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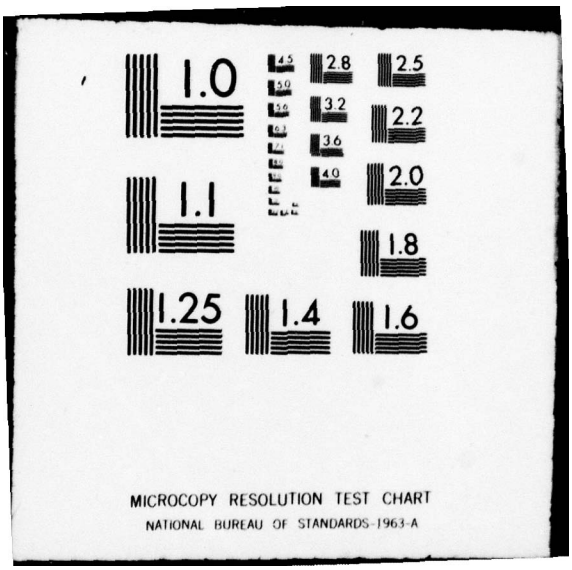
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(9) NWC Technical Memorandum 3107

LEVEL II

(1) By

(6) NAVAL WEAPONS CENTER VERSION OF THE ATMOSPHERIC TRANSMITTANCE COMPUTER CODE LOWTRAN: USER'S MANUAL AND PROGRAM LISTING.

(10) by
Dr. William M. Cornette
Weapons Systems Analysis Division
Systems Development Department

(11) MARCH 1977

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NAVAL WEAPONS CENTER
China Lake, California 93555

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1 OF 1

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LOWTRAN is a FORTRAN computer program, developed at the U.S. Air Force Geophysics Laboratory (AFGL), which calculates the transmittance of the earth's atmosphere in the spectral region from 0.25 to 28.57μm with 20 cm^{-1} spectral resolution on a linear wavenumber scale. A choice of six atmospheric models covering seasonal and latitudinal variations from sea level to 100 km are available, in addition to a capability of allowing the user to input atmospheric profile or meteorological parameters of his own choosing. The program includes four aerosol models and permits either hazy or clear haze condition to be selected, in addition to the capability of selecting a particular visibility of the user's choosing. The model accounts for molecular absorption, molecular scattering, and aerosol extinction, plus atmospheric refraction and earth's curvature effects.

In examining AFGL's version of LOWTRAN (hereafter referred to AFGL/LOWTRAN), the author became aware that it would be possible to redesign the program without changing the basic methodology. This redesign achieves two goals: (a) a significant decrease in program size and hence computer time; and (b) a more structured program flow. The first goal is critical for repeated uses of the program or if the program is to be incorporated into a weapon/sensor systems simulation. The second goal is tied to the first one in that a smooth, structured logic flow usually improves computer time. Moreover, a structured program is easier to understand, to use, and, when necessary, to modify and update.

This report documents the updated code, in addition to including some corrections which have been brought to the author's attention.

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FOREWORD

This technical memorandum contains a brief description and program listing of the atmospheric transmittance computer code NWC/LOWTRAN. The computer code development has been supported by a contract with Naval Air Systems Command (AIR-503E).

This document has been prepared primarily as an interim presentation of timely information. Although care has been taken in the preparation of the technical material presented, the results herein are to be considered as preliminary in nature.

P. B. HOMER
Head, Weapons Systems Analysis Division
Systems Development Department
28 March 1977

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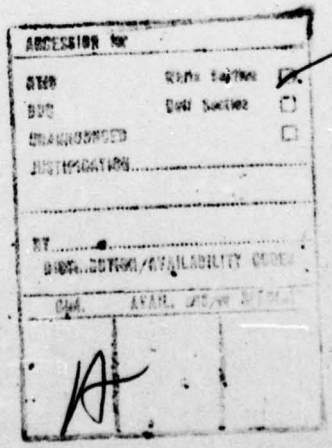

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INTRODUCTION

LOWTRAN is a FORTRAN computer program, developed at the U.S. Air Force Geophysics Laboratory (AFGL), which calculates the transmittance of the earth's atmosphere in the spectral region from 0.25 to 28.57μm (350 to 40,000 cm^{-1}) with 20 cm^{-1} spectral resolution on a linear wavenumber scale. A choice of six atmospheric models (tropical, midlatitude summer and winter, subarctic summer and winter, and the U.S. 1962 standard atmosphere) covering seasonal and latitudinal variations from sea level to 100 km are available, in addition to a capability of allowing the user to input atmospheric profile or meteorological parameters of his own choosing. The program includes four aerosol models (average continental, urban, rural, and maritime) and permits either hazy (5-km visibility) or clear (23-km visibility) haze condition to be selected, in addition to the capability of selecting a particular visibility of the user's choosing. The model accounts for molecular absorption, molecular scattering, and aerosol extinction, plus atmospheric refraction and earth's curvature effects.

LOWTRAN is presently the best available method for predicting atmospheric transmittance and, as such, should be incorporated in simulations and studies of electro-optic weapon/sensor systems performance. One advantage of LOWTRAN is that AFGL is continually improving and upgrading the computer code. For further documentation on LOWTRAN and its limitations, see Refs. 1-5, 11, and 14.

BACKGROUND

In examining AFGL's version of LOWTRAN (hereafter referred to AFGL/LOWTRAN), the author became aware that it would be possible to re-design the program without changing the basic methodology. This re-design achieves two goals:

a. a significant decrease in program size and hence computer time; and

b. a more structured program flow.

The first goal is critical for repeated uses of the program or if the program is to be incorporated into a weapon/sensor systems simulation. The second goal is tied to the first one in that a smooth, structured logic flow usually improves computer time. Moreover, a structured program is easier to understand, to use, and, when necessary, to modify and update.

The author re-designed AFGL/LOWTRAN and produced the computer code NWC/LOWTRAN. It should be emphasized that NWC/LOWTRAN does not attempt to modify the methodology or the algorithm used in AFGL/LOWTRAN in any way whatsoever. The only difference between the two versions is in the computer coding of the algorithm. In fact, where possible, NWC/LOWTRAN uses the same variable names and statement labels as AFGL/LOWTRAN III (ref. 8). This was done to assist comparison between the two codes. The author recently received the modifications to LOWTRAN III necessary to upgrade it to LOWTRAN IIIB status (Ref. 4). These changes have been implemented into NWC/LOWTRAN (Ref. 15). This report documents the updated code, in addition to some corrections which have been brought to the author's attention (e.g., Refs. 9, 10, 14, and 16).

The author would particularly like to thank Mr. T. J. Smith of the Naval Weapons Center and Dr. A. Goroch of the Naval Environmental Prediction Research Facility for indicating several errors. In addition, the author would appreciate having any additional corrections to LOWTRAN brought to his attention at the following address:

Commander (Code 3173)
Attn: Dr. William M. Cornette
Naval Weapons Center
China Lake CA 93555

Comm. Telephone (714) 939-3551
Autovon 245-3551

BASIC STRUCTURE

The NWC/LOWTRAN computer code consists of four modules:

(1) the main program;

(2) the subroutine POINT, which computes the mean refractive index above and below a given altitude and interpolates exponentially to determine the equivalent absorber amounts at that altitude;

(3) the subroutine ANGL, which calculates the initial zenith angle taking into account refraction effects; and

(4) a BLOCK DATA module, which inputs the spectral and transmittance data.

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The number of executable statements contained in each module are:

Main program	405
Subroutine POINT	26
Subroutine ANGL	217
BLOCK DATA	0
TOTAL	648

This is a reduction by over 200 lines of executable computer code from AFGL/LOWTRAN (Ref. 15).

The actual run time for execution time of NWC/LOWTRAN is dependent upon the number of levels used in the geometry, whether the subroutine ANGL is called, and the width and resolution of the spectral band. However, the execution time for the sample output in Figure 1 (shown later in this report) was approximately 470 milliseconds.

INPUT/OUTPUT

The basic inputs to NWC/LOWTRAN are only four cards:

Card 1: MODEL, IAERO, IHAZE, JP, IM, M1, M2, M3, ML, RO, VIS
---------- FORMAT (9I3,3X,2F10.3)

MODEL selects one of the following model atmospheres:

MODEL = 0 for a horizontal path when meteorological data is used. Instead of card 2, read altitude (km), pressure (mb), temperature (deg C), dew point temperature (deg C), relative humidity (%), water vapor density (gm. m^{-3}), ozone density (gm..m^{-3}), visibility (km), and range (km).
---------- FORMAT (3F10.3,2F5.2,2(1PE10.3),2(0PF10.3)).

MODEL = 1 specifies a tropical atmosphere.
MODEL = 2 specifies a midlatitude summer atmosphere.
MODEL = 3 specifies a midlatitude winter atmosphere.
MODEL = 4 specifies a sub-arctic summer atmosphere.
MODEL = 5 specifies a sub-arctic winter atmosphere.
MODEL = 6 specifies the 1962 U.S. Standard atmosphere.
MODEL = 7 for a new model atmosphere (e.g. radiosonde data). Read between cards 1 and 2, altitude (km), pressure (mb), temperature (deg C), dew point temperature (deg C), relative humidity (%), water vapor density (gm. m^{-3}), ozone density (gm. m^{-3}), and aerosol density (cm^{-3}).

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---------- FORMAT (3F10.3,2FS.2,2(1PE10.31,2(0PE10.3)).
Note that either dew point temperature, relative humidity, or water vapor density can be used.

IAERO selects the type of aerosol attenuation:

IAERO = 1 specifies an average continental aerosol model.
IAERO = 2 specifies a rural aerosol model.
IAERO = 3 specifies an urban aerosol model.
IAERO = 4 specifies a maritime aerosol model.

IHAZE selects the degree of aerosol attenuation:

If IHAZE = 0 no aerosol scattering is computed.
If IHAZE = 1 and VIS is non-zero, then aerosol attenuation for the visible range is used.
If IHAZE = 1 or 2 and VIS is zero, then aerosol attenuation for 23 km and 5 km visible ranges, respectively, is used.

JP selects the print option:

JP = 0 for normal operation.
JP = 1 to suppress the printing of the transmittance table.

IM determines when radiosonde data is to be read in:

IM = 0 for normal operation or when subsequent calculations are to be run with MODEL = 7.
IM = 1 for reading in radiosonde data initially for MODEL = 7.

M1, M2, and M3 are used to change temperature, H_2O, and O_3 altitude profiles, respectively, to another model value.

ML is the number of levels of radiosonde data for MODEL = 7.

RO is the input value for the radius of the earth. If RO = 0.0, then the program uses stored values.

VIS is the visual range at sea level (km).

Card 2: I = TYPE, LEN, H1, H2, ANGLE, RANGE, BETA---FORMAT (2I3,4X,5F10.3)

ITYPE indicates the type of atmospheric path:

ITYPE = 1, corresponds to a horizontal (constant pressure) path. Read H1 and RANGE.

ITYPE = 2, vertical or slant path between two altitudes.
Read H1 and two other geometric parameters (e.g., H2 and ANGLE).
ITYPE = 3, vertical or slant path to space.
Read H1 and ANGLE.

LEN selects the type of ray path to be used:

LEN = 0 for normal operation of the program which selects the shorter path when applicable.
LEN = 1 to select the longer path when applicable.

H1 = observer altitude (km)
H2 = source altitude (km)
ANGLE = zenith angle at H1 (degrees)
RANGE = path length (km)
BETA = earth center angle (degrees)

Card 3: V1, V2, DV----------FORMAT (3F10.3)

V1 = initial frequency (wavenumber (cm-1)) value
V2 = final frequency (wavenumber (cm-1)) value
DV = frequency intervals at which transmittance is printed
Note: V1, V2, and DV must be integral multiples of 5 cm-1

Card 4: IXY----------FORMAT (I3)

IXY is the cycling indicator:

IXY = 0 to end data
IXY = 1 for new card 3 only
IXY = 2 to continue data
IXY = 3 for new card 2 only
IXY = 4 for new card 1 only

A sample output is shown in Figure 1.

SUB-ARCTIC (60 DEG. LAT.) WINTER MODEL ATMOSPHERE

CONTINENTAL AEROSOL MODEL

HAZE MODEL = 23.0 KM VISUAL RANGE AT SEA LEVEL

H1 = 2.500 KM, H2 = 8.500 KM, ANGLE = 65.0000 GEOM. RANGE = 14.17 KM, BETA = .11547 DEG

SLANT PATH BETWEEN ALTITUDES H1 AND H2 WHERE H1 = 2.500 KM H2 = 8.500 KM, ZENITH ANGLE = 65.000 DEGREES

FREQUENCY RANGE V1 = 2350.0 CM-1 TO V2 = 2450.0 CM-1 FOR DV = 5.0 CM-1 (4.08 - 4.26 MICRONS)

FIGURE 1. Sample Output for NWC/LOWTRAN.

HORIZONTAL PROFILES

1	.0	1.233-01	1.087+00	1.937-03	8.781-01	6.633-04	1.062+00	1.000+00	1.913-03	2.853-04	2.900-02	3.052+02
2	1.0	1.091-01	8.536-01	1.834-03	6.651-01	8.144-04	9.239-01	4.399-01	1.913-03	2.504-04	2.445-02	2.654+02
3	2.0	7.629-02	6.804-01	1.744-03	5.197-01	4.114-04	8.193-01	1.899-01	1.913-03	2.219-04	1.788-02	2.354+02
4	3.0	4.918-02	5.538-01	1.738-03	4.049-01	2.422-04	7.254-01	7.975-02	2.007-03	1.970-04	1.206-02	2.084+02
5	4.0	2.647-02	4.484-01	1.729-03	3.177-01	1.101-04	6.458-01	4.216-02	2.100-03	1.757-04	7.051-03	1.855+02
6	5.0	1.153-02	3.648-01	1.717-03	2.504-01	3.801-05	5.773-01	3.177-02	2.193-03	1.569-04	3.479-03	1.659+02
7	6.0	5.027-03	2.950-01	1.700-03	1.961-01	1.376-05	5.145-01	2.241-02	2.287-03	1.396-04	1.735-03	1.479+02
8	7.0	2.457-03	2.372-01	2.335-03	1.525-01	6.006-06	4.571-01	2.082-02	3.313-03	1.238-04	9.790-04	1.313+02
9	8.0	4.423-04	1.892-01	2.802-03	1.175-01	8.156-07	4.043-01	2.146-02	4.200-03	1.086-04	2.049-04	1.162+02
10	9.0	2.955-04	1.470-01	4.693-03	8.799-02	5.326-07	3.512-01	2.057-02	7.467-03	9.359-05	1.473-04	1.009+02
11	10.0	1.680-04	1.117-01	6.611-03	6.428-02	2.898-07	3.002-01	2.007-02	1.120-02	8.000-05	8.240-05	8.626+01
12	11.0	1.008-04	8.490-02	8.279-03	4.697-02	1.681-07	2.566-01	1.880-02	1.493-02	6.837-05	4.867-05	7.374+01
13	12.0	5.984-05	6.446-02	1.045-02	3.429-02	9.673-08	2.192-01	1.975-02	2.007-02	5.844-05	2.845-05	6.300+01
14	13.0	3.598-05	4.901-02	1.072-02	2.507-02	5.657-08	1.875-01	1.823-02	2.193-02	4.996-05	1.684-05	5.387+01
15	14.0	1.736-05	3.725-02	1.050-02	1.832-02	2.639-08	1.603-01	1.785-02	2.287-02	4.270-05	7.998-06	4.606+01
16	15.0	1.145-05	2.829-02	1.127-02	1.338-02	1.707-08	1.369-01	1.677-02	2.613-02	3.654-05	5.194-06	3.935+01
17	16.0	8.386-06	2.159-02	1.173-02	9.820-03	1.229-08	1.174-01	1.595-02	2.893-02	3.131-05	3.804-06	3.374+01
18	17.0	6.371-06	1.642-02	1.101-02	7.184-03	9.194-09	1.005-01	1.576-02	2.893-02	2.682-05	2.891-06	2.888+01
19	18.0	4.946-06	1.253-02	1.035-02	5.273-03	7.033-09	8.615-02	1.525-02	2.893-02	2.298-05	2.246-06	2.476+01
20	19.0	4.209-06	9.538-03	9.406-03	3.859-03	5.918-09	7.375-02	1.285-02	2.800-02	1.967-05	1.912-06	2.119+01
21	20.0	3.357-06	7.260-03	8.245-03	2.824-03	4.657-09	6.315-02	9.431-03	2.613-02	1.683-05	1.530-06	1.815+01
22	21.0	3.301-06	5.515-03	7.049-03	2.062-03	4.571-09	5.399-02	6.838-03	2.380-02	1.439-05	1.501-06	1.552+01
23	22.0	2.863-06	4.189-03	6.099-03	1.506-03	3.942-09	4.617-02	5.145-03	2.193-02	1.230-05	1.303-06	1.327+01
24	23.0	2.629-06	3.180-03	5.238-03	1.099-03	3.624-09	3.947-02	3.936-03	2.007-02	1.052-05	1.197-06	1.134+01
25	24.0	2.533-06	2.413-03	4.115-03	8.012-04	3.528-09	3.372-02	3.121-03	1.680-02	8.984-06	1.154-06	9.691+00
26	25.0	2.451-06	1.829-03	3.432-03	5.836-04	3.481-09	2.880-02	2.627-03	1.493-02	5.968-06	1.117-06	8.277+00
27	30.0	6.381-07	4.420-04	1.166-03	1.153-04	8.463-10	1.273-02	7.912-04	7.000-03	2.649-06	2.355-07	3.659+00
28	35.0	9.587-08	1.096-04	5.216-04	2.348-05	1.113-10	5.705-03	2.082-04	4.293-03	1.190-06	2.786-08	1.639+00
29	40.0	1.879-08	2.784-05	1.710-04	4.924-06	2.001-11	2.577-03	5.481-05	1.913-03	5.448-07	3.760-09	7.405-01
30	45.0	4.317-09	7.615-06	4.056-05	1.123-06	4.311-12	1.215-03	1.443-05	6.067-04	2.600-07	6.191-10	3.492-01
31	50.0	7.692-10	2.221-06	1.018-05	2.757-07	7.224-13	5.947-04	3.809-06	2.007-04	9.178-08	8.139-11	1.709-01
32	70.0	1.604-12	2.291-08	7.112-08	1.474-09	1.118-15	4.407-05	1.962-08	4.013-06	6.388-09	1.694-13	1.267-02
33	100.0	1.499-16	5.397-12	5.175-12	1.041-13	6.038-20	3.852-07	6.961-12	2.007-09	5.535-11	2.300-17	1.107-04

FIGURE 1. Sample Output for NWC/LOWTRAN. (contd)

VERTICAL PROFILES

									PSI	PHI	BETA	THETA	RANGE
3	2.5	7.305-02	7.319-01	2.059-03	5.441-01	3.778-04	9.126-01	1.502-01	2.318-03	-.0000	115.0097	.0097	65.0000	1.2
4	3.0	1.597-01	1.912+00	6.158-03	1.394+00	7.741-04	2.532+00	2.896-01	7.173-03	.0022	115.0267	.0289	64.9326	3.5
5	4.0	2.022-01	2.870+00	1.023-02	2.062+00	9.343-04	3.976+00	3.764-01	1.225-02	.0048	115.0434	.0482	64.9759	5.9
6	5.0	2.207-01	3.646+00	1.426-02	2.587+00	9.906-04	5.264+00	4.398-01	1.754-02	.0071	115.0603	.0675	64.9589	8.3
7	6.0	2.292-01	4.272+00	1.899-02	2.996+00	1.013-03	6.409+00	4.908-01	2.407-02	.0092	115.0775	.0867	64.9418	10.6
8	7.0	2.320-01	4.773+00	2.503-02	3.313+00	1.019-03	7.424+00	5.406-01	3.289-02	.0112	115.0947	.1059	64.9245	13.0
9	8.0	2.324-01	4.982+00	2.880-02	3.442+00	1.020-03	7.884+00	5.657-01	3.863-02	.0126	115.1029	.1155	64.9067	14.2

ESTIMATED TANGENT ALTITUDE = .000 KM

EQUIVALENT SEA LEVEL ABSORBER AMOUNTS

	WATER VAPOUR GM CM-2	CO2 ETC. KM	OZONE ATM CM	NITROGEN (CONT) KM	H2O (CONT) GM CM-2	MOL SCAT KM	AEROSOL KM	OZONE(U-V) ATM CM
H(1-8) =	2.324-01	4.982+00	2.880-02	3.442+00	1.020-03 6.022-02	7.884+00	5.657-01	3.863-02

FIGURE 1. Sample Output for NWC/LOWTRAN. (contd)

FREQ CM-1	WAVELENGTH MICRONS	TOTAL TRANS	H2O TRANS	CO2+ TRANS	OZONE TRANS	N2 CONT TRANS	H2O CONT TRANS	MOL SCAT TRANS	AEROSOL TRANS	AEROSOL ABS	INTEGRATED ABSORPTION
2350	4.2553	.0000	.9964	.0000	1.0000	.6548	1.0000	1.0000	.9902	.0011	2.50
2355	4.2463	.0000	.9969	.0000	1.0000	.6639	.9986	1.0000	.9902	.0011	7.50
2360	4.2373	.0000	.9972	.0000	1.0000	.6708	.9972	1.0000	.9902	.0011	12.50
2365	4.2283	.0000	.9973	.0000	1.0000	.6754	.9958	1.0000	.9901	.0011	17.50
2370	4.2194	.0000	.9976	.0000	1.0000	.6801	.9945	1.0000	.9901	.0011	22.50
2375	4.2105	.0000	.9975	.0000	1.0000	.6801	.9931	1.0000	.9901	.0011	27.50
2380	4.2017	.0014	.9981	.0021	1.0000	.6825	.9917	1.0000	.9901	.0011	32.49
2385	4.1929	.0271	.9983	.0405	1.0000	.6825	.9903	1.0000	.9901	.0011	37.36
2390	4.1841	.1125	.9987	.1691	1.0000	.6801	.9890	1.0000	.9901	.0011	41.80
2395	4.1754	.2543	1.0000	.3851	1.0000	.6754	.9876	1.0000	.9901	.0011	45.52
2400	4.1667	.4524	1.0000	.6836	1.0000	.6778	.9862	1.0000	.9900	.0010	48.26
2405	4.1580	.5828	1.0000	.8774	1.0000	.6801	.9865	1.0000	.9900	.0010	50.35
2410	4.1494	.6612	1.0000	.9850	1.0000	.6872	.9868	1.0000	.9900	.0010	52.04
2415	4.1408	.6721	1.0000	.9940	1.0000	.6919	.9870	1.0000	.9900	.0010	53.68
2420	4.1322	.6823	1.0000	.9918	1.0000	.7039	.9873	1.0000	.9900	.0010	55.27
2425	4.1237	.6866	1.0000	.9874	1.0000	.7112	.9875	1.0000	.9900	.0010	56.84
2430	4.1152	.6919	1.0000	.9812	1.0000	.7211	.9878	1.0000	.9900	.0010	58.38
2435	4.1068	.6988	1.0000	.9738	1.0000	.7336	.9880	1.0000	.9899	.0010	59.88
2440	4.0984	.7038	1.0000	.9688	1.0000	.7425	.9883	1.0000	.9899	.0010	61.36
2445	4.0900	.7129	1.0000	.9660	1.0000	.7541	.9885	1.0000	.9899	.0010	62.80
2450	4.0816	.7254	1.0000	.9643	1.0000	.7685	.9888	1.0000	.9899	.0010	63.49

INTEGRATED ASORPTION FROM 2350 TO 2450 CM-1 = 63.49, AVERAGE TRANSMITTANCE = .3851

FIGURE 1. Sample Output for NWC/LOWTRAN. (contd)

PORTABILITY

During the development of the NWC/LOWTRAN computer code, it was attempted to use a highly portable subset of ANSI FORTRAN (Ref. 12). To facilitate this, the PFORT verifier developed by Bell Telephone Laboratories (Ref. 13) has been used to check the portability of the computer code.

To the best of the author's knowledge, the only areas where difficulties may arise in using NWC/LOWTRAN with compilers and machines other than Univac compilers and computers, are as follows:

(i) The program uses the Univac library routines ACOS (arccosine), ASIN (arcsine), and TAN (tangent); if not available on the desired machine (e.g., on Honeywell Series 32 computers) or if another name is used (e.g., ARCOS and ARSIN on the IBM 360 series computers), some changes will be necessary.

(ii) The values for the input/output units on the Univac 1110 are 5 for the card reader and 6 for the line printer; these values are input to the program in the BLOCK DATA module for easy accessibility.

(iii) Due to the large arrays used in NWC/LOWTRAN, much of the data in the BLOCK DATA module are assigned by DATA statements to an array name, or part of an array through an implicit DO; this feature may create certain difficulties on some compilers.

If anyone experiences any problems using NWC/LOWTRAN due to compiler or machine incompatibilities, the author would greatly appreciate being notified.

MAIN PROGRAM

STORAGE USED: CODE(1) 007241; DATA(0) 001525; BLANK COMMON(2) 000000

COMMON BLOCKS:

0003 LOWTRN 015730

EXTERNAL REFERENCES (BLOCK, NAME)

0004 ANGL
0005 POINT
0006 NINTRS
0007 NRDUS
0010 NIOZS
0011 NWDUS
0012 NSTOPS
0013 XPRR
0014 EXP
0015 SIN
0016 COS
0017 SQRT
0020 ACOS
0021 ATAN
0022 ASIN
0023 NIOIS
0024 ALOG
0025 ALOG10

STORAGE ASSIGNMENT (BLOCK, TYPE, RELATIVE LOCATION, NAME)

0001	003294	10220	0001	001115	109L	0001	001143	105L	0001	001607	106L
0001	001674	107L	0001	001773	108L	0001	002133	110L	0001	002137	1100L
0001	000014	1120	0001	003726	11210	0001	004207	12040	0001	004234	12170
0001	004422	12540	0001	004507	12750	0001	004646	13220	0001	005037	13420
0001	005271	14140	0001	005365	14270	0001	006020	14700	0001	006414	15550
0001	007173	16440	0001	004307	19L	0001	008513	204L	0001	007235	209L
0001	000470	2510	0001	000551	2720	0001	002351	30L	0001	002725	32L
0001	003017	33L	0001	003134	34L	0001	003202	35L	0001	003274	38L
0000	000327	%05F	0000	000331	%06F	0000	000334	%07F	0000	000350	%08F
0000	000415	%10F	0000	000426	%11F	0000	000441	%12F	0000	000454	%13F
0000	000502	%15F	0000	000513	%17F	0000	000526	%18F	0000	000553	%19F
0000	000645	%21F	0000	000655	%22F	0000	000715	%23F	0000	000721	%24F
0000	000753	%27F	0000	000761	%28F	0000	001004	%29F	0001	004214	%3L
0000	001063	%33F	0000	001105	%34F	0000	001112	%35F	0000	001120	%36F
0000	001137	%38F	0000	001158	%39F	0000	001175	%40F	0000	001213	%41F
0000	001272	%43F	0000	001303	%44F	0000	001314	%45F	0000	001325	%46F
0000	001344	%48F	0000	001351	%49F	0001	004242	%5L	0000	001358	%50F
0001	005115	%7L	0001	005175	%9L	0001	002032	5650	0001	002207	6200
0001	002676	7300	0000 R	000323	AB	0000 R	000036	AHZ1	0000 R	000100	AHZ2
0000 R	000263	ALP	0000 R	000208	ANGLE	0000 R	000252	AO	0000 R	000276	B
0000 R	000207	BETA	0000 R	000272	BJ	0003 R	015662	CA	0003 R	015660	CO

0001	003504	10630									
0001	002447	111L									
0001	004244	12260									
0001	005143	13760									
0001	007045	16150									
0001	000622	3270									
0000	000324	%00F									
0000	000375	%09F									
0000	000467	%14F									
0000	000526	%20F									
0000	000742	%25F									
0000	001012	%30F									
0000	001123	%37F									
0000	001238	%42F									
0000	001336	%47F									
0000	001304	%51F									
0001	002435	6610									
0000 R	000271	AJ									
0000 R	000266	BET									
0003 R	015657	CH									

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0003 R 002635 C1	0003 R 007881 C2	0003 R 012730 C3	0003 R 013784 C4	0003 R 014171 C5
0003 R 014218 C7	0003 R 014474 C7A	0003 R 014760 C8	0000 R 000233 D	0000 R 000174 DP
0000 R 000262 DS	0000 R 000215 DV	0000 R 000301 DZ	0000 R 000024 E	0003 R 015126 EH
0000 R 000273 EV	0000 R 000201 FAC	0003 R 002532 FO	0003 R 002427 FW	0000 R 000250 H
0000 R 000235 HAZE	0000 R 000280 HH	0000 R 000225 HMIN	0003 R 000002 HZ1	0003 R 000044 HZ2
0000 R 000177 H1	0000 R 000205 H2	0000 I 000171 I	0000 I 000161 IAERO	0003 000000 IATM
0000 I 000305 IDV	0000 I 000211 IFIND	0000 I 000162 IHAZE	0000 I 000164 IM	0000 I 000155 IP
0003 I 015735 IR	0000 I 000157 ITER	0000 I 000257 ITES	0000 I 000203 ITYPE	0000 I 000307 IV
0000 I 000303 IV1	0000 I 000304 IV2	0003 I 015734 IW	0000 I 000154 IXY	0000 I 000302 I0
0000 I 000200 J	0000 I 000254 JMIN	0000 I 000163 JP	0000 I 000244 JP1	0000 I 000228 J1
0000 I 000243 J2	0000 I 000172 K	0000 I 000242 K2	0000 I 000274 L	0000 I 000204 LEN
0003 I 015852 M	0000 I 000165 ML	0000 I 000160 MODEL	0003 I 015033 M1	0003 I 015054 M2
0003 I 015855 M3	0000 I 000251 N	0000 I 000317 NH	0003 I 000001 NL	0000 I 000170 NLP
0000 I 000158 NL1	0000 I 000255 NP	0000 I 000240 NP1	0000 I 000246 NP2	0000 I 000322 NS
0000 I 000313 NS1	0000 I 000314 NS2	0000 I 000315 NS3	0003 R 000150 P	0000 R 000277 PM
0000 R 000300 PM1	0003 015381 PI	0000 R 000234 PPM	0000 R 000227 PS	0000 R 000270 PSI
0000 R 000232 PT	0000 R 000176 RANGE	0003 R 015053 RE	0003 R 015033 REARTH	0000 R 000235 REF
0000 R 000175 RH	0000 R 000275 RN	0000 R 000231 RX	0000 R 000163 R0	0000 R 000223 R1
0000 R 000255 SALP	0000 R 000222 SPHI	0000 R 000221 SR	0000 R 000206 SUM	0003 R 000526 T
0000 R 000264 THET	0000 R 000267 THETA	0000 R 000173 TMP	0003 R 002324 TR	0000 R 000230 TS
0000 R 000231 TS1	0000 R 000202 TT	0000 R 000000 TX	0000 R 000241 TX1	0000 R 000247 TX2
0000 R 000256 TX3	0000 R 000012 VM	0000 R 000167 VIS	0003 R 002040 VX	0000 R 000213 V1
0000 R 000214 V2	0000 R 000142 W	0003 R 001104 WH	0000 R 000220 WL	0000 R 000217 WL1
0000 R 000216 WL2	0003 R 001462 WO	0000 R 000310 WS1	0000 R 000311 WS2	0000 R 000312 WS3
0000 R 000224 X	0000 R 000316 X1	0000 R 000320 XX	0000 R 000210 X1	0000 R 000212 X2
0000 R 000253 YN	0000 R 000237 YN1	0000 R 000245 YN2	0000 R 000321 YY	0003 R 015072 Z
0003 R 000106 Z0				

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00100      1*    C*************************************************************LOW00100
00100      2*    C*                                                           *LOW00200
00100      3*    C*          NAVAL WEAPONS CENTER MODIFICATION                *LOW00300
00100      4*    C*                OF AFGL LOWTRAN 3B                         *LOW00400
00100      5*    C*                                                           *LOW00500
00100      6*    C*             REVISION DATE 28 MARCH 1977                   *LOW00600
00100      7*    C*                                                           *LOW00700
00100      8*    C*          DR. WILLIAM M. CORNETTE, CODE 3173               *LOW00800
00100      9*    C*          (714) 939-3551 OR AUTOVON 295-3551               *LOW00900
00100     10*    C*                                                           *LOW01000
00100     11*    C*************************************************************LOW01100
00100     12*    C*                                                           *LOW01200
00100     13*    C*    PROGRAM LOWTRAN 3B CALCULATES THE TRANSMITTANCE OF THE ATMOS-  *LOW01300
00100     14*    C*    PHERE FROM 350 CM-1 TO 40000 CM-1 (0.25 TO 28.57 MICRONS) AT   *LOW01400
00100     15*    C*    20 CM-1 SPECTRAL RESOLUTION ON A LINEAR WAVENUMBER SCALE.      *LOW01500
00100     16*    C*    REFRACTION AND EARTH'S CURVATURE EFFECTS ARE INCLUDED.         *LOW01600
00100     17*    C*    THE ATMOSPHERE IS LAYERED IN ONE KILOMETER INTERVALS BETWEEN   *LOW01700
00100     18*    C*    GROUND LEVEL AND 25 KM., 5 KM. INTERVALS TO 50 KM., A TWENTY   *LOW01800
00100     19*    C*    KM. INTERVAL TO 70 KM., AND A THIRTY KM. INTERVAL TO 100 KM.   *LOW01900
00100     20*    C*                                                           *LOW02000
00100     21*    C*************************************************************LOW02100
00100     22*    C*                                                           *LOW02200
00100     23*    C*    PROGRAM ACTIVATED BY SUBMISSION OF FOUR CARD SEQUENCE -*LOW02300
00100     24*    C*                                                           *LOW02400
00100     25*    C**** CARD 1- MODEL,IAERO,IHAZE,JP,IM,M1,M2,M3,ML,RO,VIS     *LOW02500
00100     26*    C*                                  ------FORMAT(913,3X,2F10.3)*****LOW02600
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00100    27.     C.                                                              *LOW02700
00100    28.     C.    MODEL SELECTS ONE OF THE FOLLOWING MODEL ATMOSPHERE -      *LOW02800
00100    29.     C.       MODEL = 0 FOR HORIZ. PATH WHEN METEOROL. DATA USED -    *LOW02900
00100    30.     C.          INSTEAD OF CARD 2, READ H1,P(MB),T(DEG C),DEW PT.TEMP*LOW03000
00100    31.     C.          (DEG C), REL. HUMIDITY(PERCENT),H2O DENSITY (GM.M-3),O3*LOW03100
00100    32.     C.          DENSITY (GM.M-3), RANGE(KM)                         *LOW03200
00100    33.     C.          ---------- FORMAT(3F10.3,2F5.2,2(1PE10.3),0PF10.3).*LOW03300
00100    34.     C.       MODEL = 1 SPECIFIES A TROPICAL ATMOSPHERE.             *LOW03400
00100    35.     C.       MODEL = 2 SPECIFIES A MIDLATITUDE SUMMER ATMOSPHERE.   *LOW03500
00100    36.     C.       MODEL = 3 SPECIFIES A MIDLATITUDE WINTER ATMOSPHERE.   *LOW03600
00100    37.     C.       MODEL = 4 SPECIFIES A SUB-ARCTIC SUMMER ATMOSPHERE.    *LOW03700
00100    38.     C.       MODEL = 5 SPECIFIES A SUB-ARCTIC WINTER ATMOSPHERE.    *LOW03800
00100    39.     C.       MODEL = 6 SPECIFIES A 1962 US STANDARD ATMOSPHERE.     *LOW03900
00100    40.     C.       MODEL = 7 FOR NEW MODEL ATMOSPHERE (E.G., RADIOSONDE DATA) -*LOW04000
00100    41.     C.          READ BETWEEN CARDS 1 AND 2, ALTITUDE(KM),P(MB),T(DEG C),*LOW04100
00100    42.     C.          DEW PT.TEMP(DEG C),REL. HUMIDITY(PERCENT),H2O DENSITY*LOW04200
00100    43.     C.          (GM.M-3), O3 DENSITY(GM.M-3), AEROSOL NO. DENSITY(CM-3)*LOW04300
00100    44.     C.          ------------- FORMAT(3F10.3,2F5.2,2(1PE10.3),2(0PF10.3))*LOW04400
00100    45.     C.          NOTE - EITHER DEW PT.TEMP, REL. HUM., OR H2O DENSITY*LOW04500
00100    46.     C.          CAN BE USED.                                        *LOW04600
00100    47.     C.                                                              *LOW04700
00100    48.     C.    IAERO SELECTS THE TYPE OF AEROSOL ATTENUATION             *LOW04800
00100    49.     C.       IAERO = 1 SPECIFIES AN AVERAGE CONTINENTAL AEROSOL MODEL.*LOW04900
00100    50.     C.       IAERO = 2 SPECIFIES A RURAL AEROSOL MODEL.             *LOW05000
00100    51.     C.       IAERO = 3 SPECIFIES AN URBAN AEROSOL MODEL.            *LOW05100
00100    52.     C.       IAERO = 4 SPECIFIES A MARITIME AEROSOL MODEL.          *LOW05200
00100    53.     C.                                                              *LOW05300
00100    54.     C.    IHAZE SELECTS THE DEGREE OF AEROSOL ATTENUATION           *LOW05400
00100    55.     C.       IF IHAZE=0 NO AEROSOL SCATTERING IS COMPUTED.          *LOW05500
00100    56.     C.       IF IHAZE = 1 AND VIS IS NON-ZERO, THEN AEROSOL ATTENUATION*LOW05600
00100    57.     C.          FOR THE VISIBLE RANGE IS USED.                      *LOW05700
00100    58.     C.       IF IHAZE = 1 OR 2 AND VIS IS ZERO, THEN AEROSOL ATTENUATION*LOW05800
00100    59.     C.          FOR 23 KM AND 5 KM VISIBLE RANGES, RESPECTIVELY,    *LOW05900
00100    60.     C.          IS USED.                                            *LOW06000
00100    61.     C.                                                              *LOW00100
00100    62.     C.    JP SELECTS THE PRINT OPTION                               *LOW06200
00100    63.     C.       JP = 0 FOR NORMAL OPERATION.                           *LOW06300
00100    64.     C.       JP = 1 TO SUPPRESS THE PRINTING OF THE TRANSMITTANCE TABLE.*LOW06400
00100    65.     C.                                                              *LOW06500
00100    66.     C.    IM DETERMINES WHEN RADIOSONDE DATA IS TO BE READ IN       *LOW06600
00100    67.     C.       IM = 0 FOR NORMAL OPERATION.                           *LOW06700
00100    68.     C.       IM = 1 FOR INITIALIZING RADIOSONDE OR METEOROLOGICAL   *LOW06800
00100    69.     C.          DATA.                                               *LOW06900
00100    70.     C.                                                              *LOW07000
00100    71.     C.    M1, M2, AND M3 ARE USED TO CHANGE TEMP, H2O, AND O3 ALTITUDE*LOW07100
00100    72.     C.       PROFILES, RESPECTIVELY, TO ANOTHER MODEL VALUE.        *LOW07200
00100    73.     C.                                                              *LOW07300
00100    74.     C.    ML IS THE NUMBER OF LEVELS OF RADIOSONDE DATA FOR MODEL = 7.*LOW07400
00100    75.     C.                                                              *LOW07500
00100    76.     C.    RO IS THE INPUT VALUE FOR THE RADIUS OF THE EARTH.  IF RO IS*LOW07600
00100    77.     C.       ZERO THEN THE PROGRAM USES STORED VALUES.              *LOW07700
00100    78.     C.                                                              *LOW07800
00100    79.     C.    VIS IS THE VISUAL RANGE AT SEA LEVEL (KM)                 *LOW07900
00100    80.     C.                                                              *LOW08000
00100    81.     C**** CARD 2- ITYPE,LEN,H1,H2,ANGLE,RANGE,BETA---FORMAT(2I3,4X,5F10.3)**LOW03100
00100    82.     C.                                                              *LOW08200
00100    83.     C.    ITYPE INDICATES THE TYPE OF ATMOSPHERIC PATH               *LOW08300
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00100    84*      C*       ITYPE = 1, CORRESPONDS TO A HORIZONTAL (CONSTANT PRESSURE)    *LOW08400
00100    85*      C*          PATH.  READ H1 AND RANGE.                                   *LOW08500
00100    86*      C*       ITYPE = 2, VERTICAL OR SLANT PATH BETWEEN TWO ALTITUDES.       *LOW08600
00100    87*      C*          READ H1 AND TWO OTHER GEOMETRIC PARAMETERS (E.G., H2 AND    *LOW08700
00100    88*      C*          ANGLE).                                                     *LOW08800
00100    89*      C*       ITYPE = 3, VERTICAL OR SLANT PATH TO SPACE.                    *LOW08900
00100    90*      C*          READ H1 AND ANGLE.                                          *LOW09000
00100    91*      C*                                                                      *LOW09100
00100    92*      C*    LEN SELECTS THE TYPE OF RAY PATH TO BE USED                       *LOW09200
00100    93*      C*       LEN = 0 FOR NORMAL OPERATION OF THE PROGRAM WHICH SELECTS       *LOW09300
00100    94*      C*          THE SHORTER PATH WHEN APPLICABLE.                           *LOW09400
00100    95*      C*       LEN = 1 TO SELECT THE LONGER PATH WHEN APPLICABLE.             *LOW09500
00100    96*      C*                                                                      *LOW09600
00100    97*      C*    H1       =   OBSERVER ALTITUDE (KM)                             *LOW09700
00100    98*      C*    H2       =   SOURCE  ALTITUDE (KM)                              *LOW09800
00100    99*      C*    ANGLE    =   ZENITH ANGLE AT H1 (DEGREES)                       *LOW09900
00100   100*      C*    RANGE    =   PATH LENGTH (KM)                                   *LOW10000
00100   101*      C*    BETA     =   EARTH CENTRE ANGLE (DEGREES)                       *LOW10100
00100   102*      C*                                                                      *LOW10200
00100   103*      C**** CARD 3- V1,V2,DV----------------------------FORMAT(3F10.3)*********LOW10300
00100   104*      C*                                                                      *LOW10400
00100   105*      C*    V1 = INITIAL FREQUENCY (WAVENUMBER CM-1) INTEGER VALUE          *LOW10500
00100   106*      C*    V2 = FINAL FREQUENCY(WAVENUMBER CM-1) INTEGER VALUE             *LOW10600
00100   107*      C*    DV = FREQUENCY INTERVALS AT WHICH TRANSMITTANCE IS PRINTED      *LOW10700
00100   108*      C*       NOTE - DV MUST BE A MULTIPLE OF 5 CM-1                       *LOW10800
00100   109*      C*                                                                      *LOW10900
00100   110*      C**** CARD 4- IXY--------------------------------FORMAT(I3)**********LOW11000
00100   111*      C*                                                                      *LOW11100
00100   112*      C*    IXY IS THE CYCLING INDICATOR:                                   *LOW11200
00100   113*      C*       IXY = 0 TO END DATA                                          *LOW11300
00100   114*      C*       IXY = 1 FOR NEW CARD 3 ONLY                                  *LOW11400
00100   115*      C*       IXY = 2 TO CONTINUE DATA                                     *LOW11500
00100   116*      C*       IXY = 3 FOR NEW CARD 2 ONLY                                  *LOW11600
00100   117*      C*       IXY = 4 FOR NEW CARD 1 ONLY (PLUS RADIOSONDE OR              *LOW11700
00100   118*      C*          METEOROLOGICAL DATA, IF DESIRED)                          *LOW11800
00100   119*      C*                                                                      *LOW11900
00100   120*      C***************************************************************************LOW12000
00100   121*      C                                                                       LOW12100
00101   122*            LOGICAL          CKZERO                                         LOW12200
00103   123*            COMMON /LOWTRN/  IATM,ML,MZ1(34),MZ2(34),Z0(34),P(7,34),T(7,34),LOW12300
00103   124*           *   WM(7,34),WO(7,34),VX(4,45),TR(67),FH(67),FO(67),C1(2580),    LOW12400
00103   125*           *   C2(1575),C3(940),C4(133),C5(15),C7(4,45),C7A(4,45),C8(102),  LOW12500
00103   126*           *   EM(10,34),M,M1,M2,M3,RE,CM,CO,PI,CA,REARTH(7),Z(34),IM,IR     LOW12600
00103   127*      C                                                                       LOW12700
00104   128*            DIMENSION        TX(10),VM(10),E(10),AMZ1(34),AMZ2(34),W(10)    LOW12800
00104   129*      C                                                                       LOW12900
00105   130*            CKZERO(VAR)=ABS(VAR).LT.1.E-20                                   LOW13000
00105   131*      C                                                                       LOW13100
00106   132*            IXY=2                                                            LOW13200
00107   133*            IP=1                                                             LOW13300
00110   134*            ML1=ML-1                                                         LOW13400
00111   135*            DO 200 ITER=1,10000                                              LOW13500
00114   136*               IF (IXY.LE.0.OR.IXY.GE.5) GO TO 200                           LOW13600
00116   137*               IF (IXY.EQ.1) GO TO 107                                       LOW13700
00120   138*               IF (IXY.EQ.3) GO TO 105                                       LOW13800
00120   139*      C                                                                       LOW13900
00122   140*               READ(IR,400) MODEL,IAERO,IHAZE,JP,IM,MI,M2,M3,ML,R0,VIS       LOW14000
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00137   141*            IF (MODEL.EQ.1) WRITE(IW,410)                                    LOWI4100
00142   142*            IF (MODEL.EQ.2) WRITE(IW,411)                                    LOWI4200
00145   143*            IF (MODEL.EQ.3) WRITE(IW,412)                                    LOWI4300
00150   144*            IF (MODEL.EQ.4) WRITE(IW,413)                                    LOWI4400
00153   145*            IF (MODEL.EQ.5) WRITE(IW,414)                                    LOWI4500
00156   146*            IF (MODEL.EQ.6) WRITE(IW,415)                                    LOWI4600
00161   147*            IF (M1.NE.0) WRITE(IW,444) M1                                    LOWI4700
00165   148*            IF (M2.NE.0) WRITE(IW,445) M2                                    LOWI4800
00171   149*            IF (M3.NE.0) WRITE(IW,446) M3                                    LOWI4900
00175   150*            IF (IAERO.EQ.1) WRITE(IW,447)                                    LOWI5000
00200   151*            IF (IAERO.EQ.2) WRITE(IW,448)                                    LOWI5100
00203   152*            IF (IAERO.EQ.3) WRITE(IW,449)                                    LOWI5200
00206   153*            IF (IAERO.EQ.4) WRITE(IW,450)                                    LOWI5300
00211   154*            IF (IHAZE.EQ.0) WRITE(IW,426)                                    LOWI5400
00214   155*            IF (IHAZE.EQ.1.AND.CKZERO(VIS)) VIS=23.                          LOWI5500
00218   156*            IF (IHAZE.EQ.2.AND.CKZERO(VIS)) VIS=5.                           LOWI5600
00220   157*            IF (.NOT.CKZERO(VIS)) WRITE(IW,417) VIS                          LOWI5700
00224   158*            IF (VIS.GT.0.0.AND.VIS.LT.2.0) WRITE(IW,442)                     LOWI5800
00227   159*            IF (MODEL.EQ.0) M=7                                              LOWI5900
00231   160*            IF (MODEL.NE.0) M=MODEL                                          LOWI6000
00233   161*            IF (MODEL.EQ.0) NLP=1                                            LOWI6100
00235   162*            IF (MODEL.NE.0.AND.MODEL.NE.7) NLP=NL                            LOWI6200
00237   163*            IF (MODEL.EQ.7) NLP=MAX0(ML,1)                                   LOWI6300
00241   164*               IF (ML.GT.NL) WRITE(IW,451) ML,NL                             LOWI6400
00246   165*               IF (ML.GT.NL) STOP                                            LOWI6500
00248   166*     C                                                                       LOWI6600
00250   167*            DO 101 I = 1,NL                                                  LOWI6700
00253   168*               IF (M.NE.7) AMZ1(I)=MZ1(I)                                    LOWI6800
00255   169*               IF (M.NE.7) AMZ2(I)=MZ2(I)                                    LOWI6900
00257   170*               IF (M.NE.7) Z(I)=Z0(I)                                        LOWI7000
00261   171*      101      CONTINUE                                                      LOWI7100
00263   172*            IF (     CKZERO(R0)) RE=REARTH(M)                                LOWI7200
00265   173*            IF (.NOT.CKZERO(R0)) RE=R0                                       LOWI7300
00267   174*            IF (M.NE.7.OR.IM.EQ.0) GO TO 104                                 LOWI7400
00267   175*     C                                                                       LOWI7500
00267   176*     C**** READ IN RADIOSONDE (MODEL = 7) OR METEOROLOGICAL (MODEL = 0) DATA LOWI7600
00267   177*     C                                                                       LOWI7700
00271   178*            DO 103 K = 1,NLP                                                 LOWI7800
00274   179*               IF (MODEL.EQ.0) READ(IR,429) Z(K),P(7,K),TMP,DP,RH,WM(7,K),   LOWI7900
00274   180*         *        WO(7,K),RANGE                                             LOWI8000
00307   181*               IF (MODEL.EQ.7) READ(IR,429) Z(K),P(7,K),TMP,DP,RH,WM(7,K),   LOWI8100
00307   182*         *        WO(7,K),AMZ1(K)                                           LOWI8200
00322   183*               IF (MODEL.EQ.0) AMZ1(K)=0.0                                   LOWI8300
00324   184*               IF (MODEL.EQ.0) M1=Z(K)                                       LOWI8400
00328   185*               DO 102 I = 1,NL1                                              LOWI8500
00331   186*      102         IF (Z(K).GE.Z0(I)) J=I                                     LOWI8600
00334   187*               FAC=(Z(K)-Z0(J))/(Z0(J+1)-Z0(J))                              LOWI8700
00335   188*               T(7,K)=TMP+273.15                                             LOWI8800
00338   189*               IF (M1.NE.0) T(7,K)=T(M1,J)*(T(M1,J+1)/T(M1,J))**FAC          LOWI8900
00340   190*               IF (.NOT.CKZERO(RH)) TT=273.15/T(7,K)                         LOWI9000
00342   191*               IF (.NOT.CKZERO(DP)) TT=273.15/(273.15+DP)                    LOWI9100
00344   192*               IF (CKZERO(WM(7,K))) WM(7,K)=EXP(18.9766-14.9595*TT-2.43882   LOWI9200
00344   193*         *        *TT**2)*TT                                                LOWI9300
00348   194*               IF (.NOT.CKZERO(RH)) WM(7,K)=0.01*RH*WM(7,K)                  LOWI9400
00350   195*               IF (M2.NE.0) WM(7,K)=WM(M2,J)*(WM(M2,J+1)/WM(M2,J))**FAC      LOWI9500
00352   196*               IF (M3.NE.0) WO(7,K)=WO(M3,J)*(WO(M3,J+1)/WO(M3,J))**FAC      LOWI9600
00354   197*               IF (CKZERO(AMZ1(K))) AMZ2(K)=MZ2(J)*(MZ2(J+1)/MZ2(J))**FAC    LOWI9700
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00396   198•                IF (.NOT.CKZERO(AMZ1(K))) AMZ2(K)=AMZ1(K)                              LOW19800
00380   199•                IF (CKZERO(AMZ1(K))) AMZ1(K)=MZ1(J)*(MZ1(J+1)/MZ1(J))**FAC             LOW19900
00362   200•                IF (MODEL.EQ.0) WRITE(IW,430) Z(K),P(7,K),TMP,DP,RH,WH(7,K),LOW20000
00362   201•             •     WO(7,K),RANGE                                                      LOW20100
00375   202•                IF (MODEL.EQ.7) WRITE(IW,429) Z(K),P(7,K),TMP,DP,RH,WH(7,K),LOW20200
00375   203•             •     WO(7,K),AMZ1(K)                                                    LOW20300
00410   204•          103   CONTINUE                                                             LOW20400
00410   205•          C                                                                          LOW20500
00412   206•           104  CONTINUE                                                             LOW20600
00413   207•                IF (M1.EQ.0) M1=M                                                    LOW20700
00415   208•                IF (M2.EQ.0) M2=M                                                    LOW20800
00417   209•                IF (M3.EQ.0) M3=M                                                    LOW20900
00421   210•                IF (MODEL.EQ.0) ITYPE=1                                              LOW21000
00423   211•                IF (MODEL.EQ.0) GO TO 107                                            LOW21100
00425   212•                IF (IXY.EQ.4) GO TO 108                                              LOW21200
00425   213•          C                                                                          LOW21300
00427   214•           109  CONTINUE                                                             LOW21400
00430   215•                READ(IR,406) ITYPE,LEN,H1,H2,ANGLE,RANGE,BETA                        LOW21500
00441   216•                X1=RE+H1                                                             LOW21600
00442   217•                IFIND=0                                                              LOW21700
00443   218•                IF (CKZERO(RANGE).AND.((ITYPE.EQ.2.AND..NOT.CKZERO(BETA))            LOW21800
00443   219•             •      .OR.(ITYPE.EQ.3.AND.H2.LT.H1.AND.H2.GT.0.0))) IFIND=1            LOW21900
00445   220•                IF (ITYPE.EQ.1.OR.ITYPE.EQ.3) GO TO 106                              LOW22000
00447   221•                ITYPE=2                                                              LOW22100
00450   222•                IF (.NOT.CKZERO(ANGLE).AND..NOT.CKZERO(BETA)) H2=                    LOW22200
00450   223•             •     X1*ABS((SIN(ANGLE*CA)/SIN((ANGLE-BETA)*CA)))-RE                   LOW22300
00452   224•                IF (.NOT.CKZERO(ANGLE).AND..NOT.CKZERO(RANGE)) H2=                   LOW22400
00452   225•             •     X1*SQRT(1.+(RANGE/X1)**2+2.*(RANGE/X1)*COS(ANGLE*CA))-RE          LOW22500
00454   226•                IF (.NOT.CKZERO(BETA).AND..NOT.CKZERO(RANGE)) H2=                    LOW22600
00454   227•             •     X1*ABS(COS(BETA*CA)+SQRT((RANGE/X1)**2-SIN(BETA*CA)**2))-RE       LOW22700
00456   228•                X2=RE+H2                                                             LOW22800
00457   229•                IF (.NOT.CKZERO(RANGE)) ANGLE=ACOS(((X2/X1)*(X2/RANGE)-              LOW22900
00457   230•             •     (X1/RANGE)-(RANGE/X1))/2.)/CA                                     LOW23000
00461   231•                IF (.NOT.CKZERO(BETA*CA)) ANGLE=ATAN(X2*SIN(BETA*CA)/(X2*            LOW23100
00461   232•             •     COS(BETA*CA)-X1))/CA                                              LOW23200
00463   233•                IF (ANGLE.LT.0.0) ANGLE=ANGLE+180.                                   LOW23300
00465   234•                IF (CKZERO(RANGE)) RANGE=X1*ABS(SQRT((X2/X1)**2-SIN(ANGLE*CA)        LOW23400
00467   235•             •     **2)-COS(ANGLE*CA))                                               LOW23500
00467   236•                IF (CKZERO(BETA)) BETA=ASIN((RANGE/X2)*SIN(ANGLE*CA))/CA             LOW23600
00471   237•           106  CONTINUE                                                             LOW23700
00472   238•                WRITE(IW,428) H1,H2,ANGLE,RANGE,BETA                                 LOW23800
00501   239•                IF (ITYPE.EQ.1) WRITE(IW,407) H1,RANGE                               LOW23900
00508   240•                IF (ITYPE.EQ.2) WRITE(IW,408) H1,H2,ANGLE                            LOW24000
00514   241•                IF (ITYPE.EQ.3) WRITE(IW,409) H1,ANGLE                               LOW24100
00521   242•                IF (ITYPE.EQ.3) H2=Z(NLP)                                            LOW24200
00521   243•          C                                                                          LOW24300
00523   244•           107  CONTINUE                                                             LOW24400
00524   245•                IF (IXY.EQ.3.OR.IXY.EQ.4) GO TO 108                                  LOW24500
00528   246•                READ(IR,405) V1,V2,DV                                                LOW24600
00533   247•                WL2=10000./V1                                                        LOW24700
00534   248•                WL1=10000./V2                                                        LOW24800
00535   249•                IF (IXY.LE.2) WRITE(IW,418) V1,V2,DV,WL1,WL2                         LOW24900
00545   250•                WL=SQRT(WL1*WL2)                                                     LOW25000
00546   251•                CO=77.46 +0.459/WL**2                                                LOW25100
00547   252•                CH=43.487-0.3473/WL**2                                               LOW25200
00550   253•                IF (IXY.EQ.1) GO TO 49                                               LOW25300
00550   254•          C                                                                          LOW25400
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00552   295*      100     CONTINUE                                                        LOW25500
00553   296*              IF (IFIND.EQ.1) CALL ANGL (M1,M2,ANGLE,BETA,LEN,NLP)            LOW25600
00555   297*              IF (IFIND.EQ.1) GO TO 110                                       LOW25700
00557   298*              IF (JP.EQ.0) WRITE(IW,427)                                      LOW25800
00562   299*              IF (ITYPE.EQ.1) GO TO 1100                                      LOW25900
00564   300*              DO 109 K = 1,10                                                 LOW26000
00567   301*      109        VH(K)=0.0                                                    LOW26100
00571   302*              BETA=0.0                                                        LOW26200
00572   303*              SR=0.0                                                          LOW26300
00572   304*      C                                                                       LOW26400
00572   305*      C**** NOW DEFINE CONSTANT PRESSURE PATH QUANTITIES EH(1-8)              LOW26500
00572   306*      C                                                                       LOW26600
00573   307*              SPHI=SIN(ANGLE*CA)                                              LOW26700
00574   308*              R1=(RE+H1)*SPHI                                                 LOW26800
00575   309*              IF (H1.LE.Z(NLP)) GO TO 110                                     LOW26900
00577   310*              X=(RE+Z(NLP))/(RE+H1)                                           LOW27000
00600   311*              IF (SPHI.GT.X) HMIN=R1-RE                                       LOW27100
00602   312*              IF (SPHI.GT.X) WRITE(IW,433) HMIN                               LOW27200
00606   313*              IF (SPHI.GT.X) GO TO 209                                        LOW27300
00610   314*              H1=Z(NLP)                                                       LOW27400
00611   315*              J1=NLP                                                          LOW27500
00612   316*              SPHI=SPHI/X                                                     LOW27600
00613   317*              ANGLE=180.-ASIN(SPHI)/CA                                        LOW27700
00614   318*      110     CONTINUE                                                        LOW27800
00615   319*              R1=(RE+H1)*SPHI                                                 LOW27900
00618   320*      1100    CONTINUE                                                        LOW28000
00617   321*              DO 112 I = 1,NLP                                                LOW28100
00622   322*                 PS=P(M,I)/1013.0                                             LOW28200
00623   323*                 TS=273.15/T(M1,I)                                            LOW28300
00624   324*                 TS1=(298.0/273.15)*TS                                        LOW28400
00625   325*                 X=PS*TS                                                      LOW28500
00626   326*                 PT=PS*SQRT(TS)                                               LOW28600
00627   327*                 D=0.1*WH(M2,I)                                               LOW28700
00630   328*                 PPW=4.56E-6*T(M1,I)*WH(M2,I)                                 LOW28800
00631   329*                 IF (CKZERO(VIS)) HAZE=1.E+38                                 LOW28900
00633   330*                 IF (.NOT.CKZERO(VIS)) HAZE=115.*((AMZ2(I)-AMZ1(I))/VIS+      LOW29000
00633   331*          *         AMZ1(I)/5.0-AMZ2(I)/23.0)/18.                            LOW29100
00635   332*              EH(1,I)=D*PT**0.9                                               LOW29200
00638   333*              EH(2,I)=X*PT**0.75                                              LOW29300
00637   334*              EH(3,I)=46.667*WO(M3,I)*PT**0.4                                 LOW29400
00640   335*              EH(4,I)=0.8*PT*X                                                LOW29500
00641   336*              EH(5,I)=D*(PPW*EXP(8.08*(TS1-1.0))+0.002*(PS-PPW))              LOW29600
00642   337*              EH(6,I)=X                                                       LOW29700
00643   338*              EH(7,I)=3.5336E-4*AMAX1(HAZE,0.0)                               LOW29800
00644   339*              EH(8,I)=46.667*WO(M3,I)                                         LOW29900
00645   340*              EH(9,I)=0.0                                                     LOW30000
00648   341*              EH(10,I)=D*(0.12*PS+0.88*PPW)*EXP(4.56*(TS1-1.0))               LOW30100
00647   342*              REF=CO*P(M,I)/T(M1,I)-4.56E-6*CW*WH(M2,I)*T(M1,I)               LOW30200
00650   343*              IF (I.EQ.NLP) GO TO 111                                         LOW30300
00652   344*              PPW=4.56E-6*T(M1,I+1)*WH(M2,I+1)                                LOW30400
00653   345*              EH(9,I)=0.5E-6*(REF+CO*P(M,I+1)/T(M1,I+1)-PPW*CW)               LOW30500
00654   346*              IF (IFIND.EQ.0.OR.JP.EQ.0) WRITE(IW,434) I,Z(I),                LOW30600
00654   347*          *      (EH(K,I),K=1,10),REF                                        LOW30700
00660   348*      111     CONTINUE                                                        LOW30800
00667   349*              IF (H1.GE.Z(I)) J1=I                                            LOW30900
00671   350*              EH(9,I)=EH(9,I)+1.0                                             LOW31000
00672   351*      112     CONTINUE                                                        LOW31100
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00676   312*            IF (MODEL.NE.0) CALL POINT (H1,YN1,J1,NP1,E,IP)                    LOW31200
00676   313*            TX1=E(9)                                                           LOW31300
00677   314*            IF (ITYPE.EQ.1) GO TO 47                                           LOW31400
00677   315*      C                                                                        LOW31500
00677   316*      C**** DOWNWARD TRAJECTORY                                                LOW31600
00677   317*      C                                                                        LOW31700
00701   318*            IF (ANGLE.LE.90.) GO TO 19                                         LOW31800
00703   319*            K2=0                                                               LOW31900
00704   320*            IF (NP1.EQ.1) J1=J1-1                                              LOW32000
00708   321*            J2=J1+1                                                            LOW32100
00707   322*            JP1=J1+1                                                           LOW32200
00710   323*            IF ((H2.GT.Z(J1+1).OR.CKZERO(H2-H1)).OR.(NP1.EQ.1.AND.             LOW32300
00710   324*         *     H2.GE.Z(J1+1))) GO TO 30                                      LOW32400
00712   325*            CALL POINT (H2,YN2,J2,NP2,W,IP)                                    LOW32500
00713   326*            TX2=W(9)                                                           LOW32600
00714   327*            IF (H2.LT.H1) H=H2                                                 LOW32700
00716   328*            IF (J1.EQ.J2) TX2=TX1+YN2-EH(9,N)                                  LOW32800
00720   329*            IF (H2.GT.H1) TX1=TX2                                              LOW32900
00722   330*            IF (J1.EQ.J2.AND.H2.LT.H1) YN1=TX2                                 LOW33000
00724   331*      30    A0=(RE+H1)*SPH1*YN1                                                LOW33100
00725   332*            IF (H2.GE.H1) YN2=YN1                                              LOW33200
00727   333*            DO 31 I = 1,J1                                                     LOW33300
00732   334*               IF (I.NE.J1) HMIN=A0/EH(9,I)-RE                                 LOW33400
00734   335*               IF (I.EQ.J1) HMIN=A0/YN1-RE                                     LOW33500
00736   336*               IF (HMIN.LE.Z(I+1)) GO TO 32                                    LOW33600
00740   337*      31       CONTINUE                                                        LOW33700
00742   338*      32    X=HMIN                                                             LOW33800
00743   339*            IF (HMIN.LE.0.00) GO TO 34                                         LOW33900
00745   340*            CALL POINT (HMIN,YN,JMIN,NP,TX,IP)                                 LOW34000
00746   341*            TX3=TX(9)                                                          LOW34100
00747   342*            IF (J2.EQ.JMIN.OR.J1.EQ.JMIN) TX3=YN2+TX(9)-EH(9,N)                LOW34200
00751   343*            IF (J1.EQ.JMIN.AND.H2.GE.H1) GO TO 33                              LOW34300
00753   344*            HMIN=A0/TX3-RE                                                     LOW34400
00754   345*            IF (ABS(X-HMIN).GT.0.0001) GO TO 32                                LOW34500
00756   346*      33    IF (J1.EQ.JMIN.AND.H2.GE.H1) YN1=TX3                               LOW34600
00760   347*            IF (J2.EQ.JMIN.AND.J1.NE.J2) YN2=TX3                               LOW34700
00762   348*            IF (H2.GE.H1) TX2=TX3                                              LOW34800
00764   349*            IF (H2.GE.H1) J2=JMIN                                              LOW34900
00766   350*            IF (H2.GE.H1.OR.H2.LT.HMIN) H=HMIN                                 LOW35000
00770   351*            WRITE(IW,436) HMIN                                                 LOW35100
00773   352*            IF (H2.LT.HMIN) WRITE(IW,440) HMIN                                 LOW35200
00777   353*            GO TO 35                                                           LOW35300
00777   354*      C                                                                        LOW35400
01000   355*      34    WRITE(IW,436) HMIN                                                 LOW35500
01003   356*            IF (H2.LT.H1) GO TO 35                                             LOW35600
01005   357*            IF (ITYPE.EQ.3.OR.H2.GE.H1) WRITE(IW,437)                          LOW35700
01010   358*            ITYPE=2                                                            LOW35800
01011   359*            TX2=EH(9,1)                                                        LOW35900
01012   360*            JMIN=0                                                             LOW36000
01013   361*            J2=1                                                               LOW36100
01014   362*            H2=0.0                                                             LOW36200
01015   363*            H=0.0                                                              LOW36300
01015   364*      C                                                                        LOW36400
01015   365*      C**** NOW DEFINE VERTICAL PATH QUANTITIES VM(1-8)                        LOW36500
01015   366*      C                                                                        LOW36600
01016   367*      35    IF (JP.EQ.0) WRITE(IW,420)                                         LOW36700
01021   368*            DO 135 ITES = 1,10000                                              LOW36800
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01024    369*              IF (K2.EQ.0) REF=YN1                                                  LOW38900
01026    370*              IF (K2.EQ.1) REF=YN2                                                  LOW37000
01030    371*              X1=H1                                                                 LOW37100
01031    372*              J=JP1+1                                                               LOW37200
01032    373*        38    CONTINUE                                                              LOW37300
01033    374*              J=J-1                                                                 LOW37400
01034    375*              X2=Z(J)                                                               LOW37500
01035    376*              IF (J.EQ.J2.AND.K2.EQ.0) X2=H                                         LOW37600
01037    377*              IF (J.EQ.JMIN.AND.K2.EQ.1) X2=HMIN                                    LOW37700
01041    378*              HM=(RE+X1)*SPHI-RE                                                    LOW37800
01042    379*              IF (HM.GT.Z(J).AND.HM.GT.X2) X2=HM                                    LOW37900
01044    380*              RX=(RE+X1)/(RE+X2)                                                    LOW38000
01045    381*              DS=X1-X2                                                              LOW38100
01046    382*              ALP=90.0                                                              LOW38200
01047    383*              THET=ASIN(SPHI)/CA                                                    LOW38300
01050    384*              SALP=RX*SPHI                                                          LOW38400
01051    385*              IF (ABS(X2-HM).GT.1.E-5) ALP=ASIN(SALP)/CA                            LOW38500
01053    386*              BET=ALP-THET                                                          LOW38600
01054    387*              IF (SPHI.GT.1.E-10) DS=(RE+X2)*SIN(BET*CA)/SPHI                       LOW38700
01056    388*              THETA=180.-THET                                                       LOW38800
01057    389*              BETA=BETA+BET                                                         LOW38900
01060    390*              PSI=BETA-ALP-ANGLE+180.                                               LOW39000
01061    391*              SR=SR+DS                                                              LOW39100
01062    392*              DO 39 K = 1,10                                                        LOW39200
01065    393*                 AJ=EM(K,J)                                                         LOW39300
01066    394*                 BJ=EM(K,J+1)                                                       LOW39400
01067    395*                 IF (J.EQ.J1) BJ=E(K)                                               LOW39500
01071    396*                 IF (J.EQ.J2.AND.H2.LT.H1.AND.H2.GT.0.0) AJ=H(K)                    LOW39600
01073    397*                 IF (J.EQ.JMIN.AND.H2.GE.H1) AJ=TX(K)                               LOW39700
01075    398*                 IF (J.EQ.JMIN.AND.ABS(H2-HM).LT.1.E-5) AJ=TX(K)                    LOW39800
01077    399*                 IF (K2.NE.0.AND.J.EQ.J2) BJ=H(K)                                   LOW39900
01101    400*                 IF (K2.NE.0.AND.J.EQ.JMIN) AJ=TX(K)                                LOW40000
01103    401*                 IF (CKZERO(AJ).OR.CKZERO(BJ)) EV=0.0                               LOW40100
01105    402*                 IF (CKZERO(AJ-BJ)) EV=DS*AJ                                        LOW40200
01107    403*                 IF (.NOT.CKZERO(AJ).AND..NOT.CKZERO(BJ).AND.                       LOW40300
01107    404*                    .NOT.CKZERO(AJ-BJ)) EV=DS*(AJ-BJ)/ALOG(AJ/BJ)                   LOW40400
01111    405*                 VH(K)=VH(K)+EV                                                     LOW40500
01112    406*        39       CONTINUE                                                           LOW40600
01114    407*              IF (JP.EQ.0) WRITE(IW,435) J,X1,(VH(L),L=1,8),PSI,ALP,                LOW40700
01114    408*                 BETA,THETA,SR                                                      LOW40800
01132    409*              IF (J.EQ.J2.AND.H2.GE.H1) GO TO 45                                    LOW40900
01134    410*              IF (J.EQ.JMIN.AND.K2.EQ.1) GO TO 43                                   LOW41000
01136    411*              IF (J.NE.1) RN=REF/EM(9,J-1)                                          LOW41100
01140    412*              IF (J.EQ.J2+1) RN=REF/TX2                                             LOW41200
01142    413*              IF (J.EQ.J2.AND.K2.EQ.0) RN=REF/YN2                                   LOW41300
01144    414*              IF (J.EQ.(JMIN+1).AND.K2.EQ.1) RN=REF/TX3                             LOW41400
01146    415*              IF (SALP.GE.RN) RN=1.0                                                LOW41500
01150    416*              SPHI=SALP*RN                                                          LOW41600
01151    417*              REF=EM(9,J)                                                           LOW41700
01152    418*              IF (J.EQ.J2+1.AND.K2.EQ.0) REF=TX2                                    LOW41800
01154    419*              X1=X2                                                                 LOW41900
01155    420*              IF (J.NE.1.AND.(J.NE.J2.OR.K2.NE.0)) GO TO 38                         LOW42000
01157    421*              IF (HMIN.LE.0.0) GO TO 47                                             LOW42100
01161    422*              IF (LEN.EQ.0) WRITE(IW,438)                                           LOW42200
01164    423*              IF (LEN.EQ.0) GO TO 47                                                LOW42300
01166    424*              WRITE(IW,439)                                                         LOW42400
01170    425*              K2=1                                                                  LOW42500
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01171    428*                IF (ABS(X1-HMIN).LE.0.001) GO TO 47                    LOW42600
01173    427*                H=HMIN                                                 LOW42700
01174    428*                JP1=J2+1                                               LOW42800
01175    429*                IF (NP2.EQ.1) JP1=JP1-1                                LOW42800
01177    430*                B=BETA                                                 LOW43000
01200    431*                PH=180.-ASIN(SPHI)/CA                                  LOW43100
01201    432*                TS=SR                                                  LOW43200
01202    433*                PS=PSI                                                 LOW43300
01203    434*                DO 42 K = 1,10                                         LOW43400
01206    435*          42       E(K)=VH(K)                                         LOW43500
01210    436*         135     CONTINUE                                             LOW43600
01212    437*          43   BETA=2.*BETA-B                                         LOW43700
01213    438*               PSI=2.*PSI-PS                                          LOW43800
01214    439*               SR=2.*SR-TS                                            LOW43900
01214    440*          C                                                           LOW44000
01214    441*          C**** LONG PATH  TAKEN                                      LOW44100
01214    442*          C                                                           LOW44200
01215    443*                PHI=PH                                                LOW44300
01218    444*                DO 44 K = 1,10                                        LOW44400
01221    445*            44     VH(K)=2.*VH(K)-E(K)                               LOW44500
01223    446*                GO TO 47                                              LOW44600
01223    447*          C                                                           LOW44700
01224    448*            45  CONTINUE                                             LOW44800
01225    449*                DO 48 K = 1,10                                        LOW44900
01230    450*            48     VH(K)=2.0*VH(K)                                   LOW45000
01232    451*                BETA=2.0*BETA                                         LOW45100
01233    452*                SR=2.0*SR                                             LOW45200
01234    453*                IF (CKZERO(H2-H1)) GO TO 47                           LOW45300
01236    454*                RN=TX1/YN1                                            LOW45400
01237    455*                SPHI=SIN(ANGLE*CA)                                    LOW45500
01240    456*                IF (SPHI.LT.RN) SPHI=SPHI/RN                          LOW45600
01240    457*          C                                                           LOW45700
01240    458*          C****    UPHARD TRAJECTORY                                  LOW45800
01240    459*          C                                                           LOW45900
01242    460*            19    IF (ANGLE.GT.90..AND.NP1.GT.0) J1=J1+1              LOW46000
01244    461*                  IF (ITYPE.EQ.3) J2=NLP                              LOW46100
01248    462*                  IF (ITYPE.EQ.2) CALL POINT(H2,YN2,J2,NP,TX,IP)      LOW46200
01250    463*                  IF (ITYPE.EQ.2.AND.NP.EQ.1) J2=J2-1                 LOW46300
01252    464*                  EH(10,J1)=E(10)                                     LOW46400
01253    465*                  DO 21 K = 1,8                                       LOW46500
01256    466*                     IF (ITYPE.EQ.3) EH(K,J1)=E(K)                    LOW46600
01260    467*                     IF (ITYPE.EQ.2) EH(K,J2+1)=TX(K)                 LOW46700
01262    468*            21       CONTINUE                                        LOW46800
01264    469*                  IF (ITYPE.EQ.2) EH(10,J2+1)=TX(10)                  LOW46900
01266    470*                  IF (J1.EQ.J2) TX1=TX1+YN2-EH(9,J1)                  LOW47000
01268    471*          C                                                           LOW47100
01268    472*          C**** NOW DEFINE VERTICAL PATH QUANTITIES VH(1-8)           LOW47200
01268    473*          C                                                           LOW47300
01270    474*                IF (JP.EQ.0) WRITE(IW,420)                            LOW47400
01273    475*                X1=H1                                                 LOW47500
01274    476*                DO 25 I = J1,J2                                       LOW47600
01277    477*                   X2=Z(I+1)                                          LOW47700
01300    478*                   IF (I.EQ.J2) X2=H2                                 LOW47800
01302    479*                   DZ=X2-X1                                           LOW47900
01303    480*                   IF (I.EQ.NLP) DZ=Z(I)-Z(I-1)                       LOW48000
01305    481*                   RX=(RE+X1)/(RE+X2)                                 LOW48100
01308    482*                   THETA=ASIN(SPHI)/CA                                LOW48200
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01307   483*                PHI=ASIN(SPHI*RX)/CA                                                    LOW48300
01310   484*                BET=THETA-PHI                                                           LOW48400
01311   485*                SALP=RX*SPHI                                                            LOW48500
01312   486*                IF (SPHI.GT.1.E-10) DZ=(RE+X2)*SIN(BET*CA)/SPHI                         LOW48600
01314   487*                BETA=BETA+BET                                                           LOW48700
01315   488*                PSI=BETA+PHI-ANGLE                                                      LOW48800
01316   489*                PHI=180.-PHI                                                            LOW48900
01317   490*                SR=SR+DZ                                                                LOW49000
01320   491*                I0=MAX0(MIN0(I,NLP-1),1)                                                LOW49100
01321   492*                DO 24 K = 1,10                                                          LOW49200
01324   493*                   IF (CKZERO(EH(K,I0)).OR.CKZERO(EH(K,I0+1)).OR.                       LOW49300
01324   494*                  •    CKZERO(EH(K,I0)-EH(K,I0+1)))                                     LOW49400
01324   495*                  •    EV=DZ*AMIN1(EH(K,I0),EH(K,I0+1))                                 LOW49500
01326   496*                   IF (.NOT.CKZERO(EH(K,I0)).AND..NOT.CKZERO(EH(K,I0+1))               LOW49600
01326   497*                  •    .AND..NOT.CKZERO(EH(K,I0)-EH(K,I0+1)).AND.I.NE.NLP)              LOW49700
01326   498*                  •    EV=DZ*(EH(K,I0)-EH(K,I0+1))/ALOG(EH(K,I0)/                       LOW49800
01326   499*                  •    EH(K,I0+1))                                                      LOW49900
01330   500*                   IF (.NOT.CKZERO(EH(K,I0)).AND..NOT.CKZERO(EH(K,I0+1))               LOW50000
01330   501*                  •    .AND..NOT.CKZERO(EH(K,I0)-EH(K,I0+1)).AND.I.EQ.NLP)              LOW50100
01330   502*                  •    EV=DZ*EH(K,I0+1:/ALOG(EH(K,I0)/EH(K,I0+1))                       LOW50200
01332   503*                   VH(K)=VH(K)+EV                                                       LOW50300
01333   504*        24         CONTINUE                                                            LOW50400
01335   505*                   IF (JP.EQ.0) WRITE(IW,435) I,X1,(VH(L),L=1,8),PSI,PHI,BETA,         LOW50500
01335   506*                  •    THETA,SR                                                         LOW50600
01353   507*                   IF (I.EQ.NLP) GO TO 25                                              LOW50700
01355   508*                   IF (I.EQ.J2-1) EH(9,I+1)=YN2                                        LOW50800
01357   509*                   IF (I.EQ.J1) EH(9,I)=TX1                                            LOW50900
01361   510*                   RN=EH(9,I+1)/EH(9,I)                                                LOW51000
01362   511*                   SPHI=SPHI*RX/RN                                                     LOW51100
01363   512*                   IF (SALP.GE.RN) SPHI=SALP                                           LOW51200
01365   513*                   X1=X2                                                               LOW51300
01366   514*        25         CONTINUE                                                            LOW51400
01370   515*        27      CONTINUE                                                               LOW51500
01371   516*                IF (ITYPE.NE.1) WRITE(IW,443) HH                                       LOW51600
01375   517*                DO 48 K = 1,10                                                         LOW51700
01400   518*                   IF (ITYPE.EQ.1.AND.MODEL.NE.0) W(K)=RANGE*E(K)                      LOW51800
01402   519*                   IF (ITYPE.EQ.1.AND.MODEL.EQ.0) W(K)=RANGE*EH(K,1)                   LOW51900
01404   520*                   IF (ITYPE.NE.1) W(K)=VH(K)                                          LOW52000
01406   521*        48         CONTINUE                                                            LOW52100
01410   522*        49      WRITE(IW,419)                                                          LOW52200
01412   523*                WRITE(IW,421) (W(I),I=1,8),W(10)                                       LOW52300
01412   524*      C                                                                                LOW52400
01412   525*      C**** BEGINNING OF TRANSMITTANCE CALCULATIONS                                    LOW52500
01412   526*      C                                                                                LOW52600
01421   527*                IV1=MAX0(5*IFIX(V1/5.0),350)                                           LOW52700
01422   528*                IV2=MIN0(5*IFIX(V2/5.0+0.99),50000)                                    LOW52800
01423   529*                DV=AMAX1(DV,5.0)                                                       LOW52900
01424   530*                IDV=IFIX(DV)                                                           LOW53000
01425   531*                SUM=0.0                                                                LOW53100
01426   532*                DO 208 IV = IV1,IV2,IDV                                                LOW53200
01431   533*                   IF (IV.GE.  350.AND.IV.LT. 9875) I=(IV-  350)/5+    1               LOW53300
01433   534*                   IF (IV.GE. 9875.AND.IV.LT.12800) I=(IV- 9875)/5+ 1771               LOW53400
01435   535*                   IF (IV.GE.12800.AND.IV.LT.13400) I=(IV-12800)/5+ 2491               LOW53500
01437   536*                   IF (IV.GE.13400.AND.IV.LE.14500) I=(IV-13400)/5+ 2356               LOW53600
01441   537*                   IF (IV.GT.14500.AND.IV.LE.50000) I=(IV-14500)/5+ 2831               LOW53700
01443   538*                   IF (IV.GE.  500.AND.IV.LT. 8060) J=(IV-  500)/5+    1               LOW53800
01445   539*                   IF (IV.GT.12970.AND.IV.LT.13190) J=(IV-12970)/5+ 1520               LOW53900
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01447   540*                K=(IV-575)/5+1                                                    LOW54000
01450   541*                IF ((IV.GE.  350.AND.IV.LT.12800).OR.                             LOW54100
01450   542*       *           (IV.GE.13400.AND.IV.LE.14500))                                 LOW54200
01450   543*       *           WS1=ALOG10(AMAX1(W(1),1.0E-20))+C1(I)                          LOW54300
01452   544*                IF ((IV.LT.  350.OR. IV.GE.12800).AND.                            LOW54400
01452   545*       *           (IV.LT.13400.OR. IV.GT.14500)) WS1=FW(1)-1.0                   LOW54500
01454   546*                IF ((IV.GE.  500.AND.IV.LT. 8060).OR.                             LOW54600
01454   547*       *           (IV.GT.12970.AND.IV.LT.13190))                                 LOW54700
01454   548*       *           WS2=ALOG10(AMAX1(W(2),1.0E-20))+C2(J)                          LOW54800
01456   549*                IF ((IV.LT.  500.OR. IV.GE. 8060).AND.                            LOW54900
01456   550*       *           (IV.LE.12970.OR. IV.GE.13190)) WS2=FW(1)-1.0                   LOW55000
01460   551*                IF ( IV.GE.  575.AND.IV.LE. 3270)                                 LOW55100
01460   552*       *           WS3=ALOG10(AMAX1(W(3),1.0E-20))+C3(K)                          LOW55200
01462   553*                IF ( IV.LT.575.OR. IV.GT. 3270) WS3=FO(1)-1.0                     LOW55300
01464   554*                NS1=0                                                             LOW55400
01465   555*                NS2=0                                                             LOW55500
01466   556*                NS3=0                                                             LOW55600
01467   557*                DO 202 L = 1,67                                                   LOW55700
01472   558*                   IF (WS1.GE.FW(L)) NS1=L                                        LOW55800
01474   559*                   IF (WS2.GE.FW(L)) NS2=L                                        LOW55900
01476   560*                   IF (WS3.GE.FO(L)) NS3=L                                        LOW56000
01500   561*         202       CONTINUE                                                      LOW56100
01500   562*       C                                                                         LOW56200
01500   563*       C******* WATER VAPOUR                                                     LOW56300
01500   564*       C                                                                         LOW56400
01502   565*                IF (NS1.EQ.0) TX(1)=1.0                                          LOW56500
01504   566*                IF (NS1.GT.0.AND.NS1.LT.67) TX(1)=TR(NS1+1)+                     LOW56600
01504   567*       *           (TR(NS1)-TR(NS1+1))*(FW(NS1+1)-WS1)/(FW(NS1+1)-FW(NS1))       LOW56700
01506   568*                IF (NS1.EQ.67) TX(1)=0.0                                         LOW56800
01506   569*       C                                                                         LOW56900
01506   570*       C******* UNIFORMLY MIXED GASES                                            LOW57000
01506   571*       C                                                                         LOW57100
01510   572*                IF (NS2.EQ.0) TX(2)=1.0                                          LOW57200
01512   573*                IF (NS2.GT.0.AND.NS2.LT.67) TX(2)=TR(NS2+1)+                     LOW57300
01512   574*       *           (TR(NS2)-TR(NS2+1))*(FW(NS2+1)-WS2)/(FW(NS2+1)-FW(NS2))       LOW57400
01514   575*                IF (NS2.EQ.67) TX(2)=0.0                                         LOW57500
01514   576*       C                                                                         LOW57600
01514   577*       C******* OZONE                                                            LOW57700
01514   578*       C                                                                         LOW57800
01516   579*                IF (NS3.EQ.0) TX(3)=1.0                                          LOW57900
01520   580*                IF (NS3.GT.0.AND.NS3.LT.67) TX(3)=TR(NS3+1)+                     LOW58000
01520   581*       *           (TR(NS3)-TR(NS3+1))*(FO(NS3+1)-WS3)/(FO(NS3+1)-FO(NS3))       LOW58100
01522   582*                IF (NS3.EQ.67) TX(3)=0.0                                         LOW58200
01522   583*       C                                                                         LOW58300
01522   584*       C******* NITROGEN CONTINUUM                                               LOW58400
01522   585*       C                                                                         LOW58500
01524   586*                K=(IV- 2080)/5+    1                                             LOW58600
01525   587*                IF (IV.LT.2080.OR.IV.GE.2740) TX(4)=0.0                          LOW58700
01527   588*                IF (IV.GE. 2080.AND.IV.LT. 2740) TX(4)=C4(K)*W(4)                LOW58800
01527   589*       C                                                                         LOW58900
01527   590*       C******* WATER VAPOUR CONTINUUM                                           LOW59000
01527   591*       C                                                                         LOW59100
01531   592*                XI=FLOAT(IV-2350)/50.0+1.0                                       LOW59200
01532   593*                NH=IFIX(XI)                                                      LOW59300
01533   594*                TX(5)=0.0                                                        LOW59400
01533   595*       C                                                                         LOW59500
01533   596*       C*******       10 MICRON REGION                                           LOW59600
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01533   597*     C                                                                    LOW59700
01534   598*                    IF (IV.GE.  670.AND.IV.LE. 1350) TX(5)=(4.18+5578.0*  LOW59800
01534   599*          *            EXP(-7.87E-3*FLOAT(IV)))*W(5)                      LOW59900
01534   600*     C                                                                    LOW60000
01534   601*     C*******       4 MICRON REGION                                       LOW60100
01534   602*     C                                                                    LOW60200
01538   603*                    IF (IV.GE.2350.AND.IV.LE.3000) TX(5)=(C5(NH)+(XI-FLOAT(NH)) LOW60300
01538   604*          *            *(C5(NH+1)-C5(NH)))*W(10)                          LOW60400
01538   605*     C                                                                    LOW60500
01538   606*     C******* MOLECULAR SCATTERING                                        LOW60600
01538   607*     C                                                                    LOW60700
01540   608*                    IF (IV.LT.2740) TX(6)=0.0                             LOW60800
01542   609*                    IF (IV.GE. 2740.AND.IV.LE.50000)                      LOW60900
01542   610*          *            TX(6)=9.807E-20*(FLOAT(IV)**4.0117)*W(6)           LOW61000
01542   611*     C                                                                    LOW61100
01542   612*     C******* AEROSOL EXTINCTION                                          LOW61200
01542   613*     C                                                                    LOW61300
01544   614*                    WL=10000./FLOAT(IV)                                   LOW61400
01545   615*                    XX=0.0                                                LOW61500
01546   616*                    YY=0.0                                                LOW61600
01547   617*                    TX(7)=0.0                                             LOW61700
01550   618*                    TX(10)=0.0                                            LOW61800
01551   619*                    IF (IHAZE.EQ.0) GO TO 204                             LOW61900
01553   620*                    NS=0                                                  LOW62000
01554   621*                    DO 203 L = 1,44                                       LOW62100
01557   622*     203               IF (WL.GE.VX(IAERO,L)) NS=L                       LOW62200
01562   623*                    IF (NS.GT.0.AND.NS.LT.44) XX=C7 (IAERO,NS+1)+         LOW62300
01562   624*          *            (C7 (IAERO,NS)-C7 (IAERO,NS+1))*(VX(IAERO,NS+1)-WL)/ LOW62400
01562   625*          *            (VX(IAERO,NS+1)-VX(IAERO,NS))                     LOW62500
01564   626*                    IF (NS.GT.0.AND.NS.LT.44) YY=C7A(IAERO,NS+1)+         LOW62600
01564   627*          *            (C7A(IAERO,NS)-C7A(IAERO,NS+1))*(VX(IAERO,NS+1)-WL)/ LOW62700
01564   628*          *            (VX(IAERO,NS+1)-VX(IAERO,NS))                     LOW62800
01566   629*     204            CONTINUE                                            LOW62900
01567   630*                    TX(7)=XX*W(7)                                         LOW63000
01570   631*                    TX(10)=YY*W(7)                                        LOW63100
01570   632*     C                                                                    LOW63200
01570   633*     C******* UV OZONE                                                    LOW63300
01570   634*     C                                                                    LOW63400
01571   635*                    IF (IV.GE.13000.AND.IV.LE.23400) XI=FLOAT(IV-13000)/200.+ 1. LOW63500
01573   636*                    IF (IV.GE.27500.AND.IV.LE.50000) XI=FLOAT(IV-27500)/500.+57. LOW63600
01575   637*                    N=IFIX(XI)+1                                          LOW63700
01576   638*                    IF ((IV.GE.13000.AND.IV.LE.23400).OR.                 LOW63800
01576   639*          *            (IV.GE.27500.AND.IV.LE.50000))                     LOW63900
01576   640*          *            TX(8)=W(8)*(C8(N)+(XI-FLOAT(N))*C8(N-1))           LOW64000
01600   641*                    IF ((IV.LT.13000.OR.IV.GT.23400).AND.                 LOW64100
01600   642*          *            (IV.LT.27500.OR.IV.GT.50000)) TX(8)=0.0            LOW64200
01600   643*     C                                                                    LOW64300
01602   644*                    TX(9)=0.0                                             LOW64400
01603   645*                    IF (IV.GE. 2080.AND.IV.LT. 2740) TX(9)=TX(9)+TX(4)    LOW64500
01605   646*                    IF (IV.GT.  670.AND.IV.LT. 3000) TX(9)=TX(9)+TX(5)    LOW64600
01607   647*                    IF (IV.GE. 2740.AND.IV.LT.50000) TX(9)=TX(9)+TX(6)    LOW64700
01611   648*                    TX(9)=TX(9)+TX(7)                                     LOW64800
01612   649*                    IF ((IV.GE.13000.AND.IV.LE.23400).OR.                 LOW64900
01612   650*          *            (IV.GE.27500.AND.IV.LE.50000)) TX(9)=TX(9)+TX(8)   LOW65000
01614   651*                    DO 205 L = 4,10                                       LOW65100
01617   652*     205               TX(L)=EXP(-TX(L))                                 LOW65200
01621   653*                    TX(10)=1.0-TX(10)                                     LOW65300
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01622   654*                TX(9)=TX(1)*TX(2)*TX(3)*TX(9)                                          LOW65400
01623   655*                IF (IV.GE.13000.AND.IV.LE.50000) TX(3)=TX(8)                           LOW65500
01625   656*                IF (JP.EQ.3) TX(9)=TX(7)                                               LOW65600
01627   657*                AB=1.0-TX(9)                                                           LOW65700
01630   658*                IF (IV.EQ.IV1.OR.IV.EQ.IV2) AB=0.5*AB                                  LOW65800
01632   659*                SUM=SUM+AB*FLOAT(IDV)                                                  LOW65900
01633   660*                IF (JP.EQ.0.AND.IABS(MOD(IV-IV1,50*IDV)).EQ.0) WRITE(IW,422)LOW66000
01636   661*                IF (JP.EQ.0) WRITE(IW,423) IV,WL,TX(9),(TX(L),L=1,7),TX(10),LOW66100
01636   662*            *      SUM                                                                LOW66200
01652   663*     200        CONTINUE                                                               LOW66300
01654   664*                AB=1.-SUM/FLOAT(IV2-IV1)                                               LOW66400
01655   665*                WRITE(IW,424) IV1,IV2,SUM,AB                                           LOW66500
01663   666*                READ(IR,400) IXY                                                       LOW66600
01666   667*     208        CONTINUE                                                               LOW66700
01670   668*     209   CONTINUE                                                                   LOW66800
01671   669*           STOP                                                                       LOW66900
01671   670*     C                                                                                LOW67000
01672   671*     400   FORMAT(9I3,3X,2F10.3)                                                     LOW67100
01673   672*     405   FORMAT(3F10.3)                                                            LOW67200
01674   673*     408   FORMAT(2I3,4X,5F10.3)                                                     LOW67300
01675   674*     407   FORMAT(/10X,29H HORIZONTAL PATH, ALTITUDE = ,F7.3,13H KM, RANGE =LOW67400
01675   675*         * ,F7.3,3H KM)                                                               LOW67500
01676   676*     408   FORMAT(//10X,51H SLANT PATH BETWEEN ALTITUDES H1 AND H2 WHERE H1 =LOW67600
01676   677*         * ,F7.3,9H KM H2 = ,F7.3,20H KM, ZENITH ANGLE = ,F7.3,8H DEGREES)  LOW67700
01677   678*     409   FORMAT(//10X,40H SLANT PATH TO SPACE FROM ALTITUDE H1 = ,F7.3,19H LOW67800
01677   679*         *KM, ZENITH ANGLE =,F7.3,8H DEGREES)                                         LOW67900
01700   680*     410   FORMAT(1H1/10X,41H TROPICAL (15 DEG. LAT.) MODEL ATMOSPHERE)       LOW68000
01701   681*     411   FORMAT(1H1/10X,51H MIDLATITUDE (45 DEG. LAT.) SUMMER MODEL ATMOSPHLOW68100
01701   682*         *ERE)                                                                        LOW68200
01702   683*     412   FORMAT(1H1/10X,51H MIDLATITUDE (45 DEG. LAT.) WINTER MODEL ATMOSPHLOW68300
01702   684*         *ERE)                                                                        LOW68400
01703   685*     413   FORMAT(1H1/10X,50H SUB-ARCTIC (60 DEG. LAT.) SUMMER MODEL ATMOSPHELOW68500
01703   686*         *RE)                                                                         LOW68600
01704   687*     414   FORMAT(1H1/10X,50H SUB-ARCTIC (60 DEG. LAT.) WINTER MODEL ATMOSPHELOW68700
01704   688*         *RE)                                                                         LOW68800
01705   689*     415   FORMAT(1H1//10X,36H 1962 U.S. STANDARD ATMOSPHERE MODEL)             LOW68900
01708   690*     417   FORMAT(/10X,14H HAZE MODEL = ,F5.1,29H KM VISUAL RANGE AT SEA LEVELLOW69000
01708   691*         *L/)                                                                         LOW69100
01707   692*     418   FORMAT(/10X,22H FREQUENCY RANGE V1 = ,F7.1,14H CM-1 TO V2 = ,F7.1,LOW69200
01707   693*         *15H CM-1 FOR DV = ,F8.1,9H CM-1    (,F8.2,3H - ,F5.2,9H MICRONS)//)LOW69300
01710   694*     419   FORMAT(/10X,38H EQUIVALENT SEA LEVEL ABSORBER AMOUNTS//21X,110HWATLOW69400
01710   695*         *ER VAPOUR      CO2 ETC.        OZONE     NITROGEN (CONT)  H2O (CONT) LOW69500
01710   696*         *     MOL  SCAT      AEROSOL      OZONE(U-V)/24X,7HGM CM-2,10X,2HKM, LOW69600
01710   697*         *10X,6HATM CM,10X,2HKM,9X,7HGM CM-2,10X,2HKM,13X,2HKM,10X,6HATM CM)LOW69700
01711   698*     420   FORMAT(1H1///10X,21H  VERTICAL PROFILES  ,63X,3HPSI,4X,3HPHI,6X,  LOW69800
01711   699*         *4HBETA,4X,13HTHETA    RANGE)                                                LOW69900
01712   700*     421   FORMAT(/8X,10H W(1-8) = ,8(1PE14.3)/74X,1PE14.3/)                  LOW70000
01713   701*     422   FORMAT(1H1/10X,32H  FREQ WAVELENGTH  TOTAL      H2O,5X,4HCO2+,5X,  LOW70100
01713   702*         *6HOZONE   N2 CONT   H2O CONT MOL SCAT  AEROSOL  AEROSOL    INTEGRATELOW70200
01713   703*         *D /11X,14H CM-1   MICRONS,8(4X,5HTRANS),4X,20H ABS      ABSORPTION )LOW70300
01714   704*     423   FORMAT(10X,I8,10F9.4,F12.2)                                           LOW70400
01715   705*     424   FORMAT(/27H INTEGRATED ASORPTION FROM ,I5,4H TO ,I5,8H CM-1 = ,   LOW70500
01715   706*         *F10.2,26H, AVERAGE TRANSMITTANCE = ,F8.4)                                   LOW70600
01716   707*     426   FORMAT(/20X,42HAEROSOL SCATTERING NOT COMPUTED, IHAZE = 0)            LOW70700
01717   708*     427   FORMAT(1H1///10X,20H HORIZONTAL PROFILES)                             LOW70800
01720   709*     428   FORMAT(/10X,6H H1 = ,F7.3,10H KM, H2 = ,F7.3,13H KM, ANGLE = ,    LOW70900
01720   710*         *F8.4,14H GEOM. RANGE = ,F7.2,12H KM, BETA = ,F8.5,4H DEG)             LOW71000
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01721    711*      *20   FORMAT(3F10.3,2F5.2,2(1PE10.3),0PF10.3)                                  LOW71100
01722    712*      *30   FORMAT(10X,26HINPUT METEOROLOGICAL DATA /10X,4HZ = ,F7.2,9H KM, P LOW71200
01722    713*           *= ,F7.2,9H MB, T = ,F5.1,18H C, DEW PT.TEMP = ,F5.1,19H C, REL HUMLOW71300
01722    714*           *IDITY = ,F5.1,21H PCT, H2O DENSITY = ,1PE9.2,7H GM.M-3/10X,17H OZOLOW71400
01722    715*           *NE DENSITY = ,1PE9.2,17H GM.M-3, RANGE = ,F10.3,3H KM)            LOW71500
01723    716*      *33   FORMAT(69H TRAJECTORY MISSES EARTH ATMOSPHERE. CLOSEST DISTANCE OFLOW71600
01723    717*           * APPROACH IS ,F10.2/19H END OF CALCULATION)                        LOW71700
01724    718*      *34   FORMAT(10X,I4,F6.1,11(1PE10.3))                                    LOW71800
01725    719*      *35   FORMAT(13,F6.1,8(1PE10.3),4(0PF9.4),F6.1)                          LOW71900
01726    720*      *36   FORMAT(8H HMIN = ,F10.3)                                          LOW72000
01727    721*      *37   FORMAT(64H PATH INTERSECTS EARTH - PATH CHANGED TO TYPE 2 WITH H2 LOW72100
01727    722*           *= 0.0 KM)                                                         LOW72200
01730    723*      *38   FORMAT(85H CHOICE OF TWO PATHS FOR THIS CASE - SHORTER PATH TAKEN LOW72300
01730    724*           *  FOR LONGER PATH SET LEN = 1)                                    LOW72400
01731    725*      *39   FORMAT(85H CHOICE OF TWO PATHS FOR THIS CASE - LONGER PATH TAKEN. LOW72500
01731    726*           * FOR SHORTER PATH SET LEN = 0)                                    LOW72600
01732    727*      *40   FORMAT(70H H2 HAS SET LESS THAN HMIN AND HAS BEEN RESET EQUAL TO HLOW72700
01732    728*           *HIN I.E., H2 = ,F10.3)                                            LOW72800
01733    729*      *41   FORMAT(24H  MODEL ATMOSPHERE NO. 7/23H    Z (KM)   P (MB)     ,  LOW72900
01733    730*           * 49HT (C) DEW PT  RH  H2O(GM.M-3) O3(GM.M-3) NO. DEN.)            LOW73000
01734    731*      *42   FORMAT(61H  FOG CONDITIONS MAY EXIST AT SEA LEVEL FOR THIS VISUAL LOW73100
01734    732*           *RANGE/93H  IF SO THEN ASSUME THE TRANSMITTANCE DUE TO FOG IS GIVENLOW73200
01734    733*           *BY THE TRANSMITTANCE AT 0.55 MICRONS)                             LOW73300
01735    734*      *43   FORMAT(//5X,29HESTIMATED TANGENT ALTITUDE = ,F10.3,3H KM//)       LOW73400
01736    735*      *44   FORMAT(15X,41HTEMPERATURE PROFILE FOR MODEL ATMOSPHERE ,I5)       LOW73500
01737    736*      *45   FORMAT(15X,41HWATER VAPOR PROFILE FOR MODEL ATMOSPHERE ,I5)       LOW73600
01740    737*      *46   FORMAT(15X,41HOZONE       PROFILE FOR MODEL ATMOSPHERE ,I5)       LOW73700
01741    738*      *47   FORMAT(/10X,26H CONTINENTAL AEROSOL MODEL)                        LOW73800
01742    739*      *48   FORMAT(/10X,20H RURAL AEROSOL MODEL)                             LOW73900
01743    740*      *49   FORMAT(/10X,20H URBAN AEROSOL MODEL)                             LOW74000
01744    741*      *50   FORMAT(/10X,23H MARITIME AEROSOL MODEL)                          LOW74100
01745    742*       *51  FORMAT(10H1   ***    ,I9,37H INPUT LEVELS EXCEEDS MODEL LIMIT OF , LOW74200
01745    743*           *I5)                                                               LOW74300
01746    744*           END                                                                LOW74400

      END OF COMPILATION:        NO  DIAGNOSTICS.
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SUBROUTINE POINT     ENTRY POINT 000403

STORAGE USED: CODE(1) 000405; DATA(0) 000078; BLANK COMMON(2) 000000

 COMMON BLOCKS:

 0303   LOWTRN 015736

EXTERNAL REFERENCES (BLOCK, NAME)

 0004   XPRR
 0005   NWDUS
 0006   NIO2S
 0007   NERR3S

STORAGE ASSIGNMENT  (BLOCK, TYPE, RELATIVE LOCATION, NAME)

 0000   000007 IF       0001   000204 102L     0001   000225 103L     0001   000355 109L     0001   000021 1130
 0001   000242 1510     0003   015662 CA       0003 R 015680 CO       0003 R 015657 CW       0003   002835 C1
 0003   007631 C2       0003   012730 C3       0003   013764 C4       0003   014171 C5       0003   014210 C7
 0003   014474 C7A      0003   014760 C8       0003 R 015120 EM       0000 R 000002 FAC      0003   002532 FO
 0003   002427 FW       0003   000002 HZ1      0003   000004 HZ2      0000 I 000001 I        0003   000000 IATM
 0000   000053 INJPS    0003   015735 IR       0003 I 015734 IW       0000 I 000006 K        0003 I 015652 M
 0003   015653 M1       0003   015654 M2       0003   015655 M3       0003 I 000001 NL       0000 I 000000 NL1
 0003 R 000150 P        0003   015661 P1       0000 R 000003 PX1      0003   015656 RE       0003   015663 REARTH
 0003 R 000526 T        0003   002324 TR       0000 R 000004 TX1      0003   002040 VX       0003 R 001104 WH
 0003   001462 WO       0000 R 000005 WX1      0003 R 015672 Z        0003   000108 Z0
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00101      1*          SUBROUTINE POINT (X,YN,N,NP,TX,IP)                                  PNT00100
00101      2*     C                                                                        PNT00200
00101      3*     C*************************************************************************PNT00300
00101      4*     C*                                                                       *PNT00400
00101      5*     C*    SUBROUTINE POINT COMPUTES THE MEAN REFRACTIVE INDEX ABOVE AND      *PNT00500
00101      6*     C*    BELOW A GIVEN ALTITUDE AND INTERPOLATES EXPONENTIALLY TO DETER-    *PNT00600
00101      7*     C*    MINE THE EQUIVALENT ABSORBER AMOUNTS AT THAT ALTITUDE.             *PNT00700
00101      8*     C*                                                                       *PNT00800
00101      9*     C* X       - REAL VARIABLE REPRESENTING THE ALTITUDE (KM) (INPUT).       *PNT00900
00101     10*     C* YN      - REAL VARIABLE REPRESENTING THE MEAN REFRACTIVITY BELOW X    *PNT01000
00101     11*     C*             (N-UNITS) (OUTPUT).                                       *PNT01100
00101     12*     C* N       - INTEGER VARIABLE REPRESENTING THE ATMOSPHERIC LEVEL AT      *PNT01200
00101     13*     C*             OR BELOW X (OUTPUT).                                      *PNT01300
00101     14*     C* NP      - INTEGER VARIABLE (OUTPUT).                                  *PNT01400
00101     15*     C*             NP=1 IF X COINCIDES WITH Z(N).                            *PNT01500
00101     16*     C*             NP=0 IF X DOES NOT COINCIDE WITH Z(N).                    *PNT01600
00101     17*     C* TX      - REAL VECTOR OF LENGTH 10                                    *PNT01700
00101     18*     C*             TX(1-8) ARE ABSORBER AMOUNTS PER KM AT X.                 *PNT01800
00101     19*     C*             TX(9) REPRESENTS THE MEAN REFRACTIVITY ABOVE X (N-UNITS)  *PNT01900
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00101   20*     C*              (OUTPUT).                                                       *PNT02000
00101   21*     C* IP     - INTEGER VARIABLE (INPUT).                                           *PNT02100
00101   22*     C*            IP.EQ.0 IMPLIES A CALCULATION OF REFRACTIVE INDEX ONLY.         *PNT02200
00101   23*     C*            IP.NE.0 IMPLIES THE EQUIVALENT ABSORBER AMOUNTS ARE ALSO        *PNT02300
00101   24*     C*              CALCULATED.                                                   *PNT02400
00101   25*     C*                                                                            *PNT02500
00101   26*     C*     REFERENCES - CORNETTE AND SHLANTA, NWC TM 2985                         *PNT02600
00101   27*     C*                                                                            *PNT02700
00101   28*     C*     COMMON BLOCKS USED - LOWTRN                                            *PNT02800
00101   29*     C*                                                                            *PNT02900
00101   30*     C*                     REVISION DATE 28 MARCH 1977                            *PNT03000
00101   31*     C*                                                                            *PNT03100
00101   32*     C*****************************************************************************PNT03200
00101   33*     C                                                                             PNT03300
00103   34*           LOGICAL           CKZERO                                                PNT03400
00104   35*           COMMON /LOWTRN/  IATM,NL,HZ1(34),HZ2(34),Z0(34),P(7,34),T(7,34),        PNT03500
00104   36*          *   WM(7,34),WD(7,34),VX(4,45),TR(67),FH(67),FO(67),C1(2580),           PNT03600
00104   37*          *   C2(1575),C3(540),C4(133),C5(15),C7(4,45),C7A(4,45),C8(102),         PNT03700
00104   38*          *   EH(10,34),M,M1,M2,M3,RE,CW,CO,PI,CA,REARTH(7),Z(34),IW,IR           PNT03800
00104   39*     C                                                                             PNT03900
00105   40*           DIMENSION         TX(10)                                                PNT04000
00105   41*     C                                                                             PNT04100
00106   42*           CKZERO(VAR)=ABS(VAR).LT.1.E-20                                        PNT04200
00106   43*     C                                                                             PNT04300
00107   44*           N=0                                                                   PNT04400
00110   45*           X=AMAX1(X,0.0)                                                        PNT04500
00111   46*           NL1=NL-1                                                              PNT04600
00112   47*           DO 101  I = 1,NL1                                                     PNT04700
00115   48*              IF (X.GT.Z(I)) N=I                                                 PNT04800
00117   49*    101       CONTINUE                                                          PNT04900
00121   50*           IF (.NOT.CKZERO(X-Z(N+1))) NP=0                                       PNT05000
00123   51*           IF (     CKZERO(X-Z(N+1))) NP=1                                       PNT05100
00125   52*           FAC=0.0                                                               PNT05200
00126   53*           IF (N.EQ.0.OR.NP.EQ.1) GO TO 102                                      PNT05300
00130   54*           FAC=AMIN1((X-Z(N))/(Z(N+1)-Z(N)),1.)                                  PNT05400
00131   55*           PX1=P(M,N)*(P(M,N+1)/P(M,N))**FAC                                     PNT05500
00132   56*           TX1=T(M,N)*(T(M,N+1)/T(M,N))**FAC                                     PNT05600
00133   57*           WX1=WM(M,N)*(WM(M,N+1)/WM(M,N))**FAC                                  PNT05700
00134   58*           TX(9)=(CO*P(M,N+1)/T(M,N+1)-(4.56E-06)*CW*WM(M,N+1)*T(M,N+1)*         PNT05800
00134   59*          *   CO*PX1/TX1-(4.56E-06)*CW*WX1*TX1)/2.                              PNT05900
00135   60*           YN=(CO*P(M,N)/T(M,N)-(4.56E-06)*CW*WM(M,N)*T(M,N)*                    PNT06000
00135   61*          *   CO*PX1/TX1-(4.56E-06)*CW*WX1*TX1)/2.                              PNT06100
00136   62*           GO TO 103                                                             PNT06200
00136   63*     C                                                                           PNT06300
00137   64*    102    CONTINUE                                                            PNT06400
00140   65*           TX(9)=(EH(9,N+1)-1.)*1.E+6                                            PNT06500
00141   66*           IF (N.EQ.0) YN=0.0                                                    PNT06600
00143   67*           IF (N.NE.0) YN=(EH(9,N)-1.)*1.E+6                                     PNT06700
00145   68*    103    CONTINUE                                                            PNT06800
00145   69*     C                                                                           PNT06900
00146   70*           IF (IP.EQ.0) GO TO 105                                                PNT07000
00150   71*           DO 104 K = 1,10                                                       PNT07100
00153   72*              IF ((N.EQ.0.OR.      CKZERO(EH(K,N))).AND.K.NE.9) TX(K)=0.0        PNT07200
00155   73*              IF ((N.NE.0.AND..NOT.CKZERO(EH(K,N))).AND.K.NE.9) TX(K)=           PNT07300
00155   74*          *      EH(K,N)*(EH(K,N+1)/EH(K,N))**FAC                               PNT07400
00157   75*    104       CONTINUE                                                          PNT07500
00161   76*           WRITE(IW,1) X,N,NP,TX(9),YN,TX(1),TX(2),TX(3),TX(4),TX(5),TX(6),      PNT07600
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00181     77*          *   TX(7),TX(8)                                                    PNT07700
00200     78*      105 CONTINUE                                                           PNT07800
00201     79*          TX(9)=1.+TX(9)*1.E-6                                               PNT07900
00202     80*          YN   =1.+YN   *1.E-6                                               PNT08000
00203     81*          RETURN                                                             PNT08100
00204     82*        1 FORMAT(/23H FROM POINT - HEIGHT = ,F10.4,9H KM, N = ,I3,7H, NP = ,PNT08200
00204     83*         *12,35H, REFRACTIVITY ABOVE AND BELOW X = ,2F11.2//10X,           PNT08300
00204     84*         *40H EQUIVALENT ABSORBER AMOUNTS PER KM AT X//20X,8(1PE10.3))     PNT08400
00205     85*          END                                                                PNT08500

 END OF COMPILATION:        NO  DIAGNOSTICS.
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SUBROUTINE ANGL      ENTRY POINT 002324

STORAGE USED: CODE(1) 002453; DATA(0) 000204; BLANK COMMON(2) 000000

 COMMON BLOCKS:

 0003   LOWTRN 015738

EXTERNAL REFERENCES (BLOCK, NAME)

 0004   POINT
 0005   ACOS
 0006   COS
 0007   SIN
 0010   ATAN
 0011   TAN
 0012   ASIN
 0013   ALOG
 0014   NWDUS
 0015   NIO2S
 0016   NERR3S

STORAGE ASSIGNMENT  (BLOCK, TYPE, RELATIVE LOCATION, NAME)

 0001    000621 11L       0001    000776 12L       0001    000104 1270      0001    001020 13L       0001    001055 14L
 0001    001223 17L       0001    000260 1770      0001    001263 18L       0001    001413 19L       0001    000151 2L
 0001    001478 20L       0001    001771 23L       0001    002117 26L       0001    000554 2660      0001    002266 28L
 0001    000158 3L        0001    000166 4L        0000    000100 401F      0000    000104 404F      0000    000127 405F
 0000    000131 408F      0001    000202 5L        0001    000233 6L        0001    000443 8L        0001    000457 9L
 0000 R  000052 AL        0000 R  000045 ALP       0000 R  000021 ANG       0000 R  000075 B         0000 R  000061 BE
 0000 R  000057 BET       0000 R  000027 BET1      0000 R  000030 BET2      0000 R  000064 BMIN      0000 R  000026 B1
 0000 R  000050 C         0003 R  015662 CA        0003    015660 CO        0003    015657 CW        0003    002635 C1
 0003    007661 C2        0003    012730 C3        0003    013764 C4        0003    014171 C5        0003    014210 C7
 0003    014174 C7A       0003    014760 C8        0000 R  000071 DB1       0000 R  000072 DB2       0000 R  000073 DB3
 0000 R  000067 DIF       0000 R  000070 DNX       0003 R  015126 EM        0000 R  000060 FB        0000 R  000025 FBT
 0000 R  000031 FBT1      0000 R  000032 FBT2      0000 R  000033 FBT3      0003    002532 FO        0003    002427 FW
 0000 R  000035 HMIN      0003    000002 HZ1       0003    000044 HZ2       0003    000000 IATM      0000    000161 INJPS
 0000 I  000012 IP        0003    015735 IR        0000 I  000024 ITER      0003 I  015734 IW        0000 I  000043 J
 0000 I  000037 J1        0000 I  000042 J2        0000 I  000056 J2P       0003    015652 M         0003    015653 M1
 0003    015654 M2        0003    015655 M3        0000 I  000074 N         0003    000001 NL        0000 I  000040 NP
 0000 I  000052 NP1       0000 I  000054 NP2       0003    000150 P         0003 R  015661 PI        0000 R  000014 RE
 0003    015663 REARTH    0003    015656 REE       0000 R  000063 REF       0000 R  000046 RN        0000 R  000044 SALP
 0000 R  000020 SPHI      0003    000526 T         0000 R  000016 TANG      0000 R  000017 THET      0000 R  000047 TH1
 0000 R  000023 TM        0000 R  000077 TM1       0000 R  000022 TN        0000 R  000076 TN1       0003    002324 TR
 0000 R  000000 TX        0000 R  000041 TX1       0000 R  000055 TX2       0000 R  000065 TX3       0003    002040 VX
 0003    001104 WM        0003    001482 WO        0000 R  000066 X         0000 R  000034 XMIN      0000 R  000013 X1
 0000 R  000015 X2        0000 R  000036 YN        0000 R  000051 YN1       0000 R  000053 YN2       0003 R  015672 Z
 0003    000106 Z0
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00101     1•          SUBROUTINE ANGL (H1,H2,ANGLE,BETA,LEN,ML)                                    ANG00100
00101     2•     C                                                                                 ANG00200
00101     3•     C*****************************************************************************•ANG00300
00101     4•     C•                                                                               •ANG00400
00101     5•     C•    THIS SUBROUTINE CALCULATES THE INITIAL ZENITH ANGLE TAKING INTO             •ANG00500
00101     6•     C•    ACCOUNT EARTH CURVATURE AND ATMOSPHERIC REFRACTION EFFECTS.                 •ANG00600
00101     7•     C•    THE REFRACTIVE INDEX IS ASSUMED TO BE CONSTANT IN A GIVEN LAYER.            •ANG00700
00101     8•     C•    FOR GREATER ACCURACY INCREASE THE NUMBER OF LEVELS IN THE MODEL             •ANG00800
00101     9•     C•    ATMOSPHERE.  THIS SUBROUTINE CAN BE REMOVED FROM THE PROGRAM               •ANG00900
00101    10•     C•    IF IT IS NOT NEEDED.                                                        •ANG01000
00101    11•     C•                                                                               •ANG01100
00101    12•     C• H1,H2  - REAL VARIABLE REPRESENTING THE ALTITUDES (KM) (INPUT).               •ANG01200
00101    13•     C• ANGLE  - REAL VARIABLE REPRESENTING THE ZENITH ANGLE (RADIANS)                •ANG01300
00101    14•     C•            (OUTPUT).                                                          •ANG01400
00101    15•     C• BETA   - REAL VARIABLE REPRESENTING THE EARTH CENTER ANGLE (RADIANS)          •ANG01500
00101    16•     C•            (INPUT).                                                           •ANG01600
00101    17•     C• LEN    - INTEGER VARIABLE REPRESENTING THE TYPE OF PATH (INPUT).              •ANG01700
00101    18•     C•              LEN = 0 IMPLIES THE SHORTER PATH WHERE APPLICABLE.               •ANG01800
00101    19•     C•              LEN = 1 IMPLIES THE LONGER PATH WHERE APPLICABLE.                •ANG01900
00101    20•     C• ML     - INTEGER VARIABLE REPRESENTING THE NUMBER OF LAYERS IN THE            •ANG02000
00101    21•     C•              ATMOSPHERE (INPUT).                                              •ANG02100
00101    22•     C•                                                                               •ANG02200
00101    23•     C•     REFERENCES - CORNETTE AND SHLANTA, NWC TM 2985                            •ANG02300
00101    24•     C•                                                                               •ANG02400
00101    25•     C•     MODULES CALLED - POINT                                                    •ANG02500
00101    26•     C•                                                                               •ANG02600
00101    27•     C•     COMMON BLOCKS USED - LOWTRN                                               •ANG02700
00101    28•     C•                                                                               •ANG02800
00101    29•     C•                        REVISION DATE 15 NOVEMBER 1976                         •ANG02900
00101    30•     C•                                                                               •ANG03000
00101    31•     C*****************************************************************************•ANG03100
00101    32•     C                                                                                 ANG03200
00103    33•          LOGICAL          CKZERO                                                      ANG03300
00104    34•          COMMON /LOWTRN/  IATM,ML,MZ1(34),MZ2(34),Z0(34),P(7,34),T(7,34),             ANG03400
00104    35•         •   WM(7,34),WD(7,34),VX(4,45),TR(67),FW(67),FO(67),C1(2580),              ANG03500
00104    36•         •   C2(1575),C3(540),CN(133),C5(15),C7(4,45),C7A(4,45),C8(102),            ANG03600
00104    37•         •   EH(10,34),M,M1,M2,M3,REE,CH,CO,PI,CA,REARTH(7),Z(34),IW,IR             ANG03700
00104    38•     C                                                                                 ANG03800
00105    39•          DIMENSION        TX(10)                                                      ANG03900
00105    40•     C                                                                                 ANG04000
00106    41•          CKZERO(VAR)=ABS(VAR).LT.1.E-20                                              ANG04100
00106    42•     C                                                                                 ANG04200
00107    43•          IP=99                                                                       ANG04300
00110    44•          X1=RE+H1                                                                    ANG04400
00111    45•          X2=RE+H2                                                                    ANG04500
00112    46•          LEN=0                                                                       ANG04600
00113    47•          BETA=BETA*CA                                                                ANG04700
00114    48•          IF (CKZERO(BETA)) BETA=ACOS(X2/X1)                                          ANG04800
00116    49•          TANO=X2*SIN(BETA)/(X2*COS(BETA)-X1)                                         ANG04900
00117    50•          THET=ATAN(TANO)                                                             ANG05000
00120    51•          IF (THET.LT.0.0) THET=THET+PI                                               ANG05100
00122    52•          SPHI=SIN(THET)                                                              ANG05200
00123    53•          ANO=THET/CA                                                                 ANG05300
00124    54•          TN=THET                                                                     ANG05400
00125    55•          TN=TN-0.5*CA                                                                ANG05500
00126    56•          DO 101 ITER = 1,10                                                          ANG05600
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00131    97.          ANGLE=THET                                          ANG05700
00132    98.          FBT=0.0                                             ANG05800
00133    99.          B1=0.0                                              ANG05900
00134   100.          BET1=0.0                                            ANG06000
00135   101.          BET2=0.0                                            ANG06100
00136   102.          FBT1=0.0                                            ANG06200
00137   103.          FBT2=0.0                                            ANG06300
00140   104.          FBT3=0.0                                            ANG06400
00141   105.          IF (BETA.LE.0.0) GO TO 2                            ANG06500
00143   106.          IF (2.*THET-PI.GT.1.E-8) GO TO 9                    ANG06600
00145   107.          IF (IP.EQ.100) GO TO 6                              ANG06700
00147   108.          XMIN=X2*COS(BETA)-RE                                ANG06800
00150   109.          IF (XMIN.LT.H1) GO TO 8                             ANG06900
00152   110.          IF (XMIN.GE.H1) GO TO 4                             ANG07000
00154   111.      2   HMIN=H2                                             ANG07100
00155   112.          H2=H1                                               ANG07200
00156   113.          H1=HMIN                                             ANG07300
00157   114.      3   ANGLE=0.5*PI                                        ANG07400
00160   115.          THET=ANGLE                                          ANG07500
00161   116.          SPHI=1.0                                            ANG07600
00162   117.          ANG=ANGLE/CA                                        ANG07700
00163   118.      4   IP=100                                              ANG07800
00164   119.          CALL POINT (H1,YN,J1,NP,TX,IP)                      ANG07900
00165   120.          TX1=TX(9)                                           ANG08000
00166   121.      5   CALL POINT (H2,YN,J2,NP,TX,IP)                      ANG08100
00167   122.          IF (NP.EQ.1) J2=J2-1                                ANG08200
00171   123.          IF (J1.EQ.J2) TX1=TX1+YN-EH(9,J1)                   ANG03300
00173   124.      6   CONTINUE                                            ANG08400
00174   125.          X1=RE+H1                                            ANG03500
00175   126.          FBT=-TAN(THET)                                      ANG08600
00176   127.          DO 7 J = J1,J2                                      ANG08700
00201   128.             IF (J.NE.J2) X2=RE+Z(J+1)                        ANG08800
00203   129.             IF (J.EQ.J2) X2=RE+H2                            ANG08900
00205   130.             SALP=X1*SPHI/X2                                  ANG09000
00206   131.             ALP=ASIN(SALP)                                   ANG09100
00207   132.             RN=EH(9,J+1)/EH(9,J)                             ANG09200
00210   133.             IF ((J+1).EQ.J2) RN=YN/EH(9,J)                   ANG09300
00212   134.             IF (J.EQ.J1) RN=EH(9,J+1)/TX1                    ANG09400
00214   135.             IF ((J+1).EQ.J2.AND.J.EQ.J1) RN=YN/TX1           ANG09500
00216   136.             FBT=FBT+TAN(THET)-TAN(ALP)                       ANG09600
00217   137.             B1=B1+THET-ALP                                   ANG09700
00220   138.             TH1=THET/CA                                      ANG09800
00221   139.             C=ALP/CA                                         ANG09900
00222   140.             IF (CKZERO(X2-(RE+H2))) C=PI-ALP                 ANG10000
00224   141.             IF (SALP.GE.RN) RN=1.                            ANG10100
00226   142.             SPHI=SALP/RN                                     ANG10200
00227   143.             THET=ASIN(SPHI)                                  ANG10300
00230   144.             X1=X2                                            ANG10400
00231   145.      7      CONTINUE                                         ANG10500
00233   146.          IF (BETA.LE.0.0) THET=C                             ANG10600
00235   147.          IF (BETA.LE.0.0) GO TO 28                           ANG10700
00237   148.          GO TO 28                                            ANG10800
00240   149.      8   CONTINUE                                            ANG10900
00241   150.          TANG=-TANG                                          ANG11000
00242   151.          ANGLE=PI-ANGLE                                      ANG11100
00243   152.          TN=ANGLE                                            ANG11200
00244   153.          ANG=ANGLE/CA                                        ANG11300
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00245   114*            IF (H1.LE.0.0) GO TO 3                                  AN011400
00247   115*       9    CONTINUE                                                AN011500
00250   116*            IP=101                                                  AN011600
00251   117*            CALL POINT (H1,YN1,J1,NP1,TX,IP)                        AN011700
00252   118*            TX1=TX(9)                                               AN011800
00253   119*            IF (NP1.EQ.1) J1=J1-1                                   AN011900
00255   120*            J2=ML                                                   AN012000
00256   121*            IF (H2.GE.H1) GO TO 13.                                 AN012100
00260   122*            CALL POINT (H2,YN2,J2,NP2,TX,IP)                        AN012200
00261   123*            TX2=TX(9)                                               AN012300
00262   124*            IF (J1.EQ.J2) TX2=YN1+TX(9)-EH(9,J1)                    AN012400
00264   125*            J2P=J2-1                                                AN012500
00265   126*            DO 102 J = J1,J2P                                       AN012600
00270   127*               X1=RE+Z(J+1)                                         AN012700
00271   128*               X2=RE+Z(J)                                           AN012800
00272   129*               IF (J.EQ.J1) X1=RE+H1                                AN012900
00274   130*               IF (J.EQ.J2) X2=RE+H2                                AN013000
00276   131*               SALP=X1*SPHI/X2                                      AN013100
00277   132*               HMIN=X1*SPHI-RE                                      AN013200
00300   133*               IF (SALP.LE.1.0) GO TO 11                            AN013300
00302   134*               SALP=SPHI                                            AN013400
00303   135*               IF (HMIN.GT.H2) GO TO 18                             AN013500
00305   136*      11       ALP=ASIN(SALP)                                       AN013600
00306   137*               THET=ASIN(SPHI)                                      AN013700
00307   138*               BET=ALP-THET                                         AN013800
00310   139*               BET1=BET1+BET                                        AN013900
00311   140*               FB=TAN(ALP)                                          AN014000
00312   141*               IF (J.NE.J1) FB=FB-TAN(THET)                         AN014100
00314   142*               FBT1=FBT1+FB                                         AN014200
00315   143*               TH1=THET/CA                                          AN014300
00316   144*               BE=BET/CA                                            AN014400
00317   145*               AL=ALP/CA                                            AN014500
00320   146*               IF (CKZERO(X2-(RE+H2))) C=PI-ALP                     AN014600
00322   147*               REF=EH(9,J)                                          AN014700
00323   148*               IF (J.EQ.J1) REF=YN1                                 AN014800
00325   149*               IF (J.EQ.J2) REF=TX2                                 AN014900
00327   150*               IF (J.EQ.1) GO TO 12                                 AN015000
00331   151*               RN=EH(9,J)/EH(9,J-1)                                 AN015100
00332   152*               IF (J.EQ.J1) RN=YN1/EH(9,J-1)                        AN015200
00334   153*               IF (J.EQ.J2+1) RN=REF/TX2                            AN015300
00336   154*               IF (J.EQ.J2) RN=REF/YN2                              AN015400
00340   155*               IF (SALP.GE.RN) RN=1.                                AN015500
00342   156*               SPHI=SALP*RN                                         AN015600
00343   157*               IF (Z(J).LE.H2) GO TO 12                             AN015700
00345   158*     102       CONTINUE                                            AN015800
00347   159*      12     X1=X2                                                  AN015900
00350   160*             IF (ABS(Z(J)-H2).GE.1.0E-10.OR.J.EQ.1) GO TO 14        AN016000
00352   161*      13     J=J-1                                                  AN016100
00353   162*             X1=RE+Z(J+1)                                           AN016200
00354   163*             IF (J.EQ.J1) X1=RE+H1                                  AN016300
00356   164*             IF (J.EQ.J2.AND.J.NE.J1) X1=RE+H2                      AN016400
00360   165*      14     X2=RE+Z(J)                                             AN016500
00361   166*             HMIN=X1*SPHI-RE                                        AN016600
00362   167*             IF (HMIN.LE.0.0) B1=BET1                               AN016700
00364   168*             IF (HMIN.LE.0.0) LEN=0                                 AN016800
00366   169*             IF (HMIN.LE.0.0) FBT=FBT1                              AN016900
00370   170*             IF (HMIN.LE.0.0) GO TO 20                              AN017000
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00372   171*            IF (Z(J).LT.HMIN) GO TO 18                                                    ANO17100
00374   172*            REF=EM(9,J)                                                                   ANO17200
00375   173*            IF (J.EQ.J2) REF=YN                                                           ANO17300
00377   174*            SALP=X1*SPHI/X2                                                               ANO17400
00400   175*            ALP=ASIN(SALP)                                                                ANO17500
00401   176*            THET=ASIN(SPHI)                                                               ANO17600
00402   177*            BET=ALP-THET                                                                  ANO17700
00403   178*            FB=TAN(ALP)-TAN(THET)                                                         ANO17800
00404   179*            FBT2=FBT2+FB                                                                  ANO17900
00405   180*            BET2=BET2+BET                                                                 ANO18000
00406   181*            BMIN=BET1+BET2                                                                ANO18100
00407   182*            AL=ALP/CA                                                                     ANO18200
00410   183*            THI=THET/CA                                                                   ANO18300
00411   184*            RN=REF/EM(9,J-1)                                                              ANO18400
00412   185*            IF (SALP.GE.RN) RN=1.0                                                        ANO18500
00414   186*            SPHI=SALP*RN                                                                  ANO18600
00415   187*            GO TO 13                                                                      ANO18700
00416   188*    17      TX3=YNI+TX(9)-EM(9,J1)                                                        ANO18800
00417   189*            YNI=TX3                                                                       ANO18900
00420   190*            IF (ABS(H2-Z(J+1)).LE.1.0E-5) YNI=TX(9)                                       ANO19000
00422   191*            IF (ABS(HI-Z(J+1)).LE.1.0E-5) YNI=TX(9)                                       ANO19100
00424   192*            RN=1.0                                                                        ANO19200
00425   193*            GO TO 19                                                                      ANO19300
00426   194*    18      CALL POINT (HMIN,YN,J2,NP,TX,IP)                                              ANO19400
00427   195*            IP=102                                                                        ANO19500
00430   196*            TX3=TX(9)                                                                     ANO19600
00431   197*            IF (J.EQ.J1.AND.H2.GE.HI) GO TO 17                                            ANO19700
00433   198*            IF (J.EQ.J1.OR.J.EQ.J2) TX3=YN2+TX(9)-EM(9,J)                                 ANO19800
00435   199*            IF (HMIN.GT.H2) TX3=TX(9)                                                     ANO19900
00437   200*            IF (J.EQ.J1.AND.HMIN.GT.H2) GO TO 17                                          ANO20000
00441   201*            RN=REF/TX3                                                                    ANO20100
00442   202*            IF (SALP.GE.RN) RN=1.                                                         ANO20200
00444   203*            SPHI=SALP*RN                                                                  ANO20300
00445   204*            X=X1*SPHI-RE                                                                  ANO20400
00446   205*            DIF=ABS(HMIN-X)                                                               ANO20500
00447   206*            HMIN=X                                                                        ANO20600
00450   207*            IF (DIF.GT.1.0E-5) GO TO 18                                                   ANO20700
00452   208*    19      X2=RE+HMIN                                                                    ANO20800
00453   209*            THET=ASIN(SPHI)                                                               ANO20900
00454   210*            IF (CKZERO(RN)) FBT3=-TAN(THET)                                               ANO21000
00456   211*            IF (CKZERO(RN)) GO TO 20                                                      ANO21100
00460   212*            DNX=(TX3-1.0)*ALOG((TX3-1.0)/(REF-1.0))/(X2-X1)                               ANO21200
00461   213*            FBT3=-TAN(THET)*(1.0-1.0/(1.0+TX3/(X2*DNX)))                                  ANO21300
00462   214*    20      BET=0.5*PI-THET                                                               ANO21400
00463   215*            BET2=BET2+BET                                                                 ANO21500
00464   216*            BMIN=BET1+BET2                                                                ANO21600
00465   217*            IF (H2.GE.HI) GO TO 23                                                        ANO21700
00467   218*            BET=BET1+2.*BET2                                                              ANO21800
00470   219*            DB1=BETA-BET1                                                                 ANO21900
00471   220*            DB2=BET-BETA                                                                  ANO22000
00472   221*            DB3=ABS(BMIN-BETA)                                                            ANO22100
00473   222*            IF ((DB3.GT.DB1.OR.DB3.GE.DB2).AND.DB2.GT.DB1) B1=BET1                        ANO22200
00475   223*            IF ((DB3.GT.DB1.OR.DB3.GE.DB2).AND.DB2.GT.DB1) LEN=0                          ANO22300
00477   224*            IF ((DB3.GT.DB1.OR.DB3.GE.DB2).AND.DB2.GT.DB1) FBT=FBT1                       ANO22400
00501   225*            IF ((DB3.LE.DB1.OR.DB2.LE.DB1).AND.DB3.LE.DB1) B1=BET1+BET2                   ANO22500
00503   226*            IF ((DB3.LE.DB1.OR.DB2.LE.DB1).AND.DB3.LE.DB1) FBT=FBT1+FBT2+                 ANO22600
00503   227*              FBT3                                                                        ANO22700
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00505    228*              IF (DB3.GE.DB2.AND.DB2.LE.DB1) B1=BET                                  AN022800
00507    229*              IF (DB3.GE.DB2.AND.DB2.LE.DB1) LEN=1                                   AN022900
00511    230*              IF (DB3.GE.DB2.AND.DB2.LE.DB1) FBT=FBT1+2.*(FBT2+FBT3)                 AN023000
00513    231*              GO TO 26                                                               AN023100
00514    232*        23    B1=2.0*(BET1+BET2)                                                     AN023200
00515    233*              LEN=1.                                                                 AN023300
00516    234*              FBT=2.0*(FBT1+FBT2+FBT3)                                               AN023400
00517    235*              WRITE(IW,401) J,B1,FBT,FBT1,FBT2,FBT3,TX1,YN1                          AN023500
00531    236*              IF (CKZERO(H2-H1)) GO TO 26                                            AN023600
00533    237*              IP=103                                                                 AN023700
00534    238*              IF (NP1.EQ.1) J1=J1+1                                                  AN023800
00536    239*              SPHI=SIN(ANGLE)                                                        AN023900
00537    240*              IF (Z(J1+1).LE.H2) CALL POINT(H2,YN,N,NP,TX,IP)                        AN024000
00541    241*              IF (Z(J1+1).LE.H2) J2=J1                                               AN024100
00543    242*              RN=TX1/YN1                                                             AN024200
00544    243*              IF (SPHI.GE.RN) RN=1.                                                  AN024300
00546    244*              SPHI=SPHI/RN                                                           AN024400
00547    245*              THET=ASIN(SPHI)                                                        AN024500
00550    246*              GO TO 5                                                                AN024600
00551    247*        26    THET=ANGLE+(BETA-B1)/(1.+FBT/TANG)                                     AN024700
00552    248*              DB1=B1/CA                                                              AN024800
00553    249*              B=BET1/CA                                                              AN024900
00554    250*              TH1=THET/CA                                                            AN025000
00555    251*              WRITE(IW,404) B1,DB1,FBT,TH1,TANG                                      AN025100
00564    252*              IF (THET.GT.TN.OR.THET.LT.TM) THET=(TN+TM)/2.                          AN025200
00566    253*              TH1=THET/CA                                                            AN025300
00567    254*              WRITE(IW,404) BET1,B,FBT,TH1                                           AN025400
00575    255*              TN1=TN/CA                                                              AN025500
00576    256*              TM1=TM/CA                                                              AN025600
00577    257*              WRITE(IW,405) TN,TM,TN1,TM1                                            AN025700
00605    258*              SPHI=SIN(THET)                                                         AN025800
00606    259*              TANG=TAN(THET)                                                         AN025900
00607    260*              IF (ABS(BETA-B1).LT.1.E-7.OR.ABS(ANGLE-THET).LT.1.E-7) GO TO 28        AN026000
00611    261*        101   CONTINUE                                                               AN026100
00613    262*            THET=(ANGLE+THET)/2.                                                     AN026200
00614    263*         28   ANGLE=THET/CA                                                          AN026300
00615    264*              IF (BETA.LE.0.0) H1=H2                                                 AN026400
00617    265*              WRITE(IW,406) ANGLE,ITER                                               AN026500
00623    266*              RETURN                                                                 AN026600
00623    267*        C                                                                            AN026700
00624    268*         401  FORMAT (I8,1PE16.7,8(0PF13.8))                                        AN026800
00625    269*         404  FORMAT (14H TOTAL BETA = ,1PE14.8,0PF15.8,7H, FBT = ,1PE14.8,8H THAN026900
00625    270*             *ET = ,0PF10.8,8H TANG = ,F10.8,15H TOTAL RANGE = ,F10.1)             AN027000
00626    271*         405  FORMAT (5F12.8)                                                      AN027100
00627    272*         406  FORMAT (8X/15HZENITH ANGLE = ,F7.3,5H DEGREES - RECOMPUTED FROM SAN027200
00627    273*             *UBROUTINE ANGL (ITERATION,I3,1H))                                    AN027300
00630    274*              END                                                                    AN027400

 END OF COMPILATION:        NO  DIAGNOSTICS.
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BLOCK DATA

STORAGE USED: CODE(1) 000000; DATA(0) 000001; BLANK COMMON(2) 000000

 COMMON BLOCKS:

 0003   LOWTRN 015738

STORAGE ASSIGNMENT  (BLOCK, TYPE, RELATIVE LOCATION, NAME)

 0003 R 015682 CA      0003   015660 CO      0003   015657 CH      0003 R 002835 C1      0003 R 007661 C2
 0003 R 012730 C3      0003 R 013764 C4      0003 R 014171 C5      0003 R 014210 C7      0003 R 014474 C7A
 0003 R 014760 C8      0003   015128 EH      0003 R 002532 FO      0003 R 002427 FW      0003 R 000002 HZ1
 0003 R 000044 HZ2     0000 I 000000 I       0003 I 000000 IATM    0003 I 015735 IR      0003 I 015734 IW
 0003   015652 M       0003   015653 M1      0003   015654 M2      0003   015655 M3      0003 I 000001 ML
 0003 R 000150 P       0003 R 015661 PI      0003   015656 RE      0003 R 015663 REARTH   0003 R 000526 T
 0003 R 002324 TR      0003 R 002040 VX      0003 R 001104 WH      0003 R 001462 WO      0003   015672 Z
 0003 R 000108 Z0
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00101      1•          BLOCK DATA                                                          DAT00100
00101      2•     C                                                                        DAT00200
00101      3•     C•••••••••••••••••••••••••••••••••••••••••••••••••••••••••••••••••••••••••DAT00300
00101      4•     C•                                                                       •DAT00400
00101      5•     C•    THE SPECTRAL AND TRANSMITTANCE DATA FOR LOWTRAN IIIB.              •DAT00500
00101      6•     C•                                                                       •DAT00600
00101      7•     C•     NOTE - THE USE OF DATA STATEMENTS TO INPUT COMPLETE ARRAYS        •DAT00700
00101      8•     C•               IS NOT ANSI FORTRAN AND MAY NOT BE ACCEPTED BY ALL      •DAT00800
00101      9•     C•               COMPILERS.                                              •DAT00900
00101     10•     C•                                                                       •DAT01000
00101     11•     C•     REFERENCES - CORNETTE AND SHLANTA, NWC TM 2985                    •DAT01100
00101     12•     C•                                                                       •DAT01200
00101     13•     C•     COMMON BLOCKS USED - LOWTRN                                       •DAT01300
00101     14•     C•                                                                       •DAT01400
00101     15•     C•                  REVISION DATE 15 NOVEMBER 1976                       •DAT01500
00101     16•     C•                                                                       •DAT01600
00101     17•     C•••••••••••••••••••••••••••••••••••••••••••••••••••••••••••••••••••••••••DAT01700
00101     18•     C                                                                        DAT01800
00102     19•          COMMON /LOWTRN/  IATM,NL,HZ1(34),HZ2(34),Z0(34),P(7,34),T(7,34),    DAT01900
00102     20•         •   WH(7,34),WO(7,34),VX(4,45),TR(67),FW(67),FO(67),C1(2580),       DAT02000
00102     21•         •   C2(1575),C3(540),C4(133),C5(15),C7(4,45),C7A(4,45),C8(102),     DAT02100
00102     22•         •   EH(10,34),M,M1,M2,M3,RE,CH,CO,PI,CA,REARTH(7),Z(34),IW,IR       DAT02200
00102     23•     C                                                                        DAT02300
00102     24•     C•••••••••••••••••••••••••••••••••••••••••••••••••••••••••••••••••••••••••DAT02400
00102     25•     C•                                                                       •DAT02500
00102     26•     C•              THESE PARAMETERS ARE MACHINE DEPENDENT                   •DAT02600
00102     27•     C•                                                                       •DAT02700
00102     28•     C•••• INPUT DEVICE NUMBER                                                •DAT02800
00102     29•     C•                                                                       •DAT02900
00103     30•          DATA              IR /5/                                            DAT03000
00103     31•     C•                                                                       •DAT03100
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00103    32.     C**** OUTPUT DEVICE NUMBER                                                    *DAT03200
00103    33.     C*                                                                            *DAT03300
00105    34.           DATA              IW /6/                                                 DAT03400
00105    35.     C*                                                                            *DAT03500
00105    36.     C*****************************************************************************DAT03600
00105    37.     C                                                                             DAT03700
00105    38.     C *** THE VALUE FOR PI                                                        DAT03800
00105    39.     C                                                                             DAT03900
00107    40.           DATA              PI /3.141592653589793/                                 DAT04000
00107    41.     C                                                                             DAT04100
00107    42.     C *** THE CONVERSION FROM DEGREES TO RADIANS.                                 DAT04200
00107    43.     C                                                                             DAT04300
00111    44.           DATA              CA /0.01745329251994 3/                                DAT04400
00111    45.     C                                                                             DAT04500
00111    46.     C *** THE MEAN RADIUS OF THE EARTH (INTERNATIONAL SPHERIOD) IN KM.            DAT04600
00111    47.     C                                                                             DAT04700
00111    48.     C     DATA              REBAR /6371.299315/                                   DAT04800
00111    49.     C                                                                             DAT04900
00111    50.     C *** THE POLAR RADIUS OF THE EARTH (INTERNATIONAL SPHEROID) IN KM.           DAT05000
00111    51.     C                                                                             DAT05100
00111    52.     C     DATA              REPOL /6356.911948/                                   DAT05200
00111    53.     C                                                                             DAT05300
00111    54.     C *** THE EQUATORIAL RADIUS OF THE EARTH (INTERNATIONAL SPHEROID) IN KM.      DAT05400
00111    55.     C                                                                             DAT05500
00111    56.     C     DATA              REEQU /6378.388000/                                   DAT05600
00111    57.     C                                                                             DAT05700
00111    58.     C *** VALUES OF THE RADIUS OF THE EARTH FOR THE MODEL ATMOSPHERES IN KM.      DAT05800
00111    59.     C                                                                             DAT05900
00113    60.           DATA              REARTH(1) /6376.951637/                               DAT06000
00115    61.           DATA              REARTH(2) /6367.659029/                               DAT06100
00117    62.           DATA              REARTH(3) /6367.659029/                               DAT06200
00121    63.           DATA              REARTH(4) /6362.287754/                               DAT06300
00123    64.           DATA              REARTH(5) /6362.287754/                               DAT06400
00125    65.           DATA              REARTH(6) /6367.659029/                               DAT06500
00127    66.           DATA              REARTH(7) /6371.299315/                               DAT06600
00127    67.     C                                                                             DAT06700
00127    68.     C *** NUMBER OF TYPES OF MODEL ATMOSPHERES                                    DAT06800
00127    69.     C                                                                             DAT06900
00131    70.           DATA              IATM /8/                                              DAT07000
00131    71.     C                                                                             DAT07100
00131    72.     C *** NUMBER OF LEVELS IN MODEL ATMOSPHERE DATA                               DAT07200
00131    73.     C                                                                             DAT07300
00133    74.           DATA              NL /34/                                               DAT07400
00133    75.     C                                                                             DAT07500
00133    76.     C *** HAZE MODEL:  23 KM. VISIBLE RANGE                                       DAT07600
00133    77.     C                                                                             DAT07700
00135    78.           DATA              HZ1 /2.830E+03,1.245E+03,5.374E+02,2.257E+02,         DAT07800
00135    79.          *  1.193E+02,8.992E+01,6.341E+01,5.893E+01,6.073E+01,5.822E+01,         DAT07900
00135    80.          *  5.679E+01,5.320E+01,5.589E+01,5.159E+01,5.052E+01,4.747E+01,         DAT08000
00135    81.          *  4.514E+01,4.460E+01,4.317E+01,3.636E+01,2.669E+01,1.935E+01,         DAT08100
00135    82.          *  1.456E+01,1.114E+01,8.831E+00,7.434E+00,2.239E+00,5.893E-01,         DAT08200
00135    83.          *  1.551E-01,4.084E-02,1.078E-02,5.553E-05,1.970E-08,0.000E+00/         DAT08300
00135    84.     C                                                                             DAT08400
00135    85.     C *** HAZE MODEL:   5 KM. VISIBLE RANGE                                       DAT08500
00135    86.     C                                                                             DAT08600
00137    87.           DATA              HZ2 /1.379E+04,5.034E+03,1.845E+03,6.735E+02,         DAT08700
00137    88.          *  2.454E+02,8.992E+01,6.341E+01,5.893E+01,6.073E+01,5.822E+01,         DAT08800
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00137     89*          *  5.679E+01,5.320E+01,5.589E+01,5.159E+01,5.052E+01,4.747E+01,    DAT08900
00137     90*          *  4.514E+01,4.460E+01,4.317E+01,3.636E+01,2.669E+01,1.935E+01,    DAT09000
00137     91*          *  1.456E+01,1.114E+01,8.831E+00,7.434E+00,2.239E+00,5.893E-01,    DAT09100
00137     92*          *  1.551E-01,4.084E-02,1.078E-02,5.553E-05,1.970E-08,0.000E+00/    DAT09200
00137     93*     C                                                                      DAT09300
00137     94*     C *** ALTITUDE (KM.) AT LEVEL 1                                        DAT09400
00137     95*     C                                                                      DAT09500
00141     96*          DATA              Z0 / 0.0, 1.0, 2.0, 3.0, 4.0, 5.0, 6.0, 7.0, 8.0,DAT09600
00141     97*          *      9.0,10.0,11.0,12.0,13.0,14.0,15.0,16.0,17.0,18.0,19.0,20.0, DAT09700
00141     98*          *     21.0,22.0,23.0,24.0,25.0,30.0,35.0,40.0,45.0,50.0,70.0,      DAT09800
00141     99*          *     100.0,99999.0/                                               DAT09900
00141    100*     C                                                                      DAT10000
00141    101*     C *** PRESSURE (MB.) AT LEVEL 1 FOR THE MODEL ATMOSPHERES              DAT10100
00141    102*     C                                                                      DAT10200
00143    103*          DATA                (P(1,I),I=1,34) /1.013E+03,9.040E+02,8.050E+02,  DAT10300
00143    104*          *    7.150E+02,6.330E+02,5.590E+02,4.920E+02,4.320E+02,3.780E+02,  DAT10400
00143    105*          *    3.290E+02,2.880E+02,2.470E+02,2.130E+02,1.820E+02,1.560E+02,  DAT10500
00143    106*          *    1.320E+02,1.110E+02,9.370E+01,7.890E+01,6.660E+01,5.650E+01,  DAT10600
00143    107*          *    4.800E+01,4.090E+01,3.500E+01,3.000E+01,2.570E+01,1.220E+01,  DAT10700
00143    108*          *    6.000E+00,3.050E+00,1.590E+00,8.540E-01,5.790E-02,3.000E-04,  DAT10800
00143    109*          *    0.000E+00/                                                   DAT10900
00145    110*          DATA                (P(2,I),I=1,34) /1.013E+03,9.020E+02,8.020E+02,  DAT11000
00145    111*          *    7.100E+02,6.280E+02,5.540E+02,4.870E+02,4.260E+02,3.720E+02,  DAT11100
00145    112*          *    3.240E+02,2.810E+02,2.430E+02,2.090E+02,1.790E+02,1.530E+02,  DAT11200
00145    113*          *    1.300E+02,1.110E+02,9.500E+01,8.120E+01,6.950E+01,5.950E+01,  DAT11300
00145    114*          *    5.100E+01,4.370E+01,3.760E+01,3.220E+01,2.770E+01,1.320E+01,  DAT11400
00145    115*          *    6.520E+00,3.330E+00,1.760E+00,9.510E-01,6.710E-02,3.000E-04,  DAT11500
00145    116*          *    0.000E+00/                                                   DAT11600
00147    117*          DATA                (P(3,I),I=1,34) /1.018E+03,8.973E+02,7.897E+02,  DAT11700
00147    118*          *    6.938E+02,6.081E+02,5.313E+02,4.627E+02,4.016E+02,3.473E+02,  DAT11800
00147    119*          *    2.992E+02,2.568E+02,2.199E+02,1.882E+02,1.610E+02,1.378E+02,  DAT11900
00147    120*          *    1.178E+02,1.007E+02,8.610E+01,7.350E+01,6.280E+01,5.370E+01,  DAT12000
00147    121*          *    4.580E+01,3.910E+01,3.340E+01,2.880E+01,2.430E+01,1.110E+01,  DAT12100
00147    122*          *    8.180E+00,2.530E+00,1.290E+00,6.820E-01,4.670E-02,3.000E-04,  DAT12200
00147    123*          *    0.000E+00/                                                   DAT12300
00151    124*          DATA                (P(4,I),I=1,34) /1.010E+03,8.980E+02,7.929E+02,  DAT12400
00151    125*          *    7.000E+02,6.160E+02,5.410E+02,4.730E+02,4.130E+02,3.590E+02,  DAT12500
00151    126*          *    3.107E+02,2.677E+02,2.300E+02,1.977E+02,1.700E+02,1.460E+02,  DAT12600
00151    127*          *    1.250E+02,1.080E+02,9.280E+01,7.980E+01,6.860E+01,5.890E+01,  DAT12700
00151    128*          *    5.070E+01,4.360E+01,3.750E+01,3.227E+01,2.780E+01,1.340E+01,  DAT12800
00151    129*          *    8.610E+00,3.400E+00,1.816E+00,9.870E-01,7.070E-02,3.000E-04,  DAT12900
00151    130*          *    0.000E+00/                                                   DAT13000
00153    131*          DATA                (P(5,I),I=1,34) /1.013E+03,8.870E+02,7.775E+02,  DAT13100
00153    132*          *    6.798E+02,5.932E+02,5.158E+02,4.467E+02,3.853E+02,3.308E+02,  DAT13200
00153    133*          *    2.829E+02,2.418E+02,2.067E+02,1.766E+02,1.510E+02,1.291E+02,  DAT13300
00153    134*          *    1.103E+02,9.431E+01,8.050E+01,6.882E+01,5.875E+01,5.014E+01,  DAT13400
00153    135*          *    4.277E+01,3.647E+01,3.109E+01,2.649E+01,2.258E+01,1.020E+01,  DAT13500
00153    136*          *    4.701E+00,2.243E+00,1.113E+00,5.719E-01,4.018E-02,3.000E-04,  DAT13600
00153    137*          *    0.000E+00/                                                   DAT13700
00155    138*          DATA                (P(6,I),I=1,34) /1.013E+03,8.986E+02,7.950E+02,  DAT13800
00155    139*          *    7.012E+02,6.166E+02,5.405E+02,4.722E+02,4.111E+02,3.565E+02,  DAT13900
00155    140*          *    3.080E+02,2.650E+02,2.270E+02,1.940E+02,1.658E+02,1.417E+02,  DAT14000
00155    141*          *    1.211E+02,1.035E+02,8.850E+01,7.565E+01,6.467E+01,5.529E+01,  DAT14100
00155    142*          *    4.729E+01,4.047E+01,3.467E+01,2.972E+01,2.549E+01,1.197E+01,  DAT14200
00155    143*          *    5.746E+00,2.871E+00,1.491E+00,7.978E-01,5.520E-02,3.008E-04,  DAT14300
00155    144*          *    0.000E+00/                                                   DAT14400
00155    145*     C                                                                      DAT14500
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00155   146*     C *** TEMPERATURE (K) AT LEVEL I FOR THE MODEL ATMOSPHERES                  DAT14600
00155   147*     C                                                                           DAT14700
00157   148*           DATA                (T(1,I),I=1,34) /300.0,294.0,288.0,284.0,277.0,  DAT14800
00157   149*          *    270.0,264.0,257.0,250.0,244.0,237.0,230.0,224.0,217.0,210.0,     DAT14900
00157   150*          *    204.0,197.0,195.0,199.0,203.0,207.0,211.0,215.0,217.0,219.0,     DAT15000
00157   151*          *    221.0,232.0,243.0,254.0,265.0,270.0,219.0,210.0,210.0/           DAT15100
00161   152*           DATA                (T(2,I),I=1,34) /294.0,290.0,285.0,279.0,273.0,  DAT15200
00161   153*          *    267.0,261.0,255.0,248.0,242.0,235.0,229.0,222.0,216.0,216.0,     DAT15300
00161   154*          *    216.0,216.0,216.0,216.0,217.0,218.0,219.0,220.0,222.0,223.0,     DAT15400
00161   155*          *    224.0,234.0,245.0,258.0,270.0,276.0,218.0,210.0,210.0/           DAT15500
00163   156*           DATA                (T(3,I),I=1,34) /272.2,268.7,265.2,261.7,255.7,  DAT15600
00163   157*          *    249.7,243.7,237.7,231.7,225.7,219.7,219.2,218.7,218.2,217.7,     DAT15700
00163   158*          *    217.2,216.7,216.2,215.7,215.2,215.2,215.2,215.2,215.2,215.2,     DAT15800
00163   159*          *    215.2,217.4,227.8,243.2,258.5,265.7,230.7,210.2,210.0/           DAT15900
00165   160*           DATA                (T(4,I),I=1,34) /287.0,282.0,276.0,271.0,266.0,  DAT16000
00165   161*          *    260.0,253.0,246.0,239.0,232.0,225.0,225.0,225.0,225.0,225.0,     DAT16100
00165   162*          *    225.0,225.0,225.0,225.0,225.0,225.0,225.0,225.0,225.0,226.0,     DAT16200
00165   163*          *    228.0,235.0,247.0,262.0,274.0,277.0,216.0,210.0,210.0/           DAT16300
00167   164*           DATA                (T(5,I),I=1,34) /257.1,259.1,255.9,252.7,247.7,  DAT16400
00167   165*          *    240.9,234.1,227.3,220.6,217.2,217.2,217.2,217.2,217.2,217.2,     DAT16500
00167   166*          *    217.2,216.6,216.0,215.4,214.8,214.1,213.6,213.0,212.4,211.8,     DAT16600
00167   167*          *    211.2,216.0,222.2,234.7,247.0,259.3,245.7,210.0,210.0/           DAT16700
00171   168*           DATA                (T(6,I),I=1,34) /288.1,281.6,275.1,268.7,262.2,  DAT16800
00171   169*          *    255.7,249.2,242.7,236.2,229.7,223.2,216.8,216.6,216.6,216.6,     DAT16900
00171   170*          *    216.6,216.6,216.6,216.6,216.6,216.6,217.6,218.6,219.6,220.6,     DAT17000
00171   171*          *    221.6,228.5,236.5,253.4,264.2,270.6,219.7,210.0,210.0/           DAT17100
00171   172*     C                                                                           DAT17200
00171   173*     C *** WATER VAPOR DENSITY (GM.M-3) AT LEVEL I FOR THE MODEL ATMOSPHERES     DAT17300
00171   174*     C                                                                           DAT17400
00173   175*           DATA                (WH(1,I),I=1,34) /1.9E+01,1.3E+01,9.3E+00,       DAT17500
00173   176*          *   4.7E+00,2.2E+00,1.5E+00,8.9E-01,4.7E-01,2.5E-01,1.2E-01,          DAT17600
00173   177*          *   5.0E-02,1.7E-02,8.0E-03,1.8E-03,1.0E-03,7.6E-04,6.4E-04,          DAT17700
00173   178*          *   5.6E-04,5.0E-04,4.9E-04,4.5E-04,5.1E-04,5.1E-04,5.4E-04,          DAT17800
00173   179*          *   6.0E-04,6.7E-04,3.6E-04,1.1E-04,4.3E-05,1.9E-05,6.3E-06,          DAT17900
00173   180*          *  1.4E-07,1.0E-09,0.0E+00/                                           DAT18000
00175   181*           DATA                (WH(2,I),I=1,34) /1.4E+01,9.3E+00,5.9E+00,       DAT18100
00175   182*          *   3.3E+00,1.9E+00,1.0E+00,6.1E-01,3.7E-01,2.1E-01,1.2E-01,          DAT18200
00175   183*          *   6.4E-02,2.2E-02,8.0E-03,1.8E-03,1.0E-03,7.6E-04,6.4E-04,          DAT18300
00175   184*          *   5.6E-04,5.0E-04,4.9E-04,4.5E-04,5.1E-04,5.1E-04,5.4E-04,          DAT18400
00175   185*          *   6.0E-04,6.7E-04,3.6E-04,1.1E-04,4.3E-05,1.9E-05,6.3E-06,          DAT18500
00175   186*          *   1.4E-07,1.0E-09,0.0E+00/                                           DAT18600
00177   187*           DATA                (WH(3,I),I=1,34) /3.5E+00,2.5E+00,1.8E+00,       DAT18700
00177   188*          *   1.2E+00,8.8E-01,3.8E-01,2.1E-01,8.5E-02,3.5E-02,1.8E-02,          DAT18800
00177   189*          *   7.5E-03,6.9E-03,6.0E-03,1.8E-03,1.0E-03,7.6E-04,6.4E-04,          DAT18900
00177   190*          *   5.6E-04,5.0E-04,4.9E-04,4.5E-04,5.1E-04,5.1E-04,5.4E-04,          DAT19000
00177   191*          *   6.0E-04,6.7E-04,3.6E-04,1.1E-04,4.3E-05,1.9E-05,6.3E-06,          DAT19100
00177   192*          *   1.4E-07,1.0E-09,0.0E+00/                                           DAT19200
00201   193*           DATA                (WH(4,I),I=1,34) /9.1E+00,6.0E+00,4.2E+00,       DAT19300
00201   194*          *   2.7E+00,1.7E+00,1.0E+00,5.4E-01,2.9E-01,1.3E-01,4.2E-02,          DAT19400
00201   195*          *   1.5E-02,9.4E-03,6.0E-03,1.8E-03,1.0E-03,7.6E-04,6.4E-04,          DAT19500
00201   196*          *   5.6E-04,5.0E-04,4.9E-04,4.5E-04,5.1E-04,5.1E-04,5.4E-04,          DAT19600
00201   197*          *   6.0E-04,6.7E-04,3.6E-04,1.1E-04,4.3E-05,1.9E-05,6.3E-06,          DAT19700
00201   198*          *   1.4E-07,1.0E-09,0.0E+00/                                           DAT19800
00203   199*           DATA                (WH(5,I),I=1,34) /1.2E+00,1.2E+00,9.4E-01,       DAT19900
00203   200*          *   8.8E-01,4.1E-01,2.0E-01,9.8E-02,5.4E-02,1.1E-02,8.4E-03,          DAT20000
00203   201*          *   5.5E-03,3.8E-03,2.6E-03,1.8E-03,1.0E-03,7.6E-04,6.4E-04,          DAT20100
00203   202*          *   5.6E-04,5.0E-04,4.9E-04,4.5E-04,5.1E-04,5.1E-04,5.4E-04,          DAT20200
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00203   203*          *   6.0E-04,6.7E-04,3.6E-04,1.1E-04,4.3E-05,1.9E-05,6.3E-06,        DAT20300
00203   204*          *   1.4E-07,1.0E-09,0.0E+00/                                        DAT20400
00205   205*           DATA                (WW(6,I),I=1,34) /5.9E+00,4.2E+00,2.9E+00,     DAT20500
00205   206*          *   1.8E+00,1.1E+00,6.4E-01,3.8E-01,2.1E-01,1.2E-01,4.6E-02,        DAT20600
00205   207*          *   1.8E-02,8.2E-03,3.7E-03,1.8E-03,8.4E-04,7.2E-04,6.1E-04,        DAT20700
00205   208*          *   5.2E-04,4.4E-04,4.4E-04,4.4E-04,4.8E-04,5.2E-04,5.7E-04,        DAT20800
00205   209*          *   6.1E-04,6.6E-04,3.8E-04,1.6E-04,6.7E-05,3.2E-05,1.2E-05,        DAT20900
00205   210*          *   1.5E-07,1.0E-09,0.0E+00/                                        DAT21000
00205   211*     C                                                                        DAT21100
00205   212*     C *** OZONE DENSITY (GM.M-3) AT LEVEL I FOR THE MODEL ATMOSPHERES        DAT21200
00205   213*     C                                                                        DAT21300
00207   214*           DATA                (WO(1,I),I=1,34) /5.6E-05,5.6E-05,5.4E-05,     DAT21400
00207   215*          *   5.1E-05,4.7E-05,4.5E-05,4.3E-05,4.1E-05,3.9E-05,3.9E-05,        DAT21500
00207   216*          *   3.9E-05,4.1E-05,4.3E-05,4.5E-05,4.5E-05,4.7E-05,4.7E-05,        DAT21600
00207   217*          *   6.9E-05,9.0E-05,1.4E-04,1.9E-04,2.4E-04,2.8E-04,3.2E-04,        DAT21700
00207   218*          *   3.4E-04,3.4E-04,2.4E-04,9.2E-05,4.1E-05,1.3E-05,4.3E-06,        DAT21800
00207   219*          *   8.6E-08,4.3E-11,0.0E+00/                                        DAT21900
00211   220*           DATA                (WO(2,I),I=1,34) /6.0E-05,6.0E-05,6.0E-05,     DAT22000
00211   221*          *   6.2E-05,6.4E-05,6.6E-05,6.9E-05,7.5E-05,7.9E-05,8.6E-05,        DAT22100
00211   222*          *   9.0E-05,1.1E-04,1.2E-04,1.5E-04,1.8E-04,1.9E-04,2.1E-04,        DAT22200
00211   223*          *   2.4E-04,2.8E-04,3.2E-04,3.4E-04,3.6E-04,3.6E-04,3.4E-04,        DAT22300
00211   224*          *   3.2E-04,3.0E-04,2.0E-04,9.2E-05,4.1E-05,1.3E-05,4.3E-06,        DAT22400
00211   225*          *   8.6E-08,4.3E-11,0.0E+00/                                        DAT22500
00213   226*           DATA                (WO(3,I),I=1,34) /6.0E-05,5.4E-05,4.9E-05,     DAT22600
00213   227*          *   4.9E-05,4.9E-05,5.8E-05,6.4E-05,7.7E-05,9.0E-05,1.2E-04,        DAT22700
00213   228*          *   1.6E-04,2.1E-04,2.6E-04,3.0E-04,3.2E-04,3.4E-04,3.6E-04,        DAT22800
00213   229*          *   3.9E-04,4.1E-04,4.3E-04,4.5E-04,4.3E-04,4.3E-04,3.9E-04,        DAT22900
00213   230*          *   3.6E-04,3.4E-04,1.9E-04,9.2E-05,4.1E-05,1.3E-05,4.3E-06,        DAT23000
00213   231*          *   8.6E-08,4.3E-11,0.0E+00/                                        DAT23100
00215   232*           DATA                (WO(4,I),I=1,34) /4.9E-05,5.4E-05,5.8E-05,     DAT23200
00215   233*          *   5.8E-05,6.0E-05,6.4E-05,7.1E-05,7.5E-05,7.9E-05,1.1E-04,        DAT23300
00215   234*          *   4.3E-04,1.8E-04,2.1E-04,2.6E-04,2.8E-04,3.2E-04,3.4E-04,        DAT23400
00215   235*          *   3.9E-04,4.1E-04,4.1E-04,3.9E-04,3.6E-04,3.2E-04,3.0E-04,        DAT23500
00215   236*          *   2.8E-04,2.6E-04,1.4E-04,9.2E-05,4.1E-05,1.3E-05,4.3E-06,        DAT23600
00215   237*          *   8.6E-08,4.3E-11,0.0E+00/                                        DAT23700
00217   238*           DATA                (WO(5,I),I=1,34) /4.1E-05,4.1E-05,4.1E-05,     DAT23800
00217   239*          *   4.3E-05,4.5E-05,4.7E-05,4.9E-05,7.1E-05,9.0E-05,1.6E-04,        DAT23900
00217   240*          *   2.4E-04,3.2E-04,4.3E-04,4.7E-04,4.9E-04,5.6E-04,6.2E-04,        DAT24000
00217   241*          *   6.2E-04,6.2E-04,6.0E-04,5.6E-04,5.1E-04,4.7E-04,4.3E-04,        DAT24100
00217   242*          *   3.6E-04,3.2E-04,1.5E-04,9.2E-05,4.1E-05,1.3E-05,4.3E-06,        DAT24200
00217   243*          *   8.6E-08,4.3E-11,0.0E+00/                                        DAT24300
00221   244*           DATA                (WO(6,I),I=1,34) /5.4E-05,5.4E-05,5.4E-05,     DAT24400
00221   245*          *   5.0E-05,4.6E-05,4.5E-05,4.5E-05,4.9E-05,5.2E-05,7.1E-05,        DAT24500
00221   246*          *   9.0E-05,1.3E-04,1.6E-04,1.7E-04,1.9E-04,2.1E-04,2.4E-04,        DAT24600
00221   247*          *   2.8E-04,3.2E-04,3.5E-04,3.8E-04,3.8E-04,3.9E-04,3.8E-04,        DAT24700
00221   248*          *   3.6E-04,3.4E-04,2.0E-04,1.1E-04,4.9E-05,1.7E-05,4.0E-06,        DAT24800
00221   249*          *   8.6E-08,4.3E-11,0.0E+00/                                        DAT24900
00221   250*     C                                                                        DAT25000
00221   251*     C *** SPECTRAL DATA:  AEROSOLS                                           DAT25100
00221   252*     C                                                                        DAT25200
00221   253*     C *** AVERAGE CONTINENTAL AEROSOL MODEL                                  DAT25300
00221   254*     C                                                                        DAT25400
00223   255*           DATA                (VX(1,I),I=1,44)  / 0.20, 0.25, 0.31, 0.34, 0.49,DAT25500
00223   256*          *       0.51, 0.83, 0.69, 0.86, 1.06, 1.54, 2.00, 2.50, 2.70, 3.00,DAT25600
00223   257*          *       3.20, 3.30, 3.50, 3.75, 4.00, 4.50, 5.50, 6.00, 6.50, 7.20,DAT25700
00223   258*          *       7.90, 8.20, 8.50, 8.70, 9.00, 9.20, 9.50,10.00,10.50,11.00,DAT25800
00223   259*          *      13.00,14.80,15.00,17.20,18.50,20.00,25.00,27.90,30.00/       DAT25900
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00223   260*      C                                                                    DAT26000
00223   261*      C *** RURAL AEROSOL MODEL                                            DAT26100
00223   262*      C                                                                    DAT26200
00225   263*            DATA              (VX(2,I),I=1,44)  / 0.20, 0.25, 0.30, 0.40, 0.48,DAT26300
00225   264*           *       0.55, 0.69, 0.86, 1.06, 1.54, 1.80, 2.00, 2.50, 3.00, 3.50,DAT26400
00225   265*           *       3.75, 4.00, 5.00, 5.50, 6.00, 7.20, 7.90, 8.20, 8.50, 8.70,DAT26500
00225   266*           *       9.00, 9.20, 9.50, 9.80,10.00,10.59,11.00,11.50,12.50,13.00,DAT26600
00225   267*           *      14.00,15.00,16.40,17.20,18.50,20.00,22.50,25.00,30.00/       DAT26700
00225   268*      C                                                                    DAT26800
00225   269*      C *** URBAN AEROSOL MODEL                                            DAT26900
00225   270*      C                                                                    DAT27000
00227   271*            DATA              (VX(3,I),I=1,44)  / 0.20, 0.25, 0.30, 0.40, 0.48,DAT27100
00227   272*           *       0.55, 0.69, 0.86, 1.06, 1.54, 1.80, 2.00, 2.50, 3.00, 3.50,DAT27200
00227   273*           *       3.75, 4.00, 5.00, 5.50, 6.00, 7.20, 7.90, 8.20, 8.50, 8.70,DAT27300
00227   274*           *       9.00, 9.20, 9.50, 9.80,10.00,10.59,11.00,11.50,12.50,13.00,DAT27400
00227   275*           *      14.00,15.00,16.40,17.20,18.50,20.00,22.50,25.00,30.00/       DAT27500
00227   276*      C                                                                    DAT27600
00227   277*      C *** MARITIME AEROSOL MODEL                                         DAT27700
00227   278*      C                                                                    DAT27800
00231   279*            DATA              (VX(4,I),I=1,44)  / 0.20, 0.25, 0.30, 0.40, 0.48,DAT27900
00231   280*           *       0.55, 0.69, 0.86, 1.06, 1.54, 1.80, 2.00, 2.50, 3.00, 3.50,DAT28000
00231   281*           *       3.75, 4.00, 5.00, 5.50, 6.00, 7.20, 7.90, 8.20, 8.50, 8.70,DAT28100
00231   282*           *       9.00, 9.20, 9.50, 9.80,10.00,10.59,11.00,11.50,12.50,13.00,DAT28200
00231   283*           *      14.00,15.00,16.40,17.20,18.50,20.00,22.50,25.00,30.00/       DAT28300
00231   284*      C                                                                    DAT28400
00231   285*      C *** TRANSMITTANCE FUNCTIONS                                        DAT28500
00231   286*      C                                                                    DAT28600
00233   287*            DATA              TR /0.999,0.998,0.996,0.994,0.992,0.990,0.988,   DAT28700
00233   288*           *   0.970,0.960,0.950,0.940,0.930,0.920,0.910,0.900,0.880,0.860,DAT28800
00233   289*           *   0.840,0.820,0.800,0.780,0.760,0.740,0.720,0.700,0.680,0.660,DAT28900
00233   290*           *   0.640,0.620,0.600,0.580,0.560,0.540,0.520,0.500,0.480,0.460,DAT29000
00233   291*           *   0.440,0.420,0.400,0.380,0.360,0.340,0.320,0.300,0.280,0.260,DAT29100
00233   292*           *   0.240,0.220,0.200,0.180,0.160,0.140,0.120,0.100,0.080,0.060,DAT29200
00233   293*           *   0.040,0.030,0.020,0.015,0.010,0.008,0.006,0.004,0.002,0.001/DAT29300
00233   294*      C                                                                    DAT28400
00233   295*      C *** TRANSMITTANCE FUNCTION FOR H2O                                 DAT29500
00233   296*      C                                                                    DAT28600
00235   297*            DATA              FH      /-2.3468,-2.0382,-1.6990,-1.4815,-1.3278,DAT29700
00235   298*           *  -1.2007,-0.7825,-0.5229,-0.3468,-0.1938, 0.0655, 0.0414, 0.1593,DAT29800
00235   299*           *   0.2430, 0.3324, 0.4342, 0.8128, 0.7243, 0.8261, 0.9191, 1.0000,DAT29900
00235   300*           *   1.0792, 1.1481, 1.2122, 1.2672, 1.3284, 1.3892, 1.4409, 1.4955,DAT30000
00235   301*           *   1.5441, 1.5868, 1.6435, 1.6057, 1.7340, 1.7782, 1.8261, 1.0392,DAT30100
00235   302*           *   1.9191, 1.9838, 2.0088, 2.0607, 2.1038, 2.1481, 2.1875, 2.2304,DAT30200
00235   303*           *   2.2788, 2.3263, 2.3717, 2.4183, 2.4698, 2.5159, 2.5740, 2.6284,DAT30300
00235   304*           *   2.8952, 2.7559, 2.8261, 2.9031, 3.0000, 3.0607, 3.1461, 3.2041,DAT30400
00235   305*           *   3.2718, 3.3054, 3.3444, 3.3979, 3.4914, 3.5682/              DAT30500
00235   306*      C                                                                    DAT30600
00235   307*      C *** TRANSMITTANCE FUNCTION FOR OZONE                               DAT30700
00235   308*      C                                                                    DAT30800
00237   309*            DATA              FO      /-1.8778,-1.3980,-1.1192,-0.9508,-0.8239,DAT30900
00237   310*           *  -0.7258,-0.6318,-0.2366,-0.1074,-0.0000, 0.0969, 0.1761, 0.2304,DAT31000
00237   311*           *   0.3010, 0.3522, 0.4624, 0.5563, 0.6435, 0.7243, 0.7924, 0.8573,DAT31100
00237   312*           *   0.9191, 0.9731, 1.0253, 1.0719, 1.1173, 1.1614, 1.2095, 1.2480,DAT31200
00237   313*           *   1.2900, 1.3263, 1.3617, 1.3978, 1.4393, 1.4698, 1.4983, 1.5314,DAT31300
00237   314*           *   1.5682, 1.6021, 1.6335, 1.6721, 1.7078, 1.7482, 1.7924, 1.8325,DAT31400
00237   315*           *   1.8865, 1.9395, 2.0000, 2.0607, 2.1208, 2.1903, 2.2552, 2.3385,DAT31500
00237   316*           *   2.4313, 2.5185, 2.6435, 2.7853, 2.9777, 3.1072, 3.2553, 3.3617,DAT31600
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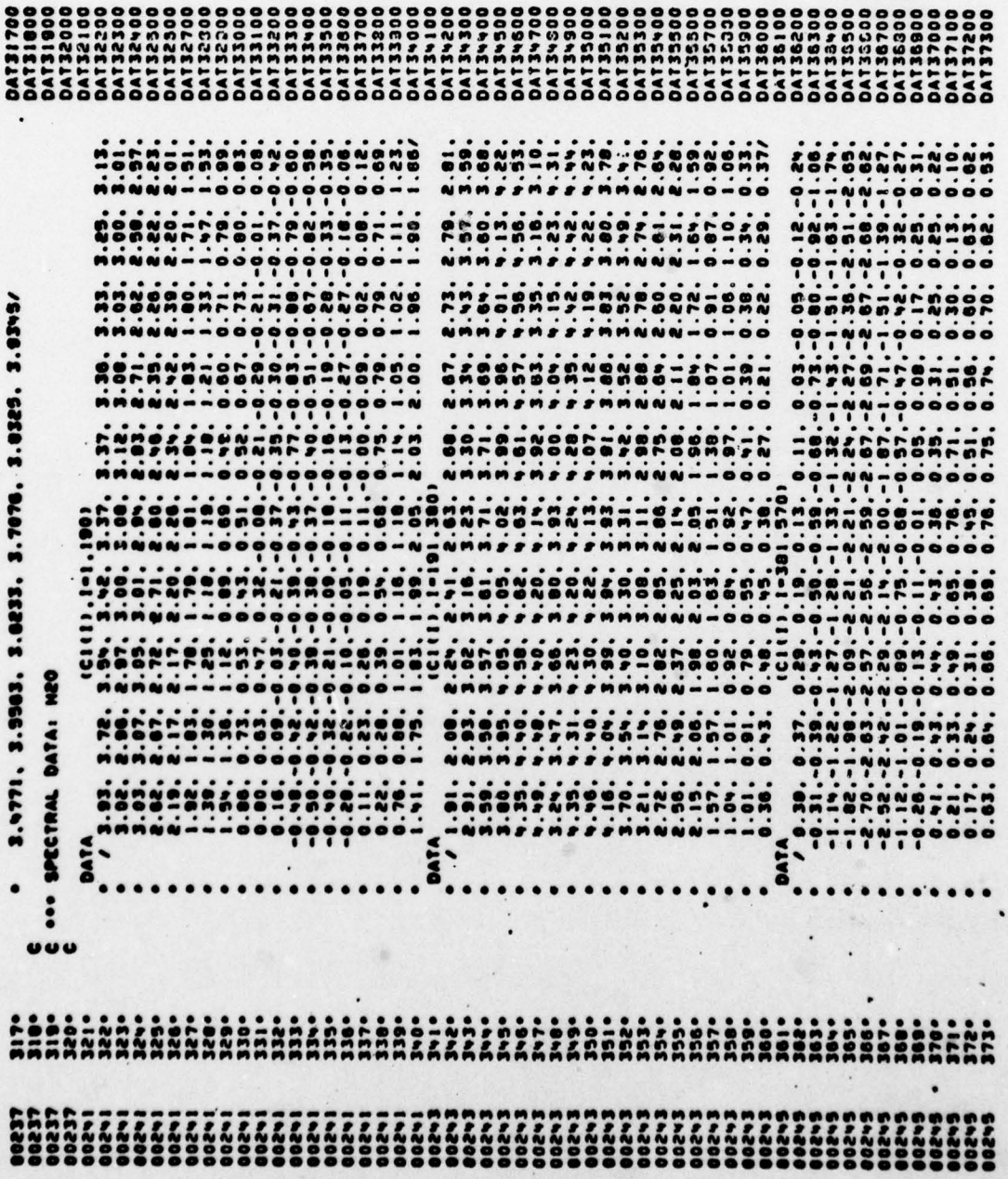

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C    3.4771, 3.9583, 3.8833, 3.7078, 3.8325, 3.8345/
C ... SPECTRAL DATA: H2O
C
      DATA
     / 3.03  3.72  3.37  3.12  3.37  3.36  3.33  3.25  3.13.
       3.02  2.98  3.42  2.83  2.71  3.08  3.03  3.00  3.01.
       3.03  3.07  3.01  2.96  2.72  2.83  2.98  2.98  2.57.
       2.82  2.87  2.71  2.80  2.42  2.35  2.62  2.20  2.23.
       2.19  2.17  2.78  2.20  2.34  2.83  2.26  2.22  2.01.
      -1.92  -1.83  -1.88  -1.81  -1.85  -1.60  -1.33  -1.71  -1.51.
      -1.38  -1.38  -1.25  -1.18  -1.18  -1.21  -1.71  -1.77  -1.53.
       0.88  -0.73  -0.53  -0.51  -0.76  -0.67  -0.73  -0.78  -0.89.
       0.80  -0.69  -0.57  -0.50  -0.52  -0.29  -0.21  -0.80  -0.83.
       0.18  -0.72  -0.32  -0.37  -0.21  -0.29  -0.31  -0.37  -0.08.
      -0.70  -0.72  -0.38  -0.37  -0.35  -0.30  -0.31  -0.79  -0.42.
      -0.50  -0.32  -0.38  -0.33  -0.77  -0.83  -0.88  -0.82  -0.60.
      -0.20  -0.21  -0.05  -0.18  -0.70  -0.67  -0.67  -0.77  -0.58.
      -0.11  -0.22  -0.10  -0.11  -0.16  -0.51  -0.82  -0.82  -0.35.
       0.22  -0.28  -0.18  -0.08  -0.13  -0.19  -0.27  -0.27  -0.06.
       0.39  -0.54  -0.18  -0.08  -0.08  -0.27  -0.02  -0.08  -0.12.
       0.18  -0.01  -0.18  -0.05  -0.75  -0.09  -0.09  -0.08  -0.09.
       0.76  -0.88  -0.99  -0.18  -1.14  -0.79  -1.05  -0.71  -0.71.
      -1.41  -1.75  -1.83  -1.99  -2.03  -2.05  -1.02  -1.96  -1.23.
     /
     DATA
     / 1.91  2.08  2.24  2.02  2.37  2.68  2.67  2.73  2.81.
       2.91  2.93  3.02  3.16  3.23  3.30  3.34  3.33  3.59.
       3.59  3.80  3.57  3.61  3.71  3.71  3.77  3.57  3.68.
       3.35  3.49  3.05  3.02  3.99  3.99  3.57  3.64  3.22.
       3.27  3.47  3.66  3.93  3.92  3.92  3.35  3.01  3.53.
       3.35  3.31  3.23  3.13  3.00  3.04  3.15  3.56  3.10.
       3.16  3.04  3.20  3.22  3.07  3.28  3.42  3.23  3.31.
       3.70  3.99  3.30  3.93  3.81  3.12  3.19  3.22  3.44.
       3.54  3.14  3.08  3.11  3.98  3.86  3.83  3.80  3.23.
       3.70  3.10  3.05  3.31  2.98  3.52  3.52  3.99  3.78.
       3.21  2.76  2.82  2.85  2.75  2.88  2.78  2.77  2.76.
       2.72  2.78  2.37  2.25  2.14  2.64  2.60  2.61  2.64.
       2.56  2.48  2.37  2.05  2.06  2.11  2.20  2.31  2.28.
       2.15  2.06  2.98  2.03  1.98  1.84  1.72  1.64  1.59.
      -1.57  -1.57  -1.60  -1.63  -1.51  -1.38  -1.91  -1.87  -0.92.
      -1.04  -1.01  -0.92  -0.84  -0.82  -0.97  -1.06  -1.10  -1.06.
      -1.01  -1.01  -0.98  -0.55  -0.47  -0.41  -0.39  -0.38  -0.33.
       0.36  -0.43  -0.79  -0.45  -0.38  -0.27  -0.21  -0.22  -0.37/
     DATA
     / 0.38  0.37  0.29  0.13  -0.11  -0.03  -0.05  -0.12  -0.24.
      -0.31  -0.39  -0.19  -0.50  -0.58  -0.68  -0.73  -0.80  -0.92  -1.06.
      -1.14  -1.22  -1.27  -1.28  -1.33  -1.32  -1.27  -1.51  -1.63  -1.74.
      -1.82  -1.98  -2.09  -2.21  -2.24  -2.27  -2.36  -2.51  -2.65.
      -2.70  -2.63  -2.57  -2.56  -2.59  -2.67  -2.69  -2.67  -2.68  -2.62.
      -2.52  -2.42  -2.29  -2.14  -2.00  -1.87  -1.71  -1.51  -1.39  -1.27.
      -1.12  -1.01  -0.89  -0.75  -0.68  -0.57  -0.47  -0.42  -0.32  -0.27.
      -0.26  -0.19  -0.13  -0.11  -0.01  -0.05  -0.08  -0.17  -0.25  -0.31.
       0.21  -0.33  -0.44  -0.43  -0.35  -0.31  -0.25  -0.25  -0.22.
       0.17  0.24  0.31  0.38  0.65  0.71  0.76  0.51  0.30  0.13  0.10.
       0.63  0.64  0.86  0.88  0.95  0.75  0.51  0.56  0.60  0.63  0.62.
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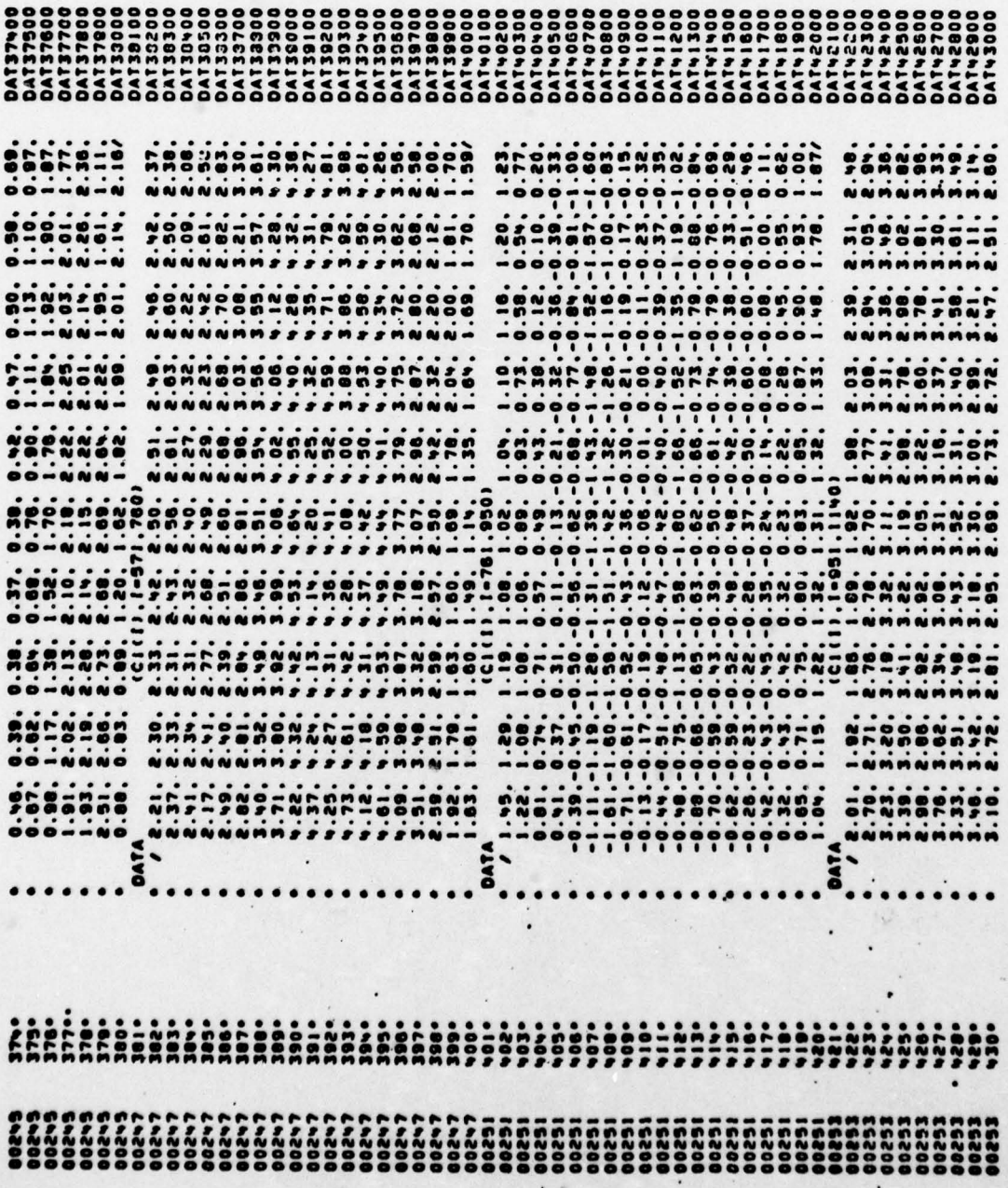

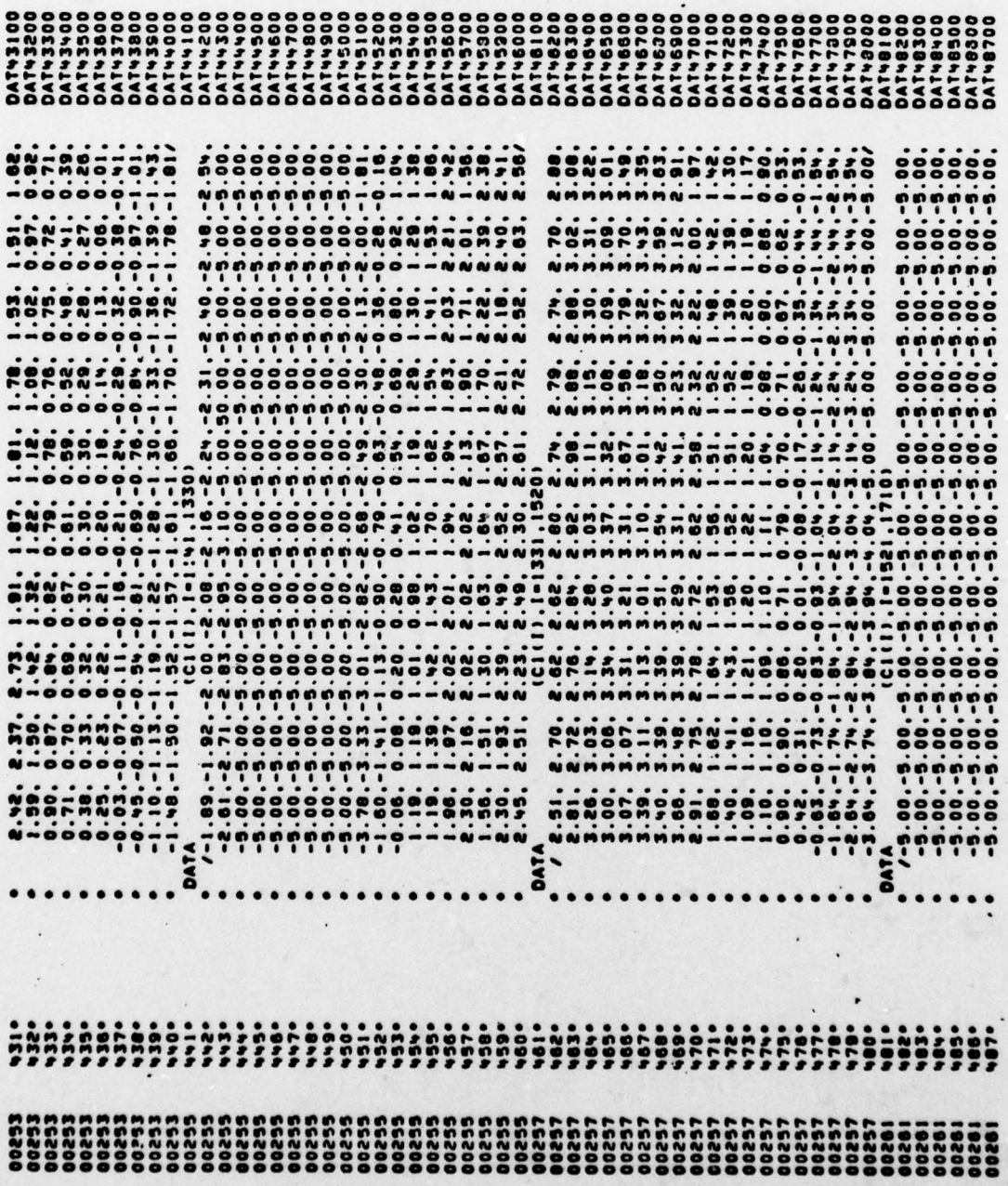

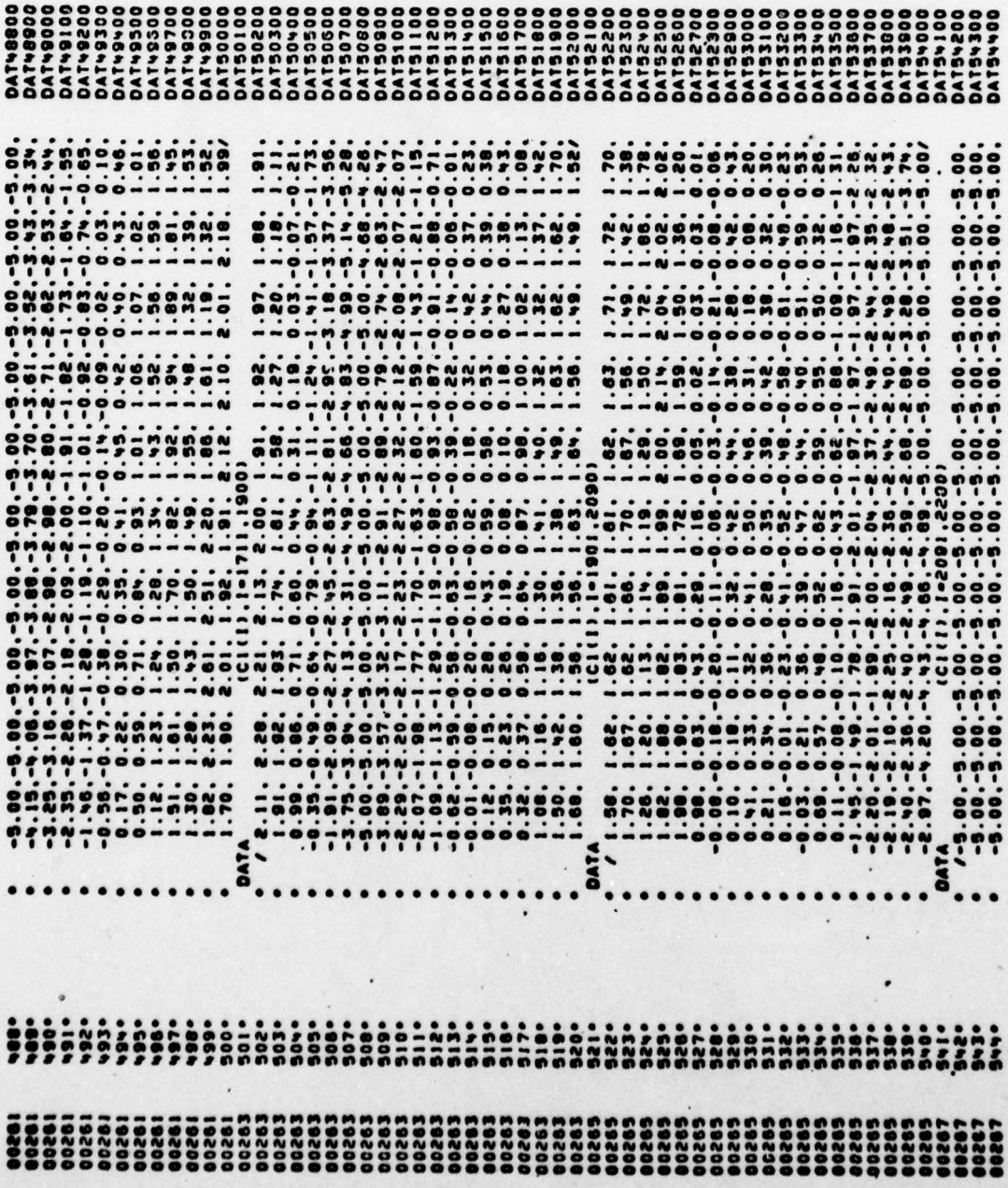

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00267   547•    •   -5.00,-5.00,-5.00,-5.00,-5.00,-3.71,-3.56,-3.40,-3.21,-3.06,   DAT54700
00267   548•    •   -2.90,-2.74,-2.60,-2.46,-2.32,-2.17,-2.03,-1.87,-1.79,-1.74,   DAT54800
00267   549•    •   -1.83,-1.82,-1.71,-1.59,-1.49,-1.46,-1.48,-1.49,-1.49,-1.25,   DAT54900
00267   550•    •   -1.24,-1.08,-0.90,-1.06,-0.91,-0.91,-1.01,-0.99,-0.87,-0.92,   DAT55000
00267   551•    •   -0.79,-0.42,-0.54,-0.38,-0.42,-0.48,-0.34,-0.27,-0.17,-0.28,   DAT55100
00267   552•    •   -0.38,-0.22,-0.30,-0.08,-0.01,-0.20, 0.06, 0.10, 0.06, 0.14,   DAT55200
00267   553•    •   -0.12,-0.02,-0.02,-0.13,-0.11,-0.10,-0.06,-0.05,-0.04,-0.10,   DAT55300
00267   554•    •   -0.04,-0.06,-0.21,-0.38,-0.61,-0.40,-0.31,-0.42,-0.58,-0.57,   DAT55400
00267   555•    •   -0.54,-0.24, 0.11, 0.51, 0.81, 0.79, 0.62, 0.26,-0.31,-0.67,   DAT55500
00267   556•    •   -0.80,-0.88,-0.50,-0.39,-0.10, 0.09, 0.06, 0.08, 0.16, 0.21,   DAT55600
00267   557•    •    0.13, 0.32, 0.35, 0.51, 0.60, 0.51, 0.51, 0.40, 0.40, 0.43,   DAT55700
00267   558•    •    0.42, 0.33, 0.43, 0.34, 0.22, 0.13,-0.11,-0.31,-0.31,-0.41,   DAT55800
00267   559•    •   -0.41,-0.39,-0.53,-0.69,-0.84,-0.88,-1.01,-1.10,-1.19,-1.29,   DAT55900
00267   560•    •   -1.45,-1.49,-1.67,-1.67,-1.51,-1.66,-1.60,-1.69,-1.83,-1.51/   DAT56000
00271   561•        DATA          (C1(I),I=2281,2470)                               DAT56100
00271   562•    •   /-1.42,-1.40,-1.24,-1.38,-1.31,-1.30,-1.30,-1.28,-1.39,-1.33,  DAT56200
00271   563•    •   -1.40,-1.35,-1.37,-1.39,-1.41,-1.49,-1.48,-1.56,-1.47,-1.46,   DAT56300
00271   564•    •   -1.41,-1.42,-1.48,-1.41,-1.31,-1.15,-1.13,-1.20,-1.41,-1.88,   DAT56400
00271   565•    •   -2.08,-2.08,-2.22,-2.35,-2.35,-1.98,-1.92,-1.78,-1.57,-1.69,   DAT56500
00271   566•    •   -1.70,-1.70,-1.66,-1.84,-1.50,-1.56,-1.42,-1.29,-1.38,-1.28,   DAT56600
00271   567•    •   -1.48,-1.58,-1.44,-1.53,-1.48,-1.48,-1.58,-1.58,-1.69,-1.79,   DAT56700
00271   568•    •   -2.00,-2.16,-1.99,-2.23,-2.04,-2.04,-2.39,-2.74,-3.09,-3.44,   DAT56800
00271   569•    •   -3.79,-4.14,-4.49,-4.84,-5.19,-2.46,-2.26,-1.99,-2.01,-2.14,   DAT56900
00271   570•    •   -2.31,-2.15,-2.01,-1.99,-2.14,-2.41,-2.12,-1.99,-1.84,-1.79,   DAT57000
00271   571•    •   -1.71,-1.78,-1.72,-1.68,-1.78,-1.52,-1.38,-1.29,-1.22,-0.91,   DAT57100
00271   572•    •   -0.90,-1.01,-0.76,-0.90,-0.90,-0.90,-1.19,-1.00,-0.79,-0.68,   DAT57200
00271   573•    •   -0.88,-0.73,-0.85,-0.85,-0.61,-0.61,-0.48,-0.51,-0.92,-0.83,   DAT57300
00271   574•    •   -0.61,-0.41,-0.29,-0.29,-0.61,-0.74,-0.19,-0.18, 0.00, 0.19,   DAT57400
00271   575•    •   -0.10, 0.20, 0.20, 0.02, 0.20,-0.01, 0.18, 0.28, 0.11, 0.00,   DAT57500
00271   576•    •   -0.37,-0.10, 0.02, 0.16, 0.20, 0.00, 0.00, 0.00, 0.00, 0.07,   DAT57600
00271   577•    •    0.22, 0.11, 0.11, 0.21, 0.09, 0.21, 0.20, 0.37, 0.28, 0.07,   DAT57700
00271   578•    •    0.09,-0.29,-0.69,-0.69,-0.74,-0.89,-1.01,-0.86,-0.54,-0.19,   DAT57800
00271   579•    •    0.19, 0.23, 0.21, 0.29, 0.28, 0.29, 0.52, 0.54, 0.51, 0.60,   DAT57900
00271   580•    •    0.40, 0.49, 0.48, 0.46, 0.49, 0.27, 0.06,-0.33,-0.81,-1.17/   DAT58000
00273   581•        DATA          (C1(I),I=2471,2580)                               DAT58100
00273   582•    •   /-1.11,-1.37,-1.52,-1.54,-1.94,-2.06,-2.06,-2.14,-1.96,-2.00,  DAT58200
00273   583•    •   -2.00,-2.08,-2.23,-2.31,-2.31,-2.53,-2.31,-2.31,-2.31,-2.28,   DAT58300
00273   584•    •   -2.34,-2.34,-1.91,-1.82,-1.69,-1.56,-1.84,-1.91,-1.75,-1.83,   DAT58400
00273   585•    •   -1.76,-1.54,-1.98,-1.80,-1.68,-1.69,-1.56,-1.60,-1.71,-1.36,   DAT58500
00273   586•    •   -1.36,-1.44,-1.48,-1.40,-1.48,-1.36,-1.45,-1.49,-1.85,-1.39,   DAT58600
00273   587•    •   -1.23,-1.18,-1.18,-1.34,-1.36,-1.23,-1.23,-1.37,-1.30,-1.40,   DAT58700
00273   588•    •   -1.28,-1.27,-1.37,-1.32,-1.32,-1.22,-1.28,-1.38,-1.69,-2.07,   DAT58800
00273   589•    •   -2.42,-2.58,-2.58,-2.80,-2.58,-2.43,-1.88,-1.60,-1.26,-1.16,   DAT58900
00273   590•    •   -1.23,-1.10,-1.23,-1.10,-0.83,-0.80,-0.80,-0.80,-0.98,-0.97,   DAT59000
00273   591•    •   -0.87,-0.91,-0.92,-1.13,-1.24,-1.50,-1.98,-2.18,-2.32,-2.63,   DAT59100
00273   592•    •   -3.91,-4.20,-4.49,-4.78,-5.07,-5.07,-5.07,-5.07,-5.07,-5.07/   DAT59200
00273   593•    C                                                                  DAT59300
00273   594•    C *** SPECTRAL DATA:  UNIFORMLY MIXED GASES                        DAT59400
00273   595•    C                                                                  DAT59500
00275   596•        DATA          (C2(I),I=1,190)                                   DAT59600
00275   597•    •   /-4.25,-3.70,-3.20,-2.75,-1.90,-1.73,-1.51,-1.29,-1.11,-0.91,  DAT59700
00275   598•    •   -0.71,-0.51,-0.30,-0.60, 0.22, 0.49, 0.76, 1.08, 1.29, 1.56,   DAT59800
00275   599•    •    1.76, 1.91, 2.08, 2.23, 2.38, 2.51, 2.72, 2.90, 3.12, 3.37,   DAT59900
00275   600•    •    3.56, 3.69, 3.73, 3.86, 3.88, 3.86, 3.73, 3.58, 3.38, 3.17,   DAT60000
00275   601•    •    2.86, 2.73, 2.52, 2.31, 2.17, 2.01, 1.89, 1.77, 1.63, 1.47,   DAT60100
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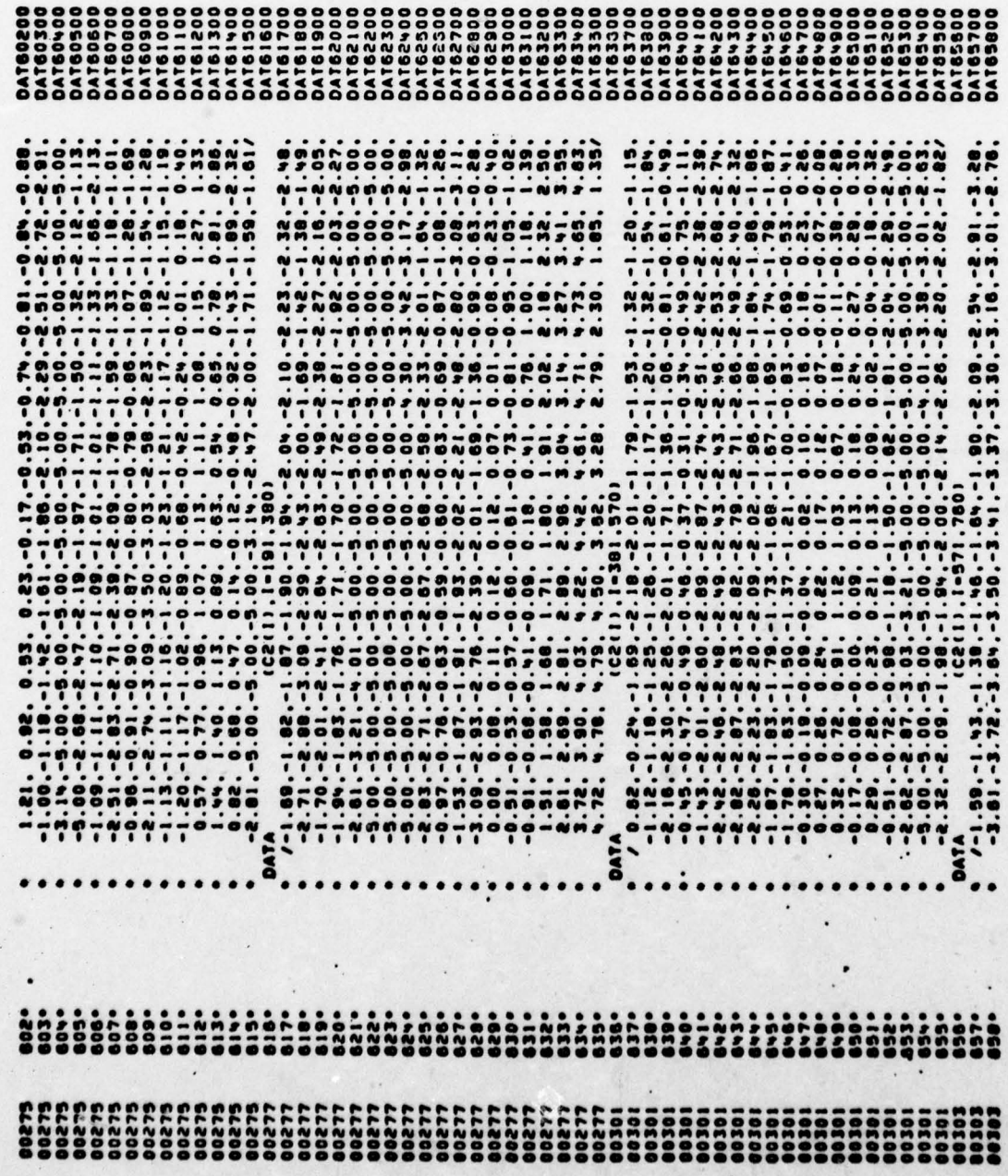

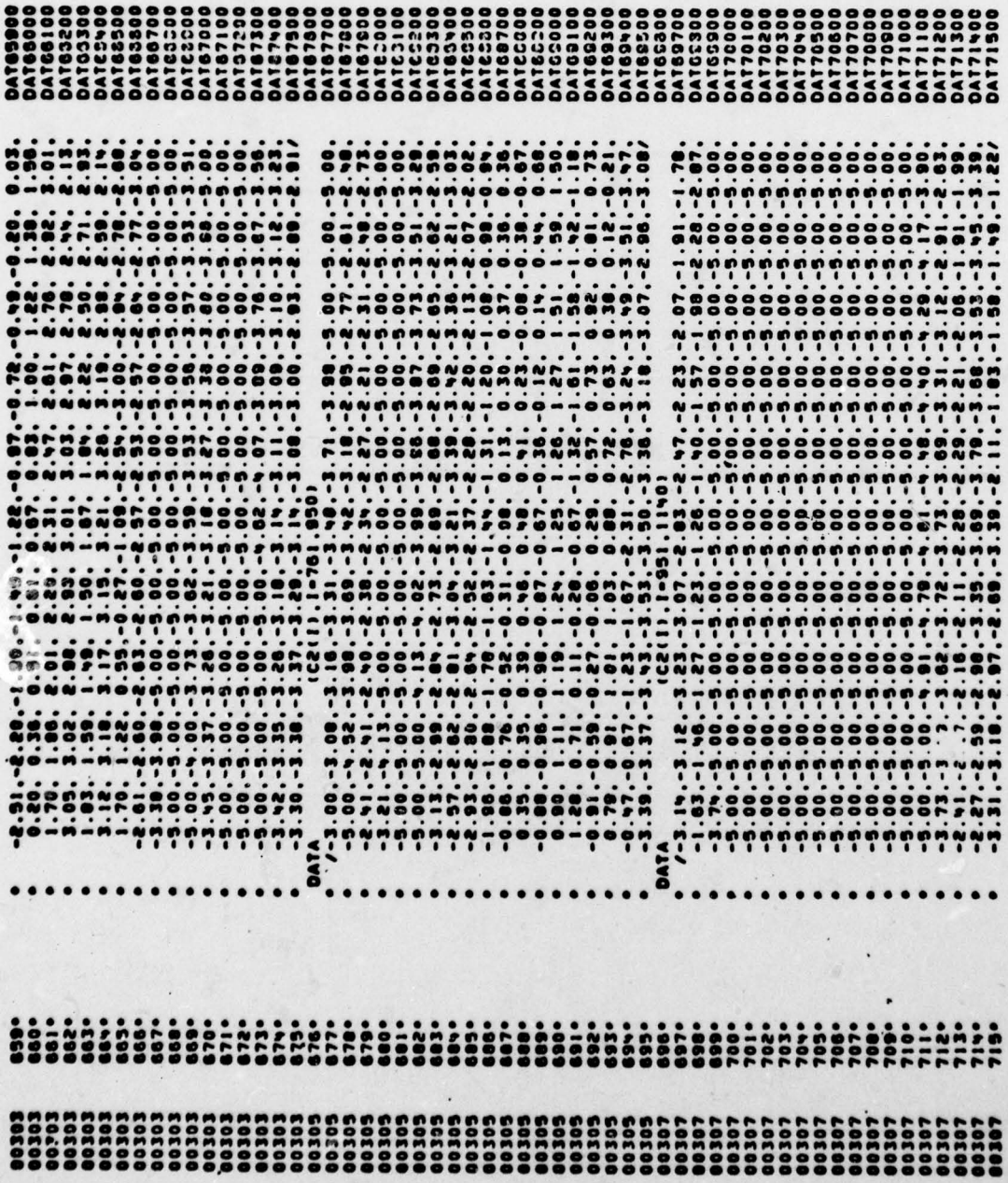

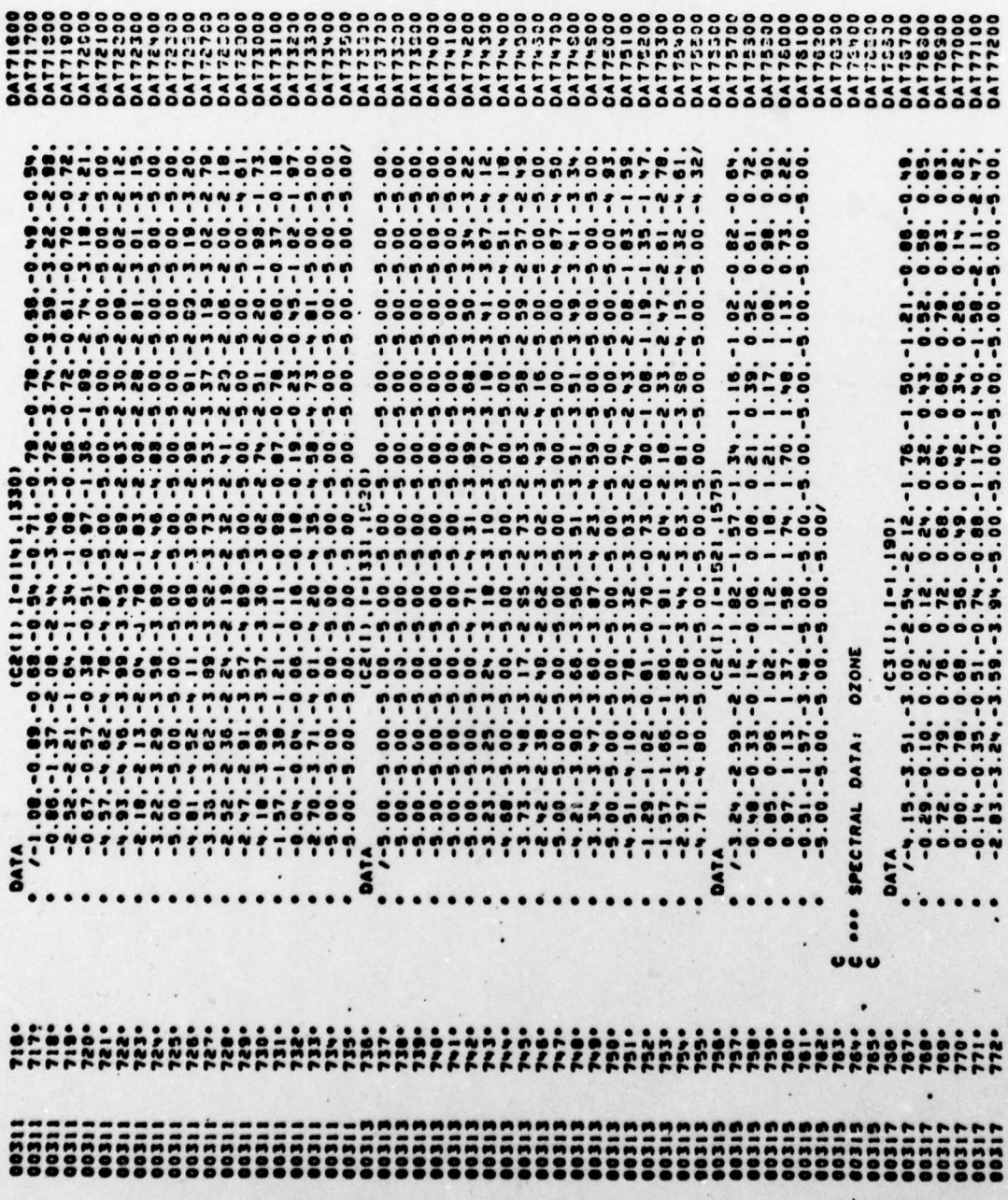

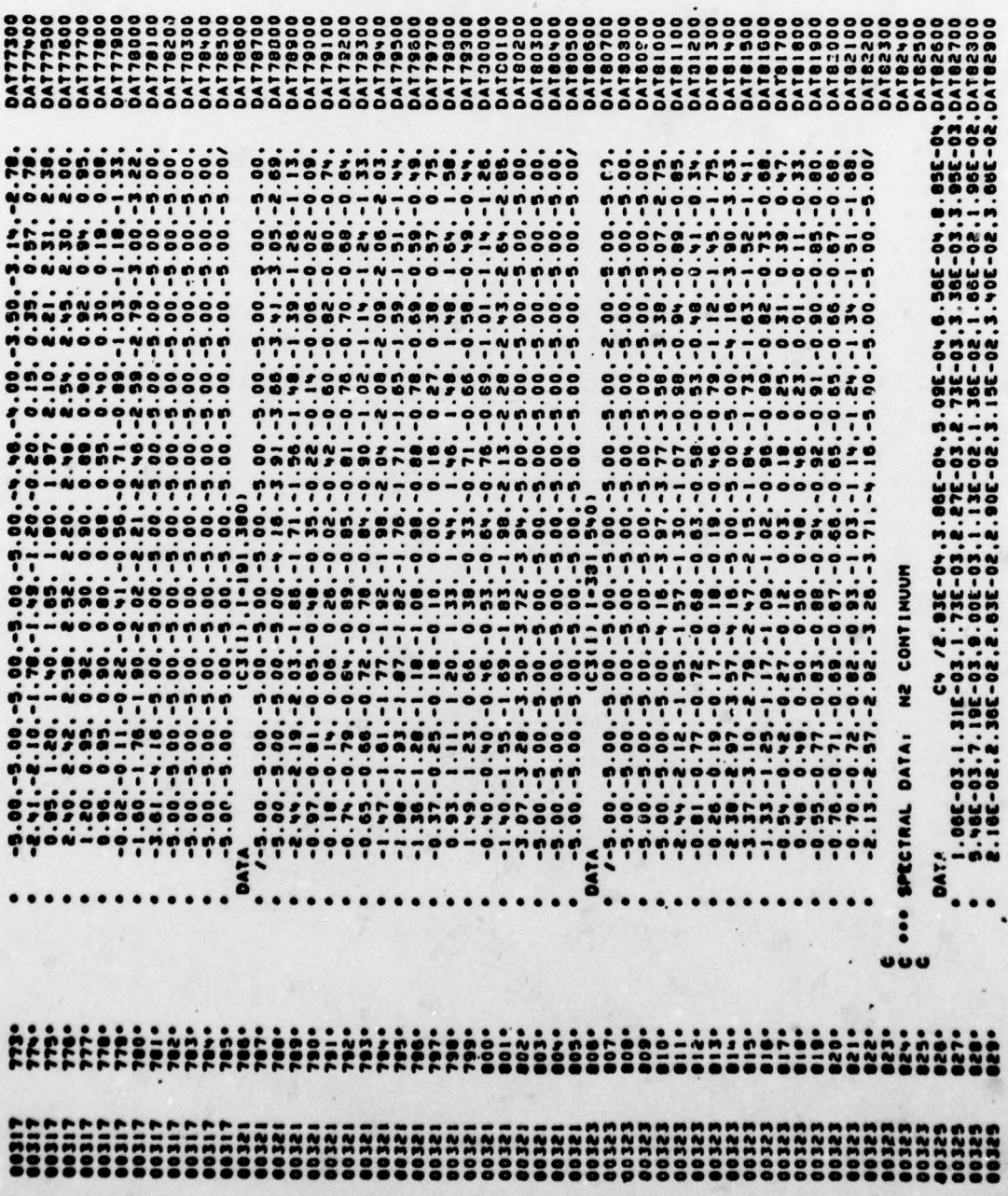

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00325   830*          *   3.92E-02,4.28E-02,4.60E-02,4.95E-02,5.30E-02,5.65E-02,6.00E-02,DAT03000
00325   831*          *   6.30E-02,6.60E-02,6.89E-02,7.18E-02,7.39E-02,7.60E-02,7.84E-02,DAT03100
00325   832*          *   8.08E-02,8.39E-02,8.70E-02,9.13E-02,9.56E-02,1.00E-01,1.20E-01,DAT03200
00325   833*          *   1.36E-01,1.52E-01,1.60E-01,1.69E-01,1.60E-01,1.51E-01,1.37E-01,DAT03300
00325   834*          *   1.23E-01,1.19E-01,1.16E-01,1.14E-01,1.12E-01,1.12E-01,1.11E-01,DAT03400
00325   835*          *   1.11E-01,1.12E-01,1.14E-01,1.13E-01,1.12E-01,1.09E-01,1.07E-01,DAT03500
00325   836*          *   1.02E-01,9.90E-02,9.50E-02,9.00E-02,8.65E-02,8.20E-02,7.65E-02,DAT03600
00325   837*          *   7.05E-02,6.50E-02,6.10E-02,5.50E-02,4.95E-02,4.50E-02,4.00E-02,DAT03700
00325   838*          *   3.75E-02,3.50E-02,3.10E-02,2.65E-02,2.50E-02,2.20E-02,1.95E-02,DAT03800
00325   839*          *   1.75E-02,1.60E-02,1.40E-02,1.20E-02,1.05E-02,9.50E-03,9.00E-03,DAT03900
00325   840*          *   8.00E-03,7.00E-03,6.50E-03,6.00E-03,5.50E-03,4.75E-03,4.00E-03,DAT04000
00325   841*          *   3.75E-03,3.50E-03,3.00E-03,2.50E-03,2.25E-03,2.00E-03,1.85E-03,DAT04100
00325   842*          *   1.70E-03,1.60E-03,1.50E-03,1.50E-03,1.54E-03,1.50E-03,1.47E-03,DAT04200
00325   843*          *   1.34E-03,1.25E-03,1.08E-03,9.08E-04,7.93E-04,6.41E-04,5.09E-04,DAT04300
00325   844*          *   4.04E-04,3.38E-04,2.86E-04,2.32E-04,1.94E-04,1.57E-04,1.31E-04,DAT04400
00325   845*          *   1.02E-04,8.07E-05/                                            DAT04500
00325   846*      C                                                                     DAT04600
00325   847*      C *** SPECTRAL DATA:  H2O CONTINUUM (4 MICRON REGION DATA)            DAT04700
00325   848*      C                                                                     DAT04800
00325   849*      C       NOTE - IN LOWTRAN 3, THE H2O CONTINUUM DATA WAS FOR THE       DAT04900
00325   850*      C            10 MICRON REGION.  IN LOWTRAN 3B, THIS DATA IS REPLACED  DAT05000
00325   851*      C            BY AN EMPIRICAL EQUATION.                                DAT05100
00325   852*      C                                                                     DAT05200
00327   853*           DATA             CS /0.230,0.187,0.147,0.117,0.097,0.087,0.100, DAT05300
00327   854*          *   0.120,0.147,0.174,0.200,0.240,0.280,0.330,0.000/              DAT05400
00327   855*      C                                                                     DAT05500
00327   856*      C *** SPECTRAL DATA:  AEROSOL EXTINCTION                              DAT05600
00327   857*      C                                                                     DAT05700
00327   858*      C *** AVERAGE CONTINENTAL AEROSOL MODEL                               DAT05800
00327   859*      C                                                                     DAT05900
00331   860*           DATA             (C7 (1,I),I=1,44)                             DAT06000
00331   861*          *  /0.28600,0.28000,0.26200,0.24500,0.18500,0.17600,0.14600,     DAT06100
00331   862*          *   0.13400,0.10800,0.08910,0.05790,0.03510,0.02860,0.02670,     DAT06200
00331   863*          *   0.02240,0.02150,0.02090,0.02100,0.01950,0.01820,0.01670,     DAT06300
00331   864*          *   0.01360,0.01190,0.01210,0.01330,0.00784,0.00809,0.01530,     DAT06400
00331   865*          *   0.02190,0.02380,0.02350,0.01850,0.01570,0.01350,0.01220,     DAT06500
00331   866*          *   0.00938,0.00827,0.01010,0.01100,0.00923,0.01010,0.00878,     DAT06600
00331   867*          *   0.00821,0.00808/                                             DAT06700
00331   868*      C                                                                     DAT06800
00331   869*      C *** RURAL AEROSOL MODEL                                             DAT06900
00331   870*      C                                                                     DAT07000
00333   871*           DATA             (C7 (2,I),I=1,44)                             DAT07100
00333   872*          *  /0.38223,0.32979,0.28540,0.22026,0.17989,0.15800,0.12084,     DAT07200
00333   873*          *   0.09151,0.07078,0.04184,0.03126,0.02510,0.02068,0.01900,     DAT07300
00333   874*          *   0.01767,0.01699,0.01654,0.01533,0.01479,0.01389,0.01569,     DAT07400
00333   875*          *   0.01102,0.01019,0.01778,0.01994,0.02112,0.02213,0.01870,     DAT07500
00333   876*          *   0.01744,0.01714,0.01588,0.01514,0.01455,0.01365,0.01339,     DAT07600
00333   877*          *   0.01286,0.01368,0.01384,0.01480,0.01353,0.01427,0.01381,     DAT07700
00333   878*          *   0.01302,0.01204/                                             DAT07800
00333   879*      C                                                                     DAT07900
00333   880*      C *** URBAN AEROSOL MODEL                                             DAT08000
00333   881*      C                                                                     DAT08100
00335   882*           DATA             (C7 (3,I),I=1,44)                             DAT08200
00335   883*          *  /0.35815,0.31452,0.27624,0.21638,0.17869,0.15800,0.12244,     DAT08300
00335   884*          *   0.09459,0.07434,0.04594,0.03574,0.02975,0.02451,0.02214,     DAT08400
00335   885*          *   0.02027,0.01940,0.01878,0.01693,0.01818,0.01518,0.01828,     DAT08500
00335   886*          *   0.01217,0.01141,0.01771,0.01947,0.02041,0.02121,0.01829,     DAT08600
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00335    887*          *   0.01719,0.01690,0.01577,0.01509,0.01454,0.01367,0.01341,      DAT88700
00335    888*          *   0.01289,0.01350,0.01355,0.01431,0.01317,0.01372,0.01323,      DAT88800
00335    889*          *   0.01249,0.01153/                                              DAT88900
00335    890*      C                                                                     DAT89000
00335    891*      C *** MARITIME AEROSOL MODEL                                          DAT89100
00335    892*      C                                                                     DAT89200
00337    893*            DATA              (C7 (4,I),I=1,44)                           DAT89300
00337    894*           * /0.18374,0.18391,0.17637,0.16615,0.16065,0.15800,0.15248,     DAT89400
00337    895*           *   0.14055,0.14487,0.13491,0.12826,0.12323,0.10682,0.11186,    DAT89500
00337    896*           *   0.10644,0.09893,0.09340,0.07573,0.06413,0.05932,0.05151,    DAT89600
00337    897*           *   0.04383,0.04239,0.04348,0.04619,0.04556,0.04282,0.03871,    DAT89700
00337    898*           *   0.03564,0.03344,0.02848,0.02729,0.02819,0.03378,0.03647,    DAT89800
00337    899*           *   0.04014,0.04205,0.04368,0.04481,0.04295,0.03973,0.03525,    DAT89900
00337    900*           *   0.03166,0.02641/                                            DAT90000
00337    901*      C                                                                     DAT90100
00337    902*      C *** SPECTRAL DATA:  AEROSOL ABSORPTION                              DAT90200
00337    903*      C                                                                     DAT90300
00337    904*      C *** AVERAGE CONTINENTAL AEROSOL MODEL                               DAT90400
00337    905*      C                                                                     DAT90500
00341    906*            DATA              (C7A(1,I),I=1,44)                           DAT90600
00341    907*           * /0.09530,0.05660,0.02060,0.01450,0.01050,0.01000,0.00914,     DAT90700
00341    908*           *   0.00914,0.01020,0.01080,0.00924,0.00348,0.00369,0.00908,    DAT90800
00341    909*           *   0.00487,0.00232,0.00222,0.00171,0.00143,0.00154,0.00248,    DAT90900
00341    910*           *   0.00295,0.00360,0.00423,0.00629,0.00504,0.00702,0.01160,    DAT91000
00341    911*           *   0.01180,0.01310,0.01430,0.00937,0.00698,0.00549,0.00439,    DAT91100
00341    912*           *   0.00386,0.00484,0.00691,0.00807,0.00506,0.00587,0.00565,    DAT91200
00341    913*           *   0.00562,0.00501/                                            DAT91300
00341    914*      C                                                                     DAT91400
00341    915*      C *** RURAL AEROSOL MODEL                                             DAT91500
00341    916*      C                                                                     DAT91600
00343    917*            DATA              (C7A(2,I),I=1,44)                           DAT91700
00343    918*           * /0.07845,0.03861,0.02110,0.01317,0.01114,0.01095,0.00968,     DAT91800
00343    919*           *   0.01058,0.01070,0.00933,0.00700,0.00437,0.00483,0.00584,    DAT91900
00343    920*           *   0.00250,0.00214,0.00232,0.00321,0.00388,0.00462,0.00745,    DAT92000
00343    921*           *   0.00617,0.00807,0.01254,0.01128,0.01209,0.01378,0.01005,    DAT92100
00343    922*           *   0.00832,0.00810,0.00680,0.00570,0.00535,0.00516,0.00523,    DAT92200
00343    923*           *   0.00538,0.00834,0.00696,0.00767,0.00677,0.00767,0.00767,    DAT92300
00343    924*           *   0.00749,0.00761/                                            DAT92400
00343    925*      C                                                                     DAT92500
00343    926*      C *** URBAN AEROSOL MODEL                                             DAT92600
00343    927*      C                                                                     DAT92700
00345    928*            DATA              (C7A(3,I),I=1,44)                           DAT92800
00345    929*           * /0.08885,0.05331,0.03938,0.03011,0.02640,0.02498,0.02160,     DAT92900
00345    930*           *   0.02050,0.01905,0.01548,0.01272,0.00998,0.00920,0.00957,    DAT93000
00345    931*           *   0.00822,0.00589,0.00503,0.00575,0.00608,0.00649,0.00854,    DAT93100
00345    932*           *   0.00729,0.00834,0.01253,0.01141,0.01207,0.01344,0.01028,    DAT93200
00345    933*           *   0.00878,0.00858,0.00743,0.00646,0.00612,0.00587,0.00589,    DAT93300
00345    934*           *   0.00595,0.00837,0.00714,0.00770,0.00689,0.00759,0.00751,    DAT93400
00345    935*           *   0.00729,0.00730/                                            DAT93500
00345    936*      C                                                                     DAT93600
00345    937*      C *** MARITIME AEROSOL MODEL                                          DAT93700
00345    938*      C                                                                     DAT93800
00347    939*            DATA              (C7A(4,I),I=1,44)                           DAT93900
00347    940*           * /0.01647,0.00710,0.00383,0.00223,0.00183,0.00178,0.00153,     DAT94000
00347    941*           *   0.00189,0.00191,0.00200,0.00181,0.00243,0.00389,0.05619,    DAT94100
00347    942*           *   0.00711,0.00298,0.00344,0.00629,0.00554,0.02521,0.01019,    DAT94200
00347    943*           *   0.00993,0.01071,0.01190,0.01202,0.01208,0.01218,0.01098,    DAT94300
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00347   944*          *   0.01072,0.01075,0.01184,0.01440,0.01784,0.02531,0.02785,        DAT94400
00347   945*          *   0.03035,0.03158,0.03182,0.03158,0.02978,0.02734,0.02442,        DAT94500
00347   946*          *   0.02218,0.01915/                                                DAT94600
00347   947*      C                                                                       DAT94700
00347   948*      C *** SPECTRAL DATA:  OZONE - UV AND VISIBLE                            DAT94800
00347   949*      C                                                                       DAT94900
00351   950*            DATA              C0 /4.50E-03,8.00E-03,1.07E-02,1.10E-02,1.27E-02,DAT95000
00351   951*          *   1.71E-02,2.00E-02,2.45E-02,3.07E-02,3.84E-02,4.78E-02,5.67E-02,DAT95100
00351   952*          *   8.54E-02,7.62E-02,9.15E-02,1.00E-01,1.09E-01,1.20E-01,1.28E-01,DAT95200
00351   953*          *   1.12E-01,1.11E-01,1.18E-01,1.19E-01,1.13E-01,4.06E-02,3.87E-02,DAT95300
00351   954*          *   3.82E-02,2.94E-02,2.09E-02,1.80E-02,1.91E-02,1.66E-02,1.03E-01,DAT95400
00351   955*          *   9.24E-02,8.28E-02,7.57E-02,7.07E-02,6.58E-02,5.56E-02,4.77E-02,DAT95500
00351   956*          *   1.17E-02,7.70E-03,8.10E-03,8.50E-03,8.10E-03,3.70E-03,3.20E-03,DAT95600
00351   957*          *   3.10E-03,2.55E-03,1.98E-03,1.40E-03,8.25E-04,2.50E-04,0.00E-04,DAT95700
00351   958*          *   0.00E-04,0.00E-04,5.65E-04,2.04E-03,7.35E-03,2.03E-02,4.98E-02,DAT95800
00351   959*          *   1.18E-01,2.46E-01,5.18E-01,1.02E-00,1.85E-00,3.79E-00,6.65E-00,DAT95900
00351   960*          *   1.24E+01,2.20E+01,3.67E+01,5.95E+01,8.50E+01,1.26E+02,1.68E+02,DAT96000
00351   961*          *   2.06E+02,2.42E+02,2.71E+02,2.91E+02,3.02E+02,3.03E+02,2.94E+02,DAT96100
00351   962*          *   2.77E+02,2.54E+02,2.26E+02,1.96E+02,1.68E+02,1.44E+02,1.17E+02,DAT96200
00351   963*          *   9.75E+01,7.65E+01,6.04E+01,4.62E+01,3.46E+01,2.52E+01,2.00E+01,DAT96300
00351   964*          *   1.57E+01,1.20E+01,1.00E+01,8.80E-00,8.30E-00,8.60E-00/          DAT96400
00393   965*           END                                                                DAT96500

      END OF COMPILATION:        NO  DIAGNOSTICS.
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1.      IN LOWTRAN.MAIN
2.      IN LOWTRAN.BLOCKDATA
3.      LIB LOWTRAN.
4.      END

ADDRESS LIMITS     001000 025014      10253 IBANK WORDS DECIMAL
                   040000 064136      10335 DBANK WORDS DECIMAL
STARTING ADDRESS   015554


          SEGMENT $MAIN$          001000 025014      040000 064136

NSHTC$/FOR69            $(1)    001000 001024
NRBLK$/FOR68            $(1)    001025 001047
NRWND$/FOR68            $(1)    001050 001131      $(2)    040000 040011
NWEF$/FOR69             $(1)    001132 001335      $(2)    040012 040031
NBDCV$/FOR64            $(1)    001336 001483      $(2)    040032 040074
NFTCH$/FOR69            $(1)    001484 001746      $(2)    040075 040110
NFTV$/FOR               $(1)    001747 001771
NCNVT$/FOR68            $(1)    001772 002213      $(2)    040111 040205
NCLOS$/FOR68            $(1)    002214 002404      $(2)    040206 040236
NWBLK$/FOR68            $(1)    002405 002516
NGSJL$/FOR68            $(1)    002517 002557
NUPDA$/FOR68            $(1)    002560 002613
NBF00$/FOR                                         $(2)    040237 042440
NOUT$/FOR69A            $(1)    002614 003773      $(2)    042441 042500
NIOER$/FOR69            $(1)    003774 004163      $(2)    042501 042637
NOTIN$/FOR69A           $(1)    004164 004460      $(2)    042640 042645
NININ$/FOR69A           $(1)    004461 004651      $(2)    042646 042651
NINPT$/FOR69            $(1)    004652 005660      $(2)    042652 042702
NFMT$/FOR69             $(1)    005661 006535      $(2)    042703 042757
NFCHK$/FOR69A           $(1)    006536 007534      $(2)    042760 043135
                                                   $(4)    043136 043207
NTAB$/FOR69A                                       $(2)    043210 043246
NERR$/FOR69A            $(1)    007535 010213      $(2)    043247 043441
TAN.OTAN$/FOR59         $(1)    010214 010411      $(2)    043442 043462
ALOG$/FOR59             $(1)    010412 010531      $(2)    043463 043523
ATAN$/FOR59             $(1)    010532 010735      $(2)    043524 043559
ASINCOS$/FOR59          $(1)    010736 011152      $(0)    043560 043803
SQRT$/FOR59             $(1)    011153 011213      $(2)    043804 043815
SINCOS$/FOR59           $(1)    011214 011346      $(2)    043816 043837
EXP$/FOR59              $(1)    011347 011436      $(2)    043840 043860
NEXP6$/FOR68            $(1)    011437 011633      $(2)    043681 043732
NSTOP$/FOR69A           $(1)    011634 011666      $(2)    043733 043743
NOBUF$/FOR69A           $(1)    011667 011730
NIER$/FOR69             $(1)    011731 012112      $(2)    043744 044064
NIBUF$/FOR68            $(1)    012113 012152      $(2)    044065 044065
QQNWC(COMMONBLOCK)                                         044066 044073
NINTR$/FOR69A           $(1)    012153 012413      $(2)    044074 044150
                                                   $(8)    QQNWC
POINT                   $(1)    012414 013100      $(0)    044151 044248
                        $(3)    LOWTRN             $(2)    BLANK$COMMON
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ANGL                          S(1)    013101 015553        S(0)    044247 044452
                              S(3)    LOWTRN               S(2)    BLANKSCOMMON
LOWTRN(COMMONBLOCK)                                             044453 062410
BLANKSCOMMON(COMMONBLOCK)
MAIN                          S(1)    015554 025014        S(0)    062411 064135
                              S(3)    LOWTRN               S(2)    BLANKSCOMMON
BLOCKDATA                     S(3)    LOWTRN               S(0)    064136 064136
                                                           S(2)    BLANKSCOMMON

SYS$*RLIB$. LEVEL 72-8
END MAP
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MAJOR SYMBOLS AND DEFINITIONS

AB	Absorption at frequency V; also average transmittance
AHZ1, AHZ2	Aerosol number density
AJ	Equivalent absorber amount per km at level J
ALP	Angle of arrival at adjacent level
ANGLE	Input zenith angle (degrees)
BET	Angle subtended at the earth's center as path traverses adjacent levels
BETA	Total angle subtended by path at earth's center
BJ	Equivalent absorber amount per km at level J + 1
CA	Conversion factor from degrees to radians
CO	Wavelength dependent coefficient used in refractive index expression
CW	Wavelength dependent coefficient used in refractive index expression
C1	Log absorption coefficient for water vapor
C2	Log absorption coefficient for uniformly mixed gases
C3	Log absorption coefficient for ozone
C4	Absorption coefficient for nitrogen ($\sim$4μm)
C5	Absorption coefficient for water vapor continuum ($\sim$4μm)
C6	Extinction coefficient for molecular scattering
C7	Extinction coefficient for aerosol models
C7A	Aerosol absorption coefficient
C8	Absorption coefficient for ozone (UV and visible regions)
D	Water vapor amount (pr. cm/km) at level I
DP	Dew point temperature (°C)
DS	Path length from level I to Level I + 1
DV	Wavenumber increment at which transmittance is calculated
DZ	Height increment from level I to level I + 1
E(K)	Equivalent absorber amounts per km at height H1
EH(1,I)	Equivalent absorber amount per km for water vapor at level Z(I)
EH(2,I)	Equivalent absorber amount per km for carbon dioxide, etc. at level Z(I)
EH(3,I)	Equivalent absorber amount per km for ozone at level Z(I)
EH(4,I)	Equivalent absorber amount per km for nitrogen at level Z(I)
EH(5,I)	Equivalent absorber amount per km for water vapor continuum at level Z(I)
EH(6,I)	Equivalent absorber amount per km for molecular scattering at level Z(I)
EH(7,I)	Equivalent absorber amount per km for aerosol extinction at level Z(I)
EH(8,I)	Equivalent absorber amount per km for ozone (UV and visible) at level Z(I)
EH(9,I)	Mean refractive index of layer above level Z(I)

EV	Integrated absorber amount from level I to level I+1
FAC	Factor for exponential and linear interpolation
FO	Transmission function logarithmic absorber amount scale for ozone
FW	Transmission function logarithmic absorber amount scale for water vapor and the uniformly mixed gases
H	Altitude (km)
H1	Initial altitude (km)
H2	Final altitude (km)
HAZE	Aerosol number density (no. cm^{-3})
HM	Estimated tangent height (km)
HMIN	Minimum altitude of path trajectory (km)
HZ1	Aerosol number density (no. cm^{-3}) for 23 km visual range
HZ2	Aerosol number density (no. cm^{-3}) for 5 km visual range
I	Running integer used as altitude (level) indicator
IAERO	Indicator for type of aerosol model
IATM	Number of levels in model atmosphere
IDV	Frequency increment (cm^{-1})
IFIND	Indicator for using subroutine ANGL
IHAZE	Aerosol model indicator
IM	Parameter used when reading in a new atmospheric model
IP	Indicator for using subroutine POINT to calculate refractive index only (IP = 0) or equivalent absorber amounts also (IP ≠ 0).
IR	Card printer number
ITER, ITES	Iteration counters
ITYPE	Indicator for type of atmospheric path
IV	Frequency at which transmittance is calculated
IV1	Starting frequency
IV2	Last frequency
IW	Line printer number
IXY	Parameter for terminating program and cycling indicator
J	Running integer for altitude identification
JMIN	Altitude indicator for minimum height of path
JP	Print option parameter
J1	Level indicator for altitude H1
J2	Level indicator for altitude H2
K	Absorber indicator, K = 1, 2, 3, etc., corresponds to water vapor, uniformly mixed gases, ozone, etc., respectively
K2	Cycling parameter for downward looking paths
L	Frequency indicator for ozone transmittance calculation
LEN	Parameter used for defining longest of two paths
M	Integer used to identify required model atmosphere
ML	Number of levels in radiosonde data input (MODEL - 7)
MODEL	Integer used to identify required model atmosphere

M1	Integer for selecting temperature altitude profile for (M=M1)
M2	Integer for selecting water vapor altitude profile for (M=M2)
M3	Integer for selecting ozone altitude profile for (M=M3)
N	Indicator for level below given input altitude used in POINT subroutine
NL,NLP	Number of levels in model atmosphere data
NP	Indicator for determining whether H1 or H2 coincide with levels in the model atmosphere
NP1	Value of NP for altitude H1
NP2	Value of NP for altitude H2
NS1,NS2,NS3	Counters corresponding to WS1, WS2, WS3
P(M,I)	Pressure (mb) at level I for model atmosphere M
PHI	Angle of arrival at H2
PI	3.141592654, that is π
PPW	Partial pressure of water vapor (in atmospheres)
PS	Total pressure in atmospheres
PSI	Angular deviation of path from initial direction
PT	Product of total pressure (atm) and the square root of 273/T(M,I)
RANGE	Path length (km)
RE,REARTH	Earth radius (km)
REF	Refractive index of air at level I
RH	Relative humidity (%)
RN	Ratio of refractive indices of air above and below a given level
RX	Ratio of earth center distances between adjacent levels
RO	Earth radius (km) read in as input (=RE)
R1	The product of the sine of the initial zenith angle and the earth center distance to starting altitude
SALP	Sine of angle of arrival at adjacent level
SPHI	Sine of the local zenith angle at a given level
SR	Slant range (km)
SUM	Accumulated integrated absorption
T(M,I)	Temperature (K) for model atmosphere M at level I
THET	Zenith angle at a given level (in radians)
THETA	Zenith angle at a given level (in degrees)
TMP	Ambient temperature (°C)
TR	Transmittance scales for transmission functions
TS	Ratio of standard temperature (273.15K) to temperature at level I
TS1	Ratio of 296.0K to temperature at level I
TT	Ratio 273.15/(TMP + 273.15)
TX(K)	Equivalent absorber amounts per km at a given altitude obtained from POINT; also transmittance values at a given wavelength for each absorber type (K = 1, 8)
TX(9)	Total transmittance at frequency IV
TX(10)	Absorption due to aerosol only at frequency IV

TX1	Refractive index of layer above initial altitude H1
TX2	Refractive index of layer above final altitude H2
TX3	Refractive index of layer above minimum altitude HMIN
VH(K)	Integral of the equivalent absorber amounts from H1 to level I
VIS	Visual range (km) at sea level
VX	Wavelength at which aerosol coefficients are read in (μm)
V1	Initial frequency for transmittance calculation, cm^{-1}
V2	Final frequency for transmittance calculation, cm^{-1}
W(K)	Total equivalent absorber amount for entire path
WH(M,I)	Water vapor density for atmospheric model M at level I ($gm\ m^{-3}$)
WL,WL1,WL2	Wavelength in microns
WO(M,I)	Ozone density for atmospheric model M at level I ($gm\ m^{-3}$)
WS1	Transmission function scaling factor for water vapor at given wavelength
WS2	Transmission function scaling factor for carbon dioxide, etc., at given wavelength
WS3	Transmission function scaling factor for ozone at given wavelength
X	Input height to POINT subroutine
XI	Wavenumber interpolation parameter
XX	Wavenumber identification parameter for UV ozone transmittance calculation
X1	Earth center distance of level I
X2	Earth center distance of level I + 1
YN	Refractive index of layer <u>below</u> input height from POINT subroutine
YN1	Refractive index of layer below initial altitude II1
YN2	Refractive index of layer below final altitude H2
YY	Aerosol absorption coefficient at frequency V
Z(I),ZO(I)	Altitude at level I in km

CONCLUSIONS

LOWTRAN is, in the author's opinion, the best available computer code for analyzing atmospheric transmittance effects on electro-optical systems. As such, it should be used in the evaluation of all electro-optic type sensors. With the release of LOWTRAN IIIB, several previously valid criticisms have been accounted for; in addition, the U.S. Air Force Geophysics Laboratory continues to improve and upgrade the existing code.

The author would appreciate being notified of any difficulties or problems that arise when using NWC/LOWTRAN. Also, any assistance that may be required, either in using the existing code or in modifying the code for use in a simulation, can be obtained by contacting the author.

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