	.05105	531.2	.48891	543.8	.21756	556.4	.00930
518.8	.05323	531.4	.49110	544.0	.20854	556.6	.00873
519.0	.05531	531.6	.49280	544.2	.19925	556.8	.00816
519.2	.05740	531.8	.49404	544.4	.18976	557.0	.00759
519.4	.05920	532.0	.49508	544.6	.18027	557.2	.00693
519.6	.06072	532.2	.49584	544.8	.17107	557.4	.00636
519.8	.06215	532.4	.49660	545.0	.16215	557.6	.00569
520.0	.06366	532.6	.49745	545.2	.15361	557.8	.00512
520.2	.06556	532.8	.49831	545.4	.14573	558.0	.00446
520.4	.06831	533.0	.49897	545.6	.13843	558.2	.00389
520.6	.07201	533.2	.49935	545.8	.13179	558.4	.00332
520.8	.07685	533.4	.49925	546.0	.12553	558.6	.00266
521.0	.08245	533.6	.49850	546.2	.11945	558.8	.00209
521.2	.08852	533.8	.49707	546.4	.11319	559.0	.00152
521.4	.09488	534.0	.49536	546.6	.10664	559.2	.00095
521.6	.10114	534.2	.49347	546.8	.09991	559.4	.00028
521.8	.10721	534.4	.49176	547.0	.09327		
522.0	.11319	534.6	.49043	547.2	.08719		
522.2	.11907	534.8	.48948	547.4	.08207		
522.4	.12505	535.0	.48891	547.6	.07828		
522.6	.13103	535.2	.48825	547.8	.07571		
522.8	.13710	535.4	.48749	548.0	.07391		
523.0	.14336	535.6	.48635	548.2	.07230		

CM^{-1}	TRANS.	CM^{-1}	TRANS.	CM^{-1}	TRANS.
818.8	.00025	831.4	.38697	844.0	.04323
819.0	.00076	831.6	.41604	844.2	.03914
819.2	.00120	831.8	.44348	844.4	.03517
819.4	.00157	832.0	.46890	844.6	.03159
819.6	.00189	832.2	.49262	844.8	.02857
819.8	.00208	832.4	.51502	845.0	.02624
820.0	.00220	832.6	.53647	845.2	.02429
820.2	.00233	832.8	.55743	845.4	.02259
820.4	.00245	833.0	.57775	845.6	.02089
820.6	.00277	833.2	.59726	845.8	.01907
820.8	.00327	833.4	.61557	846.0	.01699
821.0	.00403	833.6	.63231	846.2	.01485
821.2	.00485	833.8	.64716	846.4	.01271
821.4	.00579	834.0	.66031	846.6	.01082
821.6	.00661	834.2	.67214	846.8	.00925
821.8	.00736	834.4	.68334	847.0	.00799
822.0	.00793	834.6	.69435	847.2	.00705
822.2	.00849	834.8	.70580	847.4	.00617
822.4	.00900	835.0	.71706	847.6	.00541
822.6	.00963	835.2	.72688	847.8	.00459
822.8	.01038	835.4	.73367	848.0	.00371
823.0	.01133	835.6	.73600	848.2	.00283
823.2	.01240	835.8	.73241	848.4	.00201
823.4	.01347	836.0	.72291	848.6	.00132
823.6	.01447	836.2	.70876	848.8	.00076
823.8	.01548	836.4	.69133	849.0	.00038
824.0	.01642	836.6	.67195	849.2	.00019
824.2	.01730	836.8	.65200	849.4	.00006
824.4	.01831	837.0	.63180	849.6	*00000
824.6	.01938	837.2	.61072		
824.8	.02070	837.4	.58813		
825.0	.02227	837.6	.56341		
825.2	.02423	837.8	.53585		
825.4	.02680	838.0	.50571		
825.6	.03008	838.2	.47380		
825.8	.03417	838.4	.44121		
826.0	.03901	838.6	.40881		
826.2	.04442	838.8	.37760		
826.4	.05021	839.0	.34815		
826.6	.05606	839.2	.32071		
826.8	.06185	839.4	.29567		
827.0	.06758	839.6	.27321		
827.2	.07337	839.8	.25351		
827.4	.07953	840.0	.23659		
827.6	.08633	840.2	.22161		
827.8	.09388	840.4	.20808		
828.0	.10237	840.6	.19531		
828.2	.11181	840.8	.18266		
828.4	.12207	841.0	.16989		
828.6	.13314	841.2	.15705		
828.8	.14504	841.4	.14422		
829.0	.15762	841.6	.13138		
829.2	.17077	841.8	.11867		
829.4	.18436	842.0	.10628		
829.6	.19808	842.2	.09464		
829.8	.21192	842.4	.08406		
830.0	.22614	842.6	.07488		
830.2	.24150	842.8	.06758		
830.4	.25880	843.0	.06198		
830.6	.27875	843.2	.05764		
830.8	.30215	843.4	.05405		
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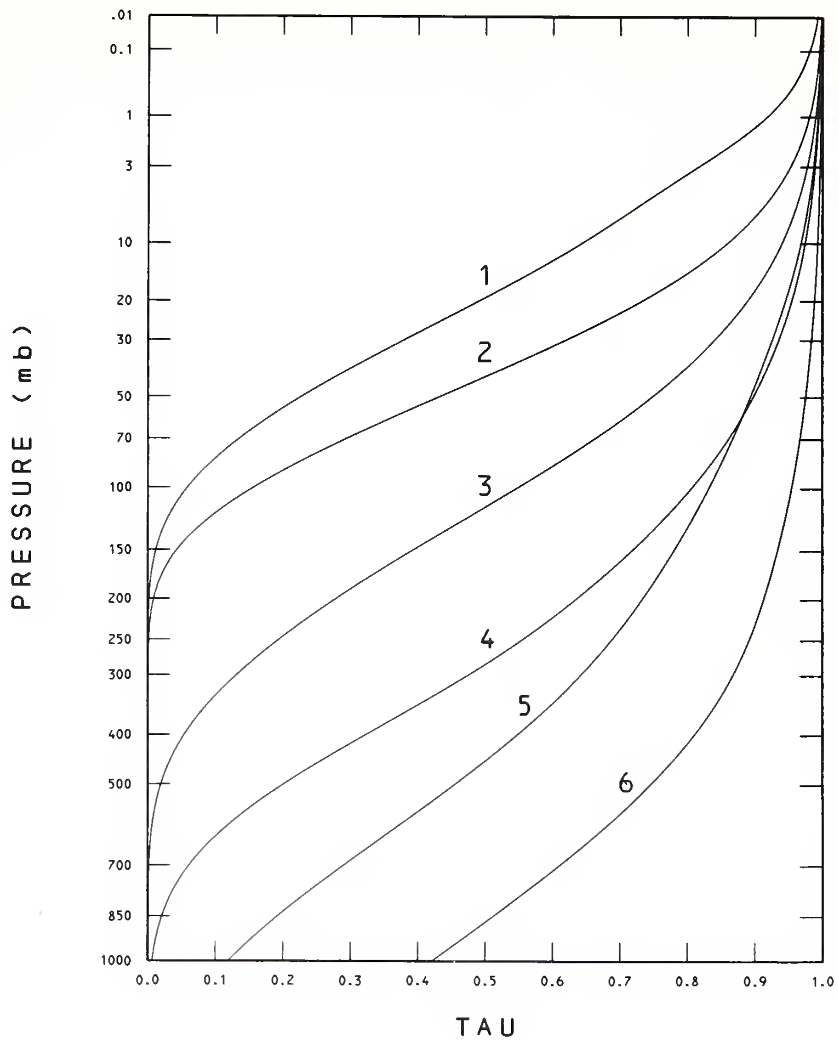
831.2	.35746	843.8	.04713		

VTPR

SET: 4

CO_2 TRANSMITTANCES



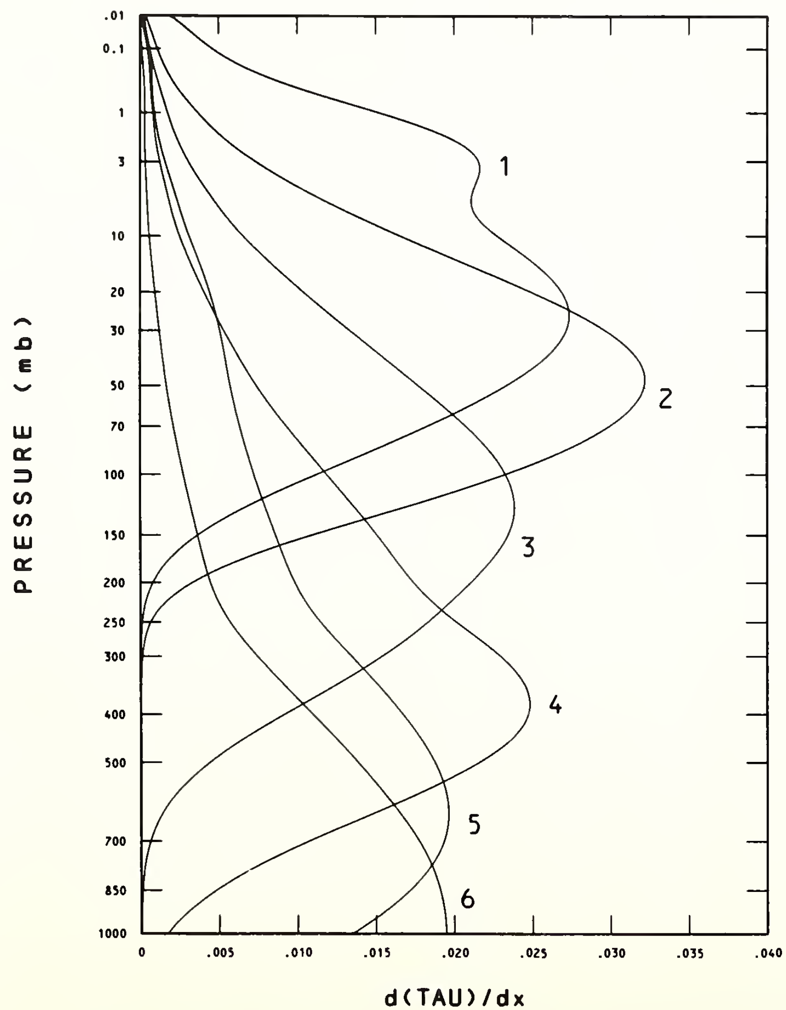
CO_2 TRANSMITTANCE VALUES

1	2	3	4	5	6
.99053	.99803	.99905	.99980	.99980	.99998
.98369	.99649	.99823	.99920	.99908	.99991
.97351	.99403	.99691	.99817	.99776	.99967
.95927	.99065	.99501	.99698	.99630	.99925
.93813	.98567	.99239	.99559	.99474	.99868
.90936	.97876	.98906	.99399	.99297	.99808
.87336	.96962	.98492	.99219	.99086	.99749
.83221	.95772	.97980	.99006	.98824	.99689
.78903	.94245	.97343	.98748	.98495	.99621
.74619	.92323	.96558	.98435	.98092	.99544
.70387	.89952	.95608	.98063	.97615	.99455
.66056	.87089	.94477	.97628	.97064	.99353
.61453	.83696	.93132	.97112	.96427	.99233
.56528	.79750	.91547	.96499	.95698	.99091
.51326	.75245	.89704	.95783	.94883	.98924
.45935	.70201	.87589	.94956	.93989	.98732
.40464	.64665	.85193	.94010	.93029	.98513
.35034	.58719	.82502	.92938	.92012	.98265
.29764	.52473	.79514	.91733	.90946	.97989
.24764	.46062	.76233	.90390	.89839	.97683
.20128	.39634	.72660	.88895	.88688	.97343
.15924	.33339	.68803	.87233	.87484	.96966
.12206	.27320	.64676	.85388	.86222	.96546
.09013	.21704	.60310	.83350	.84894	.96079
.06368	.16613	.55752	.81112	.83497	.95564
.04278	.12161	.51059	.78674	.82024	.94998
.02706	.08429	.46297	.76035	.80471	.94379
.01597	.05478	.41535	.73198	.78832	.93704
.00869	.03298	.36848	.70172	.77106	.92973
.00430	.01822	.32311	.66970	.75291	.92184
.00190	.00911	.27975	.63586	.73378	.91330
.00072	.00406	.23877	.60000	.71350	.90396
.00025	.00166	.20036	.56165	.69172	.89348
.00007	.00062	.16467	.52029	.66808	.88149
.00002	.00022	.13211	.47588	.64232	.86766
.00000	.00005	.10314	.42872	.61433	.85171
	.00000	.07803	.37977	.58417	.83354
		.05697	.33018	.55197	.81309
		.04009	.28111	.51787	.79032
		.02709	.23386	.48208	.76527
		.01747	.18979	.44487	.73806
		.01073	.14998	.40655	.70880
		.00626	.11498	.36754	.67758
		.00347	.08527	.32830	.64452
		.00180	.06119	.28929	.60977
		.00088	.04235	.25112	.57359
		.00042	.02815	.21439	.53631
		.00018	.01798	.17974	.49821
		.00007	.01106	.14774	.45958
		.00003	.00664	.11897	.42066

VTPR

SET: 4

CO_2 WEIGHTING FUNCTIONS



CO_2 WEIGHTING FUNCTION VALUES

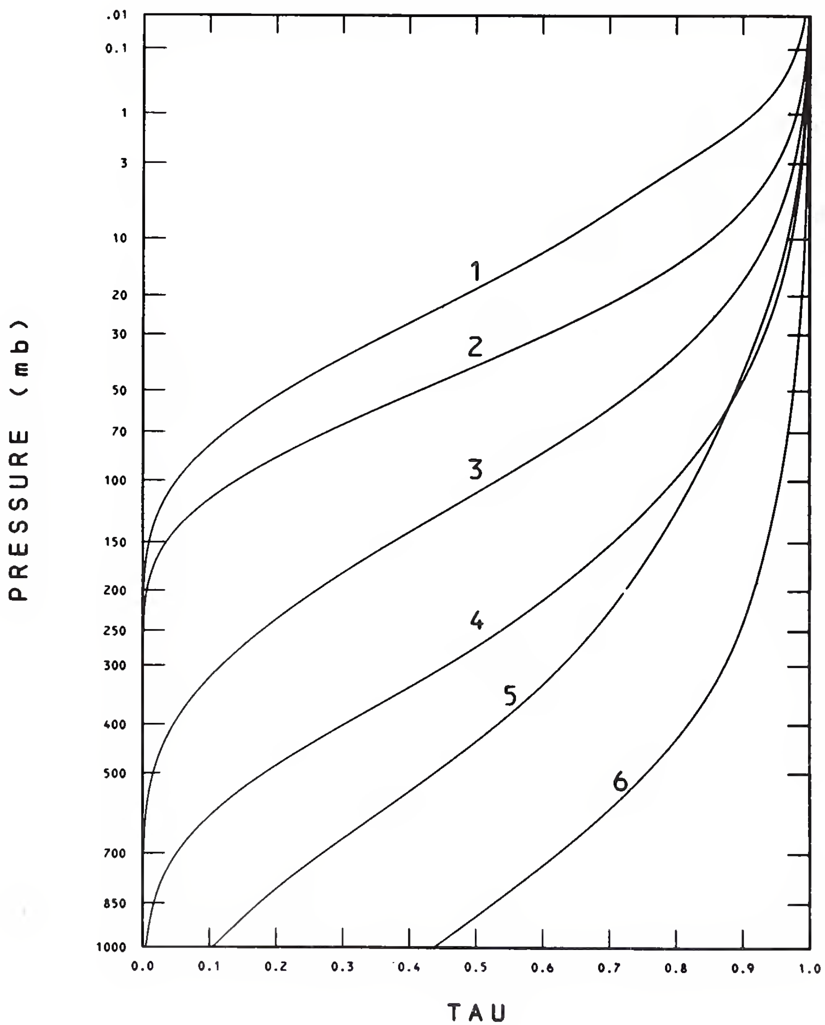
1	2	3	4	5	6
.00238	.00049	.00032	.00015	.00016	.00001
.00448	.00108	.00053	.00046	.00058	.00008
.00584	.00140	.00079	.00055	.00070	.00016
.00868	.00205	.00113	.00064	.00075	.00025
.01247	.00295	.00149	.00074	.00082	.00030
.01630	.00398	.00186	.00085	.00096	.00030
.01953	.00521	.00229	.00097	.00117	.00030
.02134	.00674	.00285	.00116	.00147	.00032
.02163	.00858	.00354	.00143	.00183	.00036
.02121	.01069	.00433	.00171	.00220	.00041
.02124	.01305	.00518	.00201	.00256	.00047
.02223	.01561	.00616	.00236	.00296	.00055
.02383	.01833	.00731	.00281	.00342	.00065
.02538	.02113	.00856	.00331	.00387	.00077
.02657	.02390	.00988	.00385	.00428	.00090
.02725	.02650	.01127	.00443	.00465	.00103
.02735	.02878	.01271	.00503	.00495	.00116
.02685	.03059	.01420	.00569	.00521	.00131
.02576	.03176	.01568	.00636	.00543	.00146
.02416	.03222	.01713	.00708	.00564	.00161
.02215	.03193	.01859	.00788	.00588	.00179
.01985	.03090	.01998	.00876	.00616	.00199
.01730	.02919	.02126	.00970	.00647	.00221
.01460	.02686	.02236	.01069	.00681	.00245
.01183	.02395	.02318	.01169	.00717	.00270
.00911	.02052	.02369	.01269	.00756	.00296
.00665	.01675	.02387	.01369	.00798	.00323
.00451	.01278	.02369	.01467	.00842	.00352
.00284	.00906	.02311	.01557	.00885	.00379
.00163	.00583	.02222	.01645	.00931	.00410
.00084	.00342	.02111	.01740	.00983	.00445
.00038	.00175	.01986	.01850	.01048	.00492
.00013	.00077	.01854	.01990	.01133	.00559
.00005	.00032	.01711	.02146	.01234	.00643
.00001	.00012	.01541	.02294	.01343	.00743
.00001	.00005	.01354	.02412	.01455	.00852
.00000	.00001	.01156	.02473	.01560	.00965
		.00948	.02477	.01659	.01081
		.00743	.02419	.01749	.01196
		.00561	.02294	.01827	.01307
		.00404	.02103	.01892	.01413
		.00275	.01874	.01937	.01513
		.00176	.01622	.01960	.01608
		.00108	.01345	.01961	.01697
		.00062	.01068	.01935	.01776
		.00032	.00821	.01878	.01839
		.00016	.00603	.01789	.01887
		.00008	.00421	.01671	.01920
		.00003	.00277	.01524	.01941
		.00001	.00172	.01348	.01948

V T P R

[ZENITH ANGLE 23°47']

SET: 4

CO_2 TRANSMITTANCES



CO_2 TRANSMITTANCE VALUES

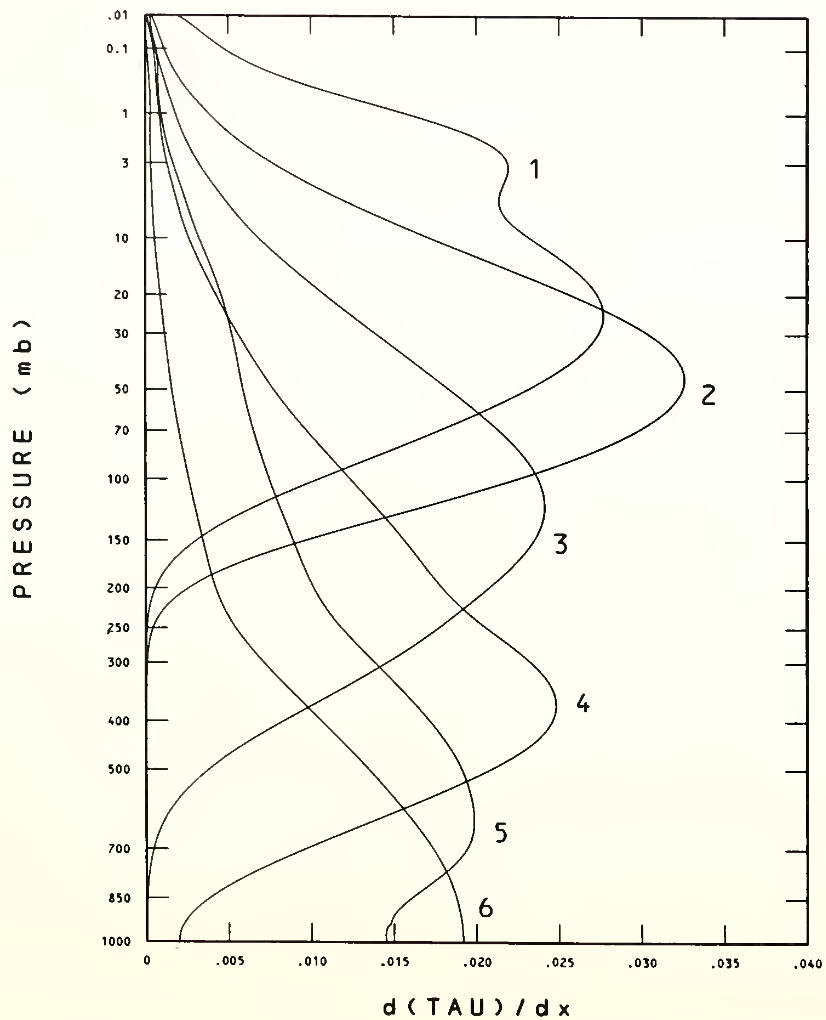
1	2	3	4	5	6
.99029	.99798	.99902	.99979	.99978	.99998
.98319	.99636	.99817	.99915	.99901	.99992
.97267	.99381	.99680	.99808	.99765	.99969
.95788	.99029	.99482	.99687	.99616	.99929
.93585	.98507	.99210	.99543	.99456	.99872
.90597	.97786	.98863	.99377	.99273	.99811
.86880	.96834	.98431	.99188	.99050	.99749
.82669	.95593	.97895	.98965	.98774	.99687
.78289	.93999	.97229	.98694	.98427	.99619
.73958	.91992	.96407	.98365	.98004	.99542
.69667	.89518	.95412	.97975	.97505	.99455
.65247	.86532	.94229	.97518	.96929	.99357
.60533	.82998	.92824	.96977	.96265	.99241
.55491	.78893	.91168	.96336	.95508	.99104
.50179	.74217	.89244	.95586	.94662	.98944
.44695	.68996	.87038	.94719	.93737	.98759
.39155	.63286	.84538	.93728	.92747	.98550
.33687	.57179	.81735	.92605	.91700	.98313
.28413	.50799	.78626	.91343	.90604	.98049
.23443	.44287	.75218	.89936	.89466	.97756
.18866	.37802	.71514	.88372	.88281	.97432
.14749	.31494	.67526	.86633	.87042	.97072
.11144	.25510	.63271	.84704	.85741	.96671
.08087	.19979	.58785	.82573	.84372	.96227
.05596	.15026	.54119	.80237	.82928	.95735
.03666	.10762	.49337	.77694	.81405	.95196
.02251	.07261	.44509	.74946	.79797	.94607
.01282	.04567	.39708	.71995	.78098	.93964
.00668	.02644	.35012	.68855	.76309	.93268
.00313	.01395	.30498	.65538	.74429	.92518
.00130	.00662	.26214	.62042	.72448	.91706
.00046	.00277	.22199	.58347	.70350	.90817
.00014	.00108	.18468	.54408	.68100	.89819
.00004	.00039	.15032	.50175	.65658	.88674
.00000	.00013	.11929	.45651	.63002	.87349
	.00003	.09199	.40874	.60117	.85816
	.00000	.06861	.35945	.57013	.84064
		.04927	.30988	.53701	.82086
		.03404	.26126	.50197	.79878
		.02252	.21491	.46529	.77445
		.01418	.17220	.42731	.74796
		.00847	.13418	.38838	.71942
		.00480	.10124	.34888	.68894
		.00259	.07369	.30921	.65662
		.00130	.05173	.26986	.62260
		.00062	.03497	.23184	.58714
		.00029	.02288	.19633	.55052
		.00011	.01470	.16387	.51305
		.00003	.00918	.13358	.47500
		.00000	.00499	.10438	.43666

VTPR

[ZENITH ANGLE 23°47']

SET: 4

CO_2 WEIGHTING FUNCTIONS



CO_2 WEIGHTING FUNCTION VALUES

1	2	3	4	5	6
.00245	.00051	.00033	.00016	.00017	.00001
.00463	.00112	.00055	.00048	.00061	.00007
.00605	.00145	.00082	.00057	.00072	.00015
.00903	.00214	.00117	.00066	.00077	.00025
.01298	.00309	.00154	.00077	.00084	.00030
.01689	.00415	.00195	.00089	.00101	.00031
.02008	.00543	.00239	.00101	.00123	.00030
.02174	.00703	.00298	.00122	.00155	.00032
.02188	.00895	.00371	.00150	.00192	.00036
.02145	.01116	.00453	.00180	.00231	.00041
.02161	.01362	.00542	.00211	.00268	.00046
.02275	.01628	.00644	.00247	.00309	.00053
.02441	.01909	.00764	.00295	.00356	.00063
.02595	.02196	.00894	.00347	.00401	.00074
.02708	.02478	.01031	.00404	.00443	.00086
.02766	.02739	.01176	.00464	.00480	.00098
.02762	.02963	.01325	.00527	.00510	.00111
.02695	.03134	.01479	.00596	.00536	.00125
.02570	.03235	.01630	.00667	.00559	.00139
.02394	.03262	.01778	.00741	.00580	.00154
.02178	.03211	.01924	.00825	.00605	.00171
.01934	.03085	.02063	.00916	.00634	.00190
.01668	.02889	.02189	.01014	.00667	.00211
.01387	.02631	.02293	.01117	.00703	.00234
.01104	.02313	.02368	.01220	.00741	.00257
.00831	.01946	.02409	.01323	.00782	.00282
.00590	.01551	.02413	.01425	.00826	.00308
.00387	.01147	.02381	.01524	.00872	.00335
.00234	.00783	.02308	.01615	.00917	.00361
.00128	.00481	.02203	.01702	.00964	.00390
.00062	.00267	.02077	.01795	.01017	.00423
.00026	.00128	.01937	.01904	.01084	.00469
.00008	.00051	.01793	.02040	.01170	.00533
.00003	.00021	.01639	.02191	.01273	.00615
.00001	.00007	.01461	.02331	.01385	.00713
	.00003	.01268	.02437	.01498	.00821
	.00001	.01069	.02481	.01605	.00932
		.00864	.02465	.01706	.01046
		.00664	.02386	.01796	.01161
		.00492	.02238	.01869	.01271
		.00346	.02023	.01926	.01377
		.00230	.01777	.01964	.01476
		.00142	.01515	.01982	.01571
		.00084	.01237	.01982	.01660
		.00047	.00964	.01944	.01740
		.00023	.00717	.01848	.01804
		.00012	.00498	.01696	.01855
		.00006	.00331	.01560	.01890
		.00002	.00232	.01478	.01912
		.00001	.00199	.01451	.01919

APPENDIX III

Archive Formats

Archival tapes for VTPR data contain earth located raw radiances, first guess information, and retrievals. Each type of data is written as a separate file.

The first file contains earth-located raw radiances. These radiances have been calibrated - that is converted from counts to radiances - but are otherwise unchanged. A description of this file is contained in tables 1 and 2. The calibration identification number referred to in table 1 is now 4. If changes in the regression coefficients used for the calibration are required because of changes on the spacecraft, this number will change. The instrument number referred to in table 2 identifies a scan line as: data from the calibration sequence in either instrument (0); earth radiances from instrument 1 (1); earth radiances from instument 2 (2); dual mode earth radiances from the secondary instrument (3). During the rarely-used dual mode, the primary instrument controls the data system, and radiances from that instrument are identified normally; radiances from the secondary instrument replace those of the primary instrument on alternate scans.

The second file on the tape contains "clear radiances" obtained by the CLRAD program, as well as the first guess information that was available. A description of this file is contained in tables 3 and 4.

The third file on the tape contains retrieved profiles that have passed the quality control tests. A description of this file is given in tables 5 and 6. Data records on this file differ from all other records on the tape in that the data are coded and six bits are required to represent each character. Table 7 shows the octal and binary representations of the characters contained in the data records. The format used for the data records is the same format used for the NMC data, except that twelve reports constitute one physical record of 30,600 bits on the NMC tape. In order to keep the buffer size small, this record was broken down into five physical records of 6,120 bits each for the archive tape.

Table 1.--VTPR archive I format and data description -- header record (6480 bits)

Description	Number of words	Bits/ word	Number of bits
Satellite number	1	36	36
Start of data (year)	1	12	12
Start of data (month)	1	12	12
Start of data (day)	1	12	12
Julian day	1	12	12
Start of data (hour)	1	12	12
Start of data (minute)	1	12	12
Start of data (second)	1	12	12
End of data (hour)	1	12	12
End of data (minute)	1	12	12
End of data (second)	1	12	12
Calibration identification number	1	12	12
Standard deviations [mW/(m^2sr cm^{-1})]x 10 (channels 1-8 of primary instrument), (8 words of fill or channels 1-8 of secondary instrument for dual mode operation)	16	12	192
Fill	1	36	36
<u>ORBITAL PARAMETERS</u>			
Eccentricity x 10^6	1	36	36
Argument of perigee (deg x 10^3)	1	36	36
Right ascension (deg x 10^3)	1	36	36
Inclination (deg x 10^3)	1	36	36
Semi-major axis (km x 10^3)	1	36	36
Mean anomaly (deg x 10^3)	1	36	36
Epoch year	1	12	12
Epoch month	1	12	12
Epoch day	1	12	12
Epoch hour	1	12	12
Epoch minute (whole)	1	12	12
Epoch fraction of minute x 100	1	12	12
Phi max x 100	1	12	12
Lambda x 10	1	12	12
Fill	481	12	5772

Table 2.--VTPR archive I format and data description -- documentation records (groups of 3 records - 6480 bits per record)

Description	Number of words	Bits/ word	Number of bits
Radiances [mW/(m^2 sr cm^{-1})] x 20 (channels 1-8 (spots 1-23 (lines 1-8)))	1472	12	17664
Latitude (deg + 90) x 10	1	12	12
East longitude (deg x 10) (spot 5 - line 4)	1	12	12
Latitude (deg + 90) x 10	1	12	12
East longitude (deg x 10) (spot 12 - line 4)	1	12	12
Latitude (deg + 90) x 10	1	12	12
East longitude (deg x 10 (spot 19 - line 4)	1	12	12
Greenwich Mean Time (GMT) (hour)	1	12	12
Greenwich Mean Time (GMT) (minute)	1	12	12
Greenwich Mean Time (GMT) (second)	1	12	12
Zenith Angles (deg x 10) (spot 1 - line 1), (spot 1 - line 23), (spot 4 - line 5), (spot 4 - line 12), (spot 4 - line 19), (spot 8 - line 1), (spot 8 - line 23)	7	12	84
Fill	1	12	12
Line count	1	12	12
Sea surface temperatures [(^{o}K-269.9)x5] (spots 1-23 (lines 1-8))	184	8	1472
Fill	1	28	28
Instrument number (see text) (8 lines)	8	3	24
Clock (spot 1 - line 1)	1	36	36

Table 3.--VTPR archive II format and data description -- header record (480 bits)

Description	Number of words	Bits/ word	Number of bits
Start of data (year)	1	12	12
Start of data (month)	1	12	12
Start of data (day)	1	12	12
Satellite number	1	36	36
Calibration table number	1	12	12
Instrument number	1	12	12
Standard deviations $[mW/(m^2 sr\ cm^{-1})] \times 100$ (channels 1-8 of primary instrument); (8 zeros or channels 1-8 of secondary instrument of dual mode operation)	16	12	192
Start of data (hour)	1	12	12
Start of data (minute)	1	12	12
Start of data (second)	1	12	12
End of data (hour)	1	12	12
End of data (minute)	1	12	12
End of data (second)	1	12	12
Fill	10	12	120

Table 4.--VTPR archive II format and data description--documentation records (720 bits)

Description	Number of words	Bits/ word	Number of bits
Latitude (deg.+ 90) x 10	1	12	12
West longitude (deg x 10)	1	12	12
Time of sounding (hour)	1	12	12
Time of sounding (minute)	1	12	12
Time of sounding (second)	1	12	12
Clear radiances [mW/(m^{2}sr cm^{-1})] x 20 (channels 1-8)	8	12	96
Zenith angle (deg x 10)	1	12	12
Sea surface temperature ($^{\circ}$K-269.9) x 5	1	12	12
First guess values temperatures* ($^{\circ}$Cx10) (15 standard pressure levels--1000 to 10mb) (tropopause temperature)	16	12	192
Pressure* (mb x 10)	1	12	12
Dew point depression† (first 10 standard levels)	10	12	120
Confidence factors (x 100) (channels 1-8)	8	12	96
First guess 850-mb height* (m) obtained from NMC forecast	1	12	12
Fill	9	12	108

*Missing data = 7777 octal

†Missing data = 0000 octal

Table 5.--VTPR archive III format and data description--
header record (480 bits)

Description	Number of words	Bits/ word	Number of bits
Start of data (year)	1	12	12
Start of data (month)	1	12	12
Start of data (day)	1	12	12
Satellite number	1	36	36
Calibration table number	1	12	12
Instrument number	1	12	12
Standard pressure levels (mb)	15	12	180
Start of data (hour)	1	12	12
Start of data (minute)	1	12	12
Start of data (second)	1	12	12
End of data (hour)	1	12	12
End of data (minute)	1	12	12
End of data (second)	1	12	12
Fill	11	12	132

Table 6.--VTPR archive III format and data description--documentation records*

Description	Number of words	Characters/ word	Bits/ charac.	No. of bits
Latitude (deg x 100)	1	5	6	30
West Longitude (deg x 100)	1	5	6	30
Fill (N)	1	1	6	6
Orbit number for 12-hour period (set to 1 at 0600 and 1800 GMT)	1	1	6	6
Sounding number	1	3	6	18
Fill	1	1	6	6
Time (hours + fraction of hours) x 100	1	4	6	24
Parameters (data used by NMC only)	1	30	6	180
Data for 15 levels	15	22	6	1980
Height (m)		5		
Temperature (°C x 10)		4		
T_d (not given) (°C x 10)		3		
Fill		10		
Fill	1	20	6	120
(End report)	1	10	6	60
(End record)†	variable	10	6	variable

*A data record consists of 12 soundings or reports and contains 30600 bits. It is broken up into five physical records of 6120 bits each. The data on this record are written as an "A" format so 6 bits are required for each character (table 7).

†When 12 reports are obtained or an orbit is ended, a data record is written. The remaining space is filled with "end record" so that the five physical records always contain a total of 30600 bits.

Table 7.--Six-bit binary code used for data records on the third file of the archival tape

Character	Octal representation	Binary representation
0	33	011011
1	34	011100
2	35	011101
3	36	011110
4	37	011111
5	40	100000
6	41	100001
7	42	100010
8	43	100011
9	44	100100
-	46	100110
.	57	101111
Blank	55	101101
R	22	010010
E	05	000101
C	03	000011
O	17	001111
R	22	010010
D	04	000100
P	20	010000
T	24	010100
N	16	001110

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