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# User's Guide for SBUV/TOMS Ozone Derivative Products

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# User's Guide for SBUV/TOMS Ozone Derivative Products

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USER'S GUIDE FOR SBUV/TOMS OZONE DERIVATIVE PRODUCTS

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Total ozone and ozone vertical profile results for Solar Backscattered Ultraviolet/Total Ozone Mapping Spectrometer (SBUV/TOMS) operation from November 1978 to November 1980 are available. The algorithms used have been tested, the instrument performance examined, and the ozone results have been compared with Dobson, Umkehr, balloon, and rocket observations. The accuracy and precision of the satellite ozone data is good to at least within the ability of the the ground truth to check.

The primary input to the ozone retrieval algorithms is the ratio of the backscattered radiance to the incident solar irradiance. Radiance and irradiance are each measured separately by both the SBUV and TOMS instruments. Accuracy in the determination of the radiance/irradiance ratio depends upon the calibration accuracy of a diffuse reflector used to measure the solar irradiance. Precision in the measurement of the radiance/irradiance is better than 0.5% for SBUV and 1.0% for TOMS. Analysis indicates that the instrument diffuser used for measuring solar flux had degraded by .8% at 339.8 nm and 2.3% at 273.5 nm by the end of the first year. By the end of the second year the degradation of the diffuser had reached 3.5% at 339.8 nm and 10.5% at 273.5 nm. The acceleration of the degradation is due to the more frequent deployment of the diffuser in the second year. The uncertainty of the estimated diffuser degradation is $\pm$ 20% of the magnitude of the degradation at the end of the second year. The second year ozone data processing includes a correction for diffuser degradation but the first year did not. This introduces an artifact in the ozone data for the first year. Diffuser degradation appears to be linear with time during the first year and the error in the derived ozone increases linearly until the end of the first year data set (Oct 1979); from then on no significant error due to diffuser degradation is expected to be present in the ozone data set. This will introduce a downward drift in the ozone derived by SBUV/TOMS for the first year at a rate that varies with height from 5% in one year at 1 mb to less than 1% at 10 mb; in total ozone the drift is estimated to be about 0.5% in one year for both SBUV and TOMS. This drift causes the annual average first year ozone to be too low by half of this amount. Measured against Dobson, total ozone derived by TOMS has increased from year 1 to year 2 by 0.34 $\pm$ 0.17%; similarly, comparison of SBUV with layer 9 (1-2 mb) Umkehr ozone shows an increase of 5.0 $\pm$ 1.3% from year 1 to

year 2. Most of this is explained by the uncorrected diffuser degradation in the first year. We are continuing to assess the instrument performance as the third and fourth years of data are becoming available.

Total ozone has been derived from both the SBUV and TOMS instruments. Analysis of the variance of comparisons between colocated TOMS and AD pair direct sun (00 code) Dobson observations at solar zenith angles up to $70^{o}$ shows that total ozone retrieval precision is better than 2%. In the first year there are biases of -6.5% and -8.3% for TOMS and SBUV respectively when compared to the Dobson network; in the second year the biases reduce to -6.2% and -8.0% respectively. If new ozone absorption coefficients available on a preliminary basis from the National Bureau of Standards were used for both SBUV/TOMS and the Dobson measurements, the biases would be 3 and 0% respectively.

Vertical profiles of ozone have been derived from the SBUV step scan radiances using an optimum statistical inversion algorithm. The inferred SBUV profiles are determined primarily by the measurements for an altitude range which typically extends from 0.7 mbar ( $\sim$ 50 km) down to the peak of the ozone density profile, 20-40 mb ( $\sim$ 22-26 km). This altitude range depends on several factors including the solar zenith angle, the total ozone amount, and the shape of the ozone profile. The reported layer ozone amounts below this region depend substantially on the **a priori** statistical information about the ozone variance in these layers as well as on the observed total ozone and upper level profile amounts.

The Nimbus-4 BUV ozone data archived at NSSDC in 1980 was derived from an algorithm different from that used for SBUV/TOMS. Comparison of 1970-1977 Ozone values from N4 with ozone values for 1978 and on from Nimbus 7 will contain substantial artifacts unless this algorithmic change is accounted for.

Variations of UV solar flux associated with the rotation of active regions on the sun with a 27-day solar rotation period have been observed with the continuous scan solar flux observations (160-400 nm). However, no significant solar flux variation was observed at the wavelengths used for the total ozone and vertical profile retrievals except at 273.5 nm with an amplitude less than 1/2%. In the processing of the first year data, a long term smoothed solar flux with no 27 day component was used at all wavelengths including 273.5 nm. This could have introduced a small (less than 1/2 %) artifact in the upper level ozone data. In the processing of the second year data the possibility of such error has been eliminated by using the short term smoothed solar flux data which reflect the 27 day variability at 273.5 nm.

The second year SBUV/TOMS ozone data sets have not been corrected for the effects of the Mt. St. Helen volcano that erupted starting May 18, 1980. In areas where the volcanic cloud had been known to be present the total ozone values derived by the algorithm show increases of up to 200 m-atm-cm. This effect is most likely caused by the presence of $SO_2$ in the volcanic cloud. As the cloud disperses and the $SO_2$ is converted to sulfate aerosols this effect disappears with a time constant that has not yet been determined. Since this particular volcanic cloud did not reach very high altitudes its effect on the SBUV profiles above the ozone density peak is not significant.

Ground truth for the validation of SBUV ozone profiles is severely limited; there are fewer than ten Umkehr and ozonesonde stations that report ozone profiles with any regularity and only eight individual ozone rocketsonde profiles taken during the SBUV overpass are so far available. Based on this limited amount of data it is not possible to determine accurately the quality of SBUV profiles at all heights or to evaluate possible latitudinal and temporal trends in the SBUV data. The bias between SBUV and the ground based sensors is less than 10% at all altitudes between 20-50 km and the SBUV precision is better than 5%. Some of the observed bias could be due to errors in the ozone absorption cross-sections used in the retrieval schemes of both the satellite and ground sensors, and to the effects of aerosols and dust on Umkehr-derived ozone.

Comparison of balloon data with SBUV results from the Payerne and Hohenpeissenberg stations confirms that the profile data has substantial information content even below the ozone maximum (i.e. from 25 km to the surface). We estimate a precision better than 10% in layers 4 and 5 and better than 15% in layer 3 and 20% in layer 2. It is clear that the retrievals provide better information in the mid latitudes than can be derived solely from knowledge of total ozone and climatology.

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SBUV/TOMS NET

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Note on Error in Diffuse Reflector Angular Calibration

Continued evaluation of the characteristics of the diffuse reflector used to measure solar irradiance has lead to the discovery of an error in its angular calibration. This causes a systematic error in the irradiance measurements which is shown in Figure i.

This irradiance error introduces a systematic error in the albedos used to calculate total ozone and ozone profiles. Our estimate is that the maximum error introduced into the total ozone values is less than $\pm$0.5%. The error introduced into the profile data is altitude dependent and ranges from $\pm$2% at 1 mb to less than $\pm$0.5% below 10 mb and its time dependence will have roughly the same shape as shown in Figure 2.1.

This error will be removed prior to processing the third and subsequent years of SBUV data.

The entire SBUV data set will be reprocessed to incorporate: a volcano correction; improved ozone absorption coefficients; an improved ozone climatology; and other minor changes following the 1984 Quadrennial Ozone Symposium. A consistent calibration method will be used which will remove both this error and the difference between first and second year processing described in the preceeding NET Validation Statement.

The goniometric calibration function for TOMS is different from that for SBUV because the diffuser plate is oriented differently when being used at TOMS than at SBUV. The TOMS goniometry was derived using a technique based on in-flight data. The TOMS goniometric correction function is being reviewed at present. We estimate, however, that based on equatorial albedo comparisons with SBUV that the TOMS goniometric errors may be similar in peak-to-peak magnitude to SBUV but have different time dependence. Consequently, we expect errors in TOMS total ozone of less than $\pm$.5%.

Additional information about this systematic error can be obtained by contacting A. Fleig, Nimbus Project Scientist or D. Heath, SBUV/TOMS NET Team Leader.

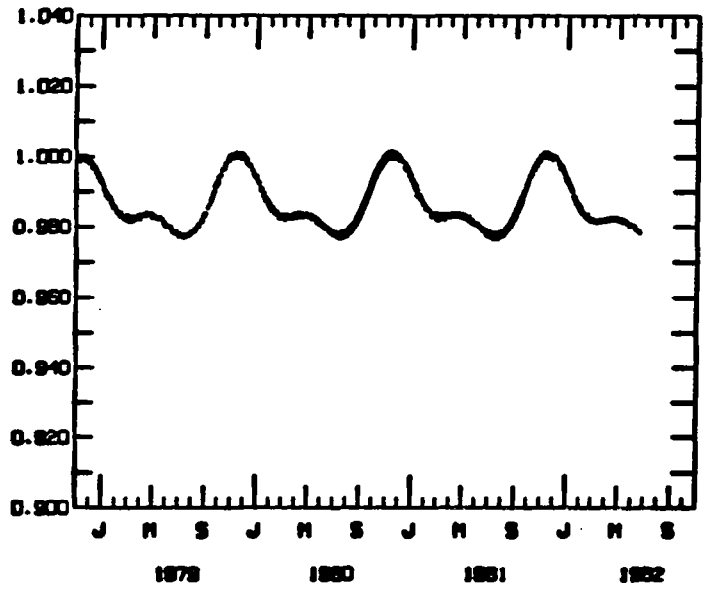



Figure i: System Matic Error in Irradiance Measurement

# 1.0 INTRODUCTION

## 1.1 Contents of this Guide

This guide is intended to provide users with the information needed to utilize the data products derived from the Solar Backscattered Ultraviolet (SBUV) and Total Ozone Mapping Spectrometer (TOMS) ozone data sets. First, a brief description of the SBUV and TOMS experiments is given. Then, a discussion is presented of several characteristics of the ozone data sets which deserve special consideration by users of the derived products. After this, a detailed description of each of the products including its derivation and presentation format is given. These products include:

Matrix-S Microfilm
: Orbital height-latitude cross-sections of the SBUV profile data

Matrix-T Microfilm
: Daily global total ozone contours in polar coordinates

Matrix-T Tape
: Daily averages of total ozone in global 5 x 5 degree latitude-longitude grid

Zonal Means Tapes
: Daily, monthly and quarterly averages of total ozone and profile data in 10 degree latitude zones.

Tables Microfilm
: Tabular presentation of zonal means

SBUV Contours Tape and Microfilm
: Daily global total ozone and profile contours in polar coordinates

Table 1-1 summarizes these products, and indicates the Nimbus-7 tape and microfilm specification numbers assigned to each.

Two years of data are currently available from the National Space Science Data Center (NSSDC) for most of these products. See Data Availability and Cost, Appendix E, and the Tape and Film Catalogs, Appendix F.

These products are derived from the Ozone-S and Ozone-T tapes, which are the primary product of the SBUV/TOMS retrieval system. The ozone tapes are also available through the NSSDC and are described in detail in the User's Guides for the SBUV (Reference 1)* and TOMS (Reference 2)* first year ozone data sets, and addenda (References 6, 7).

* See Appendix A - References

## 1.2 Other Products Currently Available

Other products available from the NSSDC for the SBUV/TOMS experiment include the Raw Units Tapes (RUT-S and RUT-T) which contain uncalibrated radiance and irradiance data, housekeeping data, wavelength and electronic calibration data, instrument field of view location and solar ephemeris information. They also contain colocated cloud, terrain height and snow/ice thickness data, each derived from an independent source. These tapes are described in the RUT Users Guide (Reference 3)*

Also available from NSSDC are high density ozone data sets (HDSBUV and HDTOMS) which duplicate the Ozone-S and Ozone-T data sets except that they are on 6250 bpi magnetic tapes instead of 1600 bpi. One year of Ozone-S tapes has typically 52 tapes, but the same data on the HDSBUV tape requires 4 tapes. For TOMS data, the comparable numbers are typically 156 and 18 (References 6, 7).*

## 1.3 Other Products to be Available

Other derived products will be made available through the NSSDC in the future. These include:

a. An SBUV solar flux/continuous scan units tape containing all continuous scan solar flux and earth radiance data, step scan solar flux data, housekeeping summaries for each orbit, and electronic and wavelength calibration data. This will be a subset of the RUT-S tape described above.

b. A TOMS solar flux units tape containing all solar flux data, housekeeping summaries for each orbit, and electronic and wavelength calibration data. This will be a subset of the RUT-T tape described above.

c. A calibrated SBUV continuous scan solar flux data set.

d. A calibrated SBUV daytime continuous scan earth radiance data set.

e. A calibrated SBUV step scan solar flux data set.

*See Appendix A — References

f. A calibrated TOMS step scan solar flux data set.

g. A compressed ozone data set (CPOZ) containing selected data items from each Ozone-S tape record, so that one year of compressed data fits on three 1600 bpi tapes.

h. A gridded TOMS data set containing daily grid point arrays.

Table 1-1

Summary Chart of Available Products

| | Tapes | Specification No. | Description |
|---|---|---|---|
| | Matrix-T | T634271 | TOMS Gridded Data |
| | ZMT-S | T634061 | SBUV Zonal Means |
| | ZMT-T | T634161 | TOMS Zonal Means |
| | SBUV Contours | T634171 | SBUV Polar Stereographic Contours |
| Microfilm | | | |
| | Matrix-S | F634030 | SBUV Orbital Cross-Section Contours |
| | Matrix-T | | TOMS Polar Stereographic Contours |
| | | F633101 | Daily |
| | | F633701 | Monthly (avg.) |
| | | F633801 | Quarterly (avg.) |
| | Tables-S | | SBUV Zonal Means: |
| | | F636162 | Daily Total Ozone |
| | | F636562 | Weekly Total Ozone |
| | | F636762 | Monthly Total Ozone |
| | | F636862 | Quarterly Total Ozone |
| | | F636163 | Daily (mass mixing ratios) |
| | | F636563 | Weekly (mass mixing ratios) |
| | | F636763 | Monthly (mass mixing ratios) |
| | | F636863 | Quarterly (mass mixing ratios) |
| | Tables-T | | TOMS Zonal Means: |
| | | F636161 | Daily |
| | | F636561 | Weekly |
| | | F636761 | Monthly |
| | | F636861 | Quarterly |
| | SBUV Contours | | SBUV Polar Sterographic Contours |

Table 1-1 (continued)

The following archived tapes (or portions of tapes) contain data suitable only for microfilm generation and are not further described in this guide. Tape specifications are available from NSSDC (See Appendix E).

| | | |
|---|---|---|
| Matrix-S | T634071 | SBUV Orbital Cross-section Contours |
| Matrix-T (Same tape as Matrix-T above) | T634271 | TOMS Polar Stereographic Contours |

## 2.0 OVERVIEW OF THE SBUV/TOMS EXPERIMENTS

### 2.1 Introduction

This section contains a brief overview of the SBUV and TOMS experiments. It contains a description of the instruments themselves and their calibration as well as their associated algorithms and data coverage. The last sub-section describes three external data sets used to support the ozone algorithms. For more detailed descriptions of these topics the reader is referred to the RUT, Ozone-S and Ozone-T User's Guides.

The SBUV and TOMS instruments were proposed by D. F. Heath and A. J. Krueger respectively for flight on board the Nimbus-G (7). The instrument designs are described by Heath, Krueger, et al. The combined instrument was built by Beckman Instruments of Anaheim, California, and has been supported by the Nimbus Evaluation Team (NET) chaired by D. F. Heath. The algorithm development, evaluation of instrument performance, groundtruth comparisons and data production have been carried out by the Ozone Processing Team managed by A. J. Fleig and supported by individuals from Goddard Space Flight Center and Systems and Applied Sciences Corp. of Riverdale, Maryland.

### 2.2 Description of the Experiments

The SBUV instrument on board the Nimbus 7 satellite is designed to measure the total ozone and its distribution with height in the atmosphere in a vertical column beneath the satellite. The SBUV contains a double monochromator and a filter photometer designed to measure ultraviolet spectral intensities. In its primary mode of operation, the monochromator measures solar radiation backscattered by the atmosphere in 12 wavelength bands in the near-UV, ranging from 255.5 to 339.8 nm, each with a bandpass of 1.0 nm. The total ozone algorithm uses the four longest wavelengths bands 312.5, 317.5, 331.2 and 339.8 nm), whereas the profiling algorithm uses the shorter wavelengths. The photometer operates at 343 nm with a 3.0 nm bandpass and is designed to measure the reflectivity of the surface in the instantaneous field of view (IFOV). The SBUV also makes periodic measurements of the solar flux by deploying a diffuser plate into the field of view (FOV) to reflect sunlight into the instrument.

The TOMS is designed to provide daily global coverage of the Earth's total ozone by measuring the backscattered ultraviolet sunlight at six wavelength bands ranging from

312.5 to 380.0 nm each with a 1.0 nm bandpass. Four wavelengths similar to those used by SBUV to derive total ozone serve the same purpose in TOMS. The two longest wavelengths are used to measure surface reflectivity. The TOMS also makes periodic measurements of the solar flux by deploying a diffuser plate to reflect sunlight directly into the instrument. The TOMS uses a single monochromator and a scanning mirror to sample the BUV radiation at 35 sample points every 8 seconds along a line perpendicular to the orbital plane. The scanning mirror moves the TOMS IFOV in 3 degree steps up to 51 degrees on each side of the nadir.

## 2.3 Instrument Calibration

The SBUV and TOMS algorithms infer ozone amounts from the Earth's geometric albedo at the various wavelengths measured. Initially a nominal value of the albedo is computed. Using pre-launch calibration factors, the backscattered intensity is converted from the raw counts measured by the instrument. This value is divided by the solar flux as measured by the instrument shortly after launch. This nominal albedo is then corrected for any changes in solar output or instrument throughput using a time-varying correction function ($F'_2$). The albedo is also corrected for changes in the Sun-Earth distance. For details of the actual correction functions applied and of diffuser degradation measurements, refer to the User's Guides for the SBUV and TOMS first year ozone data sets, and their respective addenda for year 2.

For a statement of the precision and accuracy of the SBUV/TOMS ozone data set, see the NET validation statement in the Preface.

## 2.4 Data Coverage

The Nimbus 7 satellite moves in a sun-synchronous retrograde orbit. It makes 13.8 orbits per day which are separated by 26 degrees longitude. The IFOV of the SBUV is fixed in the nadir direction and covers a square of approximately 200 km (2 degrees latitude) on the Earth's surface. Consecutive SBUV scans are separated in time by 32 seconds or about 1.8 degrees latitude. In the course of a week, the 26 degree gap between orbits is filled in giving complete global coverage when the SBUV is operating continuously. The operations schedule, however, calls for the SBUV to be ON three days and OFF one. This schedule is followed roughly during the first year. Orbit by orbit detail of the actual SBUV operating schedule is available in the RUT data inventory (ref 8).

TOMS is equipped with a scanning mirror which allows it to fill the inter-orbit gap and give complete global coverage on a daily basis. Each scan is composed of 35 samples and takes 8 seconds to complete. This means that each scan is separated by 0.45 degrees latitude and each sample within the scan is separated by 0.75 degrees longitude at the equator. At nadir, the TOMS IFOV is a square on the Earth's surface of about 50 km (0.5 degrees latitude), but it is elongated as the scanner moves off nadir.

The operations schedule for TOMS initially was for three days ON and one day OFF. This schedule was not strictly adhered to. The TOMS was ON more often than this, particularly during the second half of the first year. Orbit by orbit detail of the TOMS ON/OFF schedule is also available in the RUT data inventory (ref 8).

## 2.5 Ozone Algorithms

The total ozone algorithms for SBUV and TOMS are very similar and fundamentally simple. Given the solar zenith angle, the surface reflectivity, and the surface pressure, the columnar amount of total ozone is obtained by a lookup and interpolation procedure using a table of pre-computed radiances. The ratio of radiances measured at a pair of wavelengths is used to minimize the effect of calibration errors.

The vertical ozone distribution computed by the SBUV profile algorithm is a perturbation of a climatological 'first guess' or a priori ozone profile. The differences between measured radiances and those computed theoretically for the a priori profile are used iteratively to modify the a priori profile. The algorithm can be expected to yield high precision at the upper levels. The accuracy at the lower levels depends on a priori statistiscal information about the correlation between these layers and the observed total ozone and the upper level profile amounts. The algorithm yields ozone in 12 layers. Mass mixing ratios at 16 pressure levels are derived by differentiation and interpolation of the layer ozone amounts.

More detailed descriptions of the SBUV and TOMS algorithms can be found in the Ozone-S and Ozone-T User's Guides.

## 2.6 Merged Data

To aid in the accurate determination of surface pressure, information about cloud cover, terrain height, and snow or ice cover has been gathered for use by the ozone algorithms. Each of these data sets is described briefly below and in more detail in the RUT User's Guide, Appendix B.

Infrared radiance measurements taken at 11.5 micrometers by the Temperature Humidity Infrared Radiometer (THIR) on board Nimbus 7 have been colocated with the SBUV and TOMS data and used to compute average cloud top pressure and percent cloudiness. This information is used to determine the pressure of the reflecting surface in computation of the THIR ozone value.

The average terrain height in km for 2.5 x 2.5 degree latitude and longitude cells has been obtained from the National Oceanic and Atmospheric Administration (NOAA). These heights are converted to units of pressure and interpolated to the SBUV and TOMS IFOV's to establish the surface pressure of radiation reflected from the Earth's surface.

Snow/Ice thickness data from around the globe is collected by the Air Force Global Weather Center and mapped on a polar stereographic projection. These data have been mapped onto a 1 x 1 degree latitude longitude grid and used to indicate the presence of snow in the SBUV and TOMS IFOV. This information is used to establish the significance of high reflectivity in the identification of cloud cover.

## 3.0 SPECIAL CONSIDERATIONS

### 3.1 Ascending and Descending Modes

In normal operation, the SBUV and TOMS instruments make their measurements at local noon as the Nimbus 7 satellite moves south to north in its ascending mode. Near the summer pole however, the instruments can make daylight measurements after the satellite has passed over the pole and is travelling north to south in its descending mode. These data are of considerable scientific interest, but tend to be at high solar zenith angles and are not taken at local noon. Because of this, the descending mode data have not been included in the derivation of SBUV/TOMS contours or zonal means to avoid possible bias introduced by diurnal variations.

### 3.2 Terminator Flags

As the SBUV and TOMS both make daylight measurements, the solar terminator marks the cutoff of data coverage in the winter hemisphere. Because of this, in the creation of zonal means, a zone boundary can be altered by the presence of the terminator in the zone. In such cases, the zonal mean is computed normally, and then flagged to indicate the condition.

### 3.3 Non-THIR Data

The THIR ozone derived by the SBUV and TOMS algorithms is computed using a surface pressure inferred from colocated information from THIR about cloud height and cloud cover. Due to a variety of processing problems detailed in the RUT User's Guide, this information was only available for about 70% of the SBUV and TOMS data points. Because of this, the non-THIR total ozone has been used in creating the derivative products to avoid possible bias to nonhomogeneous coverage.

### 3.4 Quarterly Products

The quarterly derivative products for years 1 and 2 do not always cover a calendar quarter because the SBUV/TOMS data year runs from November thru October. For each of these 2 data years, there are 5 quarterly products produced. Beginning with year 3, this procedure will be modified so that only 3-month quarterly products are produced. This means that the first quarter (Oct-Dec) for each processing year will include the last month of the previous processing year (i.e. October).

| Data Year | Time Period | Number of Months |
|---|---|---|
| 1 | Nov-Dec 1978 | 2 |
| | Jan-Mar 1979 | 3 |
| | Apr-Jun 1979 | 3 |
| | Jul-Sep 1979 | 3 |
| | Oct 1979 | 1 |
| 2 | Nov-Dec 1979 | 2 |
| | Jan-Mar 1980 | 3 |
| | Apr-Jun 1980 | 3 |
| | Jul-Sep 1980 | 3 |
| | Oct 1980 | 1 |
| 3 | Oct-Dec 1980 | 3 |
| | Jan-Mar 1981 | 3 |
| | Apr-Jun 1981 | 3 |
| | Jul-Sep 1981 | 3 |

Note that this means that October 1980 will be included in both a year 2 and a year 3 quarterly product.

# 4. MATRIX TAPE AND MICROFILM PRODUCTS

## 4.1 Matrix Product Description

Three matrix products are available:

a) SBUV MATRIX Microfilm

Each reel of microfilm contains one full year of orbital cross-section matrices for SBUV ozone profiles. Each frame contains data from two orbits. There will be up to 7 frames of data per day.

b) TOMS Matrix Microfilm

Each reel of microfilm contains one full year of daily, monthly and quarterly polar stereographic projections of total ozone. Each frame will contain both a northern and a southern hemisphere map.

c) TOMS Matrix Tapes

Each tape contains daily, monthly, and quarterly averages of total ozone data at 2701 grid points (every $5^{o}$ longitude and latitude) for one full year of data. The grid matrix data are generated by averaging data in $5^{o}$ x $5^{o}$ square grids. The longitudes of the grid boundaries are located at every $5^{o}$ longitude starting at $-180^{o}$ ($180^{o}$W) eastward to $+180^{o}$. Data at precisely $+180^{o}$(180E) is counted as a separate grid point, resulting in 73 longitude grid points. Likewise the latitudes of the grid boundaries are located at every $5^{o}$ latitude starting from $90^{o}$S northward to $90^{o}$N. Data at precisely $+90^{o}$(90N) is counted as a separate grid point, resulting in 37 latitude grid points. All of the TOMS grids are simple averages of the input data. Each TOMS scene is projected on to the grid. No interpolations are performed.

## 4.2 Matrix Product Derivation

The ozone information contained on the TOMS matrix tape is comprised of simple averages of daily (in whole orbits) ozone values binned according to earth location. The day is made up of orbits whose ascending node occurs within the given day. No data from the descending portion of the satellite's orbit is included in the averaging. The values used to generate the microfilm product are binned in two 65 x 65 arrays (one for the northern hemisphere and one for the southern hemisphere) which overlay the polar

stereographic projection. These values are contoured using the Integrated Graphics System package and then output to microfilm.

The gridded ozone values are provided on the TOMS Matrix Tape as a form for general use which is more convenient than the polar stereographic map arrays used to generate the microfilm. The binning scheme for the gridded data is described in section 4.1(c) above.

No averaging is done for the SBUV orbital cross-sections. The ozone profile data is loaded into a 100 x 16 array which has dimension 100 to contain each scan of an entire orbit of SBUV data and dimension 16 for the 16 standard pressure levels for which ozone mixing ratios are given. (0.3,0.4,0.5,0.7,1.0,1.5,2.0,3.0,4.0,5.0,7.0,10,15,20,30, and 40 mb.) These pressure levels are roughly linear in log pressure or geometric height. The first index is computed so that the columns of the array increment linearly in time. The ozone values are subsequently interpolated to make this dimension linear in geodetic latitude so that the array represents a true height latitude cross-section. The values are contoured using the Integrated Graphics System package and output to microfilm.

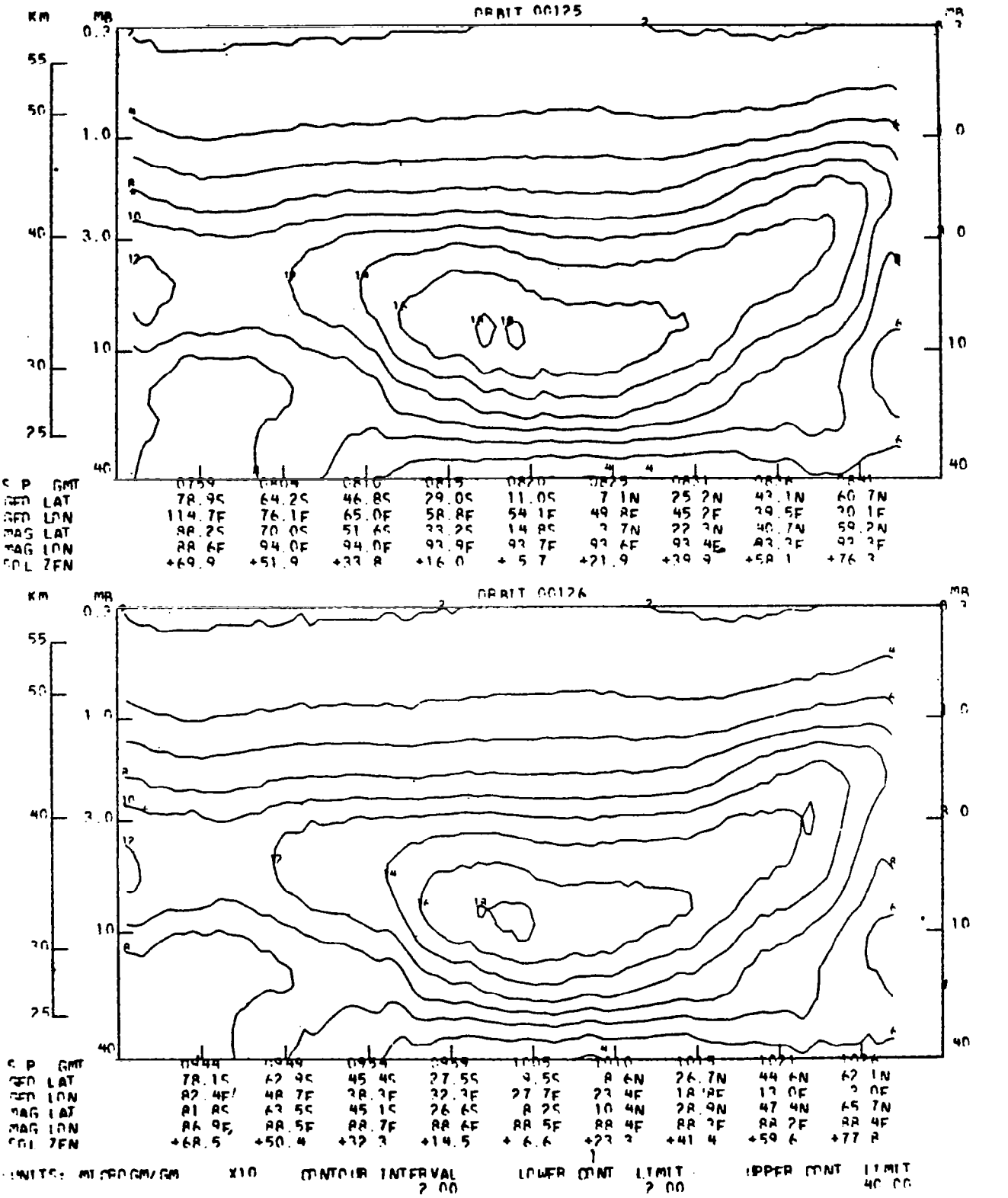
Areas in which ozone information is not available due to inhomogeneities in coverage will not contain contour lines. This is true of the TOMS contours and the SBUV orbital cross-sections.

## 4.3 Matrix Product Samples

Figures 4-1 and 4-2 display the matrix film products available.

## 4.4 Logical Structure of TOMS Matrix Tape Data Set

Map records and grid records will alternate every other record. Each map record will contain both a northern and southern hemisphere polar stereographic projection. Each map record will be followed by a grid record that applies to the preceding map record. Total ozone for TOMS will be mapped once a day. Daily contour data will appear in one file, monthly data in another file, and if the tape covers the end of a quarter, seasonal data will also appear in a separate file. Typically, daily files will have a record count = 2 x number of days in the month, though this will be decreased if data for any day(s) are not available. Monthly and seasonal files will each contain 2 records (1 map & 1 grid). Data is available only when the TOMS subsystem is in normal earth viewing step scan mode and the field of view is illuminated by the sun.


KM
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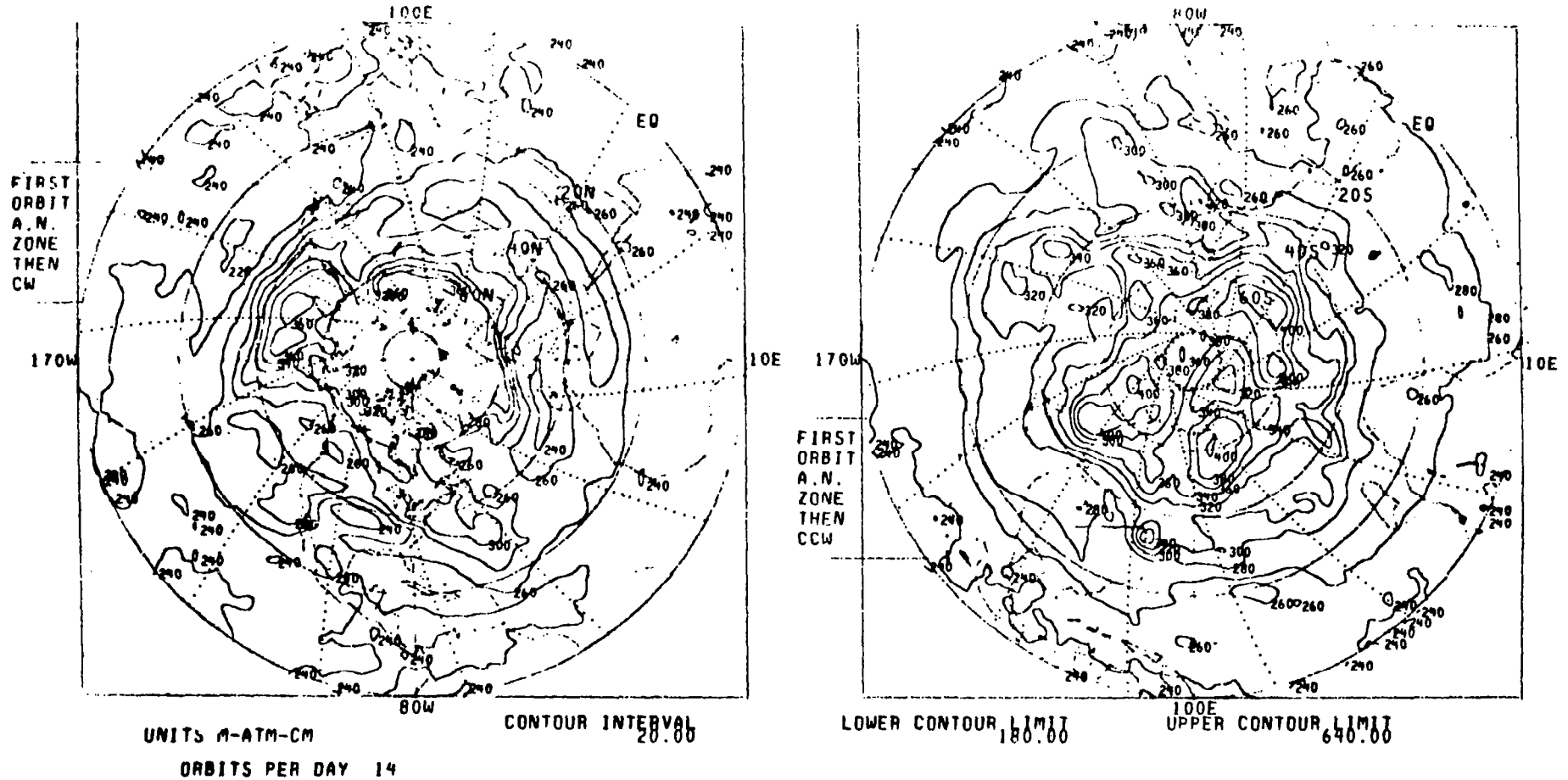
55
50
40
30
25
1.0
3.0
10
40
ORBIT 00126
UNITS: MICROGM/GM
X10
CONTOUR INTERVAL
2.00
LOWER CONT LIMIT
2.00
UPPER CONT LIMIT
40.00
SBUV
HIGH LEVEL X-SECTIONS OF OZONE MASS MIXING RATIO
NIMBUS 7
ORBITAL DISPLAYS
ORBITS 00125 AND 00126

Figure 4-1




TOMS
NIMBUS 7

TOTAL OZONE
ONE DAY

24NOV78
ORBITS 00425 THRU 00438
T83042 ALGO 0001 F633101 FA060023

NOTE: THIS CHART IS NOT SYNOPTIC

Figure 4-2

### 4.4.1 Polar Stereographic Contour Map Data

This data is only in a form suitable for producing the TOMS Matrix microfilm product and is not otherwise of analytic value. Thus, the tape format is not included.

### 4.4.2 Gridded Data

All of the TOMS grids are simple averages of the input data. Each TOMS scene is projected onto the grid. No interpolations are performed. The format for the TOMS gridded data is shown in Table 4-1 with detailed descriptions of data items in Table 4-2.

Table 4-1

TOMS MATRIX GRIDDED DATA

RECORD FORMAT

| WORDS | MSB 32 | 24 | 20 | 16 | 8 | LSB 1 | BITS |
|---|---|---|---|---|---|---|---|
| 1 | Physical Record No. | | (4) Spare | File Control Record ID | Spare(8) | | 32 |
| 2 | Spare (8) | Parm No. | | Data Cov. Code | Alt. Code | | 64 |
| 3 | Start Day of Data | | | End Day of Data | | | 96 |
| 4 | Start Time of Data | | | | | | 128 |
| 5 | End Time of Data | | | | | | 160 |
| 6 | Start Orbit Number | | | | | | 192 |
| 7 | End Orbit Number | | | | | | 224 |
| 8 | Annotation Start Day | | | Annotation End Day | | | 256 |
| 9 | Annotation Start Year | | | Annotation End Year | | | 288 |
| 10-12 | Data Distribution | | | | | | 384 |
| 13 | Algorithm ID | | | Generation Date | | | 416 |
| 14 | Spare | | | | | | 448 |
| 15-2715 | Total Ozone Values at 2701 Grid Points<br>Data is in M-ATM-CM<br>Missing Data Represented as -7777.0 (37 x 73) | | | | | | 86,880 |
| 2716-4257 | Spares | | | | | | 136,224 |

WORDS 1-13 are Binary Integers
WORDS 15-2715 are in IBM REAL*4 Format
WORDS 2716-4257 are Zero Filled

Table 4-2
TOMS GRIDDED DATA
ITEM DESCRIPTIONS

| Item No. | Word | Detailed Description of Data Items |
|---|---|---|
| 1 | 1 | PHYSICAL RECORD NO. (12 BITS) - The number of this record within the file. |
| 2 | 1 | FILE CONTROL:<br>Last record in file indicator (1 bit) - Bit 17 is set "1" to indicate last record in file.<br>Last file on tape indicator (1 bit) - Bit 18 is set to "1" in all records of the last file on the tape. |
| 3 | 1 | RECORD ID (6 BITS) - This field identifies the gridded data records:<br>20 = daily grids<br>30 = monthly grids<br>50 = seasonal (3 mos) grids |
| 4 | 2 | PARAMETER NUMBER (8 BITS) - = 1 for TOMS Total Ozone |
| 5 | 2 | COVERAGE CODE (8 BITS) -<br>1 = daily<br>30 = monthly<br>63 = quarterly |
| 6 | 2 | ALTITUDE CODE (8 BITS) - Used for vertical profile data only. Not applicable for TOMS data. |
| 7 | 3 * | START DAY OF DATA (16 BITS) -The day number for the start of the data period in this grid record. |
| 8 | 3 * | END DAY OF DATA (16 BITS) - The day number for the end of the data period in this grid record. |
| 9 | 4 * | START TIME OF DATA (32 BITS) - The integer seconds at the beginning of the data period contained in this record. |
| 10 | 5 * | END TIME OF DATA (32 BITS) - The integer seconds at the end of the data period contained in this record. |
| 11 | 6 | START DATA ORBIT NO. (32 BITS) - The data orbit at the beginning of the data used for this product. |
| 12 | 7 | END DATA ORBIT NO.(32 BITS) - The data orbit at the end of the data used for this product. |

*See Appendix B, Annotation Start Day vs. Data Start Day.

Table 4-2

TOMS GRIDDED DATA
ITEM DESCRIPTIONS

| Item No. | Word | Detailed Description of Data Items |
|---|---|---|
| 13 | 8 * | ANNOTATION START DAY (16 BITS) - The start day for the annotation period in this record. |
| 14 | 8 * | ANNOTATION END DAY (16 BITS) - The end day for the annotation period in this record. |
| 15 | 9 | ANNOTATION START YEAR (16 BITS) - The start year for the annotation period in this record. |
| 16 | 9 | ANNOTATION END YEAR (16 BITS) - The end year for the annotation period in this record. |
| 17-19 | 10-12 | DATA DISTRIBUTION (96 BITS) - (a) for daily products, the first 16 bits of Word 10 is an integer count of the number of orbits used to produce this grid. The remaining bits are undefined; (b) for monthly and seasonal products, each bit represents one day (chronologically from the left). A bit is set to "1" if data was present on that day, and "0" if no data was available. |
| 20 | 13 | ALGORITHM ID (16 BITS) - Identifies the program version used to produce this data. |
| 21 | 13 | GENERATION DATE (16 BITS) - The integer day of year on which this data was produced. |
| 22-2723 | 15-2715 | GRIDDED OZONE DATA (2701 32-BIT WORDS) - In M-ATM-CM. The longitudes of the grid boundaries are located at every $5^{o}$ longitude starting at $-180^{o}$ ($180^{o}$W) eastward to $+180^{o}$. Data at precisely $+180^{o}$(180E) is counted as a separate grid point, resulting in 73 longitude grid points. Likewise the latitudes of the grid boundaries are located at every $5^{o}$ latitude starting from $90^{o}$S, northward to $90^{o}$N. Data at precisely $+90^{o}$(90N) is counted as a separate grid point, resulting in 37 latitude grid points. Missing data is indicated by a value of -7777 |

NOTE: Due to the method of gridding, no times are associated with individual grid points.

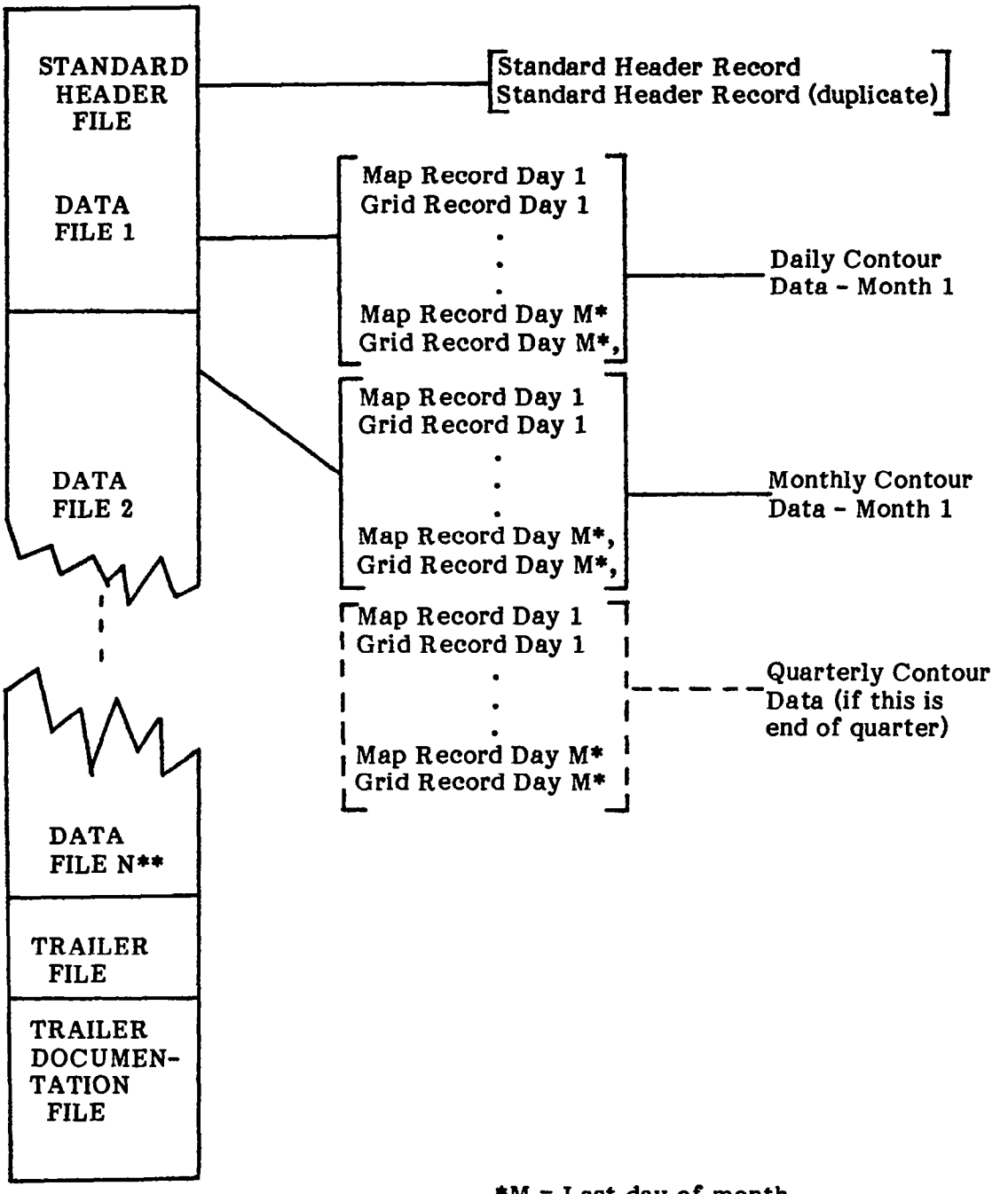
*See Appendix B Annotation Start Day vs. Data Start Day.

## 4.5 Physical Structure of TOMS Matrix Tape

### 4.5.1 Tape Organization

The TOMS MATRIX tape is a 9-track, unlabeled, 1600 BPI IBM 370/3081 compatible tape. The first file contains the Nimbus Observation Processing System (NOPS) Standard Header. The remaining files, except the last file, contain data records of contour map and grid matrices for TOMS on a daily, monthly, or seasonal basis. There will normally be a total of 28 data files. Data for each month is contained in two consecutive files; the first file contains only the daily averages whereas the second file contains the monthly averages. For the months of March, June, September or December only, there will be an additional file containing quarterly averages. The 30th file is a Trailer File which marks the end of data on the tape. A Trailer Documentation File (31st file) may be present, which contains geneological information on those input tapes used to create the current tape.

The NOPS Standard Header File and Trailer Documentation File are described in Appendix C. Figure 4-3 shows the organization of the TOMS Matrix data on the tape.




*M = Last day of month
**N normally = 28 (=2x12 months + 4 quarterly) but may contain more if tape has more than 1 year of data.

Figure 4-3: TOMS MATRIX TAPE ORGANIZATION

## 4.5.2 Tape and File Specifications

Tape Specifications: 1600 BPI, 9 track non-labeled tape (spec. #634271), PDF code = MAFG

File Specifications:

| | Header File | Data Files | Trailer File | Trailer Documentation File* |
|---|---|---|---|---|
| File location (file No.) | 1 | 2-29 | 30 | 31 |
| Physical record length (blocksize) | 630 bytes** | 17,028 bytes | 17,028 | 630 bytes bytes 136,224 bitsbits |
| 136,224 | | | | |
| Record format | unblocked | unblocked | unblocked | unblocked |
| Data type | EBCDIC | binary | binary | EBCDIC |
| No. of logical records per block | 1 | 1 | 1 | 1 |
| Record I.D. No. | none | Map records: ID=21 (Daily contour) ID=22 (Monthly contour) ID=23 Quarterly contour)<br><br>Grid records: ID=20 (Daily ID=30 (Monthly) ID=50 (Quarterly) | 0 | none |

Requirement Identification: TOMS MATRIX Tape Specification Number T634271.
Input Data Source: High density TOMS Ozone Tapes (HDTOMS) (T634426).

* Trailer documentation file only exists for tapes with an '*' character in the first byte of the NOPS Standard Header in file 1.

** 1 byte = 8 bits

EBCDIC = Extended Binary Coded Decimal Interchange Code

## 4.6 Microfilm Format for SBUV and TOMS Matrix

All microfilm is 16mm. For an explanation of the NOPS microfilm product specification see Appendix D.

For SBUV, data is in order by orbit within day, with one full year of orbital cross-sections on two reels of film. Each frame contains data from two orbits. The units used are micrograms/gram.

For TOMS, the data on film parallels the order of the TOMS Matrix data tape. Each reel of film contains one full year of daily, monthly and quarterly polar stereographic projections of total ozone. Daily data for each month are followed by monthly averages and, after every third month, by quarterly averages. The units used are milli-atmosphere-centimeters.

# 5. ZONAL MEANS TAPE (ZMT) PRODUCTS

## 5.1 ZMT Product Description

Two ZMT products are available:

a) SBUV ZMT

Each tape contains daily, weekly, monthly and quarterly zonal averages, standard deviations, sample sizes, and minimum and maximum ozone values for a full year of data. There are two different data files produced for each month, one for geodetic and one for geomagnetic coordinates.

Values are computed for each of 17 latitude zones. Each zone is 10 degrees wide, except the first and last (17th) zones which are 6 degrees and 7 degrees wide, respectively. The first zone is cut off at 81 degrees south and the 17th zone is cut off at 82 degrees north. The 9th zone is centered at the equator.

The zonal averages are computed for total ozone (1000 mb) and for ozone mixing ratios at 15 pressure levels (.4, .5, .7, 1.0, 1.5, 2.0, 3.0, 4.0, 5.0, 7.0, 10.0, 15.0, 20.0, 30.0, and 40.0 in millibars).

b) TOMS ZMT

Each tape contains daily, weekly, monthly and quarterly zonal averages, standard deviations, sample sizes, and minimum and maximum ozone values for a full year of data. There are two different data files produced for each month, one for geodetic and one for geomagnetic coordinates.

Values are computed for each of 37 latitude zones. Each zone is 5 degrees wide, except the first and last (37th) zones which are 2.5 degrees wide and include the poles. The 19th zone is centered at the equator.

The zonal averages for TOMS are computed for total ozone only.

## 5.2 ZMT Product Derivation

The statistical information presented on the ZMT is derived using the usual well known statistical equations. However, two special considerations pertaining to excluded data are discussed in sections 3.1 and 3.2. One is regarding the exclusion of data taken while the satellite is in the descending portion of its orbit. The second involves the cut off of data in latitude zones which contain the solar terminator. Such data are flagged using the terminator flag in word six of the ZMT data record.

## 5.3 Logical Structure of SBUV Zonal Means Tape Data Set

Two types of data files exist on the SBUV ZMT. They are:

1) SBUV Geodetic Zonal Means
2) SBUV Geomagnetic Zonal Means

Data is available only when the SBUV subsystem is in step scan earth viewing mode and the field of view is illuminated by the sun.

The record arrangement within a Zonal Means data file is daily data, weekly data, monthly data, and finally seasonal data, if it exists. Thus, the maximum number of records in any one file is 37 (31 days, 4 weeks, 1 month, 1 quarter). Records are written only for time periods where data exists. There will be 12 monthly data files of geodetic zonal means followed by 12 monthly data files of geomagnetic zonal means.

The format for the ZMT-S data is shown in Table 5-1, with detailed descriptions of data items in Table 5-2.

Table 5-1

SBUV ZONAL MEANS
RECORD FORMAT

| | MSB 31 LSB 0 |
|---|---|
| 1 | Physical record no. (12) Spares (8) File control (2) Record ID (6) Spares (8) |
| 2 | Logical sequence number |
| 3 | Time span counter |
| 4 | Latitude zone indicator |
| 5 | Coordinate system |
| 6 | Terminator flag |
| 7 | Time span |
| 8 | Pressure level |
| 9 | Average ozone |
| 10 | Standard deviation |
| 11 | Minimum ozone |
| 12 | Maximum ozone |
| 13 | Number of data points |
| 14 | Days (orbits) in period |
| 15-119 | Repeat words 8-14 for fifteen pressure levels |
| 120 | Year |
| 121-126 | Spares |

Table 5-2

SBUV ZONAL MEANS

ITEM DESCRIPTIONS

| Item No. | Word | Type | Detailed Description of Data Items |
|---|---|---|---|
| 1 | 1 | - | PHYSICAL RECORD NO. (12 BITS) - This is the number of this record within a file. |
| - | 1 | - | SPARE (4 BITS) |
| 2 | 1 | - | FILE CONTROL (2 BITS) - Last record in file indicator (1) - Bit 17 is set to "1" to indicate last record in file.<br><br>Last file on tape indicator (1) - Bit 18 is set to "1" in all records of the last file on the tape. |
| 3 | 1 | - | RECORD ID (6 BITS) - This field identifies the data records type:<br><br>34 = Daily Means<br>35 = Monthly Means<br>36 = Seasonal (Quarterly) Means<br>62 = Weekly Means |
| - | 1 | - | SPARE (8 BITS) |
| 4 | 2 | I*4 | LOGICAL SEQUENCE NUMBER - Count of logical records in a file:<br><br>Data Records: Greater than or equal 1<br>Trailer Record: Less than -1 |
| 5 | 3 | I*4 | TIME SPAN COUNTER - Day (1-366) or week (1-53) or month (1-12) or season (1-4) depending on the value of the time span (item 9). |
| 6 | 4 | I*4 | LATITUDE ZONE INDICATOR - (-80,...,0,+10, +20,...,+80). The latitude zones, except the first and the last, are $10^{o}$ apart and the middle zone is centered at the equator, covering from $5^{o}$ south to $5^{o}$ north. The first zone goes from $81^{o}$ south to $75^{o}$ south, and the last zone goes from $75^{o}$ north to $81^{o}$ north. |
| 7 | 5 | I*4 | COORDINATE SYSTEM -<br>+1 = geomagnetic<br>-1 = geodetic. |

Table 5-2

SBUV ZONAL MEANS
ITEM DESCRIPTIONS

| Item No. | Word | Type | Detailed Description of Data Items |
|---|---|---|---|
| 8 | 6 | I*4 | TERMINATOR FLAG - +1 = terminator in zone, 0 = otherwise. On the longer term means, the flag will be set if the terminator is in this zone at any time during the period. |
| 9 | 7 | I*4 | TIME SPAN - 1 = daily, 2 = weekly, 3 = monthly, 4 = seasonal. |
| 10 | - | - | ZONAL MEANS DATA FOR TOTAL OZONE |
| 10.1 | 8 | R*4 | PRESSURE LEVEL - In millibars. For total ozone, this value is +1000. |
| 10.2 | 9 | R*4 | AVERAGE OZONE - Zonal mean. For high level data, this is the mixing ratio expressed in g/gm and for total ozone, it is m-atm-cm. A zero average ozone value indicates no mean could be calculated. |
| 10.3 | 10 | R*4 | STANDARD DEVIATION - Expressed in same units as average ozone. Zero indicates no value computed. |
| 10.4 | 11 | R*4 | MINIMUM OZONE - Minimum value found while computing mean. Zero indicates no data in that zone. |
| 10.5 | 12 | R*4 | MAXIMUM OZONE -Maximum value found while computing mean. Zero indicates no data in that zone. |
| 10.6 | 13 | I*4 | NUMBER OF DATA POINTS - Number of data points used in computing mean. |
| 10.7 | 14 | I*4 | DAYS (ORBITS) IN PERIOD - Actual number of days in the period which had valid data. For daily data, this indicates number of orbit. |
| 11-25 | 15-119 | - | ZONAL MEANS DATA FOR PRESSURE LEVELS 1-15 - Words 8-14 are for total ozone. Words 15-21 repeat the same information for first pressure level. Words 22-119 repeat same information for 14 remaining pressure levels. (15 total pressure levels written). |
| 26 | 120 | I*4 | YEAR OF DATA. |
| - | 121-126 | I*4 | SPARES. |

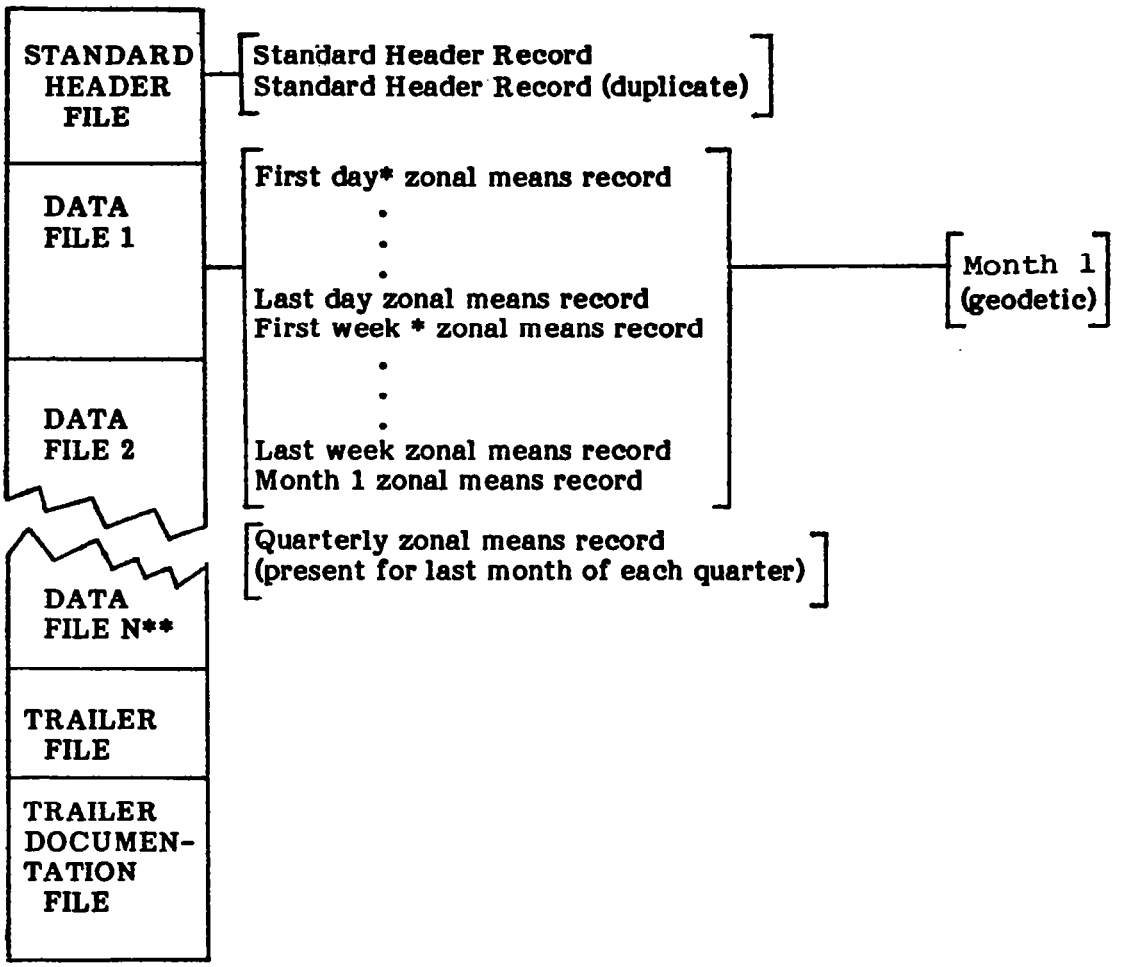
I*4 = 32 bit binary integer
R*4 = 32 bit real (floating point) number

## 5.4 Physical Structure of SBUV Zonal Means Tape

### 5.4.1 Tape Organization

The SBUV Zonal Means Tape (ZMT-S) is a 9-track, 1600 BPI, unlabeled, IBM 370/3081 compatible tape. Each tape contains 1 year's worth of data. The first file contains a Nimbus Observation Processing System (NOPS) Standard Header. There will be 12 data files containing zonal means in geodetic co-ordinate followed by another 12 data files in geomagnetic coordinate. The Trailer File (file 26) contains only one record with a trailer file identification and filled values. There may also be a Trailer Documentation File (file 27), which contains geneological information on those input tapes used to create the current tape.

The NOPS Standard Header File and Trailer Documentation File are described in Appendix C. Figure 5-1 shows the organization of the zonal means data on tape.




* Day and week numbers are the absolute numbers (starting from the beginning of the data year) that are included in the current month.

** N normally = 24 (1 each per month for geodetic and geomagnetic).

Figure 5-1: SBUV/TOMS ZONAL MEANS TAPE ORGANIZATION

### 5.4.2 Trailer Record

Every data file ends with one or more Trailer Records. This is a logical record for SBUV Zonal Means. The logical record is repeated enough times so that the physical record is full size. There is no unique Record ID for a Trailer Record. It will have the same Record ID as the last data record in that file. The Trailer Record contains no data and is used simply to fill up the physical block and to mark the end of data in each file. The Trailer Record can be identified by a negative integer less than -1 in the logical sequence number field (Word 2).

5.4.3. Tape & File Specifications

Tape Specifications: 1600 B.P.I., 9 track unlabeled tape (spec. #634061), PDF code - ZMFH

File Specifications:

| | Header File | Data Files | Trailer File | Trailer Documentation File* |
|---|---|---|---|---|
| File location (file No.) | 1 | 2-25 | 26 | 27 |
| Logical record length (bytes)** | 630 | 504 | 504 | 630 |
| Physical record length (blocksize) (bytes) | 630 | 15120 | 15120 | 630 |
| Record format | unblocked | fixed-blocked | fixed-blocked | unblocked |
| Data type | EBCDIC | binary | binary | EBCDIC |
| No. of logical records per block | 1 | 30 | 30 | 1 |
| Record I.D. No. | N/A | 34 = Daily means<br>35 = Monthly means<br>36 = Seasonal means<br>62 = Weekly means | 0 N/A | |
| Logical Sequence No. | N/A | $\geq 1$ (Data Record<br>$< -1$ (Trailer Record) | -1 | N/A |
| Coordinate System | N/A | -1 geodetic<br>+1 geomagnetic | N/A | N/A |

Requirements Identification: SBUV ZMT Tape Specification Number T634061 for SBUV.

Input Data Source: High Density SBUV Ozone Tapes (HDSBUV) (T634416).

* Trailer documentation file only exist for tapes with an '*' character in the first byte of the NOPS Standard Header in file 1.

** 1 byte = 8 bits
EBCDIC = Extended Binary Coded Decimal Interchange Code

N/A = Not Applicable

## 5.5 Logical Structure of TOMS Zonal Means Data

Two types of data files exist on the TOMS ZMT. They are:

1) TOMS Geodetic Zonal Means
2) TOMS Geomagnetic Zonal Means

Data is available only when the TOMS subsystem is in step scan earth viewing mode and the field of view is illuminated by the sun.

The record arrangement within a Zonal Means data file is daily data, weekly data, monthly data, and finally seasonal data, if it exists. Thus, the maximum number of records in any one file is 37 (31 days, 4 weeks, 1 month, 1 quarter). Records are written only for time periods where data exists. There will be 12 monthly data files of geodetic zonal means followed by 12 monthly data files of geomagnetic zonal means.

The format for the ZMT-T data is shown in Table 5-3, with detailed descriptions of data items in Table 5-4.

Table 5-3

TOMS ZONAL MEANS
RECORD FORMAT

| | MSB 31 LSB 0 |
|---|---|
| 1 | Physical record no. (12) Spares (8) File control (2) Record ID (6) Spares (8) |
| 2 | Logical sequence number |
| 3 | Time span counter |
| 4 | Latitude zone indicator |
| 5 | Coordinate system |
| 6 | Terminator flag |
| 7 | Time span |
| 8 | Year |
| 9 | Average ozone |
| 10 | Standard deviation |
| 11 | Minimum ozone |
| 12 | Maximum ozone |
| 13 | Number of data points |
| 14 | Days (orbits) in period |
| 15-18 | Spares |

Table 5-4

TOMS ZONAL MEANS
ITEM DESCRIPTIONS

| Item No. | Word | Type | Detailed Description of Data Items |
|---|---|---|---|
| 1 | 1 | - | PHYSICAL RECORD NO. (12 BITS) - This is the number of this record within a file. |
| - | 1 | - | SPARE (4 BITS) |
| 2 | 1 | - | FILE CONTROL (2 BITS) - Last record in file indicator (1) - Bit 17 is set to "1" to indicate last record in file.<br><br>Last file on tape indicator (1) - Bit 18 is set to "1" in all records of the last file on the tape. |
| 3 | 1 | - | RECORD ID (6 BITS) - This field identifies the data records type:<br><br>31 = Daily Means<br>32 = Monthly Means<br>33 = Seasonal (Quarterly) Means<br>60 = Weekly Means |
| - | 1 | - | SPARE (8 BITS) |
| 4 | 2 | I*4 | LOGICAL SEQUENCE NUMBER - Count of logical records in a file:<br><br>Data Records: Greater than or equal 1<br>Trailer Record: Less than -1 |
| 5 | 3 | I*4 | TIME SPAN COUNTER - Day (1-366) or week (1-53) or month (1-12) or season (1-4) depending on the value of the time span (item 9). |
| 6 | 4 | I*4 | LATITUDE ZONE INDICATOR - (-90,...,0,+5,+10,+15,..., +85,+90). The latitude zones, except the first and the last, are $5^{o}$ apart and the middle zone is centered at the equator, covering from $2\frac{1}{2}^{o}$ south to $2\frac{1}{2}^{o}$ north. The first zone goes from $90^{o}$ south to $87.5^{o}$ south, and the last zone goes from $87.5^{o}$ north to $90^{o}$ north. |
| 7 | 5 | I*4 | COORDINATE SYSTEM -<br>+1 = geomagnetic<br>-1 = geodetic. |

Table 5-4 Cont'd

TOMS ZONAL MEANS
ITEM DESCRIPTIONS

| | | | |
|---|---|---|---|
| 8 | 6 | I*4 | TERMINATOR FLAG -<br>+1 = terminator in zone,<br>0 = otherwise.<br>On the longer term means, the flag will be set if the terminator is in this zone at any time during the period. |
| 9 | 7 | I*4 | TIME SPAN - 1 = daily, 2 = weekly, 3 = monthly, 4 = seasonal. |
| 10 | 8 | I*4 | YEAR OF DATA |
| 11 | 9 | R*4 | AVERAGE OZONE - Zonal mean. A zero average ozone value indicates no mean could be calculated. |
| 12 | 10 | R*4 | STANDARD DEVIATION - Expressed in same units as average ozone. Zero indicates no value computed. |
| 13 | 11 | R*4 | MINIMUM OZONE - Minimum value found while computing mean. Zero indicates no data in that zone. |
| 14 | 12 | R*4 | MAXIMUM OZONE -Maximum value found while computing mean. Zero indicates no data in that zone. |
| 15 | 13 | I*4 | NUMBER OF DATA POINTS - Number of data points used in computing mean. |
| 16 | 14 | I*4 | DAYS (ORBITS) IN PERIOD - Actual number of days in the period which had valid data. For daily data, this indicates number of orbit. |
| - | 15-18 | I*4 | SPARES. |

I*4 = 32 bit binary integer
R*4 = 32 bit real (floating point) number

## 5.6 Physical Structure of ZMT-T Tape

### 5.6.1 Tape Organization

The TOMS Zonal Means Tape (ZMT-T) is a 9-track, 1600 BPI, unlabeled, IBM 370/3081 compatible tape. Each tape contains 1 year's worth of data. The first file contains a Nimbus Observation Processing System (NOPS) Standard Header. There will be 12 data files containing zonal means in geodetic co-ordinate followed by another 12 data files in geomagnetic coordinate. The Trailer File (file 26) contains only one record with a trailer file identification and filled values. There may also be a Trailer Documentation File (file 27), which contains geneological information on those input tapes used to create the current tape.

The NOPS Standard Header File and Trailer Documentation File are described in Appendix C. Figure 5-1 shows the organization of the zonal means data on tape.

### 5.6.2 Trailer Record

Every data file ends with one or more Trailer Records. This is a logical record for TOMS Zonal Means. The logical record is repeated enough times so that the physical record is full size. There is no unique Record ID for a Trailer Record. It will have the same Record ID as the last data record in that file. The Trailer Record contains no data and is used simply to fill up the physical block and to mark the end of the data in each file. The Trailer Record can be identified by a negative integer less than -1 in the logical sequence number field (Word 2).

5.6.3 Tape & File Specifications

Tape Specifications: 1600 B.P.I., 9 track unlabeled tape (spec. #634161), PDF code - ZMFI

File Specifications:

| | Header File | Data Files | Trailer File | Trailer Documentation File* |
|---|---|---|---|---|
| File location (file No.) | 1 | 2-25 | 26 | 27 |
| Logical record length (bytes)** | 630 | 72 | 72 | 630 |
| Physical record length (blocksize) (bytes) | 630 | 13320 | 13320 | 630 |
| Record format | unblocked | fixed-blocked | fixed-blocked | unblocked |
| Data type | EBCDIC | binary | binary | EBCDIC |
| No. of logical records per block | 1 | 30 | 30 | 1 |
| Record I.D. No. | N/A | 31 = Daily means<br>32 = Monthly means<br>33 = Seasonal means<br>60 = Weekly means | 0 N/A | |
| Logical Sequence No. | N/A | ≥1 (Data Record<br><-1 (Trailer Record) | -1 | N/A |
| Coordinate System | N/A | -1 geodetic<br>+1 geomagnetic | N/A | N/A |

Requirements Identification: TOMS ZMT Tape Specification Number T634161 for TOMS.

Input Data Source: High Density TOMS Ozone Tapes (HDTOMS) (T634426).

* Trailer documentation file only exist for tapes with an '*' character in the first byte of the NOPS Standard Header in file 1.

** 1 byte = 8 bits
EBCDIC = Extended Binary Coded Decimal Interchange Code

N/A = Not Applicable

# 6. TABLES MICROFILM PRODUCTS

## 6.1 Tables Product Description

Two tables products are available:

a) SBUV Tables Microfilm

Each 2 reel set of microfilm contains one full year of daily, weekly, monthly and quarterly zonal averages in tabular form. One reel contains geodetic data and the other reel geomagnetic. Data is provided for total ozone and for 15 values of ozone mass mixing ratio at pressures from 0.4 millibars to 40 millibars.

Values are computed for each of 17 latitude zones. Each zone is 10 degrees wide, except the first and last (17th) zones which are 6 degrees and 7 degrees wide, respectively. The first zone is cut off at 81 degrees south and the 17th zone is cut off at 82 degrees north. The 9th zone is centered at the equator.

The zonal averages are computed for total ozone (1000 mb) and for ozone mixing ratios at 15 pressure levels (.4, .5, .7, 1.0, 1.5, 2.0, 3.0, 4.0, 5.0, 7.0, 10.0, 15.0, 20.0, 30.0, and 40.0 in millibars).

b) TOMS Tables Microfilm

Each reel of microfilm contains one full year of daily, weekly, monthly and quarterly geodetic and geomagnetic zonal averages for total ozone.

Values are computed for each of 37 latitude zones. Each zone is 5 degrees wide, except the first and last (37th) zones which are 2.5 degrees wide and include the poles. The 19th zone is centered at the equator.

The zonal averages for TOMS are computed for total ozone only.

## 6.2 Tables Product Derivation

The statistical information presented in the Tables Microfilm is taken directly from the ZMT. Its derivation is described in section 5.2.

## 6.3 Tables Product Samples

Figures 6-1 through 6-4 display the tables film products available.

## 6.4 Microfilm Format for SBUV and TOMS Tables

The data on the SBUV and TOMS Tables microfilm parallel the order of the ZMT-S and ZMT-T data tapes respectively. Twelve months of geodetic zonal means are followed by 12 months of geomagnetic zonal means. For each month, daily data is first, followed by weekly, monthly and quarterly (when appropriate).

All microfilm is 16mm. For an explanation of the NOPS microfilm product specification number, see Appendix D.

For TOMS one day (or week, month or quarter) of total ozone data occupies one microfilm frame. For SBUV, each set of data occupies three frames: the first is for total ozone, the second for mass mixing ratio from 0.4 millibars to 4.0 mb, and the third from 5.0 mb to 40 mb. The units used are milli-atmosphere-centimeters for total ozone and micrograms/gram for mass mixing ratios.

At the beginning of each reel, a table of contents lists the data available and the corresponding start frame for that data. Each month of printout is separated by block letter title pages.

| | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 30N | 9.49 | .89 | 8.1 | 11. | 60 | 13 | 6.61 | .87 | 5.7 | 7.5 | 60 | 13 | 4.50 | .49 | 3.6 | 5.5 | 60 | 13 | | |
| 40N | 8.58 | .78 | 7.1 | 10. | 81 | 14 | 6.85 | .63 | 5.7 | 8.1 | 81 | 14 | 5.20 | .58 | 4.0 | 6.4 | 81 | 14 | | |
| 50N | 7.77 | .43 | 6.8 | 9.0 | 62 | 13 | 6.97 | .41 | 5.8 | 8.0 | 62 | 13 | 5.80 | .46 | 4.5 | 6.5 | 62 | 13 | | |
| 60N | 6.86 | .71 | 5.5 | 8.2 | 48 | 11 | 6.63 | .60 | 5.4 | 8.3 | 48 | 11 | 5.83 | .62 | 4.9 | 7.2 | 48 | 11 | | |
| 70N | NO DATA AVAILABLE | | | | | | NO DATA AVAILABLE | | | | | | NO DATA AVAILABLE | | | | | | | |
| 80N | NO DATA AVAILABLE | | | | | | NO DATA AVAILABLE | | | | | | NO DATA AVAILABLE | | | | | | | |

NIMBUS-7 SBUV TABLES T634051 NO 83041 VERSION 8203.12 DEC 1978 F636162 PB 10009

SBUV ZONAL MEANS - GEODETIC LATITUDE ZONES

DAILY ZONAL MEANS FOR 2 DEC 1978

TOTAL OZONE

| LATITUDE ZONE (CENTER) | TERM FLAG | TOTAL OZONE (M-ATM-CM) AVG | STD DEV | MIN | MAX | POPULATION NUMBER POINTS | NUM ORBS |
|---|---|---|---|---|---|---|---|
| 80S | | 337.7 | 18.99 | 302.8 | 373.8 | 82 | 12 |
| 70S | | 346.4 | 16.21 | 308.7 | 379.5 | 76 | 12 |
| 60S | | 342.8 | 16.31 | 299.7 | 382.3 | 68 | 12 |
| 50S | | 328.3 | 27.56 | 287.5 | 391.6 | 66 | 12 |
| 40S | | 303.9 | 19.54 | 273.4 | 357.6 | 66 | 12 |
| 30S | | 284.1 | 16.55 | 255.9 | 334.5 | 65 | 12 |
| 20S | | 262.6 | 9.87 | 238.9 | 283.3 | 64 | 12 |
| 10S | | 250.8 | 9.18 | 236.1 | 281.1 | 60 | 11 |
| 0 | | 230.7 | 8.65 | 221.7 | 259.7 | 60 | 11 |
| 10N | | 239.7 | 7.88 | 224.3 | 261.2 | 59 | 11 |
| 20N | | 246.3 | 13.08 | 216.3 | 273.1 | 59 | 11 |
| 30N | | 254.6 | 17.27 | 221.0 | 293.2 | 60 | 11 |
| 40N | | 262.5 | 22.25 | 210.3 | 302.9 | 62 | 12 |
| 50N | | 294.8 | 39.24 | 237.9 | 362.7 | 64 | 12 |
| 60N | | 305.3 | 37.12 | 237.8 | 359.8 | 45 | 11 |
| 70N | | NO DATA AVAILABLE | | | | | |
| 80N | | NO DATA AVAILABLE | | | | | |

NIMBUS-7 SBUV TABLES T634051 NO 83041 VERSION 8203.12 DEC 1978 F636163 PB 10010

SBUV ZONAL MEANS - GEODETIC LATITUDE ZONES

DAILY ZONAL MEANS FOR 2 DEC 1978

HIGH-LEVEL MASS MIXING RATIOS (UGM/GM) PAGE 1 OF 2

PRESSURE LEVELS

| LATITUDE ZONE (CTR) | TERM FLAG | .40 MB AVG | STD DEV | MIN | MAX | NUM PTS | NUM ORBS | .50 MB AVG | STD DEV | MIN | MAX | NUM PTS | NUM ORBS | .70 MB AVG | STD DEV | MIN | MAX | NUM PTS | NUM ORBS | 1.0 MB AVG | STD DEV | MIN | MAX | NUM PTS | NUM ORBS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 80S | | 1.99 | .04 | 1.9 | 2.1 | 79 | 12 | 2.33 | .05 | 2.2 | 2.5 | 79 | 12 | 2.95 | .06 | 2.8 | 3.1 | 79 | 12 | 3.79 | .06 | 3.6 | 3.9 | 79 | 12 |
| 70S | | 2.11 | .05 | 2.0 | 2.2 | 73 | 12 | 2.48 | .07 | 2.3 | 2.6 | 73 | 12 | 3.15 | .09 | 3.0 | 3.3 | 73 | 12 | 4.03 | .11 | 3.8 | 4.3 | 73 | 12 |
| 60S | | 2.24 | .04 | 2.1 | 2.3 | 71 | 12 | 2.66 | .05 | 2.5 | 2.8 | 71 | 12 | 3.41 | .07 | 3.3 | 3.6 | 71 | 12 | 4.37 | .10 | 4.2 | 4.6 | 71 | 12 |
| 50S | | 2.36 | .04 | 2.3 | 2.5 | 65 | 12 | 2.81 | .05 | 2.7 | 2.9 | 65 | 12 | 3.63 | .07 | 3.5 | 3.8 | 65 | 12 | 4.67 | .09 | 4.5 | 4.9 | 65 | 12 |
| 40S | | 2.43 | .05 | 2.3 | 2.6 | 62 | 12 | 2.91 | .07 | 2.8 | 3.1 | 62 | 12 | 3.77 | .09 | 3.6 | 4.0 | 62 | 12 | 4.87 | .11 | 4.7 | 5.2 | 62 | 12 |
| 30S | | 2.53 | .05 | 2.4 | 2.6 | 71 | 12 | 3.03 | .07 | 2.9 | 3.2 | 71 | 12 | 3.95 | .09 | 3.8 | 4.1 | 71 | 12 | 5.11 | .11 | 4.9 | 5.3 | 71 | 12 |
| 20S | | 2.59 | .05 | 2.5 | 2.7 | 60 | 12 | 3.12 | .06 | 2.9 | 3.2 | 60 | 12 | 4.08 | .08 | 3.9 | 4.2 | 60 | 12 | 5.30 | .09 | 5.1 | 5.5 | 60 | 12 |
| 10S | | 2.60 | .05 | 2.6 | 2.8 | 64 | 11 | 3.23 | .06 | 3.1 | 3.4 | 64 | 11 | 4.23 | .08 | 4.1 | 4.4 | 64 | 11 | 5.51 | .09 | 5.3 | 5.7 | 64 | 11 |
| 0 | | 2.72 | .05 | 2.6 | 2.8 | 56 | 11 | 3.20 | .06 | 3.2 | 3.4 | 56 | 11 | 4.31 | .07 | 4.2 | 4.4 | 56 | 11 | 5.61 | .07 | 5.4 | 5.8 | 56 | 11 |
| 10N | | 2.64 | .06 | 2.5 | 2.7 | 63 | 11 | 3.19 | .07 | 3.0 | 3.3 | 63 | 11 | 4.20 | .08 | 4.0 | 4.4 | 63 | 11 | 5.53 | .08 | 5.4 | 5.7 | 63 | 11 |
| 20N | | 2.51 | .08 | 2.3 | 2.7 | 56 | 11 | 3.04 | .10 | 2.8 | 3.2 | 56 | 11 | 4.07 | .12 | 3.8 | 4.3 | 56 | 11 | 5.49 | .13 | 5.2 | 5.8 | 56 | 11 |
| 30N | | 2.48 | .12 | 2.2 | 2.7 | 63 | 11 | 3.05 | .16 | 2.7 | 3.3 | 63 | 11 | 4.20 | .23 | 3.7 | 4.7 | 63 | 11 | 5.94 | .37 | 5.2 | 6.9 | 63 | 11 |
| 40N | | 2.61 | .15 | 2.3 | 2.9 | 57 | 12 | 3.29 | .19 | 2.8 | 3.8 | 57 | 12 | 4.73 | .28 | 4.1 | 5.4 | 57 | 12 | 7.00 | .40 | 6.2 | 8.0 | 57 | 12 |
| 50N | | 2.54 | .17 | 2.1 | 2.9 | 68 | 12 | 3.21 | .22 | 2.7 | 3.7 | 68 | 12 | 4.64 | .33 | 3.9 | 5.4 | 68 | 12 | 6.57 | .54 | 5.8 | 8.2 | 68 | 12 |
| 60N | | 2.57 | .18 | 2.2 | 3.1 | 47 | 11 | 3.18 | .19 | 2.8 | 3.6 | 47 | 11 | 4.43 | .27 | 3.9 | 4.9 | 47 | 11 | 6.44 | .48 | 5.4 | 7.4 | 47 | 11 |
| 70N | | NO DATA AVAILABLE | | | | | | NO DATA AVAILABLE | | | | | | NO DATA AVAILABLE | | | | | | NO DATA AVAILABLE | | | | | |
| 80N | | NO DATA AVAILABLE | | | | | | NO DATA AVAILABLE | | | | | | NO DATA AVAILABLE | | | | | | NO DATA AVAILABLE | | | | | |

PRESSURE LEVELS

| LATITUDE ZONE (CTR) | TERM FLAG | 1.5 MB AVG | STD DEV | MIN | MAX | NUM PTS | NUM ORBS | 2.0 MB AVG | STD DEV | MIN | MAX | NUM PTS | NUM ORBS | 3.1 MB AVG | STD DEV | MIN | MAX | NUM PTS | NUM ORBS | 4.0 MB AVG | STD DEV | MIN | MAX | NUM PTS | NUM ORBS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 80S | | 5.28 | .06 | 5.1 | 5.4 | 79 | 12 | 7.09 | .08 | 6.9 | 7.3 | 79 | 12 | 10.3 | .12 | 10. | 11. | 79 | 12 | 11.7 | .13 | 11. | 12. | 79 | 12 |
| 70S | | 5.52 | .12 | 5.3 | 5.8 | 73 | 12 | 7.29 | .13 | 7.1 | 7.6 | 73 | 12 | 10.5 | .15 | 10. | 11. | 73 | 12 | 11.9 | .18 | 11. | 12. | 73 | 12 |
| 60S | | 5.95 | .14 | 5.7 | 6.2 | 71 | 12 | 7.79 | .16 | 7.4 | 8.2 | 71 | 12 | 11.1 | .27 | 11. | 12. | 71 | 12 | 13.8 | .36 | 13. | 14. | 71 | 12 |
| 50S | | 6.31 | .12 | 6.1 | 6.6 | 65 | 12 | 8.10 | .15 | 7.9 | 8.6 | 65 | 12 | 11.6 | .21 | 11. | 12. | 65 | 12 | 13.6 | .24 | 13. | 14. | 65 | 12 |
| 40S | | 6.59 | .14 | 6.3 | 6.9 | 62 | 12 | 8.50 | .16 | 8.2 | 8.9 | 62 | 12 | 12.3 | .21 | 11. | 13. | 62 | 12 | 14.1 | .24 | 13. | 15. | 62 | 12 |
| 30S | | 6.89 | .15 | 6.6 | 7.2 | 71 | 12 | 8.81 | .17 | 8.4 | 9.3 | 71 | 12 | 12.7 | .19 | 12. | 13. | 71 | 12 | 14.5 | .19 | 14. | 15. | 71 | 12 |
| 20S | | 7.15 | .11 | 6.9 | 7.4 | 60 | 12 | 9.10 | .13 | 8.8 | 9.4 | 60 | 12 | 12.6 | .20 | 12. | 13. | 60 | 12 | 15.1 | .24 | 14. | 16. | 60 | 12 |

Figure 6-1

| | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 10N | 7.49 | .38 | 7.3 | 7.7 | 63 | 11 | 9.37 | .09 | 9.2 | 9.6 | 63 | 11 | 12.5 | .14 | 12. | 13. | 63 | 11 | 14.5 | .22 | 14. | 15. | 63 | 11 |
| 20N | 7.66 | .16 | 7.4 | 8.0 | 56 | 11 | 9.63 | .18 | 9.3 | 11. | 56 | 11 | 12.7 | .24 | 12. | 13. | 56 | 11 | 14.6 | .28 | 14. | 15. | 56 | 11 |
| 30N | 8.60 | .57 | 7.7 | 10. | 63 | 11 | 10.7 | .60 | 9.9 | 12. | 63 | 11 | 13.4 | .40 | 13. | 14. | 63 | 11 | 14.7 | .40 | 14. | 15. | 63 | 11 |
| 40N | 10.3 | .54 | 9.3 | 12. | 57 | 12 | 12.3 | .47 | 11. | 13. | 57 | 12 | 13.7 | .39 | 13. | 14. | 57 | 12 | 13.6 | .61 | 12. | 15. | 57 | 12 |
| 50N | 10.4 | .84 | 8.8 | 12. | 68 | 12 | 12.2 | .89 | 10. | 14. | 68 | 12 | 12.8 | .78 | 10. | 14. | 68 | 12 | 12.2 | .76 | 9.8 | 13. | 68 | 12 |
| 60N | 9.31 | .85 | 7.5 | 12. | 47 | 11 | 10.7 | .99 | 8.6 | 13. | 47 | 11 | 11.2 | 1.1 | 9.2 | 13. | 47 | 11 | 10.7 | 1.1 | 8.8 | 12. | 47 | 11 |
| 70N | NO DATA AVAILABLE | | | | | | NO DATA AVAILABLE | | | | | | NO DATA AVAILABLE | | | | | | NO DATA AVAILABLE | | | | | |
| 80N | NO DATA AVAILABLE | | | | | | NO DATA AVAILABLE | | | | | | NO DATA AVAILABLE | | | | | | NO DATA AVAILABLE | | | | | |

NIMBUS-7 SBUV TABLES T634051 NU 83041 VERSION 8203.12 DEC 1978 F636163 FB 10011

SBUV ZONAL MEANS - GEODETIC LATITUDE ZONES

DAILY ZONAL MEANS FOR 2 DEC 1978

HIGH-LEVEL MASS MIXING RATIOS (UGM/GM) PAGE 2 OF 2

PRESSURE LEVELS

| LATITUDE ZONE (CTR) | TERM FLAG | 5.0 MB AVG | STD DEV | MIN | MAX | NUM PTS | NUM ORBS | 7.0 MB AVG | STD DEV | MIN | MAX | NUM PTS | NUM ORBS | 10. MB AVG | STD DEV | MIN | MAX | NUM PTS | NUM ORBS | 15. MB AVG | STD DEV | MIN | MAX | NUM PTS | NUM ORBS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 80S | | 11.6 | .17 | 11. | 12. | 79 | 12 | 10.1 | .26 | 9.6 | 11. | 79 | 12 | 7.36 | .26 | 6.9 | 8.1 | 79 | 12 | 6.44 | .24 | 6.0 | 7.1 | 79 | 12 |
| 70S | | 12.1 | .27 | 12. | 13. | 73 | 12 | 10.9 | .41 | 10. | 12. | 73 | 12 | 8.31 | .47 | 7.5 | 9.4 | 73 | 12 | 7.21 | .41 | 6.6 | 8.2 | 73 | 12 |
| 60S | | 13.3 | .48 | 12. | 14. | 71 | 12 | 12.4 | .67 | 11. | 14. | 71 | 12 | 10.0 | .74 | 8.7 | 12. | 71 | 12 | 8.49 | .61 | 7.4 | 9.9 | 71 | 12 |
| 50S | | 14.5 | .33 | 14. | 15. | 65 | 12 | 14.3 | .51 | 13. | 15. | 65 | 12 | 12.3 | .66 | 11. | 14. | 65 | 12 | 10.2 | .54 | 9.0 | 11. | 65 | 12 |
| 40S | | 15.1 | .30 | 14. | 16. | 62 | 12 | 15.4 | .48 | 15. | 16. | 62 | 12 | 13.8 | .62 | 13. | 15. | 62 | 12 | 11.5 | .49 | 10. | 13. | 62 | 12 |
| 30S | | 15.8 | .24 | 15. | 16. | 71 | 12 | 16.5 | .41 | 15. | 17. | 71 | 12 | 15.4 | .53 | 14. | 16. | 71 | 12 | 12.9 | .41 | 12. | 14. | 71 | 12 |
| 20S | | 16.6 | .31 | 16. | 17. | 60 | 12 | 17.9 | .45 | 17. | 19. | 60 | 12 | 17.0 | .53 | 16. | 18. | 60 | 12 | 14.1 | .43 | 13. | 15. | 60 | 12 |
| 10S | | 16.4 | .29 | 16. | 17. | 64 | 11 | 17.6 | .42 | 17. | 18. | 64 | 11 | 17.1 | .42 | 15. | 18. | 64 | 11 | 14.6 | .37 | 14. | 16. | 64 | 11 |
| 0 | | 15.8 | .20 | 15. | 16. | 56 | 11 | 16.8 | .28 | 16. | 17. | 56 | 11 | 16.6 | .25 | 16. | 17. | 56 | 11 | 14.3 | .20 | 14. | 15. | 56 | 11 |
| 10N | | 15.7 | .31 | 15. | 16. | 63 | 11 | 16.6 | .41 | 16. | 17. | 63 | 11 | 16.1 | .41 | 15. | 17. | 63 | 11 | 13.7 | .34 | 13. | 14. | 63 | 11 |
| 20N | | 15.6 | .33 | 15. | 16. | 56 | 11 | 16.1 | .43 | 15. | 17. | 56 | 11 | 15.1 | .51 | 14. | 16. | 56 | 11 | 12.7 | .52 | 11. | 14. | 56 | 11 |
| 30N | | 15.1 | .65 | 14. | 16. | 63 | 11 | 14.7 | .99 | 13. | 17. | 63 | 11 | 13.2 | 1.0 | 11. | 15. | 63 | 11 | 11.1 | .79 | 9.3 | 13. | 63 | 11 |
| 40N | | 13.0 | .61 | 12. | 15. | 57 | 12 | 11.7 | 1.0 | 9.9 | 15. | 57 | 12 | 10.2 | .94 | 8.6 | 13. | 57 | 12 | 9.02 | .69 | 7.6 | 11. | 57 | 12 |
| 50N | | 11.4 | .74 | 9.2 | 13. | 68 | 12 | 9.82 | .69 | 7.9 | 11. | 68 | 12 | 8.38 | .60 | 6.8 | 9.7 | 68 | 12 | 7.77 | .48 | 6.5 | 8.8 | 68 | 12 |
| 60N | | 9.21 | 1.1 | 8.3 | 12. | 47 | 11 | 8.47 | .97 | 6.9 | 9.9 | 47 | 11 | 7.05 | .83 | 5.6 | 8.2 | 47 | 11 | 6.77 | .75 | 5.3 | 7.9 | 47 | 11 |
| 70N | | NO DATA AVAILABLE | | | | | | NO DATA AVAILABLE | | | | | | NO DATA AVAILABLE | | | | | | NO DATA AVAILABLE | | | | | |
| 80N | | NO DATA AVAILABLE | | | | | | NO DATA AVAILABLE | | | | | | NO DATA AVAILABLE | | | | | | NO DATA AVAILABLE | | | | | |

PRESSURE LEVELS

| LATITUDE ZONE (CTR) | TERM FLAG | 20. MB AVG | STD DEV | MIN | MAX | NUM PTS | NUM ORBS | 30. MB AVG | STD DEV | MIN | MAX | NUM PTS | NUM ORBS | 40. MB AVG | STD DEV | MIN | MAX | NUM PTS | NUM ORBS | MB AVG | STD DEV | MIN | MAX | NUM PTS | NUM ORBS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 80S | | 6.98 | .26 | 6.4 | 7.6 | 79 | 12 | 7.31 | .28 | 6.7 | 7.9 | 79 | 12 | 6.96 | .29 | 6.3 | 7.5 | 79 | 12 | | | | | | |
| 70S | | 7.53 | .35 | 7.0 | 8.4 | 73 | 12 | 7.63 | .26 | 7.3 | 8.2 | 73 | 12 | 7.10 | .22 | 6.6 | 7.6 | 73 | 12 | | | | | | |
| 60S | | 8.30 | .46 | 7.5 | 9.3 | 71 | 12 | 7.68 | .28 | 7.1 | 8.2 | 71 | 12 | 6.79 | .25 | 6.0 | 7.3 | 71 | 12 | | | | | | |
| 50S | | 9.32 | .38 | 8.4 | 9.6 | 65 | 12 | 7.70 | .38 | 7.0 | 8.3 | 65 | 12 | 6.26 | .46 | 5.6 | 7.1 | 65 | 12 | | | | | | |
| 40S | | 10.3 | .28 | 9.3 | 11. | 62 | 12 | 7.46 | .25 | 7.0 | 8.1 | 62 | 12 | 5.58 | .34 | 5.0 | 6.3 | 62 | 12 | | | | | | |
| 30S | | 11.7 | .28 | 10. | 11. | 71 | 12 | 7.23 | .33 | 6.6 | 8.3 | 71 | 12 | 4.98 | .36 | 4.2 | 5.9 | 71 | 12 | | | | | | |
| 20S | | 11.3 | .32 | 11. | 12. | 60 | 12 | 6.94 | .28 | 6.3 | 7.6 | 60 | 12 | 4.24 | .23 | 3.8 | 4.8 | 60 | 12 | | | | | | |
| 10S | | 11.7 | .36 | 11. | 13. | 64 | 11 | 6.99 | .29 | 6.6 | 8.0 | 64 | 11 | 4.01 | .18 | 3.7 | 4.7 | 64 | 11 | | | | | | |
| 0 | | 11.5 | .32 | 11. | 12. | 56 | 11 | 6.85 | .32 | 6.2 | 7.6 | 56 | 11 | 3.83 | .19 | 3.5 | 4.3 | 56 | 11 | | | | | | |
| 10N | | 11.1 | .34 | 10. | 12. | 63 | 11 | 6.72 | .31 | 6.2 | 7.6 | 63 | 11 | 3.87 | .23 | 3.5 | 4.4 | 63 | 11 | | | | | | |
| 20N | | 10.4 | .54 | 9.2 | 12. | 56 | 11 | 6.63 | .45 | 5.5 | 7.6 | 56 | 11 | 4.11 | .33 | 3.4 | 4.8 | 56 | 11 | | | | | | |
| 30N | | 9.50 | .62 | 8.1 | 11. | 63 | 11 | 6.63 | .48 | 5.5 | 7.7 | 63 | 11 | 4.52 | .40 | 3.6 | 5.5 | 63 | 11 | | | | | | |
| 40N | | 8.38 | .54 | 7.0 | 9.6 | 57 | 12 | 6.71 | .49 | 5.5 | 7.3 | 57 | 12 | 5.11 | .48 | 4.1 | 5.8 | 57 | 12 | | | | | | |
| 50N | | 7.75 | .45 | 6.7 | 8.6 | 68 | 12 | 6.92 | .50 | 5.5 | 7.7 | 68 | 12 | 5.75 | .54 | 4.2 | 6.6 | 68 | 12 | | | | | | |
| 60N | | 7.14 | .76 | 5.7 | 8.3 | 47 | 11 | 6.86 | .70 | 5.6 | 8.1 | 47 | 11 | 6.00 | .61 | 5.0 | 7.2 | 47 | 11 | | | | | | |
| 70N | | NO DATA AVAILABLE | | | | | | NO DATA AVAILABLE | | | | | | NO DATA AVAILABLE | | | | | | | | | | | |
| 80N | | NO DATA AVAILABLE | | | | | | NO DATA AVAILABLE | | | | | | NO DATA AVAILABLE | | | | | | | | | | | |

NIMBUS-7 SBUV TABLES T634051 NU 83041 VERSION 8203.12 DEC 1978 F636162 FB 10012

SBUV ZONAL MEANS - GEODETIC LATITUDE ZONES

DAILY ZONAL MEANS FOR 3 DEC 1978

TOTAL OZONE

| LATITUDE ZONE (CENTER) | TERM FLAG | TOTAL OZONE (M-ATM-CM) AVG | STD DEV | MIN | MAX | POPULATION NUMBER POINTS | NUM ORBS |
|---|---|---|---|---|---|---|---|
| 80S | | NO DATA AVAILABLE | | | | | |
| 70S | | NO DATA AVAILABLE | | | | | |
| 60S | | NO DATA AVAILABLE | | | | | |
| 50S | | NO DATA AVAILABLE | | | | | |

Figure 6-2

DATA IN THIS SECTION IS REPRODUCED FROM TOMS ZONAL MEANS TAPE SD NO F183041-2, FILE 3

NIMBUS-7 TOMS TABLES T634151 SDNO F83042 VERSION 2.0-3/82 DEC 1978 F636161 FP 10006

TOMS TOTAL OZONE - GEODETIC LATITUDE ZONES

DAILY ZONAL MEANS FOR 1 DEC 1978

| LATITUDE ZONE (CENTER) | TERM FLAG | TOTAL OZONE (M-ATM-CM) AVG | STD DEV | MIN | MAX | POPULATION NUMBER POINTS | NUM ORBS |
|---|---|---|---|---|---|---|---|
| 90S | | 337.9 | 7.27 | 319.0 | 352.0 | 227 | 14 |
| 85S | | 341.0 | 18.99 | 299.0 | 376.0 | 2095 | 14 |
| 80S | | 340.1 | 20.39 | 300.0 | 386.0 | 4607 | 14 |
| 75S | | 352.6 | 24.79 | 304.0 | 409.0 | 6248 | 14 |
| 70S | | 357.3 | 20.04 | 299.0 | 407.0 | 6800 | 14 |
| 65S | | 352.3 | 20.42 | 297.0 | 407.0 | 6283 | 14 |
| 60S | | 350.3 | 26.02 | 285.0 | 421.0 | 5767 | 14 |
| 55S | | 347.7 | 29.30 | 273.0 | 419.0 | 5393 | 14 |
| 50S | | 335.9 | 29.33 | 290.0 | 402.0 | 4709 | 14 |
| 45S | | 321.7 | 24.37 | 272.0 | 400.0 | 4663 | 14 |
| 40S | | 309.8 | 20.08 | 269.0 | 389.0 | 4606 | 14 |
| 35S | | 297.9 | 14.94 | 263.0 | 361.0 | 4884 | 14 |
| 30S | | 284.9 | 10.89 | 250.0 | 326.0 | 5219 | 14 |
| 25S | | 273.1 | 8.47 | 239.0 | 305.0 | 5344 | 14 |
| 20S | | 264.7 | 9.32 | 238.0 | 304.0 | 4991 | 14 |
| 15S | | 259.4 | 9.25 | 238.0 | 297.0 | 5254 | 14 |
| 10S | | 251.3 | 7.77 | 232.0 | 289.0 | 5336 | 14 |
| 5S | | 244.4 | 7.31 | 226.0 | 271.0 | 5247 | 14 |
| 0 | | 241.2 | 7.27 | 224.0 | 276.0 | 4765 | 13 |
| 5N | | 242.0 | 8.10 | 221.0 | 275.0 | 5003 | 13 |
| 10N | | 244.4 | 8.55 | 223.0 | 267.0 | 4941 | 13 |
| 15N | | 246.7 | 8.58 | 226.0 | 285.0 | 4882 | 13 |
| 20N | | 248.9 | 13.75 | 214.0 | 296.0 | 4856 | 13 |
| 25N | | 253.4 | 16.06 | 217.0 | 301.0 | 4978 | 13 |
| 30N | | 260.1 | 17.99 | 226.0 | 309.0 | 4789 | 14 |
| 35N | | 268.7 | 21.76 | 229.0 | 329.0 | 4698 | 14 |
| 40N | | 273.7 | 24.94 | 223.0 | 374.0 | 4785 | 14 |
| 45N | | 289.4 | 36.71 | 216.0 | 380.0 | 4440 | 14 |
| 50N | | 305.5 | 36.22 | 218.0 | 384.0 | 4289 | 13 |
| 55N | | 309.5 | 34.40 | 230.0 | 392.0 | 4010 | 12 |
| 60N | | 310.1 | 38.48 | 232.0 | 429.0 | 3339 | 11 |
| 65N | | 303.0 | 37.80 | 231.0 | 406.0 | 391 | 11 |
| 70N | | NO DATA AVAILABLE | | | | | |
| 75N | | NO DATA AVAILABLE | | | | | |
| 80N | | NO DATA AVAILABLE | | | | | |
| 85N | | NO DATA AVAILABLE | | | | | |



Figure 6-3

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 70S | | 304.2 | 23.97 | 238.0 | 369.0 | 36306 | 7 |
| 65S | | 304.2 | 23.27 | 239.0 | 372.0 | 38879 | 7 |
| 60S | | 305.7 | 20.80 | 244.0 | 369.0 | 37452 | 7 |
| 55S | | 306.4 | 20.60 | 255.0 | 379.0 | 34941 | 7 |
| 50S | | 299.7 | 22.01 | 242.0 | 373.0 | 33954 | 7 |
| 45S | | 289.7 | 21.99 | 240.0 | 370.0 | 33052 | 7 |
| 40S | | 281.2 | 20.70 | 240.0 | 367.0 | 33300 | 7 |
| 35S | | 273.0 | 19.54 | 228.0 | 372.0 | 32925 | 7 |
| 30S | | 265.0 | 16.73 | 228.0 | 348.0 | 32531 | 7 |
| 25S | | 257.4 | 13.08 | 224.0 | 321.0 | 32537 | 7 |
| 20S | | 249.8 | 10.75 | 220.0 | 296.0 | 32140 | 7 |
| 15S | | 242.9 | 9.19 | 217.0 | 290.0 | 32141 | 7 |
| 10S | | 237.8 | 8.85 | 211.0 | 292.0 | 32382 | 7 |
| 5S | | 234.4 | 8.53 | 204.0 | 271.0 | 32502 | 7 |
| 0 | | 231.6 | 7.02 | 206.0 | 269.0 | 32949 | 7 |
| 5N | | 230.5 | 5.45 | 207.0 | 253.0 | 32794 | 7 |
| 10N | | 230.8 | 7.28 | 208.0 | 256.0 | 32414 | 7 |
| 15N | | 235.4 | 12.79 | 206.0 | 309.0 | 32398 | 7 |
| 20N | | 250.3 | 24.93 | 206.0 | 346.0 | 32602 | 7 |
| 25N | | 276.4 | 40.11 | 215.0 | 406.0 | 32153 | 7 |
| 30N | | 301.8 | 50.69 | 219.0 | 465.0 | 32680 | 7 |
| 35N | | 323.5 | 59.09 | 224.0 | 501.0 | 33104 | 7 |
| 40N | | 346.5 | 67.03 | 229.0 | 534.0 | 32868 | 7 |
| 45N | | 361.8 | 64.63 | 236.0 | 508.0 | 31136 | 7 |
| 50N | | 364.4 | 63.90 | 241.0 | 538.0 | 28956 | 7 |
| 55N | | 364.1 | 63.14 | 241.0 | 586.0 | 23843 | 7 |
| 60N | | 345.5 | 62.88 | 240.0 | 554.0 | 17651 | 7 |
| 65N | | 341.5 | 67.97 | 232.0 | 546.0 | 13465 | 7 |
| 70N | X | 327.4 | 66.24 | 216.0 | 512.0 | 8721 | 7 |
| 75N | | 311.6 | 52.39 | 211.0 | 460.0 | 3020 | 7 |
| 80N | | 322.8 | 24.75 | 244.0 | 366.0 | 42 | 6 |
| 85N | | NO DATA AVAILABLE | | | | | |
| 90N | | NO DATA AVAILABLE | | | | | |

NIMBUS-7 TOMS TABLES I634151 SONO E P83042 VERSION 2.0-V02 JAN 1979 F636761 FP 18158

TOMS TOTAL OZONE - GEOMAGNETIC LATITUDE-ZONES

MONTHLY ZONAL MEANS FOR JAN 1979

| LATITUDE ZONE (CENTER) | TERN FLAG | TOTAL OZONE (M-ATM-CM) AVG | STD DEV | MIN | MAX | POPULATION NUMBER POINTS | NUM DAYS |
|---|---|---|---|---|---|---|---|
| 90S | | 303.3 | 8.66 | 276.0 | 328.0 | 6942 | 26 |
| 85S | | 304.3 | 13.02 | 266.0 | 356.0 | 52670 | 28 |
| 80S | | 306.1 | 17.80 | 262.0 | 368.0 | 95142 | 28 |
| 75S | | 307.6 | 19.44 | 256.0 | 373.0 | 127431 | 29 |
| 70S | | 308.7 | 20.25 | 238.0 | 380.0 | 149587 | 29 |
| 65S | | 312.9 | 21.78 | 239.0 | 391.0 | 157361 | 29 |
| 60S | | 314.4 | 22.44 | 235.0 | 391.0 | 153193 | 29 |
| 55S | | 313.0 | 22.39 | 243.0 | 393.0 | 144526 | 29 |
| 50S | | 306.1 | 24.96 | 242.0 | 393.0 | 139510 | 29 |
| 45S | | 296.4 | 26.64 | 240.0 | 392.0 | 136941 | 29 |
| 40S | | 286.9 | 25.68 | 232.0 | 395.0 | 135864 | 29 |
| 35S | | 277.9 | 23.22 | 224.0 | 379.0 | 133519 | 29 |
| 30S | | 269.6 | 20.09 | 224.0 | 372.0 | 132834 | 29 |
| 25S | | 261.7 | 16.48 | 222.0 | 349.0 | 133322 | 29 |
| 20S | | 254.3 | 14.55 | 217.0 | 331.0 | 132467 | 29 |
| 15S | | 246.7 | 12.89 | 214.0 | 311.0 | 132455 | 29 |
| 10S | | 241.2 | 11.66 | 210.0 | 295.0 | 132123 | 29 |
| 5S | | 237.6 | 10.79 | 204.0 | 285.0 | 132043 | 29 |
| 0 | | 234.6 | 8.87 | 206.0 | 276.0 | 132670 | 29 |
| 5N | | 233.0 | 7.06 | 207.0 | 265.0 | 132919 | 29 |
| 10N | | 233.4 | 7.87 | 206.0 | 268.0 | 132371 | 29 |
| 15N | | 238.3 | 12.33 | 206.0 | 309.0 | 131962 | 29 |
| 20N | | 250.4 | 23.41 | 206.0 | 400.0 | 132514 | 29 |
| 25N | | 270.9 | 39.35 | 203.0 | 430.0 | 131921 | 29 |
| 30N | | 295.6 | 52.10 | 208.0 | 475.0 | 132712 | 29 |
| 35N | | 320.2 | 62.22 | 221.0 | 538.0 | 132466 | 29 |
| 40N | | 340.6 | 67.05 | 225.0 | 564.0 | 130836 | 29 |
| 45N | | 352.7 | 64.66 | 217.0 | 598.0 | 124701 | 29 |
| 50N | | 353.4 | 59.42 | 210.0 | 588.0 | 113501 | 29 |
| 55N | | 344.0 | 56.35 | 206.0 | 586.0 | 89222 | 29 |
| 60N | | 338.0 | 55.99 | 199.0 | 554.0 | 67395 | 27 |
| 65N | X | 338.6 | 57.13 | 207.0 | 546.0 | 49539 | 27 |
| 70N | X | 338.0 | 55.08 | 216.0 | 545.0 | 28936 | 27 |
| 75N | | 335.4 | 53.28 | 211.0 | 520.0 | 7138 | 27 |

Figure 6-4

# 7. SBUV POLAR STEREOGRAPHIC CONTOURS MICROFILM PRODUCT

## 7.1 SBUV Contours Product Description

A single SBUV Polar Stereographic Contours Microfilm product is available. Each reel of microfilm contains daily and monthly average global, synoptic analyses of total ozone and ozone mass mixing ratio at 0.4, 1, 2, 5, 10 and 30 mb for one year of data.

## 7.2 SBUV Contours Product Derivation

The analysis system employed is a modification of the iterative correction scheme put forth initially by Cressman (1959) (ref 4)* and Yanai (1964) (ref 5)* and extended to the standard NMC 65 x 65 rectangular array on a polar stereographic projection. The gridded array for the Northern Hemisphere is depicted in Figure 7-1.

The technique is based on the adjustment of a first guess field toward the data and, as such, the initial creation of a reasonable first guess field is critical to the procedure. For day 1, the first guess is derived from zonal average values of the reported data over $15^{o}$ latitude bands. To avoid discontinuities in the guess field, a linear interpolation, based on the actual latitude of the gridpoints, is performed between the latitude bands. Due to the northern termination of daylight, winter hemisphere data are averaged only in the five latitude bands: $0^{o}$-$15^{o}$, $15^{o}$-$30^{o}$, $30^{o}$-$45^{o}$, $45^{o}$-$60^{o}$ and $60^{o}$-$75^{o}$. First guess values beyond $75^{o}$ latitude are extrapolated from the $45^{o}$-$60^{o}$, and $60^{o}$-$75^{o}$ latitude bands in winter. Thus, in winter the analyses are considered to be valid equatorward of approximately $65^{o}$, but as the data become available poleward of $65^{o}$ they are included and, ultimately, in summer the analysis is valid to $80^{o}$. In practice, the latitude of the most poleward data value is delineated and noted as part of the analysis archival.

After the initial day, each following analysis utilizes the previous day's analysis as the first guess. Persistence up to about 2 days has been shown to be a reasonable first guess field. Beyond this time window the analyses are reinitialized by using the zonal average as the first guess field.

*See Appendix A, References

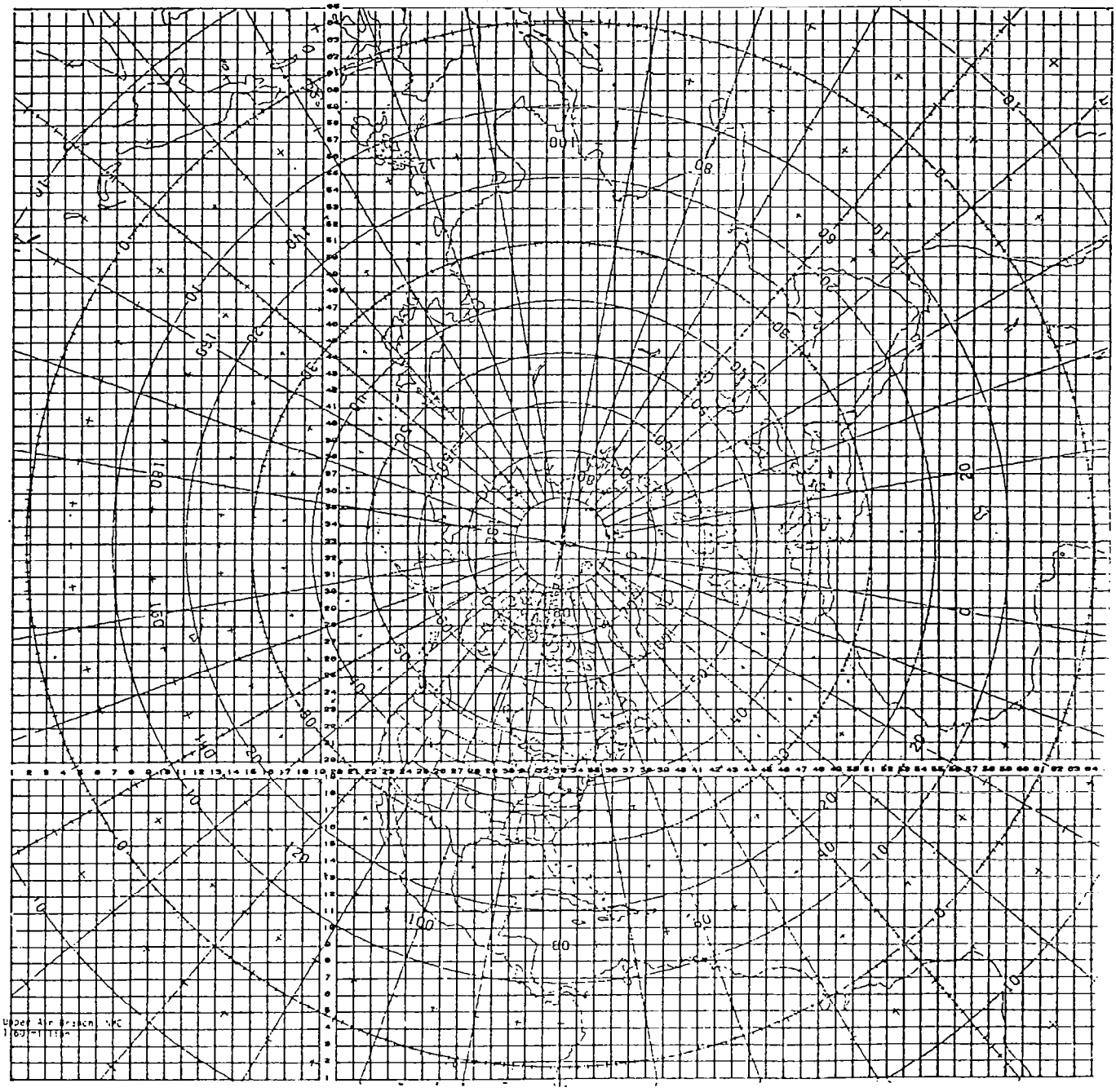


Figure 7-1

With an established first guess, the analysis uses five scans to successfully adjust the values at all gridpoints to nearby data. The technique is described by Yanai (1967) and is similar to that described by Cressman (1959). The five scans allow influence by data within 6, 5, 4, 3, and 2 gridlengths of any gridpoint at latitudes poleward of 37.5° and 10, 9, 8, 7, and 6 gridlengths of any gridpoint at latitudes equatorward of 37.5°, respectively. Gridpoint adjustments are a function of the difference between data values and the first guess field interpolated (bilinearly) to the data location. (The interpolation is performed using the four gridpoints surrounding the data location.) The differences are multiplied by a weighting ratio, W, whose numerator is the difference of the squares of the maximum grid radius and the actual grid distance (between gridpoint and observation). The denominator is the sum of these squares. (See equation (1) below.) Weighted corrections are algebraically added, then averaged, and finally added to gridpoints. (See equation (2) below.) This process is applied for all 4225 points and five scans over each point.

$$W = \frac{M^2 - D^2}{M^2 + D^2} \qquad (1)$$

: W = weight, $W \geq 0$ only

: M = current maximum scan radius

: D = distance between gridpoint and an observation

$$C_N = \frac{\sum W_i \times E_i}{\sum W_i} \qquad (2)$$

: $C_N$ = composite gridpoint correction for scan 'N'

: $W_i$ = weight for each observation (equation 1)

: $E_i$ = error (difference) between data and interpolation

Prior to final output, the analyses are smoothed with a routine using each gridpoint and the eight surrounding gridpoints. As an indication of the precision of the analyses, the root mean square differences of data minus analyses are less than about 5%.

Examples of the output products are presented in Section 7.3 using analyses for February 28, 1979. One final point on the analysis procedure is that since the SBUV data are for near local noon only, no attempt has been made to time-interpolate the data. The analyses, then, actually represent a near-noon value rather than a true synoptic time. Finally, the daily analyses are averaged to produce monthly average charts.

## 7.3 SBUV Contours Product Samples

Figures 7-2 through 7-8 display the contours film products available.

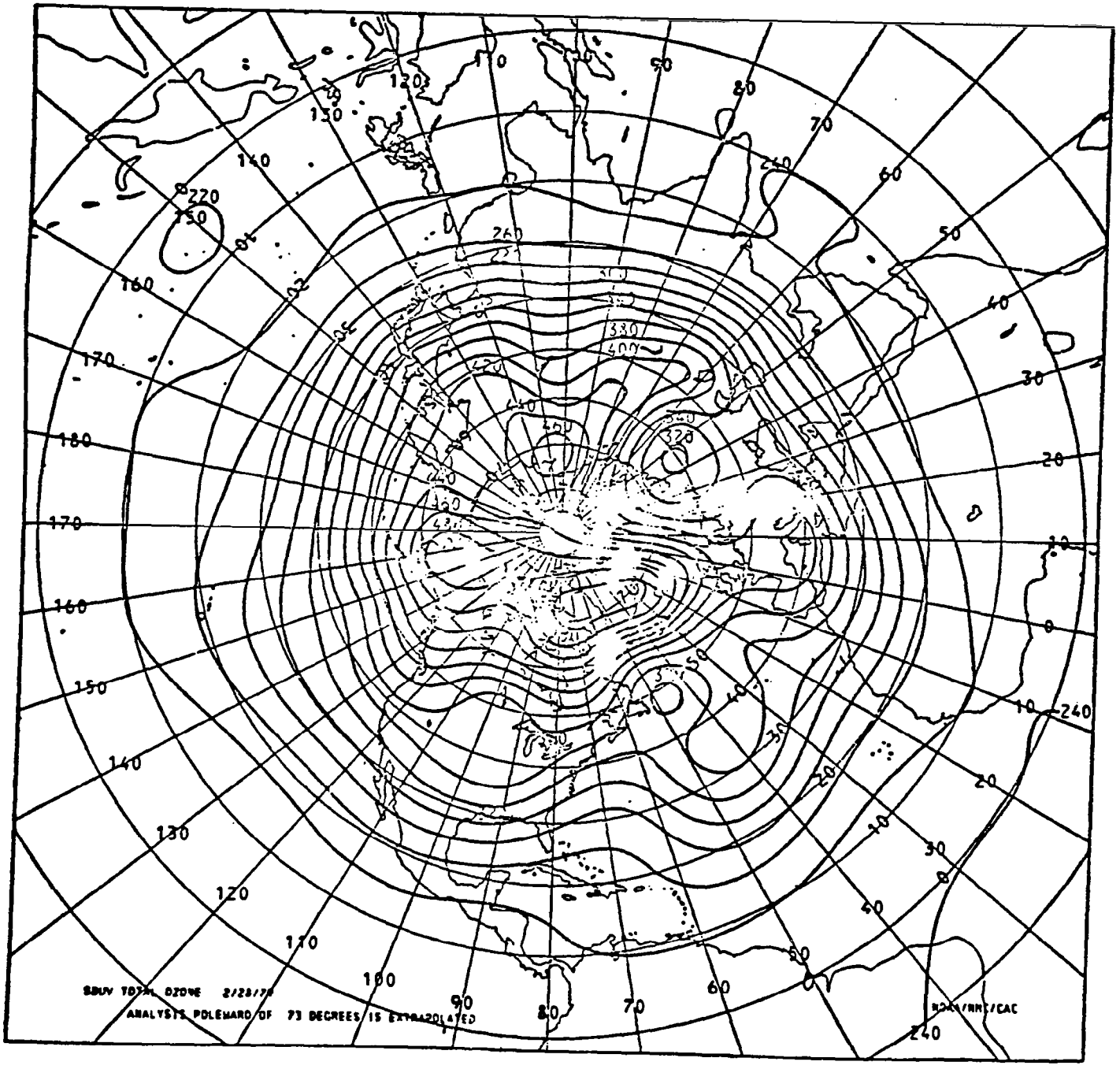

SBUV TOTAL OZONE 2/28/79
ANALYSIS POLEWARD OF 73 DEGREES IS EXTRAPOLATED

Figure 7-2

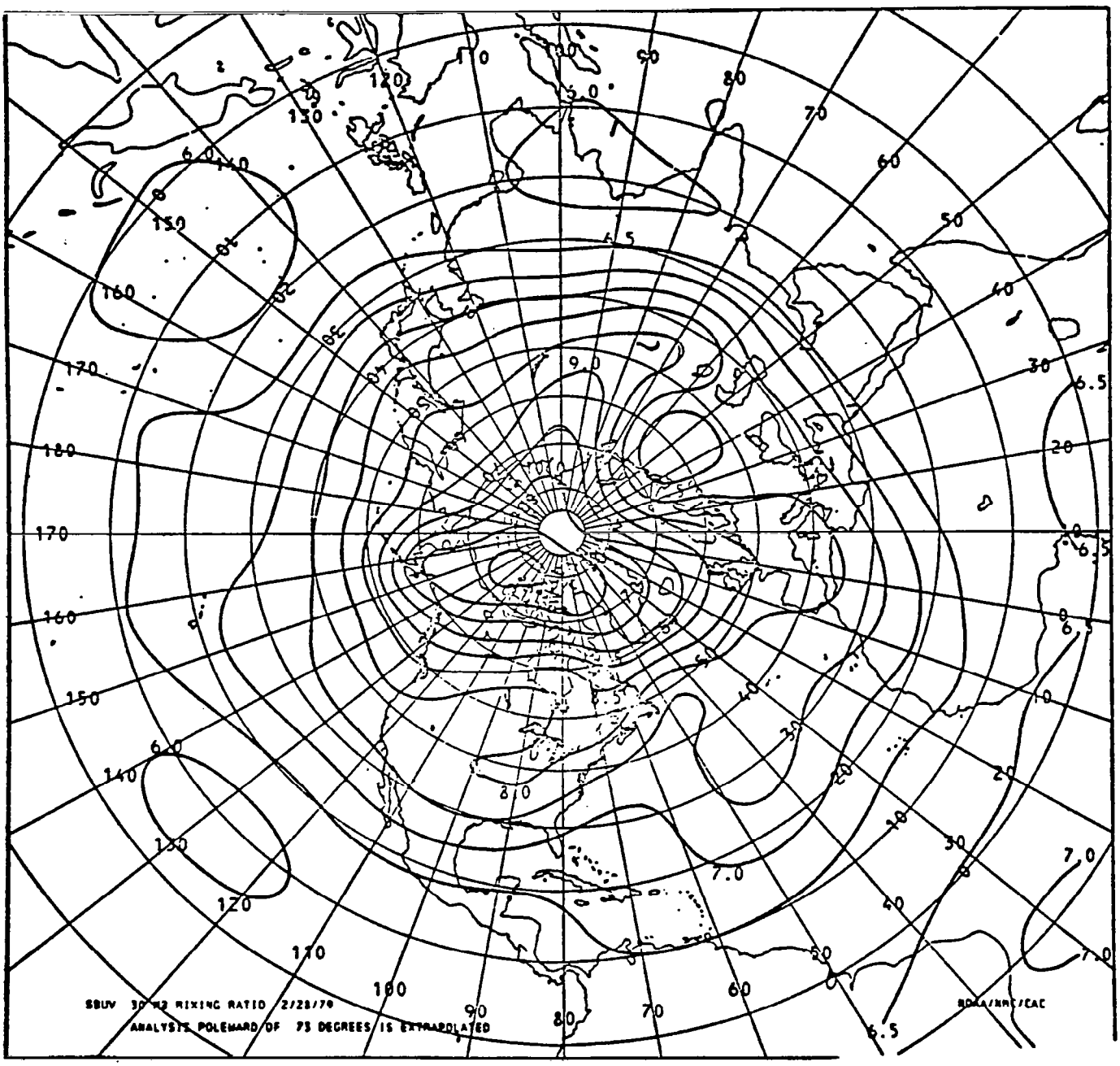

SBUV 3D H2 MIXING RATIO 2/28/79
ANALYSIS POLEWARD OF 75 DEGREES IS EXTRAPOLATED

Figure 7-3

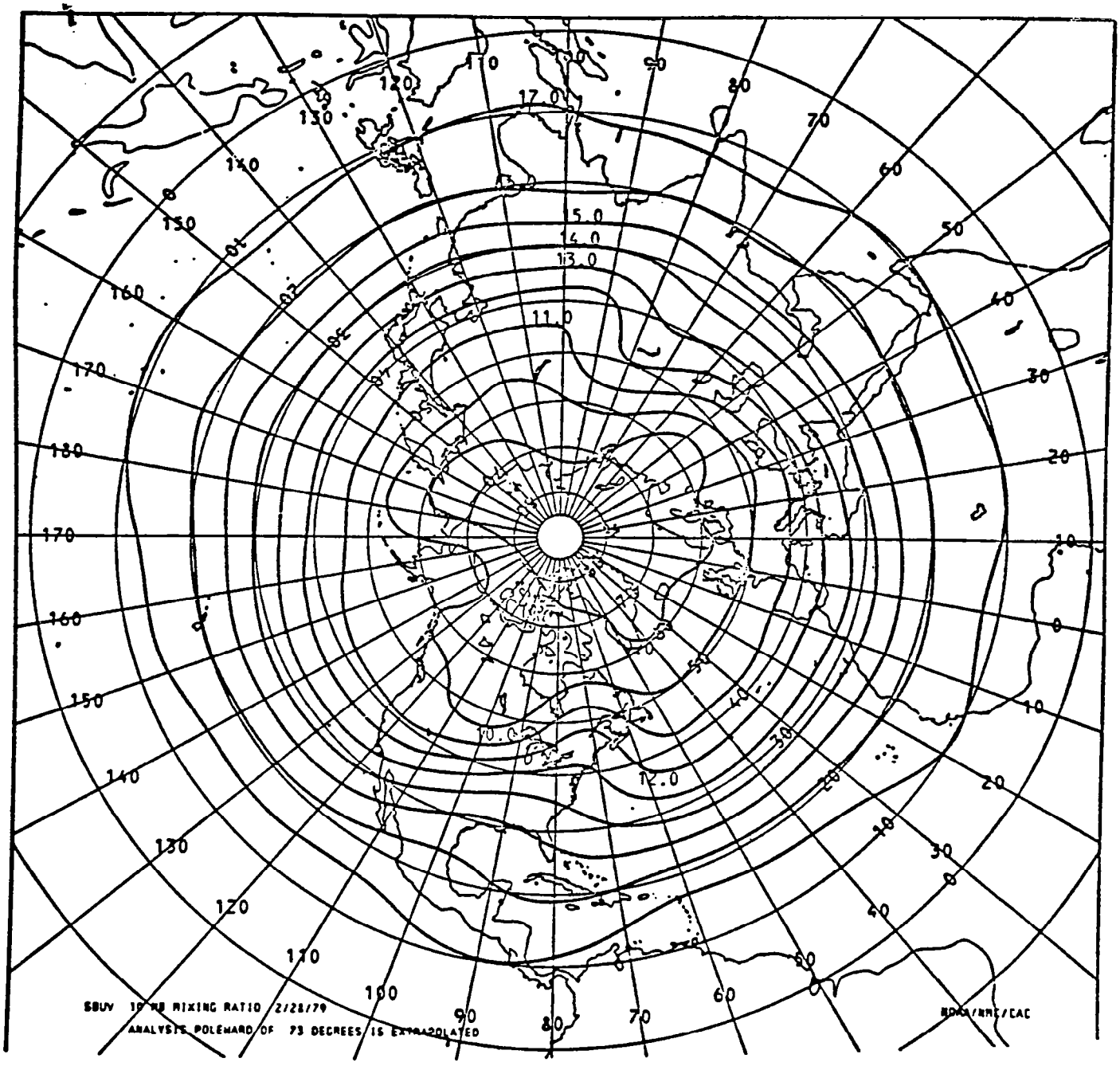

15.0
14.0
13.0
11.0
12.0
10.0
SBUV
MIXING RATIO 2/28/79
ANALYSIS POLEWARD OF 73 DEGREES IS EXTRAPOLATED

Figure 7-4

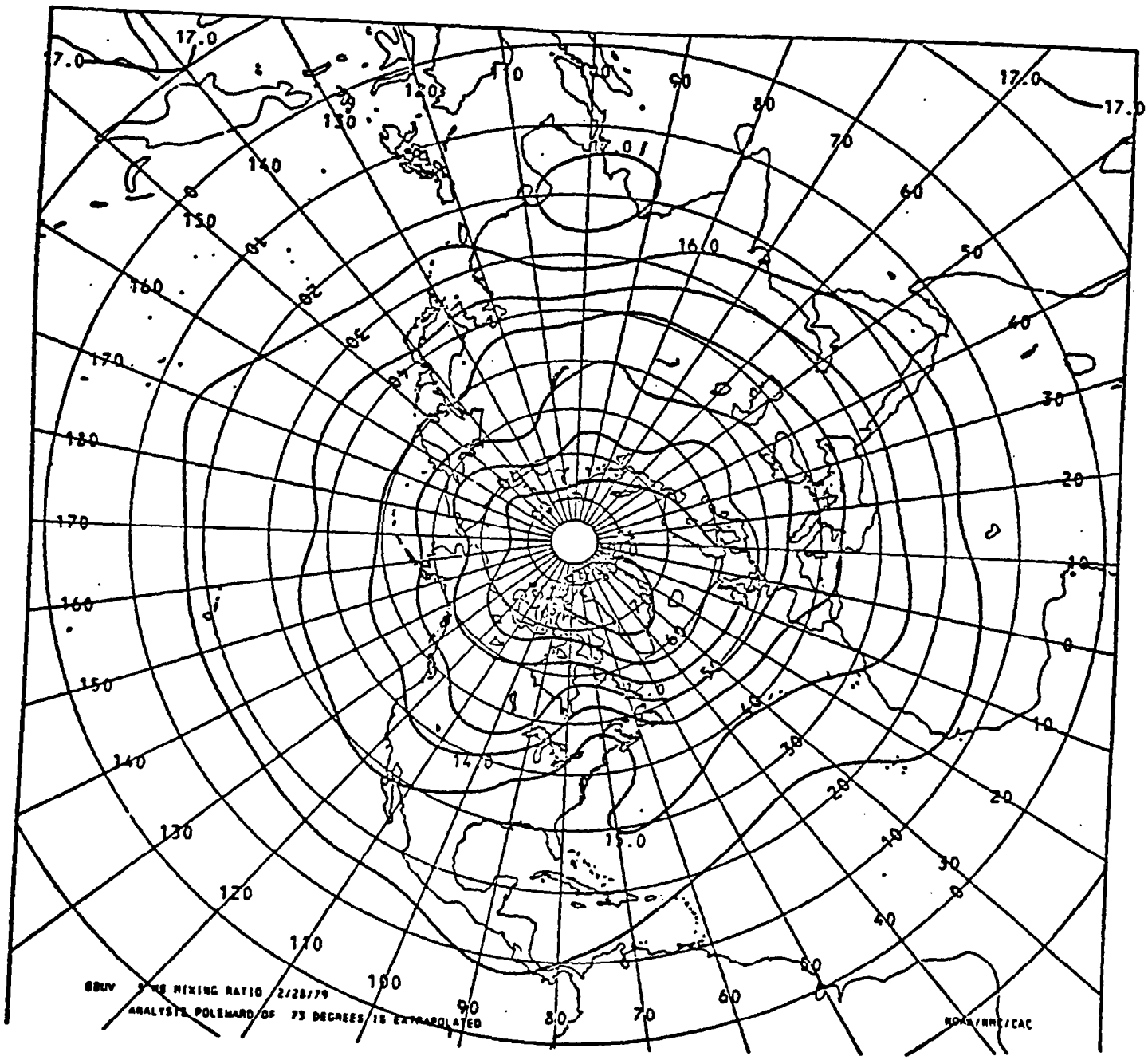

17.0
16.0
15.0
14.0
13.0
12.0
11.0
10.0
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0
SBUV
MIXING RATIO 2/28/79
ANALYSIS POLEWARD OF 73 DEGREES IS EXTRAPOLATED
NOAA/NMC/CAC

Figure 7-5

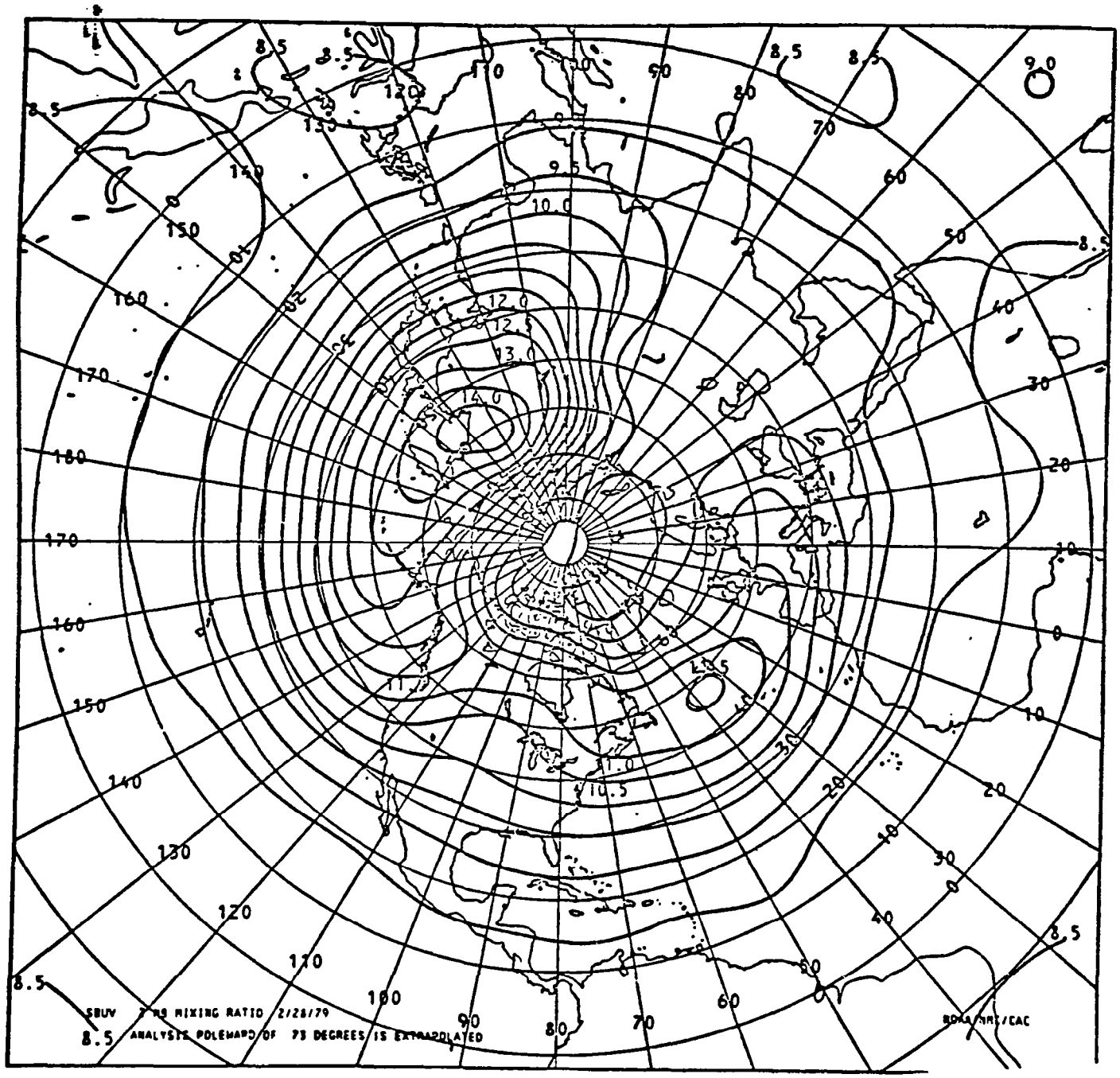

SBUV
MIXING RATIO 2/28/79
ANALYSIS POLEWARD OF 73 DEGREES IS EXTRAPOLATED

Figure 7-6

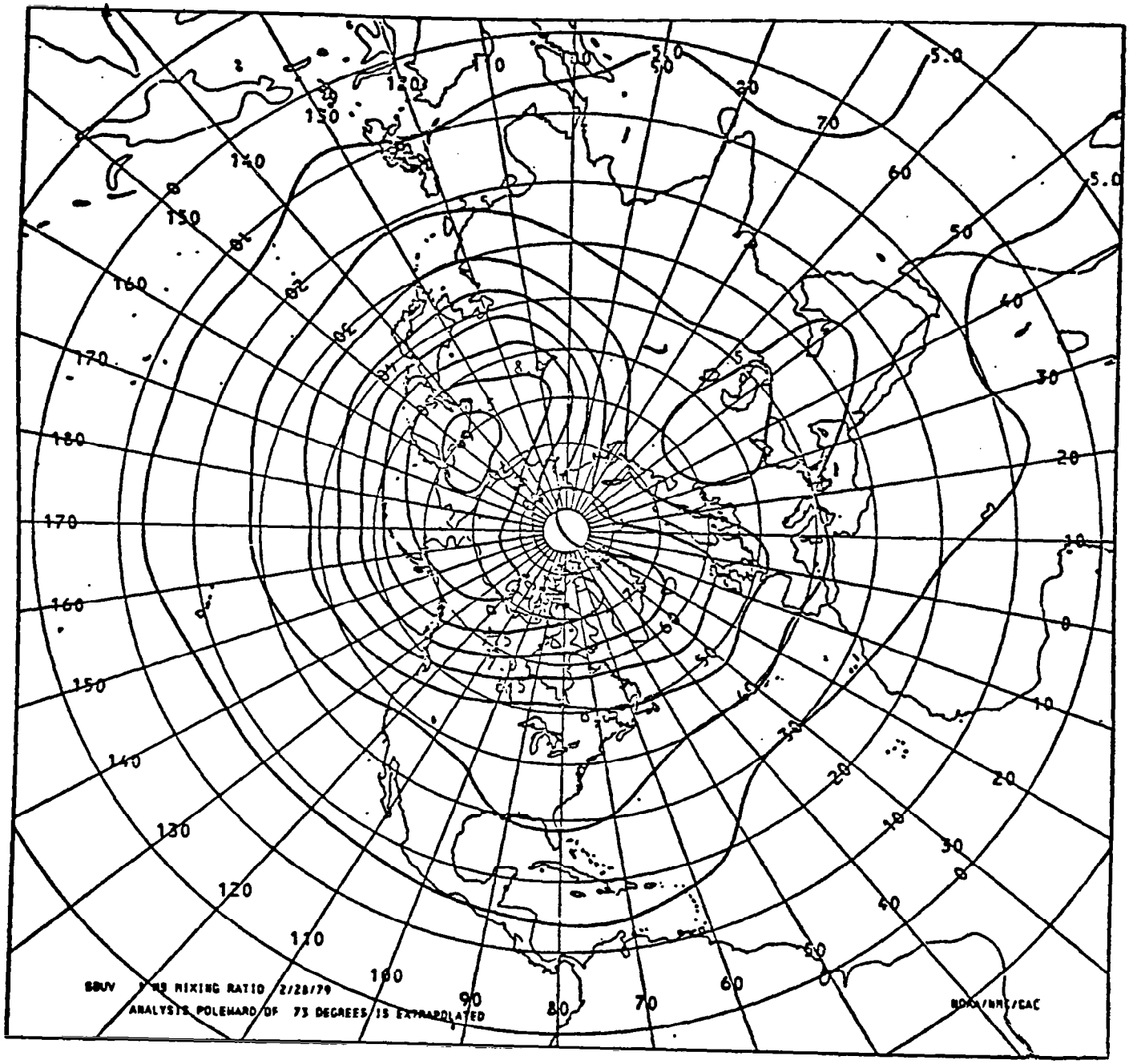



Figure 7-7

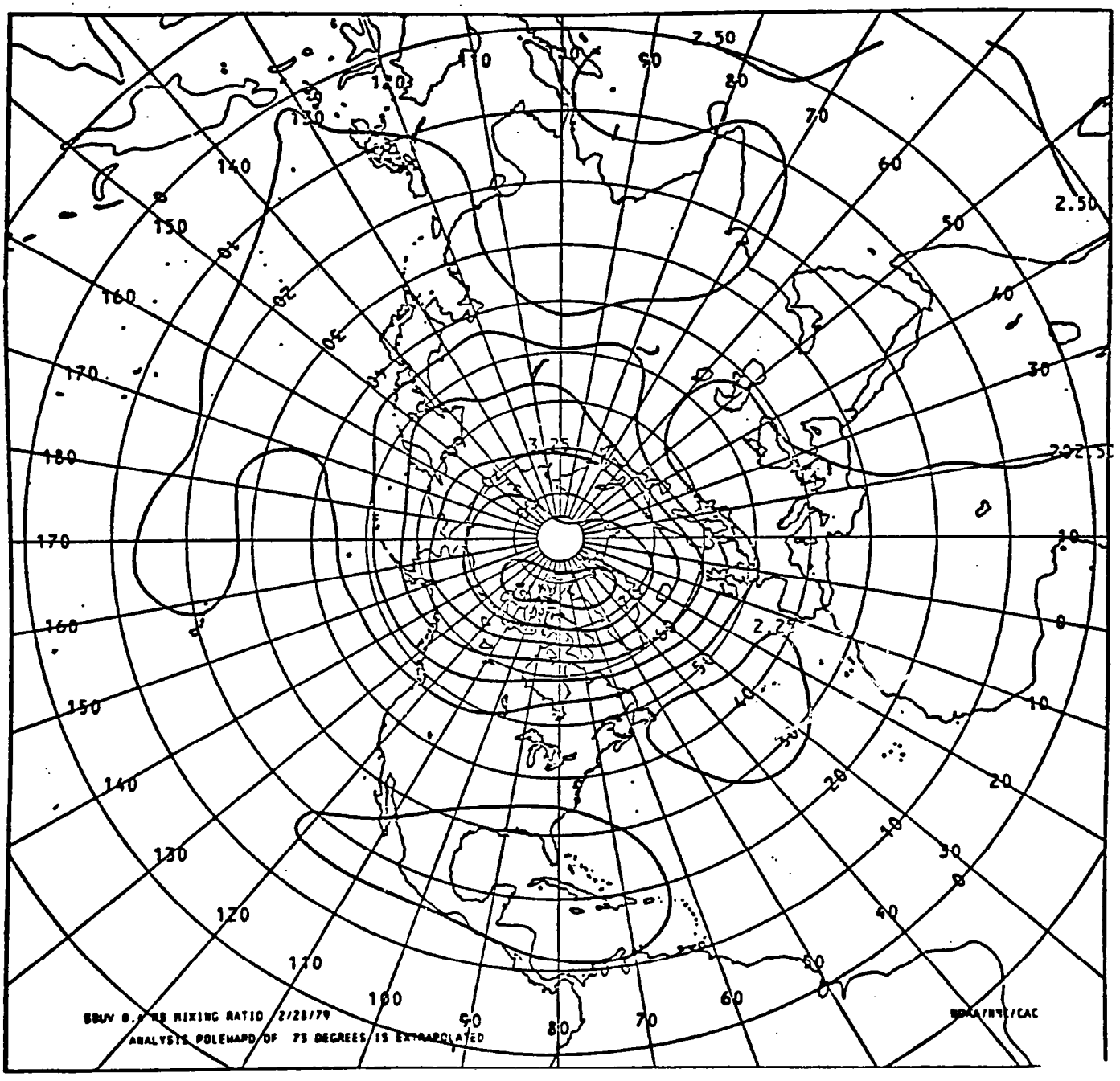

2.50
2.50
2.75
2.75
202.5
SBUV
MIXING RATIO 2/28/79
ANALYSIS POLEWARD OF 73 DEGREES IS EXTRAPOLATED

Figure 7-8

## 7.4 Logical Structure of SBUV Contours Tape

Each data record is a map record containing both a northern and southern hemisphere polar stereographic projection. Each file contains one day of data, which is seven records in the order total ozone followed by mass mixing ratios at 30, 10, 5, 2, 1 and 0.4 mb. There are no monthly or quarterly products. Data are available only when the SBUV subsystem is in normal earth viewing step scan mode and the field of view is illuminated by the sun.

Table 7-1

SBUV DAILY CONTOURS MAP

RECORD FORMAT

MSB LSB

32 24 16 12 1

WORDS BITS

| WORDS | | | | | BITS |
|---|---|---|---|---|---|
| 1 | Physical Record No.(12) | Spare (4) | File Control (2) Record ID (6) | Spare(8) | 32 |
| 2 | Data Coverage Code (8) | Altitude Code (8) | Day of Data | | 64 |
| 3 | Northern Hemisphere Mid-Range Value(IBM REAL*4 Floating Point) | | | | 96 |
| 4 | Year of Data | | Northern Hemisphere Scaling Value | | 128 |
| 5 | Southern Hemisphere Mid-Range Value(IBM REAL*4 Floating Point) | | | | 160 |
| 6 | Spare | | Southern Hemisphere Scaling Value | | 192 |
| 7 | Units Code | | Units Scale | | 224 |
| 8 | Pressure Level in Millibars | | | | 256 |
| 9-12 | Northern Polar Map Orientation Words (8, 16-Bit Words) | | | | 384 |
| 13-16 | Southern Polar Map Orientation Words (8, 16-Bit Words) | | | | 512 |
| 17 | Hem. Vert. Size (I) | | Hem. Hor. Size (J) | | 544 |
| 18-2130 | Northern Hemisphere Polar Map Matrix 4225 16-Bit Words | | Northern Limit | | 68,160 |
| 2131-4243 | Southern Hemisphere Polar Map Matrix 4225 16-Bit Words | | Southern Limit | | 135,776 |
| 4244 4320 | Spares | | | | 138,240 |

Table 7-2

SBUV POLAR STEREOGRAPHIC CONTOURS

ITEM DESCRIPTIONS

| Item No. | Word | Detailed Description of Data Items |
|---|---|---|
| 1 | 1 | PHYSICAL RECORD NO. (12 BITS) - This is the number of this record within a file. |
| 2 | 1 | FILE CONTROL (2 BITS):<br>Last record in file indicator (1) - The most significant bit (MSB) is set to "1" to indicate last record in file.<br><br>Last file on tape indicator (1) - The second MSB is set to "1" in all records of the last file on the tape. |
| 3 | 1 | RECORD ID (6 BITS) - This field identifies the map data records<br><br>24 = SBUV Daily |
| 4 | 2 | DATA COVERAGE (8 BITS) - A code to indicate length of data period of this record. (01 = DAILY) . |
| 5 | 2 | ALTITUDE CODE (8 BITS) - A number which defines the pressure level at which the parameter is to be mapped: |

| Code | Value |
|---|---|
| 13 | 30 mb |
| 17 | 10 mb |
| 19 | 5 mb |
| 22 | 2 mb |
| 24 | 1 mb |
| 27 | .4 mb |
| 58 | Total Ozone, in Dobson Units |

Table 7-2

SBUV POLAR STEREOGRAPHIC CONTOURS

ITEM DESCRIPTIONS (Cont.)

| Item No. | Word | Detailed Description of Data Items |
|---|---|---|
| 6 | 2 | DAY OF DATA (16 BITS) - The day number for the period in this record |
| 7 | 3 | NORTHERN HEMISPHERE MID-RANGE VALUE (32 BITS, IBM Real*4 floating point) - see item no. 9. |
| 8 | 4 | YEAR OF DATA (16 BITS) - Year for the data in this record |
| 9 | 4 | NORTHERN HEMISPHERE SCALING VALUE (16 BITS) - The method for scaling and packing the data are as follows: First, find the maximum and minimum data values QMAX and QMIN, respectively. This determines the mid-range value A: $$A = (QMAX + QMIN) / 2.0$$ Now find the binary scaling value n, the least integer such that: $$QMAX - A < 2^{**}n$$ The mid-range value A is stored in the Northern Hemisphere Mid-Range Value as a 32-bit IBM floating number and the binary scaling value n is stored as a 16-bit integer in the right half of this word. The data array is now scaled according to: $$H(j) = (Q(j - A) * 2^{**}(15 - n), j = 1,...,J$$ where the scaled values H(j) are rounded and converted to 16-bit integers and stored in sequence. |
| 10 | 5 | SOUTHERN HEMISPHERE MID-RANGE (32 BITS, IBM Real*4 floating point) - same as item no. 7 but for southern hemisphere |

Table 7-2

SBUV POLAR STEREO GRAPHIC CONTOURS

ITEM DESCRIPTIONS (Cont.)

| Item No. | Word | Detailed Description of Data Items |
|---|---|---|
| 11 | 6 | SOUTHERN HEMISPHERE SCALING VALUE (16 BITS) - Same as item no. 9 but for southern hemisphere |
| 12 | 7 | UNITS CODE (16 BITS) - A coded number which indicates the units used on the map (=19, for M-ATM-CM (for total ozone) or 7, for MICROGM/GM (for mixing ratios)) |
| 13 | 7 | UNIT SCALE CODE (16 BITS) - This number will be the exponent to the base 10 that applies to the units used above. A negative exponent will be expressed using a 2's complement (=0 for SBUV contours data). |
| 14 | 8 | PRESSURE LEVEL (32 BITS) - This is the atmospheric pressure level in millibars of the data presented in this map. |
| 15 | 9-12 | NORTHERN POLAR MAP ORIENTATION DEFINITION WORDS (8 16-BIT WORDS) - The eight 16-bit words which define a hemisphere orientation. The word order and definitions are as follows:<br>Word 1. Upper Latitude<br>$180^{o}$ if Northern Hemisphere map perimeter.<br>$90^{o}$ if Southern Hemisphere map perimeter.<br>Word 2. Lower Latitude<br>$0^{o}$ if Southern Hemisphere map perimeter.<br>$90^{o}$ if Northern Hemisphere map perimeter.<br>Word 3. Orientation of Greenwich (No. of Degrees) CW from the Vertical Meridian;<br>$100^{o}$ if Northern Hemisphere;<br>$80^{o}$ if Southern Hemisphere. |

Table 7-2

SBUV POLAR STEREO GRAPHIC CONTOURS

ITEM DESCRIPTIONS (Cont.)

| Item No. | Word | Detailed Description of Data Items |
|---|---|---|
| | | Word 4. Number of mesh intervals between pole and equator. 1/2(N-1) for N x N matrix. |
| | | Word 5. Horizontal index of the pole (from left of the map). |
| | | Word 6. Vertical index of the pole (from the top of the map). |
| | | Word 7. Total number of horizontal map grid/values. (Must be square and odd). Maximum = 65. |
| | | Word 8. Total number of vertical map grid/values. (Must be square and odd). Maximum = 65. |
| 16 | 13-16 | SOUTHERN POLAR MAP ORIENTATION DEFINITION WORDS (8, 16 BIT WORDS) - Same as Item (15) only for the Southern Hemisphere. |
| 17 | 17 | HEMISPHERE VERTICAL SIZE (I) (16 BITS) - This word defines the number of points along the vertical scale of the map matrix (Maximum of 65). |
| 18 | 17 | HEMISPHERE HORIZONTAL SIZE (J) (16 BITS) - This word defines the number of points along the horizontal scale of the map matrix (Maximum of 65). |
| 19 | 18-2130 | NORTHERN HEMISPHERE POLAR MAP (67,600 BITS) - This is a 65 x 65 (4225 16 BIT WORDS) matrix for the Northern Hemisphere Polar Stereographic Map. There will be 32 values on either side of the vertical median and the horizontal |

Table 7-2

SBUV POLAR STEREO GRAPHIC CONTOURS

ITEM DESCRIPTIONS (Cont.)

| Item No. | Word | Detailed Description of Data Items |
|---|---|---|

meridian. The matrix is numbered beginning at the upper left hand corner with Row 1, Column 1 and proceeding to the upper right corner to Row 1, Column 65. The pole will then be Row 33, Column 33 and the last data point will be Row 65, Column 65. The matrix words will be arranged in the output as shown below. If less than 65 x 65, pad at end.

| 32 BIT WORD # | MSB 32 | 16 LSB 1 |
|---|---|---|
| 18 | ROW 1, COLUMN 1 | ROW 1, COLUMN 2 |
| | ROW 1, COLUMN 3 | ROW 1, COLUMN 4 |
| | . | . |
| | . | . |
| | . | . |
| 50 | ROW 1, COLUMN 65 | ROW 2, COLUMN 1 |
| | . | . |
| | . | . |
| | . | . |
| 2129 | ROW 65, COLUMN 63 | ROW 65, COLUMN 64 |
| 2130 | ROW 65, COLUMN 65 | ROW 65, COLUMN 64 |

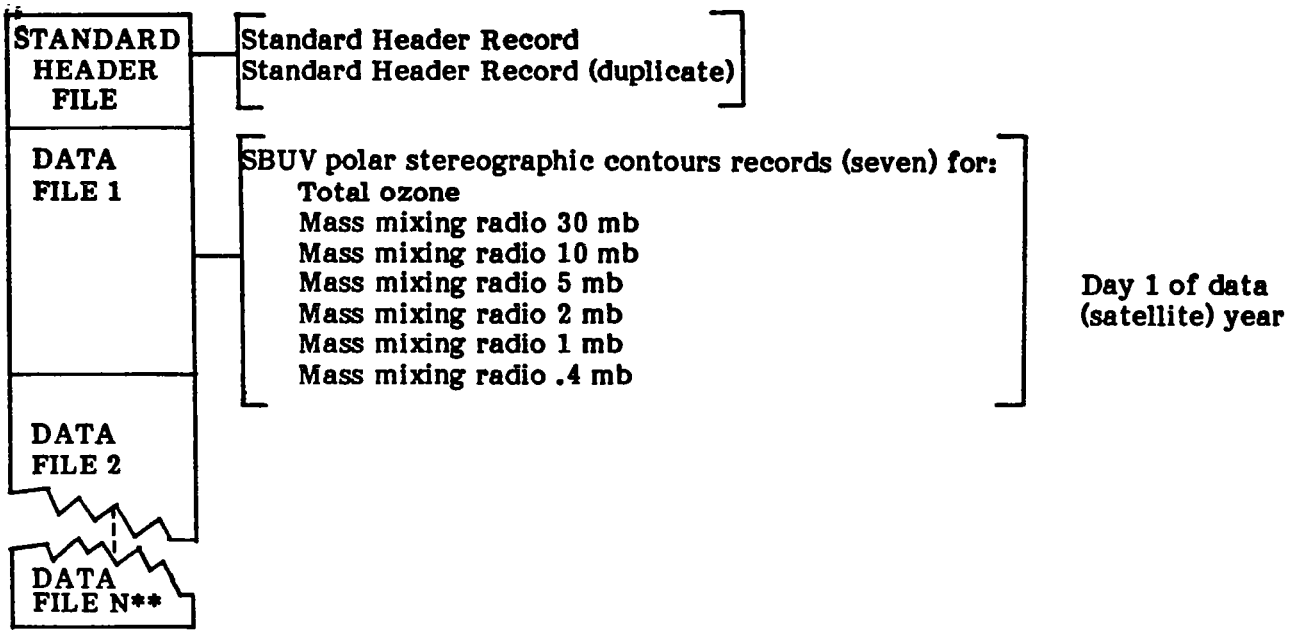
| | | |
|---|---|---|
| 20 | 2130 | NORTHERN HEMISPHERE DATA LIMIT (16 BITS) - This number is the latitude limit of data, rounded to the nearest degree. The data limit should range from $81^{o}$ in the summer to $67^{o}$ in the winter. |
| 21 | 2131-4243 | SOUTHERN HEMISPHERE POLAR MAP (67,600 BITS) - Same as Item (19) except for southern hemisphere. |
| 22 | 4243 | SOUTHERN HEMISPHERE DATA LIMIT (16 BITS) - This number is the latitude limit of data, rounded to the nearest degree. The data limit should range from $67^{o}$ in the summer to $81^{o}$ in the winter. |

## 7.5 Physical Structure of SBUV Contours Tape

### 7.5.1 Tape Organization

The SBUV Polar Stereographic Contours Tape is a 9-track 1600 bpi unlabeled tape created on the IBM 360/195. Two tapes contain one year's worth of data. The first file on each tape contains a Nimbus Observation Processing System (NOPS) Standard Header. There is one data file for each day of data. There is no dummy Trailer File. A tape mark indicates end of data on a tape. First year data does not contain a NOPS Trailer Documentation File.

The NOPS Standard Header File is described in Appendix C. Figure 7-9 shows the organization of the SBUV contours data on tape.




Each product (year) requires 2 tapes with $N_1$ (tape 1) + $N_2$ (tape 2) = 365 (or 366)

Figure 7-9: SBUV POLAR STEREOGRAPHIC CONTOURS TAPE ORGANIZATION

## 7.52 Tape and File Specifications

Tape Specifications: 1600 BPI, 9 track non-labeled tape (spec. #634171), PDF code - MAFQ

File Specifications:

| | Header File | Data Files | Trailer File | Trailer Documentation File* |
|---|---|---|---|---|
| File Location (file No.) | 1 | 2-29 | 30 | 31 |
| Physical record length (blocksize) | 630 bytes** | 17,012 bytes 136,096 bits | 17,012 bytes 136,096 bits | 630 bytes |
| Record format | unblocked | unblocked | unblocked | unblocked |
| Data type | EBCDIC | binary | binary | EBCDIC |
| No. of logical records per block | 1 | 1 | 1 | 1 |
| Record I.D. No. | None | ID = 24 (Daily contour) | 0 | none |

Requirement Identification: SBUV Upper Level Contours Tape Specification Number T634171.

Input Data Source: SBUV Compressed Ozone Tapes (T634441).

* Trailer documentation file only exists for tapes with an '*' character in the first byte of the NOPS Standard Header in file 1.
** 1 byte = 8 bits

EBCDIC = Extended Binary Coded Decimal Interchange Code

## 7.6 Microfilm Format for SBUV Contours

All microfilm is 35mm. The microfilm is produced directly from the tape records, with one record generating two maps (northern and southern hemisphere). Data is ordered the same as the tape: total ozone followed by mass mixing ratios at 30, 10, 5, 2, 1 and 0.4 mb. The data items included in the maps are defined in detail in Table 7-2.

## APPENDIX A

## REFERENCES


1. Fleig, A. J. et al, 1982: User's Guide for the Solar Backscattered Ultraviolet (SBUV) Instrument First-Year Ozone-S Data Set, NASA Reference Publication 1095.

2. Fleig, A. J. et al, 1982: User's Guide for the Total-Ozone Mapping Spectrometer (TOMS) Instrument First-Year Ozone-T Data Set, NASA Reference Publication 1096.

3. Fleig, A.J. et al, 1983: User's Guide for the Solar Backscattered Ultraviolet (SBUV) and the Total Ozone Mapping Spectrometer (TOMS) RUT-S and RUT-T Data Sets: October 31, 1978 - November 1, 1980, NASA Reference Publication 1112.

4. Cressman, G. P., 1959: An Operational Objective Analysis System, Monthly Weather Review, Vol. 87, No. 10, 367-374.

5. Yanai, M., 1964: An Experimental Objective Analysis in the Tropics, Technical Paper No. 62, Dept. Of Atmos. Sci., Colorado State Univ.

6. Second Year Addendum to the "User's Guide for the Solar Backscattered Ultraviolet (SBUV) Instrument First Year Ozone-S Data Set," May 1983.

7. Second Year Addendum to the "Total Ozone Mapping Spectrometer (TOMS) Instrument First Year Ozone-T Data Set," May 1983.

8. Lee, et al, 1983: Inventory for the Solar Backscattered Ultraviolet (SBUV) and the Total Ozone Mapping Spectrometer (TOMS) RUT-S and RUT-T Data Sets: October 31, 1978 - November 1, 1980.

## APPENDIX B

### ANNOTATION START DAY VS. DATA START DAY

When maps or grid records are made for daily data, the data is not cut off strictly on day boundaries. Complete orbits are processed, and the method used to determine in which day to process a particular orbit is to use the time of the ascending node of the orbit. An orbit is included in the processing for whichever day contains the ascending node. Thus, it is possible for some data to be included from the previous day and/or the next day.

For example, to make a contour map or grid record for day 200, the Annotation Start Day is 200. (The Annotation End Day is also 200 since this is a daily product).

Now, suppose there is an orbit whose ascending node is on day 200 at 700 seconds. This orbit will be included in day 200. But since it takes about 1500 seconds for the satellite to get from the southernmost orbital point to the equator, the actual data for this orbit could start on day 199 at about 85600 seconds. So the Start Day of the Data would be day 199 and the Start Time of the Data would be 85600.

A similar situation could exist at the end of the day so that the End Day of the Data could be day 201 in the above example.

# APPENDIX C

## NOPS STANDARD HEADER FILE AND TRAILER DOCUMENTATION FILE (TDF)

Every individual derivative products tape contains a standard Header File and a Trailer Documentation File.* Each is written in a format common to all archival tapes produced by the Nimbus Observation Processing System (NOPS).

The Standard Header File is the first file on any tape. It is used to define key characteristics of the tape.

The Trailer Documentation File (TDF) is the last file on any tape. It is intended to provide a geneology of the current product by providing data relating to previous products that went into the making of the current product.

### C.1 Standard Header File

The standard header file contains two identical blocks (physical records) of 630 characters written in EBCDIC. Each block consists of five 126-Character lines.

Lines 1 and 2 are written according to a standardized format called the NOPS Standard Header Record.

Line 1:

| COLUMNS | DESCRIPTION |
|---|---|
| 1 | An indicator to show that a TDF will be found at the end of a tape<br>blank = No TDF<br>* = TDF present |
| 2-24 | Label: NIMBUS-7$_b$NOPS$_b$SPEC$_b$No$_b$T |
| 25-30 | Tape Specification Number. See Appendix D |
| 31-37 | Label: $_b$SQ$_b$NO$_b$ |
| 38-39 | PDF Code: |

*Except first year SBUV polar stereographic contours.

b = blank

| COLUMNS | DESCRIPTION |
|---|---|
| | FA = SBUV Matrix<br>FG = TOMS Matrix<br>FH = ZMT-S<br>FI = ZMT-T<br>FB = Tables-S<br>FP = Tables-T<br>FQ = SBUV Contours |
| 40-45,47 | Tape sequence number, defined as follows: |
| 40 | The last digit of the year in which the data were acquired. |
| 41-43 | Julian day of the year in which the data were acquired. |
| 44 | Sequence number for this particular product |
| 45 | The existing hyphen remains unless there is a remake of the tape for any reason. In this case, an ascending alpha character will replace the hyphen, and the most recent reasons for remake will be recorded in logical record 4 of the header. |
| 47 | This will remain as a blank unless it is needed to remove ambiguities in character 40. This may occur if data are being acquired on or after October 24, 1988. |
| 46 | Copy number<br>1 = original<br>2 = copy<br>See Section C.3 |
| 47-52 | Subsystem ID (with leading and trailing blank). For derivative products valid codes are SBUV or TOMS. |
| 53-56 | Generation (Source) Facility. For derivative products, valid codes are: NOAA (National Oceanographic and Atmospheric Administration); SACC (Science Applications Computing Center) |
| 57-60 | Label: $_{b}TO_{b}$ |
| 61-64 | Destination Facility. For derivative products, this is $IPD_{b}$ (Information Processing Division, Goddard) |

| COLUMNS | DESCRIPTION |
|---|---|
| 65-87 | Start year, julian day, hour, minute, second for data coverage on this tape, in the form $_bSTART_b19YY_bDDD_bHHMMSS_b$ |
| 88-106 | End year, julian day, hour, minute, second for data coverage on this tape, in the form $TO_b19YY_bDDD_bHHMMSS_b$ In order to avoid unnecessary processing complications, the true ending date does not appear in the header record, Instead a fill date is used: $1999_b365_b240000$ |
| 107-126 | Generation year, julian day, hour, minute, second that the tape was created in the form: $GEN_b19YY_bDDD_bHHMMSS_b$ |

Line 2:

| | |
|---|---|
| 1-12 | Software program name and version number. |
| 13-18 | Program documentation reference number, if it exists. |
| 19 | Blank |
| 20-126 | User defined comments that may be more relevant to the user than the preceding ones. |

Lines 3-5 May contain further descriptive information about the tape such as which software was used (program name, version number, and version date), or how this version of the data differs from the previous version.

C.2 Trailer Documentation File

The Trailer Documentation File is the last file on each volume (tape). It is written in EBCDIC and is used to identify the geneology of each tape. Its structure is the same as

the standard header and contains a collection of standard headers (non-duplicated) from all input tapes that were used to produce this tape. The Trailer Documentation File only exists for tapes with an * in the first byte (character) of the NOPS Standard Header File. All ozone derivative products will have a TDF, except first year SBUV polar stereographic contours.

The first record identifies this as the Trailer Documentation File

| | |
|---|---|
| Chars. 1-10: | ********** |
| 11-126: | NOPS TRAILER DOCUMENTATION FILE FOR TAPE PRODUCT T (Spec No. (6 digit)) GENERATED ON DDDHHMM. |

The second physical record will be a repeat of the Standard Header File for the current tape with the provision that data referring to end time are correct. Following physical records contain the historical standard header records from the various input tapes.

C.3 Tape Duplication

Because of the real possibility of an original tape being damaged in handling (resulting in the loss of many computations), each processing facility within NOPS will generate duplicate copies of master tapes. These duplicates will be indicated by the characters "-2" added to the sequence number in the STD HDR. The original will be indicated by the characters "-1" and will be retained in a secure environment at the originating facility.

## APPENDIX D

## NOPS PRODUCT SPECIFICATION CODES

Film: A six digit number prefixed with an F to denote film products

F $X_1$ $X_2$ $X_3$ $X_4$ $X_4$ $X_5$ $X_6$

$X_1$ SUBSYSTEM

0 - Other
1 - ERB
2 - SMMR
3 - THIR
4 - SAM II
5 - LIMS
6 - SBUV/TOMS
7 - CZCS
8 - SAMS
9 - JLT

$X_2$ SOURCE FACILITY

0 - Unused
1 - NOC
2 - MDHS
3 - SACC
4 - IPD
5 - LaRC
6 - NCAR
7 - NOAA
8 - Oxford
9 - Other

$X_3$ PRODUCT TYPE

0 - Unused
1 - Color
2 - B&W Image
3 - Contour Map
4 - Contour Cross Section
5 - Profile
6 - Table
7 - Plot
8 - Other
9 - Unused

$X_4$ TIME PERIOD

0 - Orbital or Less
1 - 1 Day
2 - 2 Days
3 - 3 Days
4 - 6 Days (Cycle)
5 - 7 Days (Week)
6 - 12 Days (Bi-Cycle)
7 - 27, 28, 29, 30, or 31 Days (Month or Bartel's Period)
8 - 90, 91, or 91 Days (Season)
9 - Other

$X_5$,$X_6$, SEQUENCE NUMBER

16 mm MICROFILM PRODUCTS
01 to 29 Contour Maps
30 to 49 Contour Cross Sections
50 to 59 Profiles (Graphs)
60 to 79 Tables (Listings)
80 to 89 Plots (Graphs)
90 to 99 Other

105 MM COLOR FILM PRODUCTS
01 to 39 All Maps

9 1/2 INCH FILM PRODUCTS
40 to 49 All Images

Tapes: A six digit number prefixed with a T to denote TAPE will be used.

| T | $X_1$ | $X_2$ | $X_3$ | $X_4$ | $X_5$ | $X_6$ |
|---|---|---|---|---|---|---|

$X_1$ Subsystem
1 = ERB
2 = SMMR
3 = THIR
4 = SAM II
5 = LIMS
6 = SBUV/TOMS
7 = CZCS
8 = SAMS
9 = ILT

$X_2$ Source Facility (Same code as Destination Facility)

$X_3$ Destination Facility:
1 = NOC (Pre-NOPS)
2 = MDHS (NOPS)
3 = SACC
4 = IPD
5 = LARC
6 = NCAR
7 = NOAA
8 = OXFD
9 = USER

$X_4$,$X_5$: Tape number in sequence for subsystem (code to be derived depending on how many tapes are needed)

$X_6$ Tape Description:
1 = 9 Trk 1600 BPI
2 = 9 Trk 800 BPI
3 = 7 Trk 800 BPI
4 = 7 Trk 556 BPI
5 = HDT (IPD)
6 = 9 Trk 6250 BPI

# APPENDIX E

## DATA AVAILABILITY AND COST

The derivative products (tapes and microfilm) defined in this User's Guide are archived and available from the National Space and Science Data Center (NSSDC). The NSSDC will furnish limited quantities of data to qualified users without charge. The NSSDC may establish a nominal charge for production and dissemination if a large volume of data is requested. Whenever a charge is required, a cost estimate will be provided to the user prior to filling the data request.

Domestic requests for data should be addressed to:

National Space Science Data Center
Code 601
NASA/Goddard Space Flight Center
Greenbelt, MD 20771

All requests from foreign researchers must be specifically addressed to:

Director, World Data Center A for Rockets and Satellites
Code 601
NASA/Goddard Space Flight Center
Greenbelt, MD 20771 USA

When ordering data from either NSSDC or the World Data Center, a user should specify why the data are needed, the subject of his work, the name of the organization with which he is connected, and any government contracts he may have for performing his study. Each request should specify the experiment data desired, the time period of interest, plus any other information that would facilitate the handling of the data request.

A user requesting data on magnetic tapes should provide additional information concerning the plans for using the data, i.e. what computers and operating systems will be used. In this context, the NSSDC is compiling a library of routines that can unpack or transform the contents of many of the data sets into formats that are appropriate for the user's computer. NSSDC will provide, upon request, information concerning its services.

When requesting data on magnetic tape, the user must specify whether he will supply new tapes prior to the processing, or return the original NSSDC tapes after the data have been copied.

Data product order forms may be obtained from NSSDC/World Data Center A.

## APPENDIX F

## DERIVATIVE PRODUCTS AVAILABLE THROUGH NSSDC

| Product Name | Range of Data | Sequence # | Generation Date |
|---|---|---|---|
| TOMS Matrix Tape | 11/5/78 - 10/31/79 | FG83042 | 9/18/82 |
| TOMS Matrix Tape | 11/1/79 - 10/31/80 | FG93052 | 10/13/82 |
| TOMS Matrix Microfilm | 11/5/78 - 10/31/79 | FG83042 | 12/13/82 |
| TOMS Matrix Microfilm | 11/1/79 - 10/31/80 | FG93052 | 10/26/82 |
| SBUV Matrix Microfilm | 11/5/78 - 10/31/79 | FA83041 | 11/3/82 |
| SBUV Matrix Microfilm | 11/1/79 - 10/31/80 | FA93051 | 11/3/82 |
| SBUV Zonal Means Tape* | 11/5/78 - 10/31/79 | FH83041 | 4/1/82 |
| SBUV Zonal Means Tape* | 11/1/79 - 10/31/80 | FH93051 | 9/23/82 |
| TOMS Zonal Means Tape* | 11/5/78 - 10/31/79 | FI83041 | 4/1/82 |
| TOMS Zonal Means Tape* | 11/1/79 - 10/31/80 | FI93052 | 10/13/82 |
| SBUV Tables Microfilm | 11/5/78 - 10/31/79 | FB83041 | (geod) 3/24/82 |
| SBUV Tables Microfilm* | 11/5/78 - 10/31/79 | FB83042 | (geom) 3/24/82 |
| SBUV Tables Microfilm | 11/1/79 - 10/31/80 | FB93051 | (geod) 10/6/82 |
| SBUV Tables Microfilm* | 11/1/79 - 10/31/80 | FB93052 | (geom) 10/6/82 |
| TOMS Tables Microfilm* | 11/5/78 - 10/31/79 | FP83041 | 3/23/82 |
| TOMS Tables Microfilm* | 11/1/79 - 10/31/80 | FP93051 | 10/14/82 |
| SBUV Contours Tape (2 tapes) | 11/5/78 - 10/31/79 | FQ13351 | 83/054 |
| | | FQ13352 | 83/054 |
| | 11/1/79 - 10/31/80 | FQ23231 | 83/229 |
| | | FQ23232 | 83/230 |

*NOTE: ZMT and Tables geomagnetic data for years 1 and 2 are in error. Revised products will be placed in the archives in the near future. Geodetic products are not affected.

## APPENDIX G

| | |
|---|---|
| bpi | Bytes Per Inch |
| CCT | Computer Compatible tape |
| EBCDIC | Extended Binary-Coded Decimal Interchange Code |
| ERB | Earth Radiation Budget |
| ID | Identification |
| IPD | Information Processing Division |
| ILT | Image Location Tape |
| LSB | Least Significant Bit |
| MSB | Most Significant Bit |
| NOAA | National Oceanic and Atmospheric Administration |
| NOPS | Nimbus Observation Processing System |
| PDFC | Project Data Format Code |
| SACC | Science and Applications Computer Center |
| SBUV | Solar Backscattered Ultraviolet |
| SHF | Standard Header File |
| SHR | Standard Header Record |
| TDF | Trailing (or Trailer) Documentation File |
| TOMS | Total Ozone Mapping Spectrometer |

| 1. Report No. NASA RP-1116 | 2. Government Accession No. | 3. Recipient's Catalog No. |
|---|---|---|
| 4. Title and Subtitle<br>User's Guide for SBUV/TOMS Ozone Derivative Products | | 5. Report Date<br>January 1984<br>6. Performing Organization Code<br>910 |
| 7. Author(s) A. J. Fleig, C. Wellemeyer, N. Oslik, K. D. Lee, A. J. Miller, and R. Nagatani | | 8. Performing Organization Report No. |
| 9. Performing Organization Name and Address<br>NASA Goddard Space Flight Center<br>Greenbelt, Maryland 20771 | | 10. Work Unit No.<br>11. Contract or Grant No.<br>NAS5-27393<br>13. Type of Report and Period Covered<br>Reference Publication |
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15. Supplementary Notes

A. J. Fleig: Goddard Space Flight Center, Greenbelt, Maryland.
C. Wellemeyer, N. Oslik, and K. D. Lee: Systems and Applied Sciences Corporation, Hyattsville, Maryland.
A. J. Miller and R. Nagatani: National Meteorological Center, National Oceanic and Atmospheric Administration, Washington, D.C.

16. Abstract

A series of products are available derived from the total-ozone and ozone vertical profile results for the Solar Backscattered Ultraviolet/ Total-Ozone Mapping Spectrometer (SBUV/TOMS) Nimbus-7 operation. Products available are (1) orbital height-latitude cross sections of the SBUV profile data, (2) daily global total ozone contours in polar coordinates, (3) daily averages of total ozone in global 5x5 degree latitude-longitude grid, (4) daily, monthly and quarterly averages of total ozone and profile data in 10 degree latitude zones, (5) tabular presentation of zonal means, (6) daily global total zone and profile contours in polar coordinates.

The "Derivative Products User's Guide" describes each of these products in detail, including their derivation and presentation format. Information is provided on how to order the tapes and microfilm from the National Space Science Data Center.

| 17. Key Words (Selected by Author(s)) | 18. Distribution Statement |
|---|---|
| Ozone, Total ozone, Nimbus-7 SBUV/TOMS, Ultraviolet radiation, Atmospheric ozone | STAR Category 47<br>Unclassified-Unlimited |

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