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**The 1989 Airborne Arctic  
Stratospheric Expedition  
Nimbus-7 TOMS Data Atlas**

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Office of Management  
Scientific and Technical  
Information Division

THE 1989 AIRBORNE ARCTIC STRATOSPHERIC EXPEDITION:  
THE NIMBUS-7 TOMS DATA ATLAS  
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# **1. INTRODUCTION**

## **1.1 The 1988 Airborne Arctic Stratospheric Expedition**

Over the past several years, world scientific attention has been focussed on the rapid and unanticipated decrease in the abundance of ozone over Antarctica during the Austral Spring. A major airborne campaign was conducted during August and September of 1987 which directly implicated man-made chemical compounds, chlorofluorocarbons, in the ozone loss over the southern hemisphere. A second major aircraft campaign was conducted from December 1988 to February 1989 in response to the recently published Ozone Trends Panel Report which found that the largest decreases in Arctic ozone occurred during January to February at latitudes near the edge of the Arctic vortex.

The primary objectives of the 1989 Airborne Arctic Stratospheric Expedition were to: (1) study the production and loss mechanisms of ozone in the north polar stratospheric environment and (2) study the effect on ozone distribution of the Arctic polar vortex and of the cold temperatures associated with the formation of Polar Stratospheric Clouds (PSCs). These objectives were to be achieved by flying specially instrumented DC-8 and ER-2 aircraft from a base in Stavanger, Norway. Scientists in Stavanger planned the aircraft flights with the aid of meteorological forecasts of air parcel trajectory and potential vorticity as well as near-real-time total ozone analyses from the TOMS instrument aboard Nimbus-7.

## **1.2 The Nimbus-7 TOMS Experiment**

Background information on the Nimbus-7 TOMS experiment, as well as the processing used to produce hemispheric and orbital total ozone contour plots may be found in Krueger et al. (1988).

## 2. TOMS DATA PREPARATION AND TRANSFER

The near-real-time processing and transfer of TOMS ozone data commenced on December 27, 1988 and concluded on February 16, 1989. The processing involved two data sets: (1) complete southern hemispheric data for the 24 hours ending at midnight of the day prior to transmission and (2) orbital swath data for the region from Greenland to Scandinavia.

### 2.1 Data Available to Stavanger

The orbital swath data consisted of 2 to 3 orbits daily, which were processed and transferred to Stavanger as they were received. Selection of the particular orbits was effected well in advance through the use of predictive ephemeris to generate tables of the orbital ascending-node times and longitudes and plots of the orbital subsatellite tracks. Telemetry from the Nimbus-7 spacecraft was downlinked to one of NASA's network of spaceflight tracking stations, such as at Wallops Island, Goldstone, Madrid, or Canberra, and then transmitted over the NASA Deep-Space Network to the Goddard Space Flight Center (GSFC). The raw TOMS data from each orbit were received at the Mission Operations Control Center (MOCC) in Building 3 at the GSFC and placed onto magnetic tape. This tape was then manually transferred to the NASA Space and Earth Sciences Computing Center (NSESCC) in Building 1 at the GSFC where the raw data were processed into total ozone and reflectivity data on an IBM 3081 computer in Ozone-T standard tape format.

The ozone data were copied to the dedicated TOMS MicroVAX II computer in Building 21 at the GSFC via an Ethernet connection. At this point, the orbital swath data were processed prior to release to Stavanger. This processing included the gridding of the calibrated Ozone-T data to create an image file, with further processing to display the image file. Once the image was viewed and deemed acceptable, the Ozone-T data files, one for each of up to three orbital swaths, were then transferred via DECnet and two Concord 296 Trellis forward error-checking modems at 9.6 kilobits/second (kbps) to a second MicroVAX II located in Stavanger. The orbital-swath processing required approximately 30 minutes. The total elapsed time between the actual Nimbus-7 pass over the orbital area and the receipt of total ozone data in Stavanger varied between 3 and 4 hours. Once received at Stavanger (and at GSFC as well), the data were plotted using a Tektronix 4692 plotter and 4208 color graphics terminal and a standardized color look-up



table. The color plots facilitated comparison and permitted rapid interpretation of day-to-day changes in the ozone pattern.

The hemispheric data were processed in a similar fashion, but the elapsed time was greater. A full duration of 24 hours is required for the Nimbus-7 TOMS to obtain global (or southern hemispheric) coverage. The hemispheric data set, containing total ozone data from a complete day of Nimbus-7 orbits, was available to the TOMS MicroVAX by approximately 10:00 AM of the following day, or 10 hours after Nimbus-7 completed its last orbit of the day. This data set was gridded on the IBM 3081 in Grid-T format and required minimal further processing prior to transfer. The hemispheric ozone data were also transferred to the Stavenger MicroVAX II via a DECnet link.

## **2.2 Data Analysis and Presentation**

An atlas of the TOMS coverage of 1987 Antarctic Airborne Ozone Experiment, background information on the Nimbus-7 TOMS Experiment, as well as the processing used to produce hemispheric and orbital total ozone contour plots, may be found in Krueger et al. (1988).

### **3. TOMS TOTAL OZONE DATA**

#### **3.1 Chronology of the Experiment**

**DECEMBER 26, 1988**

This is the first day for which a TOMS hemispheric image was obtained in near-real-time. Total ozone values below 275 DU are located over southern Norway and Sweden and the adjacent North Sea. Maximum values above 400 DU are located over New Brunswick, Canada and the western Pacific.

**DECEMBER 28, 1988**

A relative minimum continues to be located over the southern Baltic and adjacent North Sea. Minimum values below 250 DU are observed. Maximum ozone values above 450 DU are located over the USSR Pacific Coast.

**JANUARY 3, 1989**

The minimum over the Scandinavian countries continues to persist. The area with total ozone values below 275 DU has expanded to cover much of western Europe with the Scandinavian countries and adjacent waters below 250 DU. Maximum ozone values above 475 DU are located over the northeastern USSR.

**JANUARY 7, 1989**

The Scandinavian minimum has moved to the east and has been replaced by total ozone values of about 300 DU. A large maximum persists over the northeastern USSR and adjacent north Pacific with ozone values above 475 DU.

**JANUARY 11, 1989**

A new relative minimum is located over the southern Scandinavian, North Sea area, with total ozone values below 275 DU. Maximum values in excess of 425 DU are located over the north central USSR and over the southern Canadian plains.

JANUARY 25, 1989

During the past two weeks, several small minima traversed the Scandinavian countries with total ozone values below 275 DU. Commencing January 23, a more significant minimum has been developing in the region. Total ozone values are now below 200 DU over a very small area of Finland, with most of northwestern Europe experiencing values below 250 DU. Maximum ozone values are located over the Bering Sea and are above 525 DU.

JANUARY 29, 1989

The strong minimum over Scandinavia has moved eastward over the north central USSR and filled. A new minimum, with total ozone values below 275 DU has developed over Great Britain. Maximum ozone values above 525 DU are located over northern Hudson Bay and over the USSR Pacific coast.

FEBRUARY 1, 1989

By this time, the weak minimum over Great Britain has deepened rapidly, and expanded. Total ozone values below 275 DU cover most of western Europe, with values below 200 DU covering most of Scandinavia. Minimum values below 150 DU are located over northern Sweden and Norway. The TOMS measurements of total ozone in this region are interfered with by high stratospheric clouds. At the same time, maximum values of 450 to 525 DU cover most of Canada. At this time, much of northern and western North America was experiencing record high surface pressure and cold.

FEBRUARY 4, 1989

The minimum over Scandinavia which produced the lowest apparent total ozone values of the experiment has filled and moved over the northwestern USSR. Total ozone values over the Yukon Territory of Canada are now below 275 DU, a reduction of 225 DU in four days. Maximum ozone values above 550 DU are located over the Pacific coast of the USSR.

**FEBRUARY 8, 1989**

Total ozone values over central Norway and Sweden now exceed 425 DU. The minimum over the Yukon has moved southeastward over the plains of Canada. Maximum ozone values persist over the Pacific coast of the USSR.

**FEBRUARY 15, 1989**

A very pronounced maximum has expanded over the north Atlantic to include much of northern Europe. Total ozone values above 550 DU are located just west of Norway. Minimum values below 275 DU persist over northwestern North America. The persistent maximum over northeastern USSR contains total ozone levels above 500 DU.

**FEBRUARY 17, 1989**

Maximum ozone values over the north Atlantic between Greenland and northern Norway now exceed 600 DU. Minimum values below 275 DU persist over north central Canada. The polar vortex has, at this time, split into two vortices; one coincident with the Canadian ozone minimum, the other appearing as an ozone minimum projecting from the polar night at 120°E longitude.

**FEBRUARY 21, 1989**

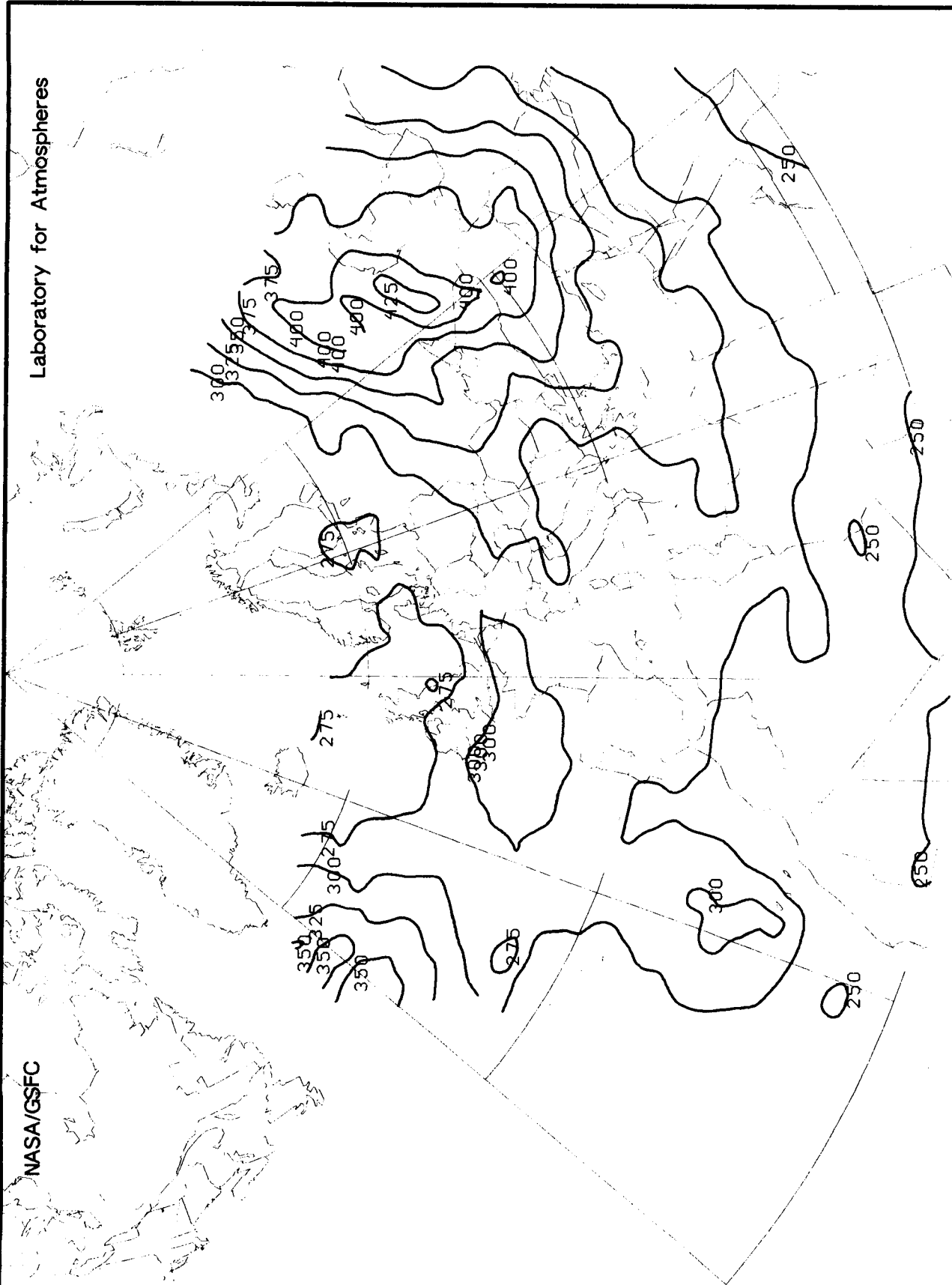
The two lobes of the polar vortex are now clearly defined as a circular total ozone minimum over eastern Siberia and as a second minimum centered over Baffin Island.

**FEBRUARY 23, 1989**

As the terminator retreats northward toward the pole, very high total ozone values above 450 DU cover the polar regions. Ridges of high ozone values extend southward from the polar region like spokes of a wheel. These maxima are surrounded by generally steep ozone gradients. This pattern persists into mid-March 1989. The Siberian lobe of the vortex remained nearly fixed in location until the end of February. The Canadian lobe at the same time drifted across Greenland to western Europe before becoming lost in meteorological noise.

### **3.2 Near-Real-Time Orbital Charts**

A set of orbital TOMS total ozone plots for a northern hemisphere domain covering western Europe, North Africa, and the eastern North Atlantic is presented here. The daily data, over the period December 27, 1988 through February 16, 1989 on the uniform 2° latitude by 1.5° longitude grid for each day, and include those orbits incorporating measurements which were of interest to the experiment for near-real-time mission planning purposes.

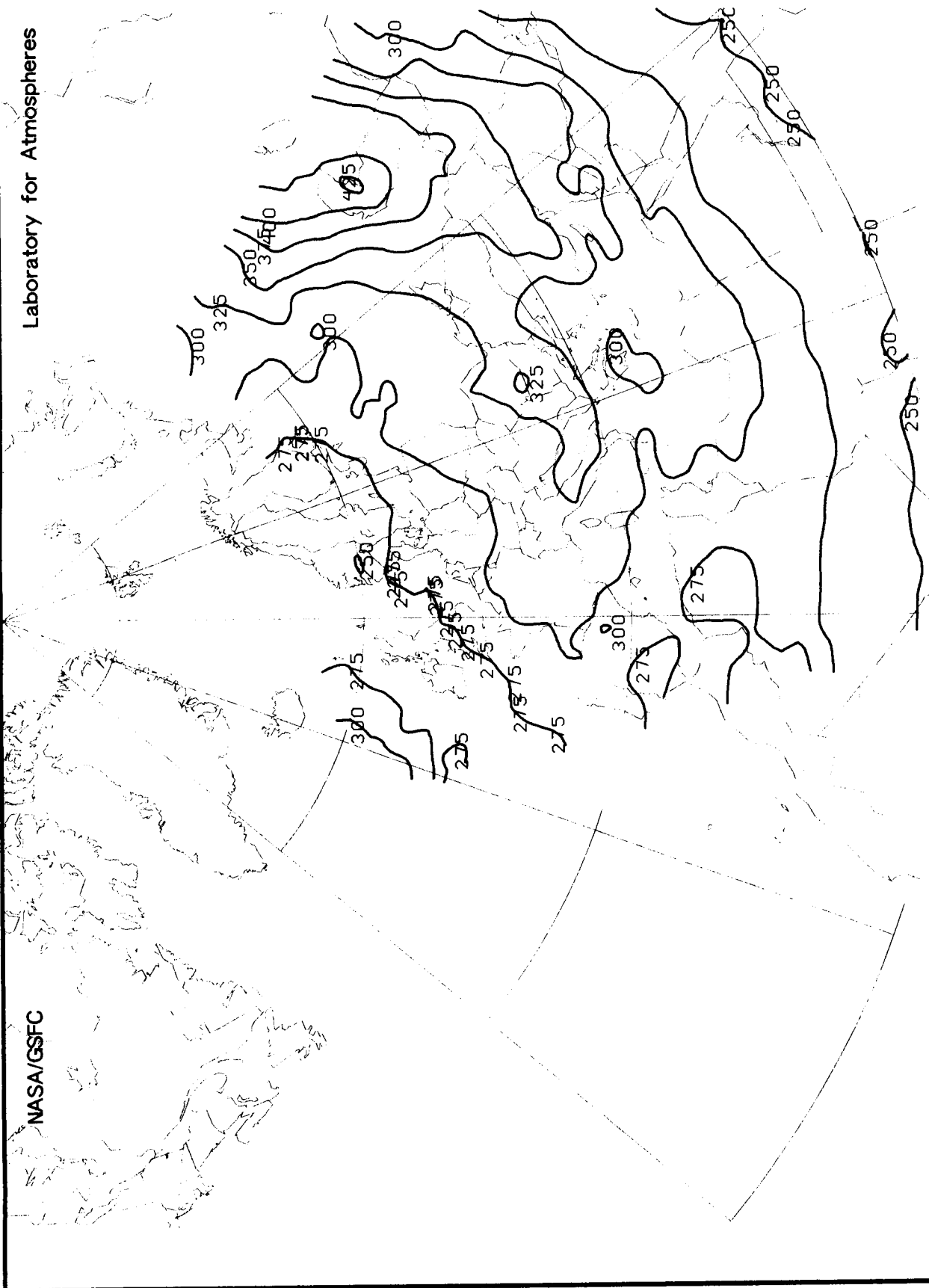


December 27, 1988

Orbital (51379-51382) TOMS Ozone (Dobson units)

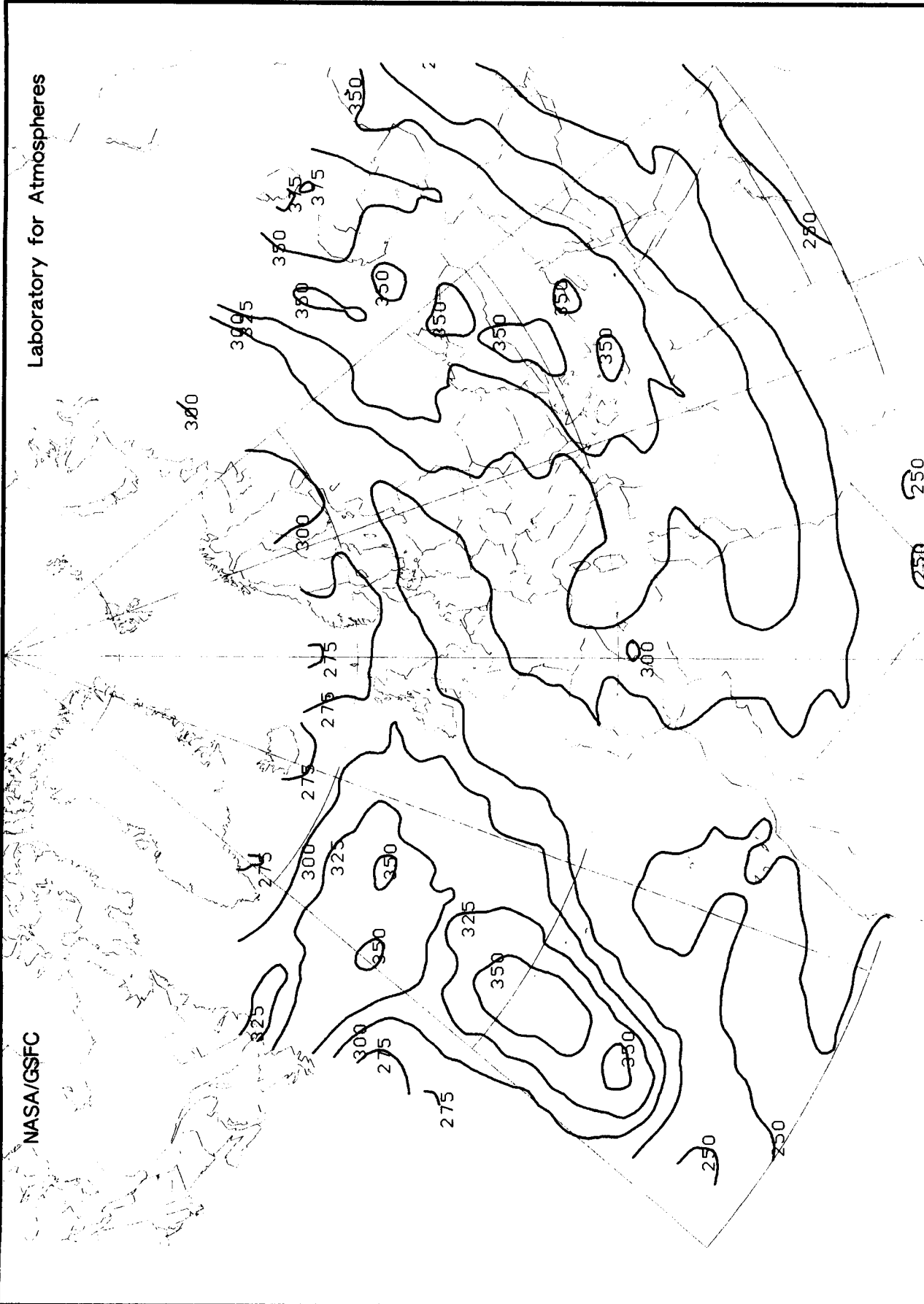
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December 28, 1988

Orbital (51393-51396) TOMS Ozone (Dobson units)



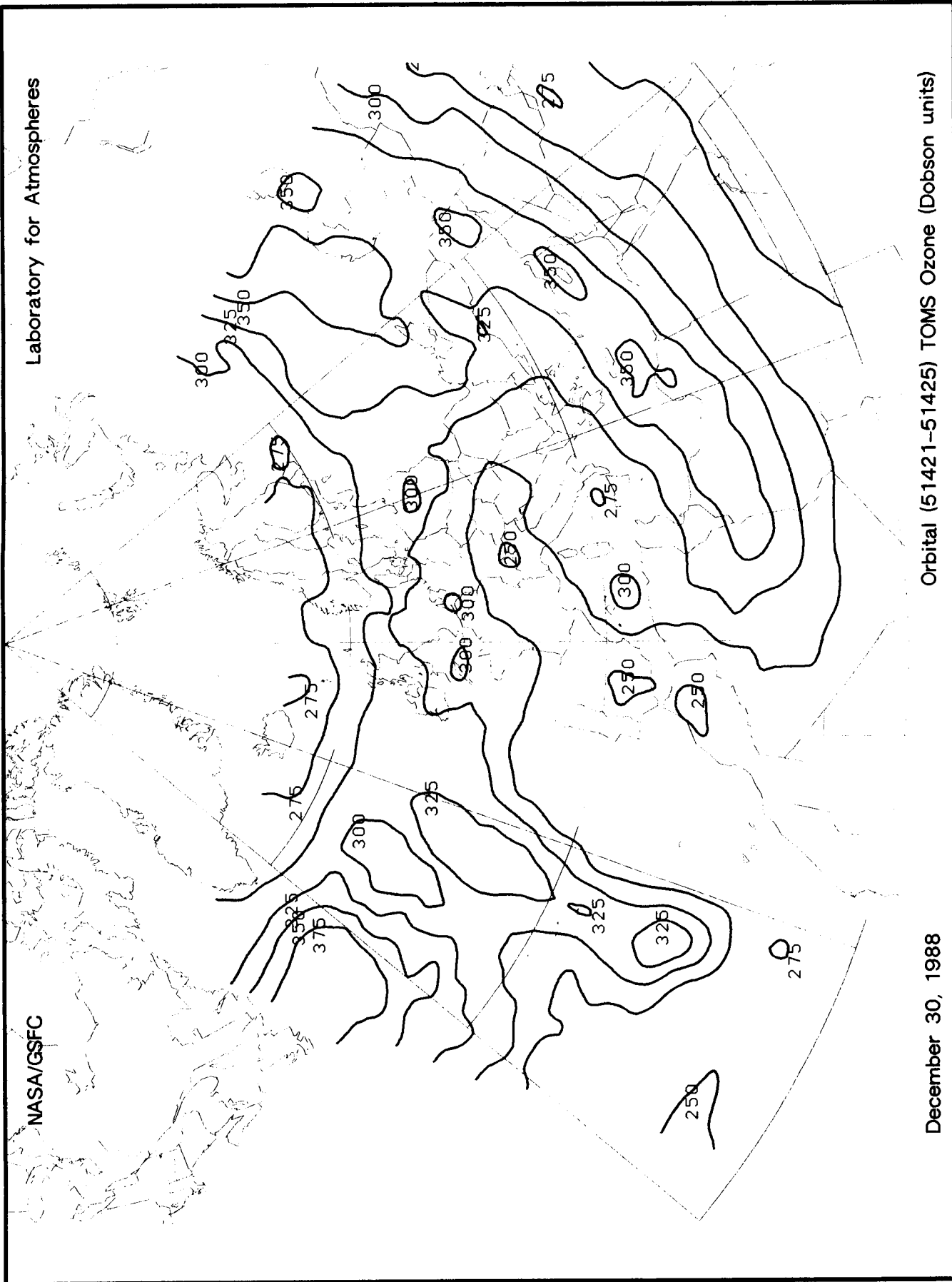
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Orbital (51407-51410) TOMS Ozone (Dobson units)



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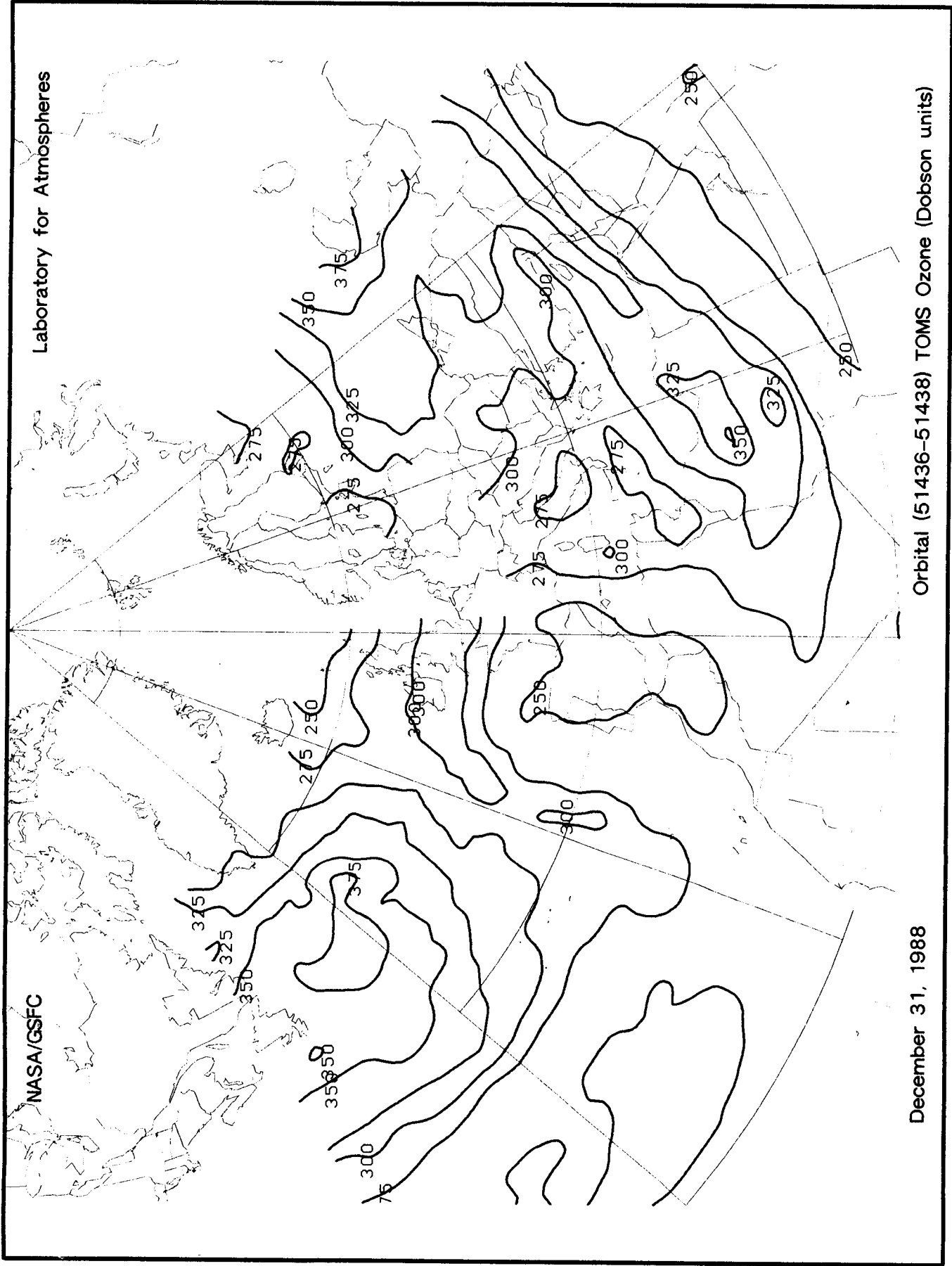


December 30, 1988

Orbital (51421-51425) TOMS Ozone (Dobson units)

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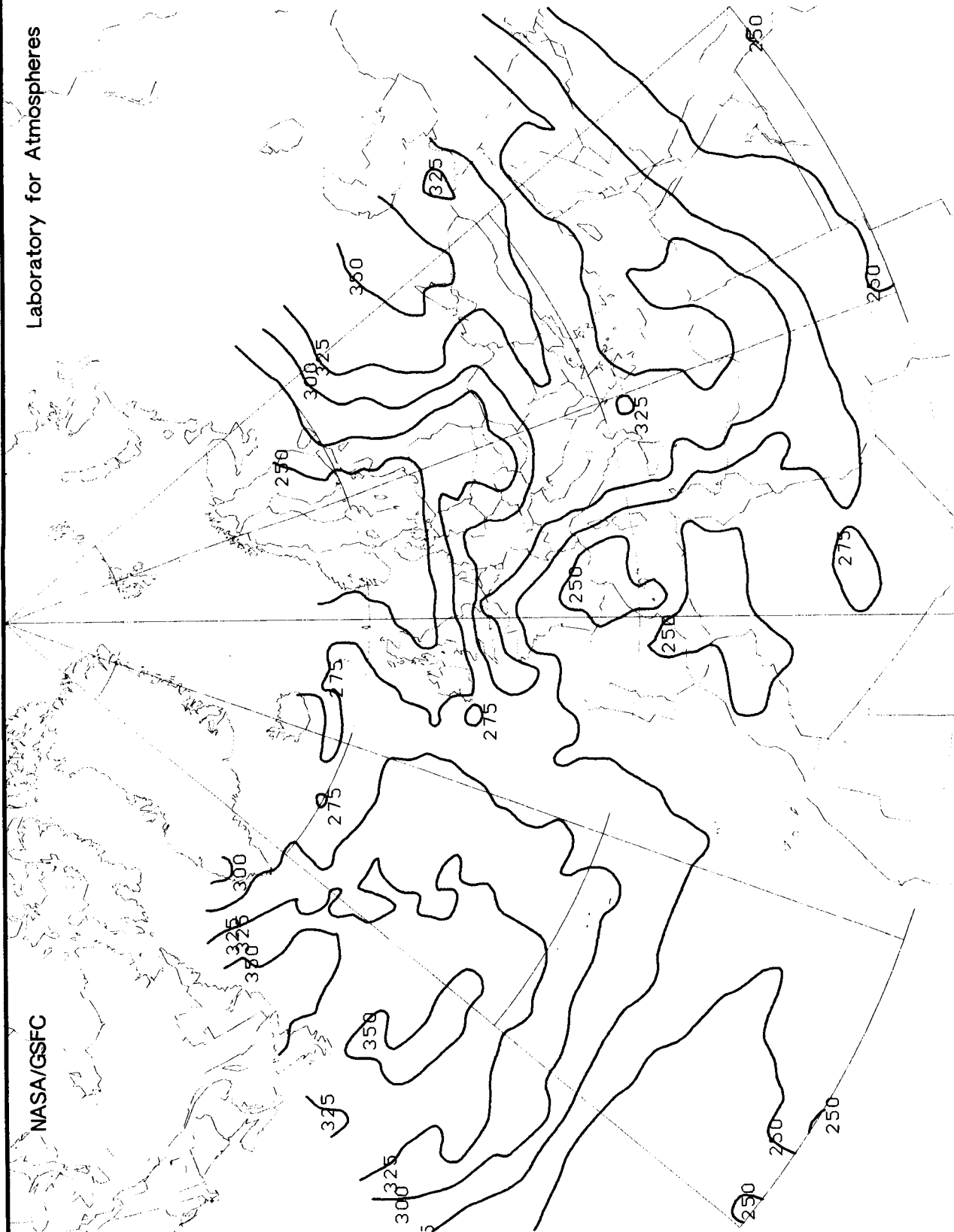


December 31, 1988

Orbital (51436-51438) TOMS Ozone (Dobson units)

NASA/GSFC

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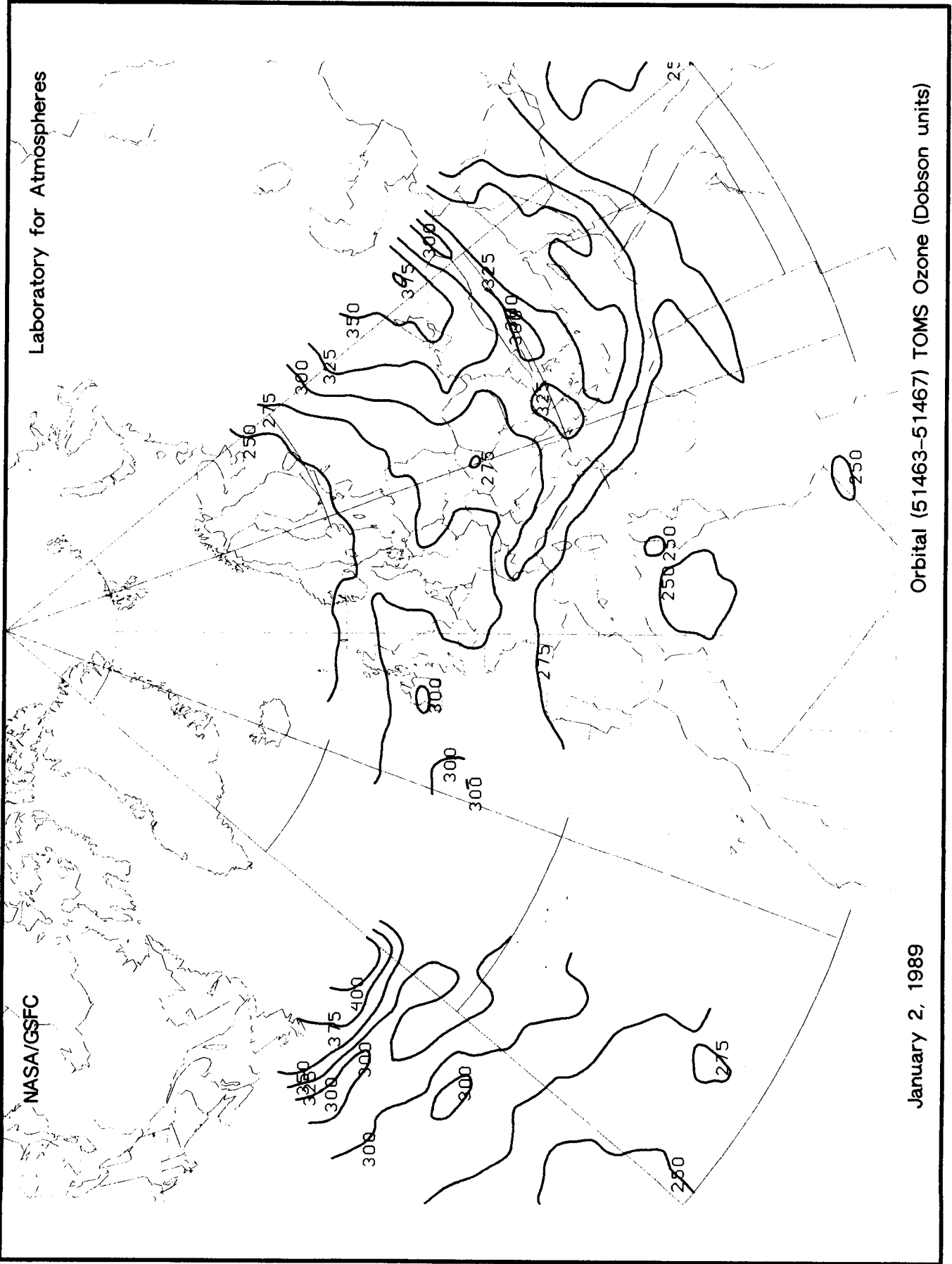


January 1, 1989

Orbital (51449-51452) TOMS Ozone (Dobson units)

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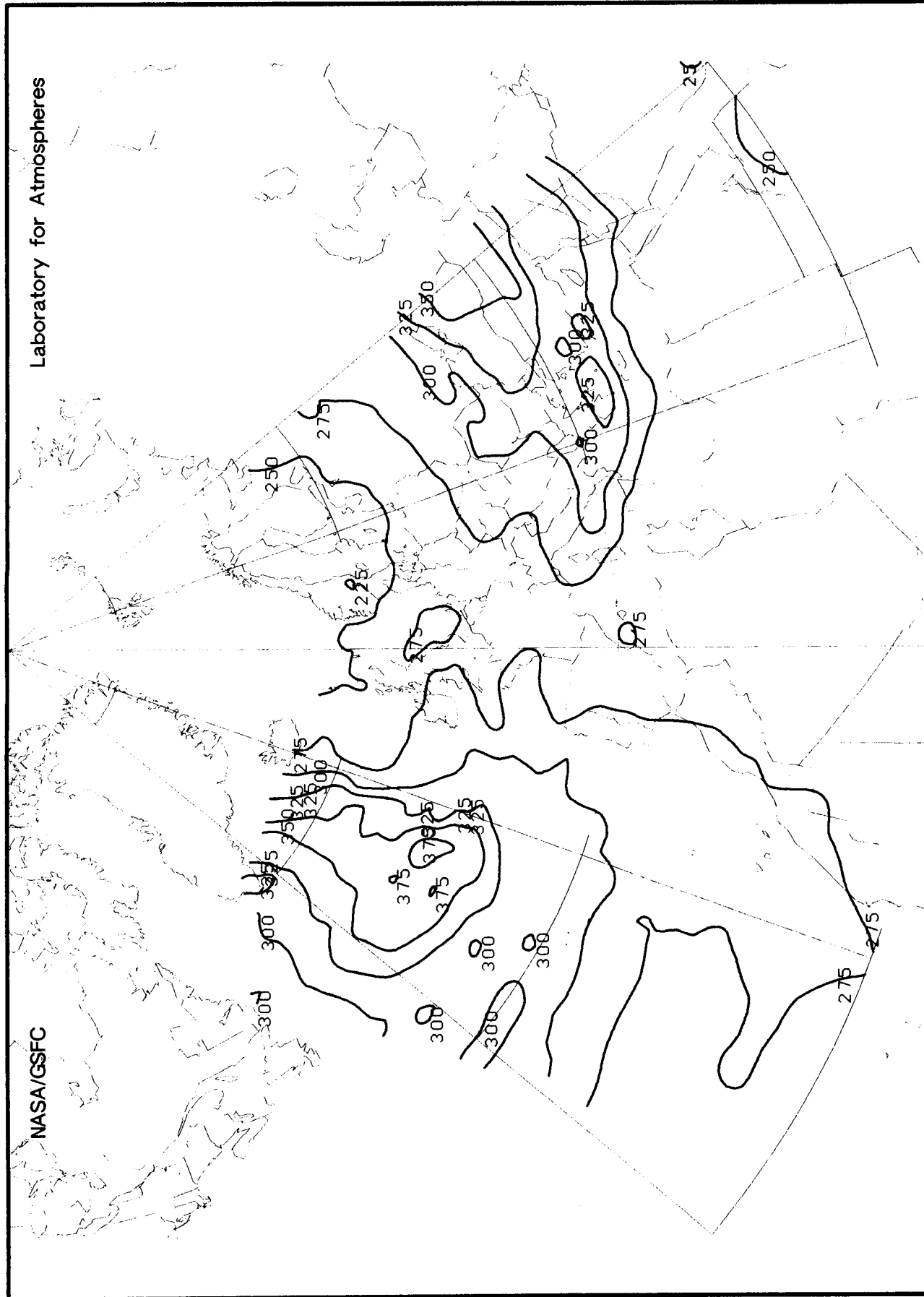


January 2, 1989

Orbital (51463-51467) TOMS Ozone (Dobson units)

NASA/GSFC

Laboratory for Atmospheres

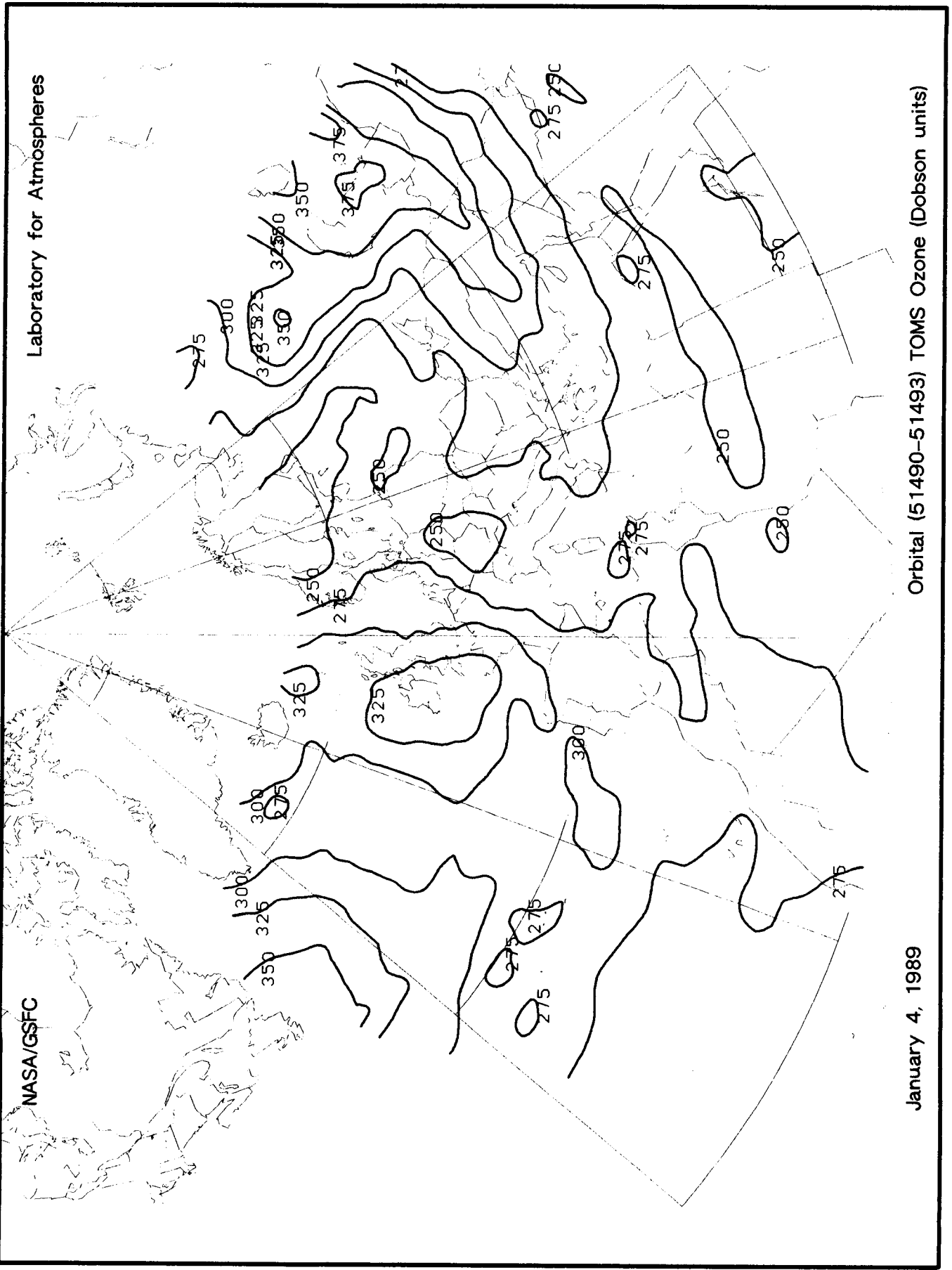


January 3, 1989

Orbital (51477-51479) TOMS Ozone (Dobson units)

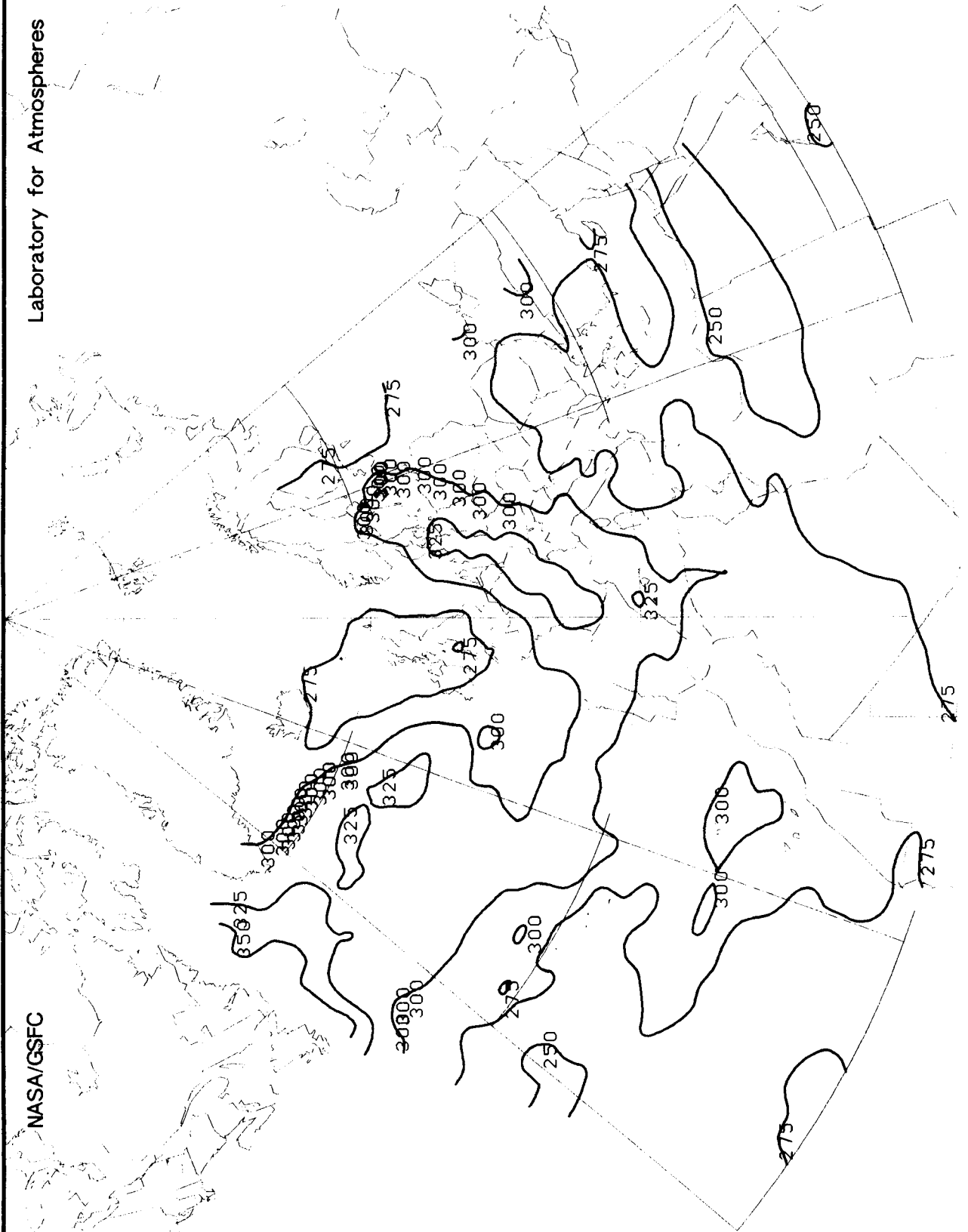
NASA/GSFC

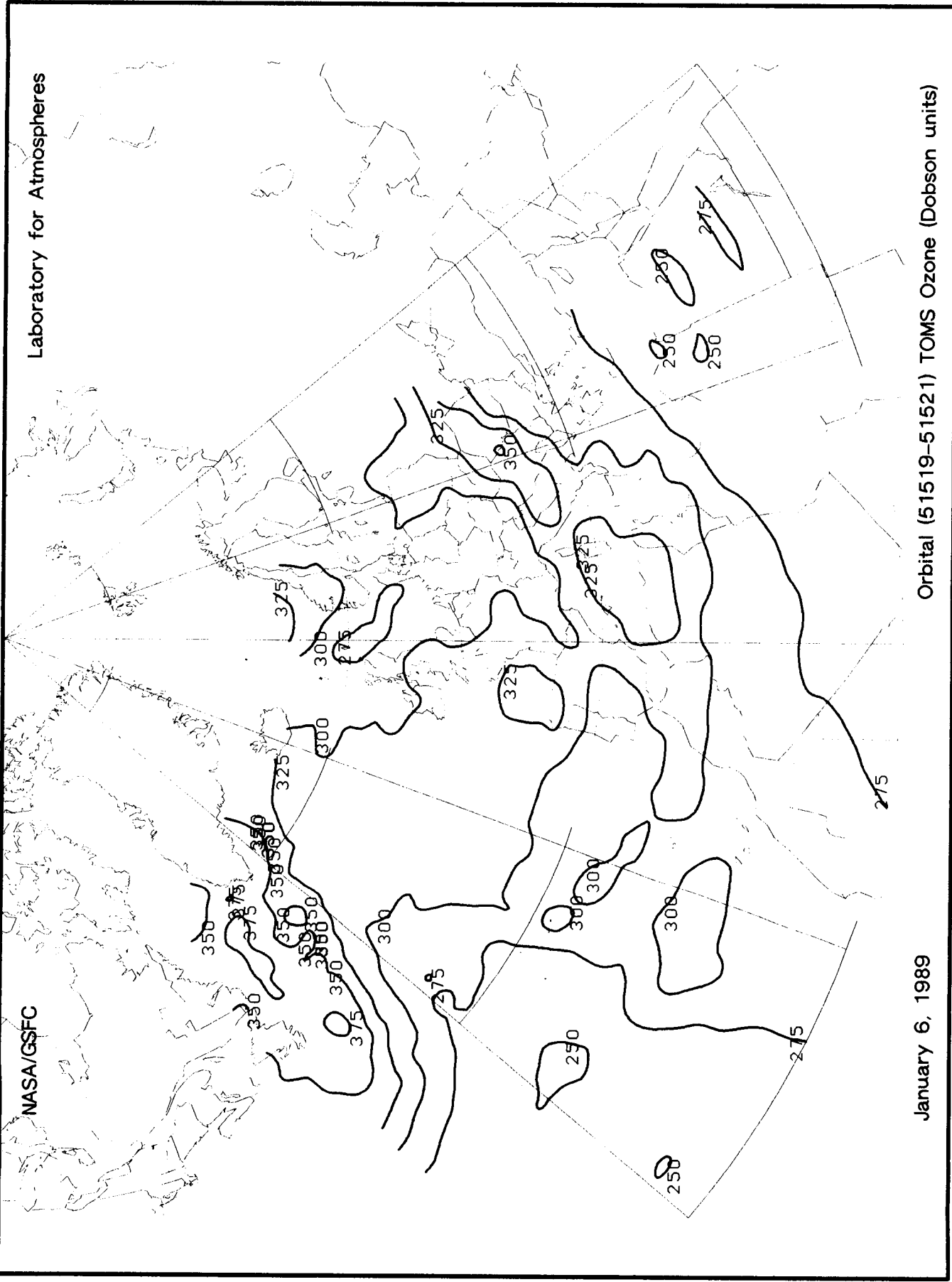
Laboratory for Atmospheres



January 4, 1989

Orbital (51490-51493) TOMS Ozone (Dobson units)





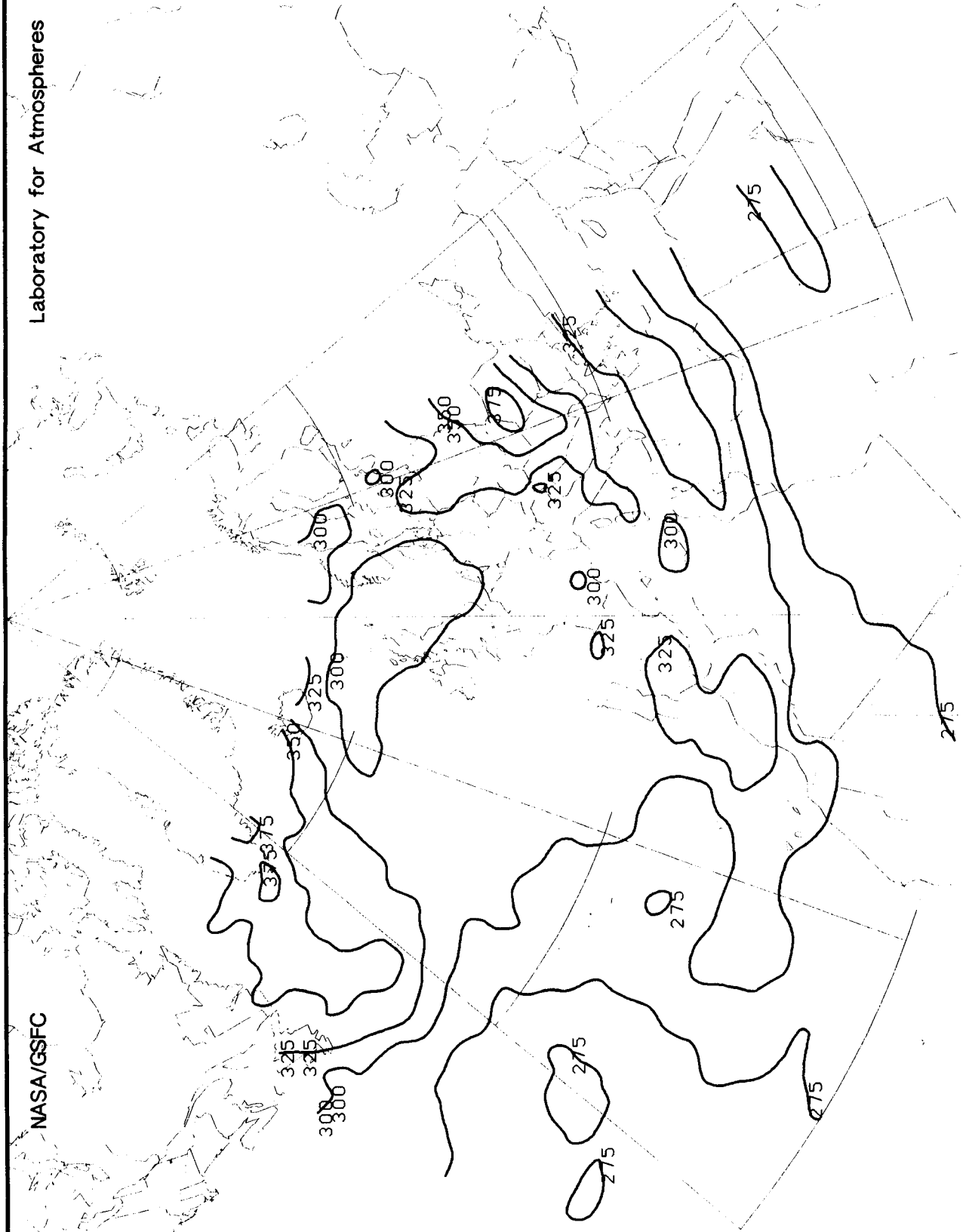
January 6, 1989

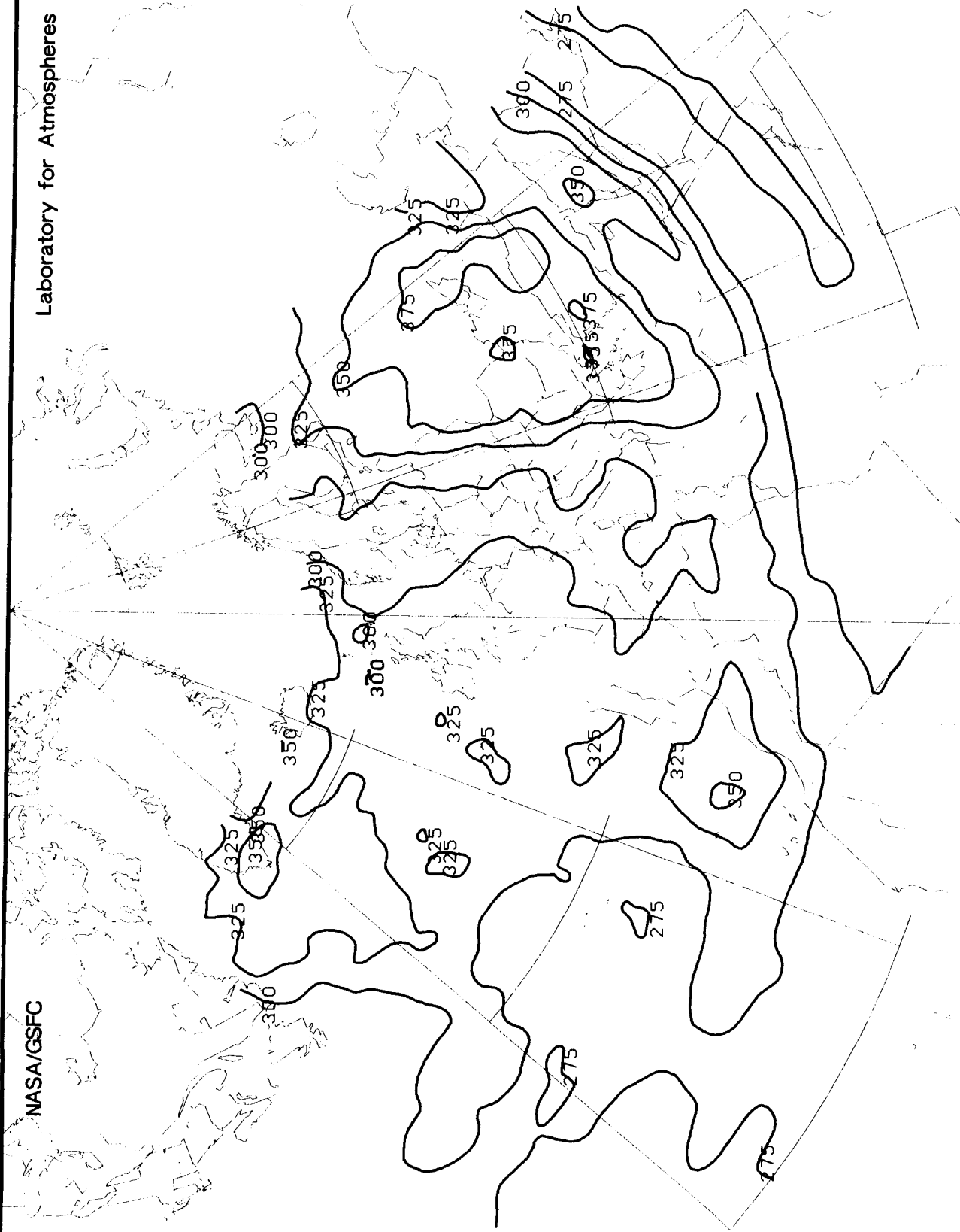
Orbital (51519-51521) TOMS Ozone (Dobson units)



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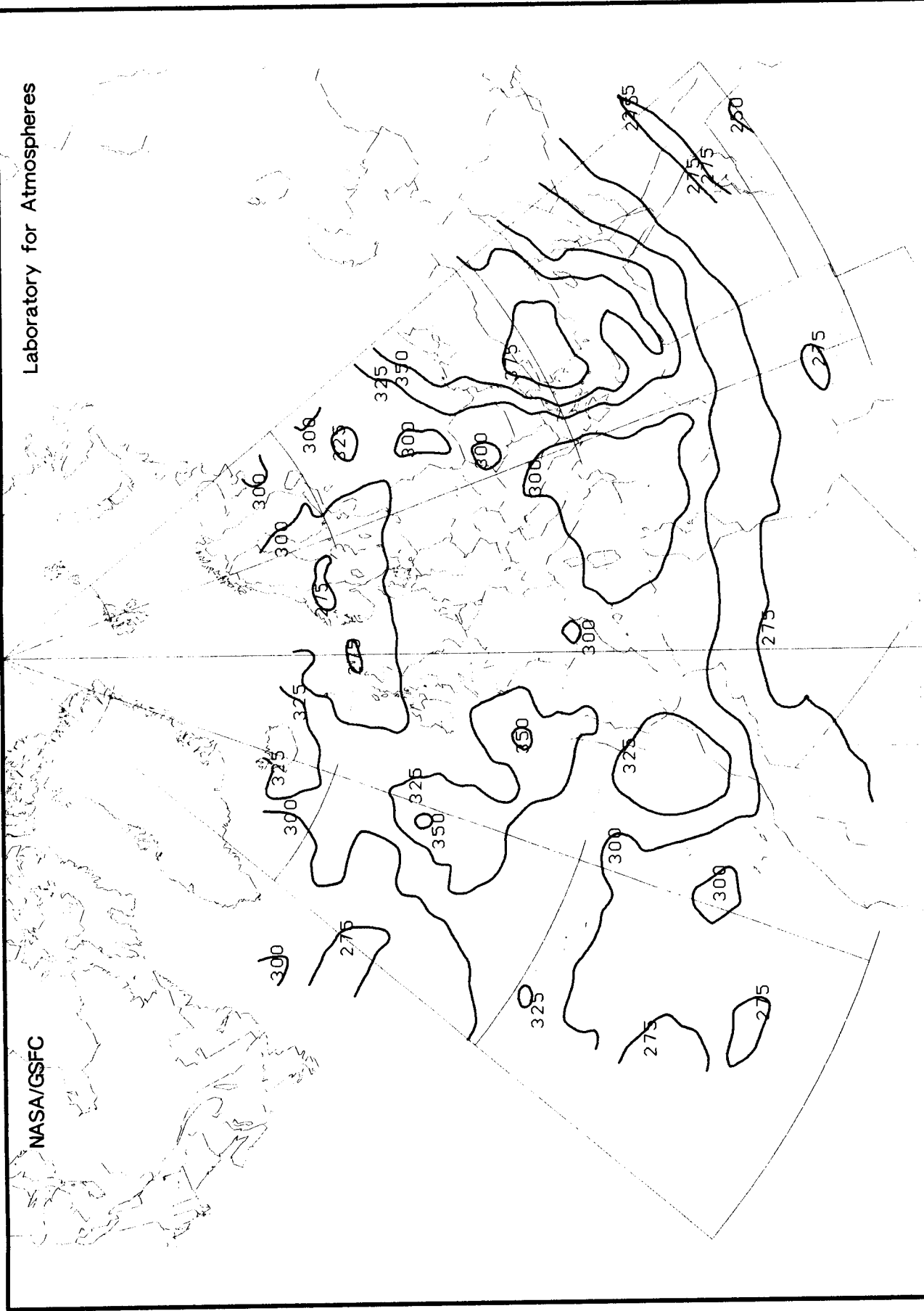
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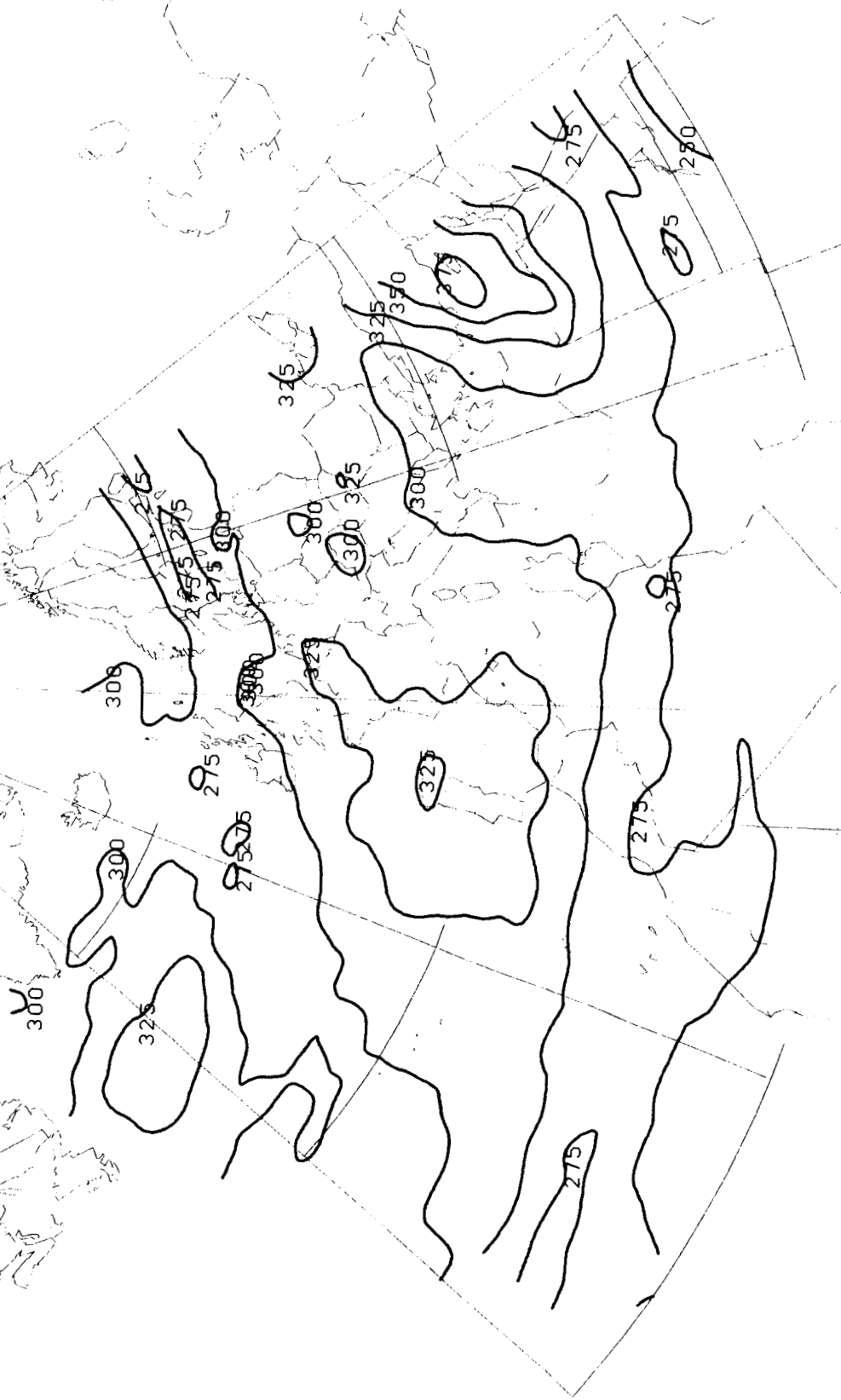




January 8, 1989

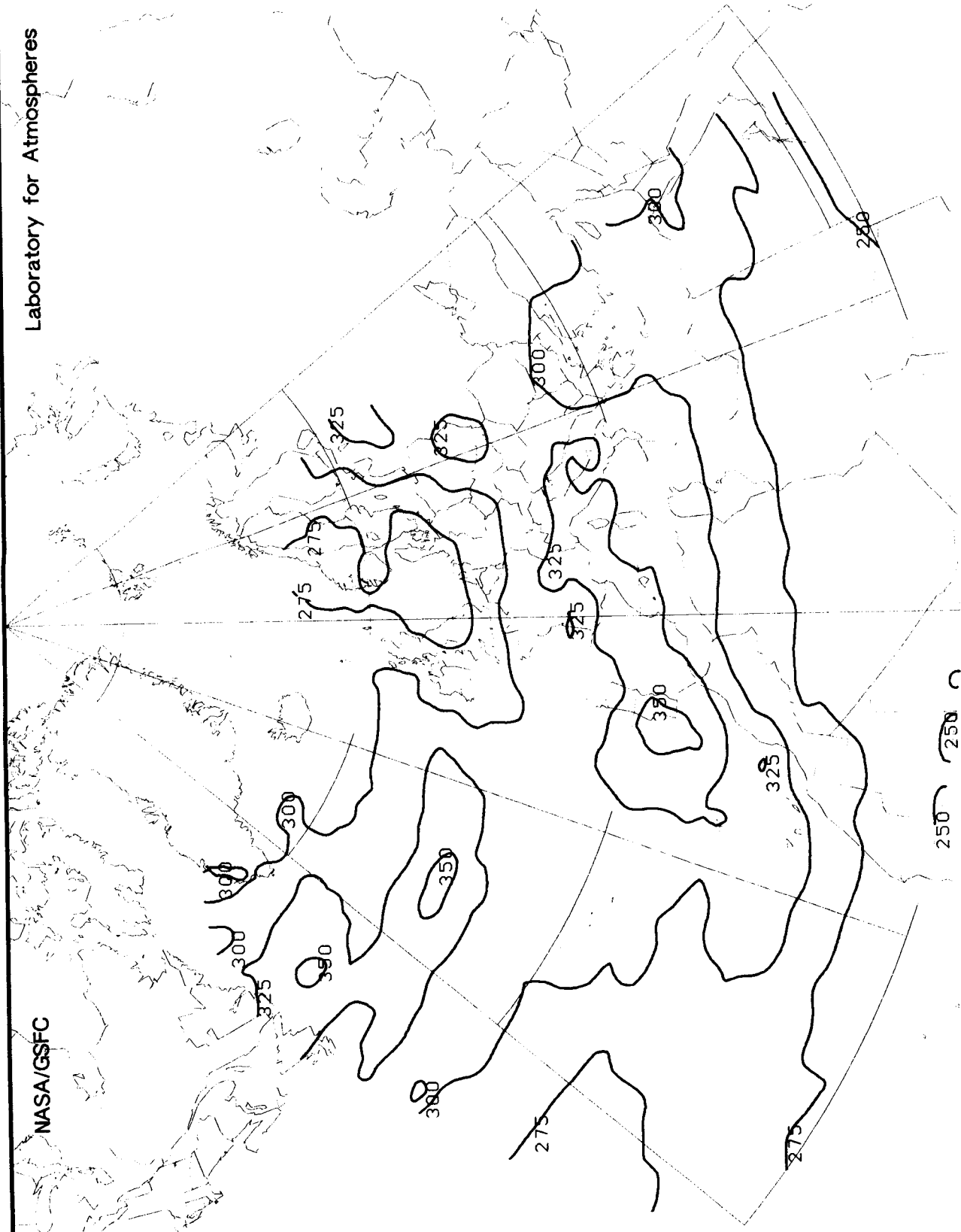
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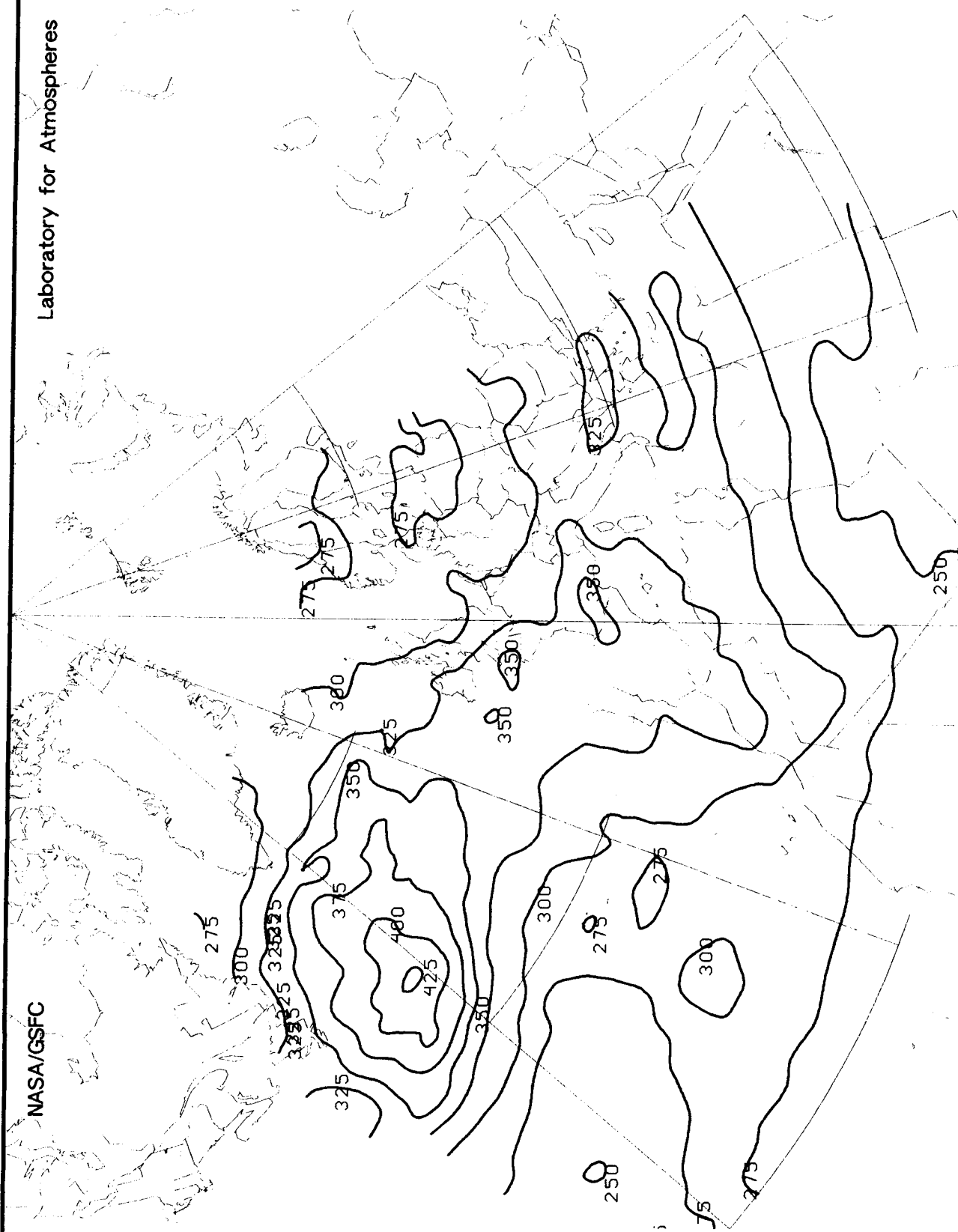




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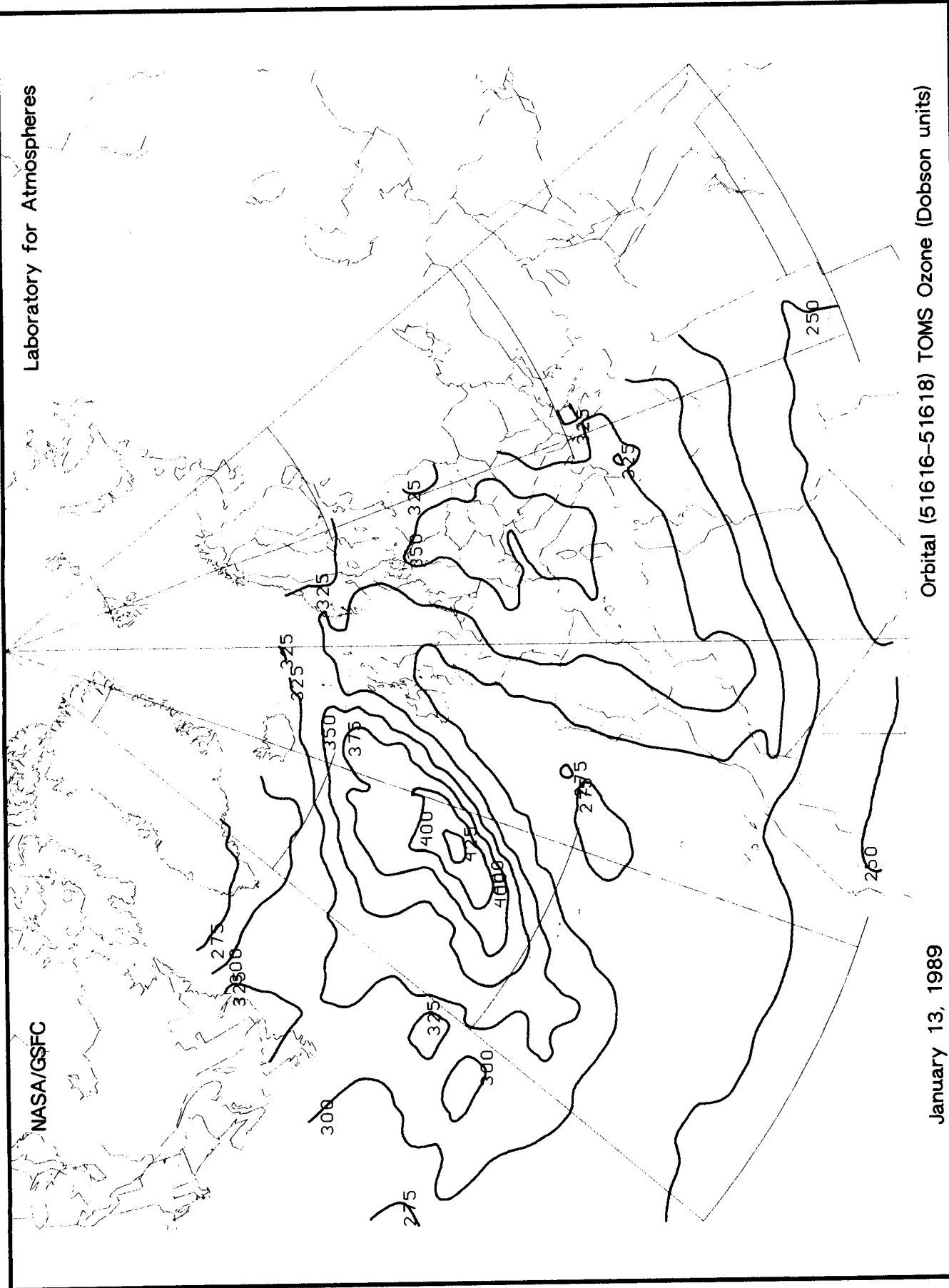
Orbital (51574-51576) TMS Ozone (Dobson units)

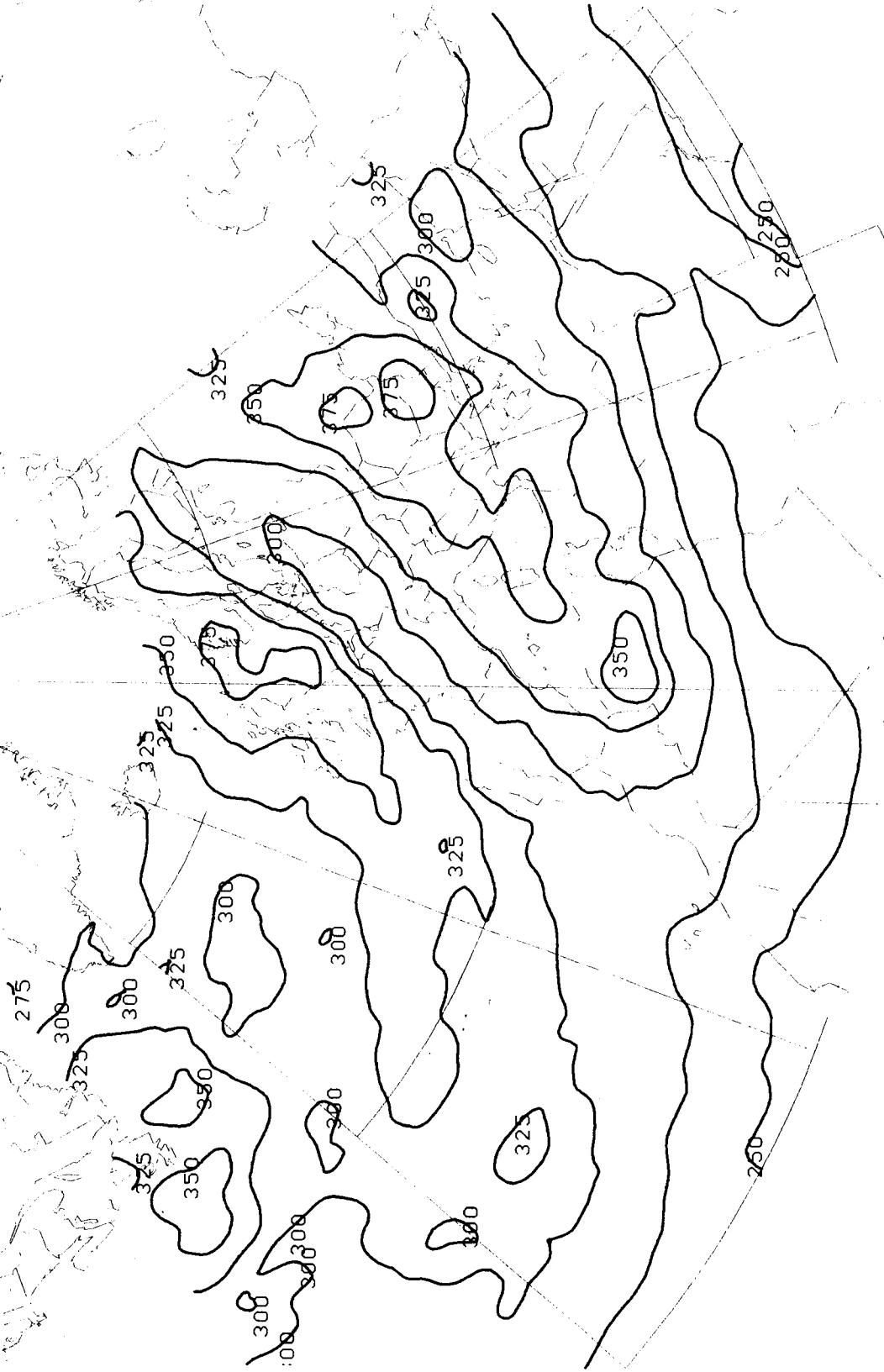




January 12, 1989

Orbital (51602-51604) TOMS Ozone (Dobson units)

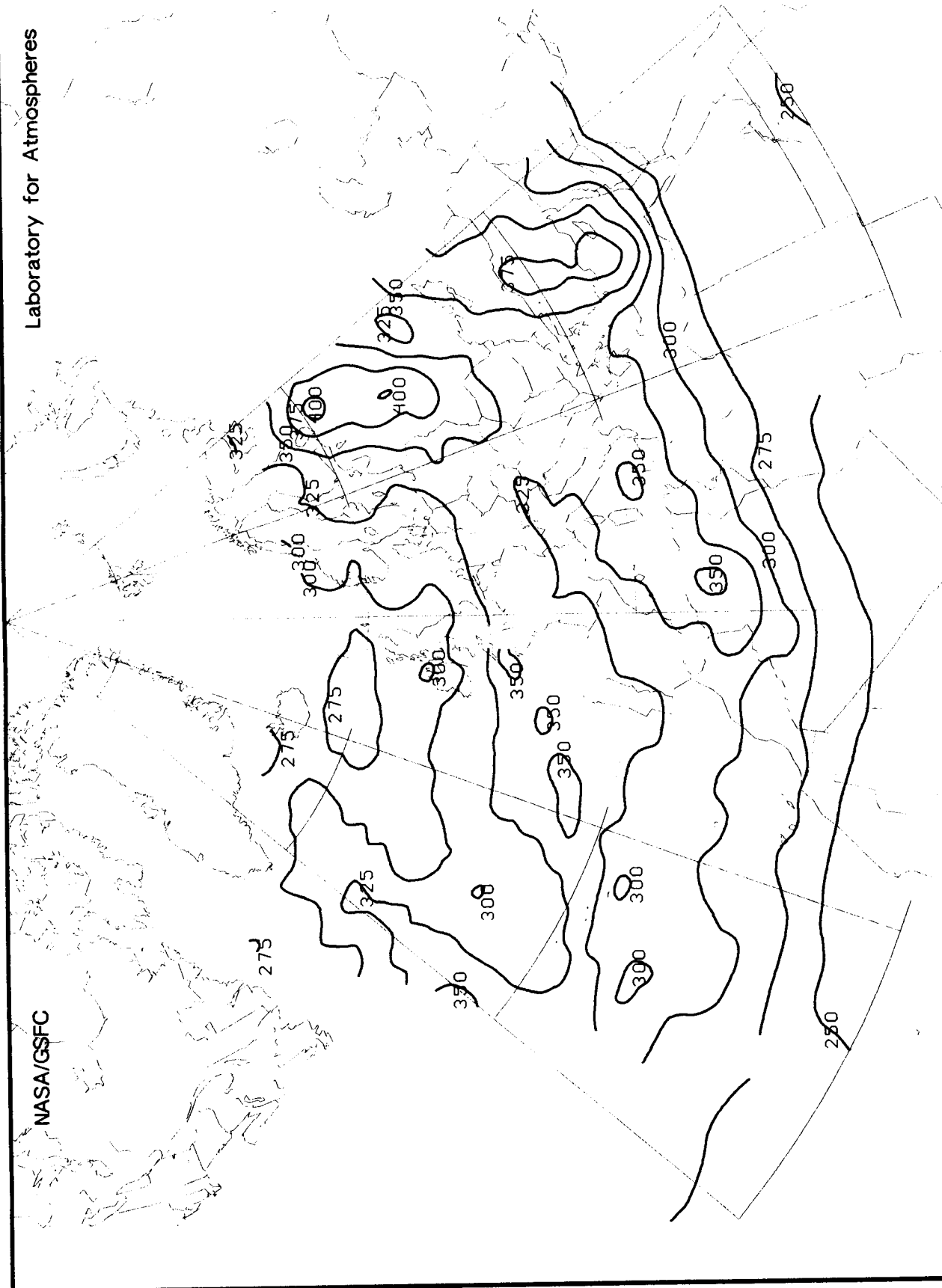


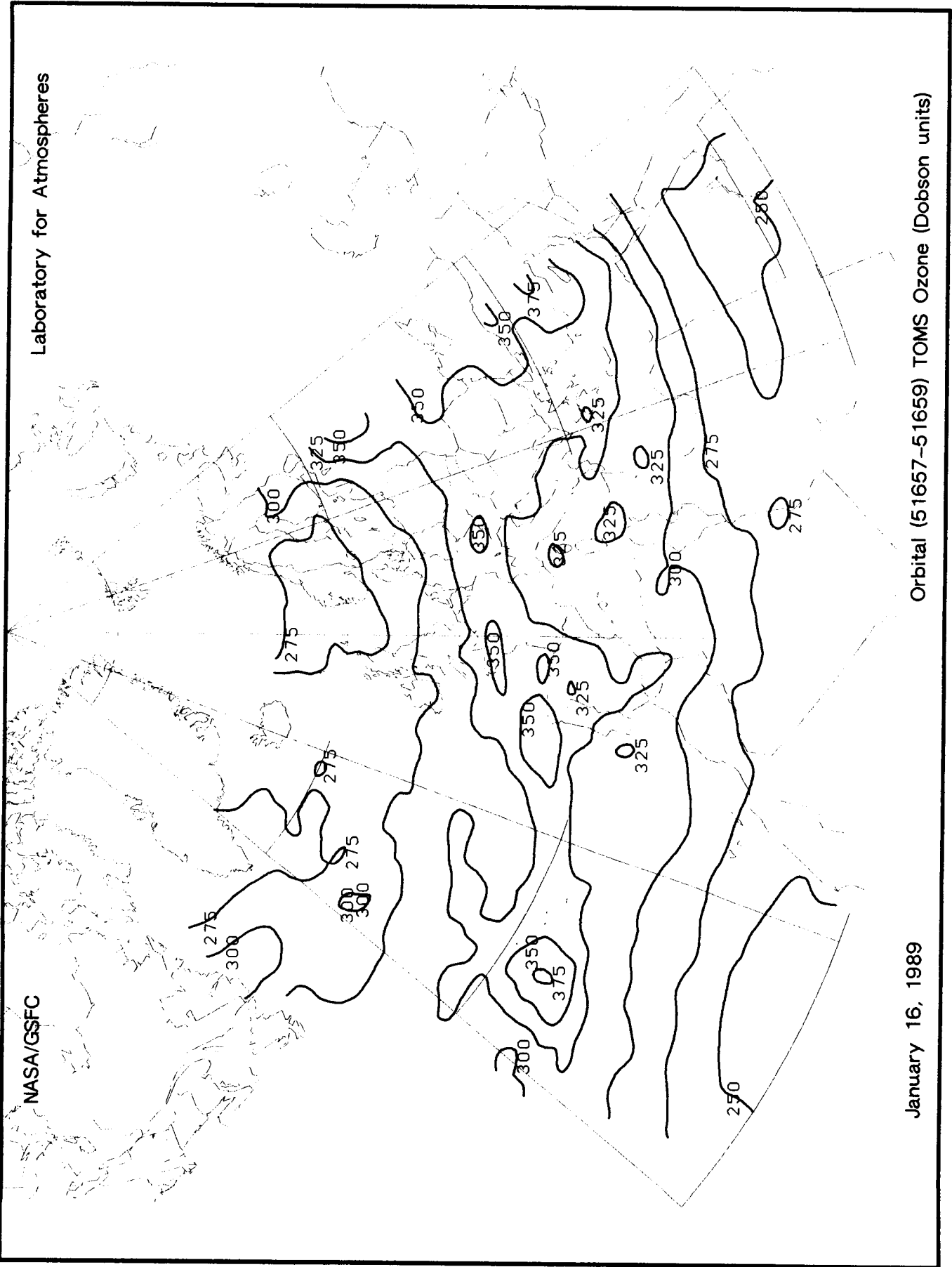


January 14, 1989

Orbital (51629-51633) TOMS Ozone (Dobson units)

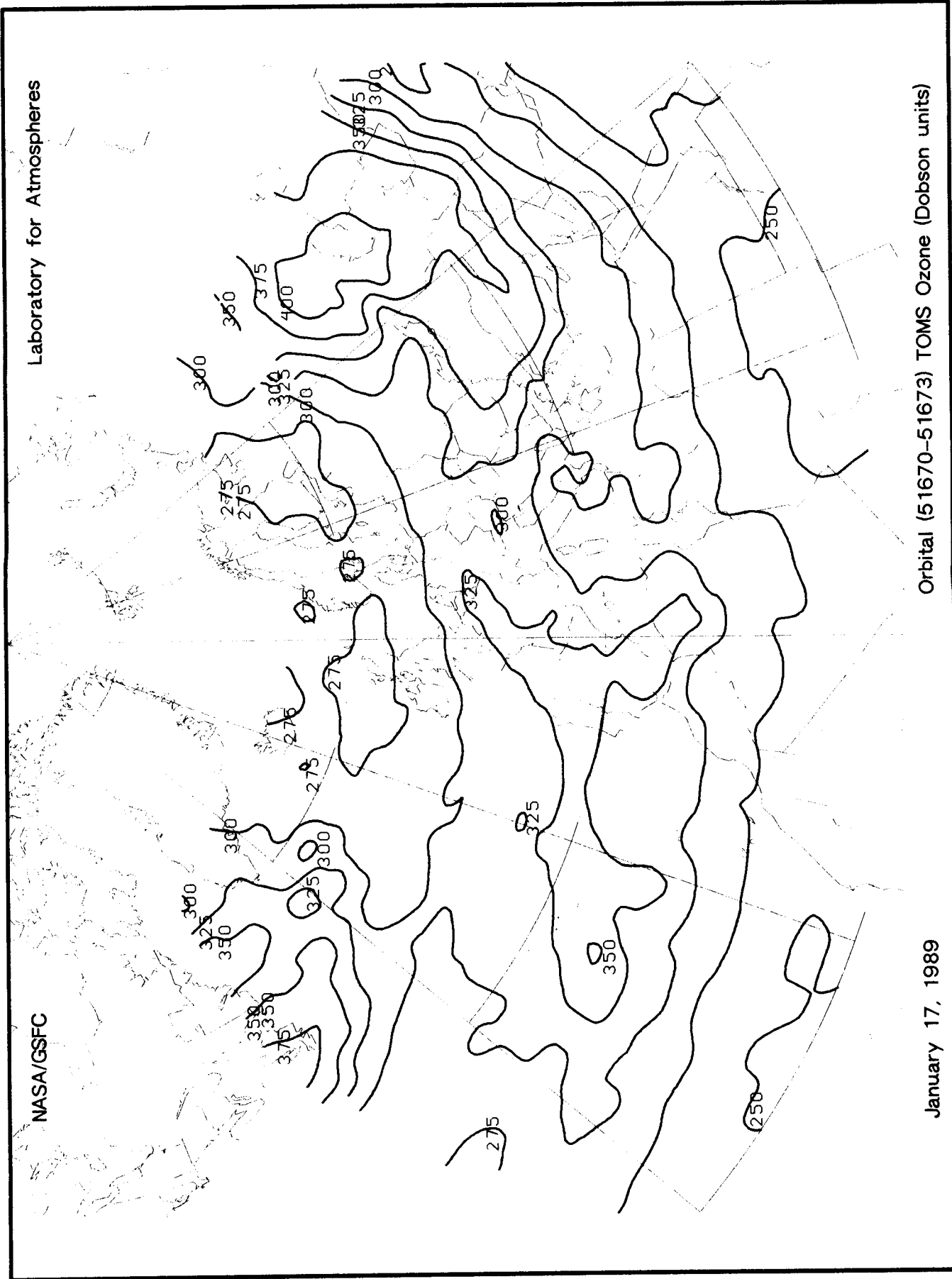


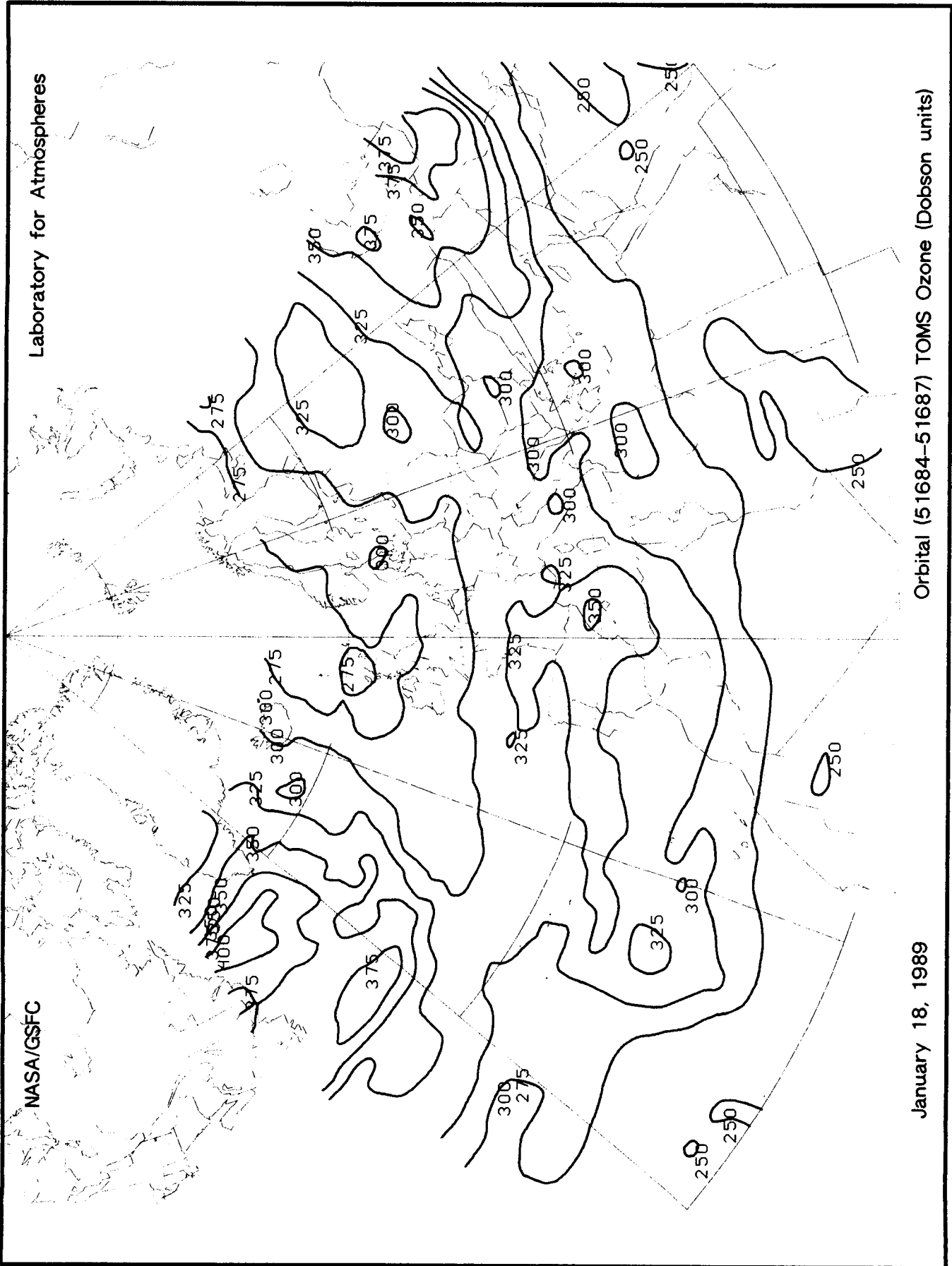




January 16, 1989

Orbital (51657-51659) TOMS Ozone (Dobson units)



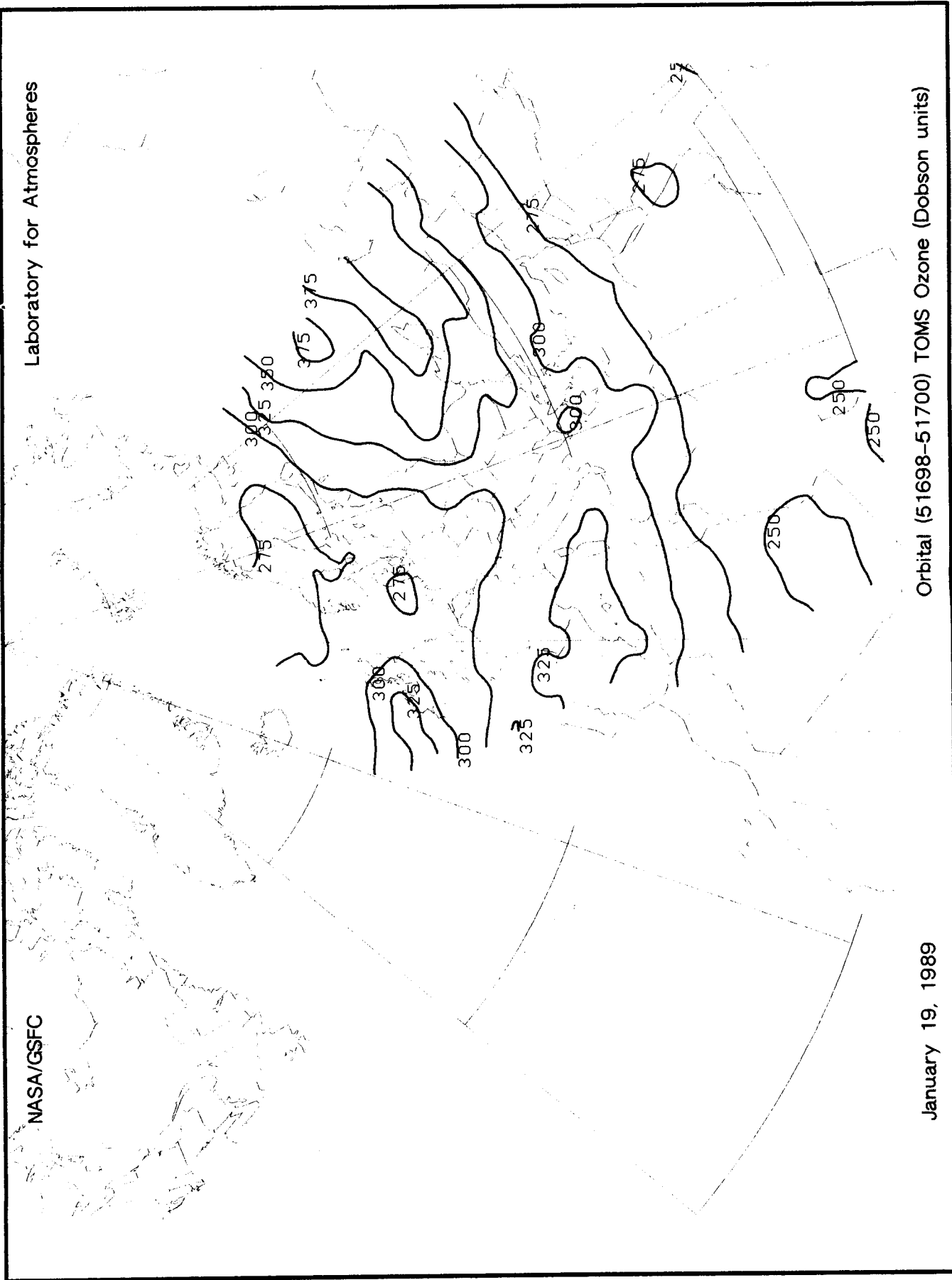


January 18, 1989

Orbital (51684-51687) TOMS Ozone (Dobson units)

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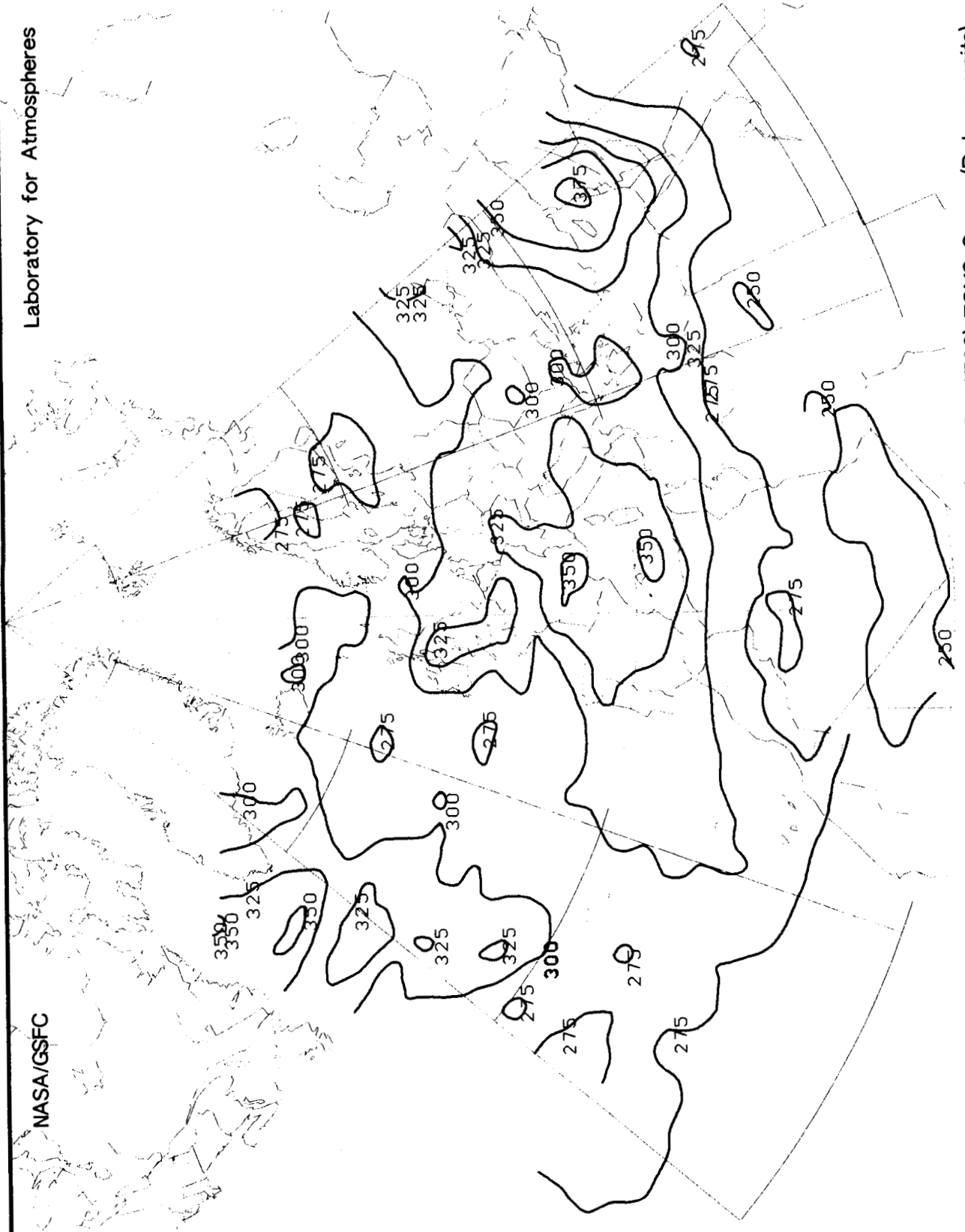
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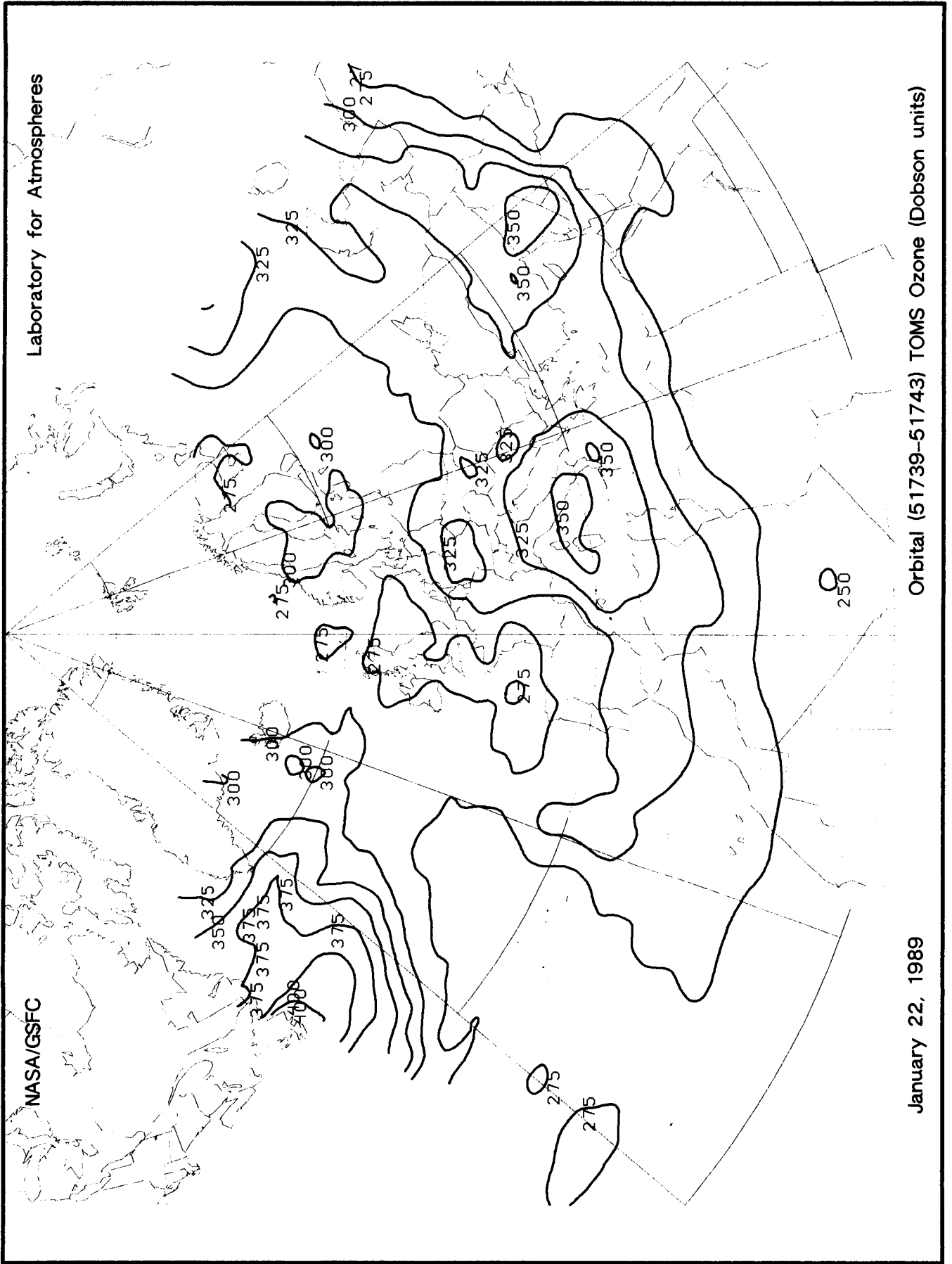
Orbital (51698-51700) TOMS Ozone (Dobson units)



January 20, 1989

Orbital (51712-51714) TOMS Ozone (Dobson units)





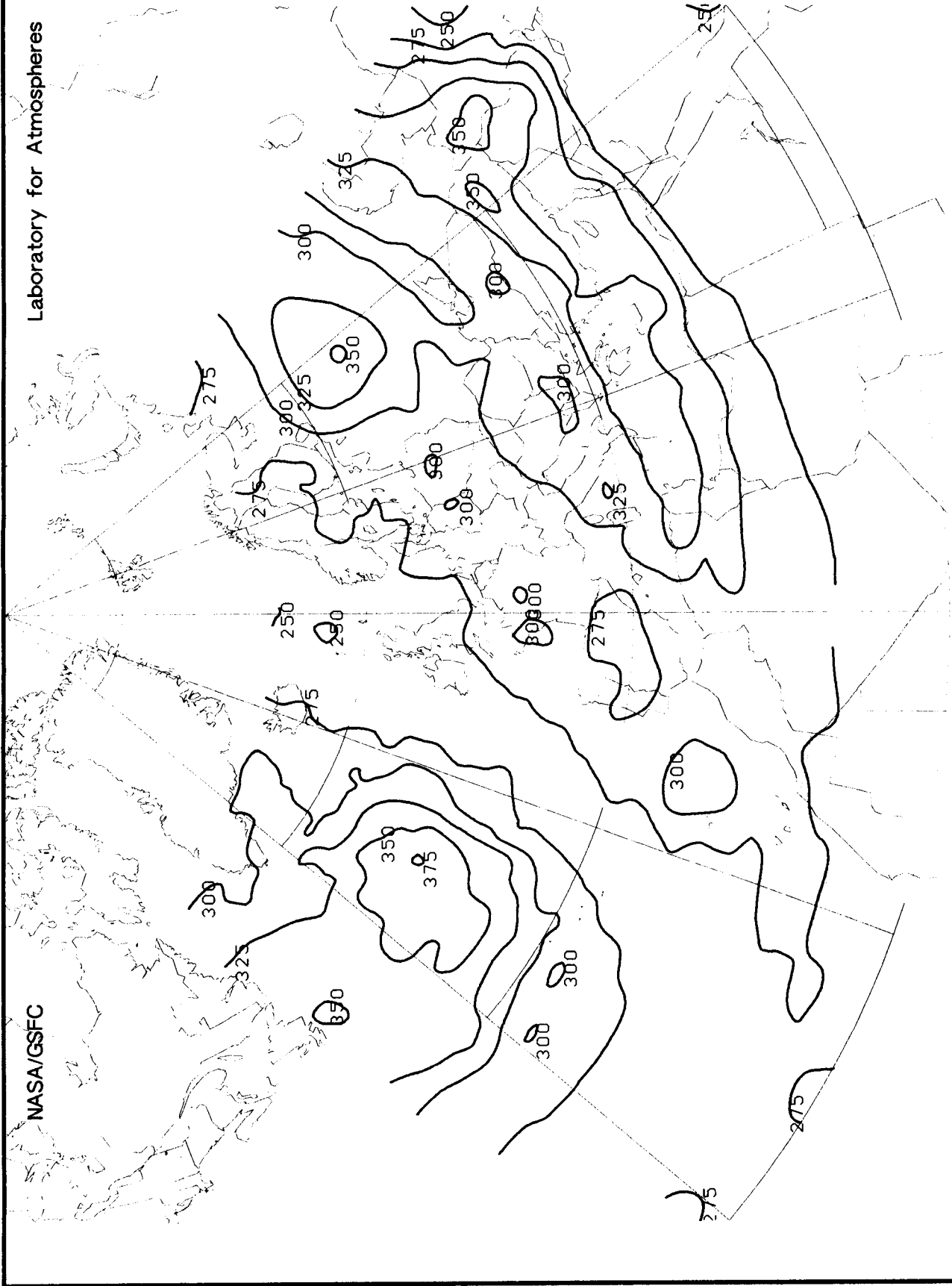
January 22, 1989

Orbital (51739-51743) TOMS Ozone (Dobson units)



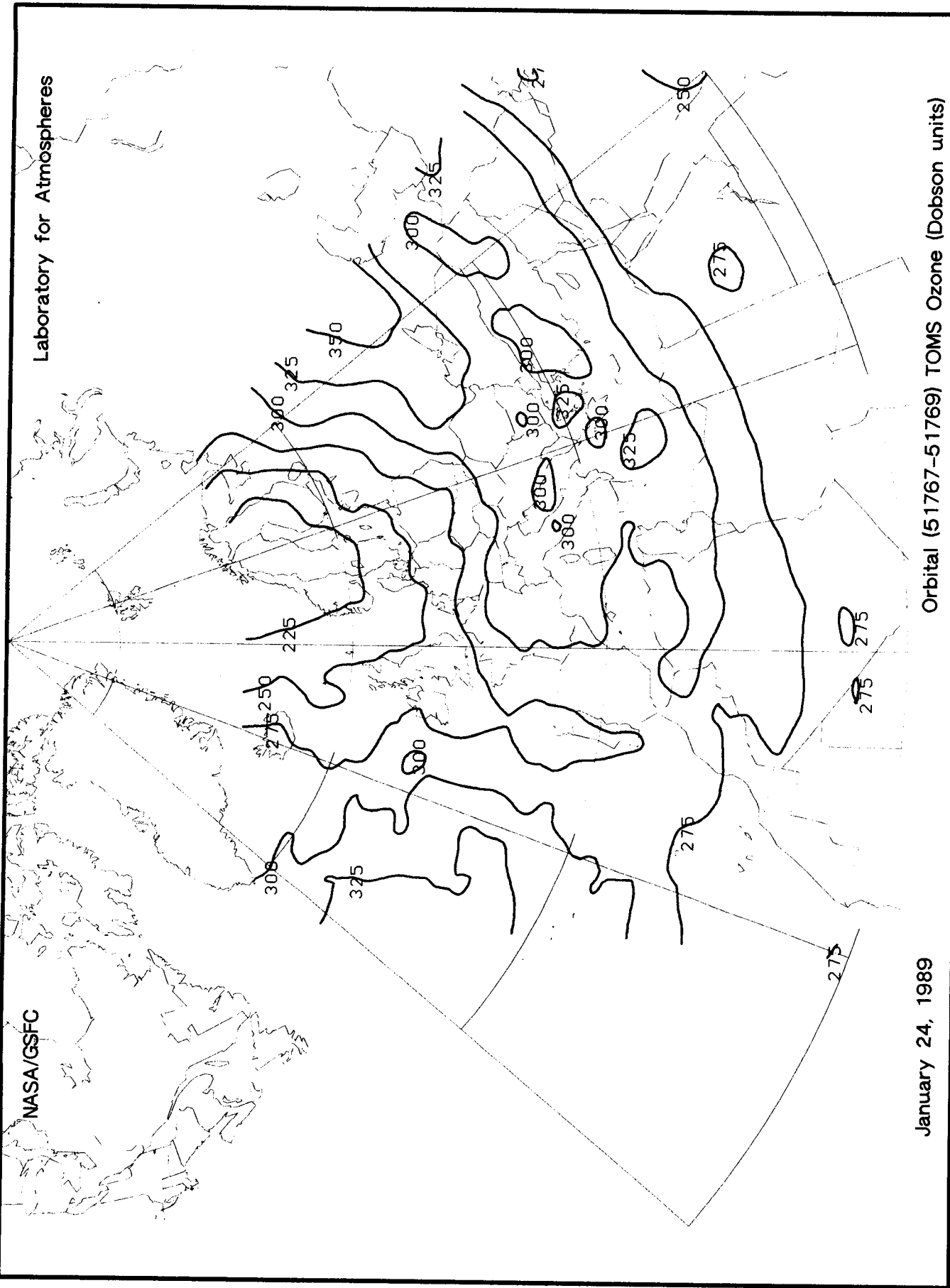
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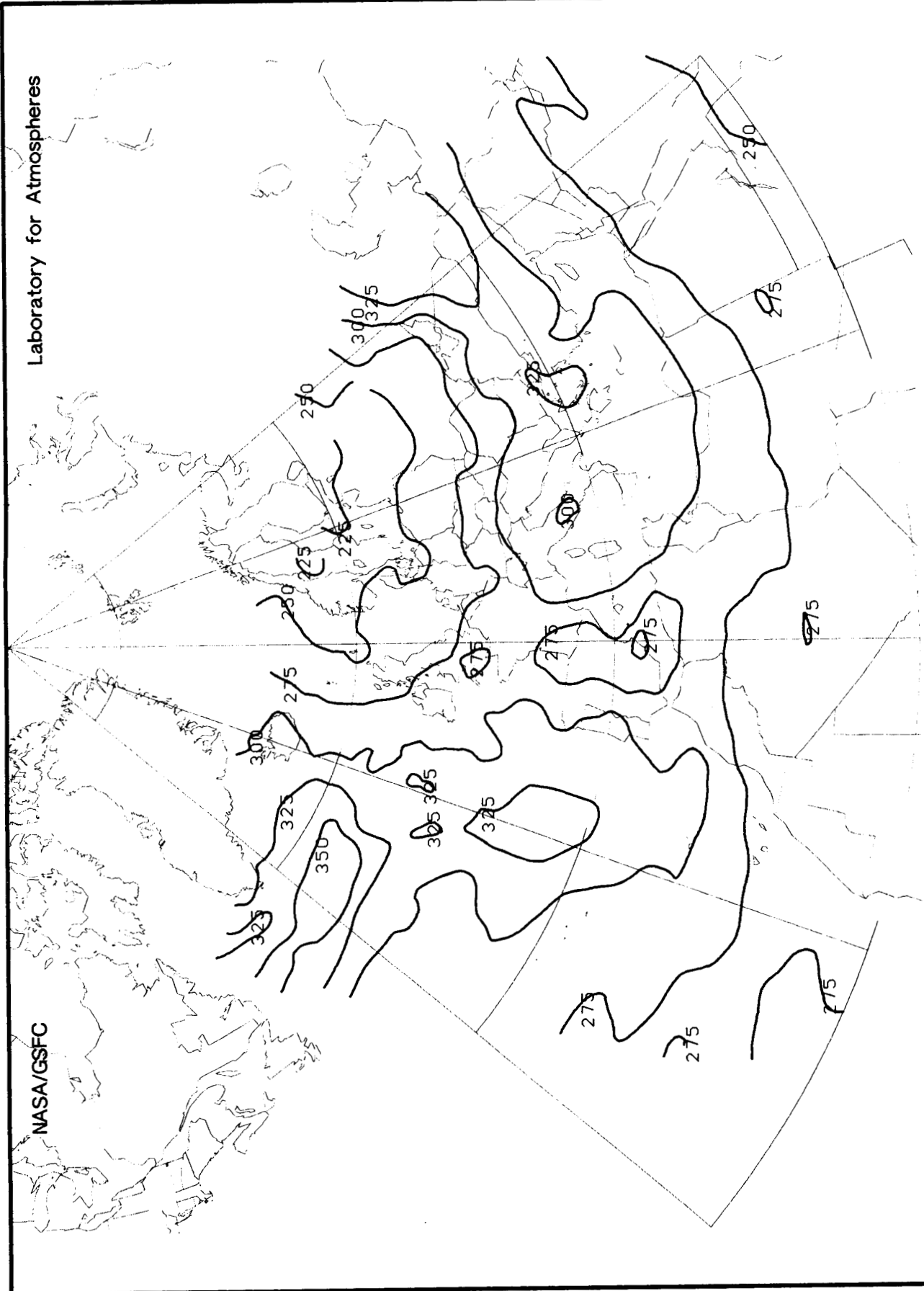
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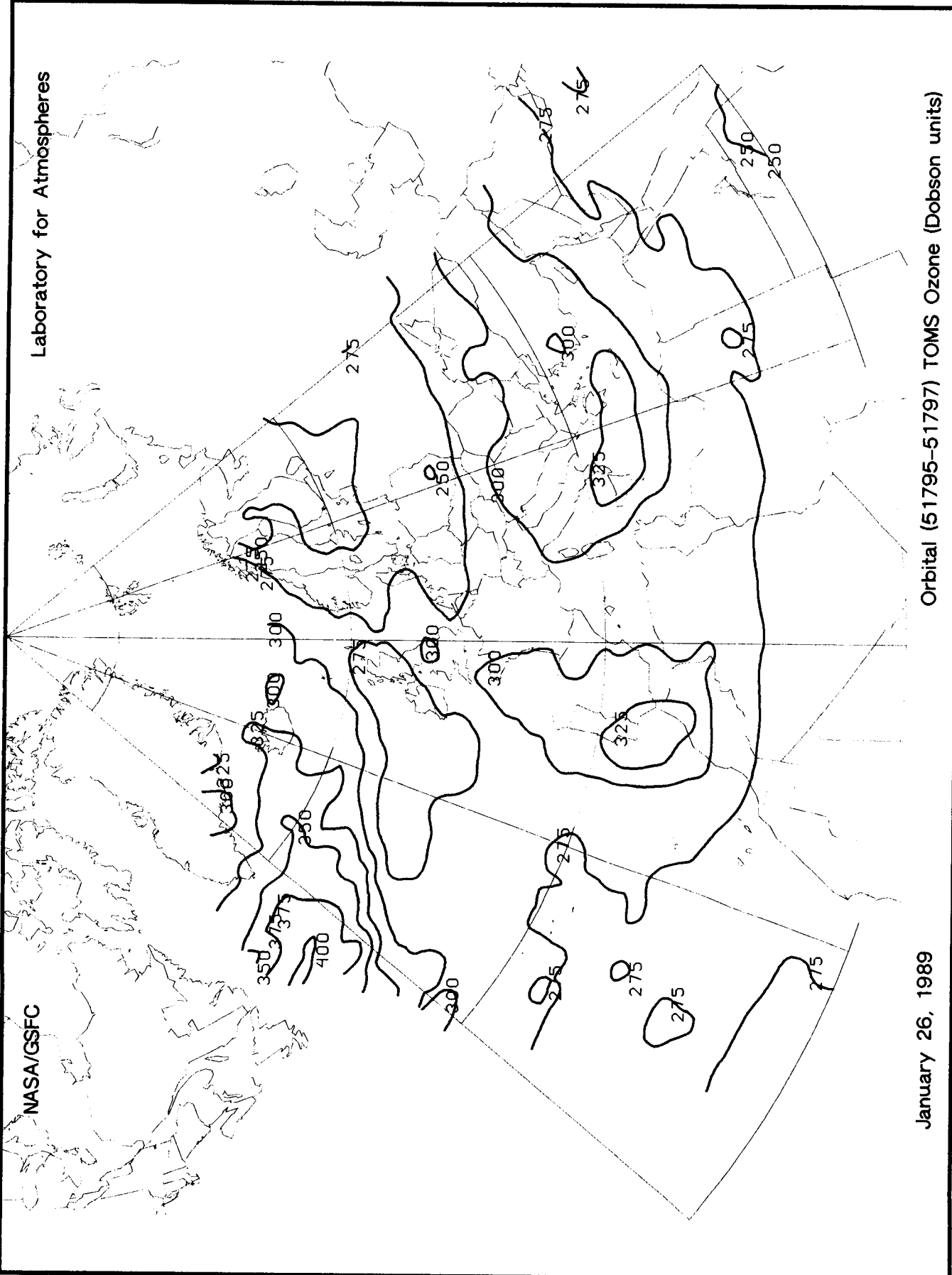
Orbital (51753-51756) TOMS Ozone (Dobson units)



January 24, 1989

Orbital (51767-51769) TOMS Ozone (Dobson units)

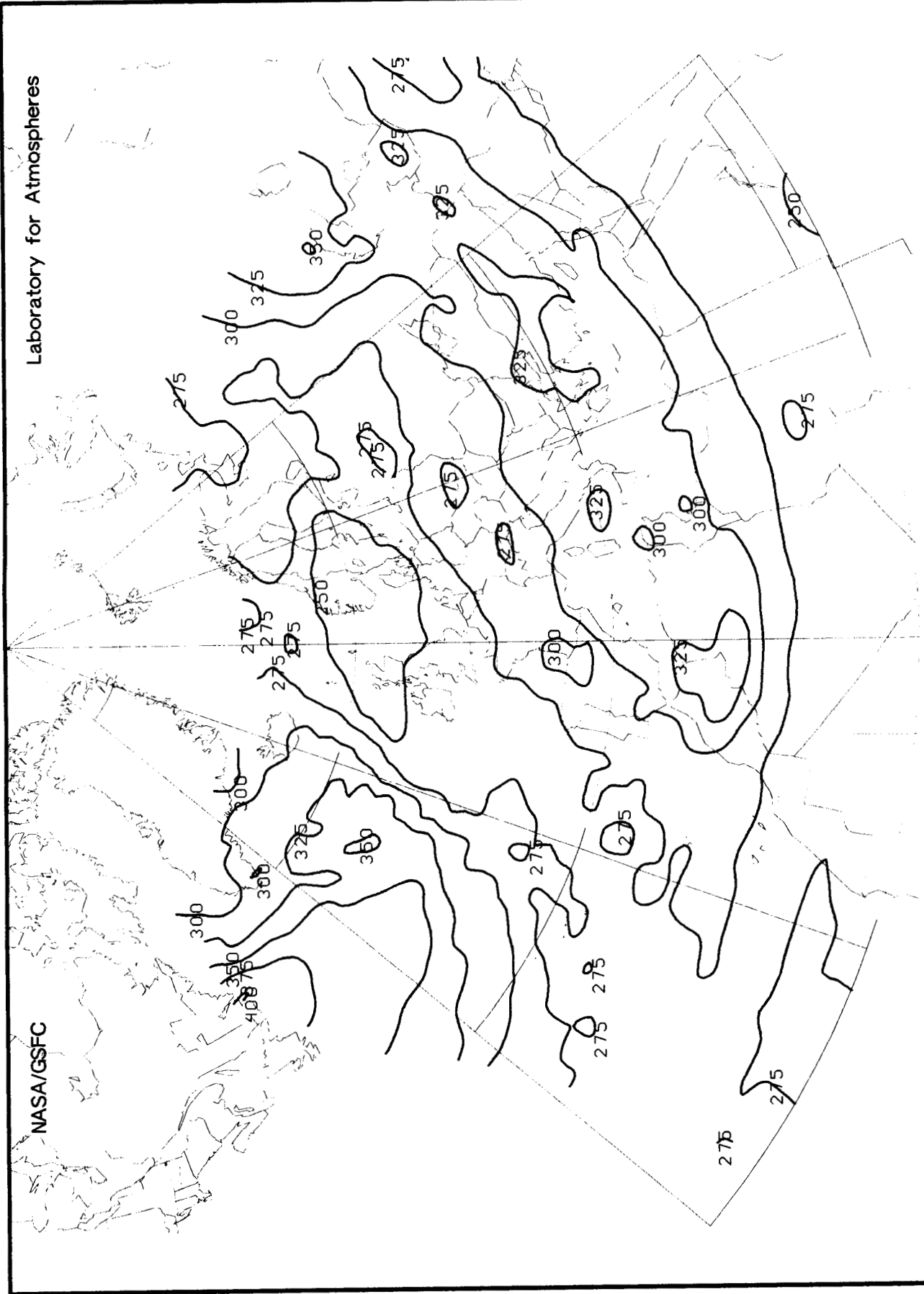




January 26, 1989

Orbital (51795-51797) TOMS Ozone (Dobson units)

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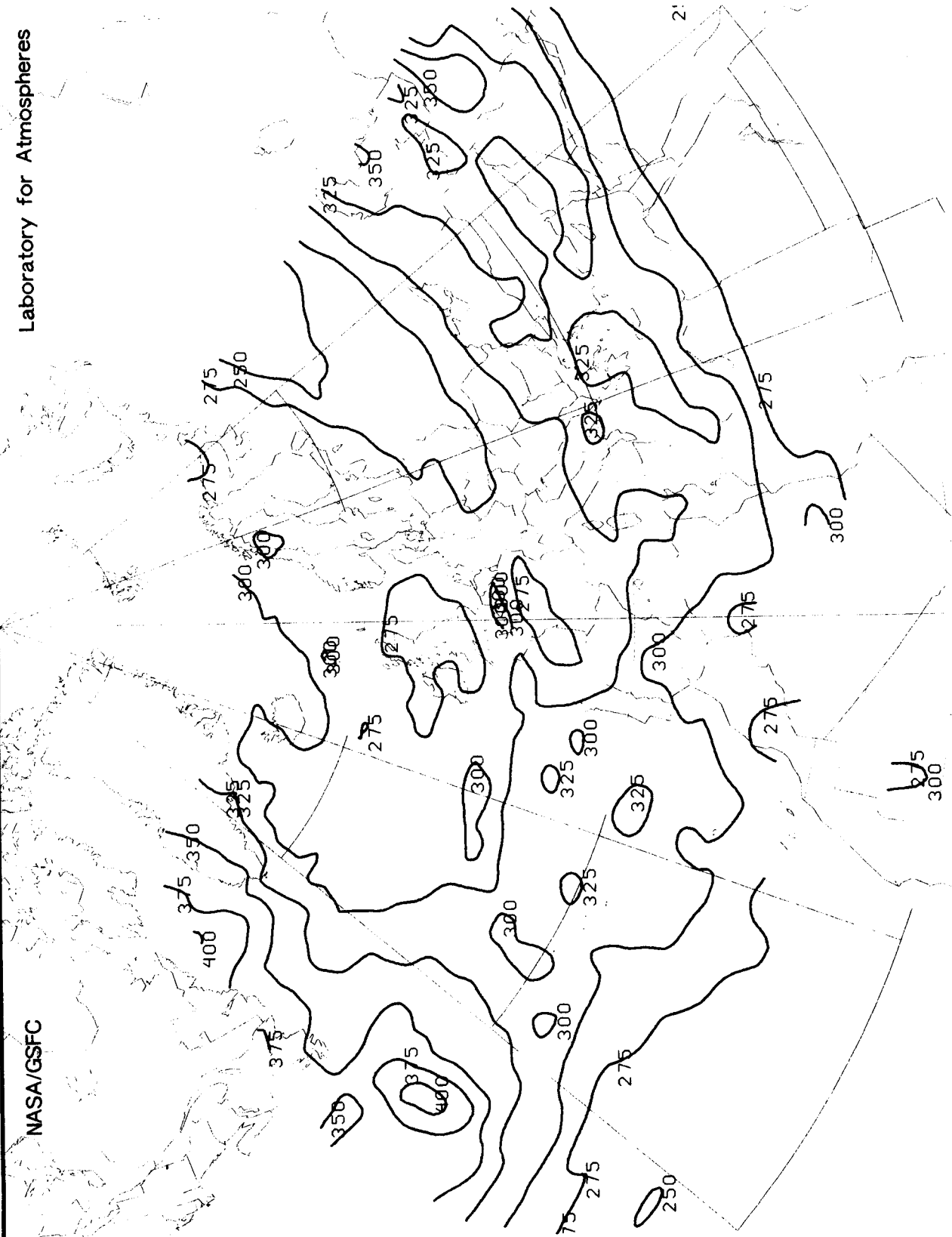
Orbital (51808-51811) TOMS Ozone (Dobson units)

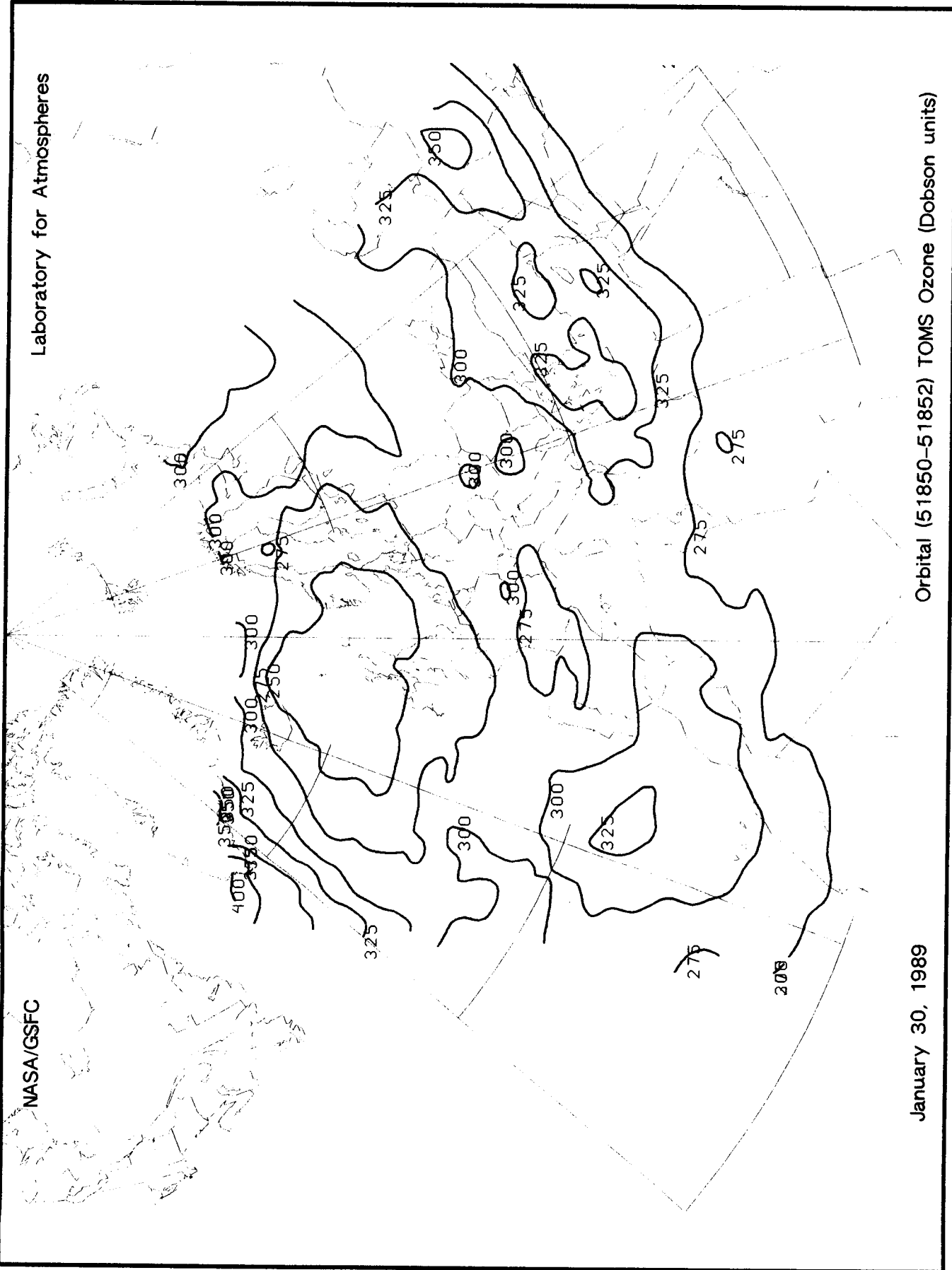
January 27, 1989



January 28, 1989

Orbital (51822-51825) TOMS Ozone (Dobson units)





January 30, 1989

Orbital (51850-51852) TOMS Ozone (Dobson units)

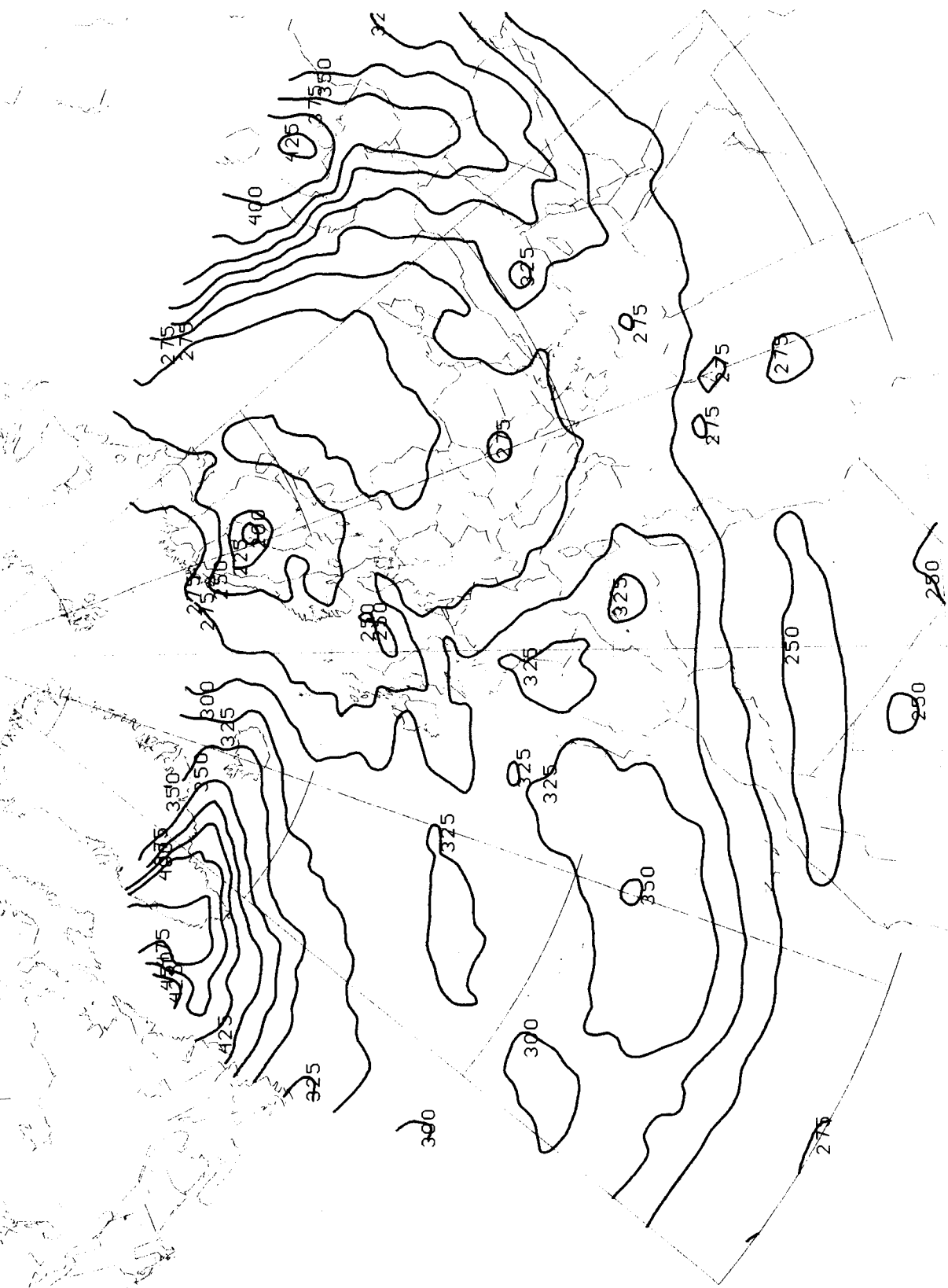






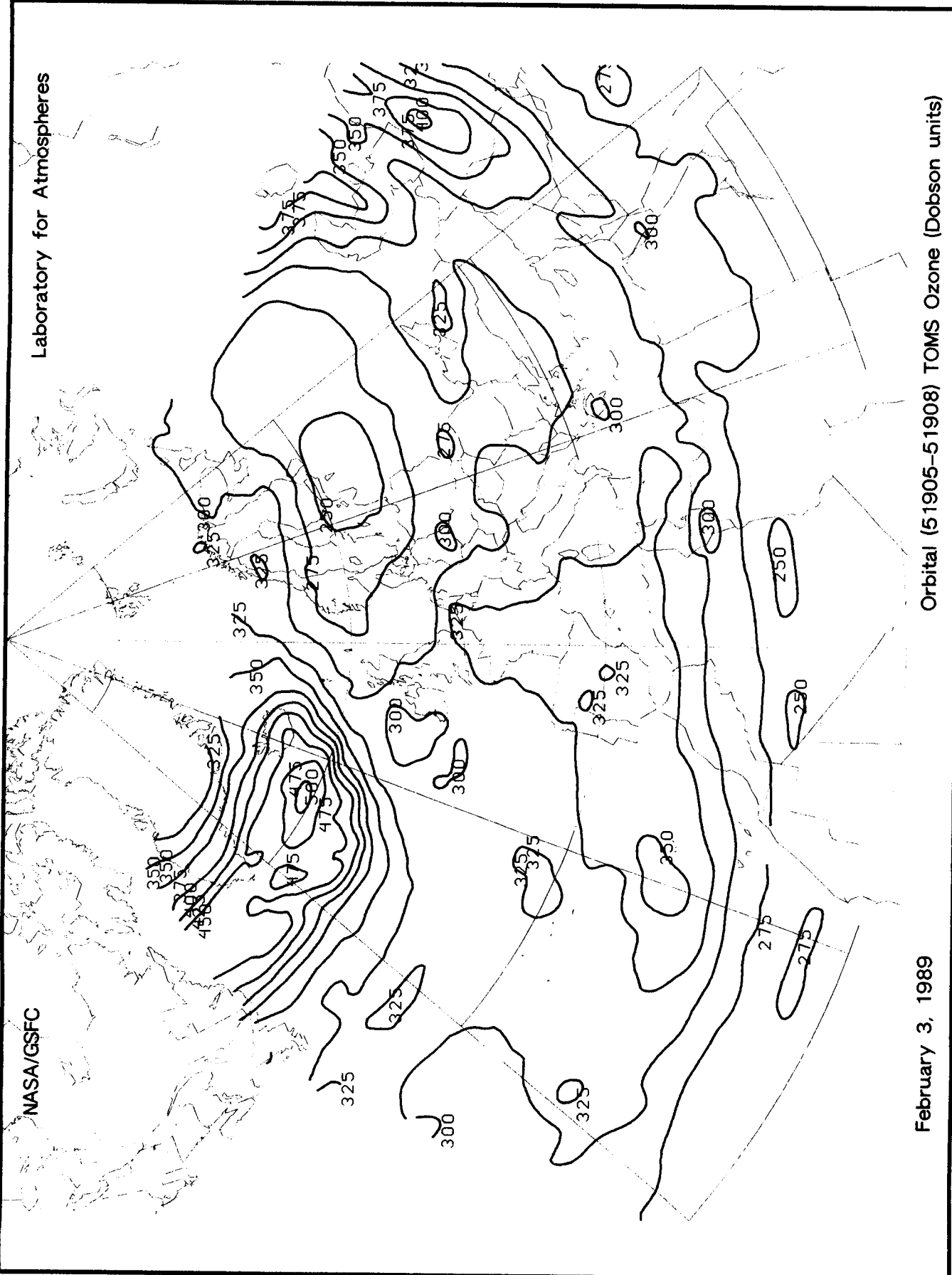
Laboratory for Atmospheres

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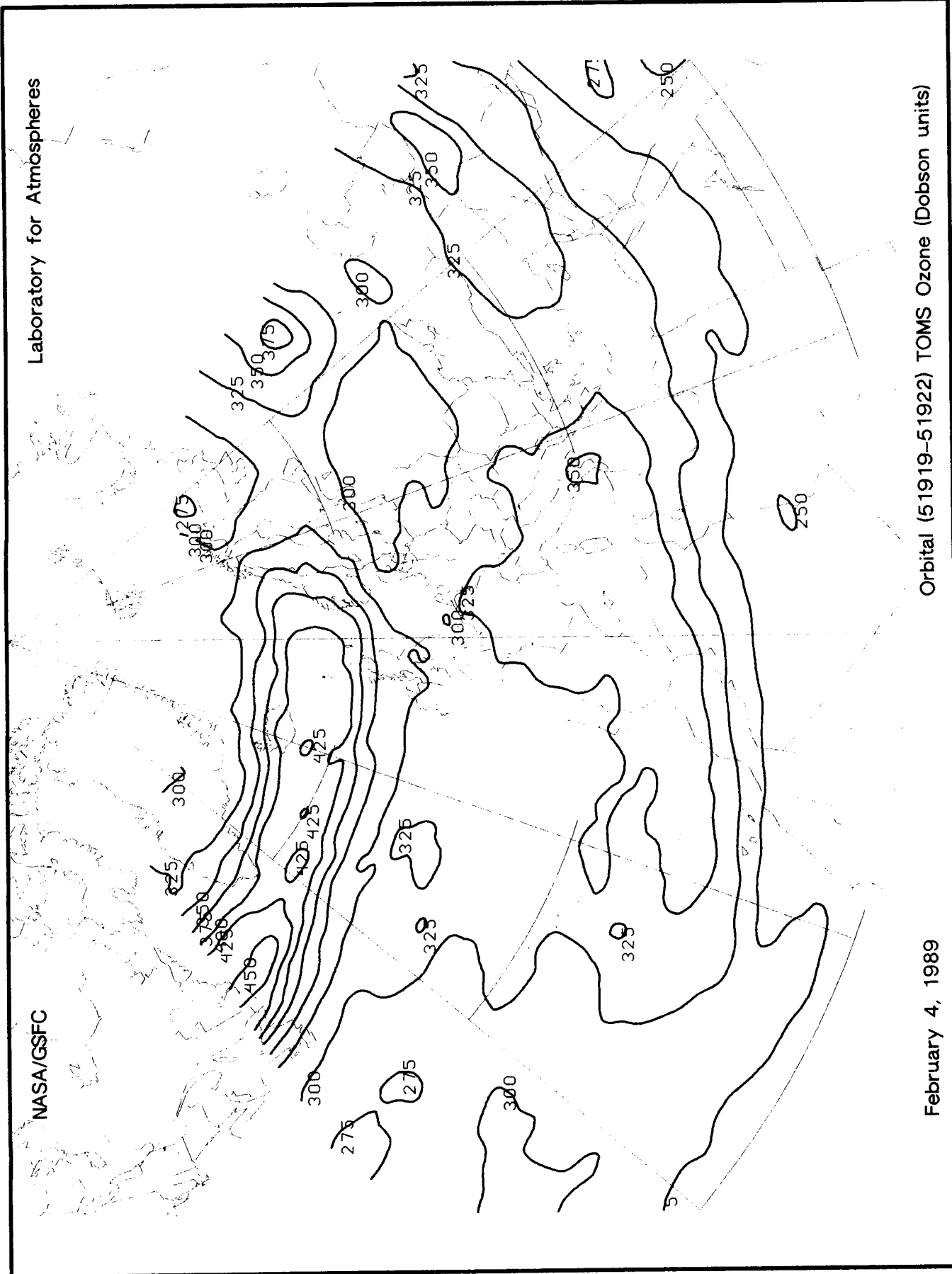
Orbital (51891-51894) TOMS Ozone (Dobson units)

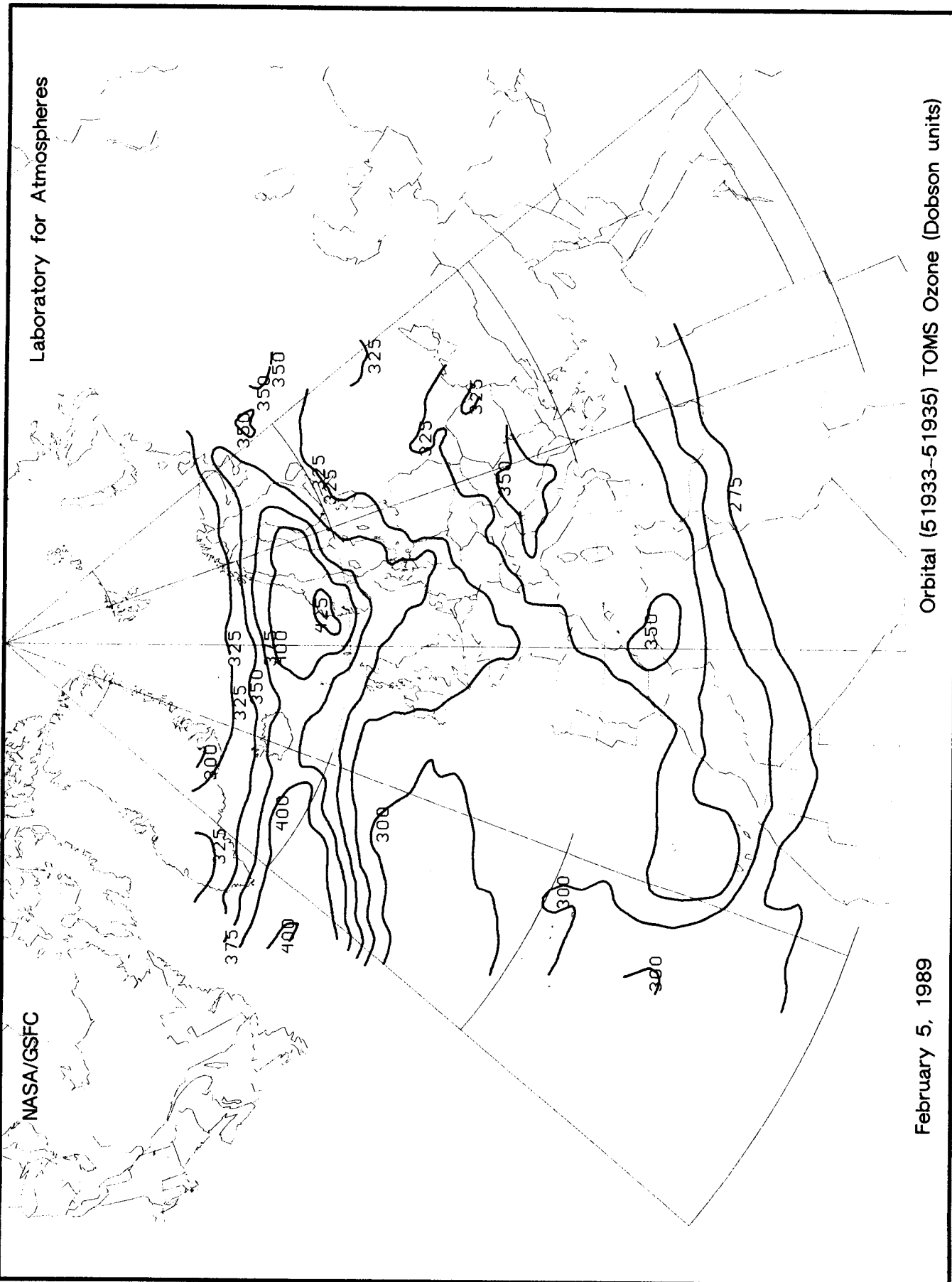
February 2, 1989



February 3, 1989

Orbital (51905-51908) TOMS Ozone (Dobson units)



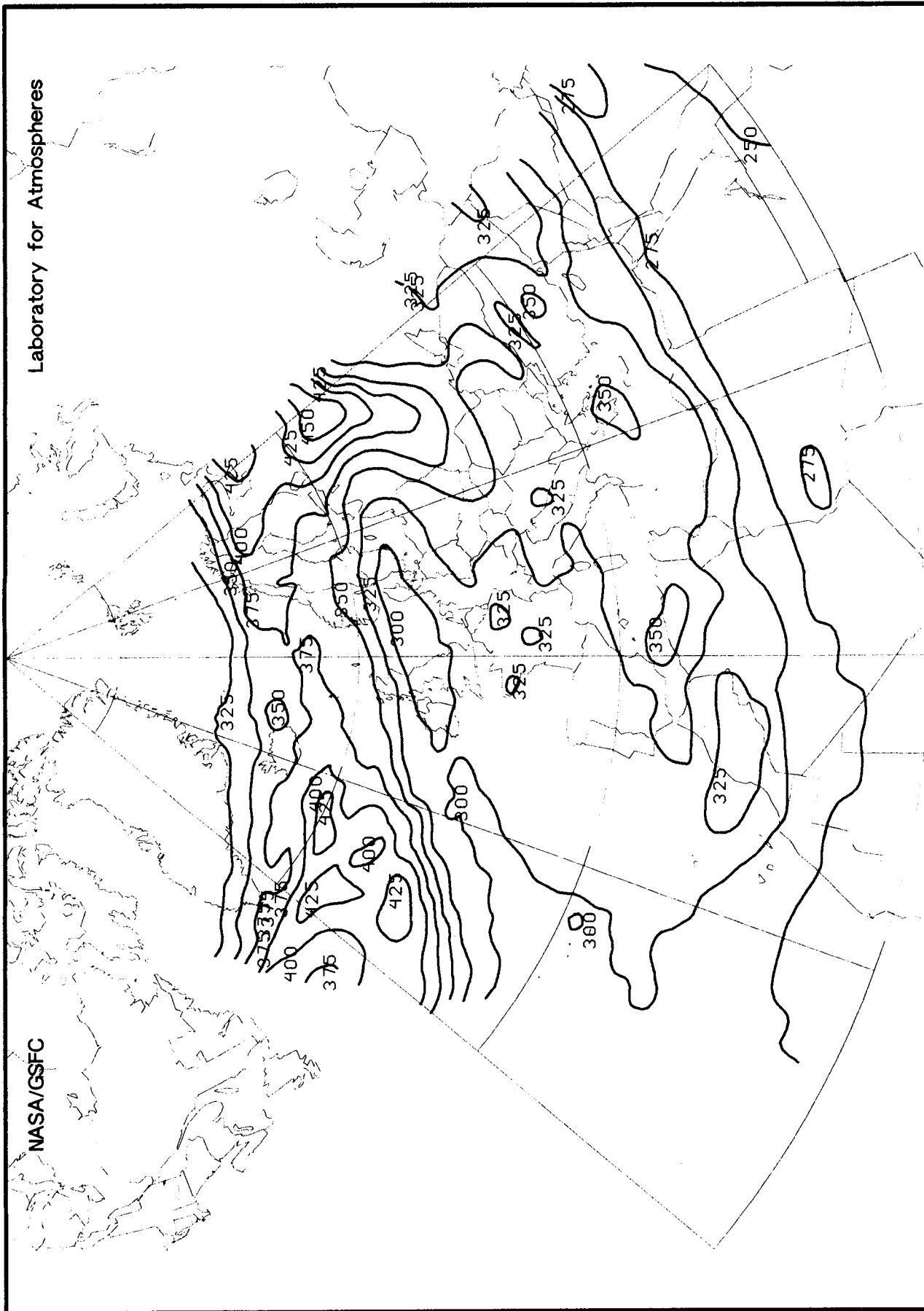


February 5, 1989

Orbital (51933-51935) TOMS Ozone (Dobson units)

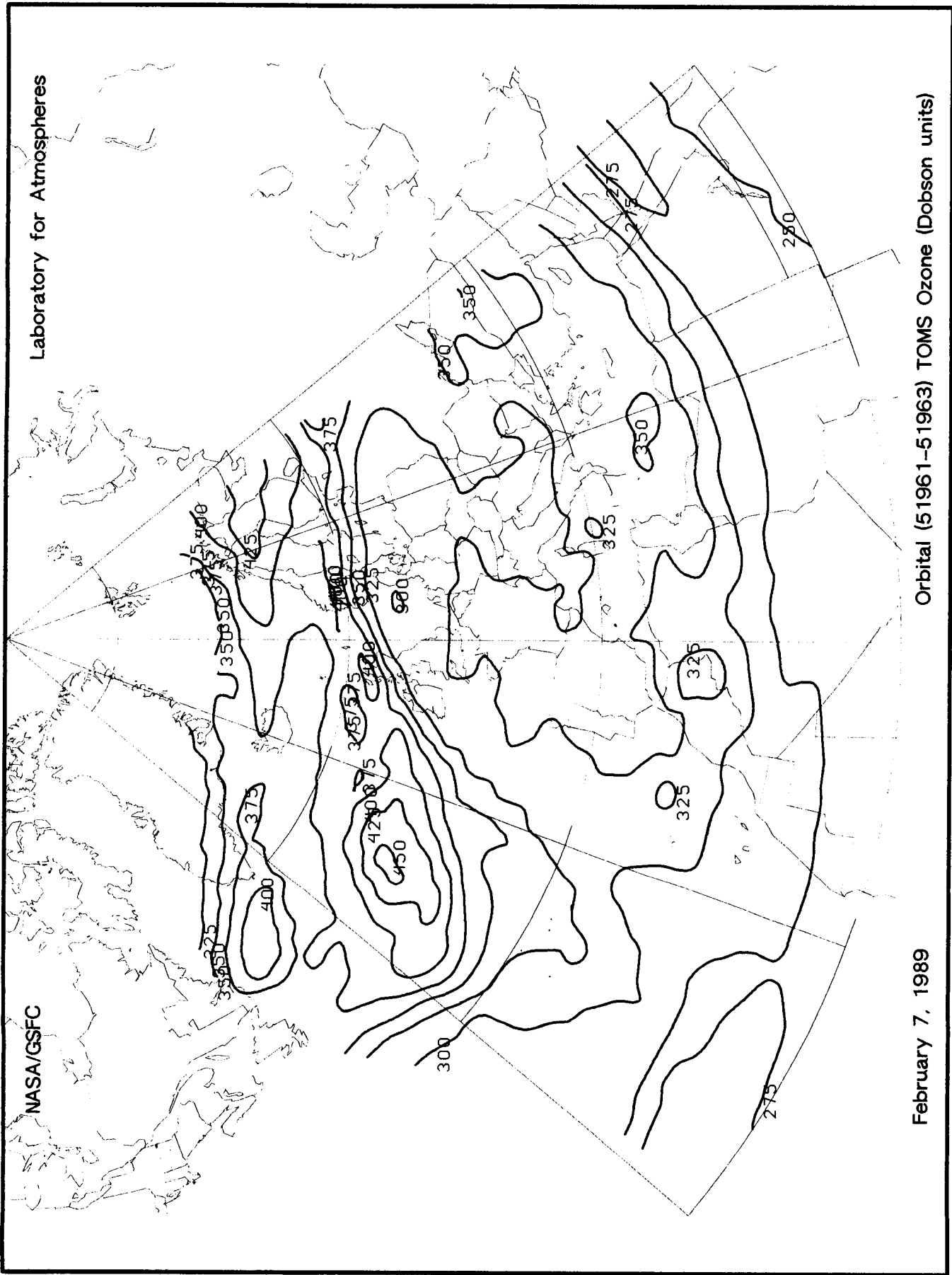
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February 6, 1989

Orbital (51947-51949) TOMS Ozone (Dobson units)



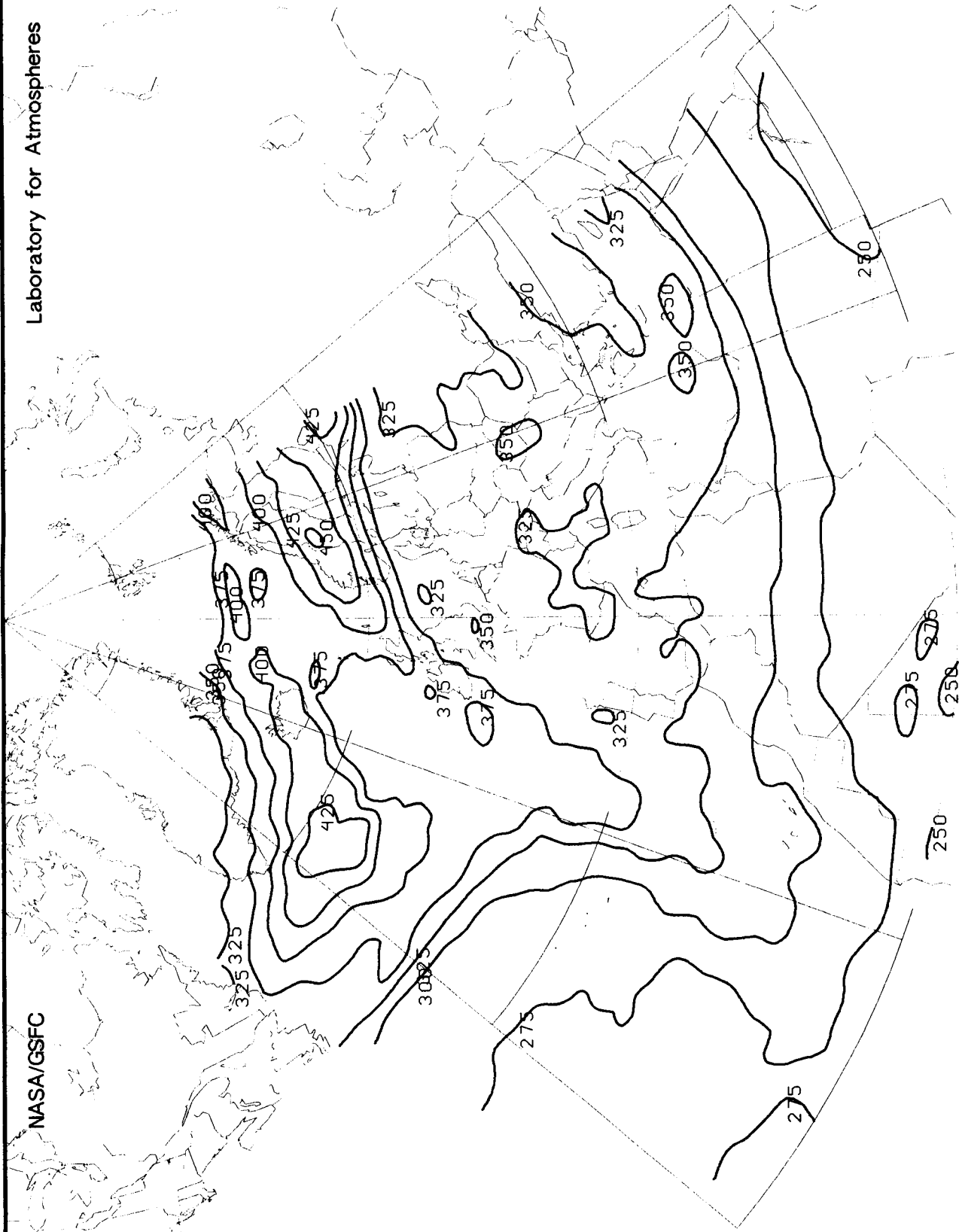
February 7, 1989

Orbital (51961-51963) TOMS Ozone (Dobson units)



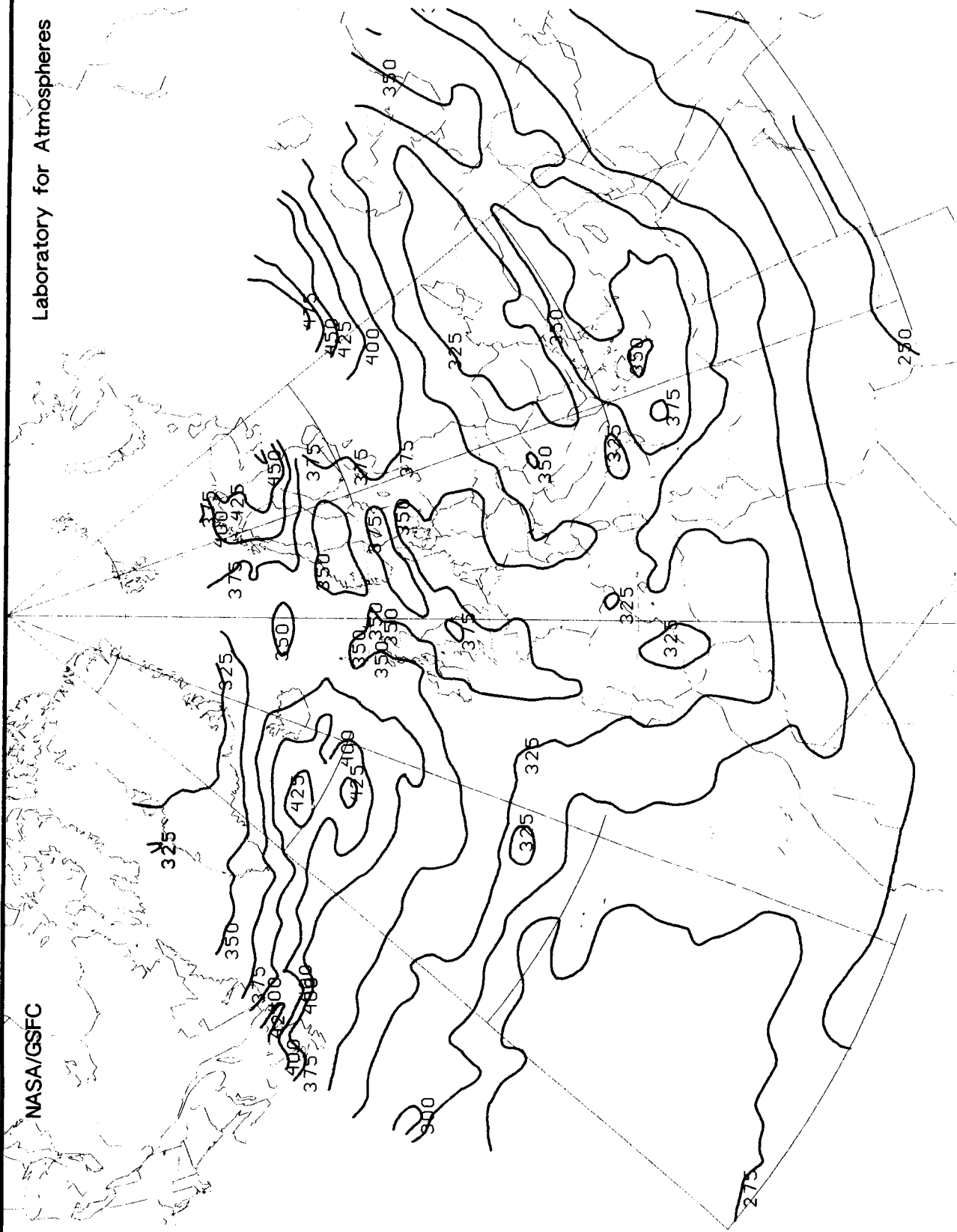
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February 8, 1989

Orbital (51975-51977) TOMS Ozone (Dobson units)

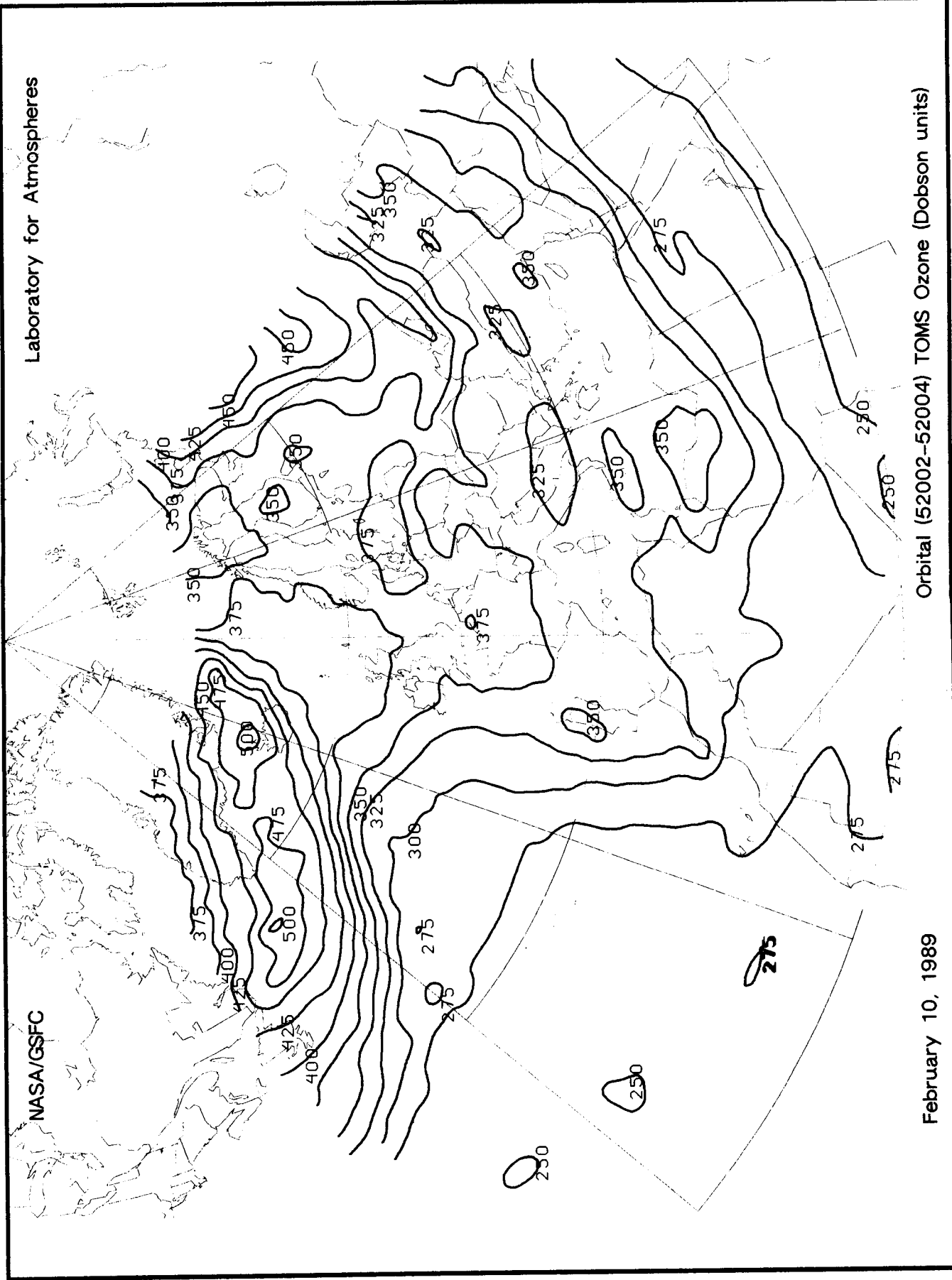


February 9, 1989

Orbital (51988-51991) TOMS Ozone (Dobson units)

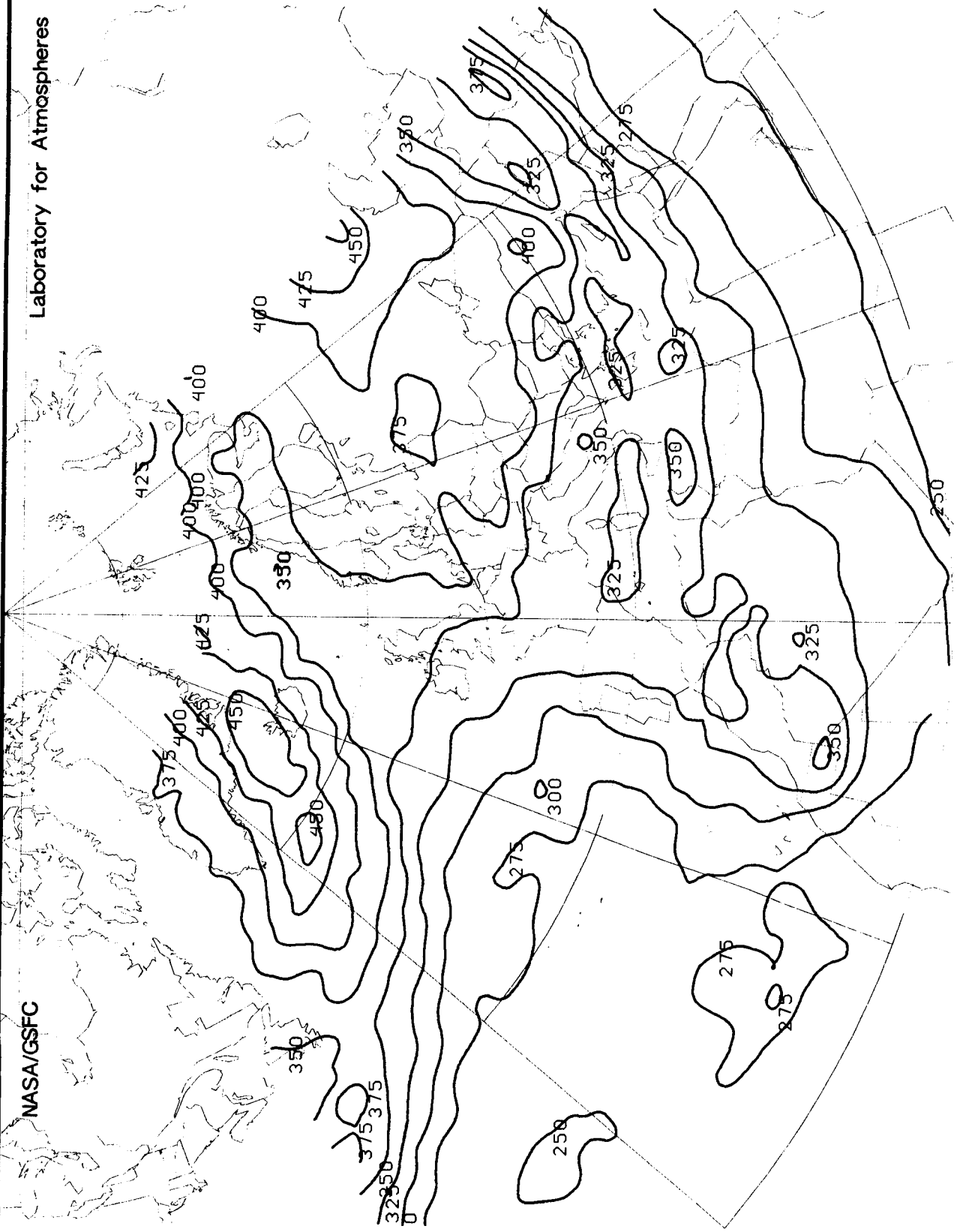
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February 10, 1989

Orbital (52002-52004) TOMS Ozone (Dobson units)

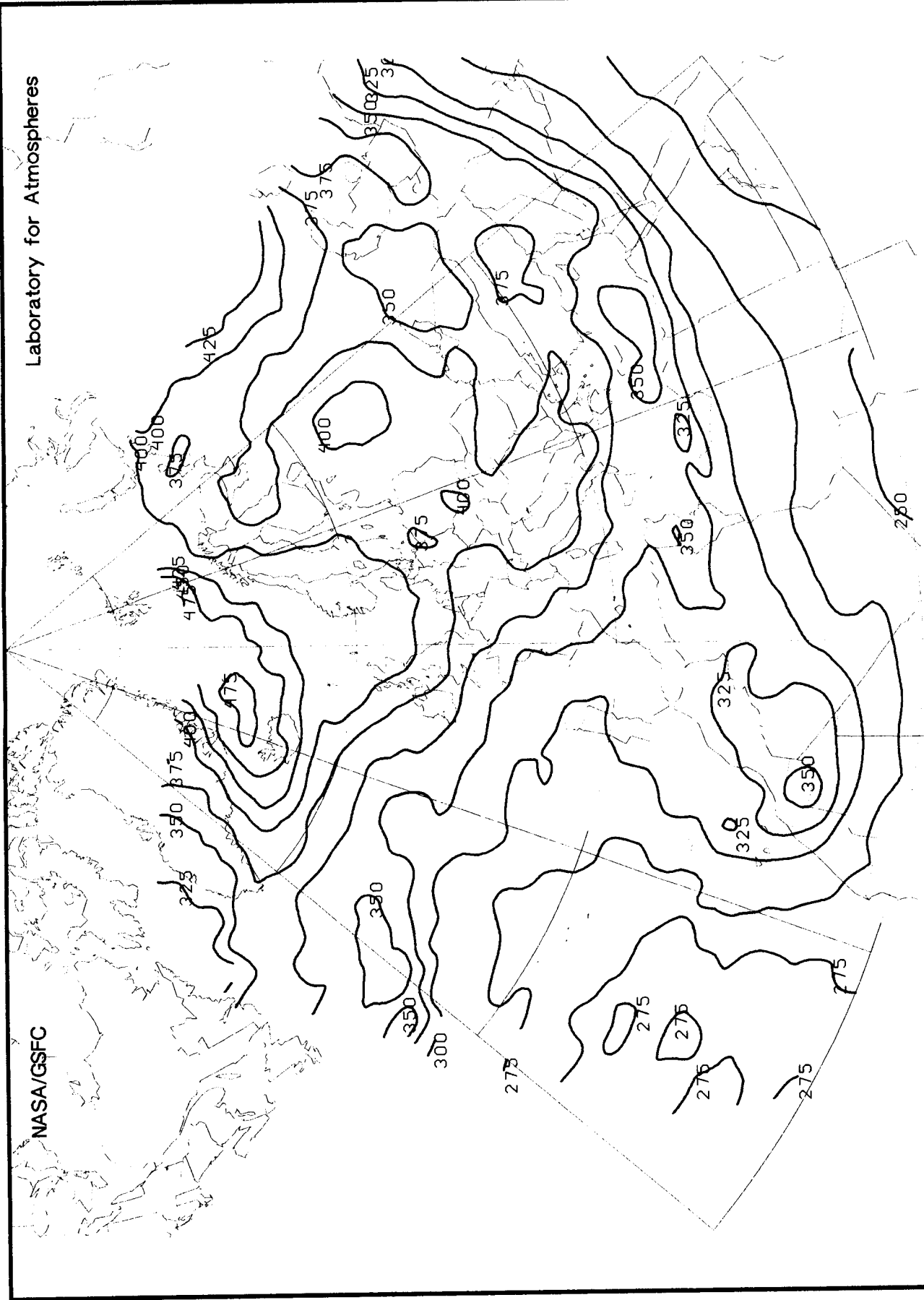


Orbital (52016-52020) TMS Ozone (Dobson units)

February 11, 1989

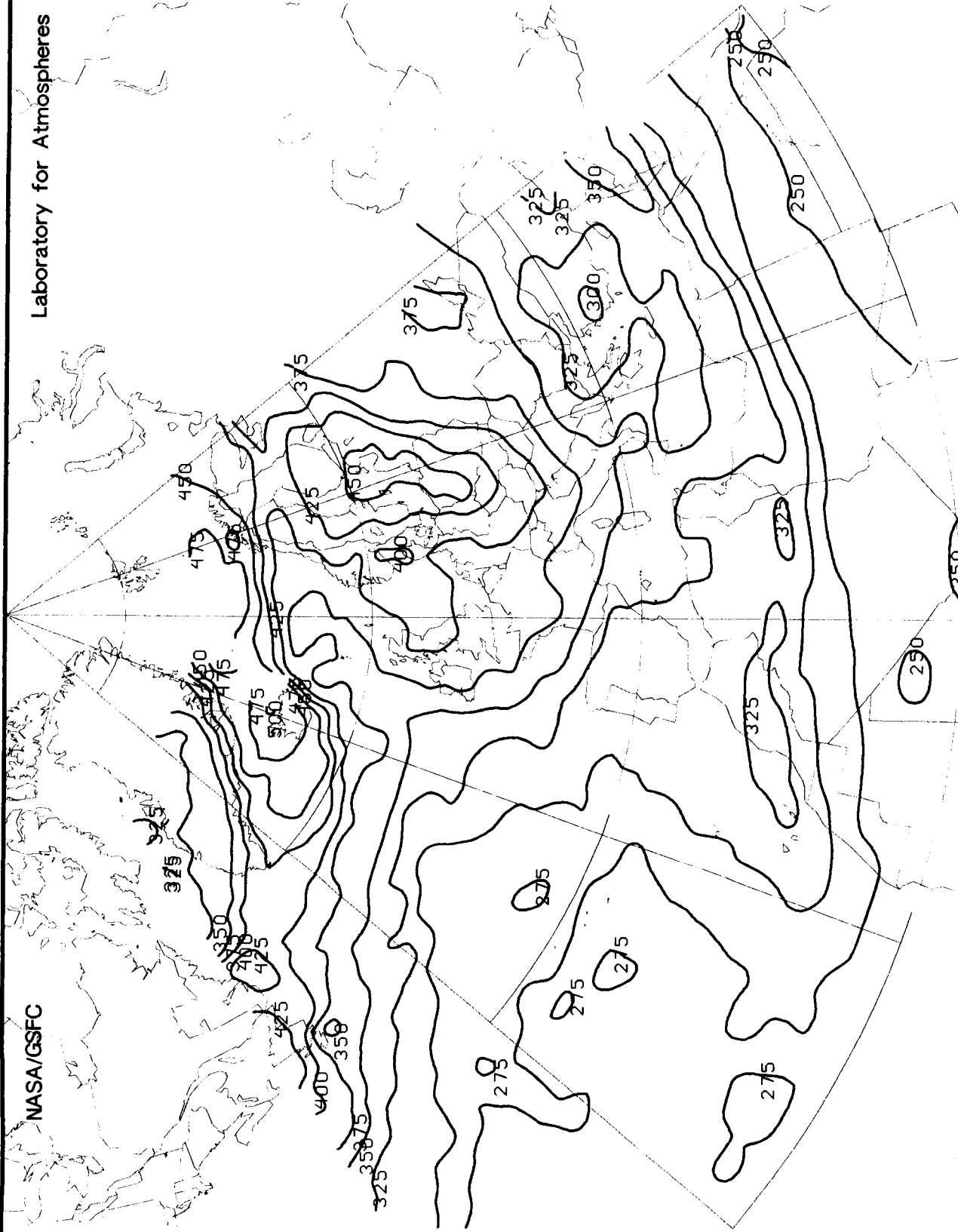
Laboratory for Atmospheres

NASA/GSFC



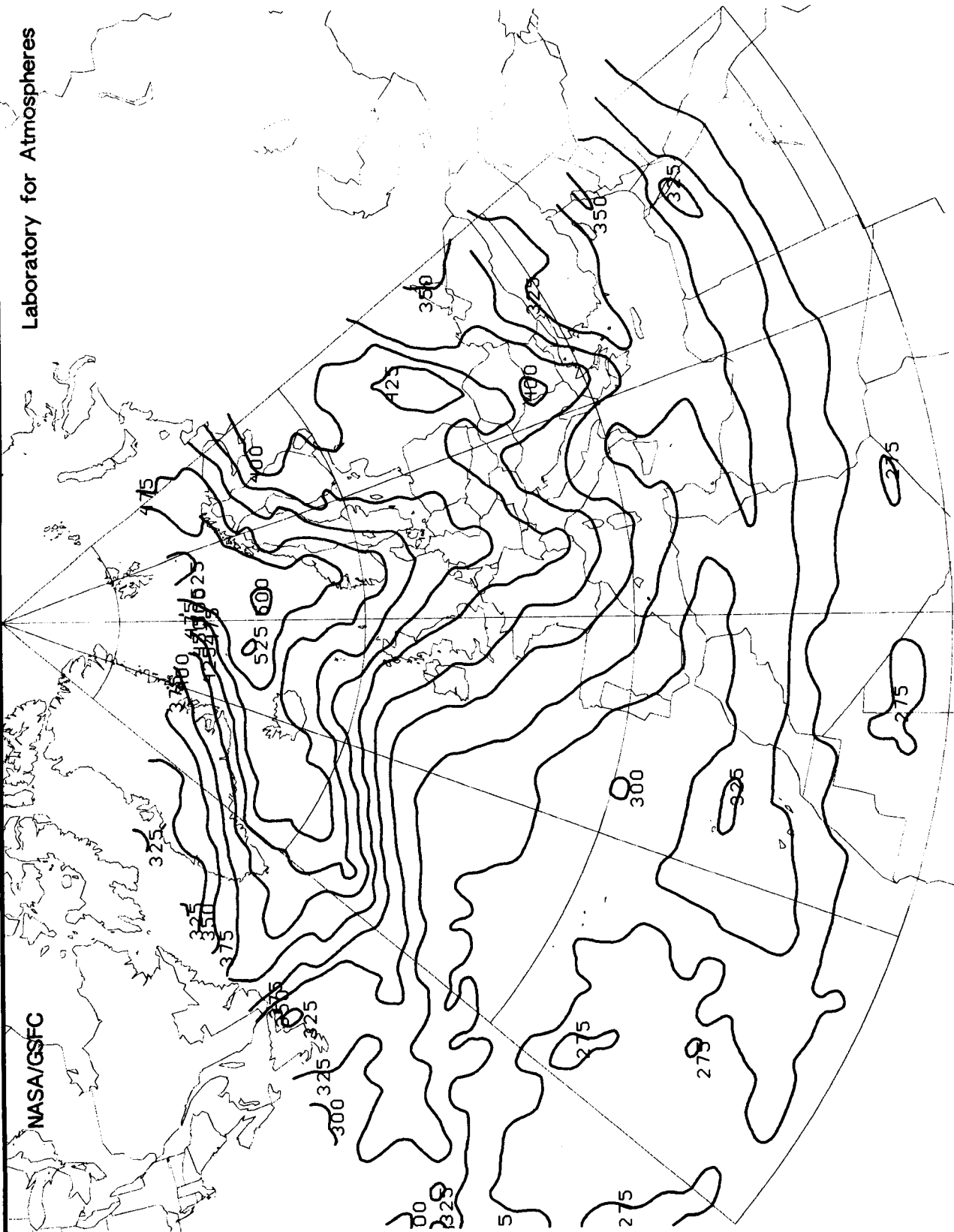
Orbital (52029-52032) TOMS Ozone (Dobson units)

February 12, 1989



February 13, 1989

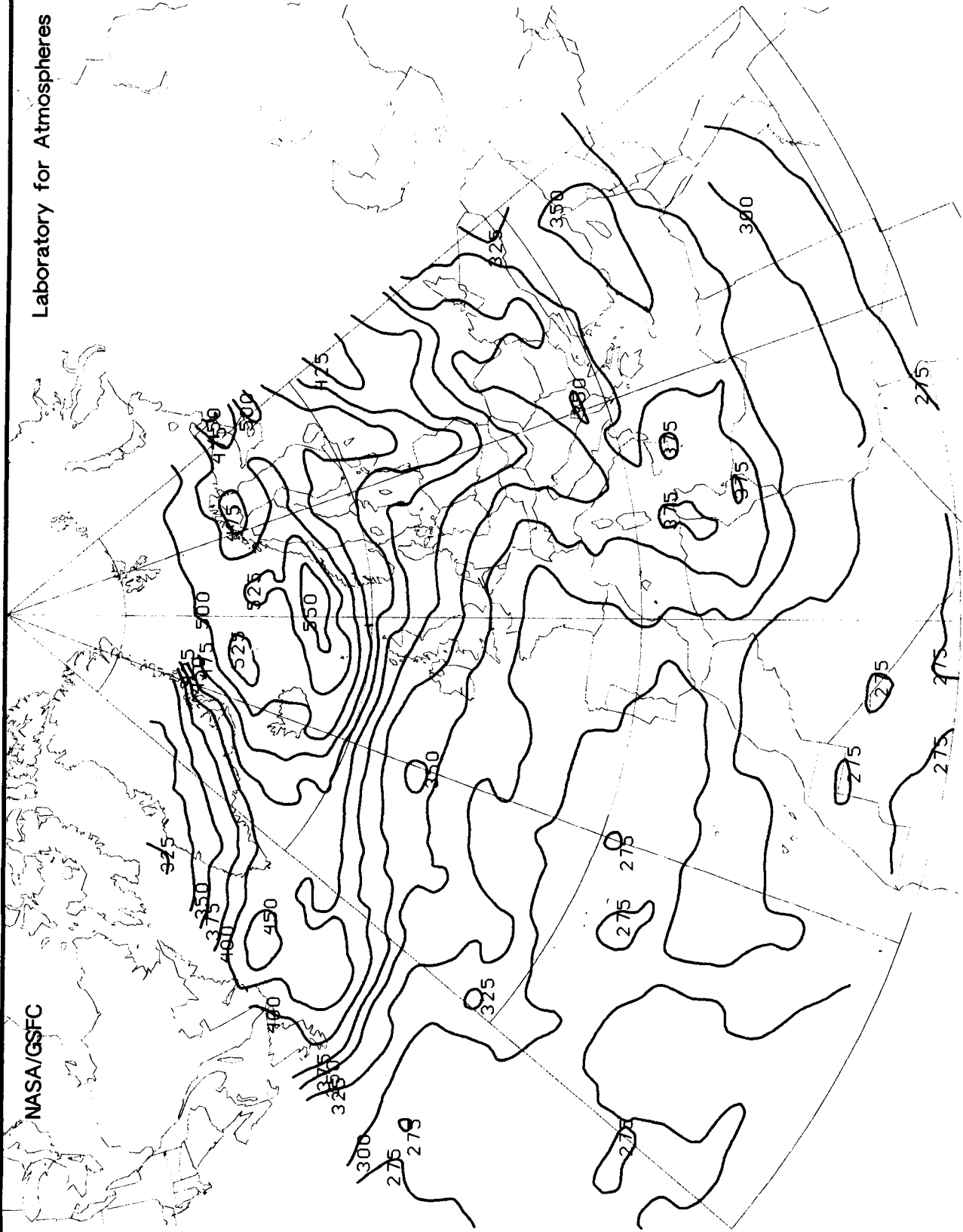
Orbital (52044-52046) TOMS Ozone (Dobson units)



NASA/GSFC

February 14, 1989

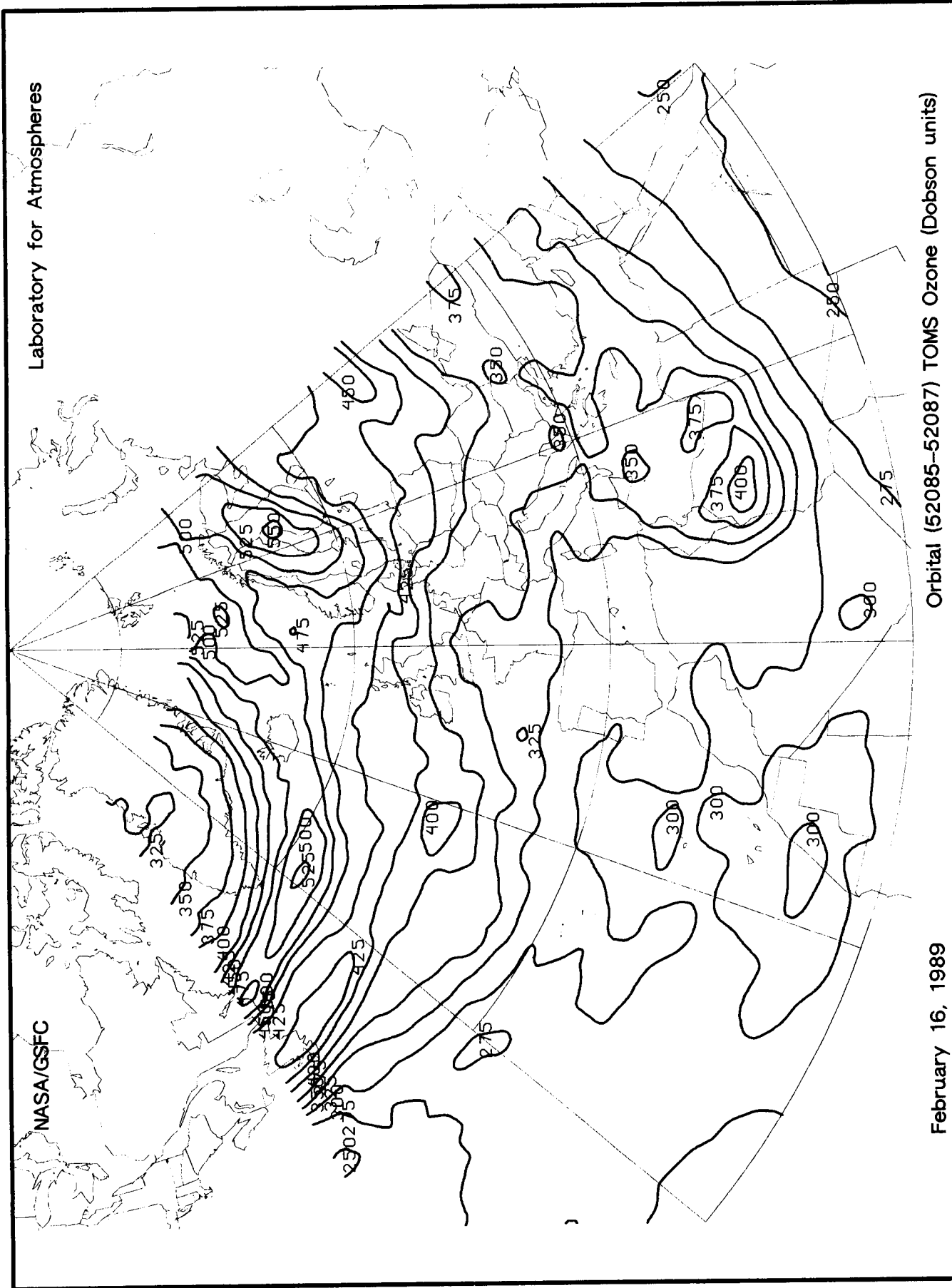
Orbital (52057-52060) TOMS Ozone (Dobson units)



February 15, 1989

Orbital (52071-52074) TMS Ozone (Dobson units)

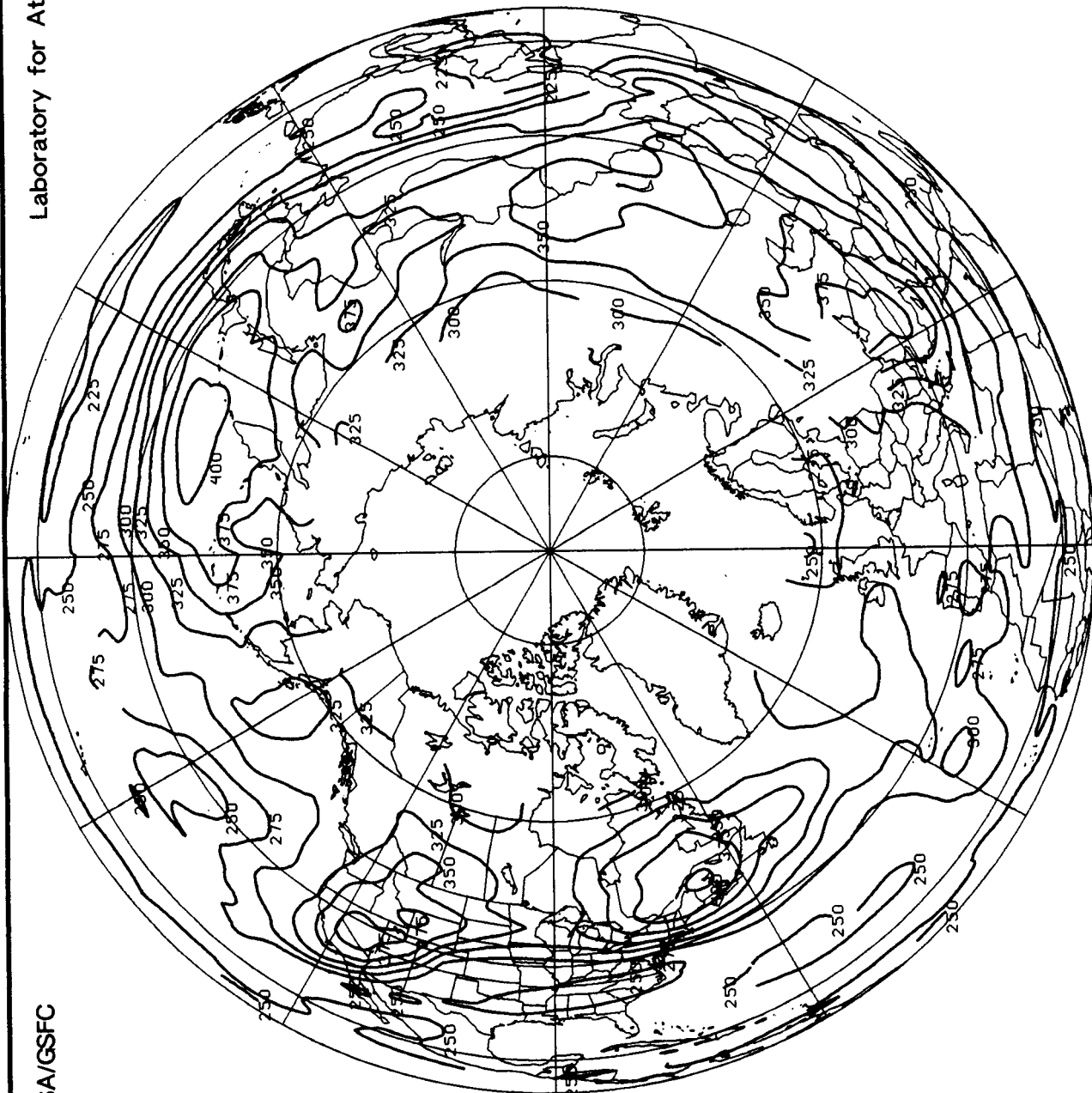




### **3.3 Northern Hemisphere Polar Charts**

A set of TOMS total ozone maps for the northern hemisphere, over the period December 26, 1988 through March 20, 1989 is presented here. The daily data are resolved on a uniform 2° latitude by 5° longitude grid for each day, and displayed using a north-polar orthographic projection.

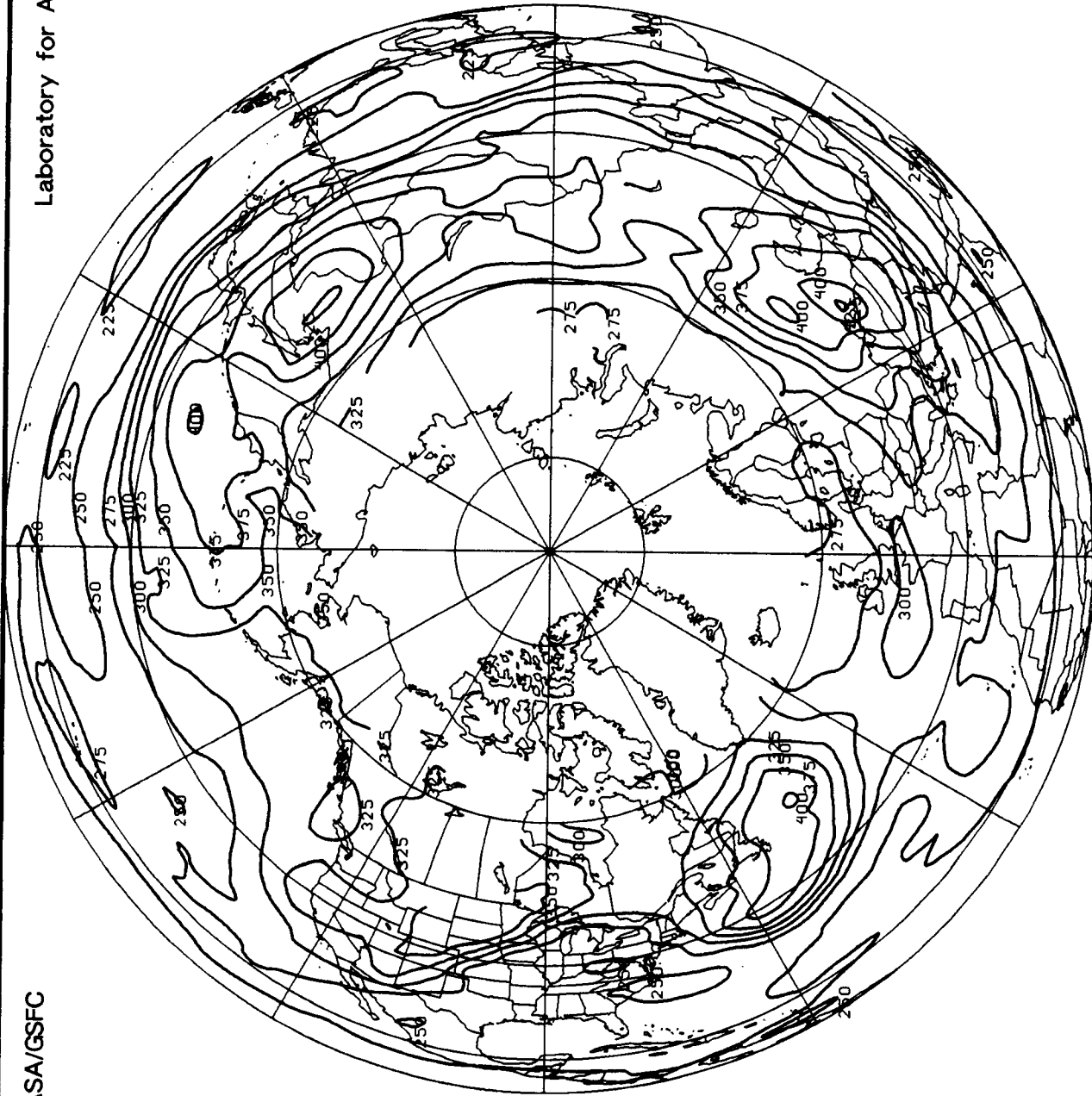
Laboratory for Atmospheres



NASA/GSFC

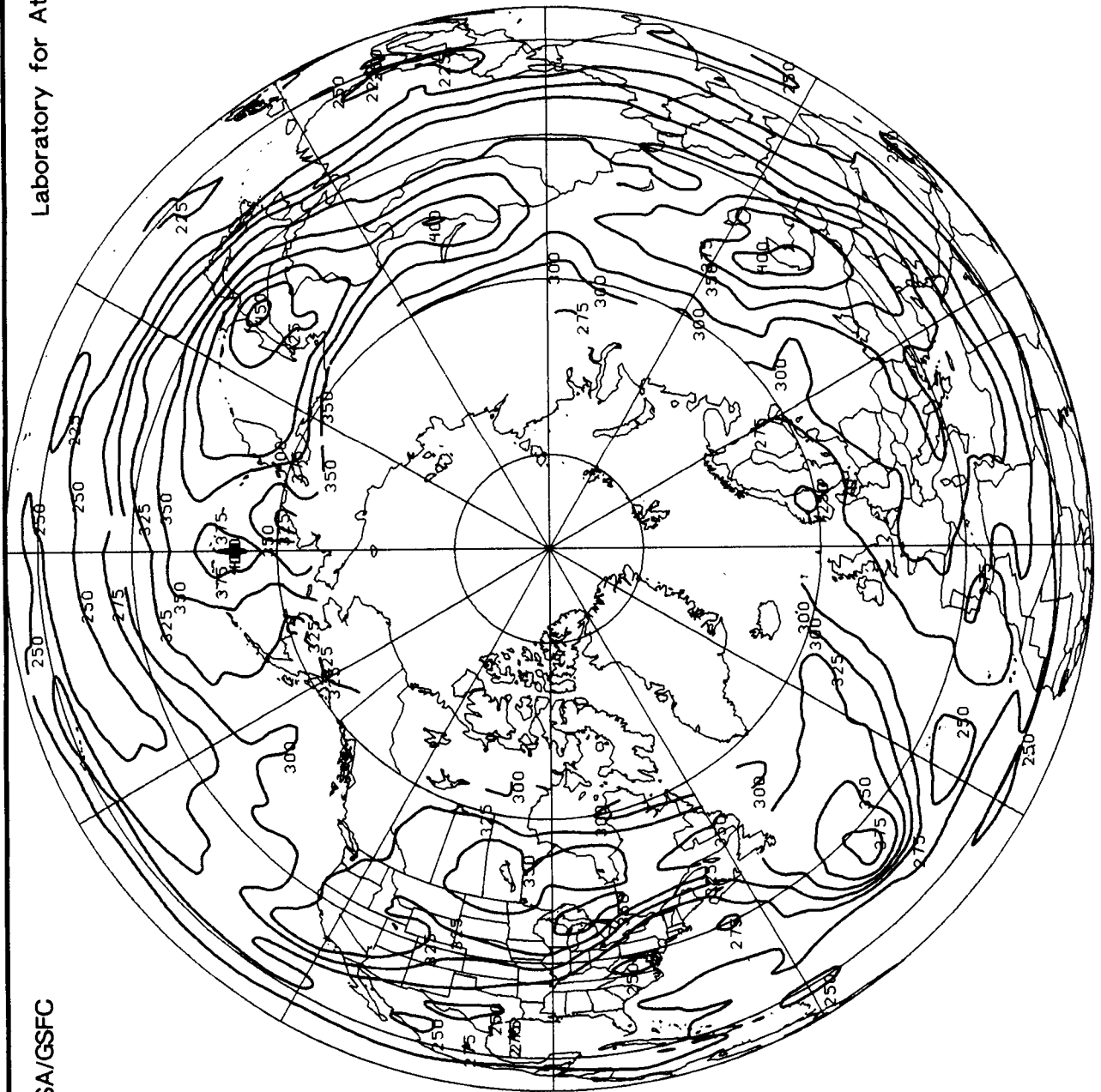
Gridded TOMS Ozone (Dobson Units)

December 26, 1988



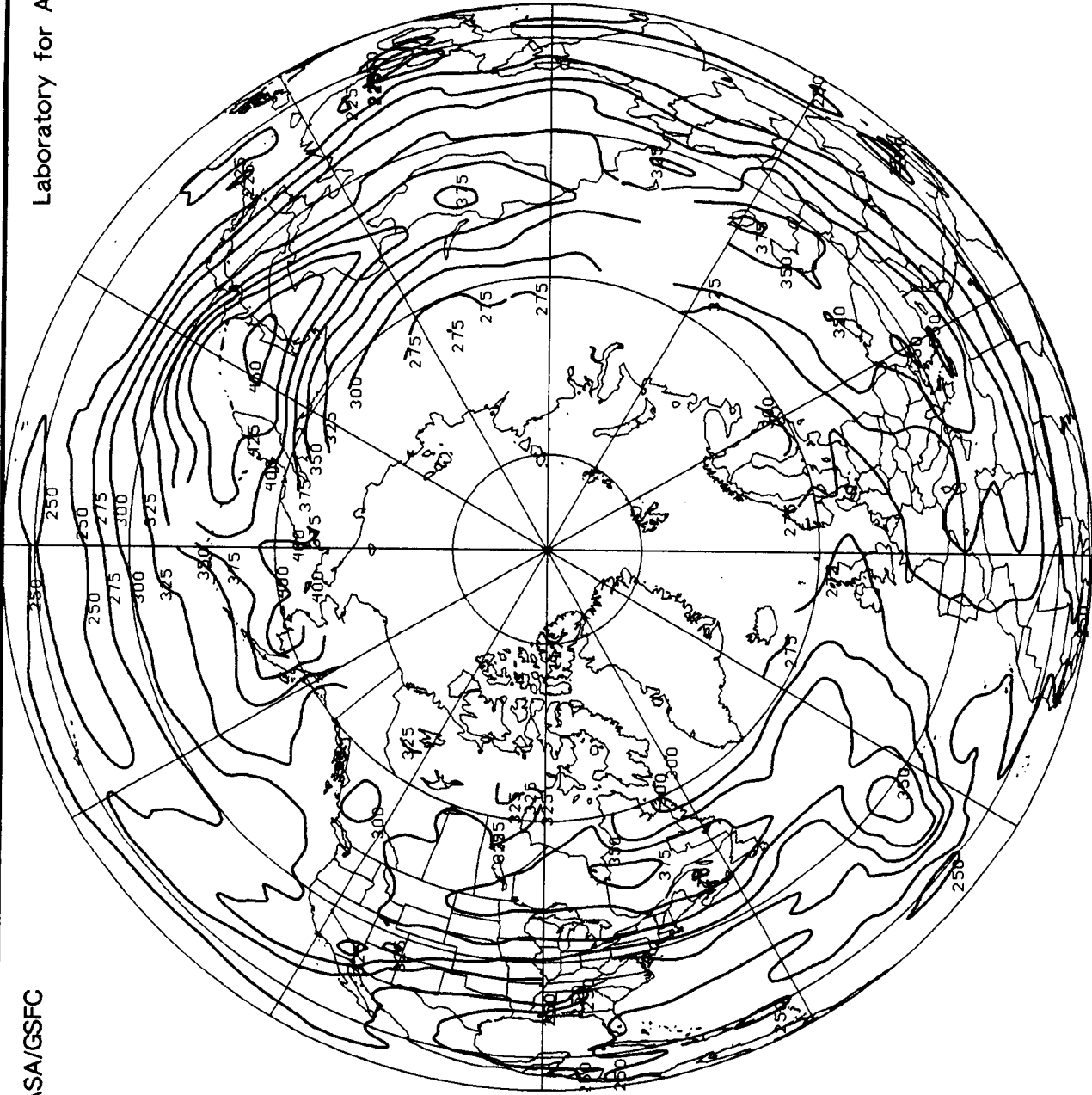
December 27, 1988

Gridded TOMS Ozone (Dobson Units)



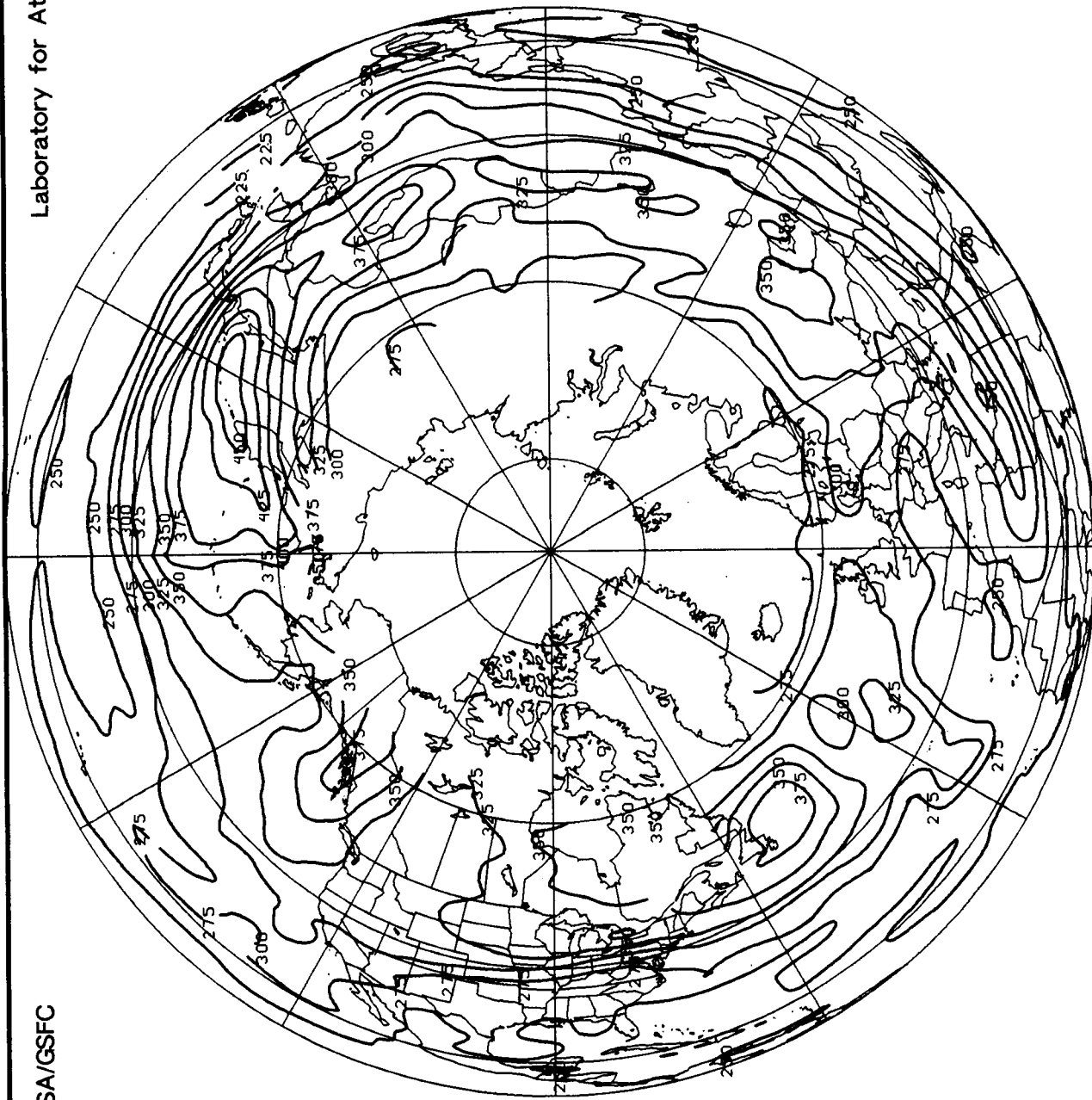
NASA/GSFC

Laboratory for Atmospheres



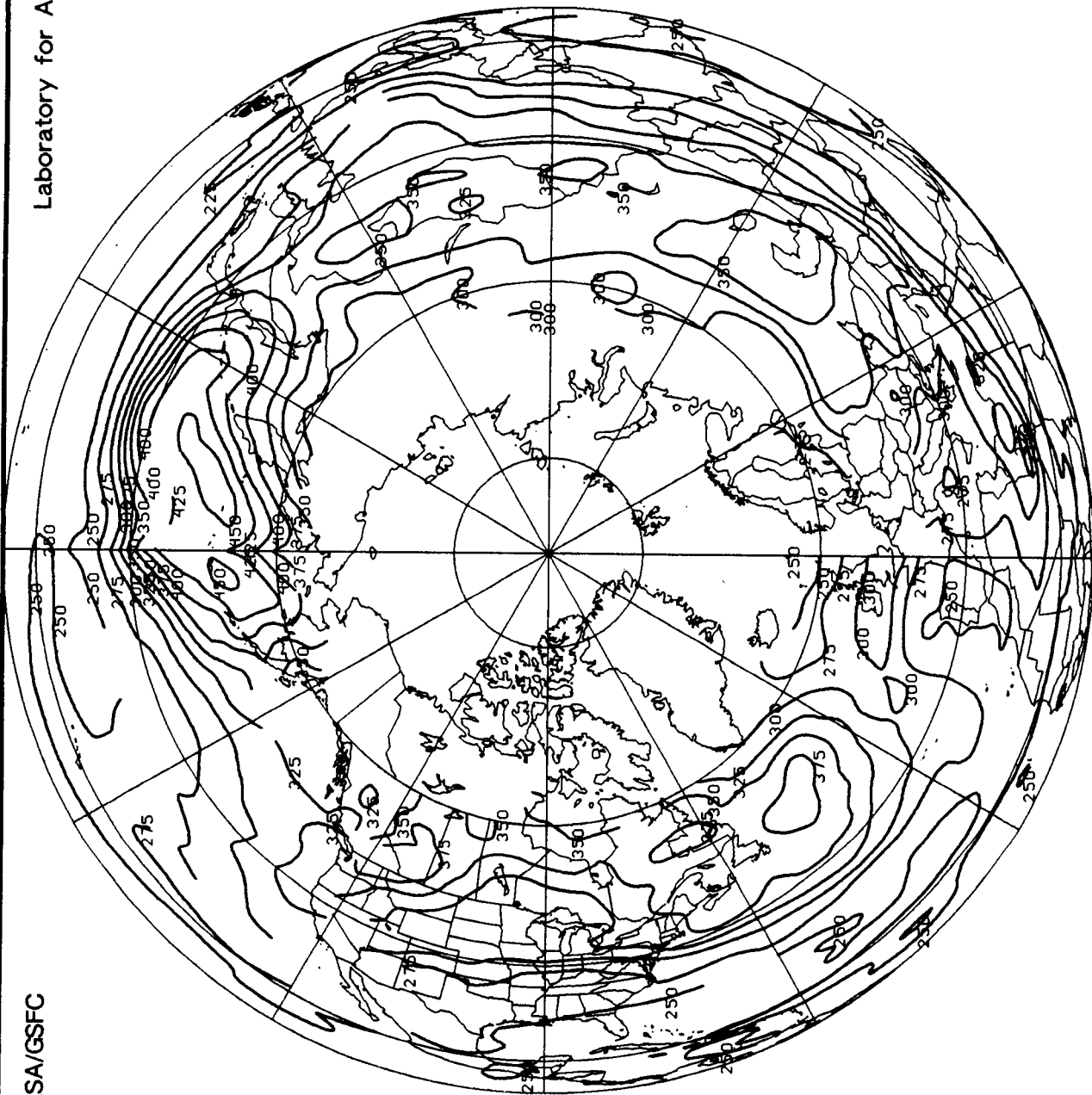
December 29, 1988

Gridded TOMS Ozone (Dobson Units)



NASA/GSFC

Laboratory for Atmospheres

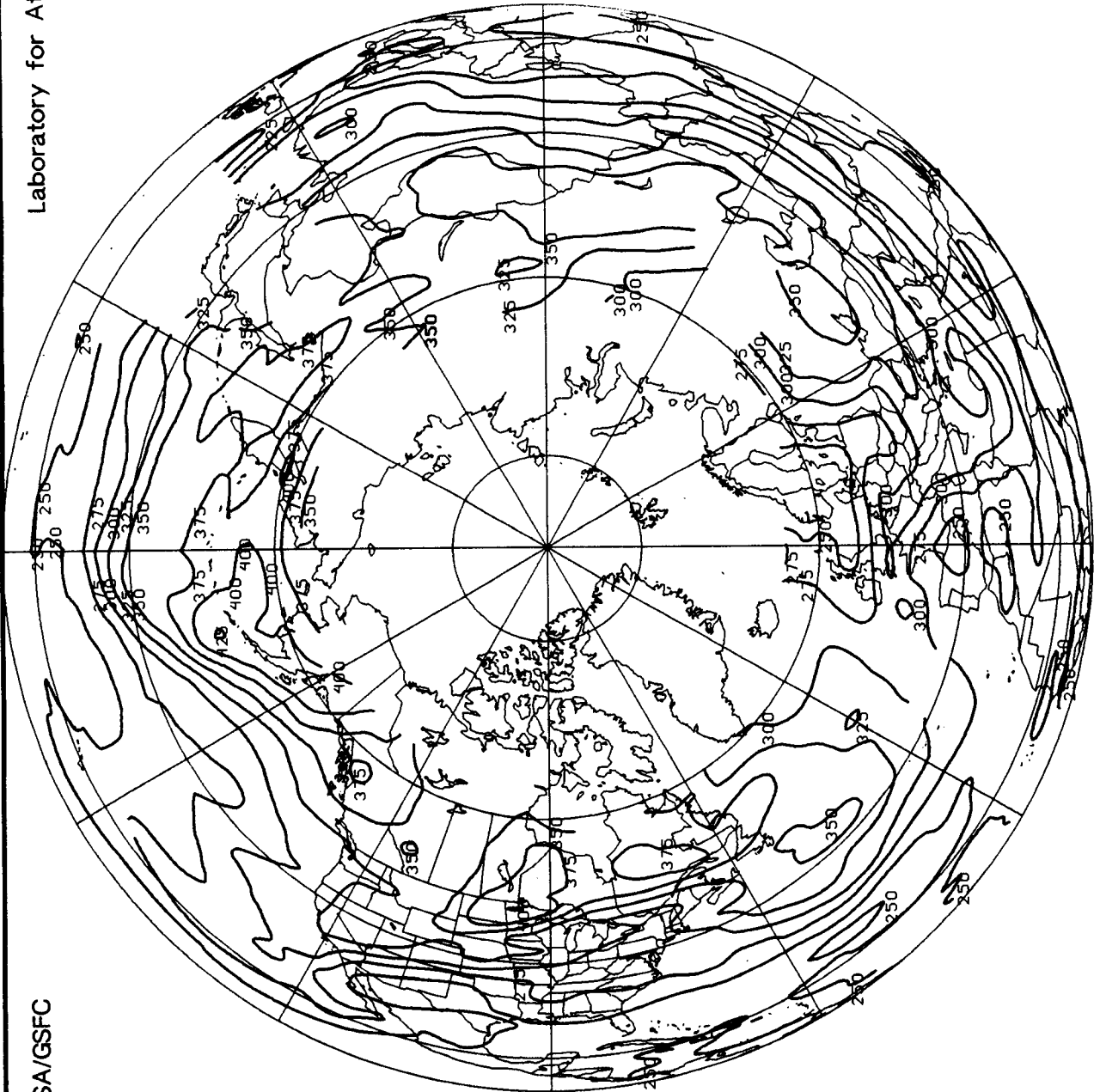


December 31, 1988

Gridded TOMS Ozone (Dobson Units)



Laboratory for Atmospheres



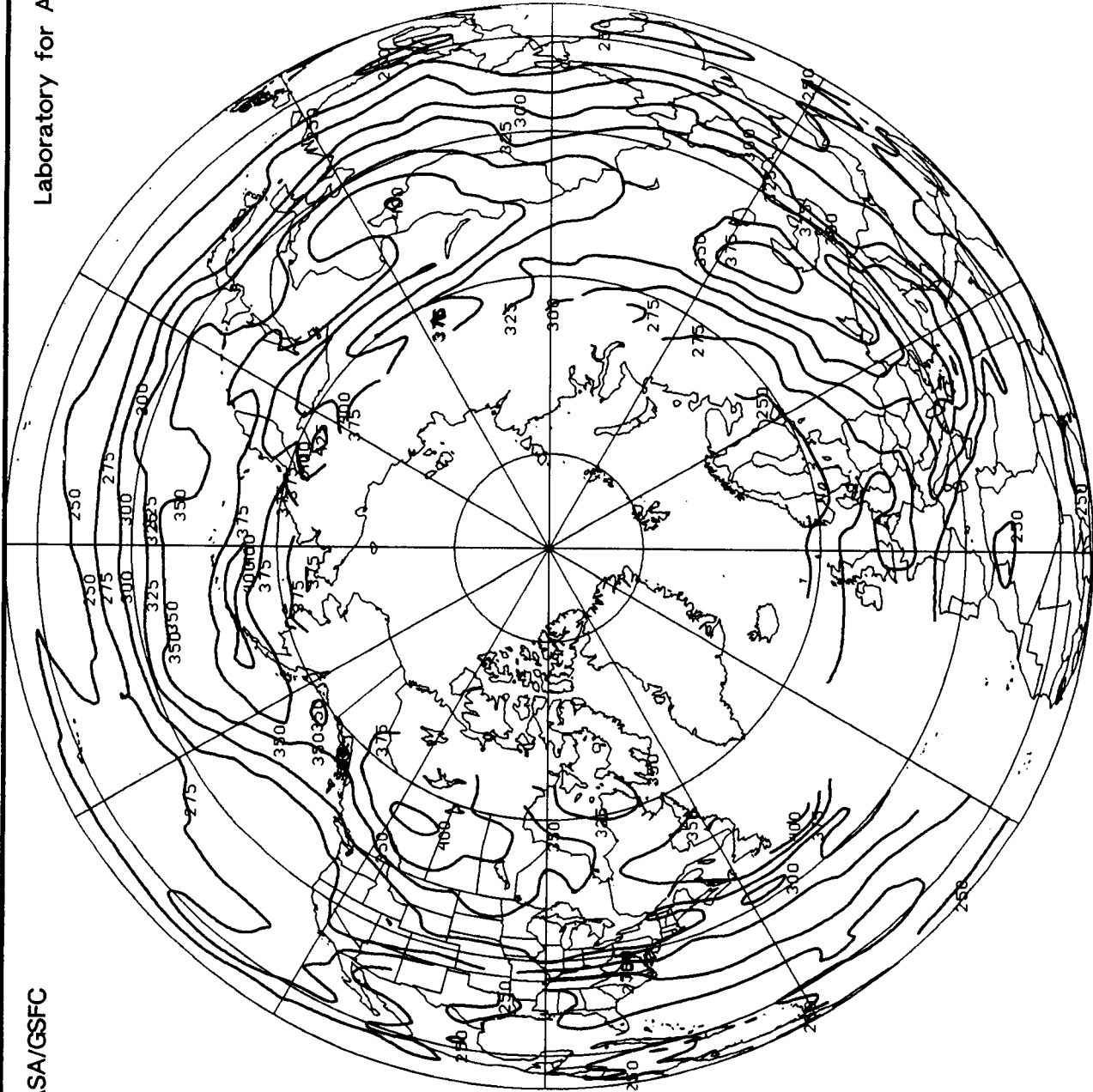
NASA/GSFC

Gridded TOMS Ozone (Dobson Units)

January 1, 1989

NASA/GSFC

Laboratory for Atmospheres

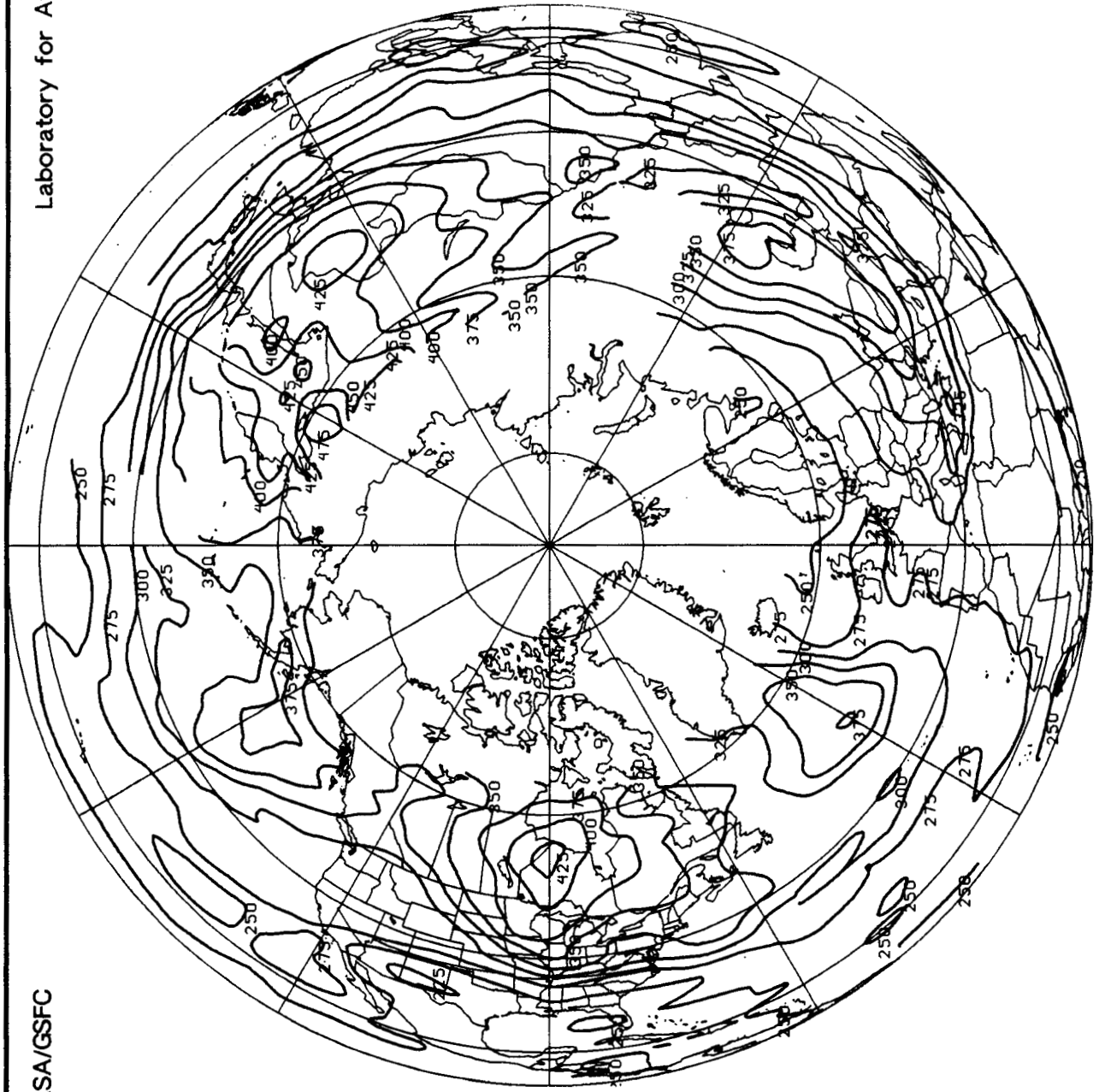


January 2, 1989

Gridded TOMS Ozone (Dobson Units)

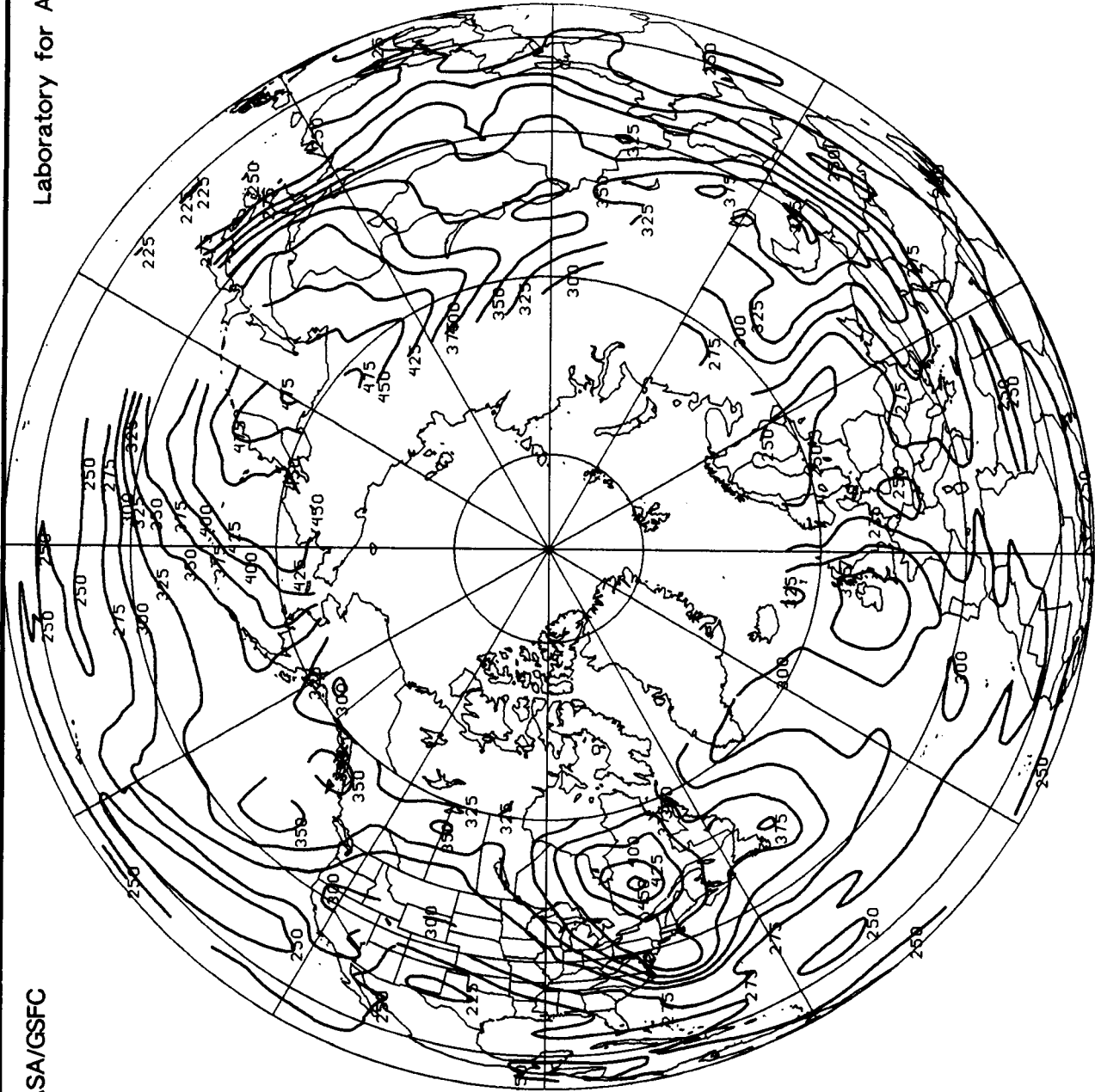
NASA/GSFC

Laboratory for Atmospheres



January 3, 1989

Gridded TOMS Ozone (Dobson Units)

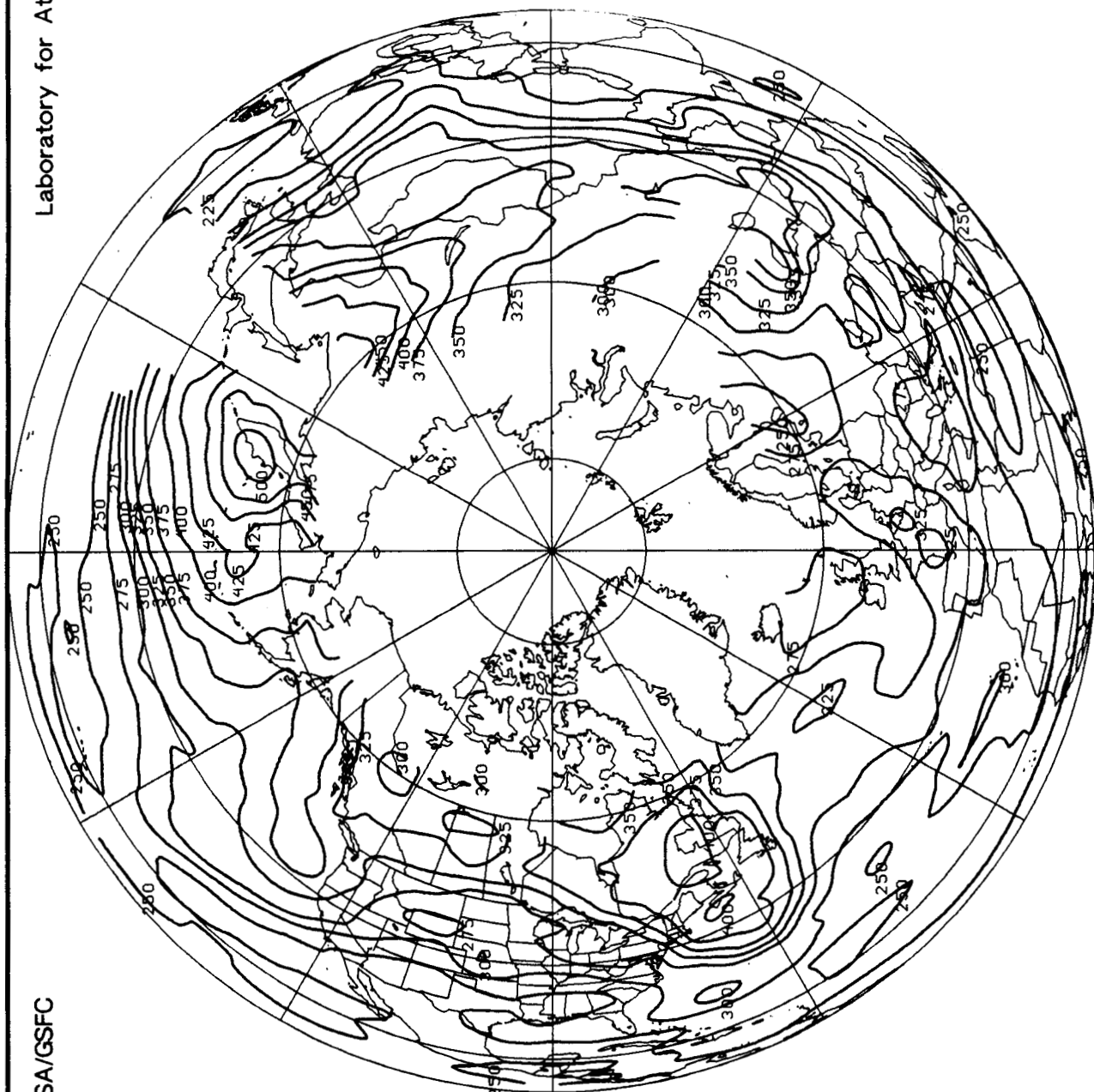


January 4, 1989

Gridded TOMS Ozone (Dobson Units)

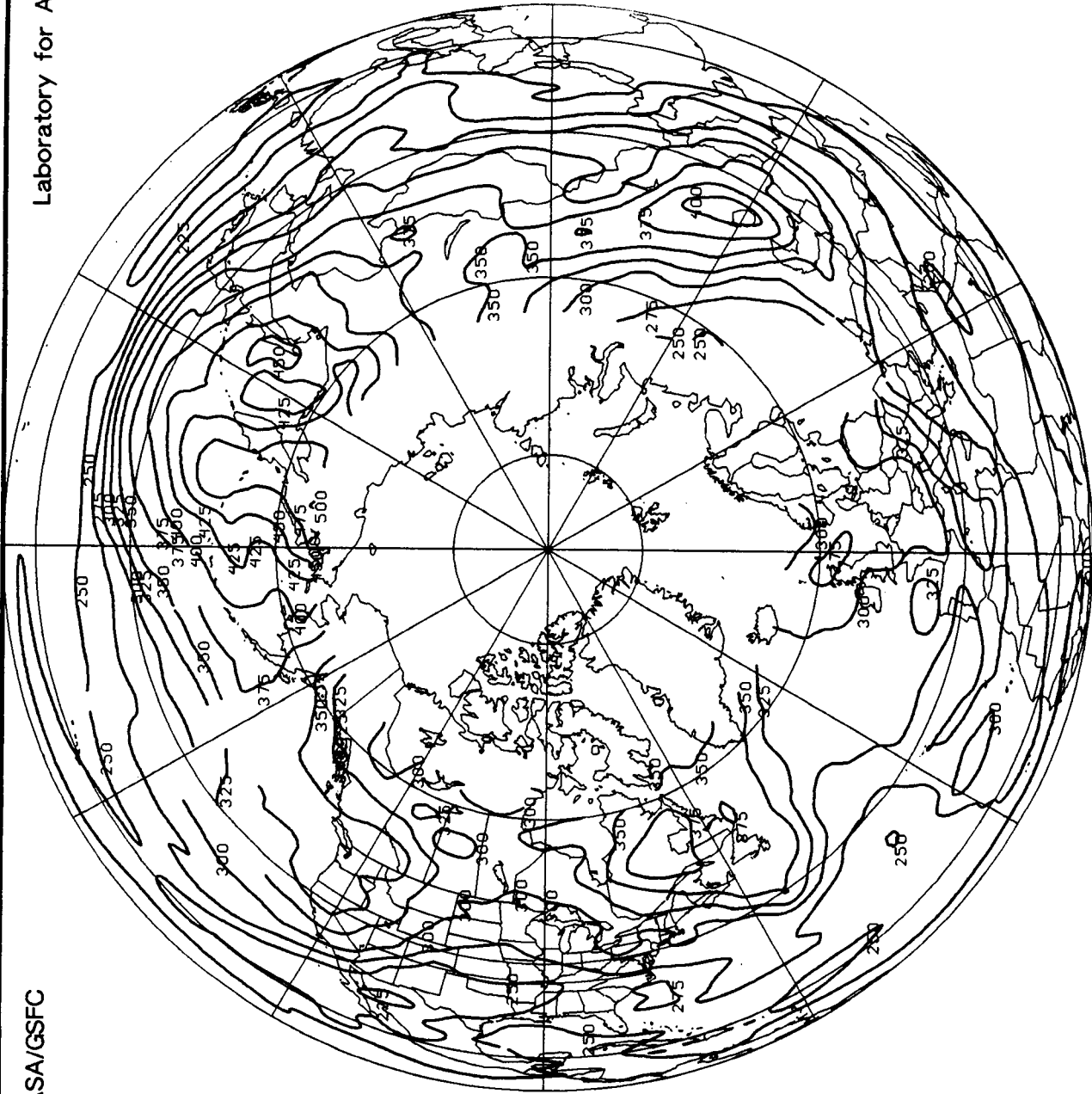
NASA/GSFC

Laboratory for Atmospheres



January 5, 1989

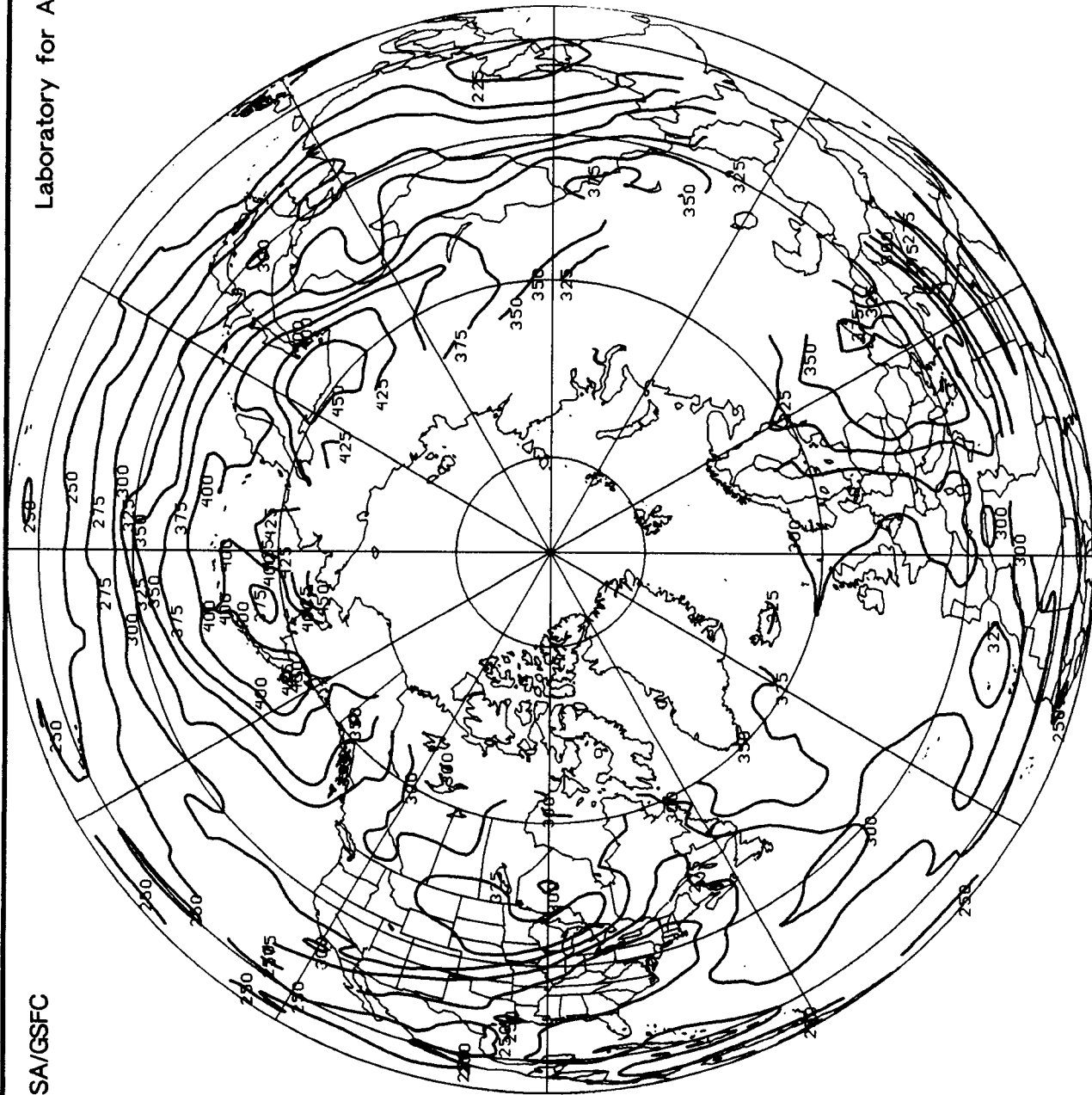
Gridded TOMS Ozone (Dobson Units)



January 6, 1989

Gridded TOMS Ozone (Dobson Units)

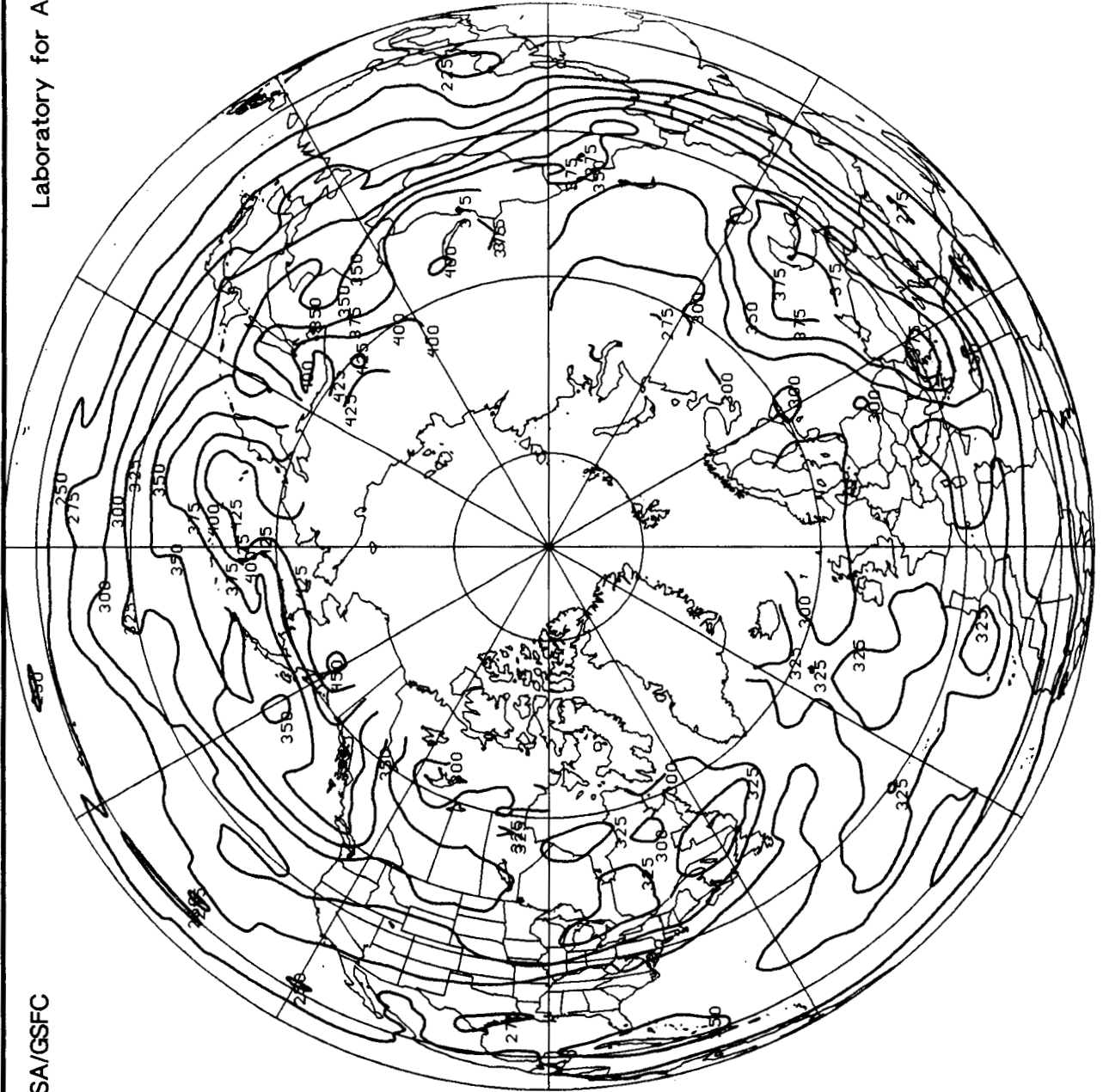




January 8, 1989

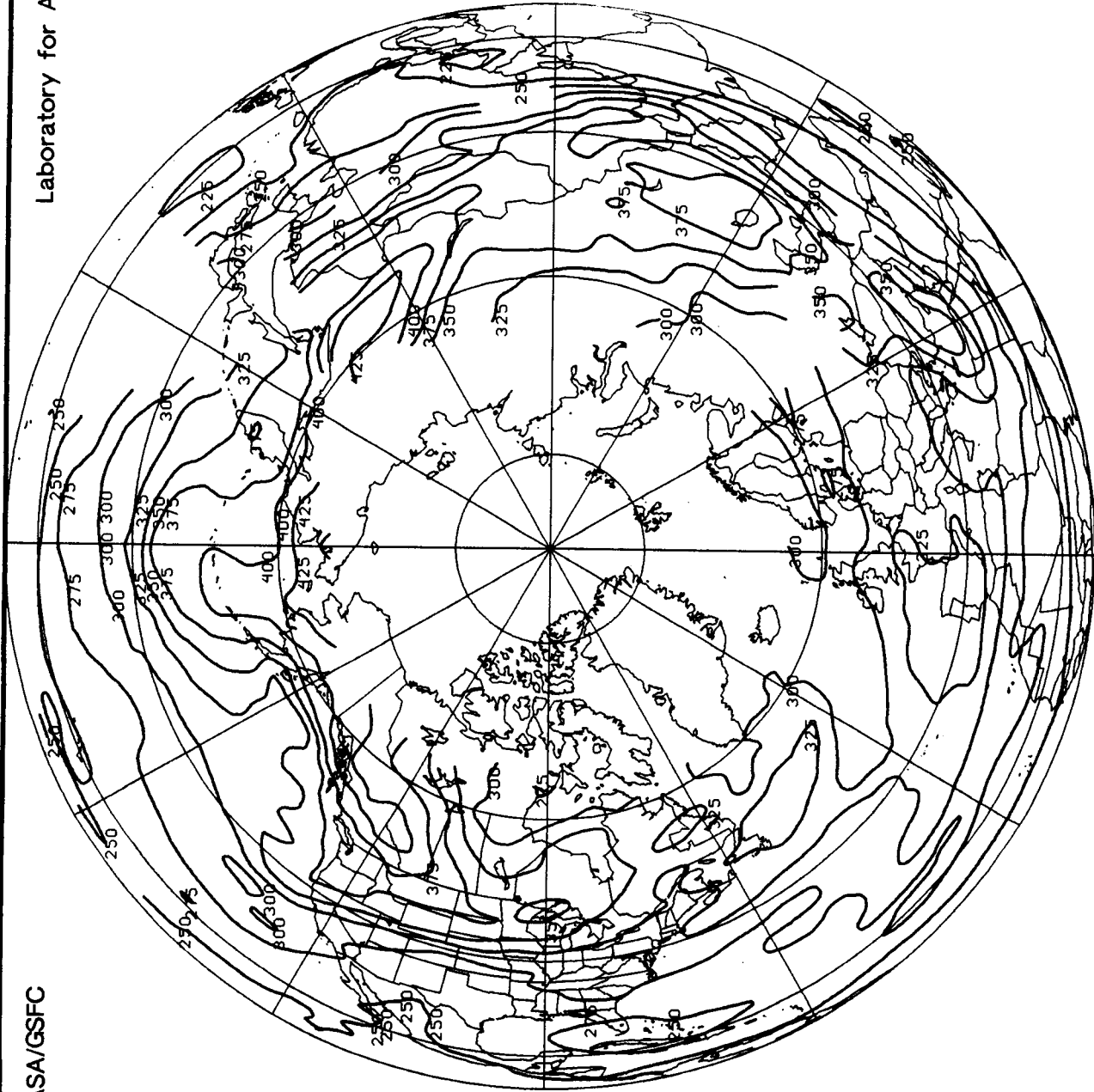
Gridded TOMS Ozone (Dobson Units)





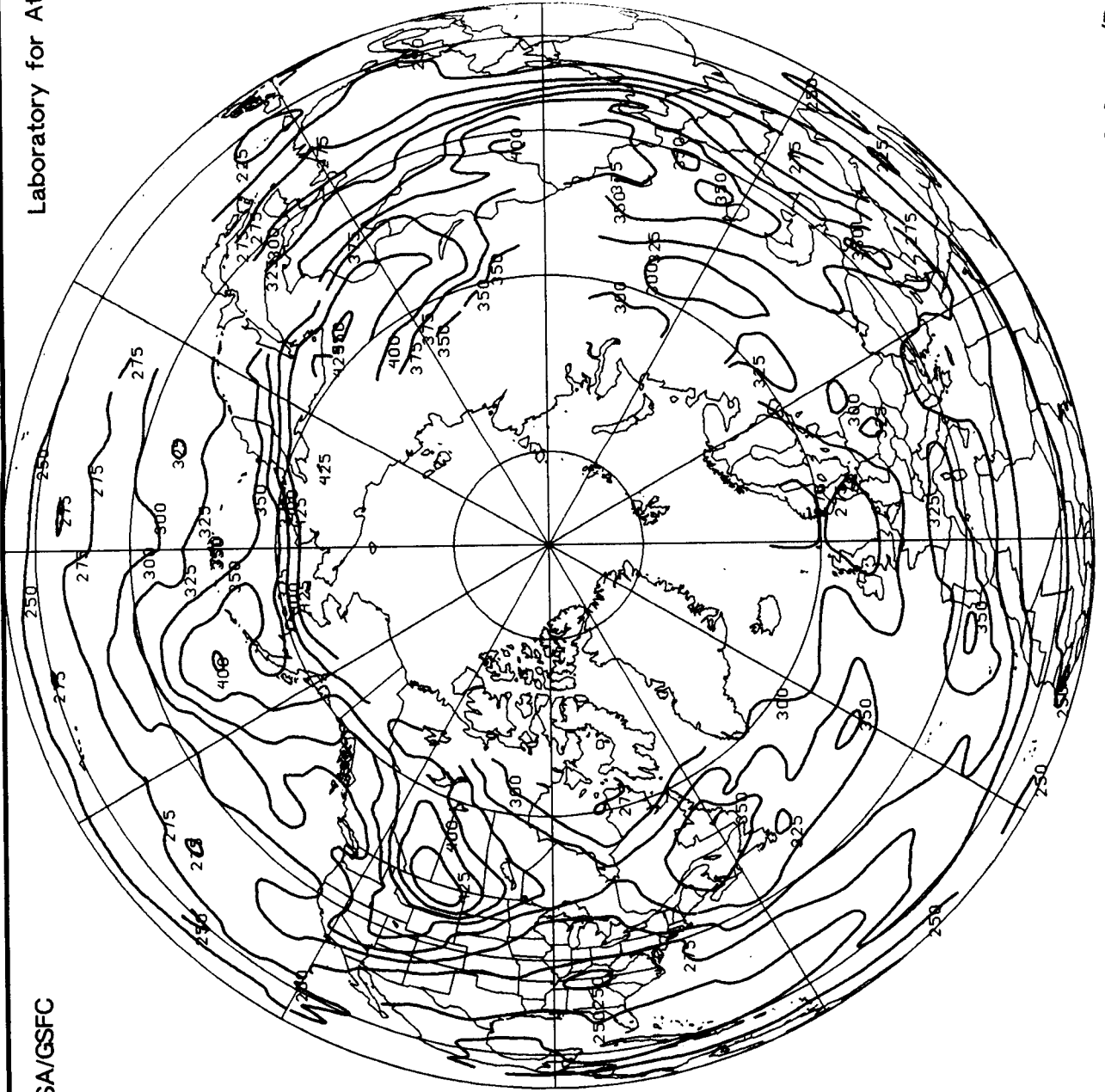
NASA/GSFC

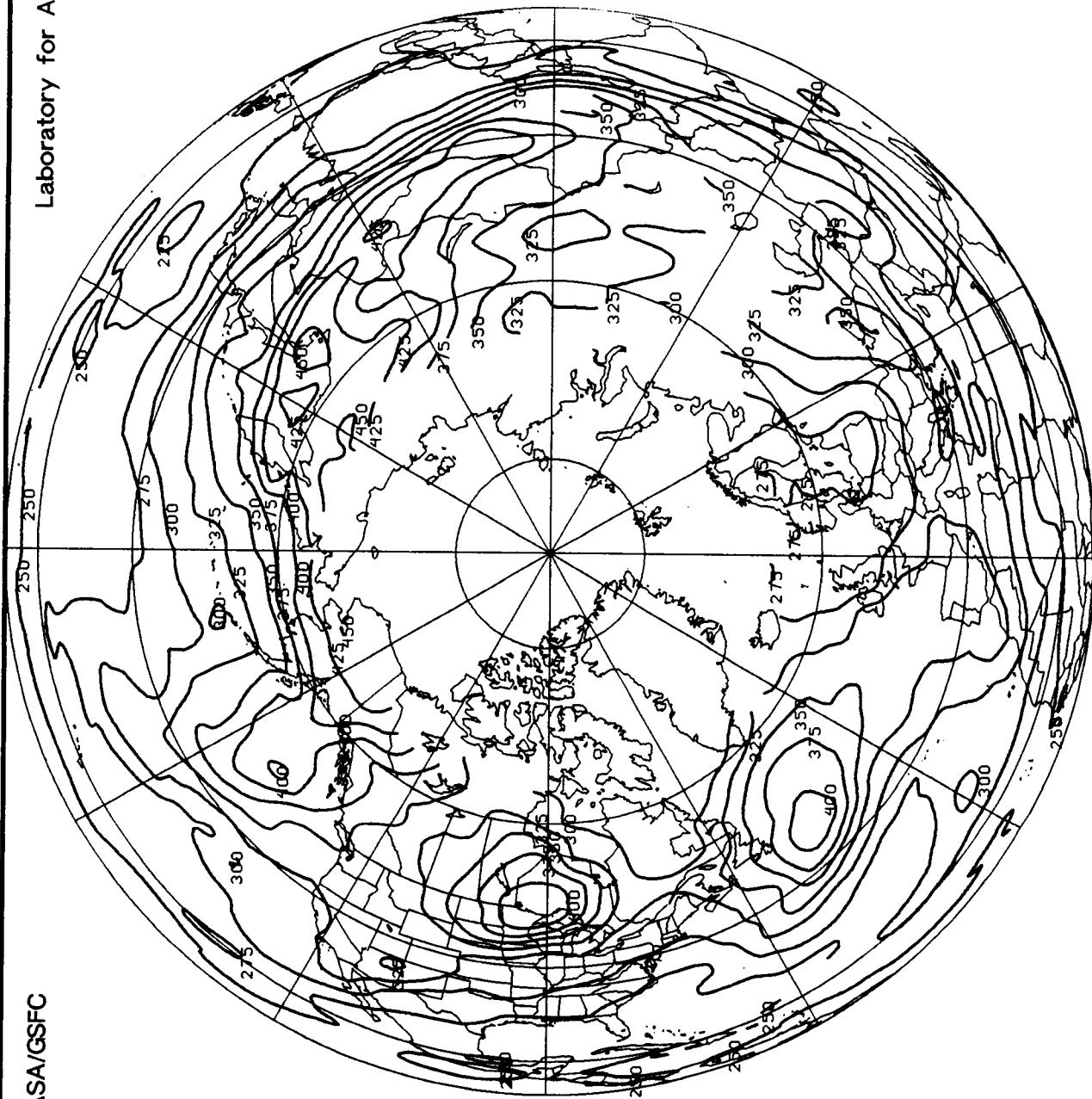
Laboratory for Atmospheres



January 10, 1989

Gridded TOMS Ozone (Dobson Units)



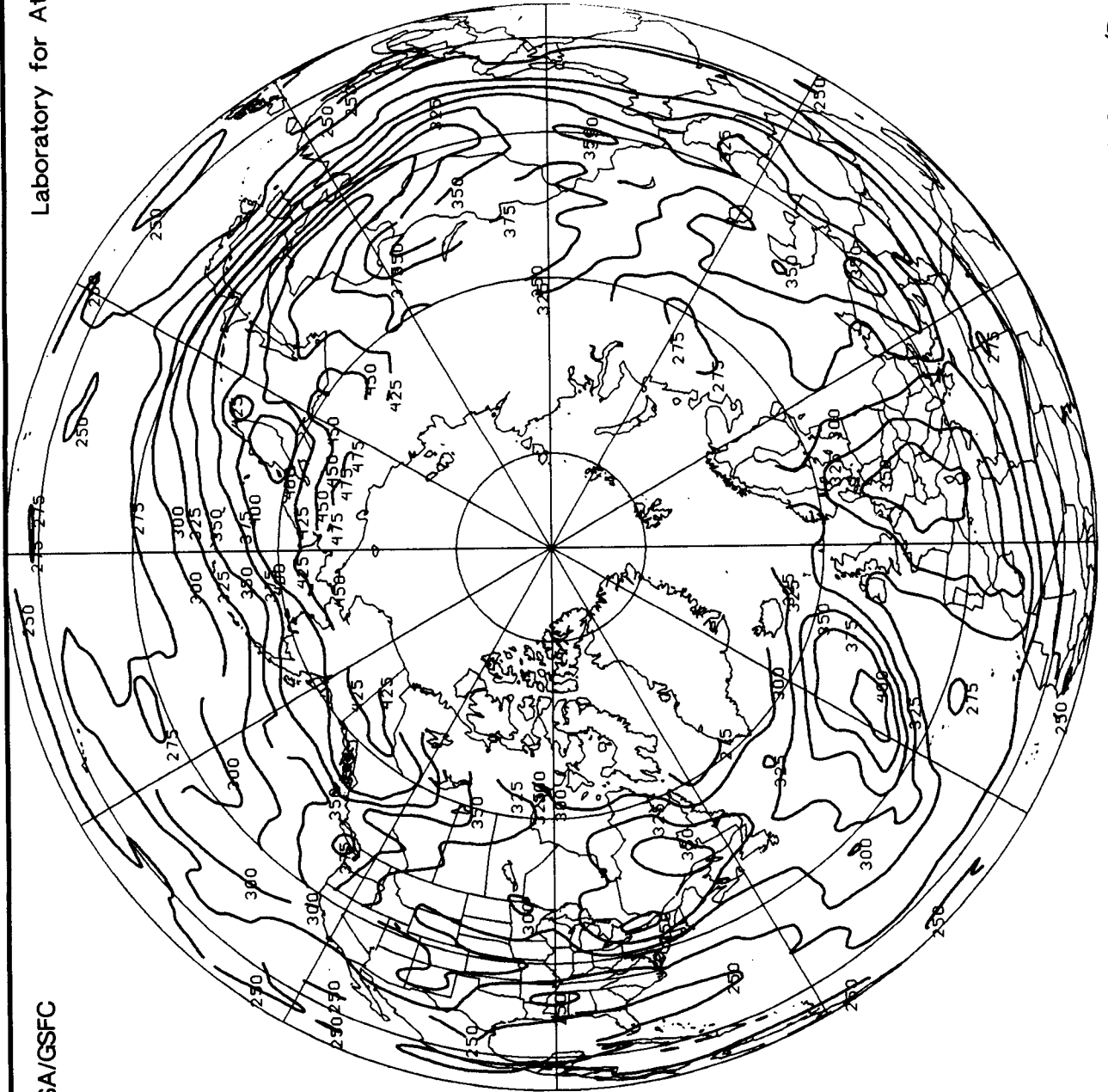


January 12, 1989

Gridded TOMS Ozone (Dobson Units)

Laboratory for Atmospheres

NASA/GSFC

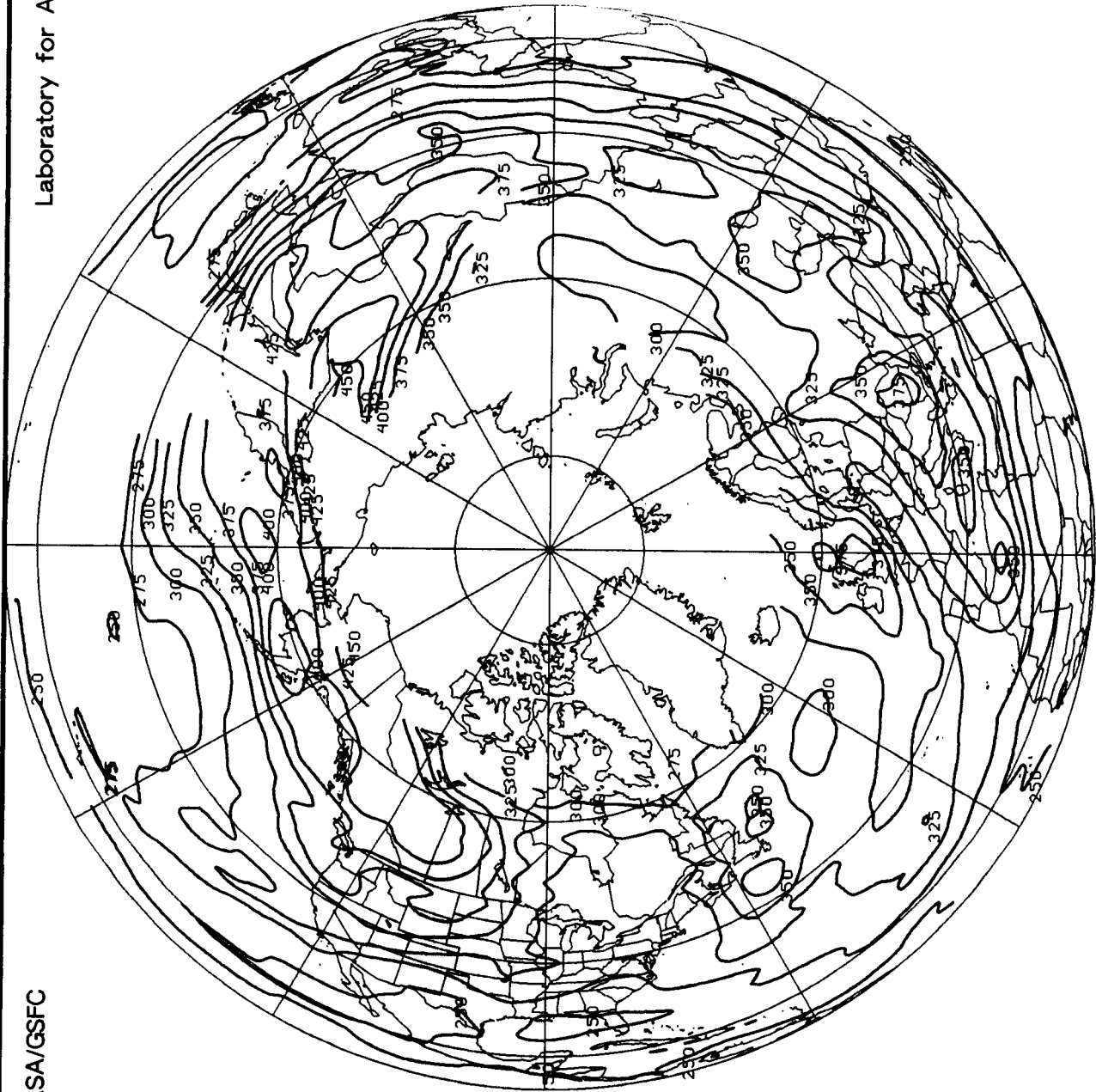


Gridded TOMS Ozone (Dobson Units)

January 13, 1989

NASA/GSFC

Laboratory for Atmospheres

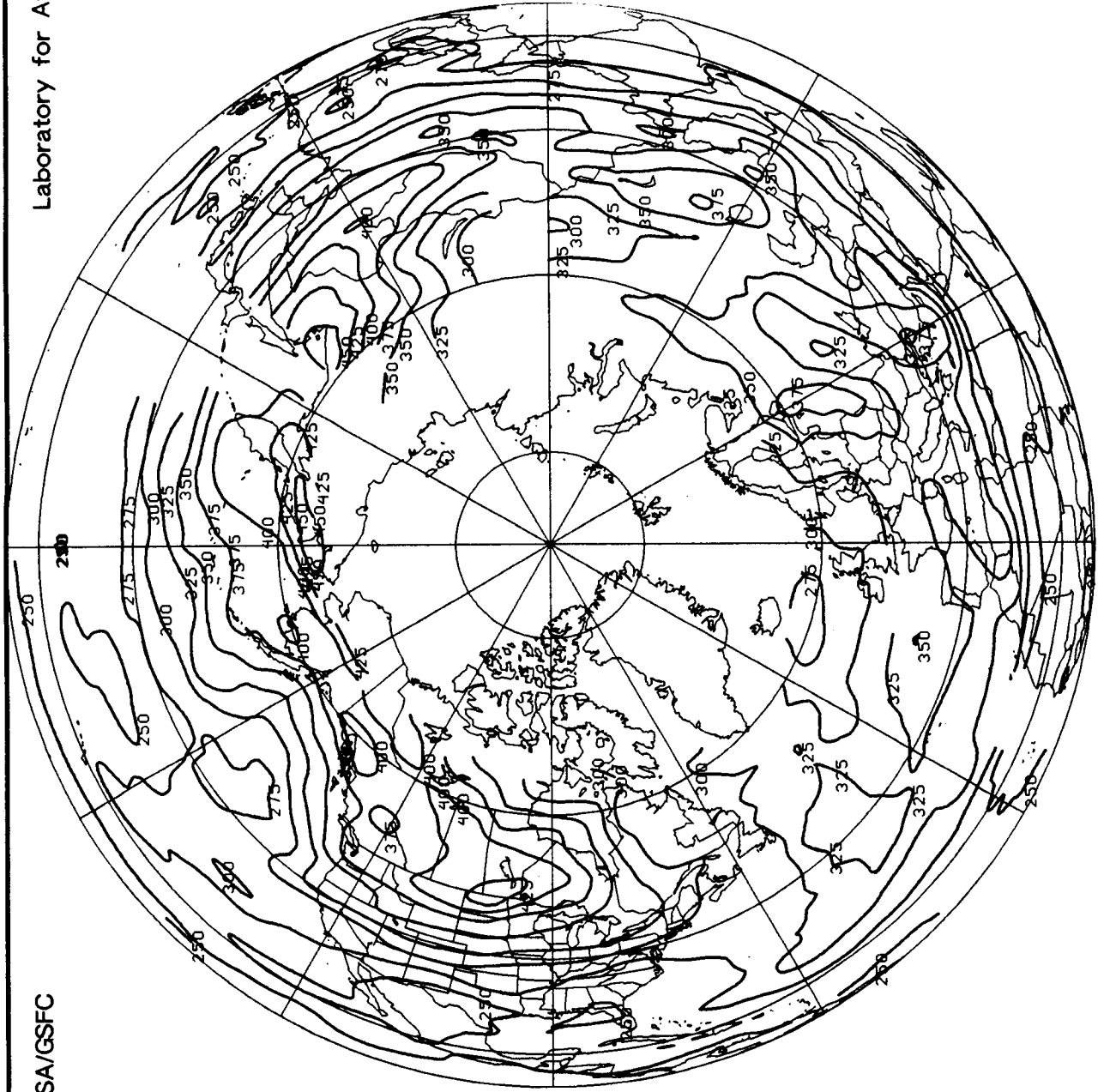


January 14, 1989

Gridded TOMS Ozone (Dobson Units)

NASA/GSFC

Laboratory for Atmospheres

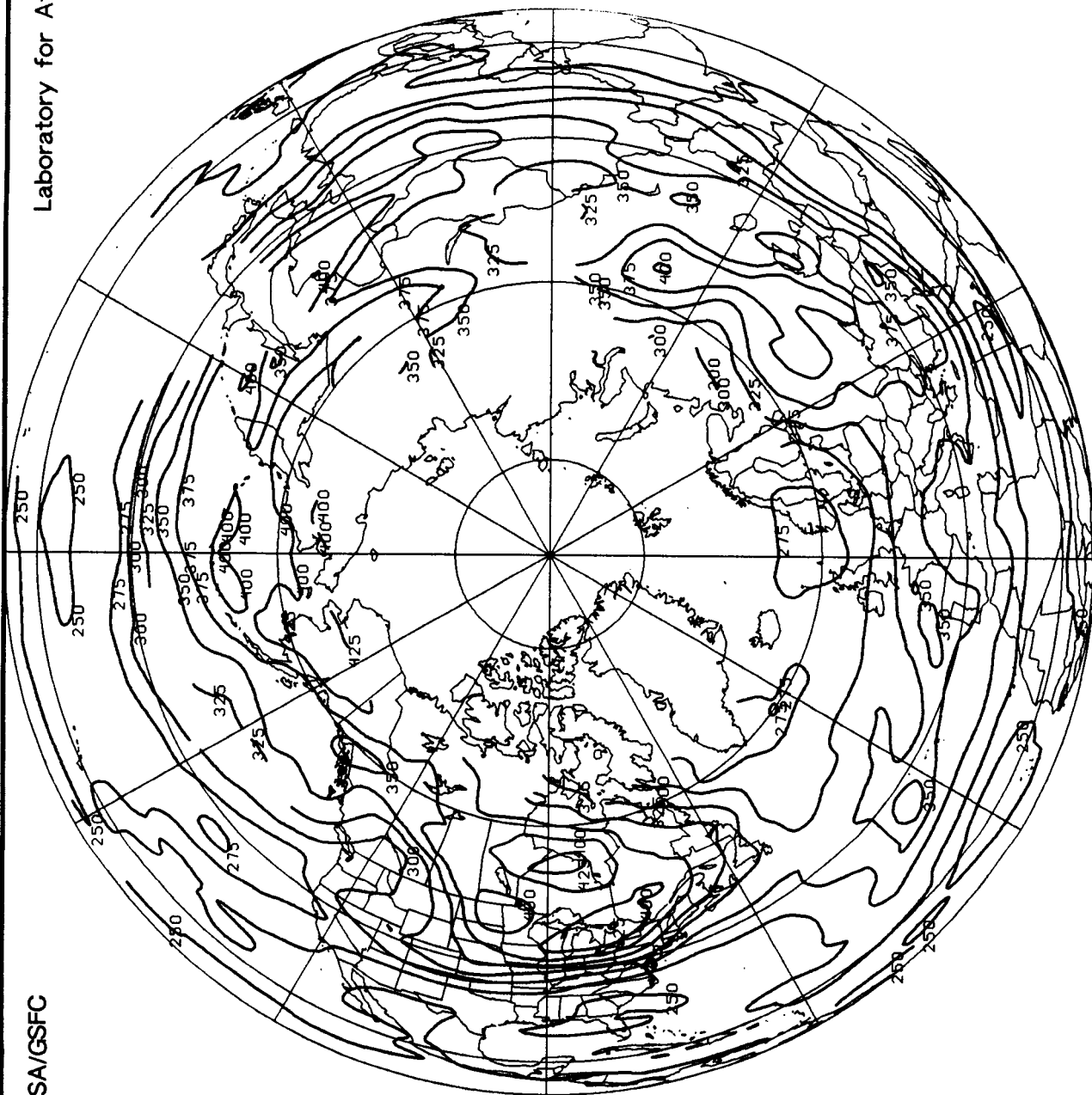


January 15, 1989

Gridded TOMS Ozone (Dobson Units)

NASA/GSFC

Laboratory for Atmospheres



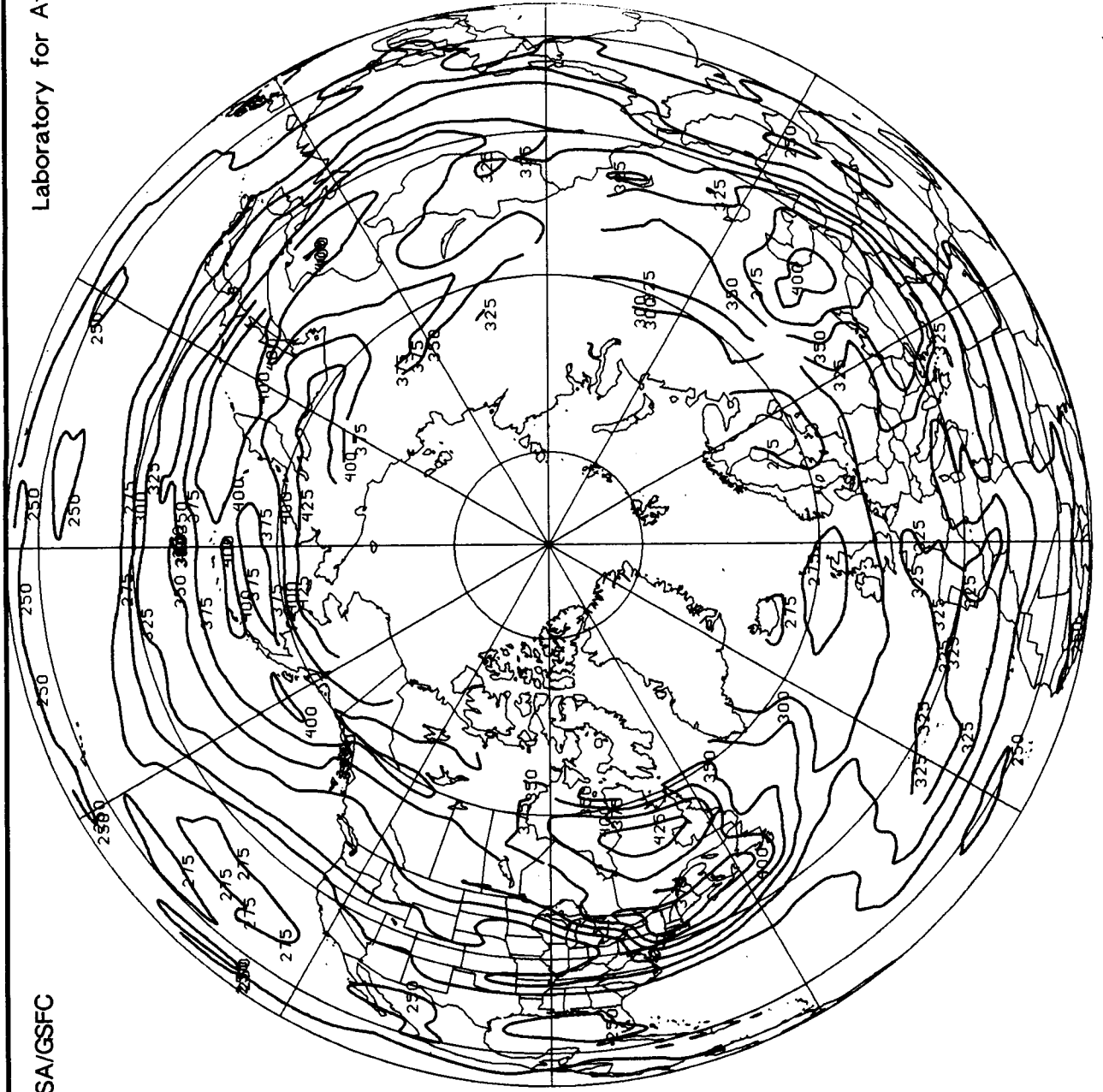
January 16, 1989

Gridded TOMS Ozone (Dobson Units)



Laboratory for Atmospheres

NASA/GSFC

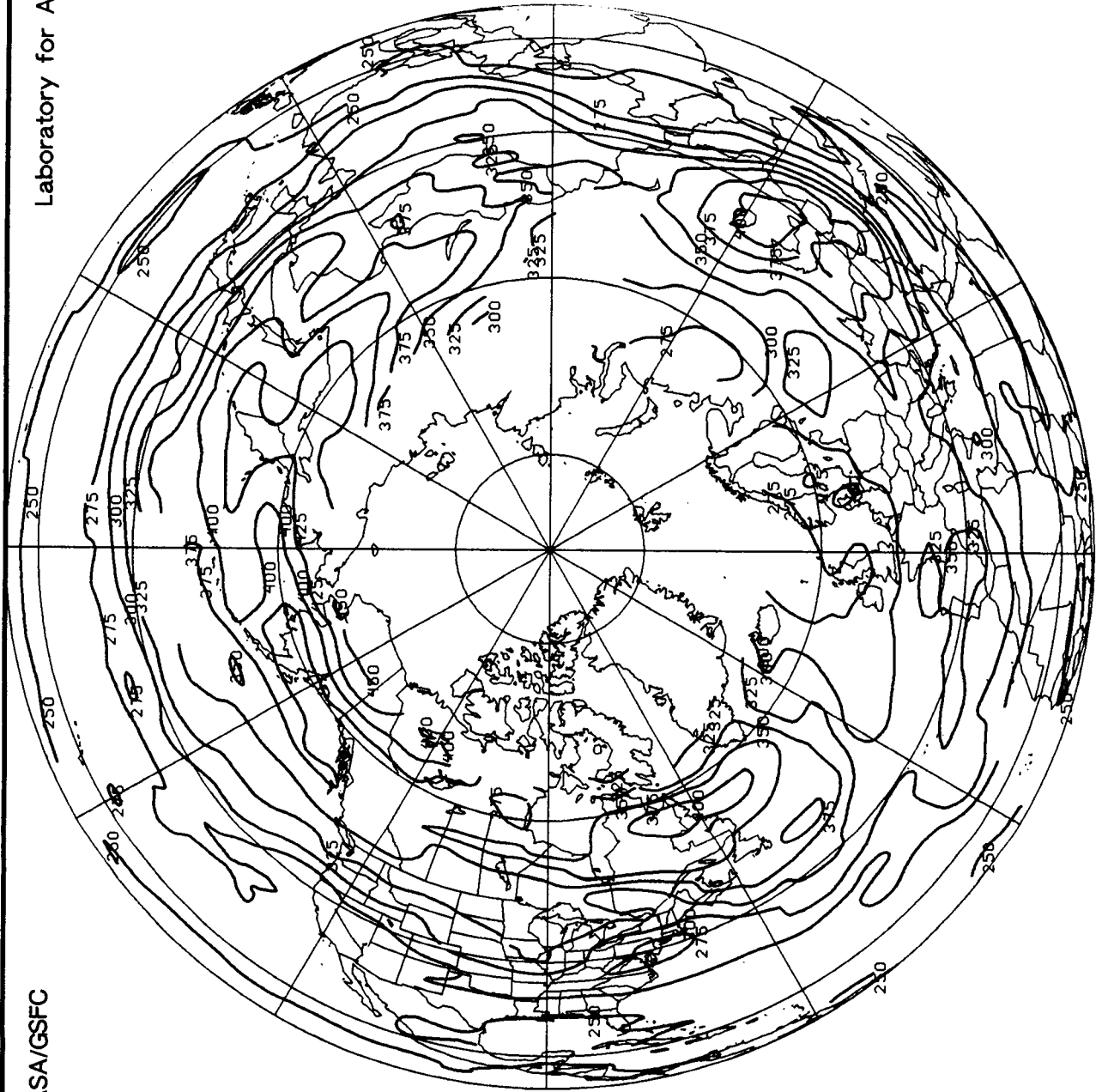


Gridded TOMS Ozone (Dobson Units)

January 17, 1989

NASA/GSFC

Laboratory for Atmospheres

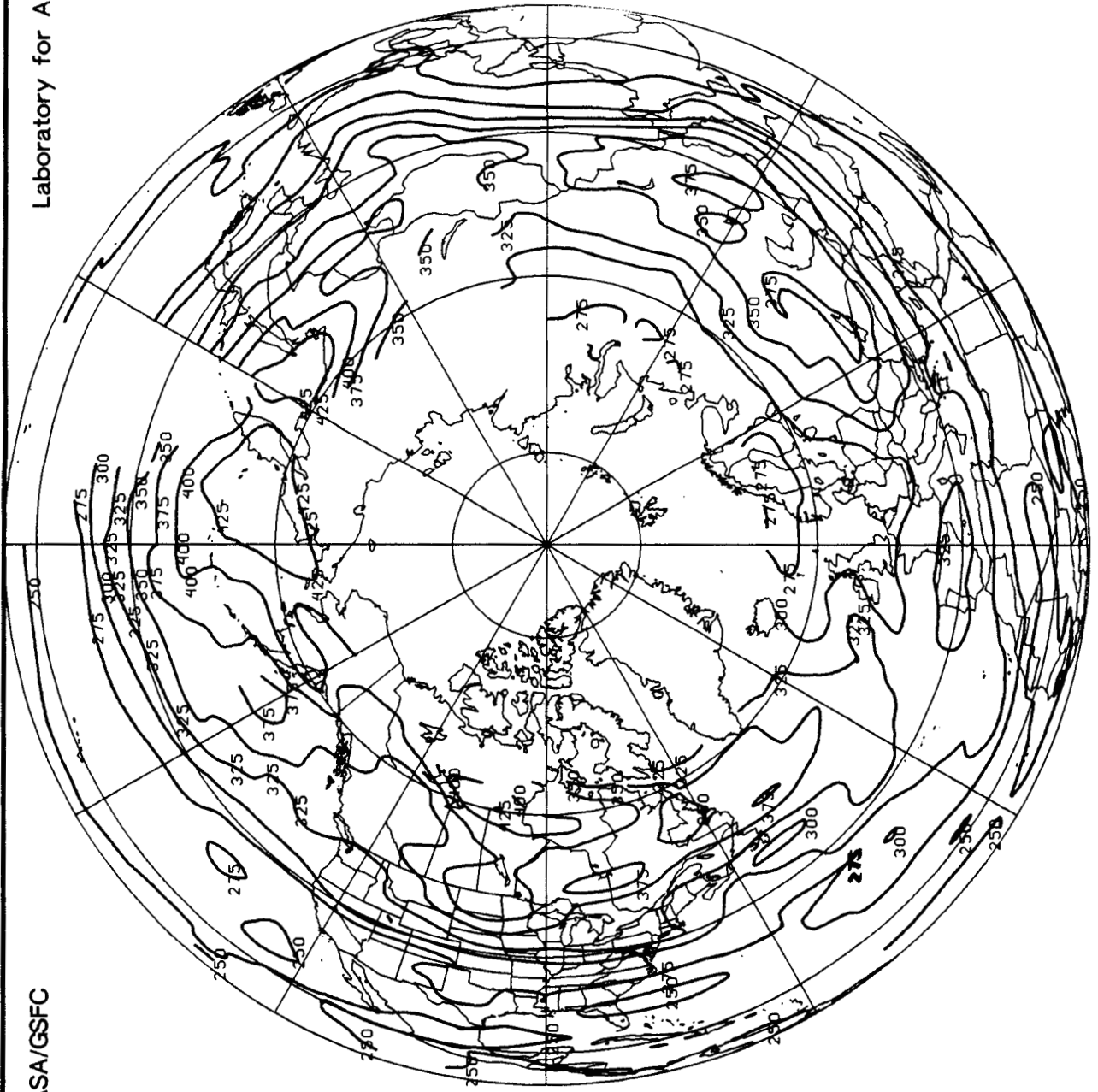


January 18, 1989

Gridded TOMS Ozone (Dobson Units)

NASA/GSFC

Laboratory for Atmospheres

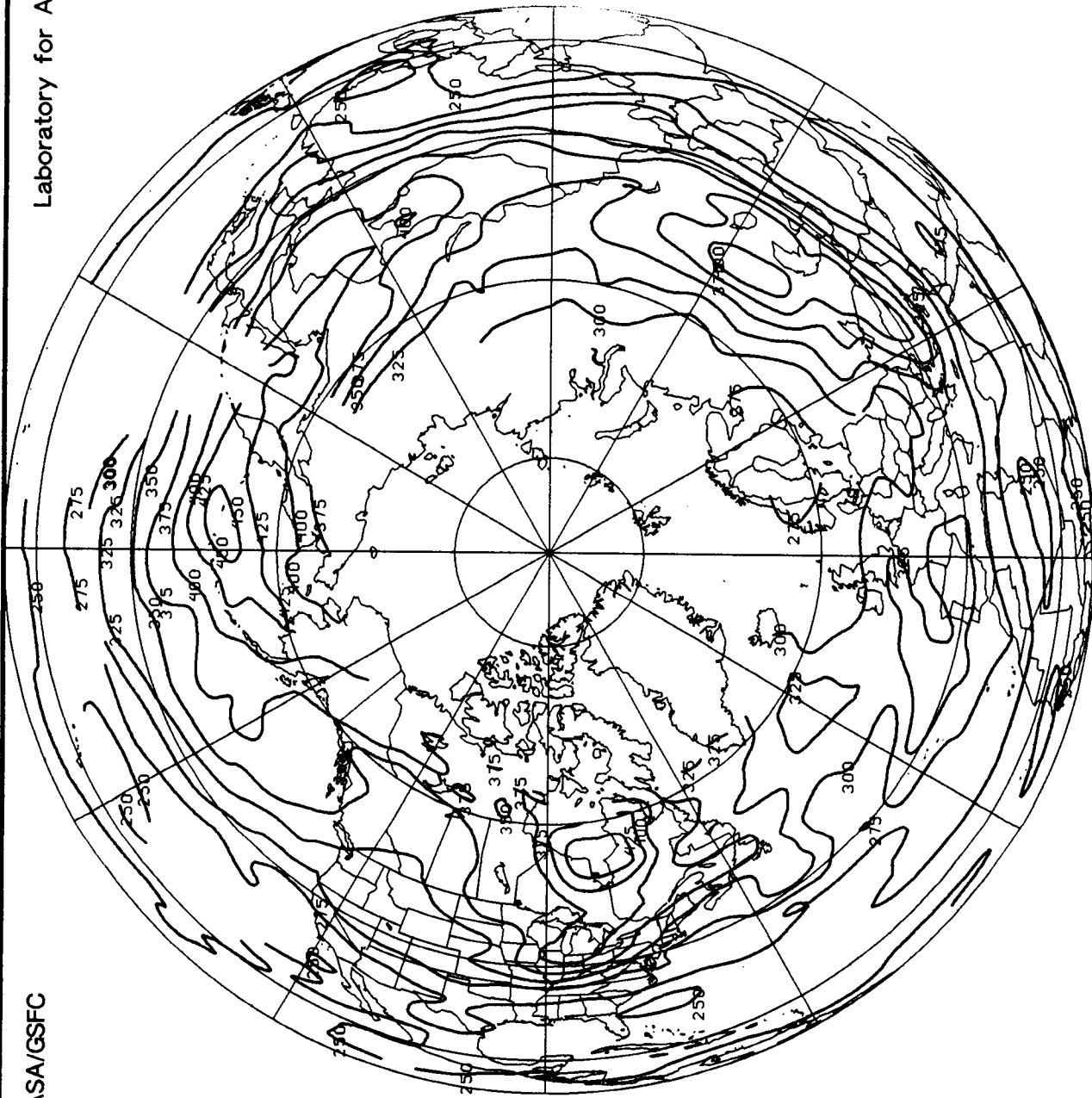


January 19, 1989

Gridded TOMS Ozone (Dobson Units)

NASA/GSFC

Laboratory for Atmospheres

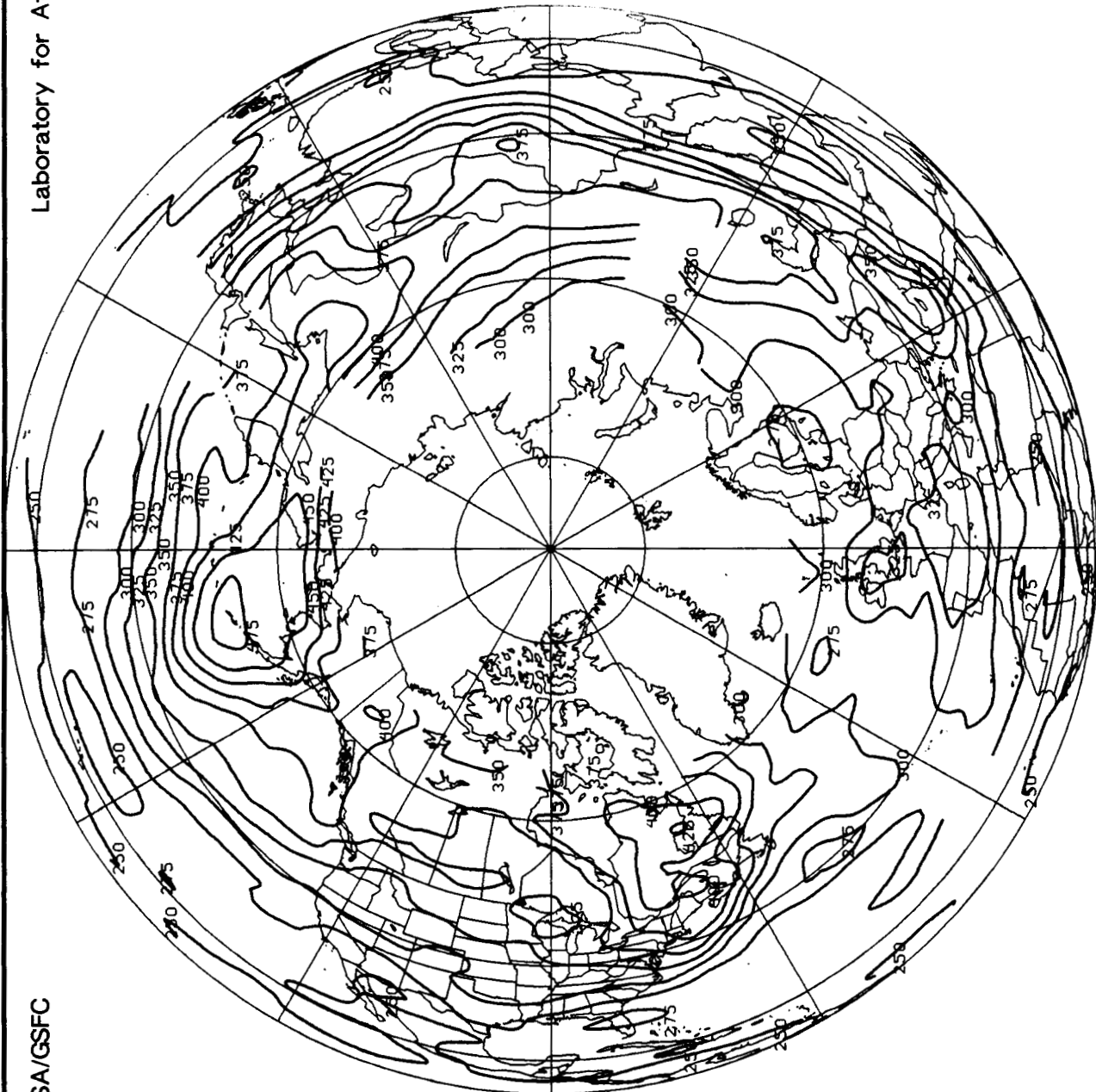


January 20, 1989

Gridded TOMS Ozone (Dobson Units)

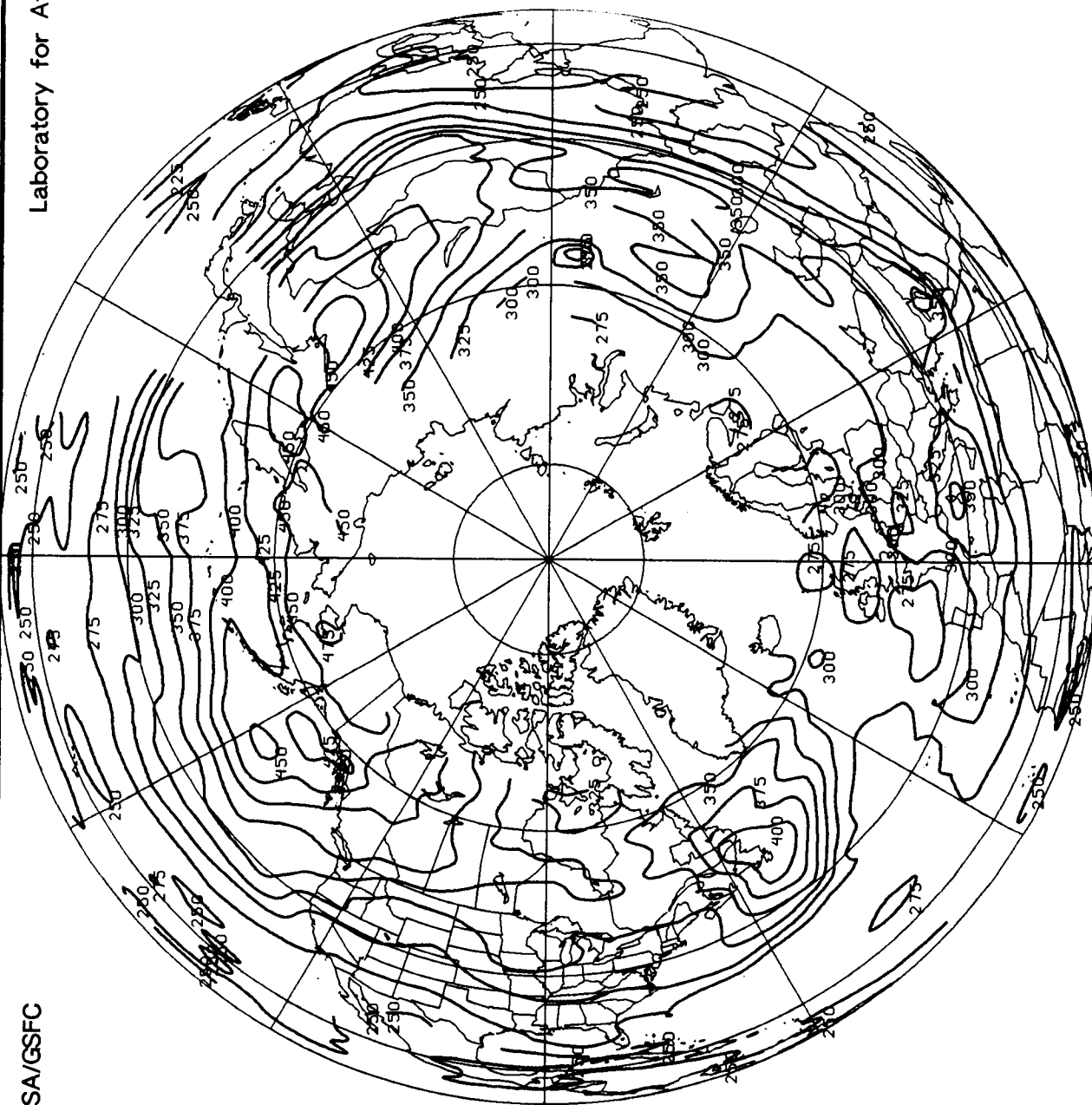
NASA/GSFC

Laboratory for Atmospheres



January 21, 1989

Gridded TOMS Ozone (Dobson Units)

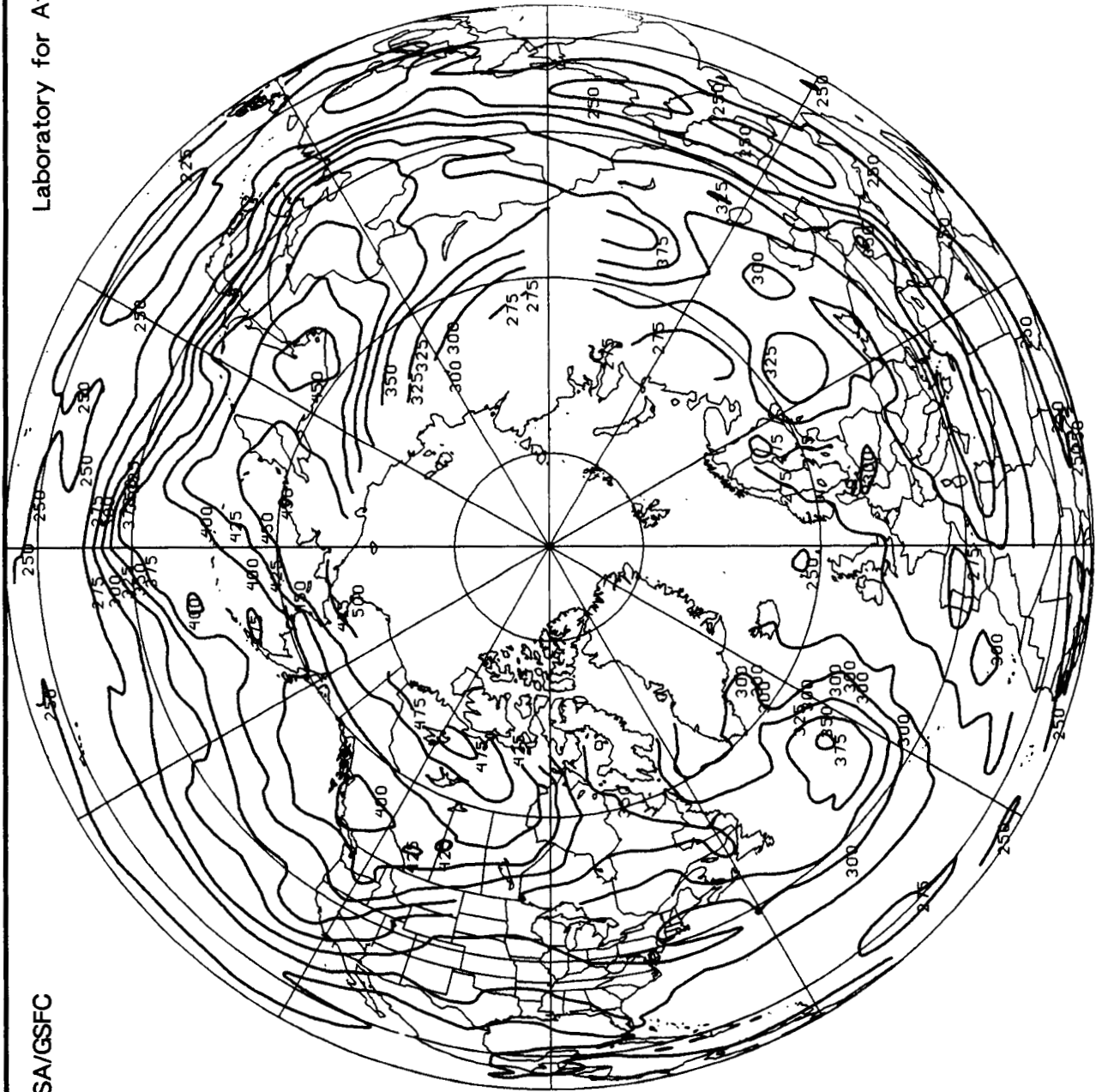


January 22, 1989

Gridded TOMS Ozone (Dobson Units)

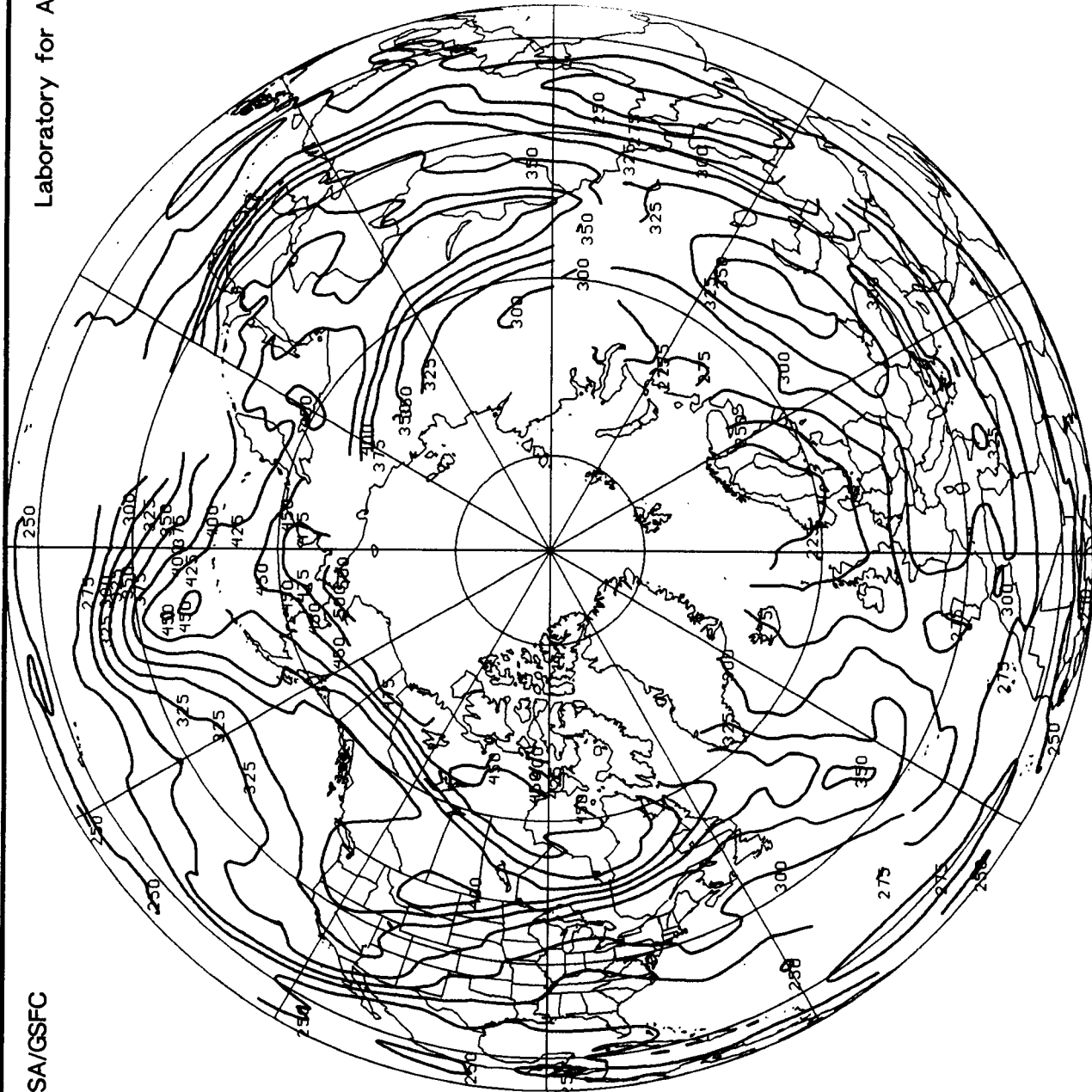
Laboratory for Atmospheres

NASA/GSFC



Gridded TOMS Ozone (Dobson Units)

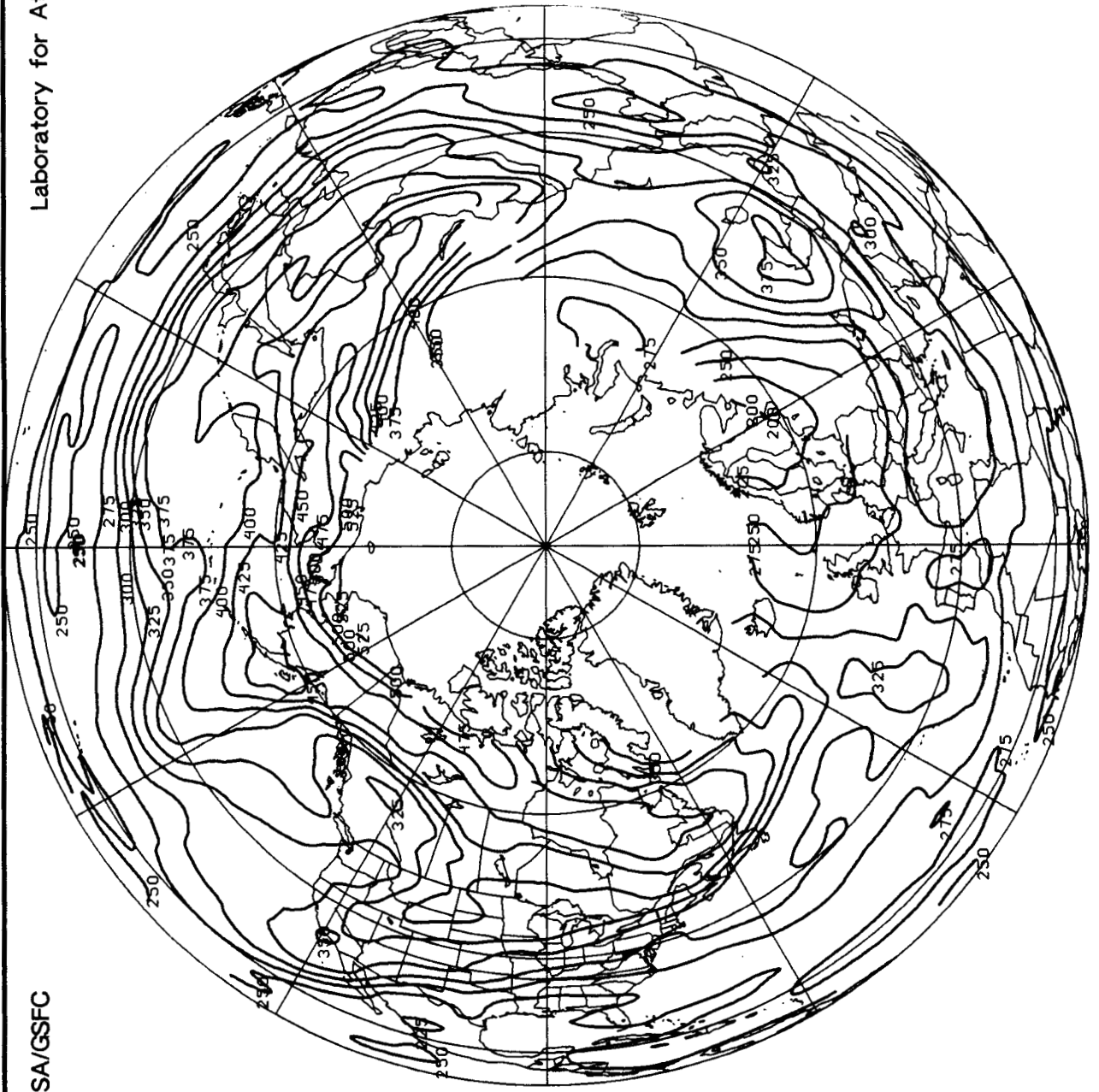
January 23, 1989



January 24, 1989

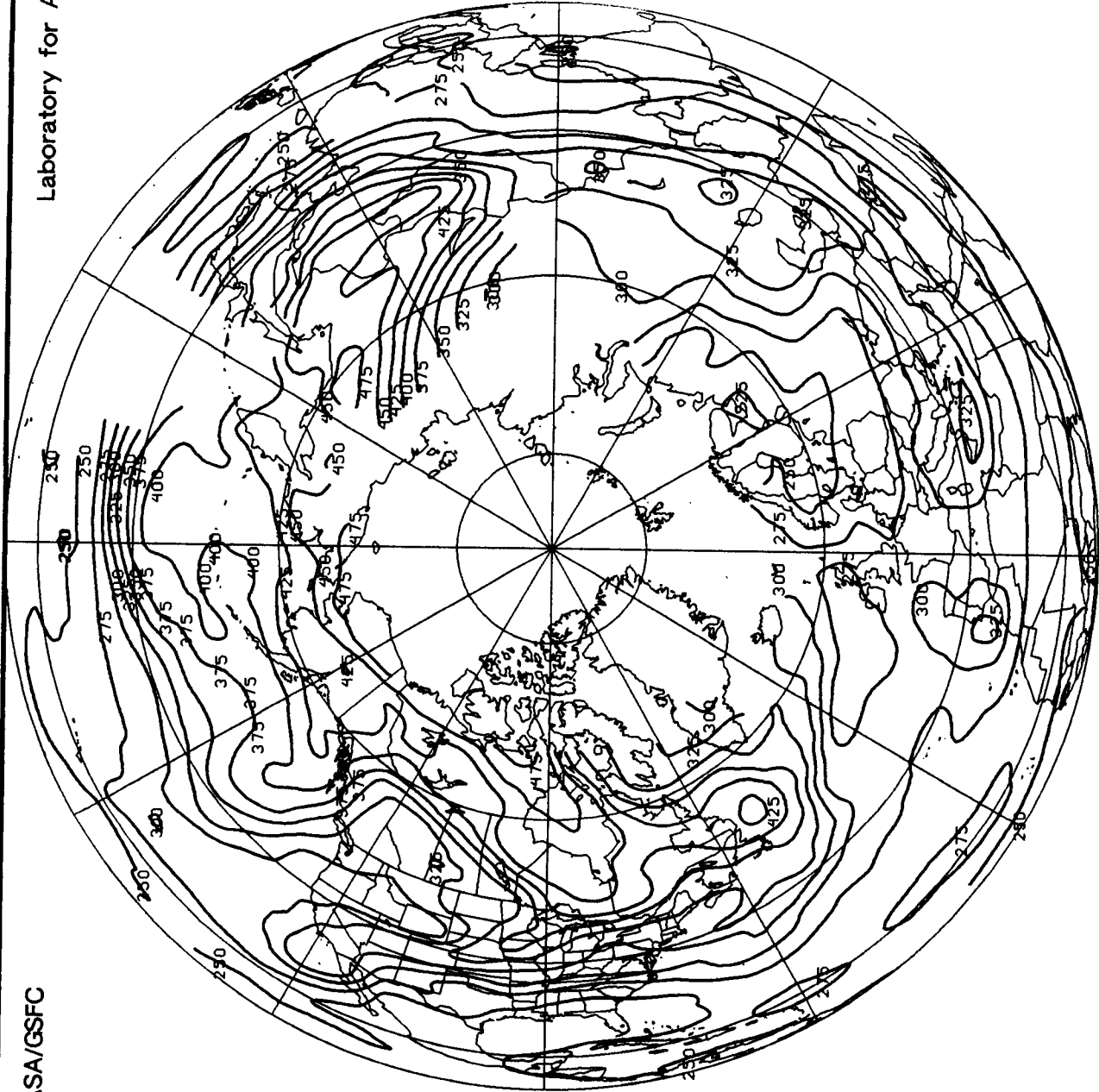
Gridded TOMS Ozone (Dobson Units)





NASA/GSFC

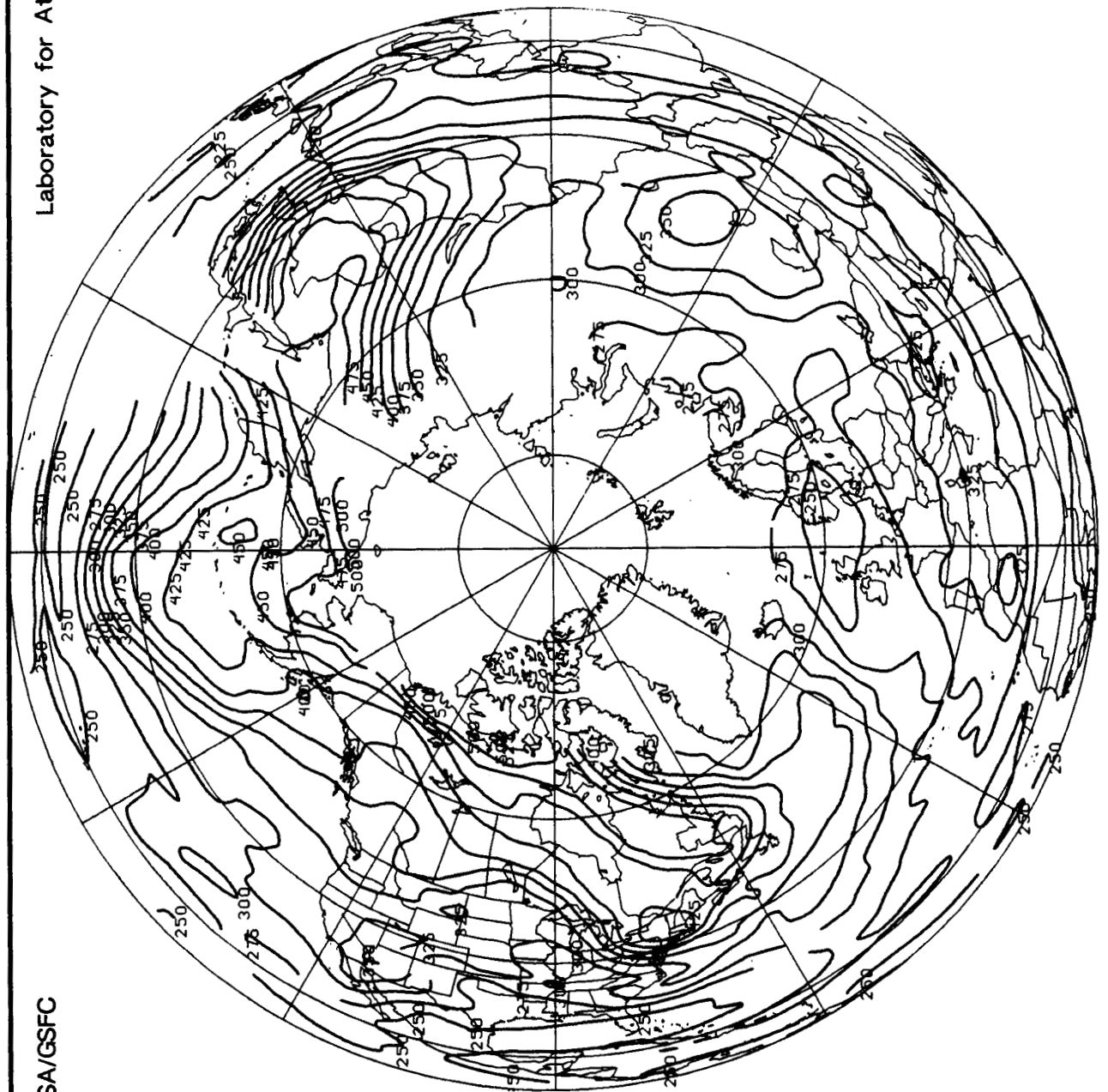
Laboratory for Atmospheres



January 26, 1989

Gridded TOMS Ozone (Dobson Units)

Laboratory for Atmospheres



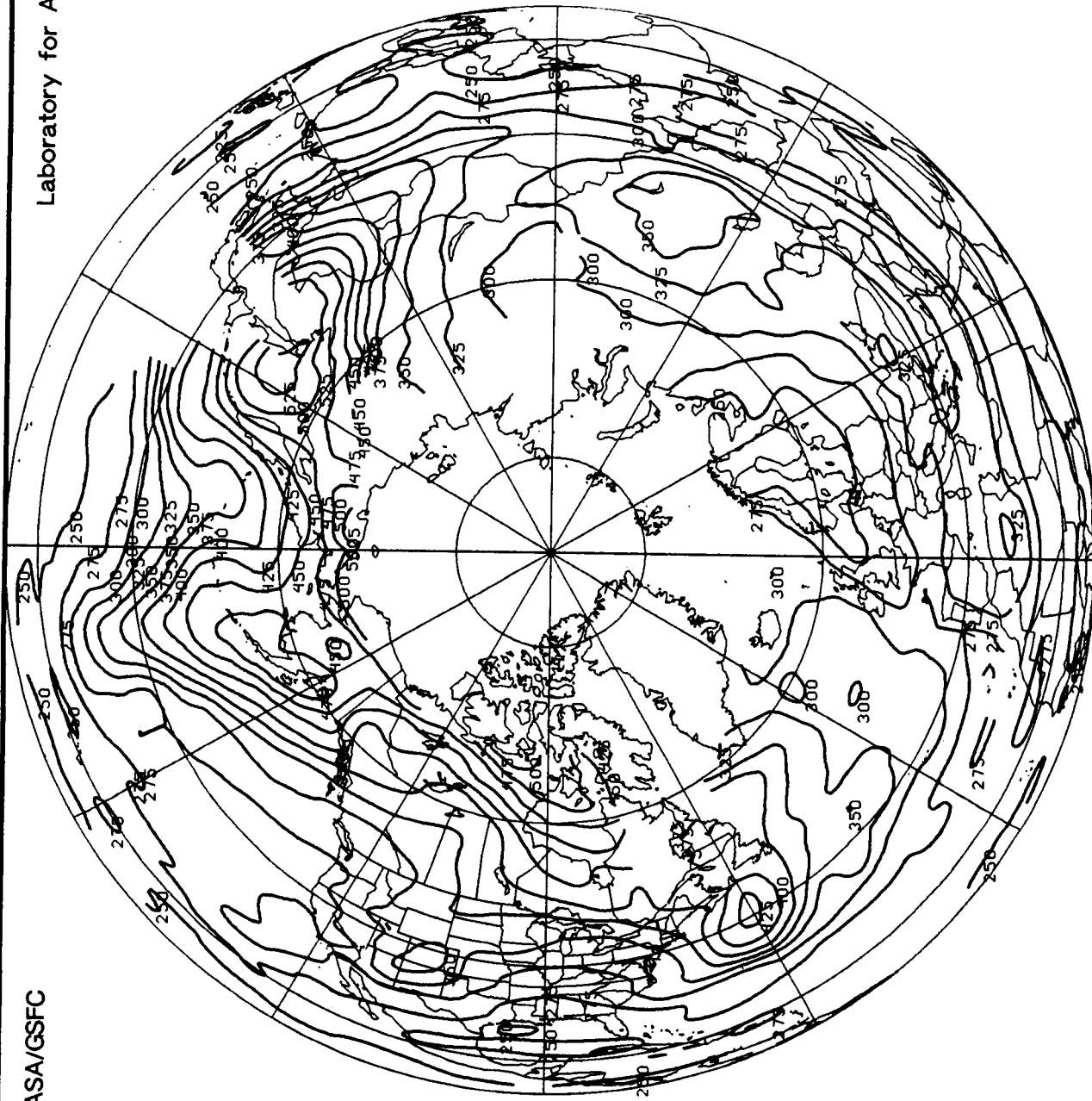
NASA/GSFC

Gridded TOMS Ozone (Dobson Units)

January 27, 1989

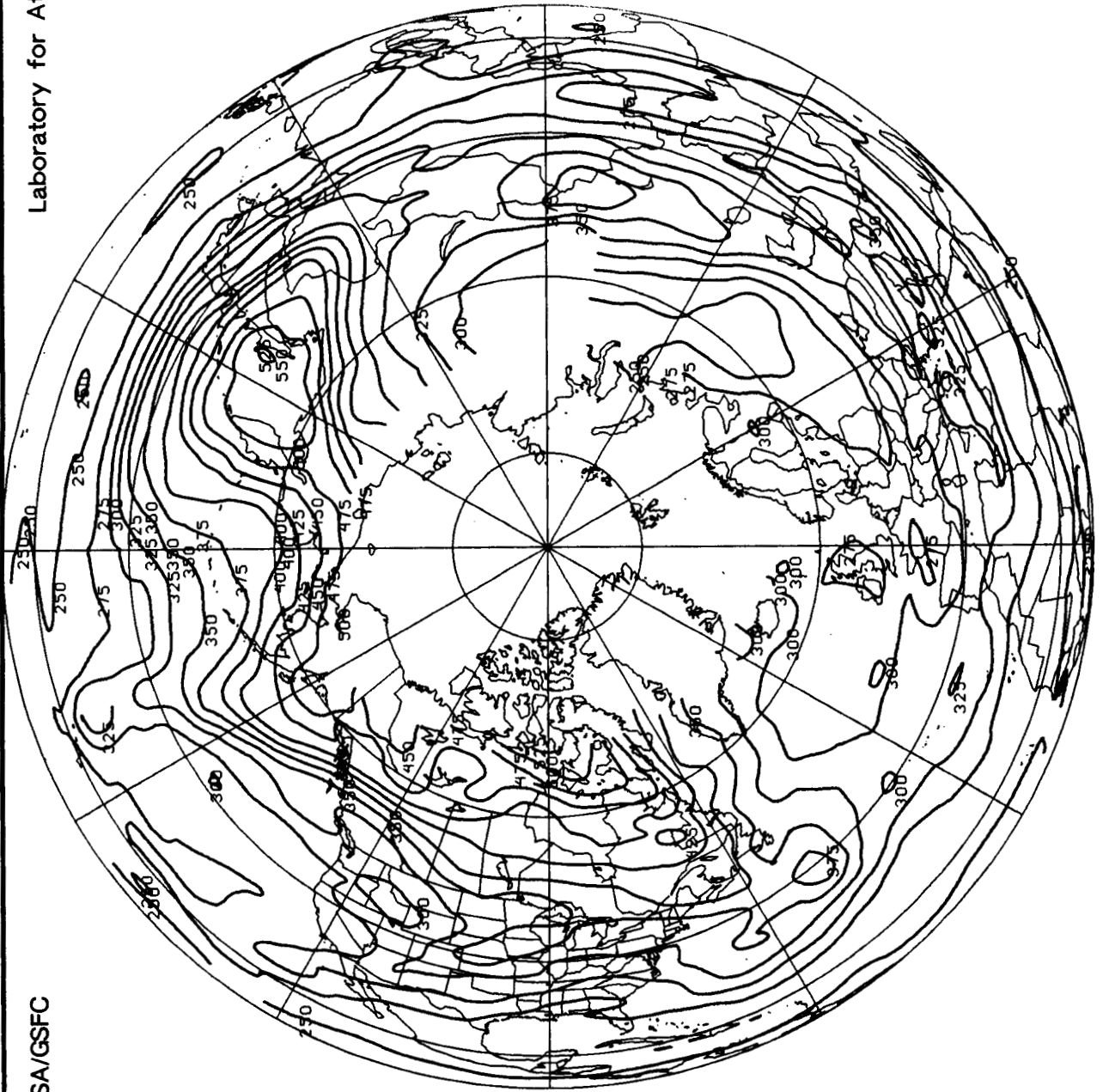
NASA/GSFC

Laboratory for Atmospheres



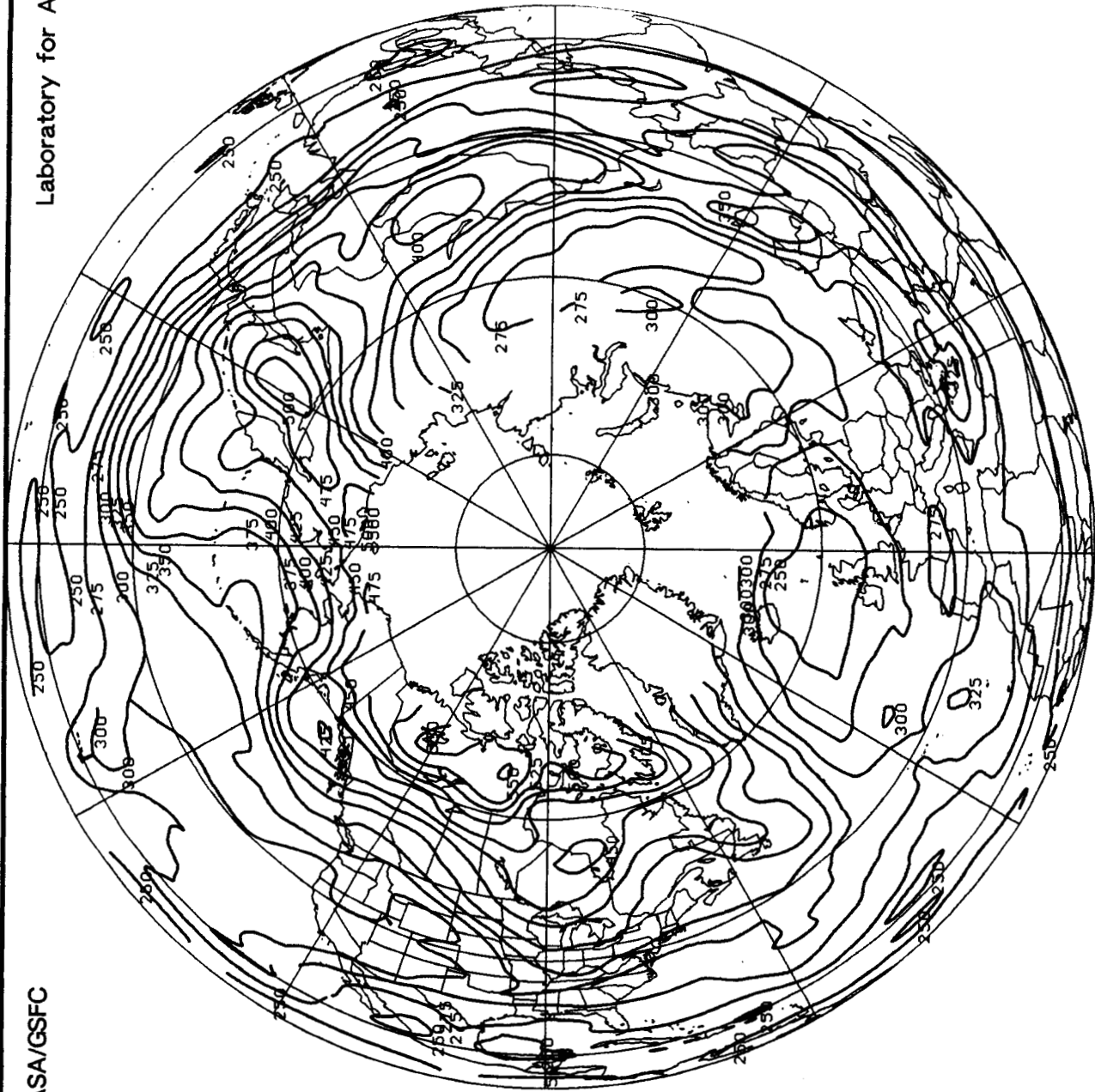
January 28, 1989

Gridded TOMS Ozone (Dobson Units)



NASA/GSFC

Laboratory for Atmospheres

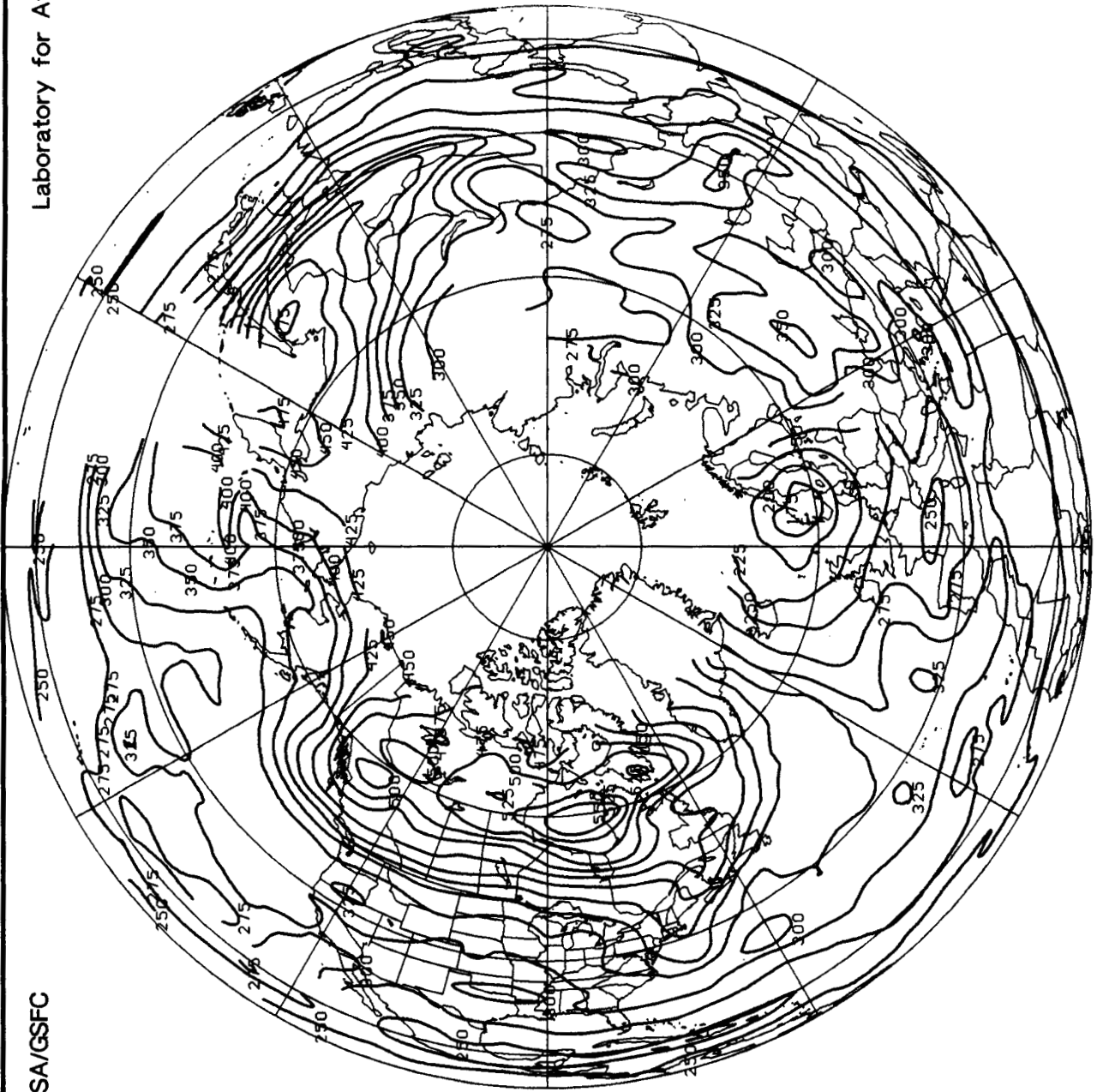


January 30, 1989

Gridded TOMS Ozone (Dobson Units)

Laboratory for Atmospheres

NASA/GSFC

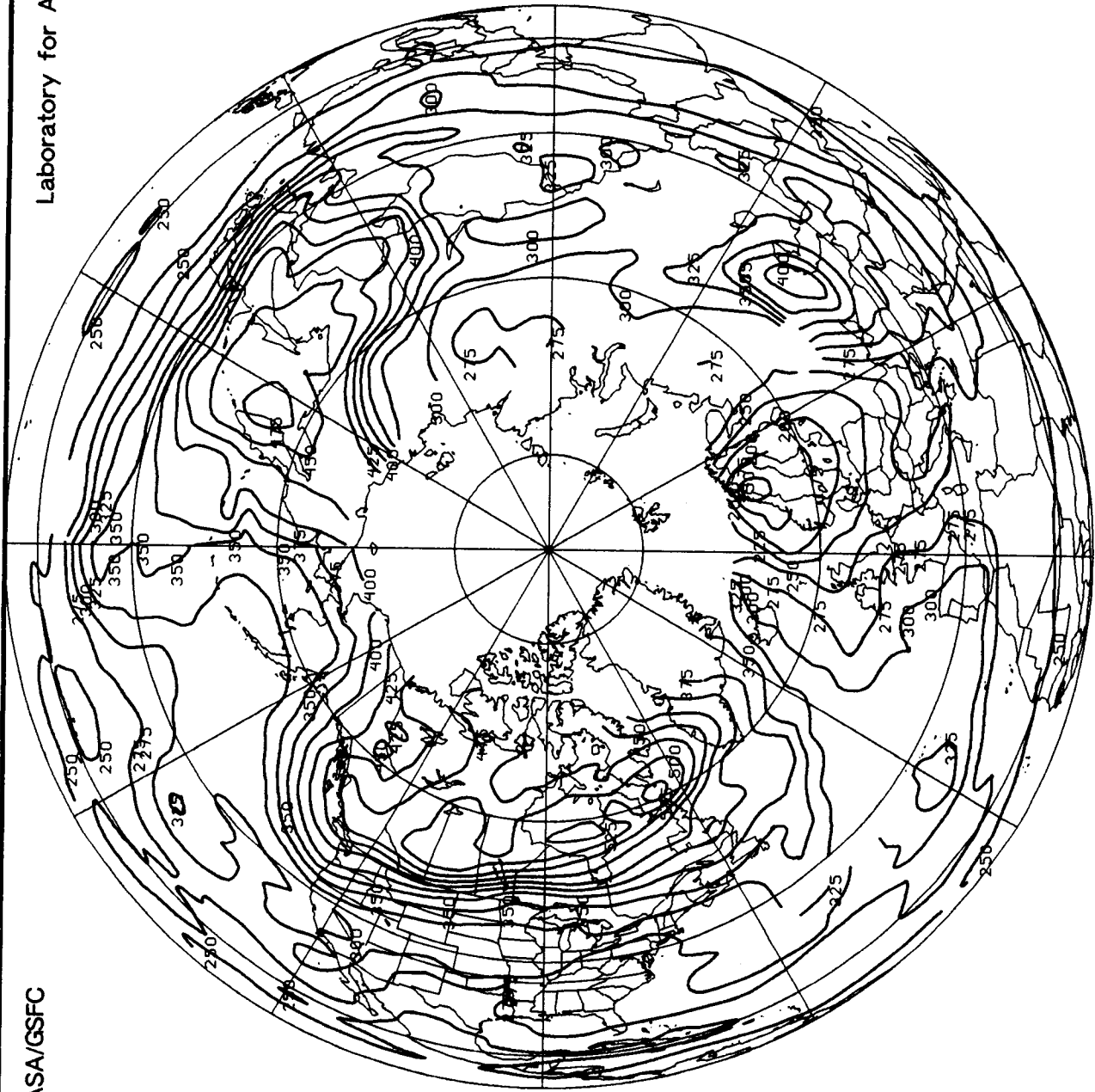


Gridded TOMS Ozone (Dobson Units)

January 31, 1989

NASA/GSFC

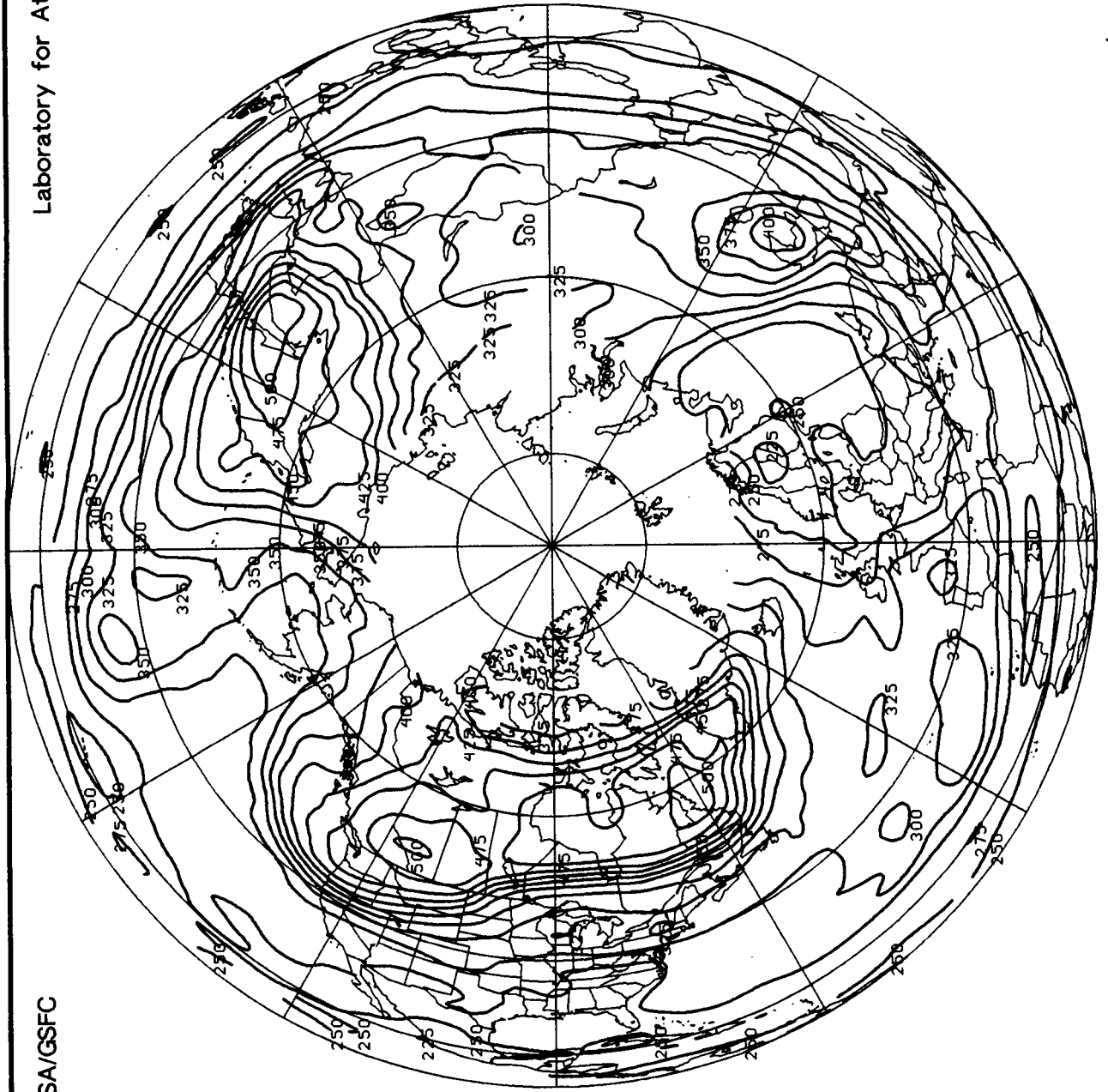
Laboratory for Atmospheres



February 1, 1989

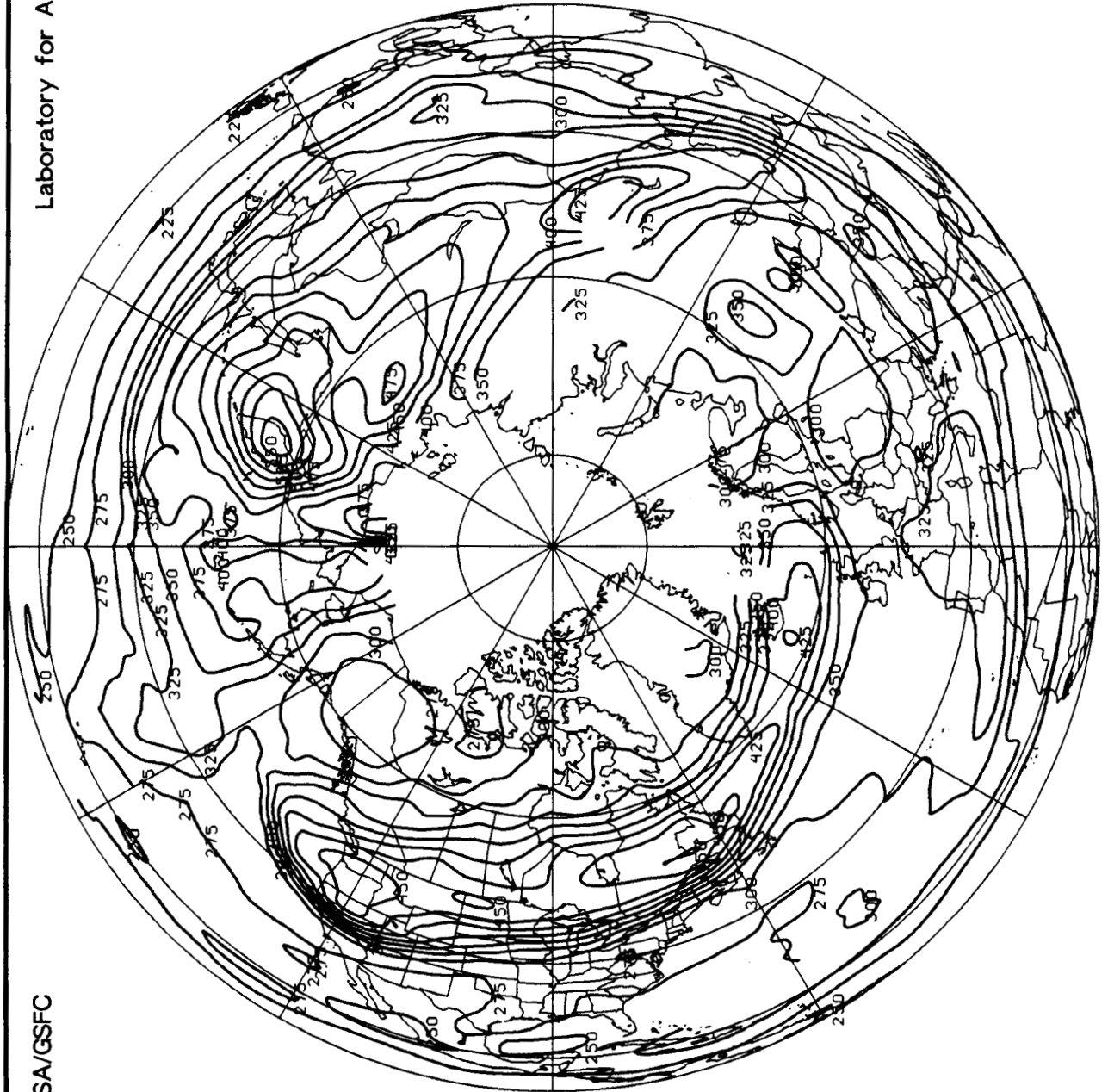
Gridded TOMS Ozone (Dobson Units)







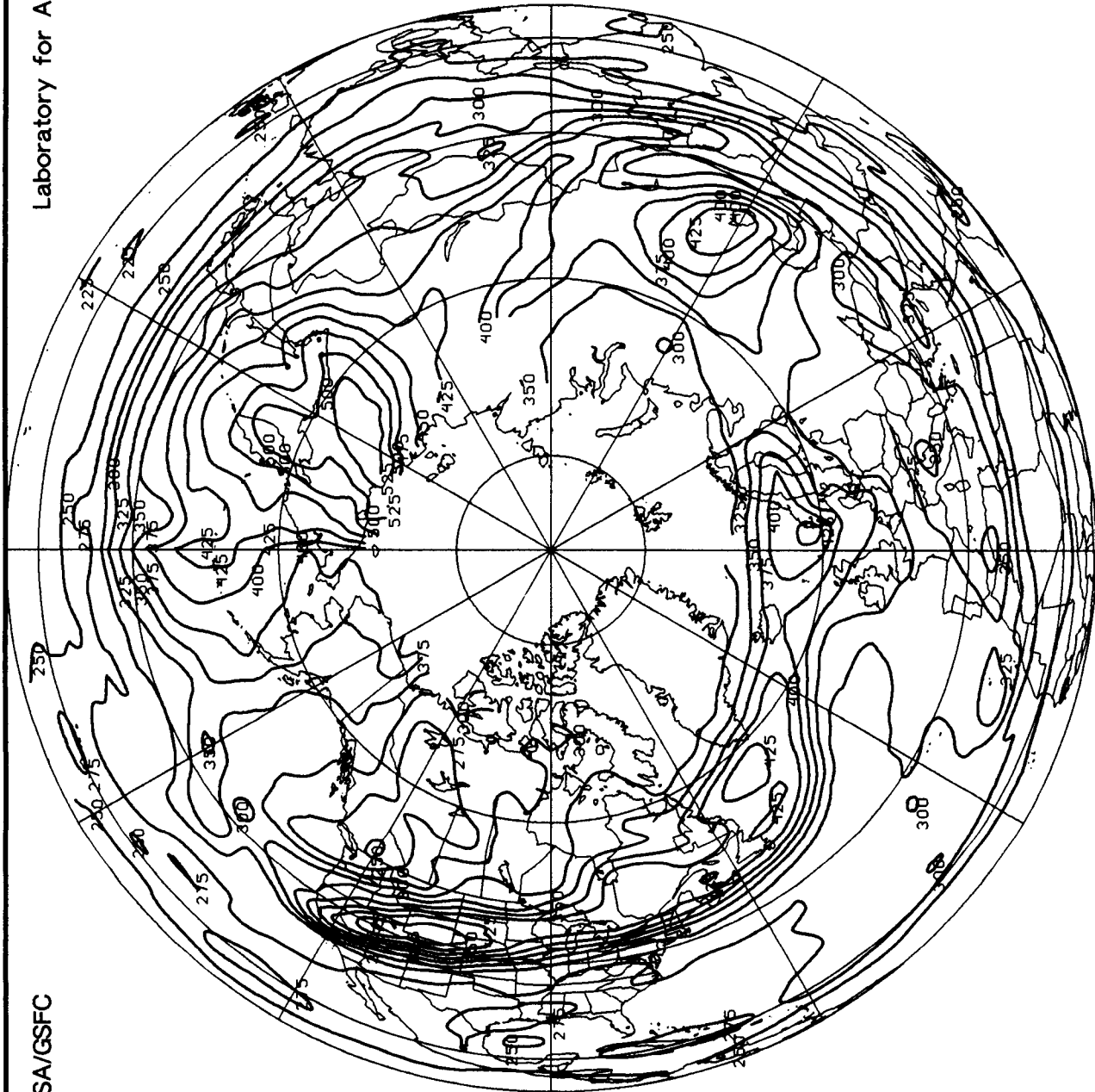
Laboratory for Atmospheres

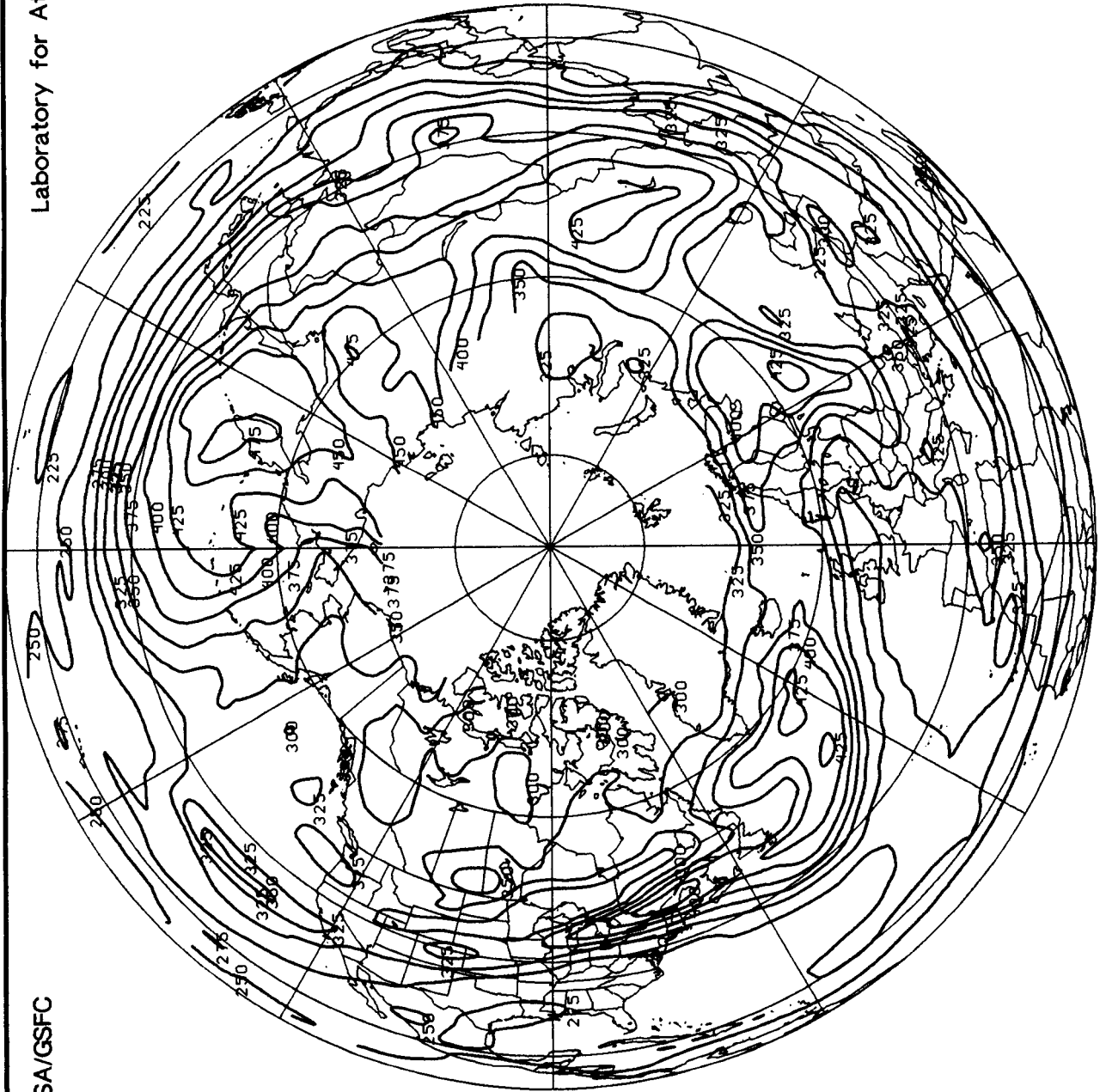


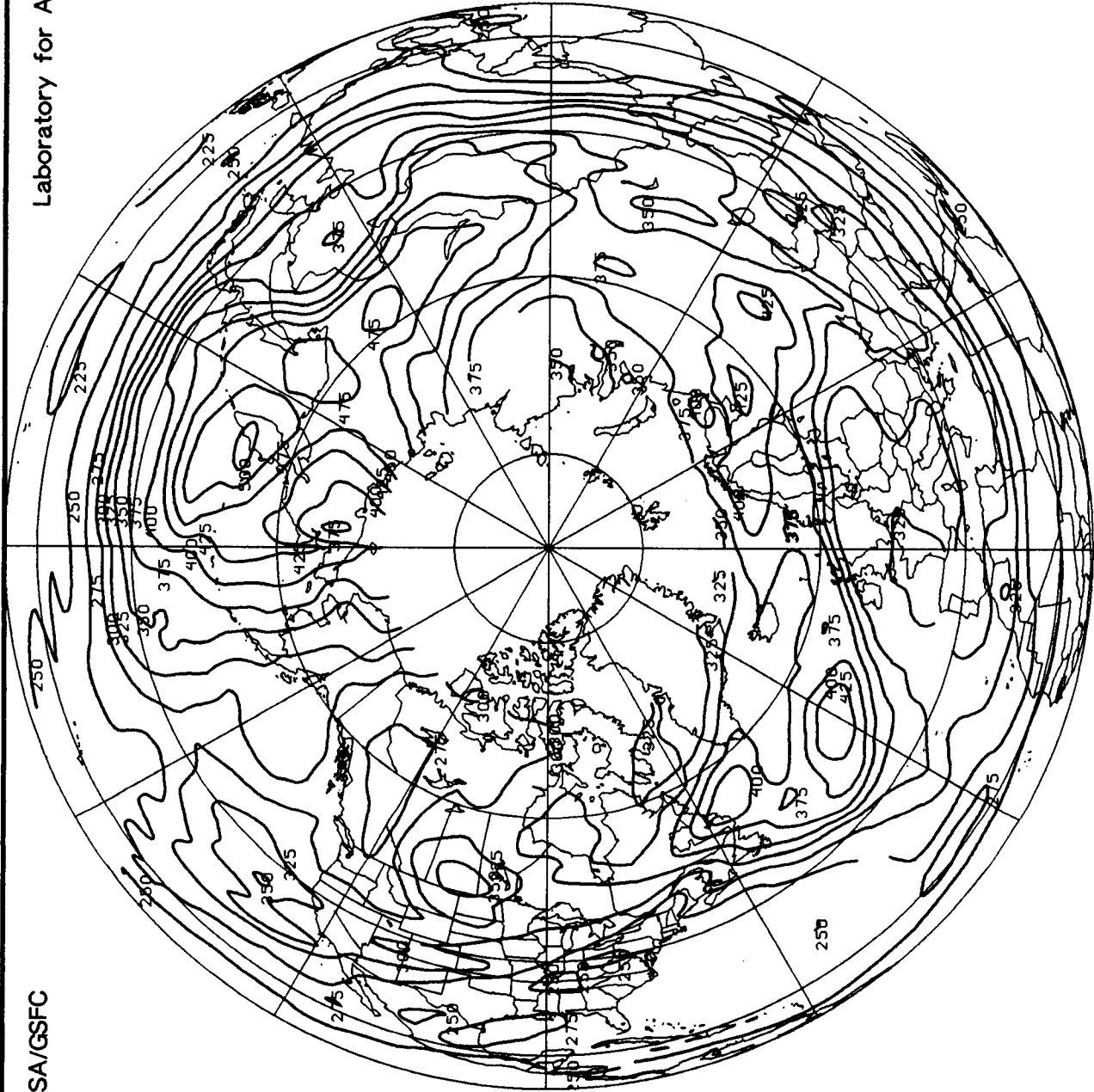
NASA/GSFC

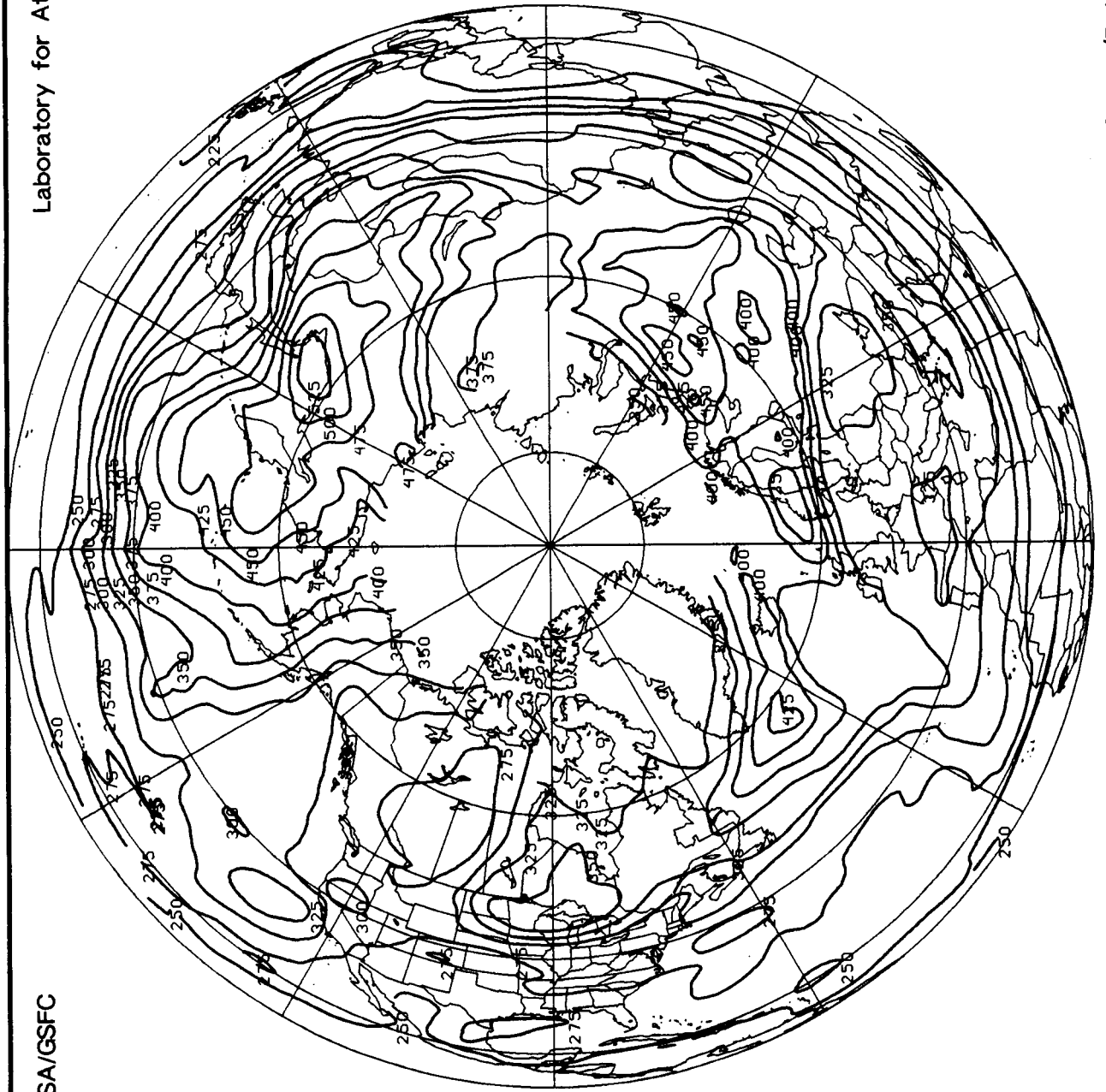
Gridded TOMS Ozone (Dobson Units)

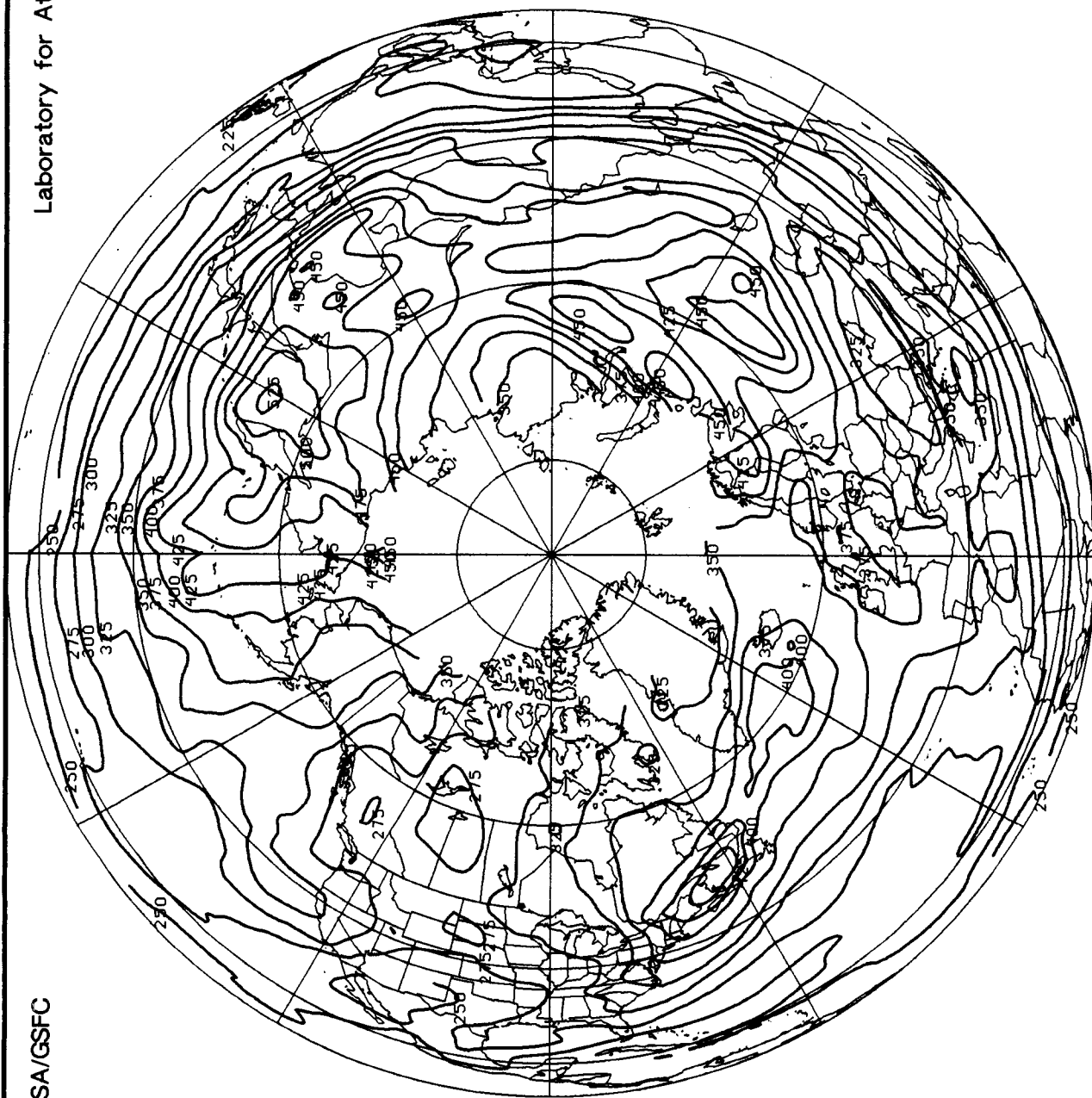
February 4, 1989







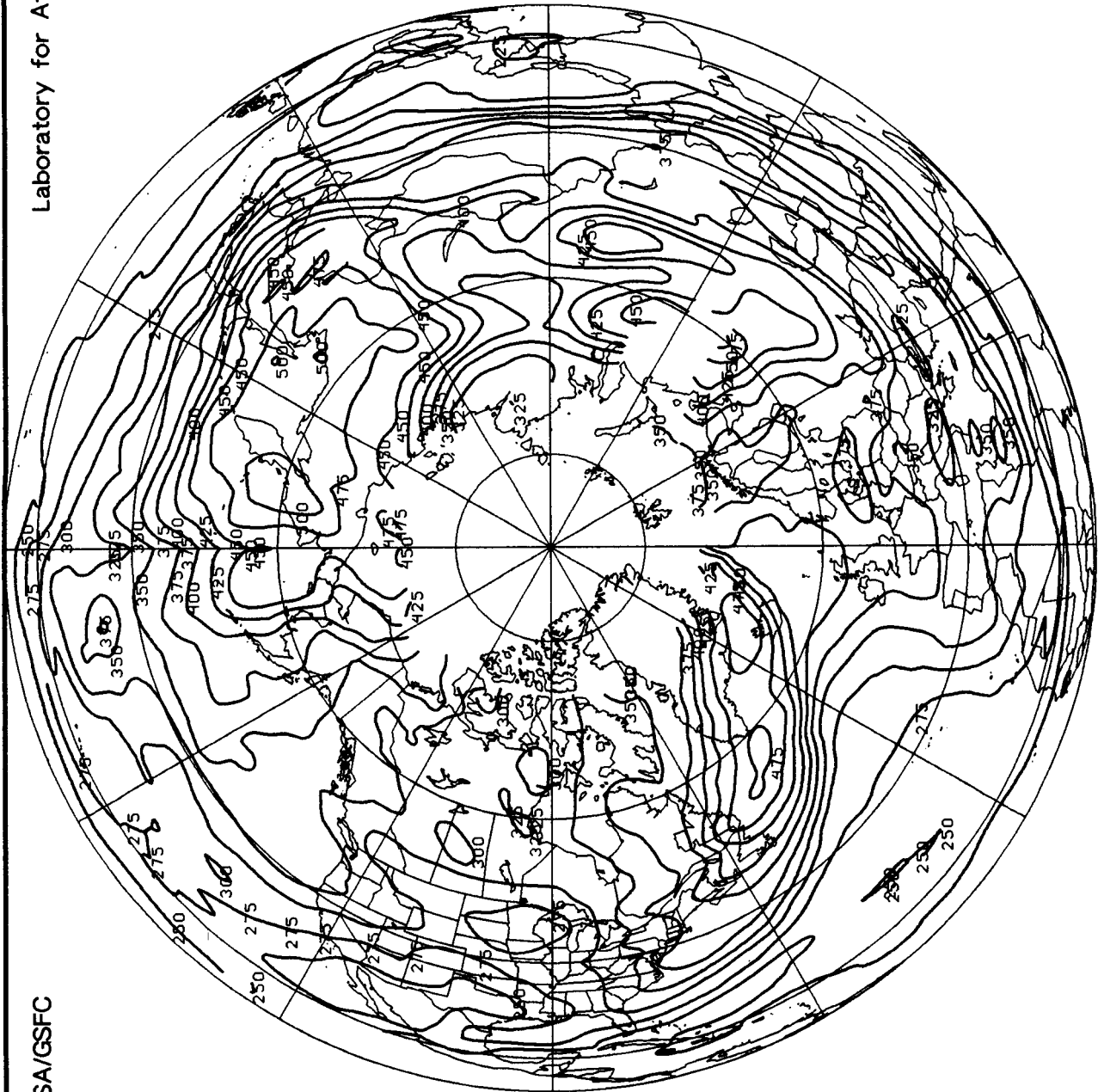


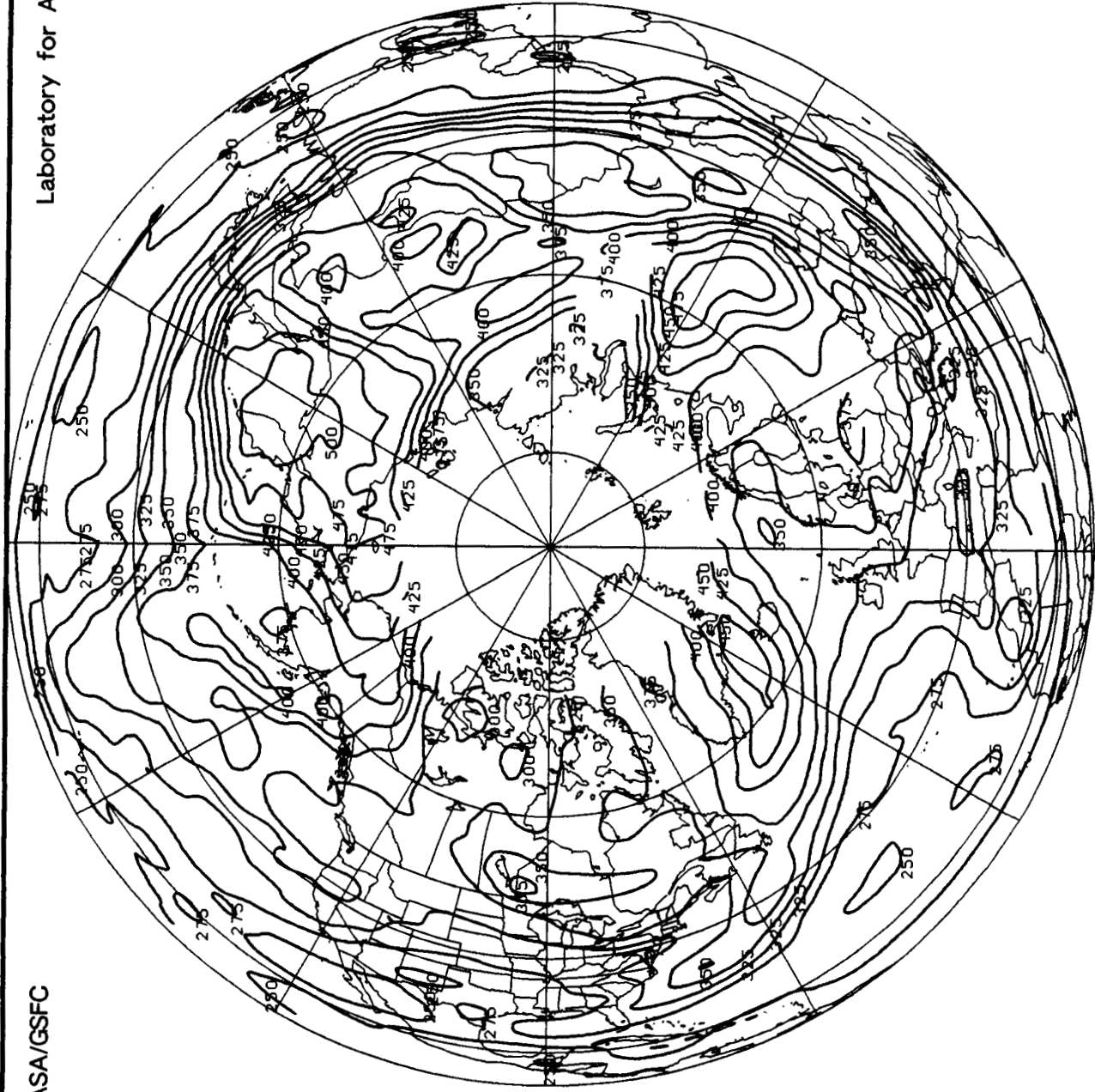


February 9, 1989

Gridded TOMS Ozone (Dobson Units)

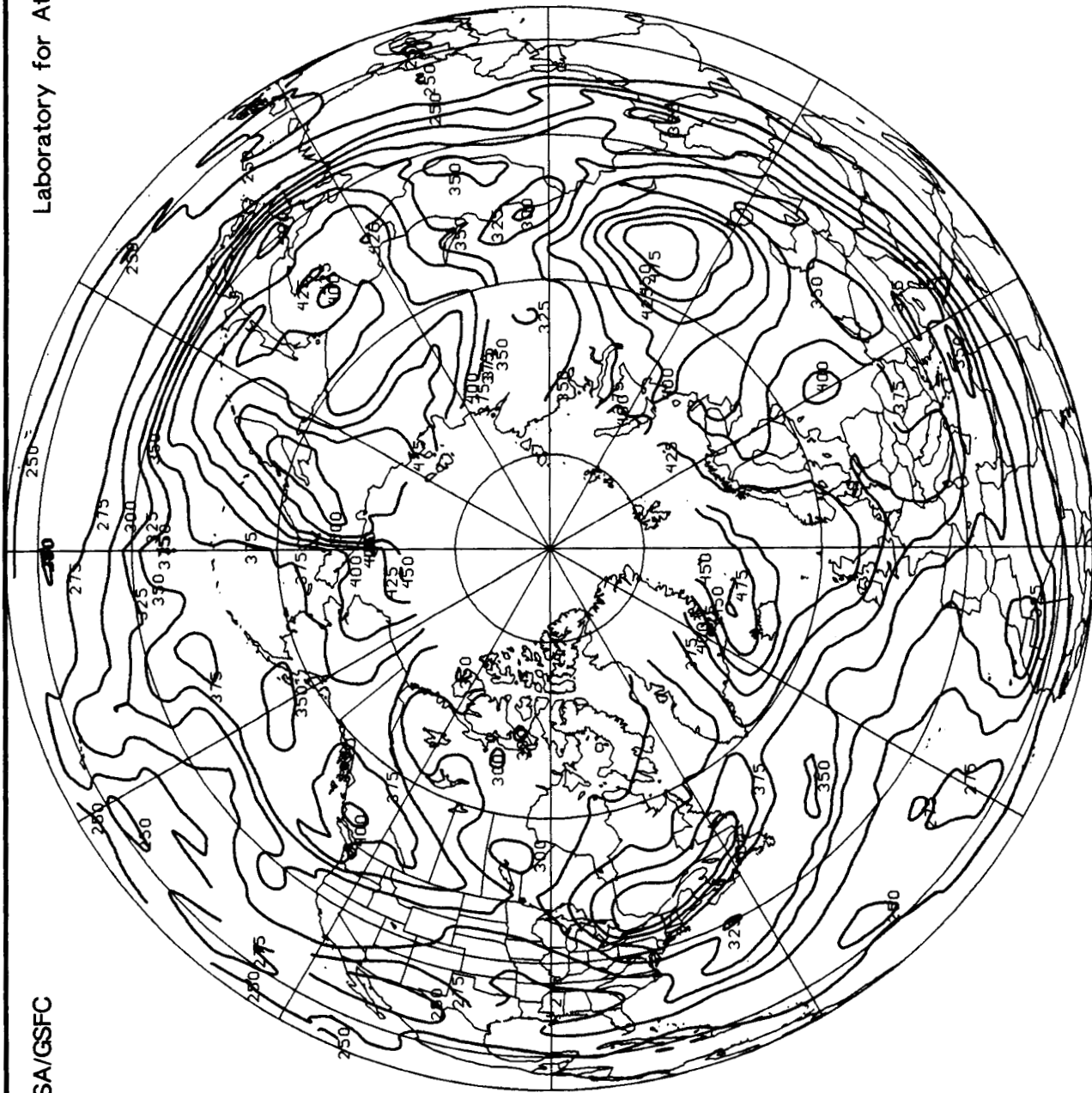


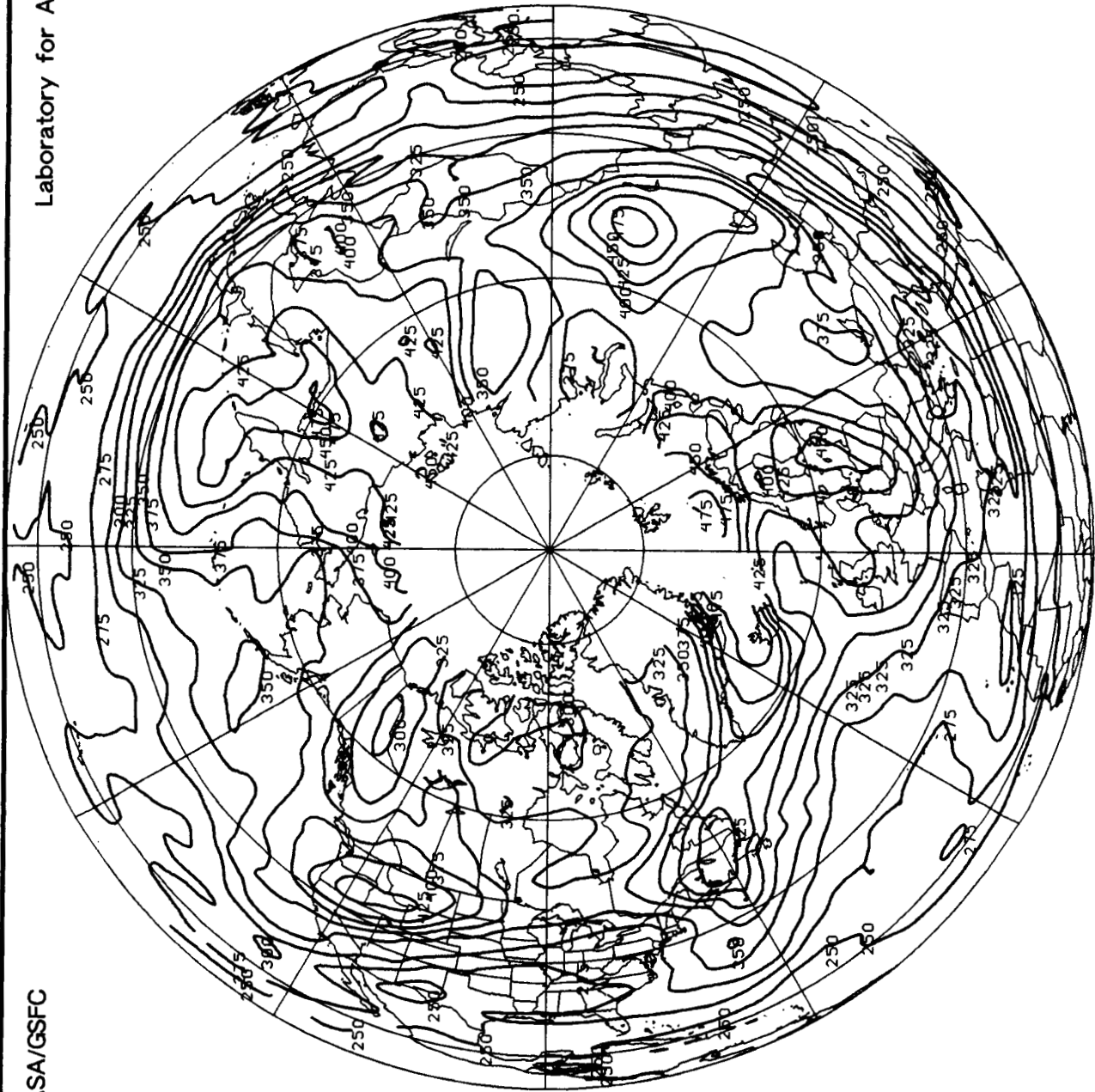




February 11, 1989

Gridded TOMS Ozone (Dobson Units)

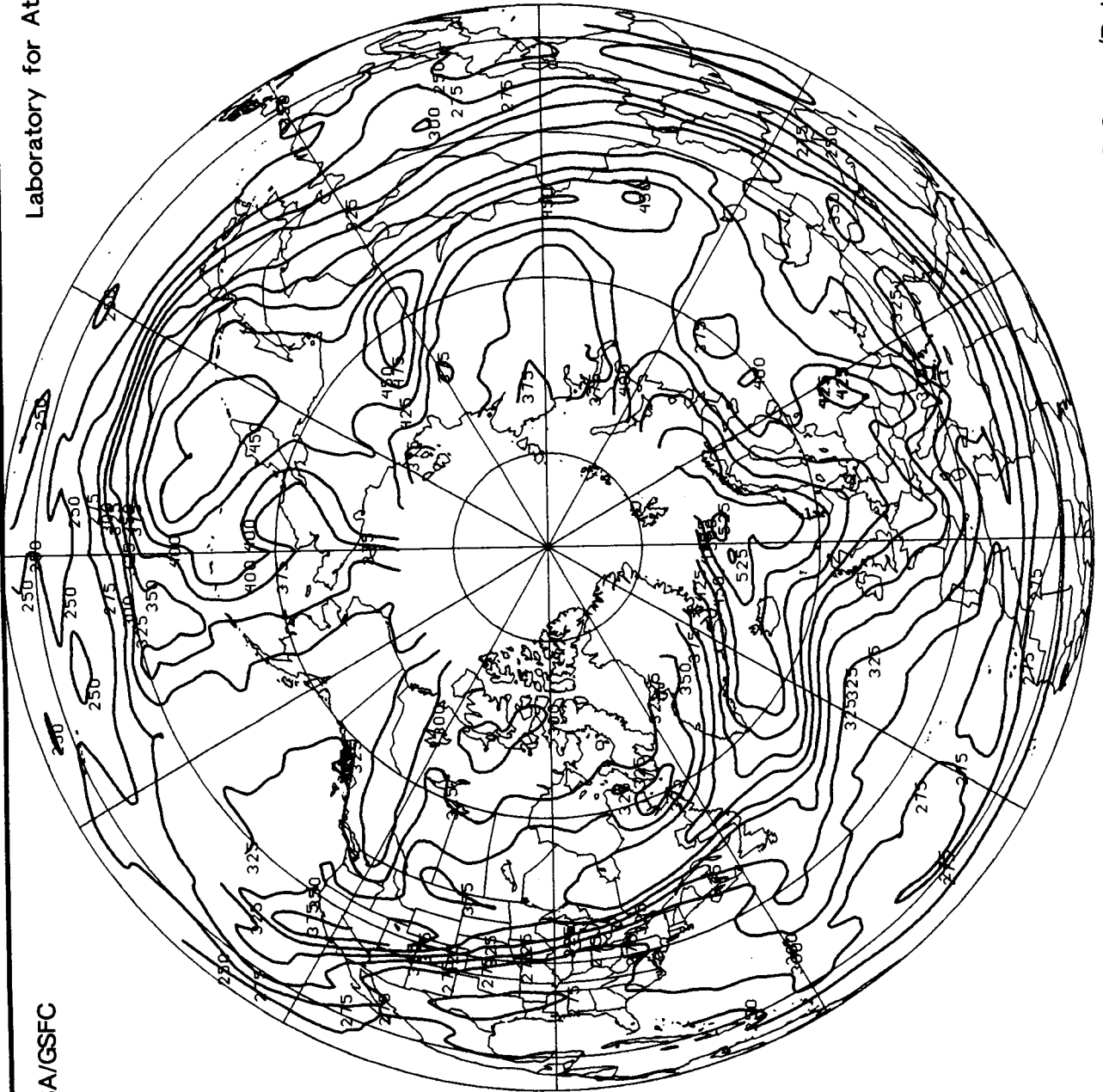




February 13, 1989

Gridded TOMS Ozone (Dobson Units)

Laboratory for Atmospheres



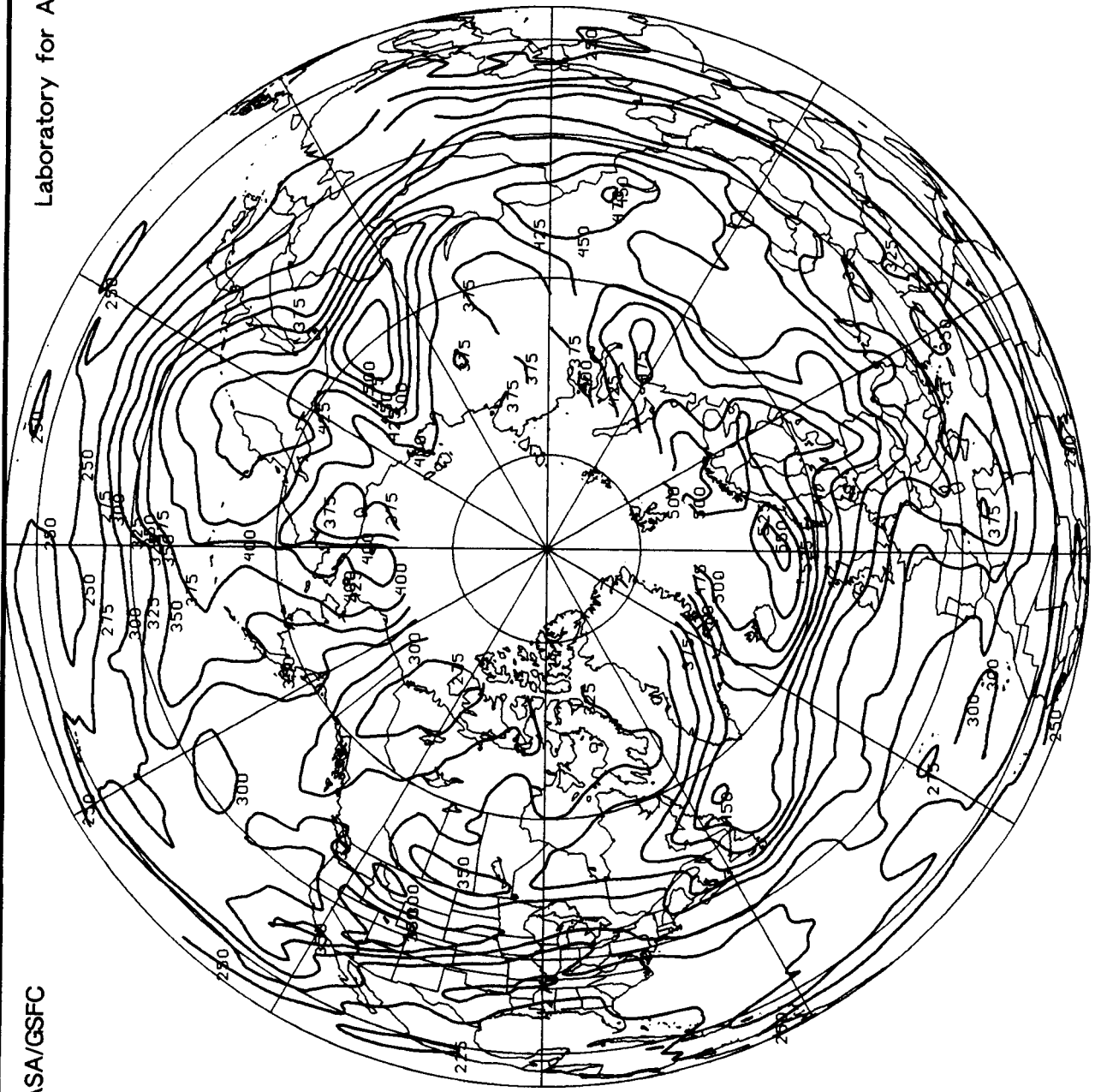
NASA/GSFC

Gridded TOMS Ozone (Dobson Units)

February 14, 1989

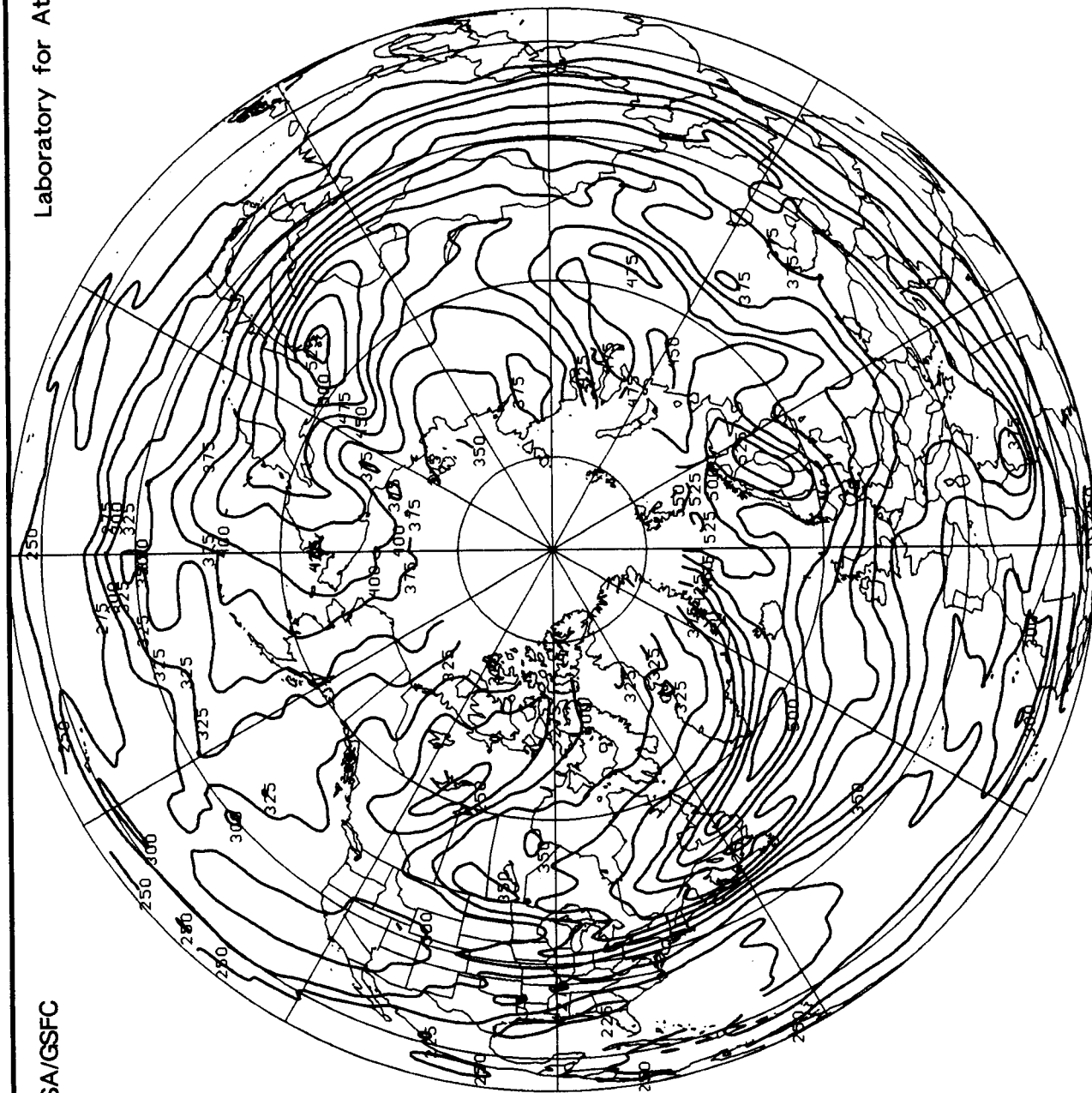
NASA/GSFC

Laboratory for Atmospheres



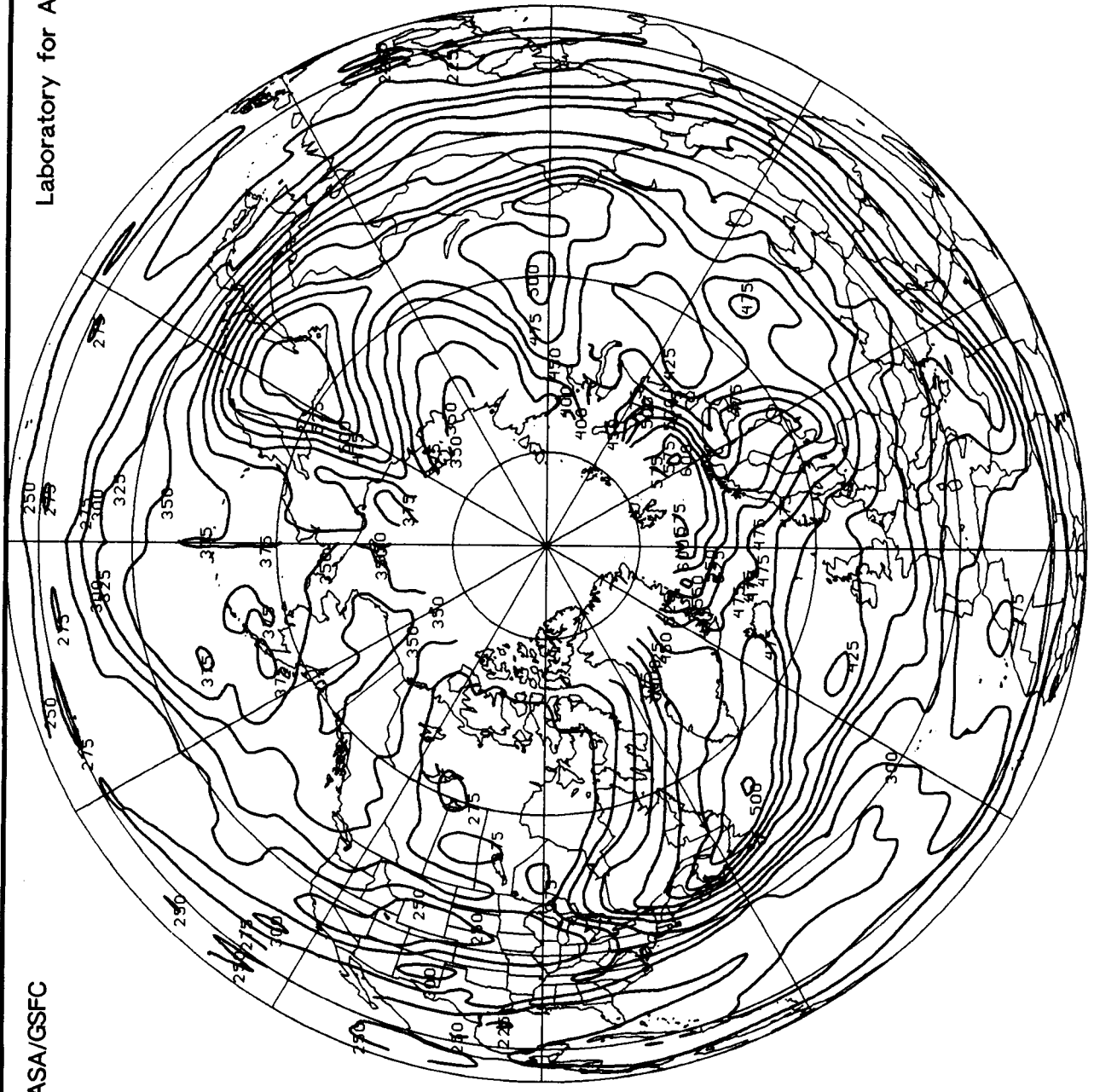
February 15, 1989

Gridded TOMS Ozone (Dobson Units)



NASA/GSFC

Laboratory for Atmospheres

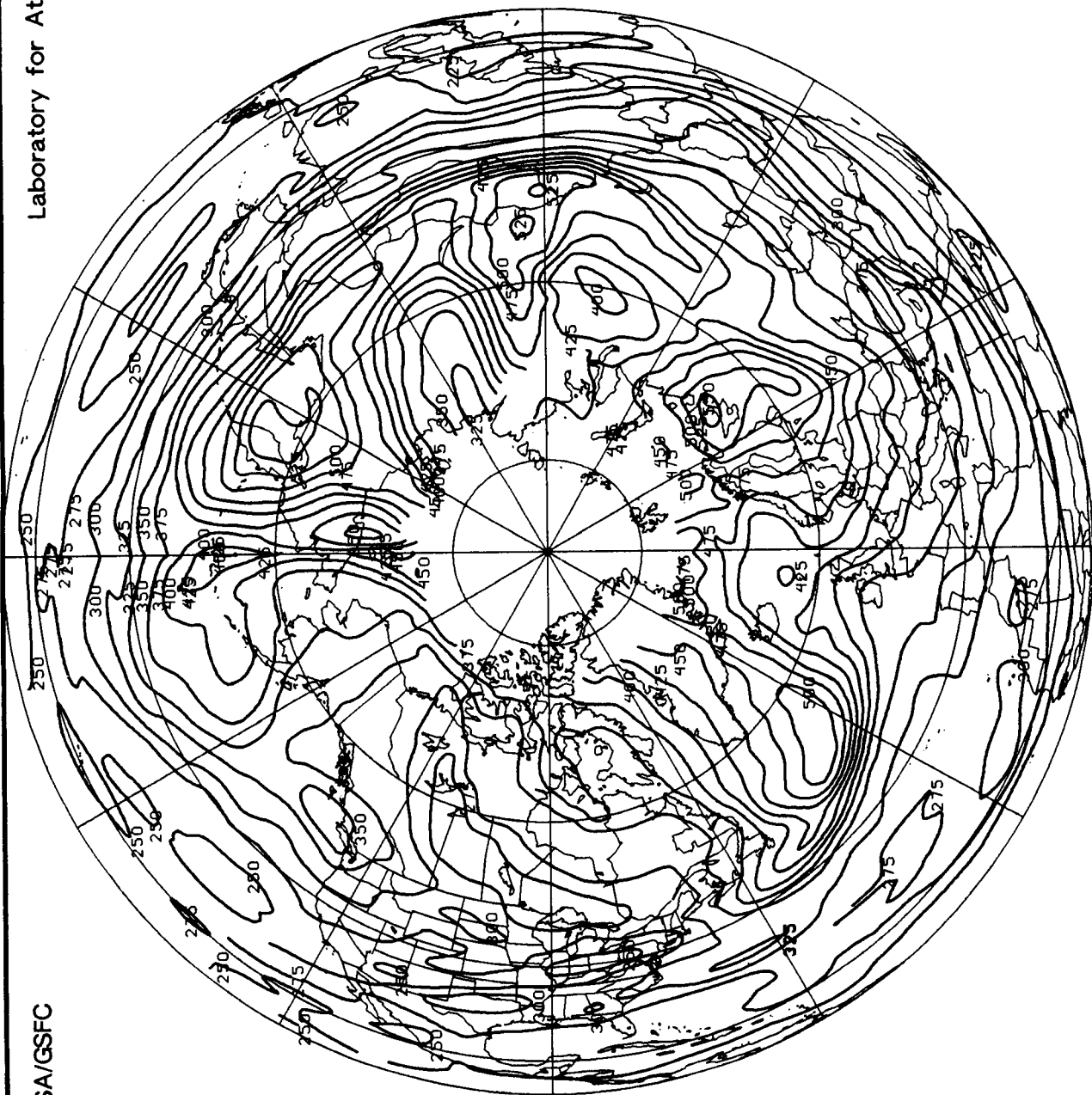


February 17, 1989

Gridded TOMS Ozone (Dobson Units)



Laboratory for Atmospheres



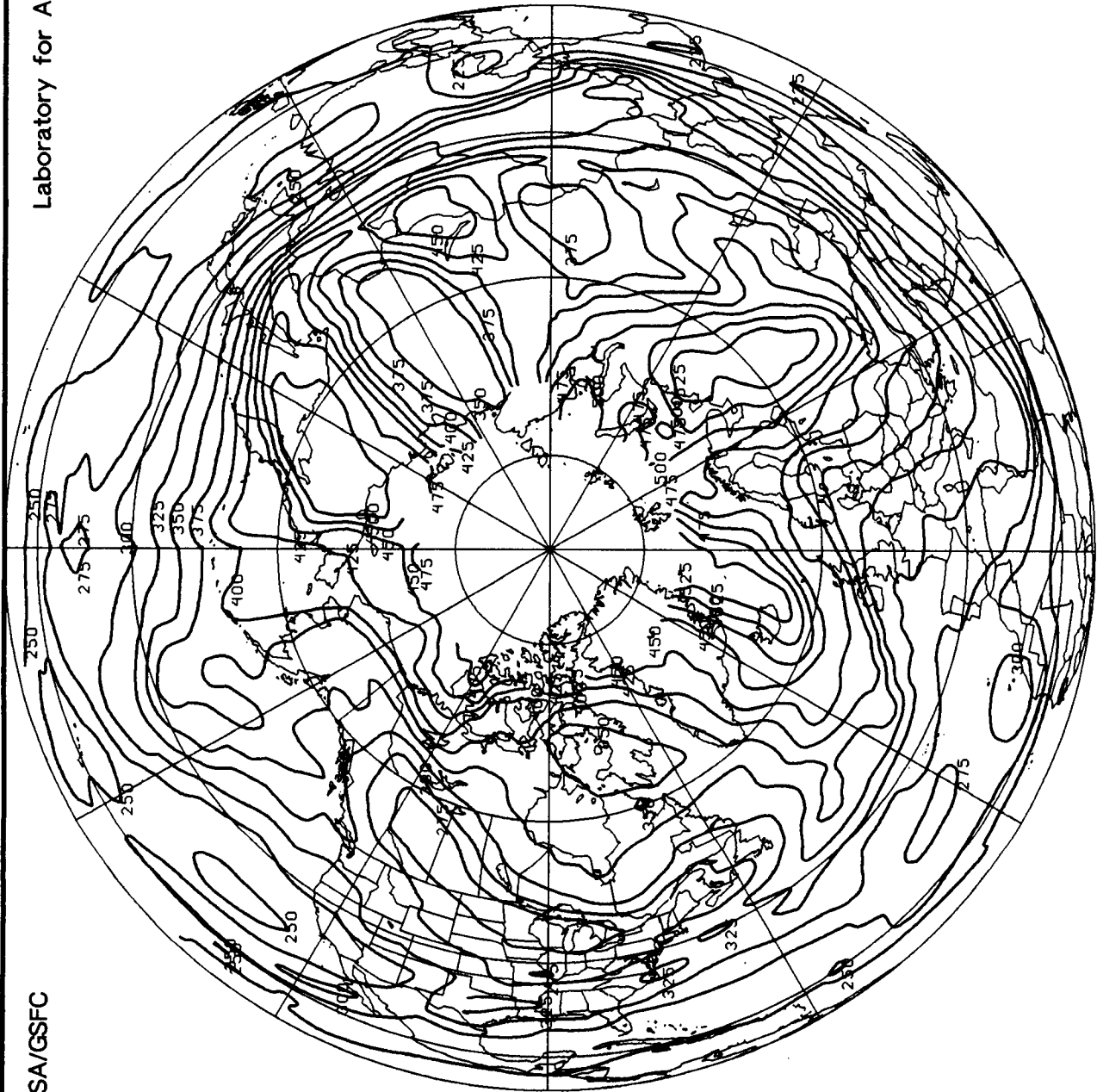
NASA/GSFC

Gridded TOMS Ozone (Dobson Units)

February 18, 1989

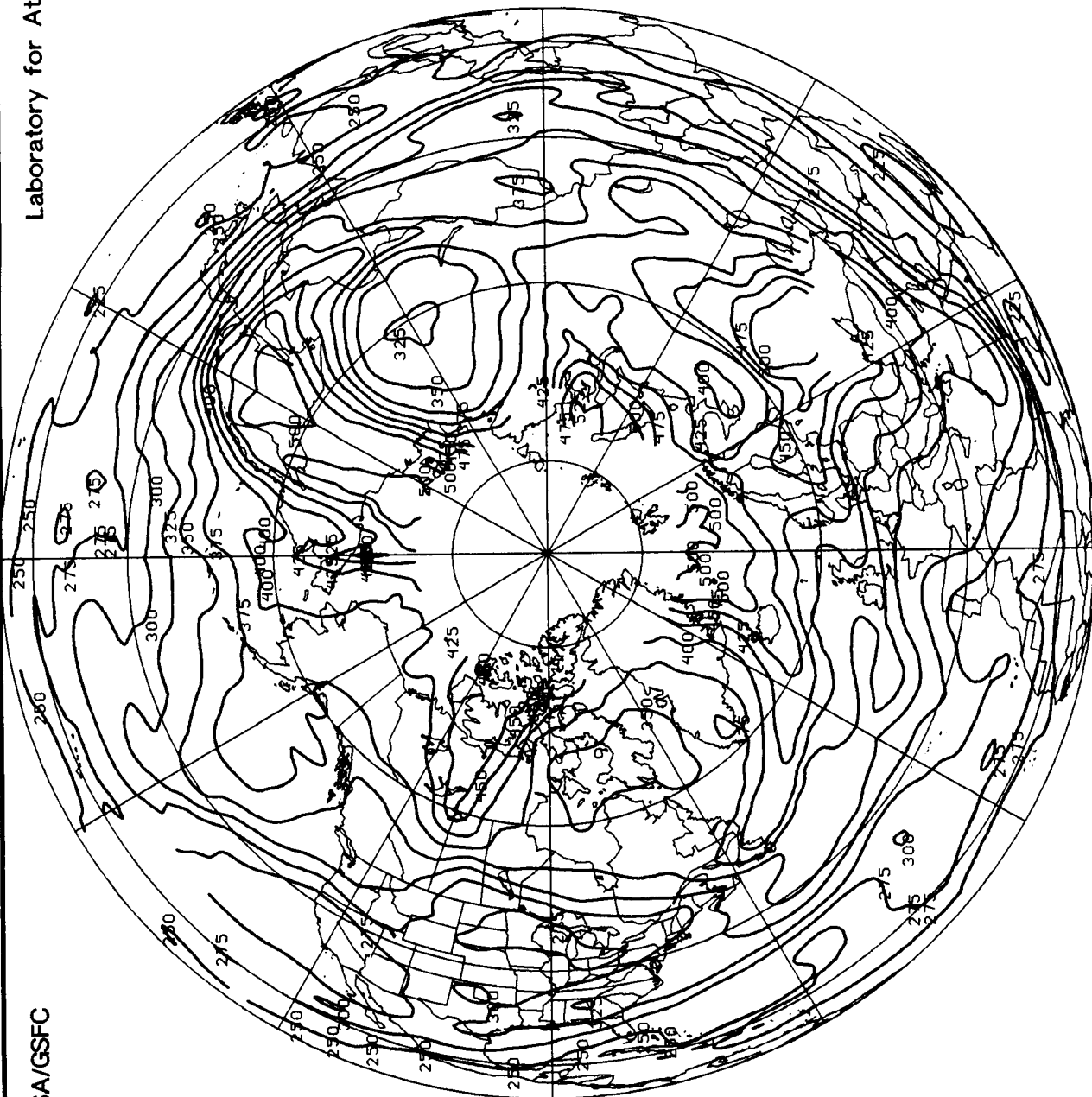
NASA/GSFC

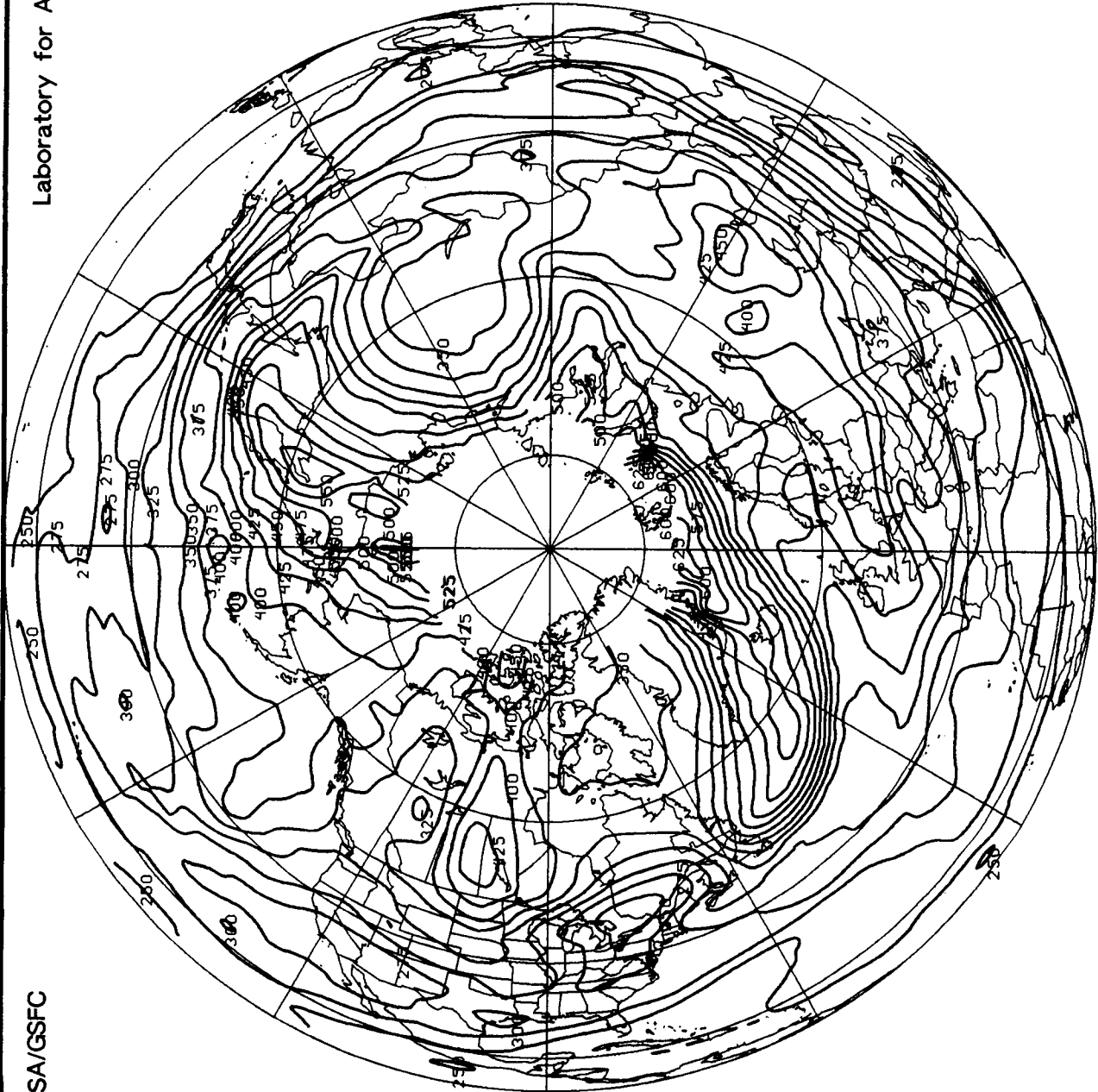
Laboratory for Atmospheres



February 19, 1989

Gridded TOMS Ozone (Dobson Units)



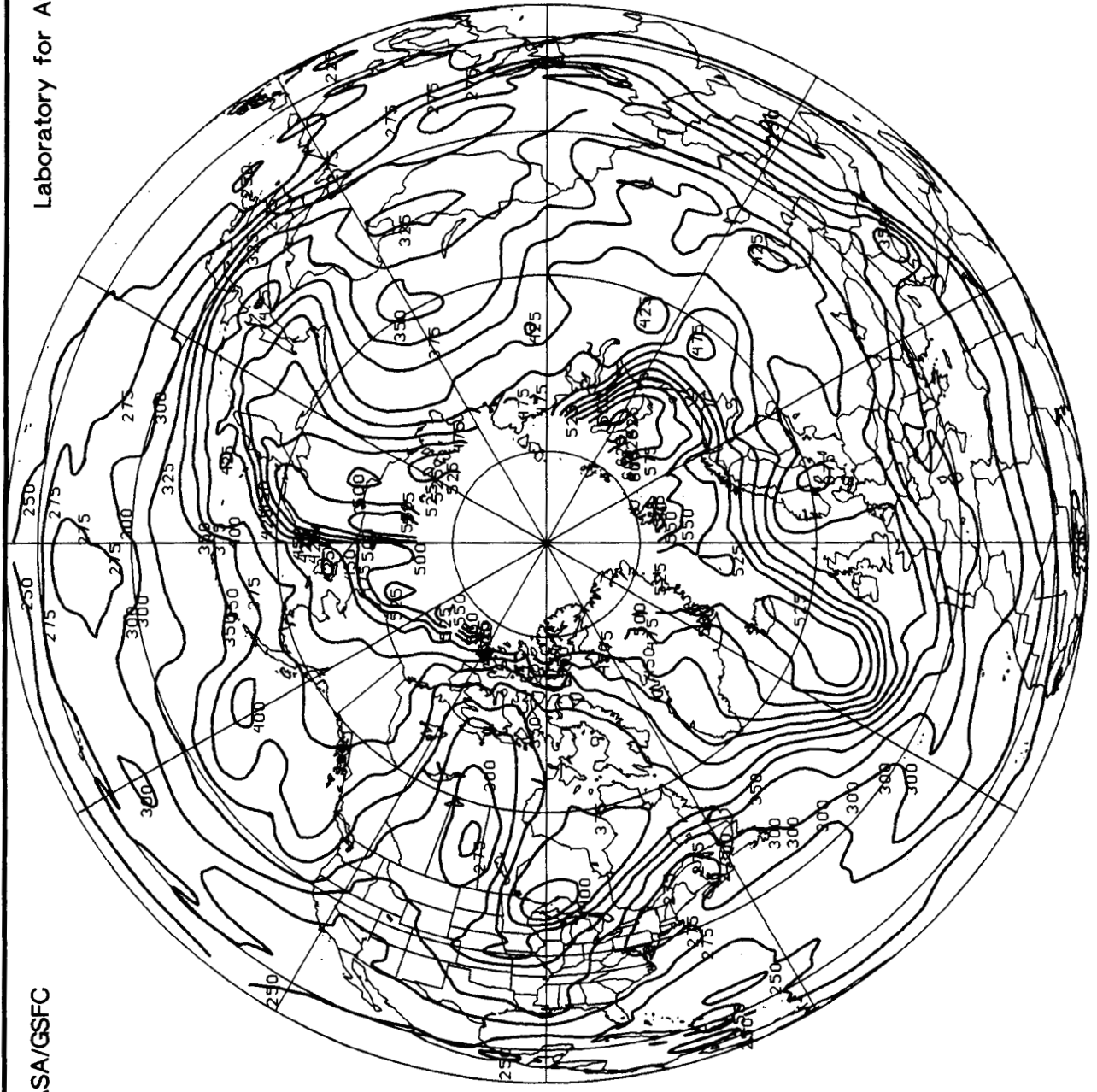


February 21, 1989

Gridded TOMS Ozone (Dobson Units)

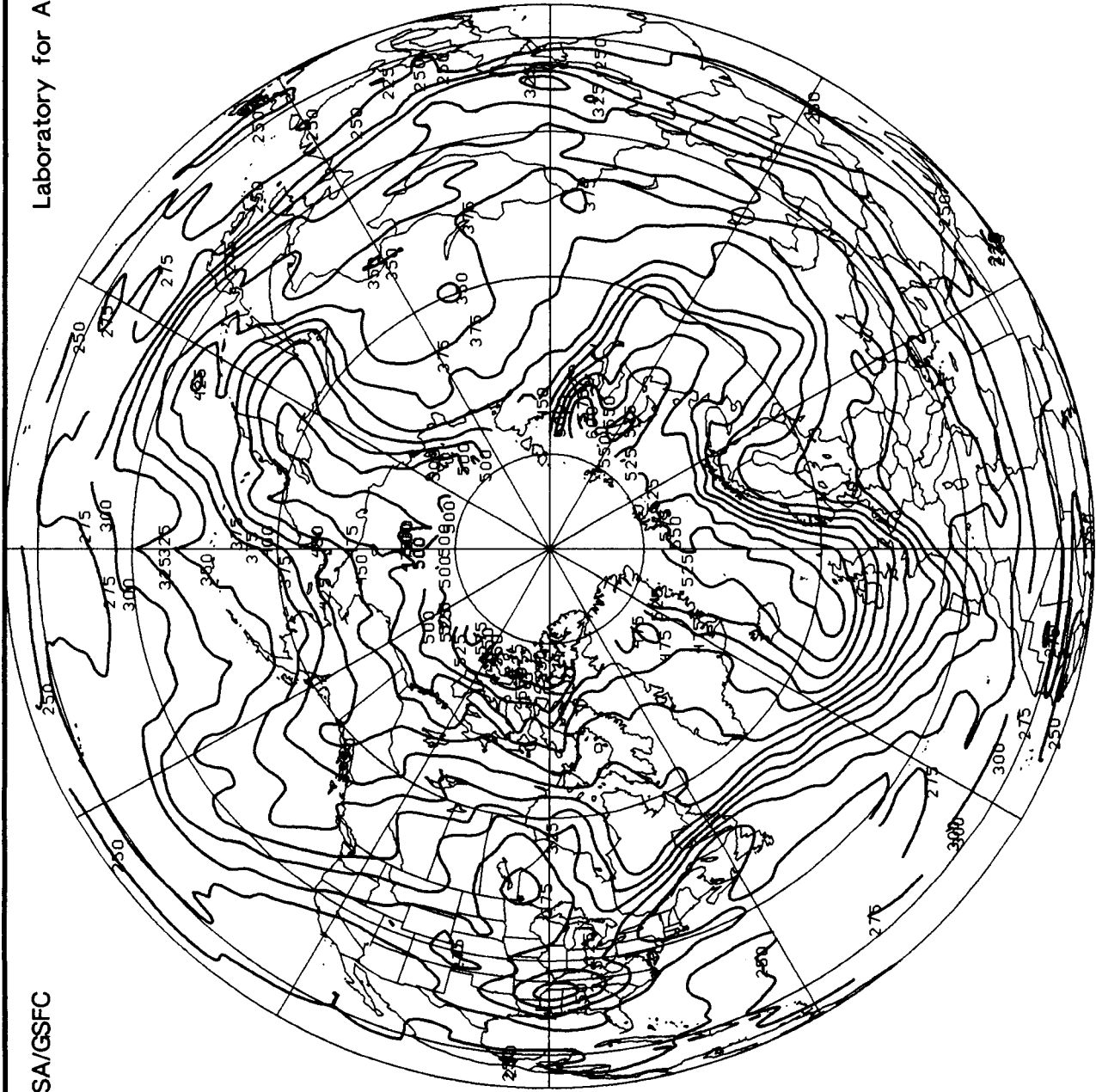
NASA/GSFC

Laboratory for Atmospheres



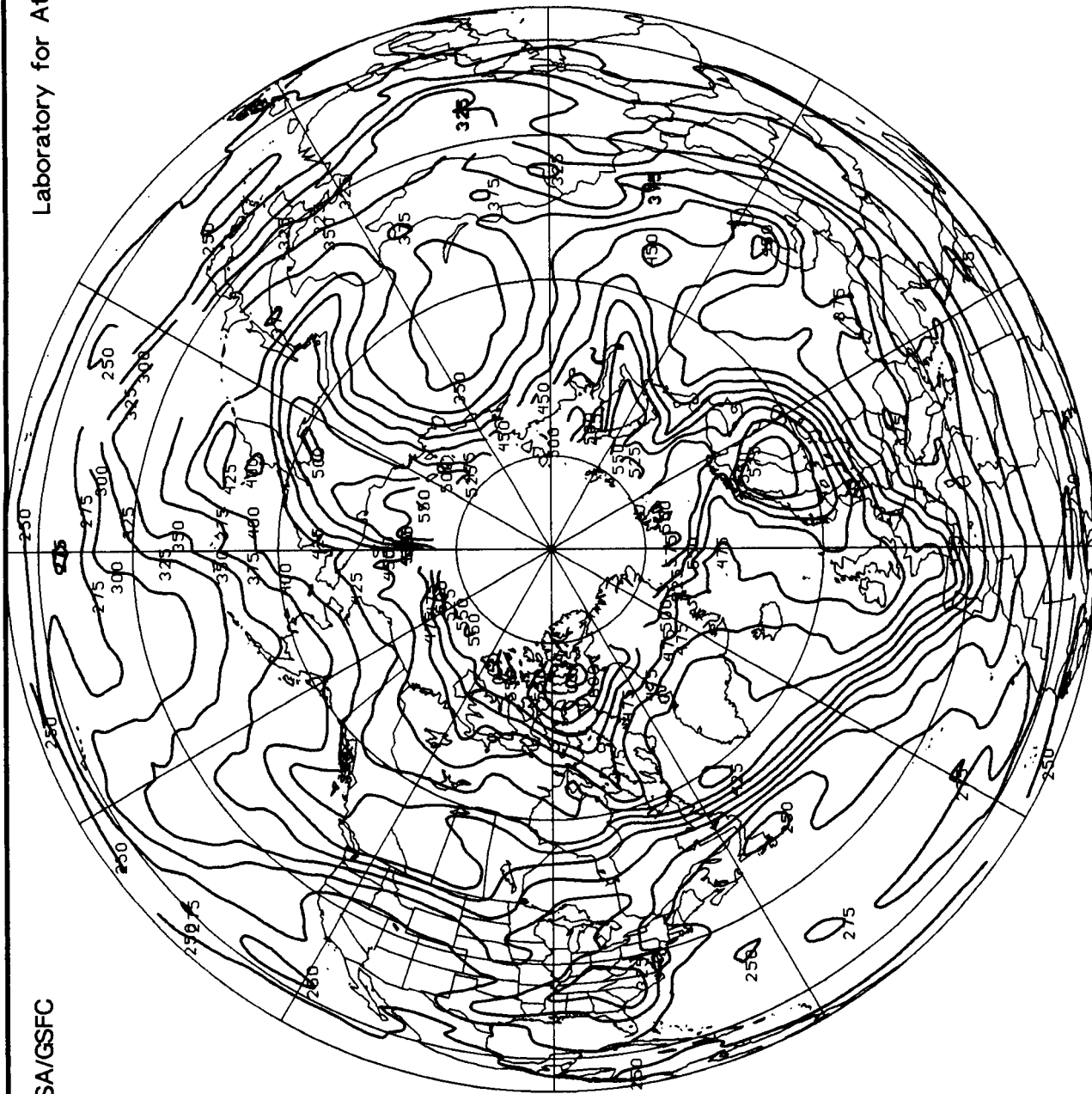
February 22 1990

Gridded TOMS Ozone (Dobson Units)



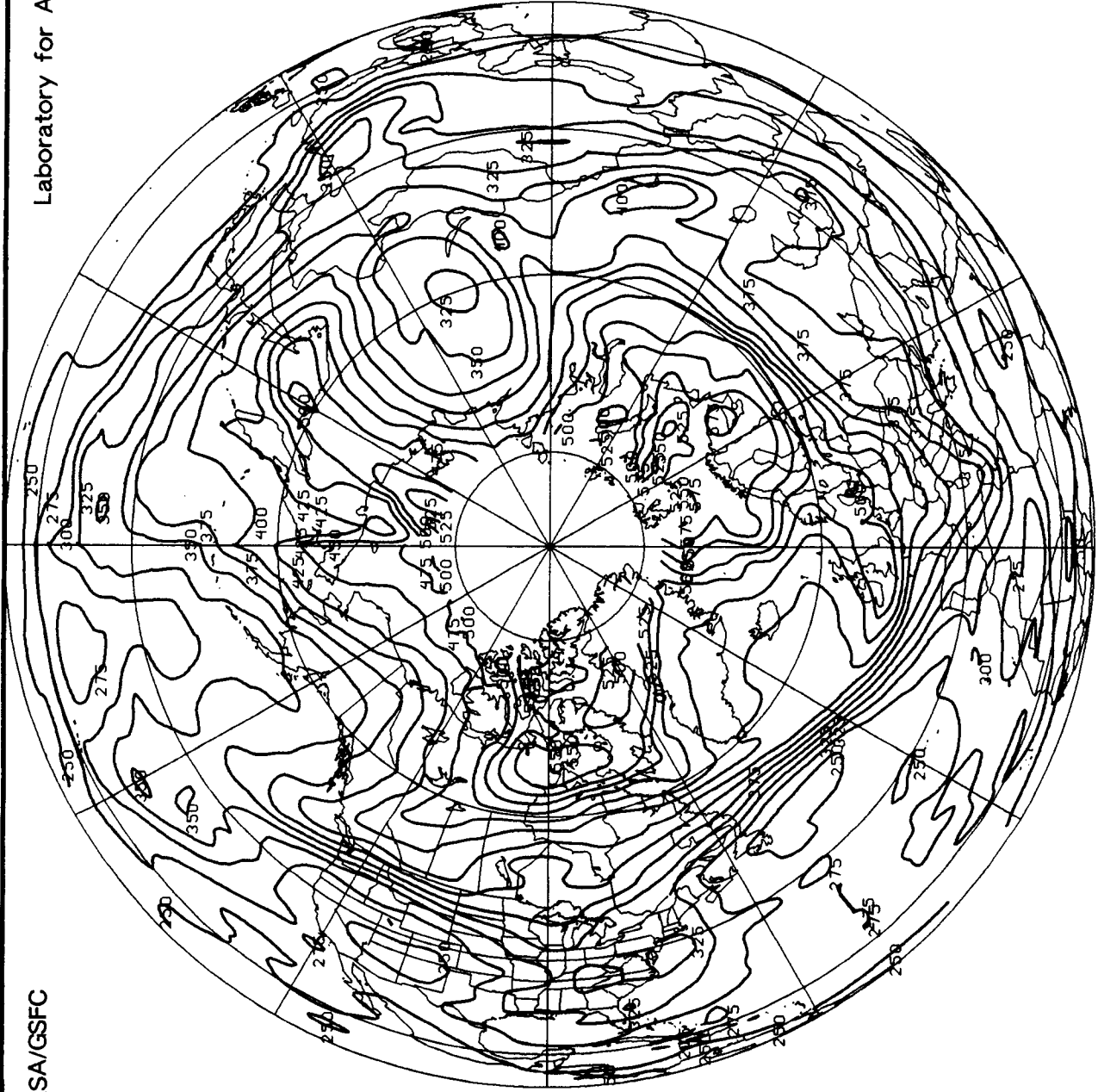
Gridded TOMS Ozone (Dobson Units)

February 23, 1989



NASA/GSFC

Laboratory for Atmospheres

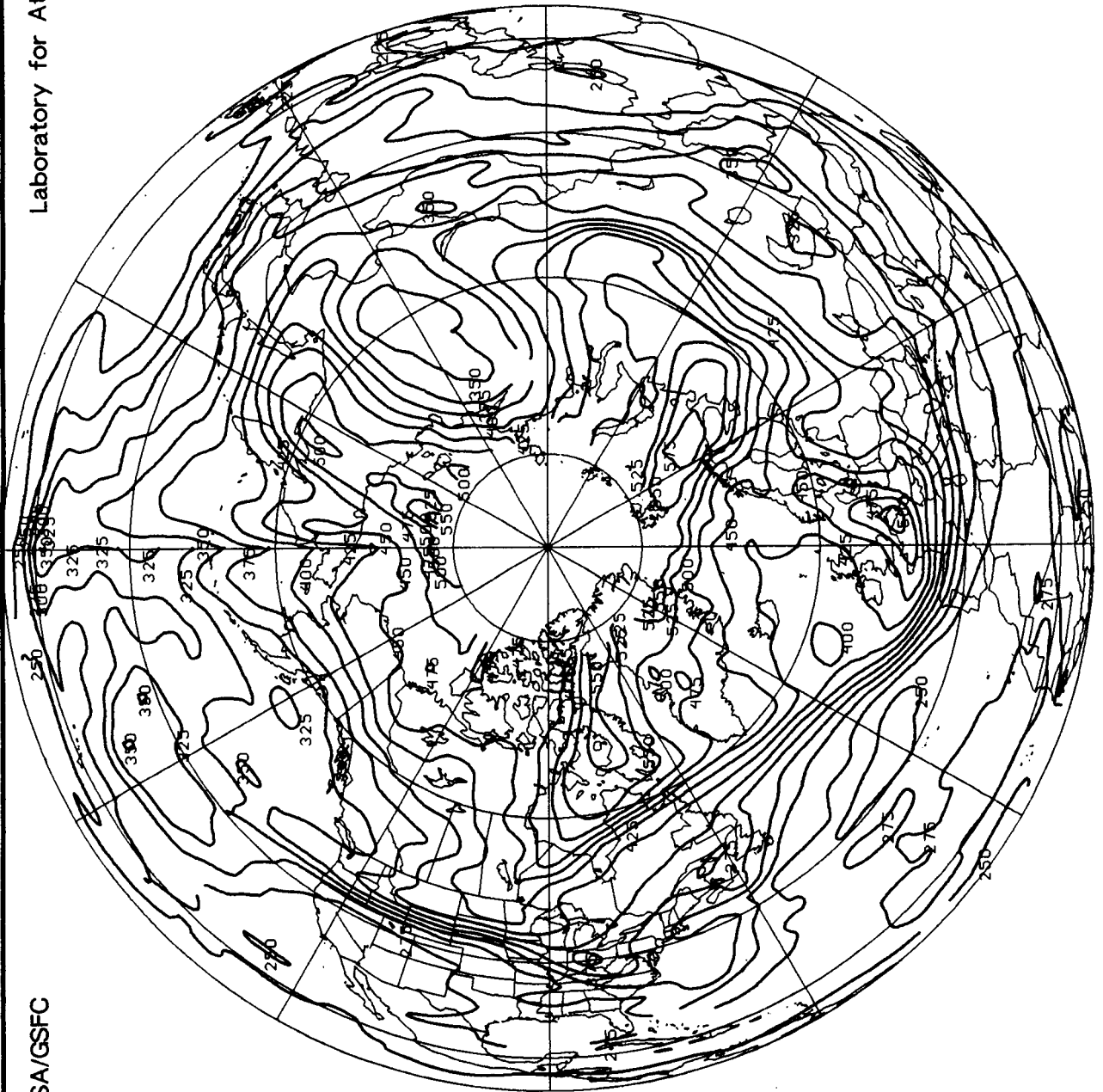


February 25, 1989

Gridded TOMS Ozone (Dobson Units)



Laboratory for Atmospheres



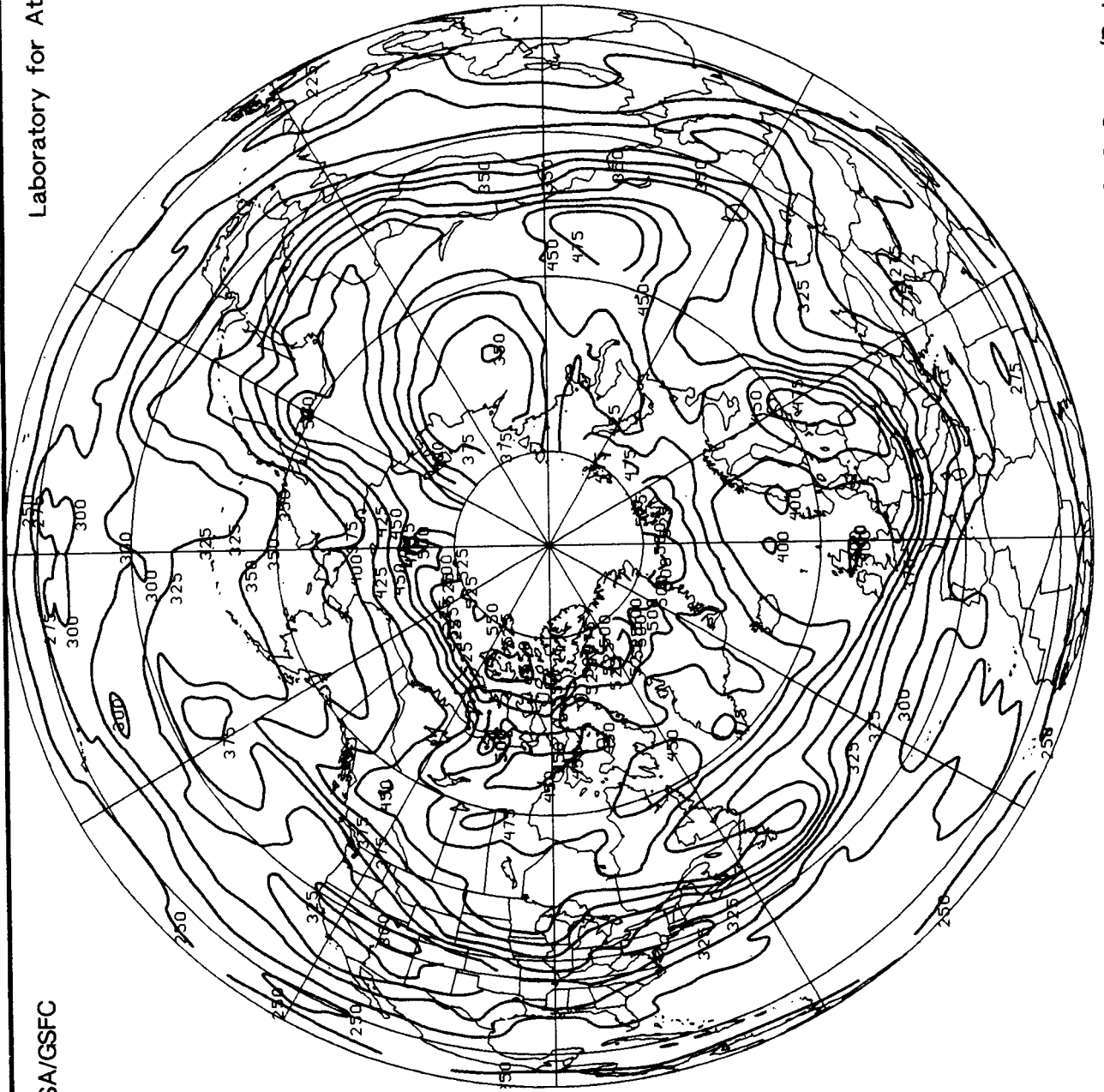
NASA/GSFC

Gridded TOMS Ozone (Dobson Units)

February 26, 1989



Laboratory for Atmospheres



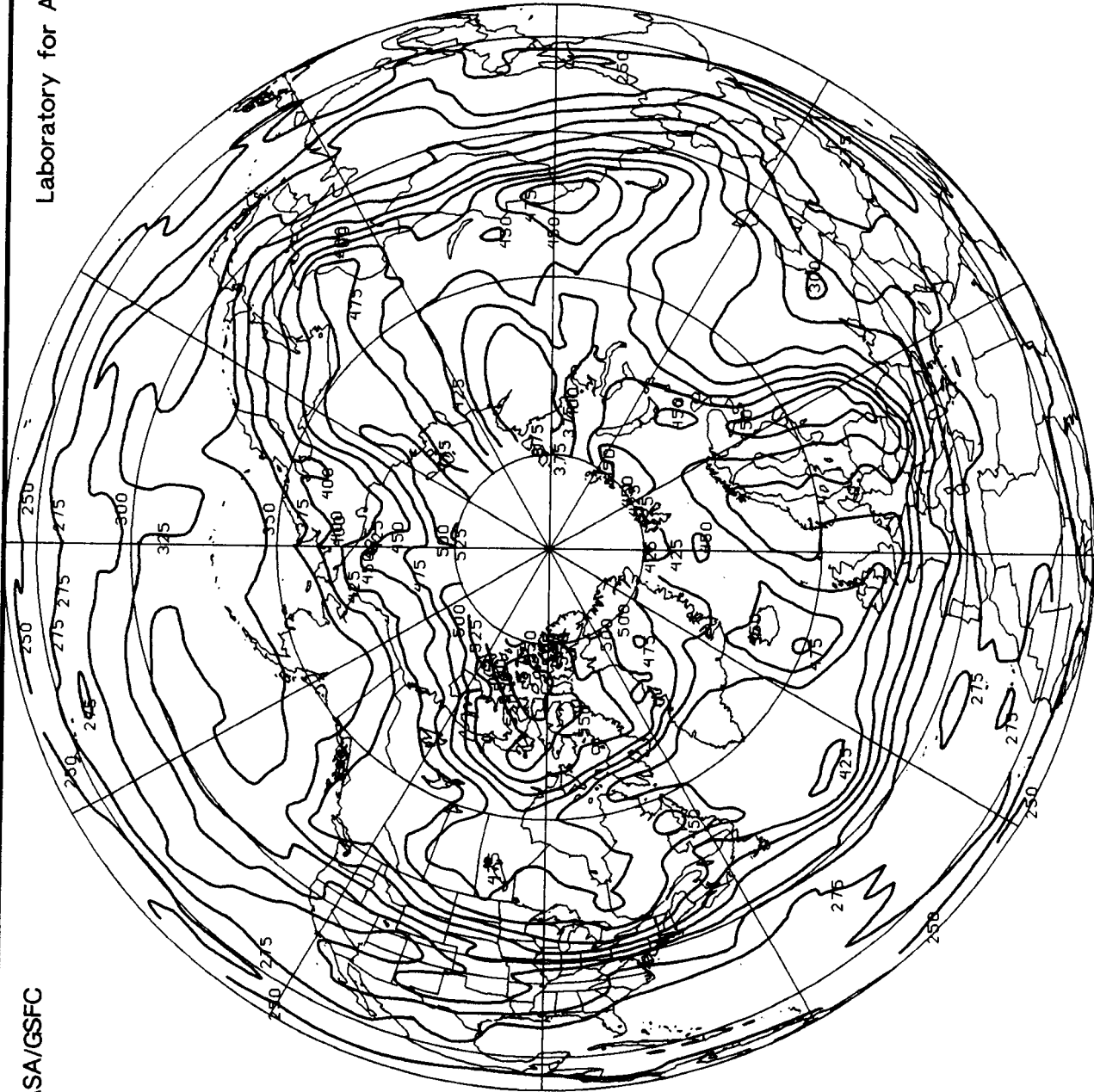
NASA/GSFC

Gridded TOMS Ozone (Dobson Units)

February 28, 1989

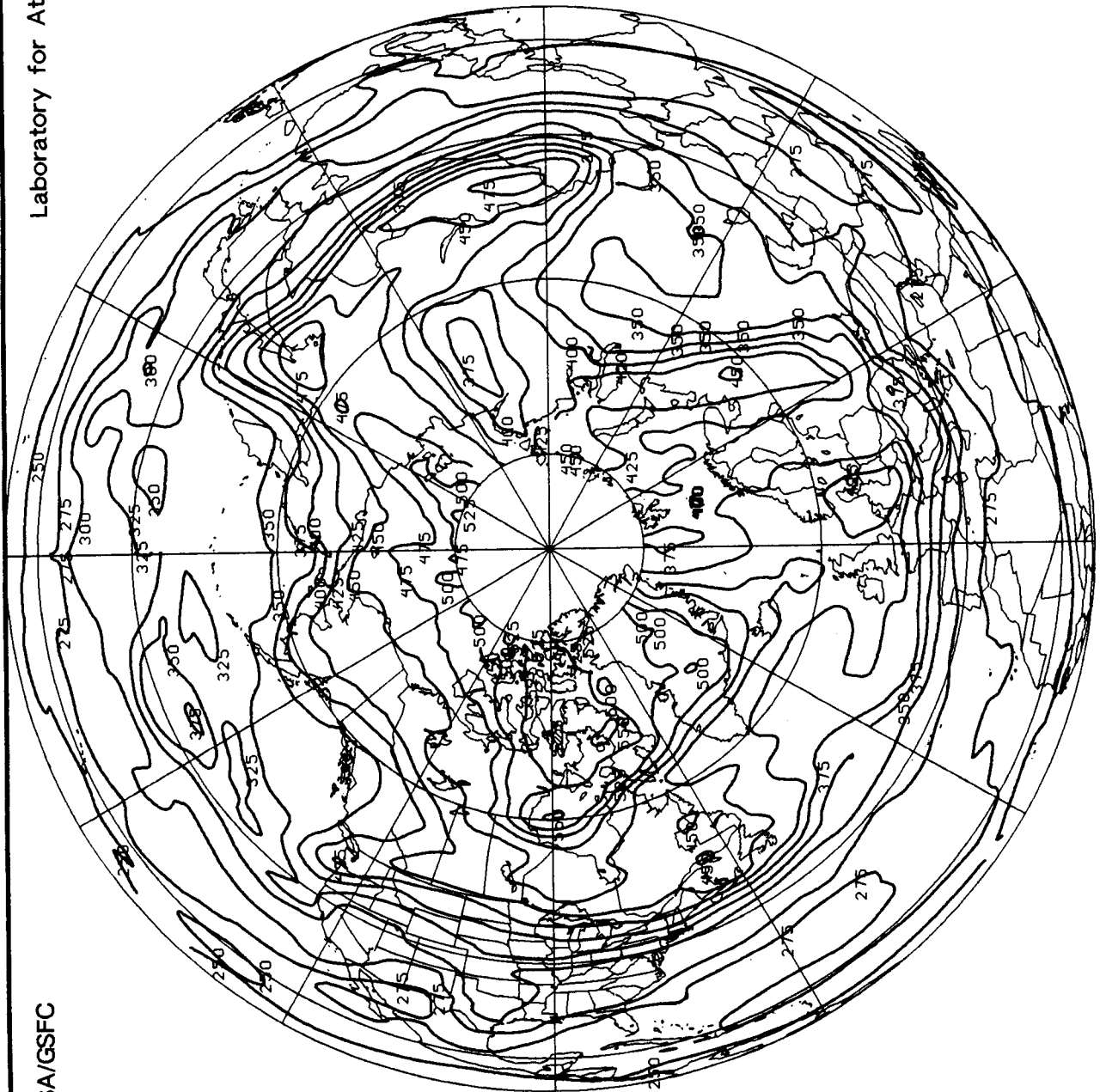
NASA/GSFC

Laboratory for Atmospheres



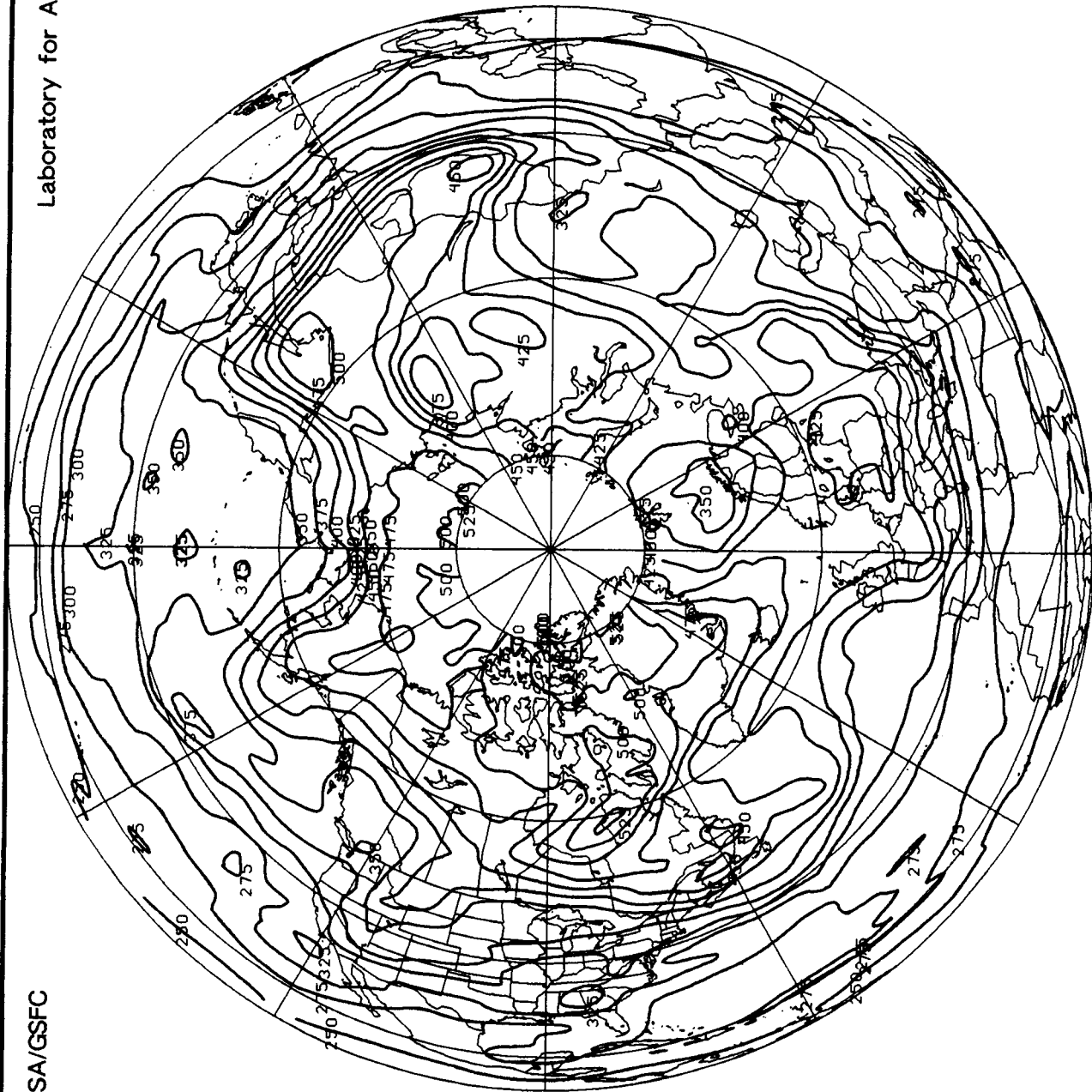
March 1, 1989

Gridded TOMS Ozone (Dobson Units)



NASA/GSFC

Laboratory for Atmospheres

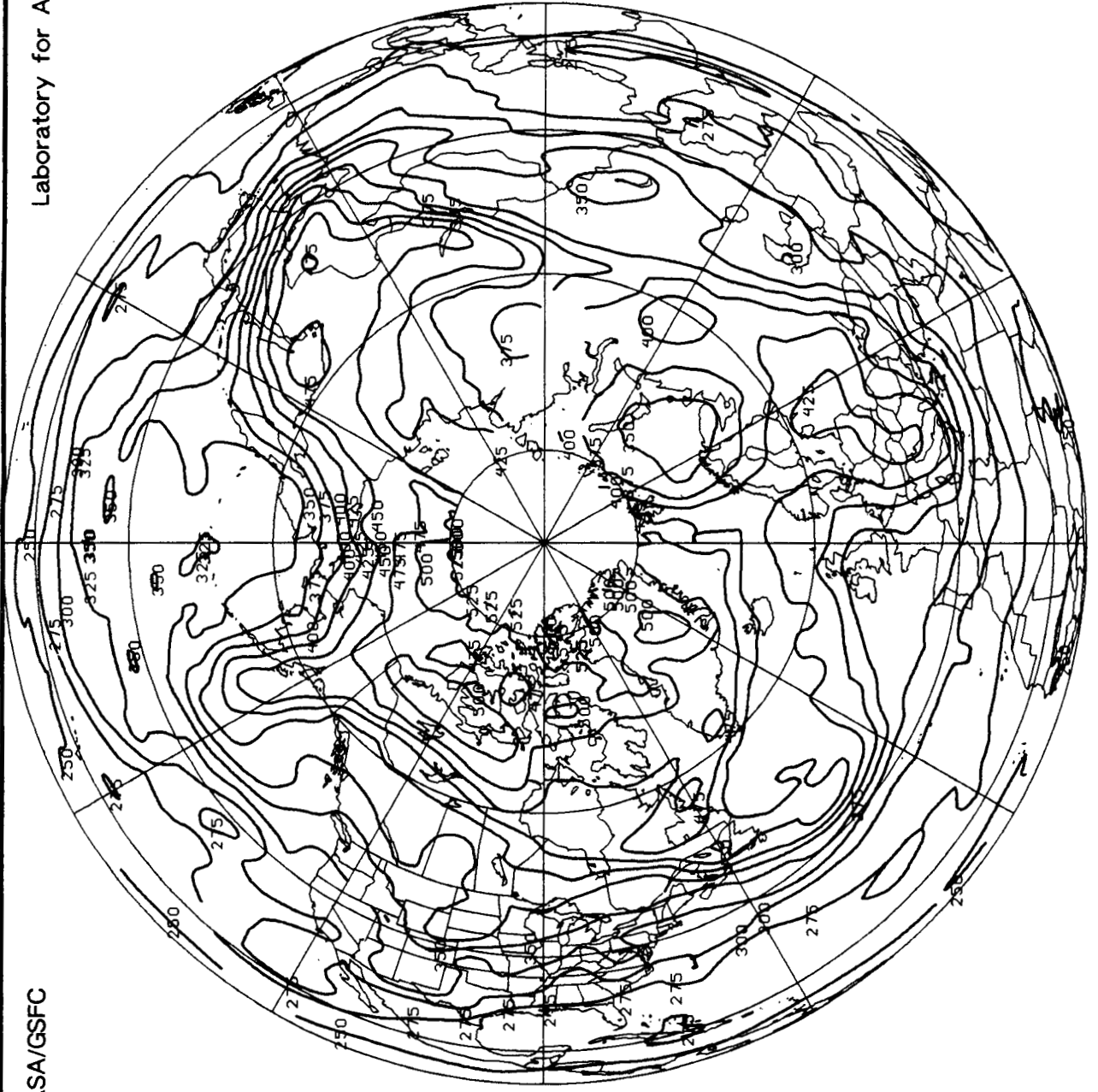


March 3, 1989

Gridded TOMS Ozone (Dobson Units)

NASA/GSFC

Laboratory for Atmospheres

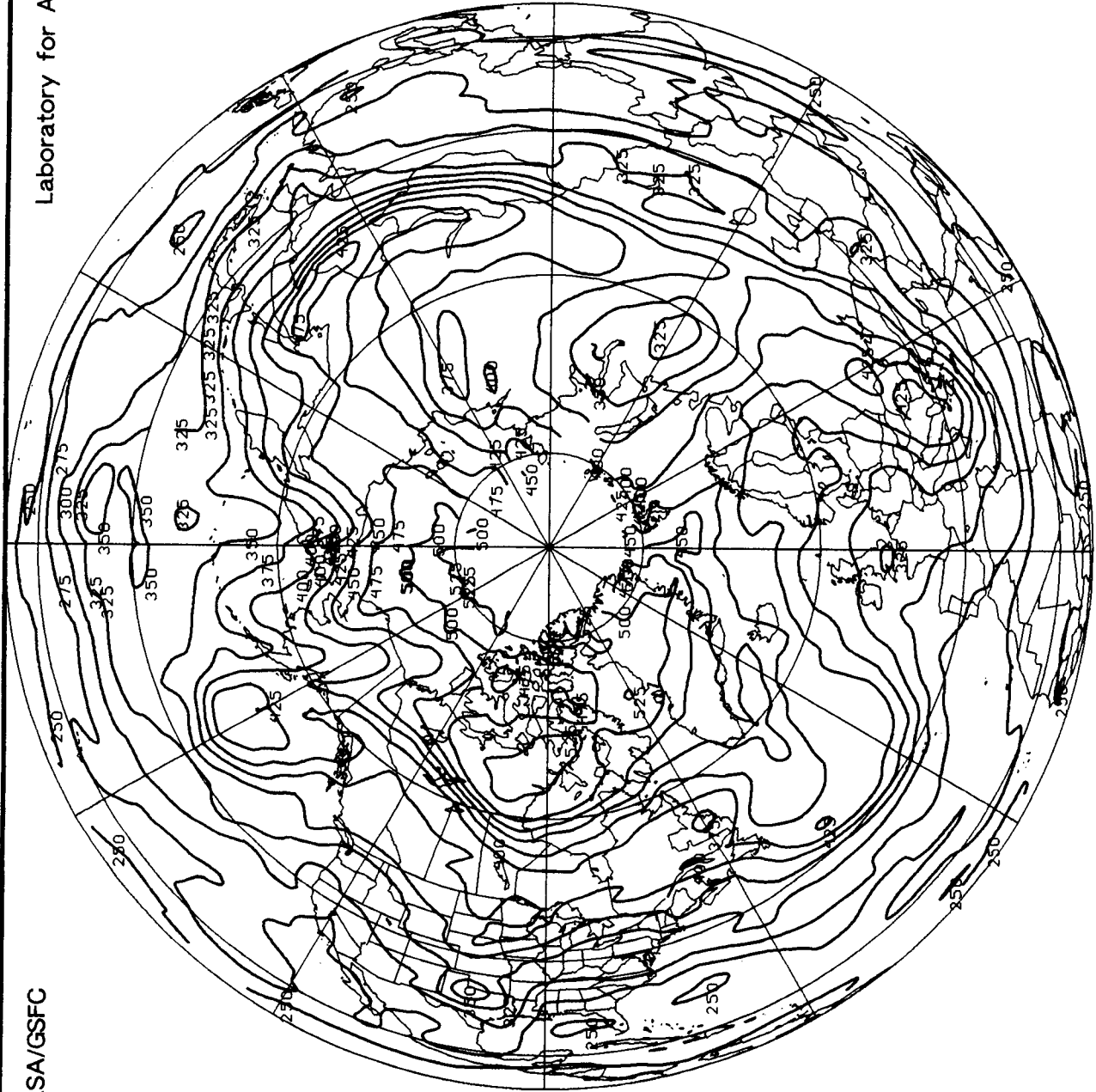


March 4, 1989

Gridded TOMS Ozone (Dobson Units)

NASA/GSFC

Laboratory for Atmospheres



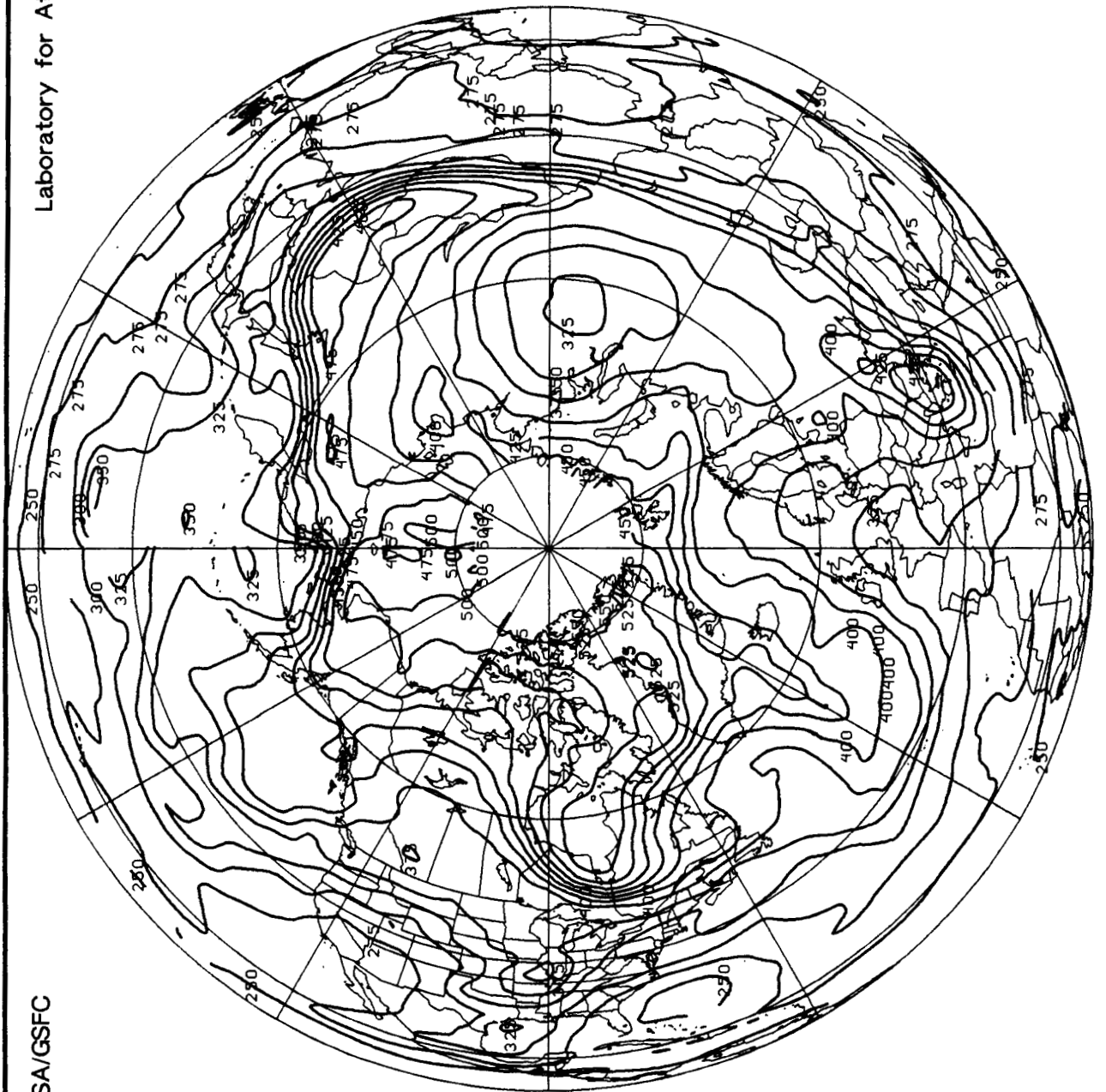
March 5, 1989

Gridded TOMS Ozone (Dobson Units)



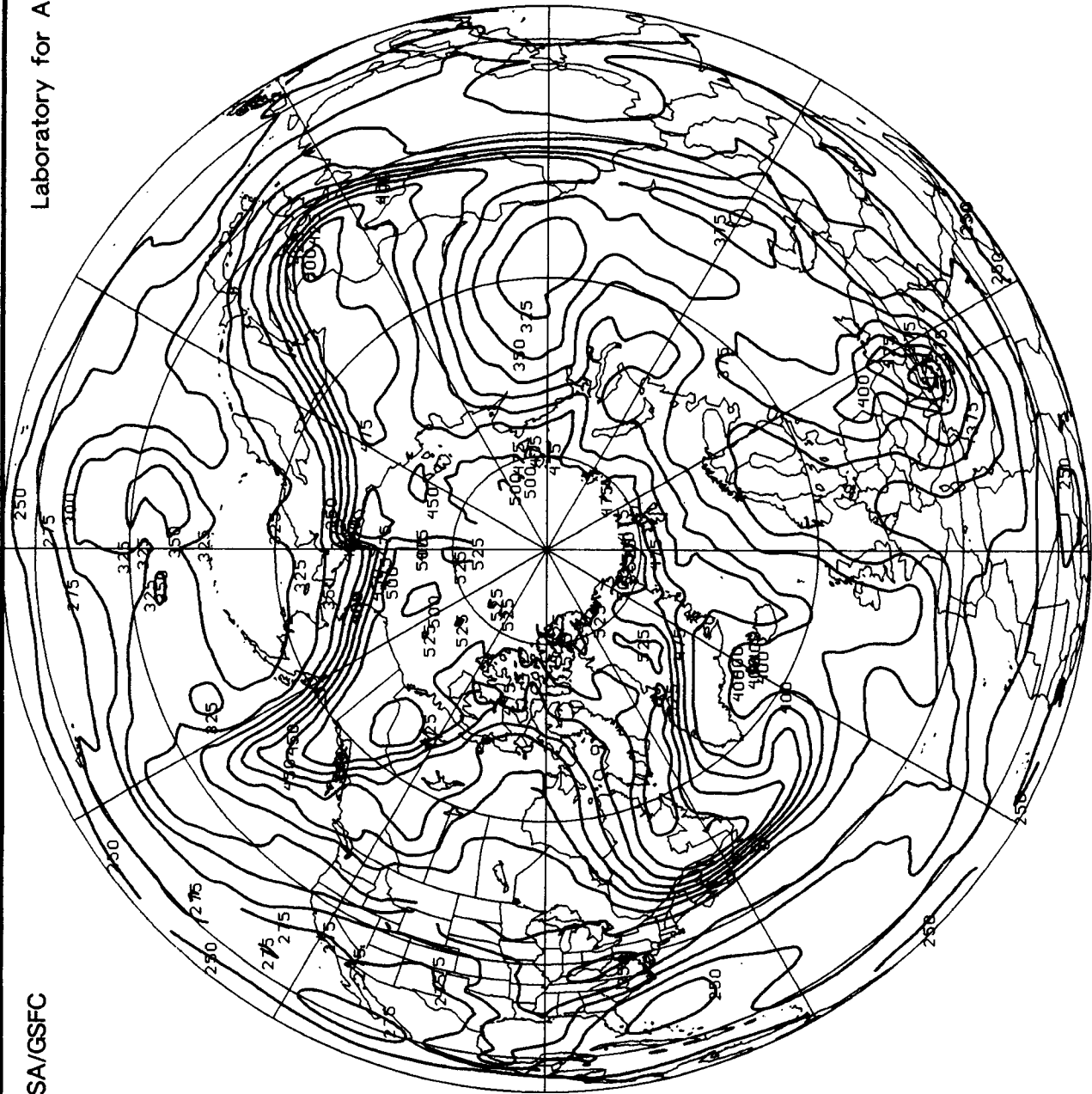
NASA/GSFC

Laboratory for Atmospheres



March 6, 1989

Gridded TOMS Ozone (Dobson Units)

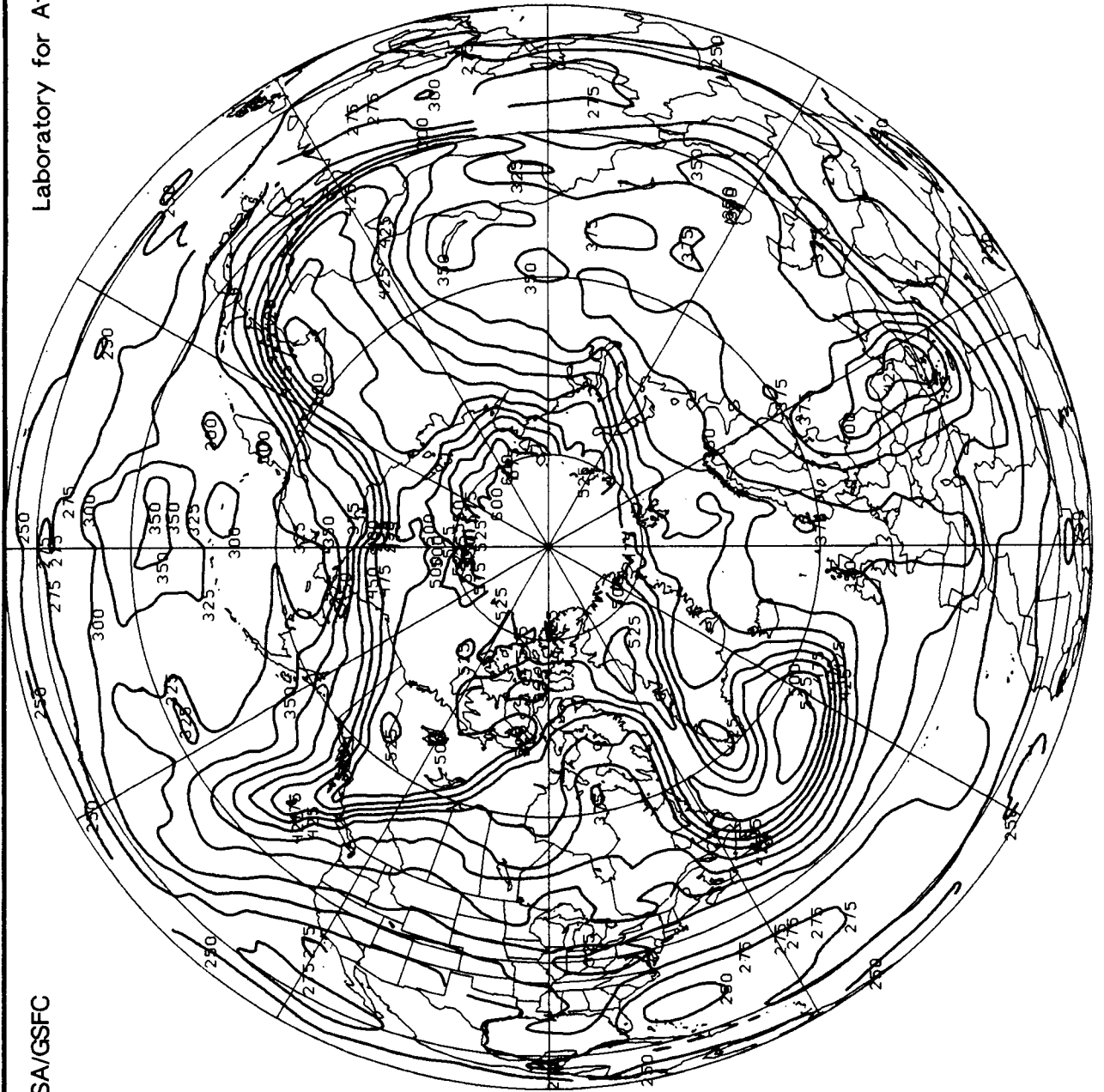


March 7, 1989

Gridded TOMS Ozone (Dobson Units)

NASA/GSFC

Laboratory for Atmospheres

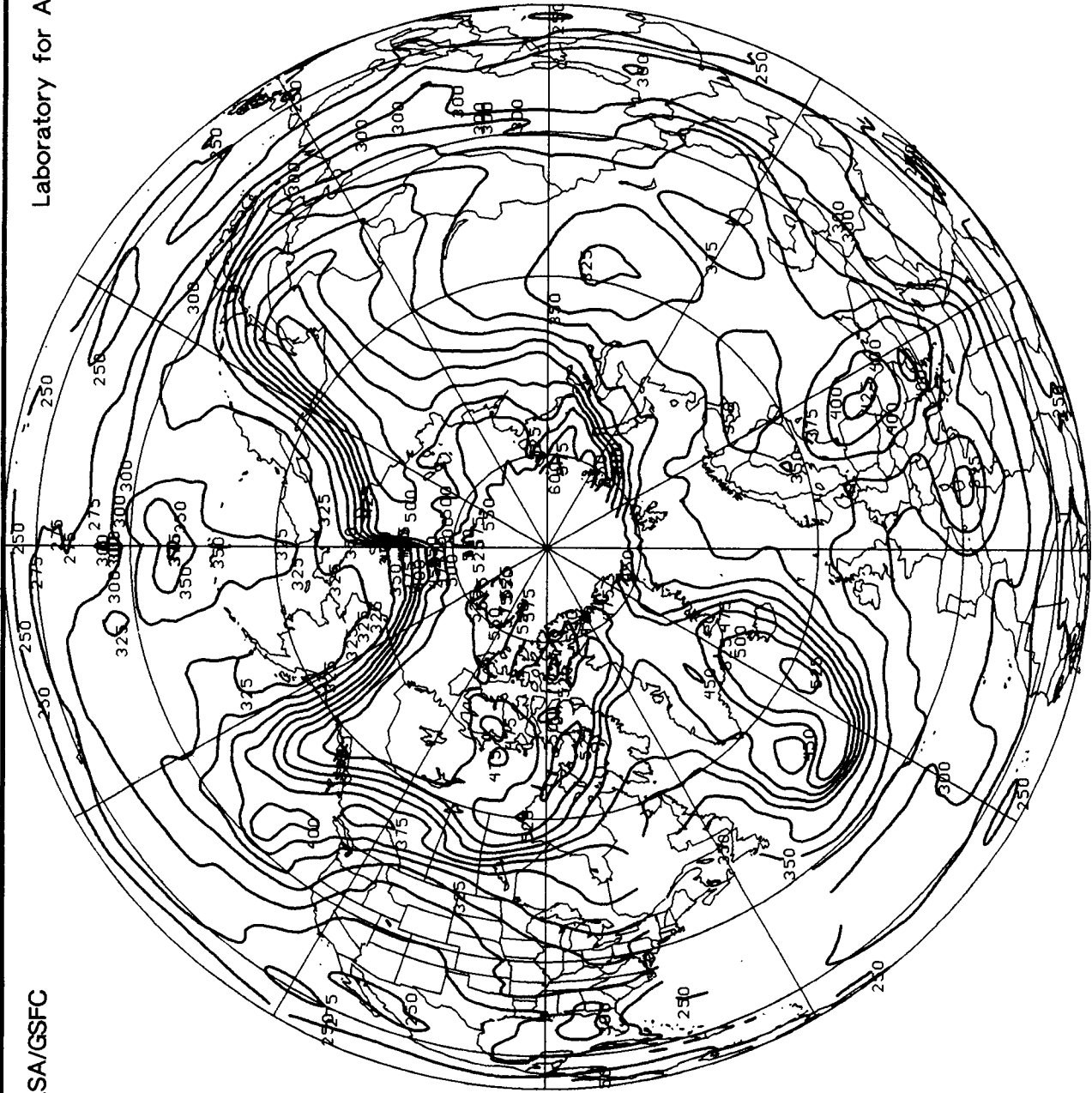


March 8, 1989

Gridded TOMS Ozone (Dobson Units)

NASA/GSFC

Laboratory for Atmospheres

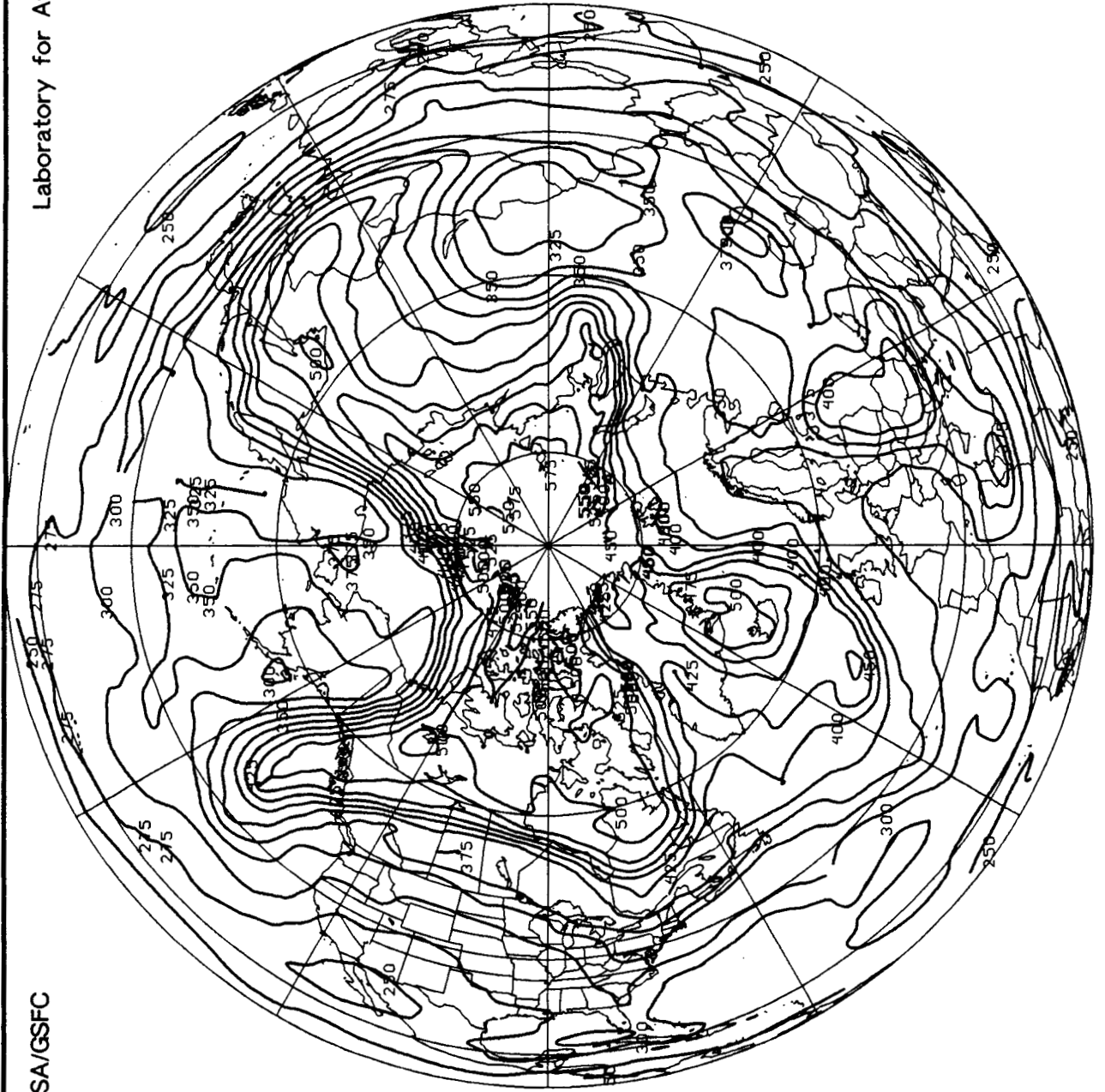


March 9, 1989

Gridded TOMS Ozone (Dobson Units)

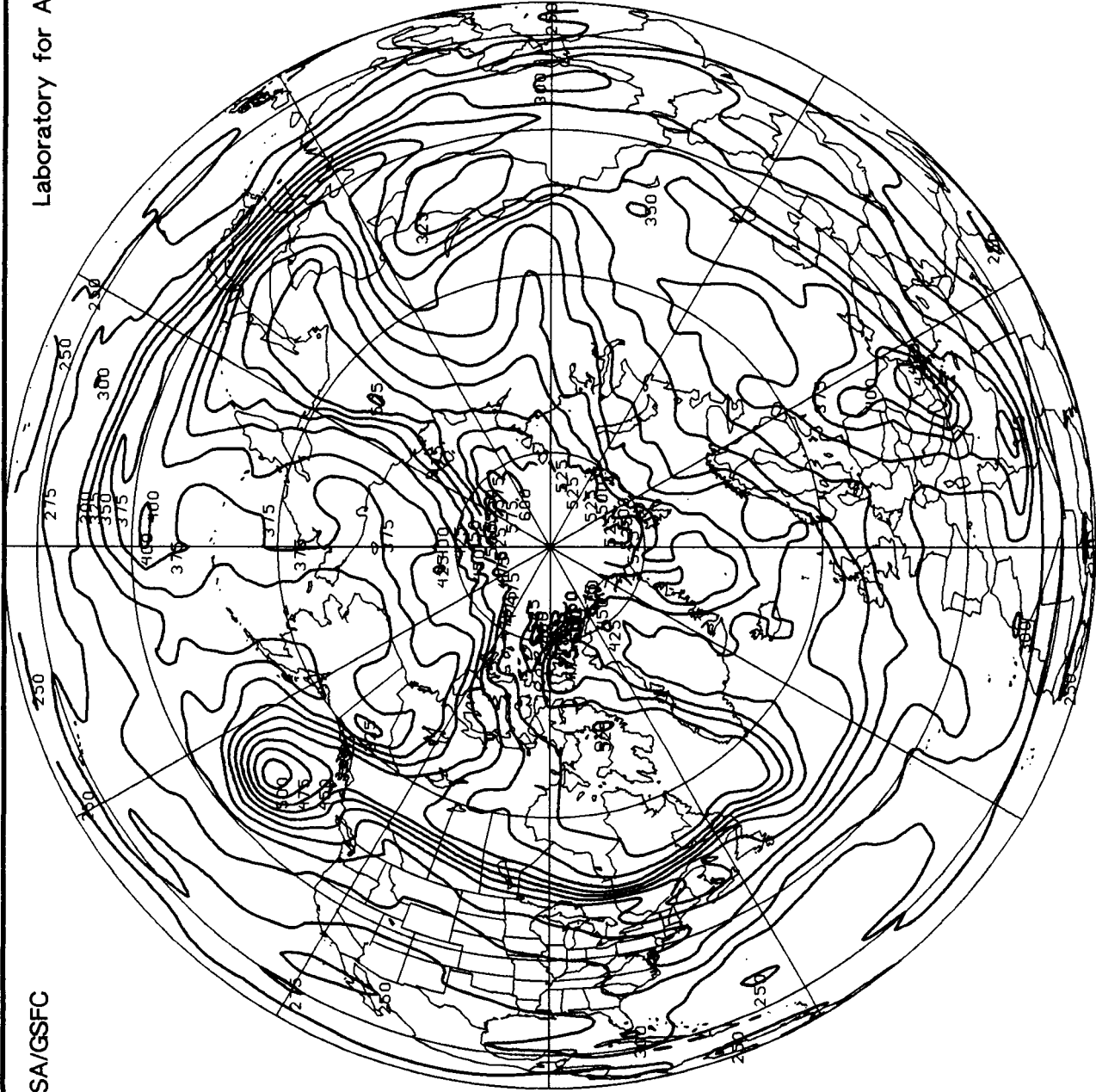
NASA/GSFC

Laboratory for Atmospheres



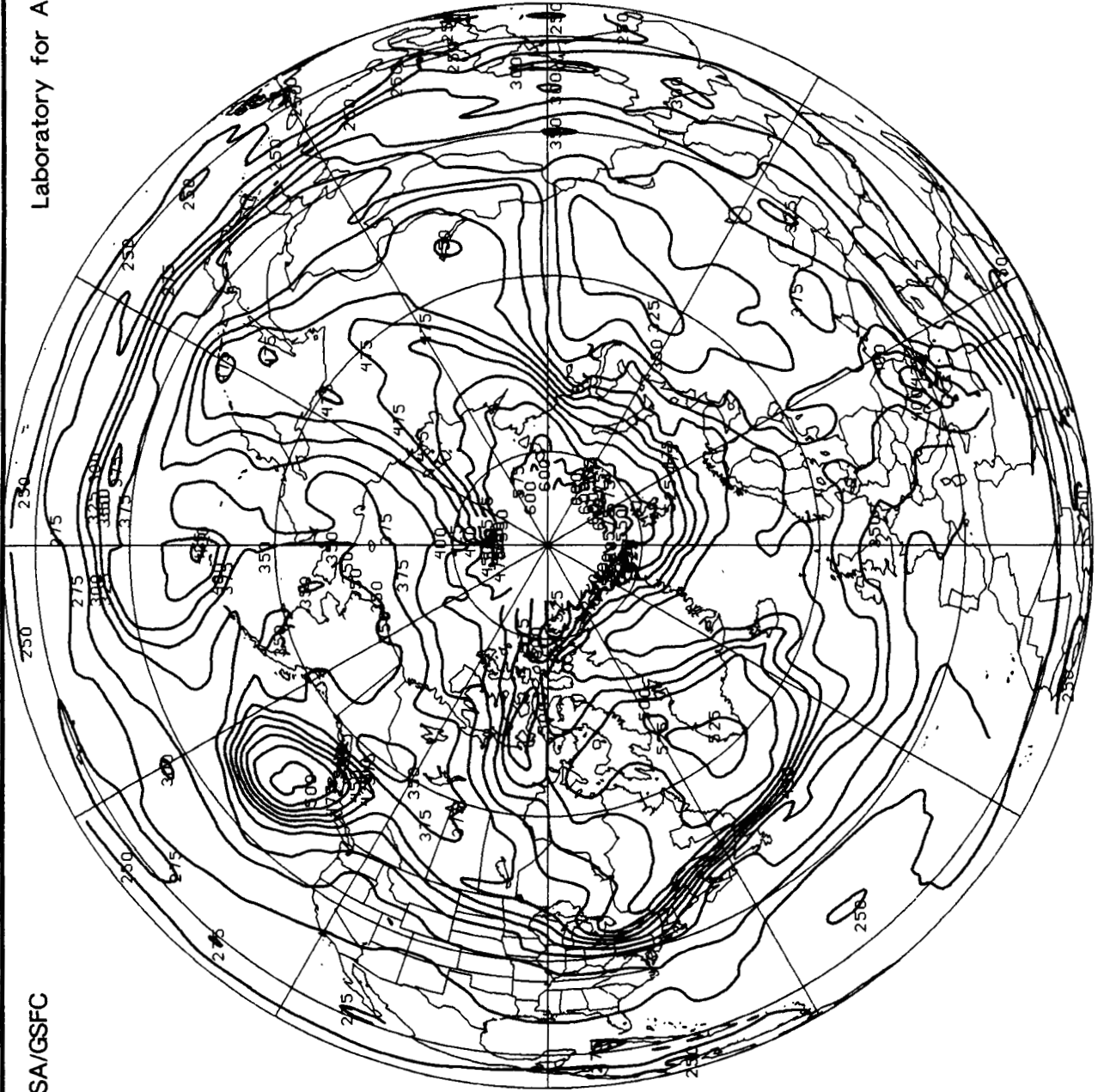
March 10, 1989

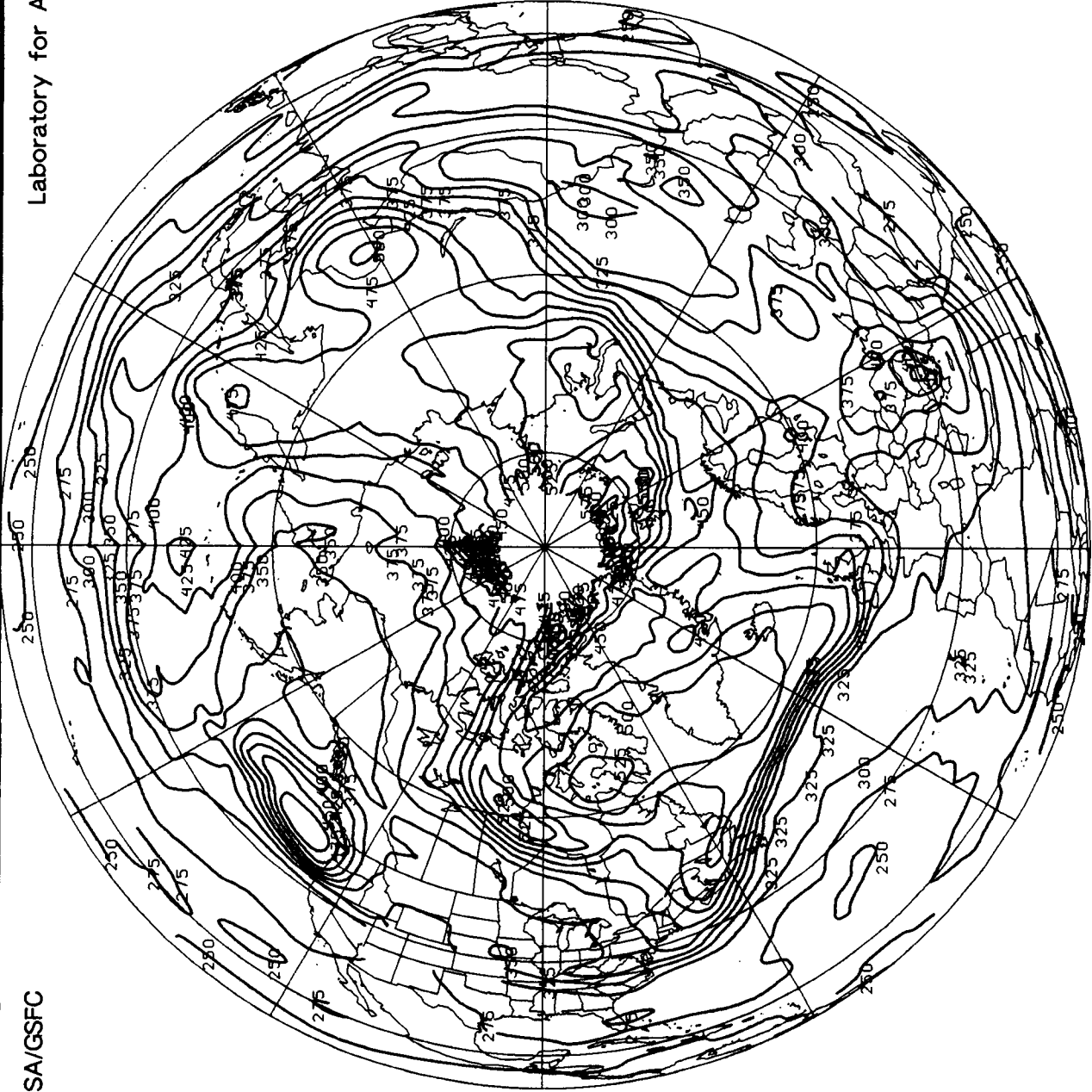
Gridded TOMS Ozone (Dobson Units)



March 11, 1989

Gridded TOMS Ozone (Dobson Units)



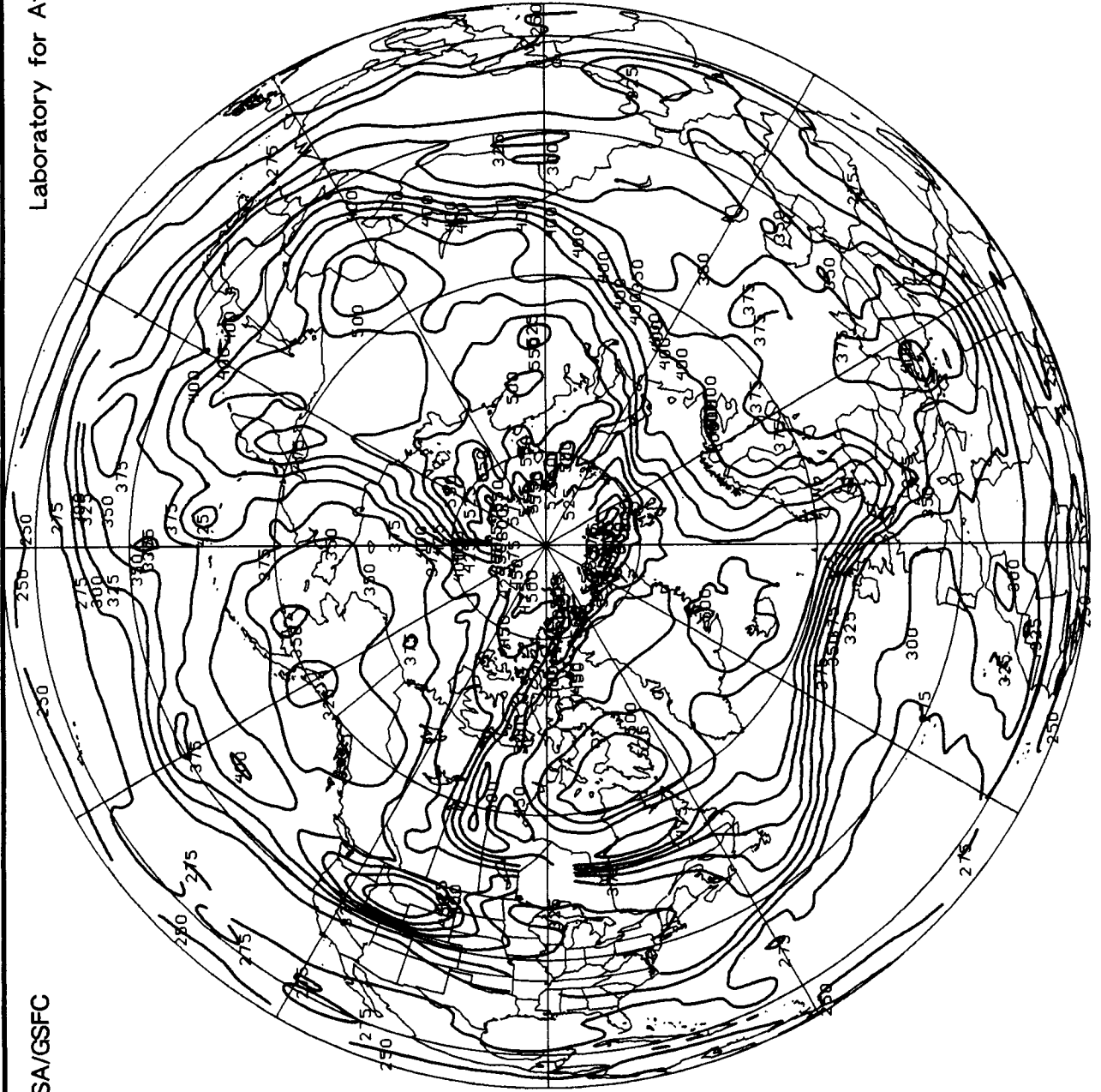


March 13, 1989

Gridded TOMS Ozone (Dobson Units)



Laboratory for Atmospheres



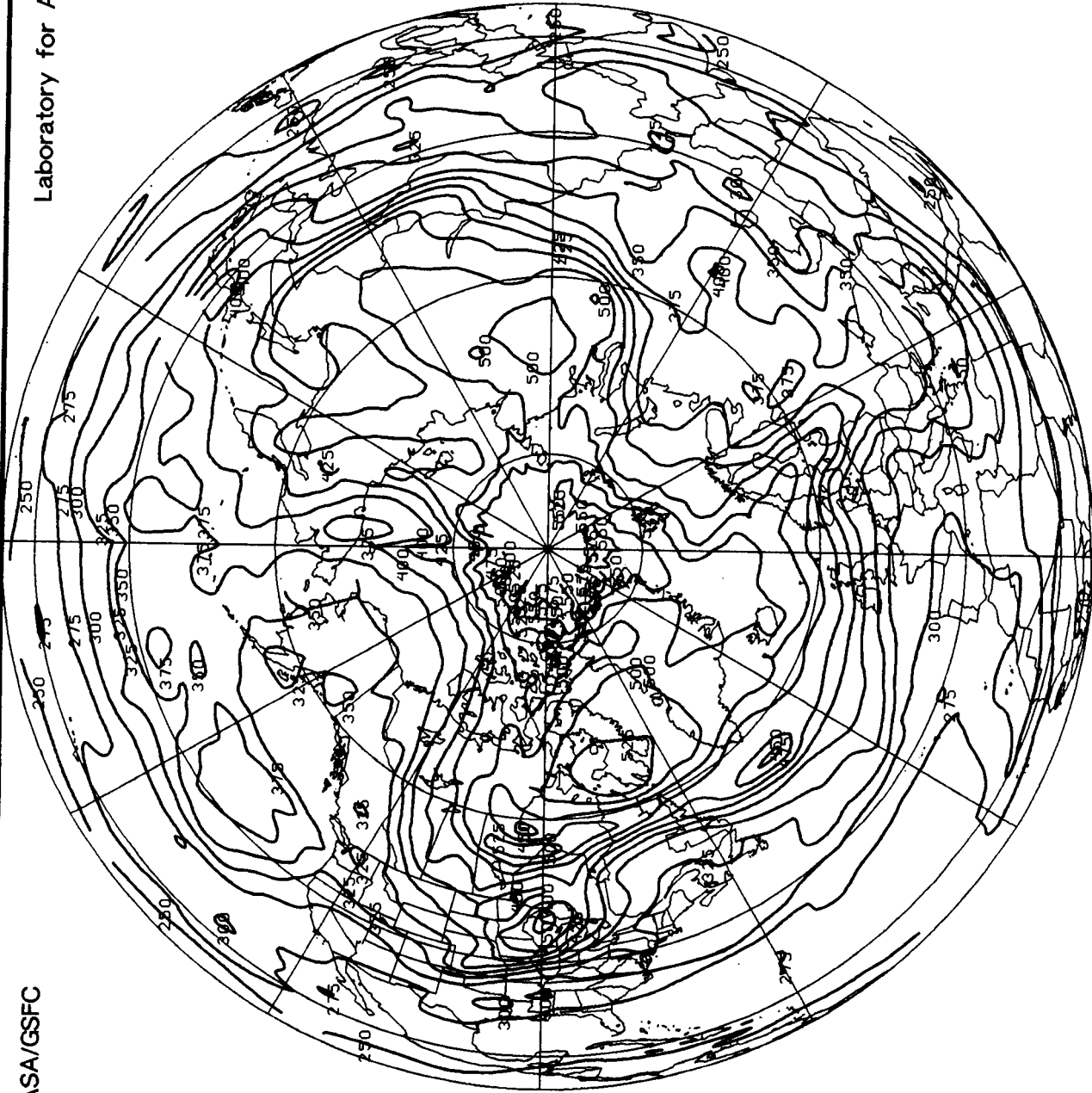
NASA/GSFC

March 14, 1989

Gridded TOMS Ozone (Dobson Units)

NASA/GSFC

Laboratory for Atmospheres

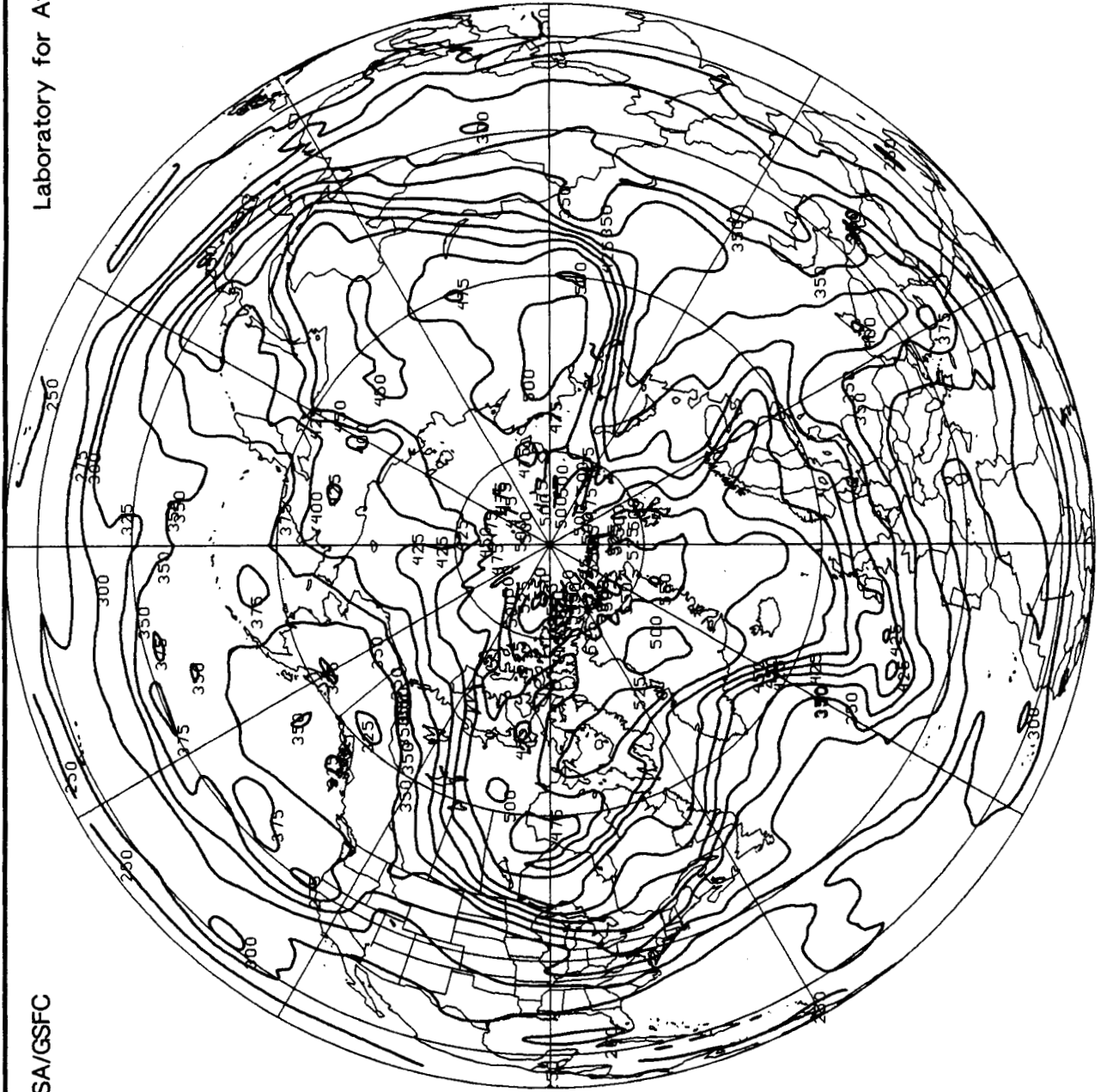


March 15, 1989

Gridded TOMS Ozone (Dobson Units)

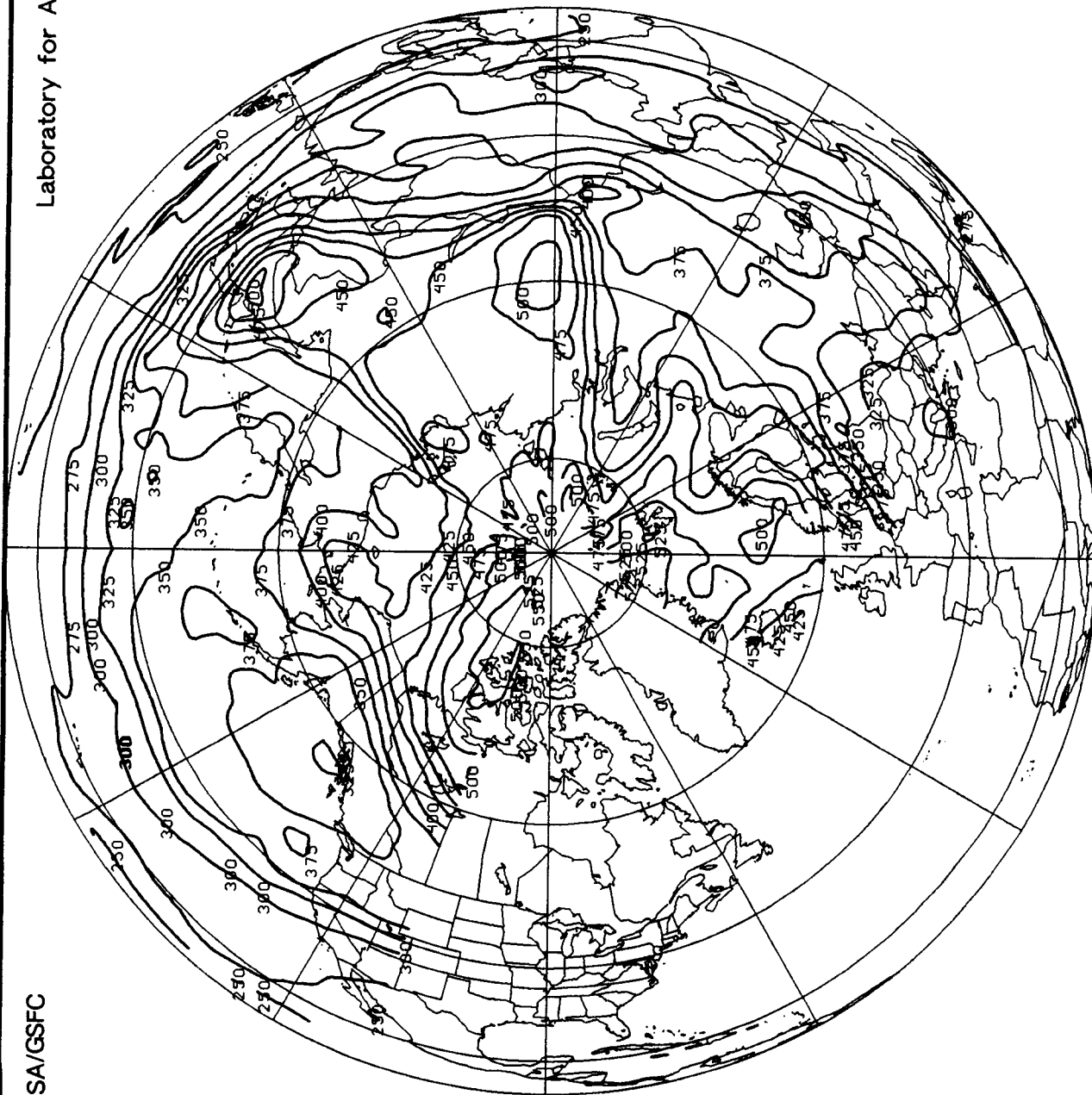
NASA/GSFC

Laboratory for Atmospheres



March 16, 1989

Gridded TOMS Ozone (Dobson Units)

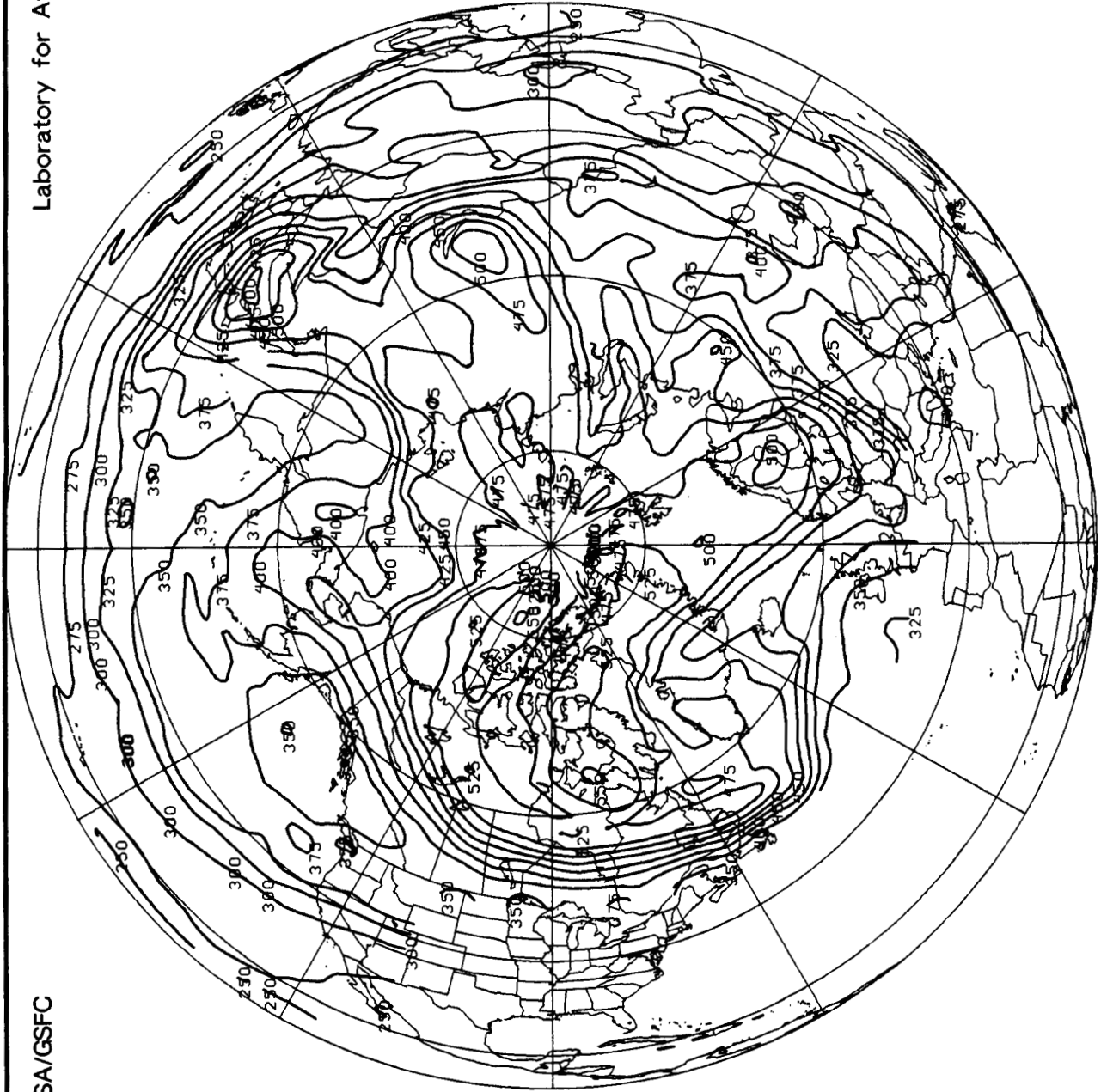


March 17, 1989

Gridded TOMS Ozone (Dobson Units)

NASA/GSFC

Laboratory for Atmospheres

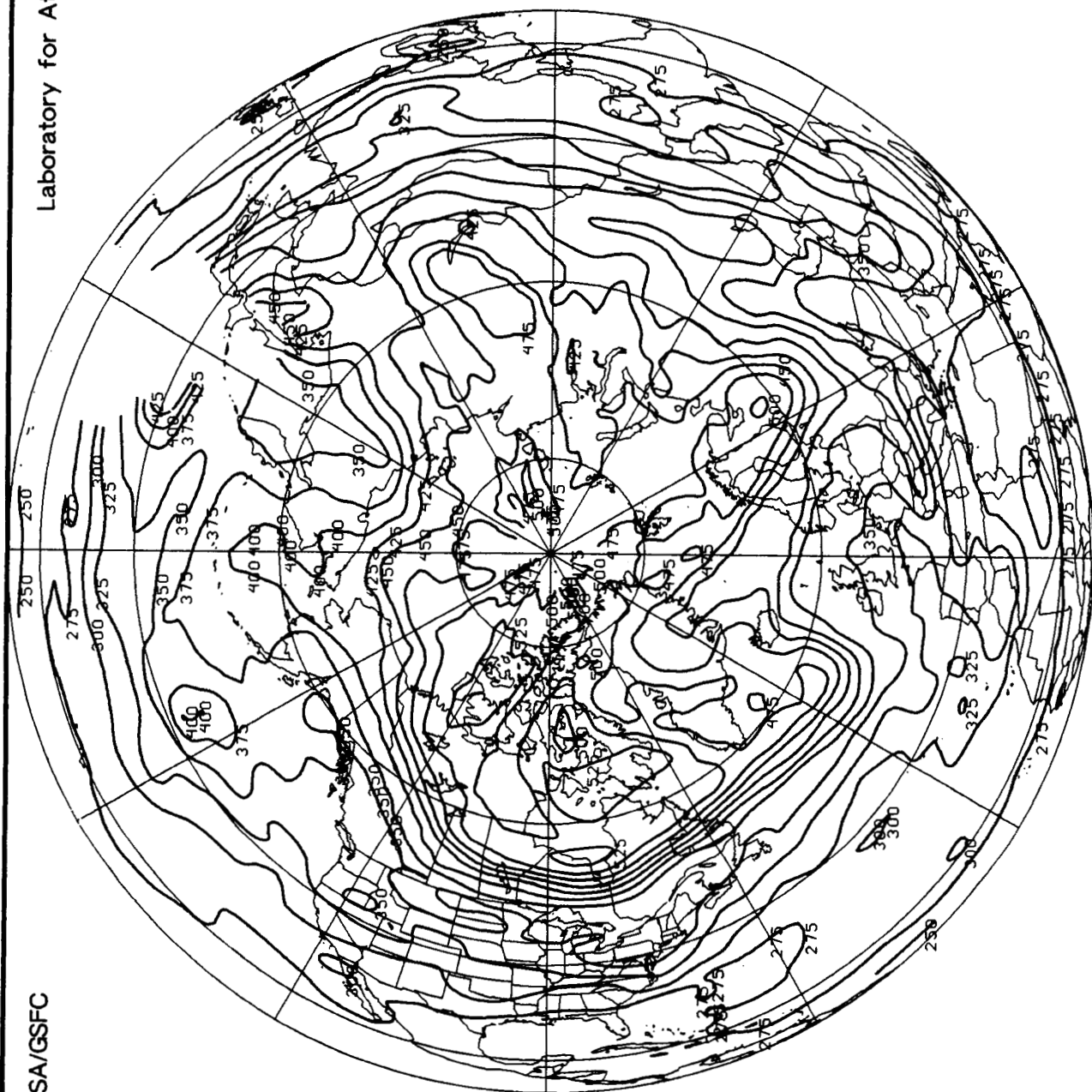


March 18, 1989

Gridded TOMS Ozone (Dobson Units)

NASA/GSFC

Laboratory for Atmospheres

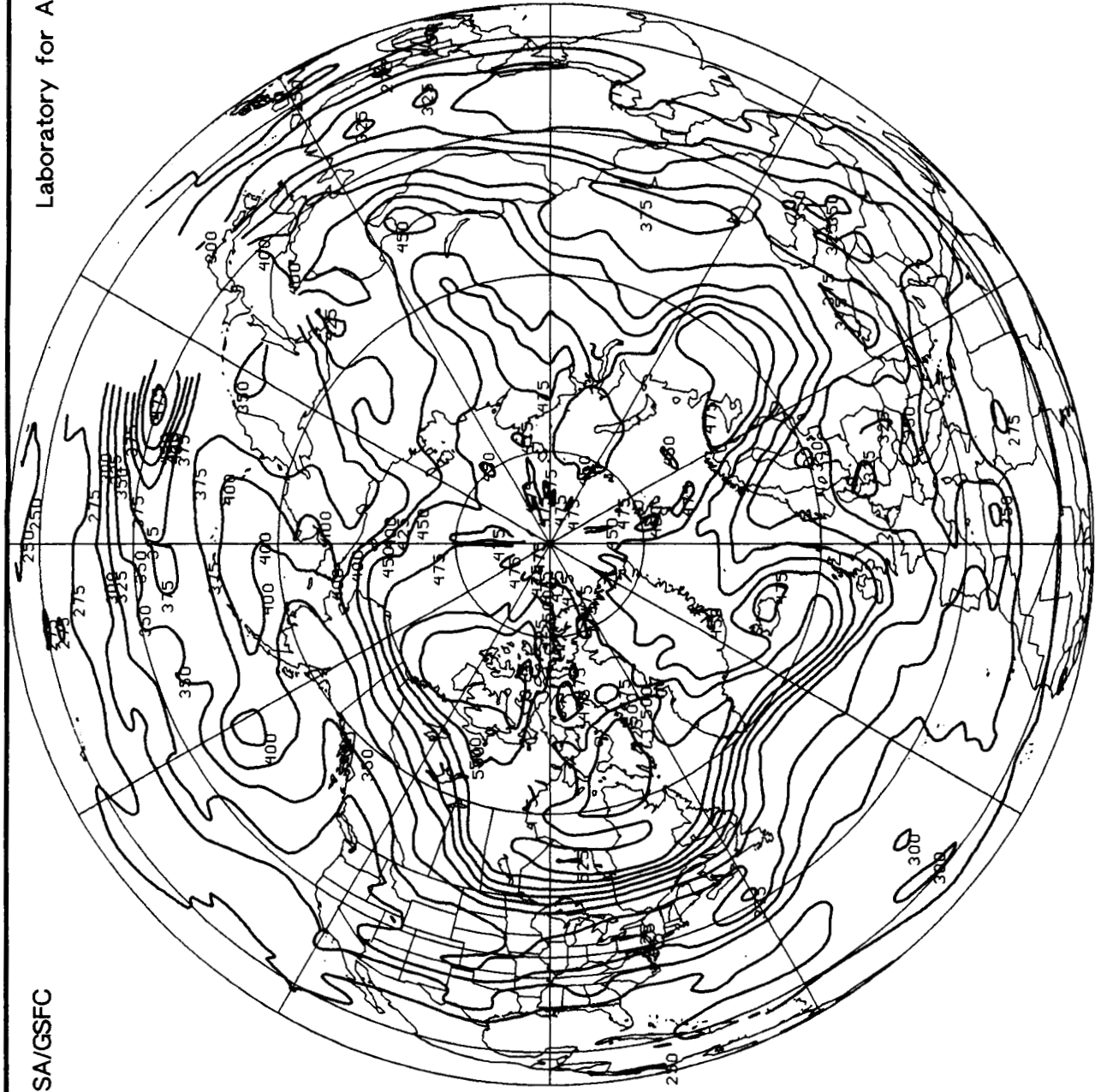


March 19, 1989

Gridded TOMS Ozone (Dobson Units)

NASA/GSFC

Laboratory for Atmospheres



March 20, 1989

Gridded TOMS Ozone (Dobson Units)

### **3.4 Monthly Mean Comparisons to Past Years**

Figures 1a and 1b present the hemispheric differences between total ozone for the months of January and February 1989 and a four-year reference mean (1979 through 1982). In both cases, the values are in Dobson units with the differences expressed as the month in question minus the four-year mean. Isopleths are solid where this difference is positive and dashed where it is negative.

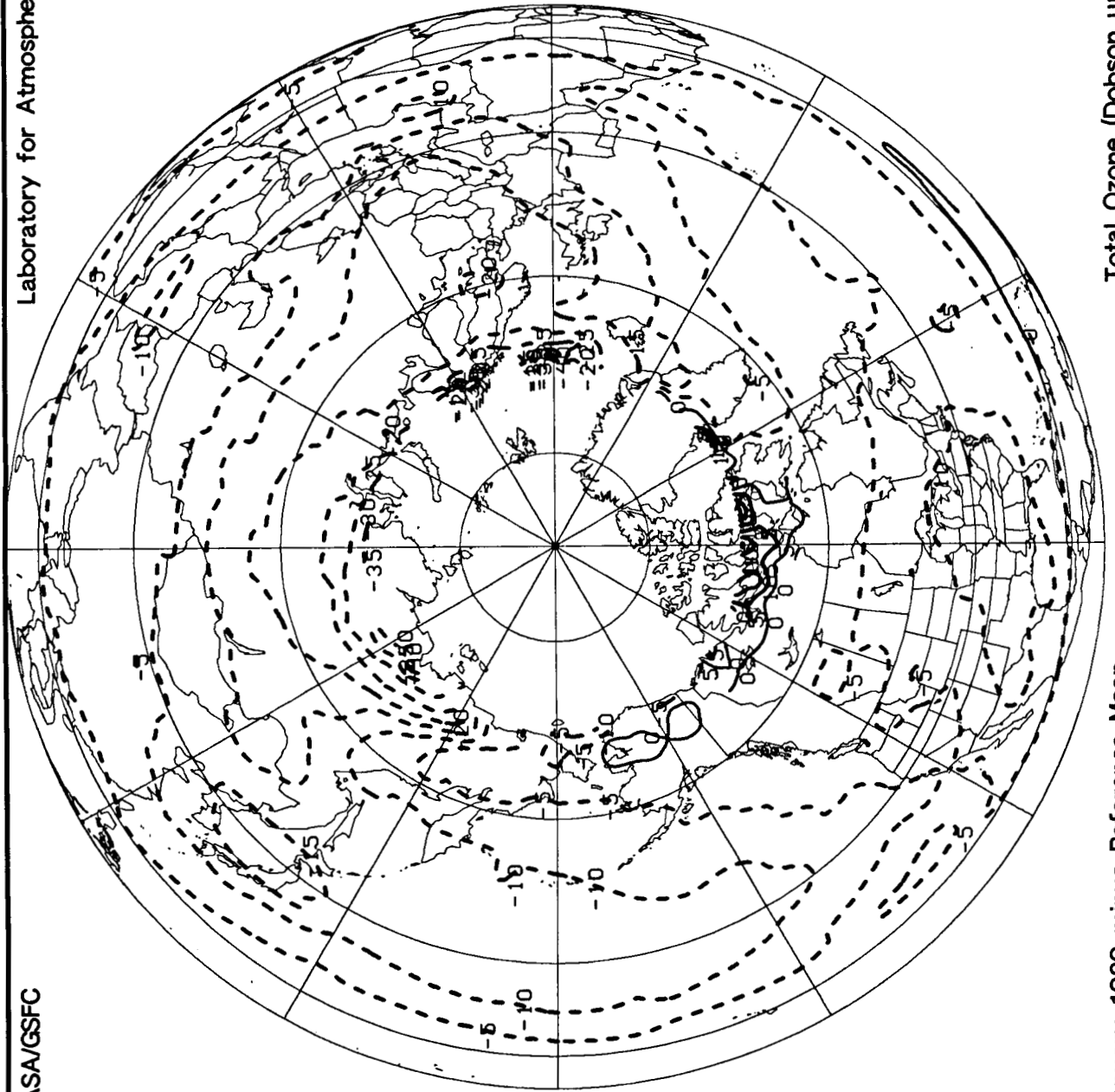
During January (Figure 1a), virtually the entire northern hemisphere is covered by negative differences. These differences are between 5 and 10 Dobson units over most of the hemisphere. Negative values as low as 40 DU are present near the terminator across Eurasia. Positive values up to 15 DU are present near the terminator across North America. A large area of negative differences greater than 10 DU exists across western Asia and much of the Pacific centered at latitude 40°N. A minimum difference of -15 DU is present near Japan and Korea. It should be noted that small negative differences could be explained by instrument calibration drift, which reduces uncorrected total ozone values by 4% over 10 years.

During February (Figure 1b), once again, much of the hemisphere is lowered by negative differences. These differences exceed 10 DU over large areas, including Southern Europe, Eastern and Central U.S., the North Pacific, Central USSR and Northern North America. Negative differences in excess of 20 DU exist over North Central USSR, Alaska and Northern Canada. A large area of positive differences exists over Northern Europe and the adjacent Atlantic. A small area of positive difference exists over Northwestern USSR.



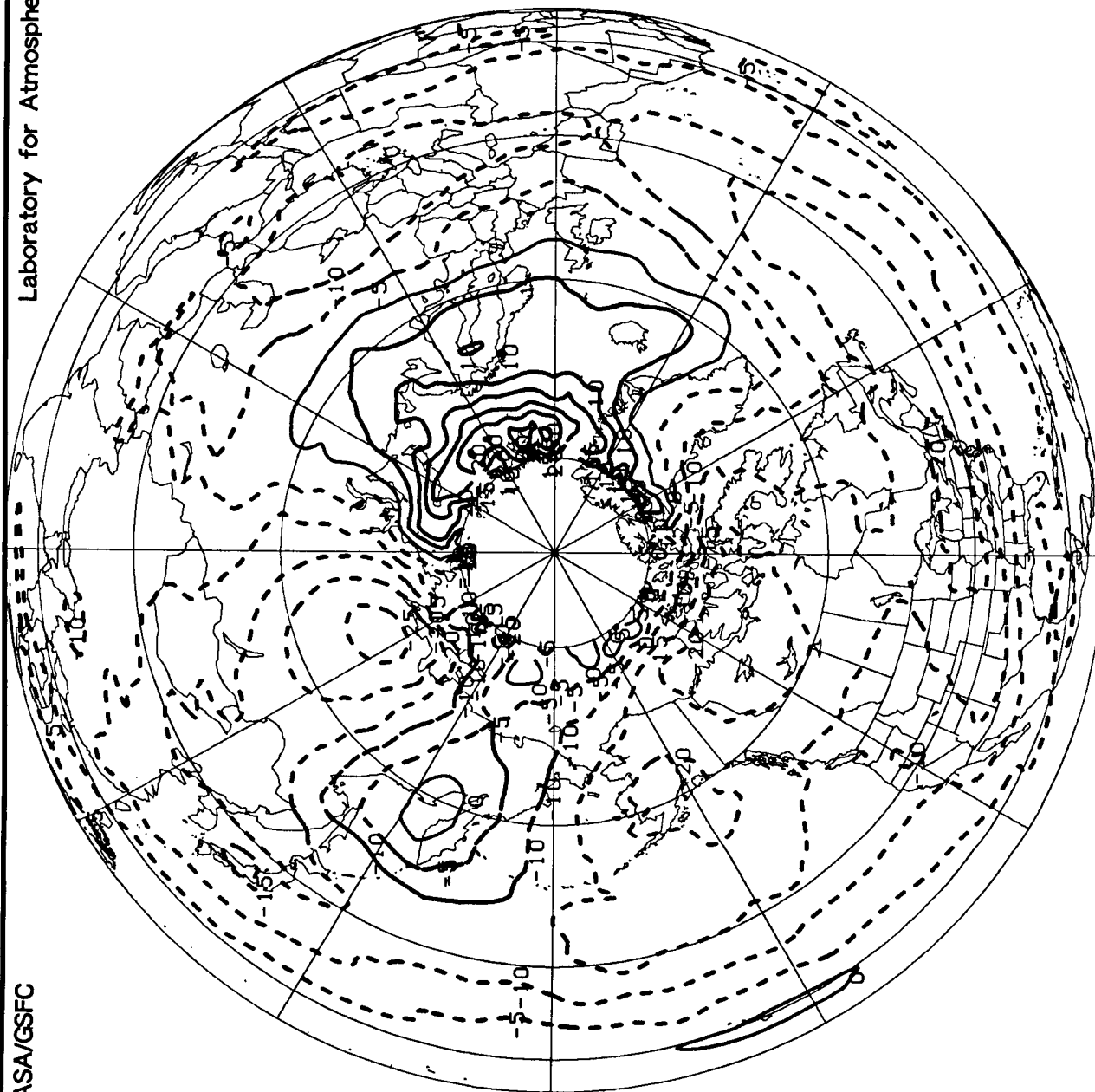
Laboratory for Atmospheres

NASA/GSFC



Total Ozone (Dobson units)

January 1989 minus Reference Mean



February 1989 minus Reference Mean

Total Ozone (Dobson units)

#### 4. REFERENCES

Krueger, A. J., P. E. Ardanuy, F. S. Sechrist, L. M. Penn, D. E. Larko, S. D. Doiron, and R. N. Galimore, 1988: The 1987 Airborne Antarctic Ozone Experiment: The Nimbus-7 TOMS Data Atlas, NASA Reference Publication 1201, 252 pages.

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## 5. ACKNOWLEDGEMENTS

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