

**NASA
Reference
Publication
1281**

October 1992

Atlas of Albedo and
Absorbed Solar Radiation
Derived From Nimbus 7
Earth Radiation Budget
Data Set—November 1985
to October 1987

G. Louis Smith,
David Rutan,
and T. Dale Bess

(NASA-RP-1281) ATLAS OF ALBEDO AND
ABSORBED SOLAR RADIATION DERIVED
FROM NIMBUS 7 EARTH RADIATION
BUDGET DATA SET, NOVEMBER 1985 TO
OCTOBER 1987 (NASA) 57 p

N93-11168

Unclas

H1/47 0122407

1N-11
120001
P-57



[The left side of the page contains a dense column of text that is almost entirely illegible due to extreme horizontal line noise and heavy blacking out. The text appears to be organized into several paragraphs, but the individual words and sentences cannot be discerned.]

[The middle section of the page contains a large block of text that is almost entirely illegible due to extreme horizontal line noise and heavy blacking out. The text appears to be organized into several paragraphs, but the individual words and sentences cannot be discerned.]

[The right side of the page contains a large block of text that is almost entirely illegible due to extreme horizontal line noise and heavy blacking out. The text appears to be organized into several paragraphs, but the individual words and sentences cannot be discerned.]

**NASA
Reference
Publication
1281**

1992

**Atlas of Albedo and
Absorbed Solar Radiation
Derived From Nimbus 7
Earth Radiation Budget
Data Set—November 1985
to October 1987**

G. Louis Smith
*Langley Research Center
Hampton, Virginia*

David Rutan
*Lockheed Engineering & Sciences Company
Hampton, Virginia*

T. Dale Bess
*Langley Research Center
Hampton, Virginia*



National Aeronautics and
Space Administration
Office of Management
Scientific and Technical
Information Program



Introduction

The solar radiation absorbed within the atmosphere and surface of the Earth provides the energy that moves the Earth's atmosphere and oceans and that governs our weather and climate (Hartmann et al. 1986). Absorbed solar radiation (ASR) is computed from the albedo at the "top of the atmosphere," which is computed from measurements, and from the incident solar radiation. The albedo and ASR depend on the surface properties of the Earth and clouds as well as the atmospheric transmissivity and reflectivity. The ASR varies spatially and temporally over a range of scales, from rapid local changes to large-scale fluctuations lasting months. The investigation of these slower fluctuations requires a data set of many years; this extended period also offers several opportunities to observe climatological events, such as the El Niño/Southern Oscillation (Philander 1990), and to provide a valid climatological mean.

To provide a long-term data set of radiation budget measurements at the top of the atmosphere, wide-field-of-view (WFOV) radiometers were part of the Earth Radiation Budget (ERB) instrument that was aboard the Nimbus 6 and 7 spacecraft. The ERB instrument began providing shortwave WFOV measurements from Nimbus 6 in July 1975 and from Nimbus 7 in October 1978 (Smith et al. 1977; Jacobowitz et al. 1984). Because those spacecraft were placed into orbits with near-noon equatorial crossings, their positions were ideal for measuring the albedo of the Earth at low and mid latitudes. Therefore, the data sets presented here are particularly interesting because the shortwave radiometers provide broadband measurements in a spectral range of 0.2 to 3.8 μm . Computations of broadband fluxes from narrowband instruments require extensive spectral corrections; however, the corrections themselves introduce errors. The present measurements do not require such extensive corrections, thus are inherently more accurate. Also, the Nimbus 7 ERB WFOV radiometers have consistently provided data from a single instrument since 1978.

Because WFOV radiometers have such a large field of view, a method of retrieving the albedo distribution was developed that enhances radiometer resolution (Smith and Rutan 1990). The Nimbus 6 and 7 ERB data from July 1975 to October 1985 were analyzed with this technique, and the results were compiled in two atlases (Smith, Rutan, and Bess 1990a, 1990b). The outgoing longwave radiation has likewise been analyzed and documented (Bess and Smith 1987a, 1987b).

Nimbus 7 ERB Project personnel at the Goddard Space Flight Center have recently processed measurements from November 1985 to October 1987. In this compilation, the resulting shortwave measurements are analyzed to produce resolution-enhanced maps of monthly averaged albedo and ASR. This paper presents an atlas of these maps; when combined with the previously published atlases, these three atlases cover a 12-year span. Bess and Smith (1991) used the corresponding longwave measurements to produce monthly mean maps of outgoing longwave radiation for this period in a companion paper. Nimbus 7 ERB data from 1985 to 1987 are especially useful because they are partially contiguous in time with the data from the Earth Radiation Budget Experiment (ERBE) scanning and non-scanning radiometers aboard the National Oceanic and Atmospheric Administration (NOAA) 9 and 10 spacecraft and the dedicated Earth Radiation Budget Satellite. Thus, the data can be used for comparison and validation studies.

Data Processing and Analysis

From October 1985 to September 1987, the ERB instrument operated continuously except for short periods, when it was on a duty cycle of 3 days on and 1 day off. This duty cycle was used early in the Nimbus 7 mission to conserve power, but that approach did not seriously degrade the results (Bess and Smith 1987a, 1987b; Smith, Rutan, and Bess 1990b). However, power limitations did preclude ERB measurements from April 10 to June 23, 1986. Thus, April, May, and June 1986 are missing from this set.

When the ERB instrument is on, WFOV measurements are taken at 4-second intervals. Four consecutive measurements are averaged to produce one value every 16 seconds. The data consist of these 16-second averages together with the time, latitude, and longitude for each measurement. Kyle et al. (1990) describe the data processing to account for instrument degradation.

Monthly maps of albedo were computed from the shortwave WFOV radiometer measurements based on Smith and Rutan's retrieval method (1990). Also, Smith, Rutan, and Bess (1990b) discuss their additional application of the method to 7 years of Nimbus 7 ERB measurements. First, monthly average maps of the measurements are compiled in a 5° by 5° grid. Then, the albedo map that corresponds to this

measurement map is computed. The albedo field A is expressed as a Fourier series in longitude as

$$A(\theta, \Phi) = \sum_{n=-N}^N \exp(i n \Phi) f_n(\theta)$$

where θ and Φ are the colatitude and longitude of a point, i is the square root of -1 , and N is the number of Fourier terms in longitude. The $f_n(\theta)$ terms are also computed as a series, with the coefficients determined from the measurements.

The numbers of terms that can be retrieved for each $f_n(\theta)$ to describe the albedo distributions determine the latitudinal resolution of the resulting distribution. These numbers depend on the space and time sampling errors for the average map and are listed in table I for each month in the data period. For wave number 0 (i.e., the zonal average), 28 to 34 terms are retrievable, which provides a latitudinal resolution better than 10° . Although measurements are averaged into 5° longitude grid boxes, Rutan and Smith (1991) have shown that, because of space and time variability and corresponding sampling problems, better results for monthly mean maps are obtained by retaining only 12 Fourier waves in longitude, which is equivalent to 15° longitudinal resolution.

The albedo cannot be unambiguously computed near the terminator from WFOV measurements. The limits of observability given by Smith and Rutan (1987) and Smith, Rutan, and Bess (1990b) for the Nimbus 7 orbit depend on time of year. The ASR is the product of albedo and solar insolation. Thus, even though the albedo error increases near the terminator, the insolation decreases more rapidly than the albedo error increases, and the ASR error also decreases.

Results

This atlas contains monthly mean maps of albedo and ASR from November 1985 to October 1987, excluding April, May, and June 1986; the data were computed from Nimbus 7 shortwave WFOV measurements. The albedo maps (at the back of this report) show contours with intervals of 5 percent. Dotted lines indicate albedos less than 30 percent. Because of the limitations of albedo results retrieved from WFOV measurements, the resolution is limited

to 10° in latitude and 15° in longitude. At high latitudes the results are based on a priori data. The ASR maps show contours with intervals of 25 W/m^2 , with contours of 250 W/m^2 or greater given as dotted lines. Table II lists the mean zonal averages of albedo for 5° latitudinal widths for each month of the period.

The nearly 2 years of albedo and ASR maps in this atlas, combined with the ASR data sets of Smith, Rutan, and Bess (1990a, 1990b), completes a 12-year data set of albedo and ASR. Thus, for each January, 12 realizations are among the three atlases. The standard deviation of the ASR for January about the mean is a measure of the interannual variability of the ASR and is shown in figure 1. Figures 2 to 12 reflect the same treatment for the remaining months. The strongest interannual variations occur in the tropics and subtropics from January to March; these variations are associated with the El Niño/Southern Oscillation (ENSO) climatological events. These ENSO events occurred during the northern winters of 1977-1978, 1982-1983, and 1986-1987. The present 2-year data set thus contributes another ENSO event to the ASR record.

Concluding Remarks

Geographical distributions of albedo and absorbed solar radiation are presented here as a resource for researchers studying the radiation budget of the Earth. This atlas of shortwave data extends to 12 years and comprises the absorbed solar radiation data set from the Earth Radiation Budget (ERB) wide-field-of-view (WFOV) radiometers aboard the Nimbus 6 and 7 spacecraft reported by Smith, Rutan, and Bess in 1990. This compilation complements the atlases of outgoing longwave radiation based on Nimbus 6 and 7 WFOV measurements analyzed by Bess and Smith in 1987 and 1991.

The last 3 years are particularly interesting because, during this time, the Earth Radiation Budget Experiment (ERBE) was also operating, thereby providing an excellent opportunity for comparison and validation studies. Also, the El Niño/Southern Oscillation event of 1986-1987 occurred during this period.

NASA Langley Research Center
Hampton, VA 23681-0001
August 7, 1992

References

- Bess, T. Dale; and Smith, G. Louis 1987a: *Atlas of Wide-Field-of-View Outgoing Longwave Radiation Derived From Nimbus 6 Earth Radiation Budget Data Set July 1975 to June 1978*. NASA RP-1185.
- Bess, T. Dale; and Smith, G. Louis 1987b: *Atlas of Wide-Field-of-View Outgoing Longwave Radiation Derived From Nimbus 7 Earth Radiation Budget Data Set November 1978 to October 1985*. NASA RP-1186.
- Bess, T. Dale; and Smith, G. Louis 1991: *Atlas of Wide-Field-of-View Outgoing Longwave Radiation Derived From Nimbus 7 Earth Radiation Budget Data Set November 1985 to October 1987*. NASA RP-1261.
- Hartmann, D. L.; Ramanathan, V.; Berroir, A.; and Hunt, G. E. 1986: Earth Radiation Budget Data and Climate Research. *Reviews Geophys.*, vol. 24, no. 2, pp. 439-468.
- Jacobowitz, Herbert; and Tighe, Richard J. 1984: The Earth Radiation Budget Derived From the Nimbus 7 ERB Experiment. *J. Geophys. Res.*, vol. 89, no. D4, pp. 4997-5010.
- Kyle, H. Lee; Mecherikunnel, Ann; Ardamy, Philip; Penn, Lanning; Groveman, Brian; Campbell, G. Garrett; and Vonder Haar, T. H. 1990: A Comparison of Two Major Earth Radiation Budget Data Sets. *J. Geophys. Res.*, vol. 95, no. D7, pp. 9951-9970.
- Philander, S. George c.1990: *El Niño, La Niña, and the Southern Oscillation*. Academic Press, Inc.
- Rutan, David; and Smith, G. Louis 1991: Shortwave Wide-Field-of-View Results From the Earth Radiation Budget Experiment. *Seventh Symposium on Meteorological Observations and Instrumentations*, American Meteorological Soc., pp. 160-165.
- Smith, G. L.; and Rutan, D. 1990: Deconvolution of Wide-Field-of-View Measurements of Reflected Solar Radiation. *J. Appl. Meteorol.*, vol. 29, pp. 109-122.
- Smith, G. Louis; Rutan, David.; and Bess, T. Dale 1990a: *Atlas of Albedo and Absorbed Solar Radiation Derived From Nimbus 6 Earth Radiation Budget Data Set July 1975 to May 1978*. NASA RP-1230.
- Smith, G. Louis; Rutan, David.; and Bess, T. Dale 1990b: *Atlas of Albedo and Absorbed Solar Radiation Derived From Nimbus 7 Earth Radiation Budget Data Set November 1978 to October 1985*. NASA RP-1231.
- Smith, W. L.; Hickey, J.; Howell, H. B.; Jacobowitz, H.; Hilleary, D. T.; and Drummond, A. J. 1977: Nimbus-6 Earth Radiation Budget Experiment. *Appl. Opt.*, vol. 16, no. 2, pp. 306-318.
- Smith, G. Louis; and Rutan, David 1987: Observability of Albedo by Shortwave Wide-Field-of-View Radiometers in Various Orbits. *RSRM '87 Advances in Remote Sensing Retrieval Methods*, Adarsh Deepak, Henry E. Fleming, and John S. Theon, eds., A. Deepak Publ., pp. 475-484.

Table I. Number of Singular Vectors Used To Describe Each Fourier Longitudinal Wave Number

Month	Number of singular vectors for wave number of--											
	0	1	2	3	4	5	6	7	8	9	10	11
Nov. 1985	30	30	26	26	26	20	12	12	6	6	4	4
Dec. 1985	28	28	26	26	24	24	14	14	10	6	2	2
Jan. 1986	32	30	28	28	24	24	12	8	4	2	2	2
Feb. 1986	30	30	26	16	16	16	10	10	10	4	4	4
Mar. 1986	30	30	24	24	24	24	10	10	4	4	4	4
Apr. 1986												
May 1986												
Jun. 1986												
Jul. 1986	30	30	30	22	14	14	12	12	6	6	4	4
Aug. 1986	30	30	28	18	18	18	6	6	6	6	2	2
Sep. 1986	30	30	28	22	22	18	14	12	12	8	2	2
Oct. 1986	36	32	28	10	10	10	4	4	4	4	2	2
Nov. 1986	30	30	30	18	18	16	16	8	4	2	2	2
Dec. 1986	30	30	30	28	28	28	14	14	8	8	2	0
Jan. 1987	32	30	28	28	20	16	14	10	10	2	2	2
Feb. 1987	30	30	30	24	20	20	14	14	6	6	6	6
Mar. 1987	30	30	30	28	26	10	8	4	4	2	2	2
Apr. 1987	30	30	26	26	26	26	14	14	8	8	4	4
May 1987	30	30	30	30	28	28	14	14	14	14	8	8
Jun. 1987	30	30	30	26	26	26	14	14	8	8	4	2
Jul. 1987	30	30	30	28	28	28	14	14	10	10	10	10
Aug. 1987	32	30	30	28	26	24	12	12	8	4	4	4
Sep. 1987	30	30	30	26	26	26	10	10	6	6	2	2
Oct. 1987	34	34	32	30	26	26	12	12	12	8	4	4

Table II. Zonal Albedo Means for 1985 to 1987

(a) November 1985 to October 1986

LATITUDE	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT
85-90 N	----	----	----	----	.651	----	----	----	.589	.625	.624	----
80-85 N	----	----	----	----	.732	----	----	----	.590	.623	.629	----
75-80 N	----	----	----	----	.636	----	----	----	.564	.581	.609	.699
70-75 N	----	----	----	.699	.661	----	----	----	.483	.526	.600	.610
65-70 N	.681	----	.627	.600	.645	----	----	----	.426	.432	.539	.615
60-65 N	.570	.625	.589	.567	.589	----	----	----	.410	.404	.455	.576
55-60 N	.549	.510	.576	.535	.519	----	----	----	.425	.418	.398	.485
50-55 N	.530	.451	.554	.512	.471	----	----	----	.404	.401	.390	.400
45-50 N	.495	.404	.509	.478	.448	----	----	----	.371	.346	.384	.376
40-45 N	.436	.372	.436	.438	.417	----	----	----	.342	.305	.338	.376
35-40 N	.371	.364	.373	.404	.370	----	----	----	.301	.282	.289	.342
30-35 N	.334	.360	.344	.369	.328	----	----	----	.266	.255	.276	.300
25-30 N	.318	.326	.316	.319	.300	----	----	----	.261	.251	.266	.282
20-25 N	.283	.276	.272	.266	.264	----	----	----	.255	.272	.239	.255
15-20 N	.243	.247	.234	.227	.216	----	----	----	.244	.274	.236	.231
10-15 N	.240	.238	.228	.202	.199	----	----	----	.269	.260	.265	.250
5-10 N	.260	.233	.242	.197	.223	----	----	----	.288	.261	.272	.267
0-5 N	.251	.242	.255	.218	.243	----	----	----	.259	.249	.247	.246
0-5 S	.236	.258	.262	.239	.246	----	----	----	.231	.212	.230	.229
5-10 S	.246	.254	.263	.242	.244	----	----	----	.233	.204	.223	.229
10-15 S	.243	.230	.254	.236	.230	----	----	----	.228	.225	.206	.213
15-20 S	.230	.223	.243	.233	.216	----	----	----	.226	.227	.212	.212
20-25 S	.237	.231	.229	.226	.226	----	----	----	.261	.228	.242	.233
25-30 S	.257	.228	.223	.225	.243	----	----	----	.292	.277	.255	.243
30-35 S	.268	.245	.239	.253	.255	----	----	----	.303	.330	.268	.264
35-40 S	.285	.291	.271	.297	.295	----	----	----	.338	.339	.314	.312
40-45 S	.322	.333	.321	.341	.365	----	----	----	.406	.346	.356	.350
45-50 S	.358	.366	.380	.392	.414	----	----	----	.476	.400	.367	.378
50-55 S	.402	.424	.428	.440	.424	----	----	----	.525	.487	.398	.430
55-60 S	.476	.481	.458	.466	.449	----	----	----	.551	.567	.498	.501
60-65 S	.582	.531	.499	.497	.534	----	----	----	.578	.624	.641	.597
65-70 S	.699	.554	.604	.598	.659	----	----	----	.642	.657	.746	.728
70-75 S	.691	.741	.645	.745	.745	----	----	----	----	.681	.758	.831
75-80 S	.727	.886	.721	.770	.735	----	----	----	----	----	.707	.829
80-85 S	.721	.888	.727	.762	.715	----	----	----	----	----	.699	.762
85-90 S	.707	.761	.719	.711	.702	----	----	----	----	----	.692	.717

Table II. Concluded

(b) November 1986 to October 1987

LATITUDE	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT
85-90 N	----	----	----	----	.651	.635	.664	.646	.569	.619	.624	----
80-85 N	----	----	----	----	.791	.655	.693	.650	.589	.600	.628	----
75-80 N	----	----	----	----	.636	.677	.685	.622	.555	.550	.603	.698
70-75 N	----	----	----	.701	.660	.666	.609	.529	.444	.497	.588	.605
65-70 N	.681	----	.627	.609	.642	.599	.577	.429	.404	.413	.527	.606
60-65 N	.571	.624	.587	.582	.589	.530	.497	.443	.401	.391	.448	.569
55-60 N	.551	.510	.573	.555	.514	.484	.447	.424	.430	.412	.401	.483
50-55 N	.529	.450	.554	.523	.475	.440	.400	.405	.406	.408	.399	.401
45-50 N	.490	.403	.517	.473	.464	.388	.371	.384	.367	.365	.388	.375
40-45 N	.427	.372	.455	.423	.440	.356	.361	.346	.343	.328	.331	.380
35-40 N	.364	.366	.397	.396	.390	.349	.331	.305	.309	.305	.280	.350
30-35 N	.333	.363	.360	.371	.344	.327	.297	.281	.269	.268	.279	.300
25-30 N	.322	.329	.323	.321	.312	.284	.279	.269	.256	.242	.285	.278
20-25 N	.286	.278	.278	.262	.268	.247	.248	.249	.252	.248	.259	.257
15-20 N	.249	.250	.238	.225	.210	.213	.207	.237	.244	.255	.241	.229
10-15 N	.258	.240	.222	.208	.187	.190	.209	.261	.262	.255	.253	.237
5-10 N	.284	.233	.235	.208	.213	.214	.252	.283	.278	.273	.255	.259
0-5 N	.266	.240	.260	.235	.237	.257	.265	.263	.254	.272	.235	.247
0-5 S	.238	.260	.275	.264	.243	.258	.243	.231	.227	.229	.228	.230
5-10 S	.245	.262	.264	.263	.239	.231	.227	.221	.224	.207	.225	.233
10-15 S	.240	.240	.235	.240	.217	.224	.217	.214	.216	.225	.209	.221
15-20 S	.218	.232	.217	.231	.199	.232	.222	.231	.217	.230	.210	.214
20-25 S	.221	.235	.215	.226	.218	.236	.256	.269	.253	.225	.239	.238
25-30 S	.242	.228	.222	.222	.247	.258	.292	.282	.283	.267	.252	.259
30-35 S	.258	.241	.242	.246	.261	.305	.310	.288	.298	.321	.264	.276
35-40 S	.287	.281	.271	.291	.296	.348	.333	.341	.340	.334	.312	.315
40-45 S	.339	.320	.319	.336	.368	.373	.389	.430	.414	.351	.362	.352
45-50 S	.376	.357	.378	.384	.421	.415	.463	.491	.484	.426	.384	.381
50-55 S	.405	.420	.419	.437	.430	.494	.513	.519	.530	.535	.420	.440
55-60 S	.465	.479	.444	.469	.450	.571	.532	.542	.553	.620	.513	.523
60-65 S	.569	.525	.487	.500	.535	.613	.552	.567	.578	.662	.646	.615
65-70 S	.693	.549	.598	.593	.663	.635	.594	----	.643	.674	.744	.727
70-75 S	.687	.739	.643	.738	.750	.647	----	----	----	.684	.755	.822
75-80 S	.721	.888	.722	.764	.739	.670	----	----	----	----	.705	.823
80-85 S	.716	.871	.729	.759	.717	----	----	----	----	----	.699	.762
85-90 S	.705	.762	.720	.711	.702	----	----	----	----	----	.691	.717

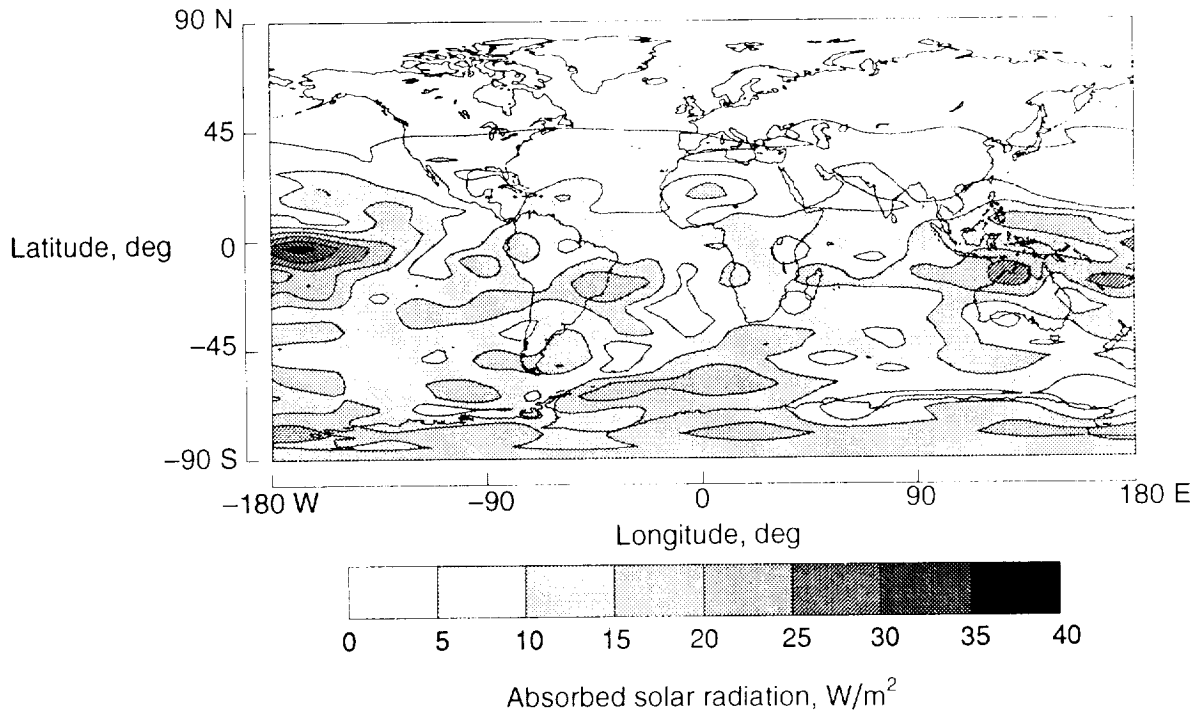


Figure 1. Standard deviation of absorbed solar radiation about monthly mean for January.

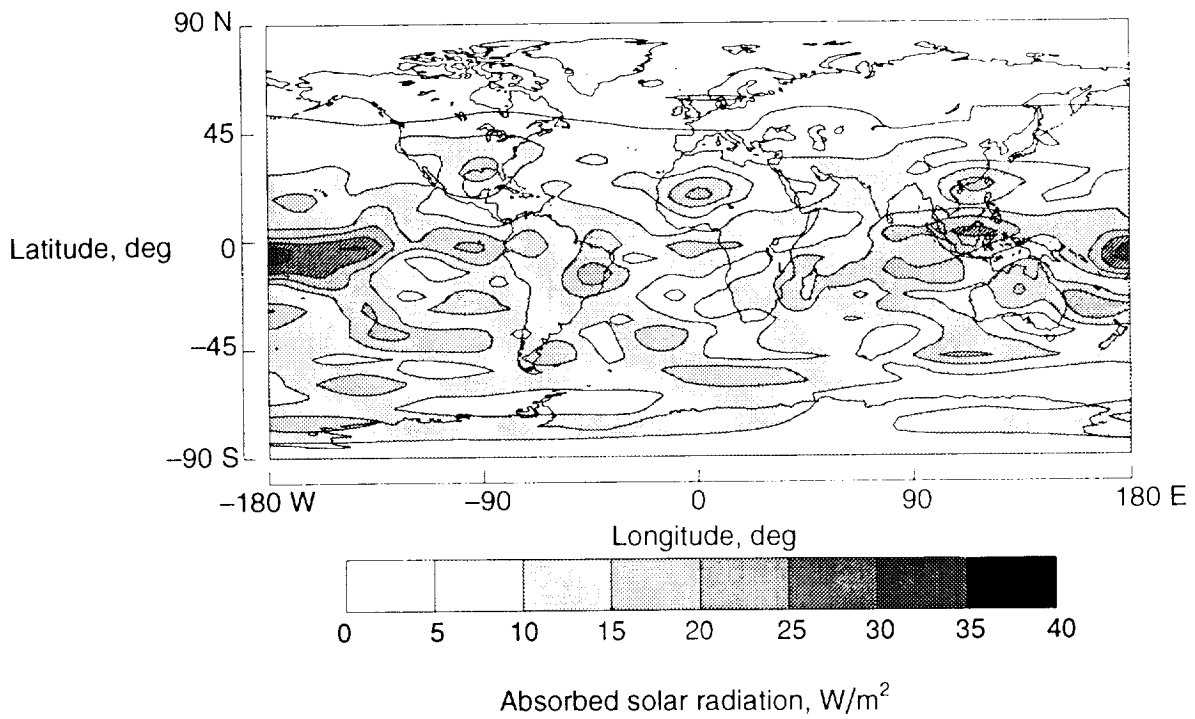


Figure 2. Standard deviation of absorbed solar radiation about monthly mean for February.

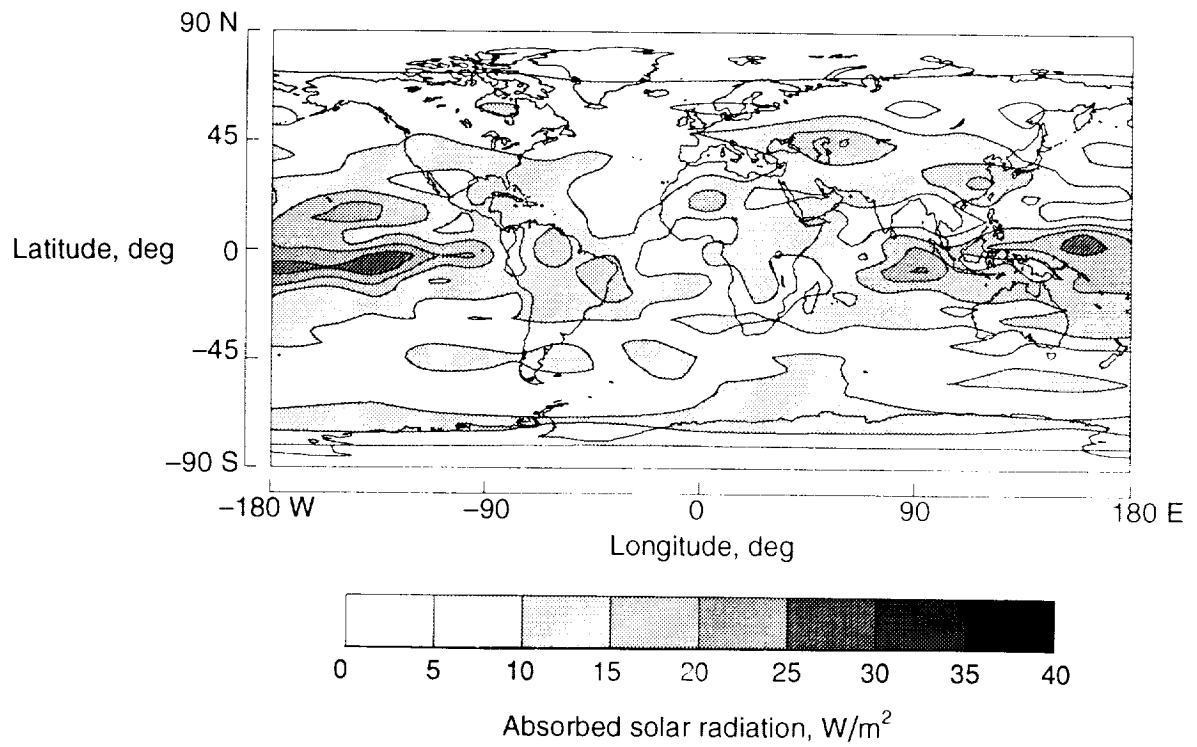


Figure 3. Standard deviation of absorbed solar radiation about monthly mean for March.

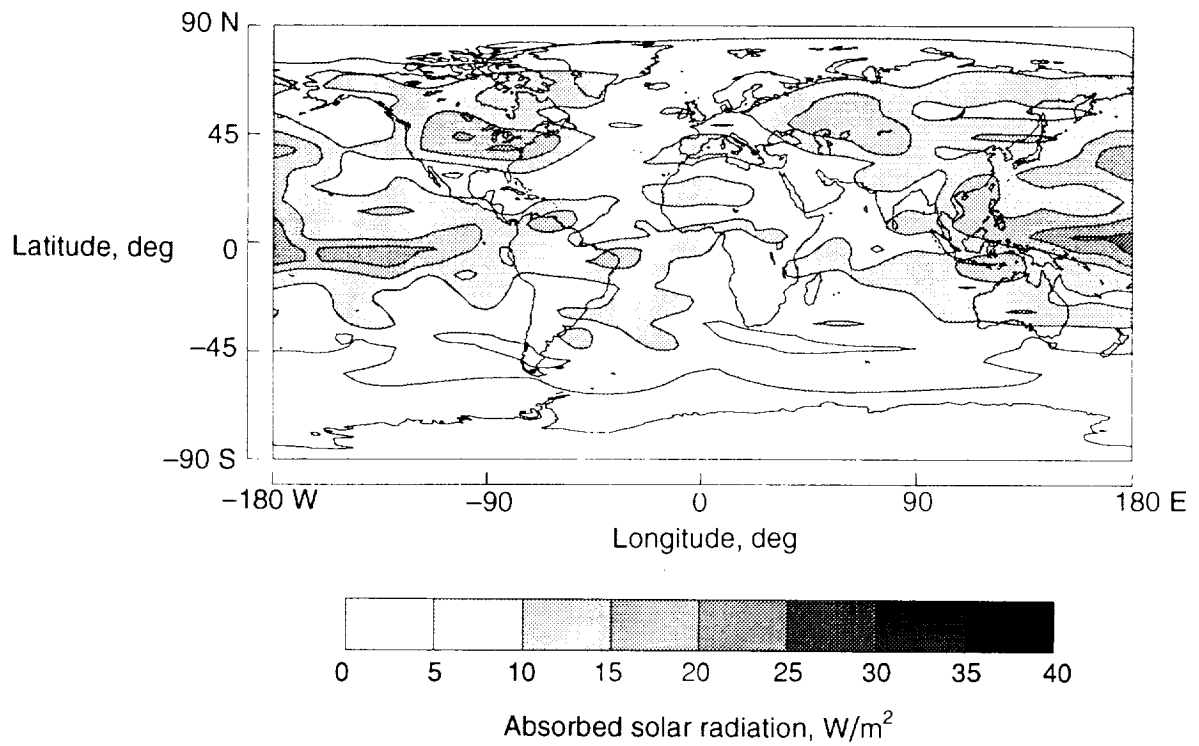


Figure 4. Standard deviation of absorbed solar radiation about monthly mean for April.

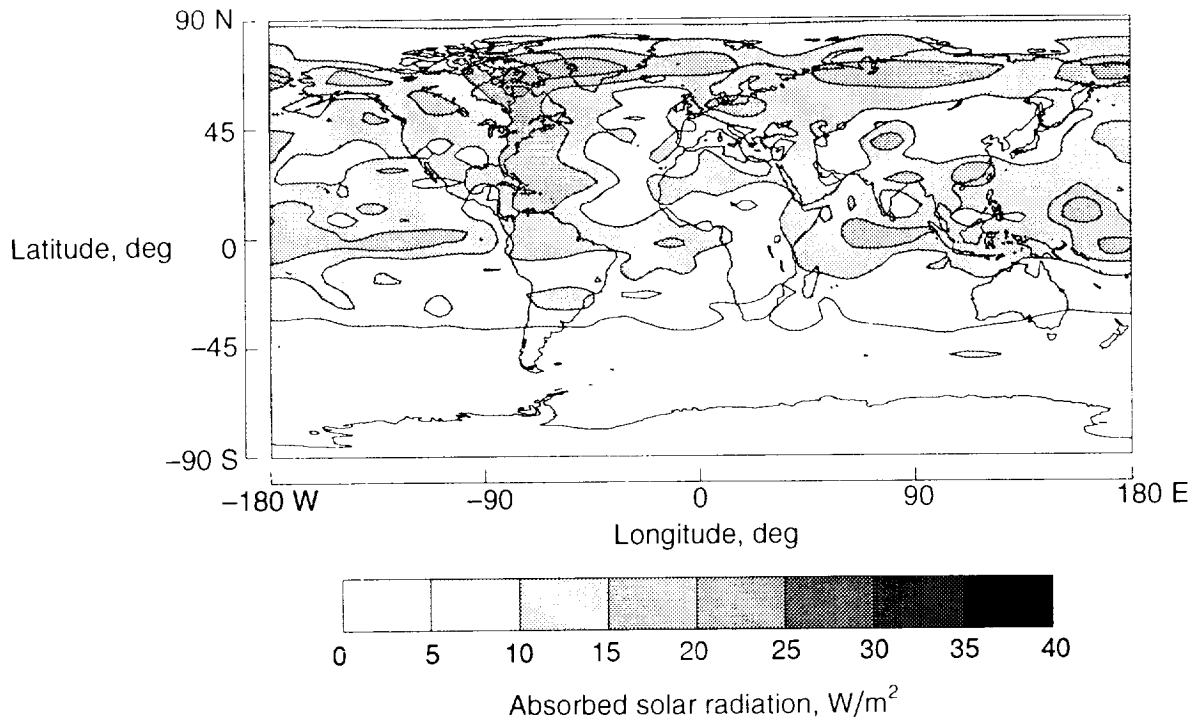


Figure 5. Standard deviation of absorbed solar radiation about monthly mean for May.

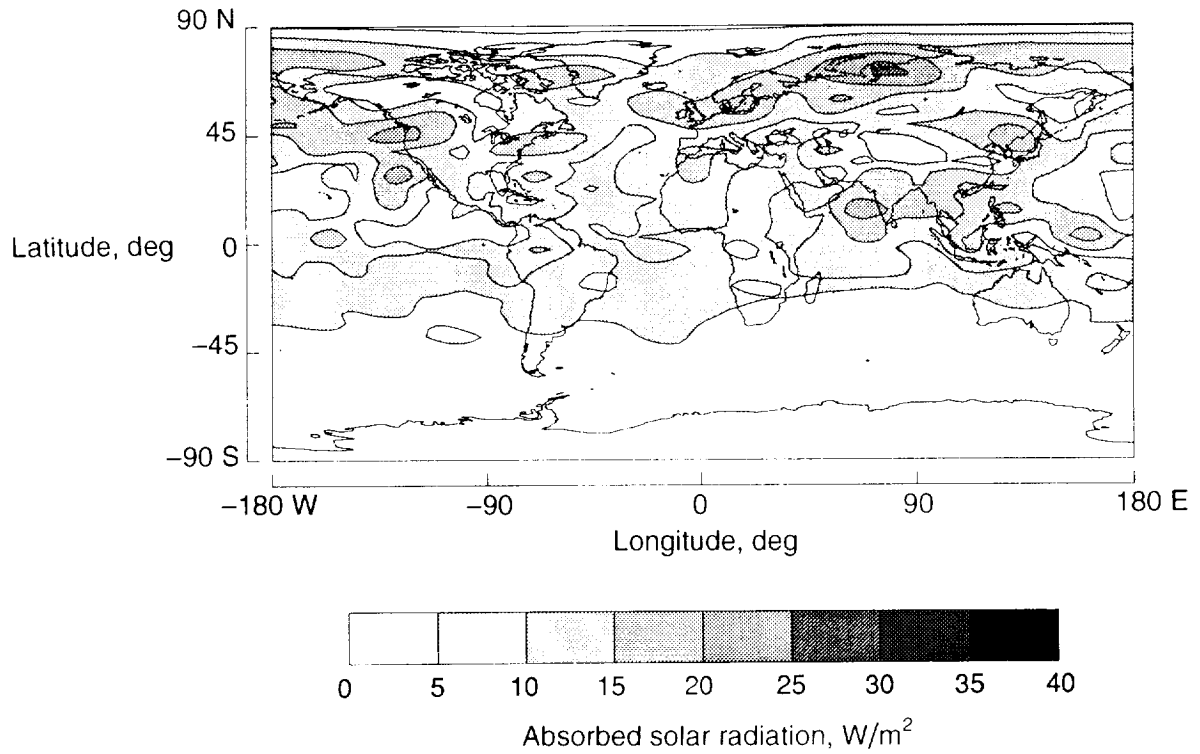


Figure 6. Standard deviation of absorbed solar radiation about monthly mean for June.

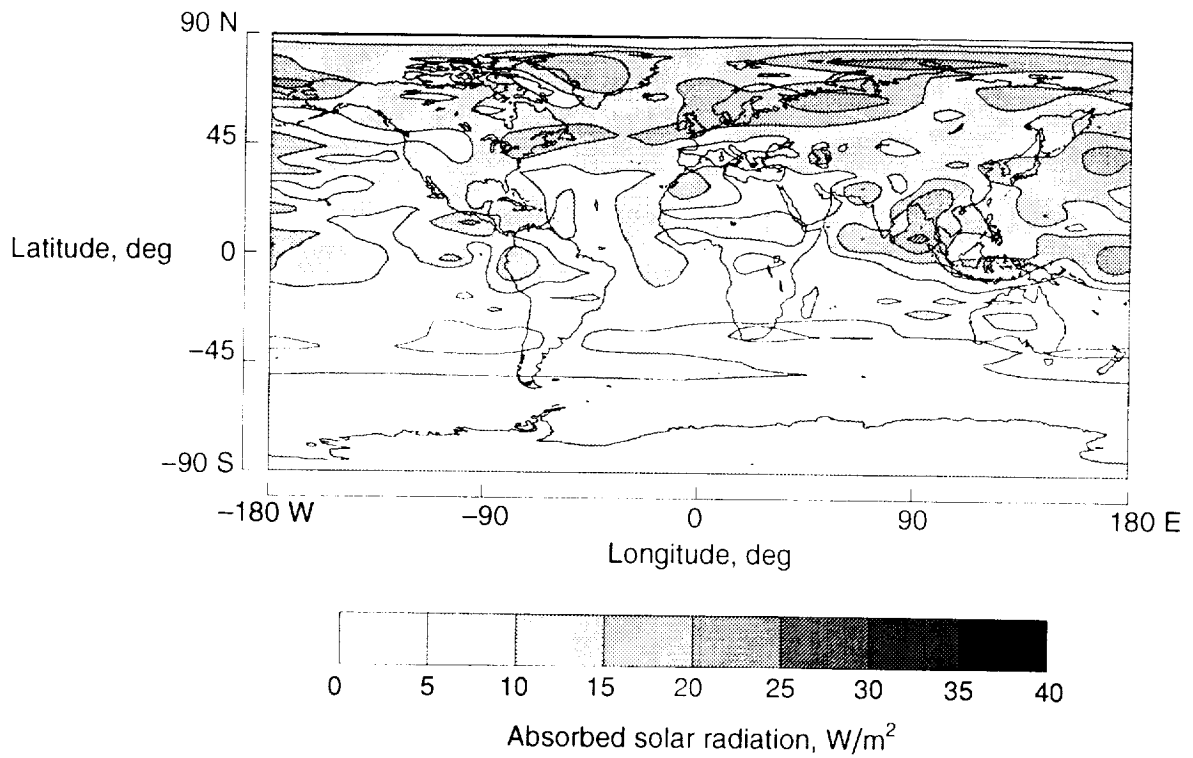


Figure 7. Standard deviation of absorbed solar radiation about monthly mean for July.

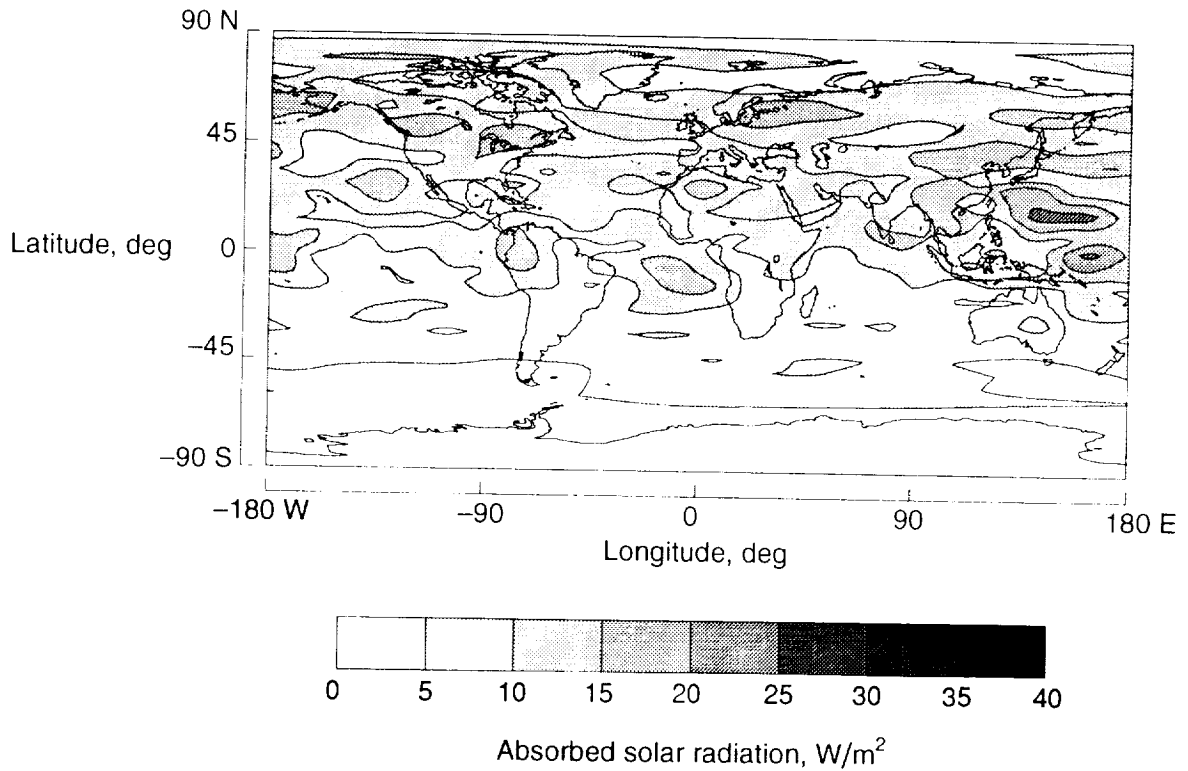


Figure 8. Standard deviation of absorbed solar radiation about monthly mean for August.

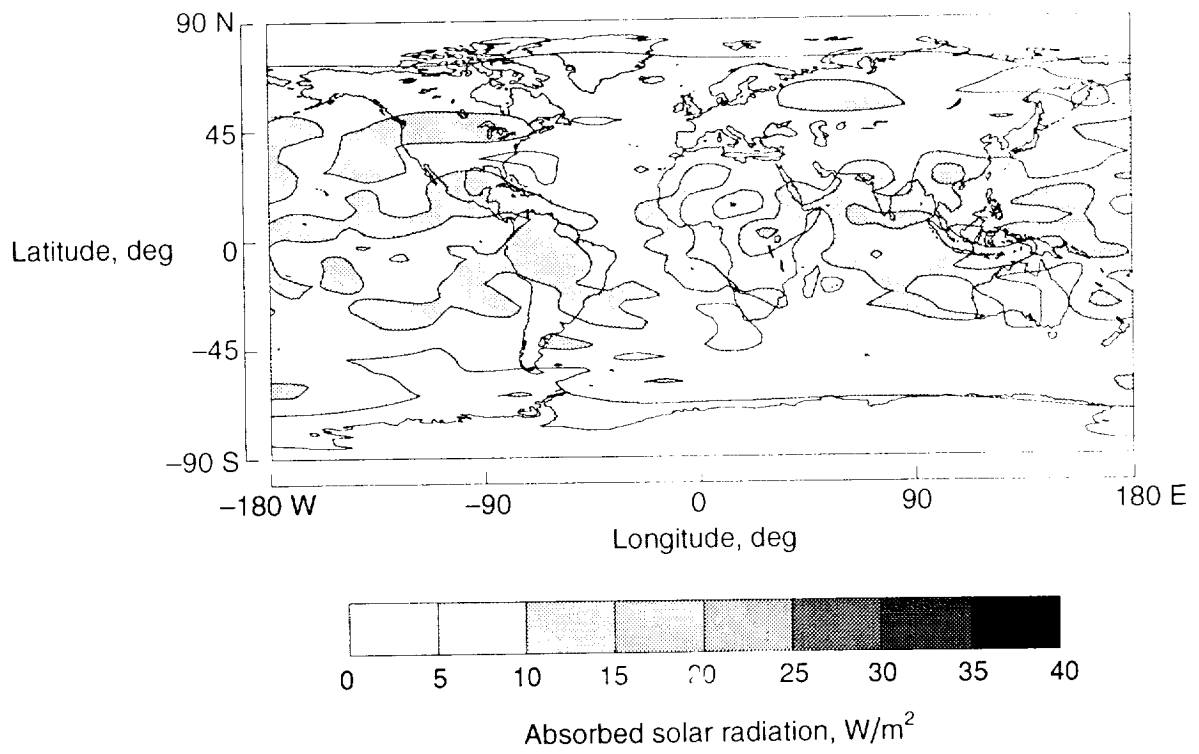


Figure 9. Standard deviation of absorbed solar radiation about monthly mean for September.

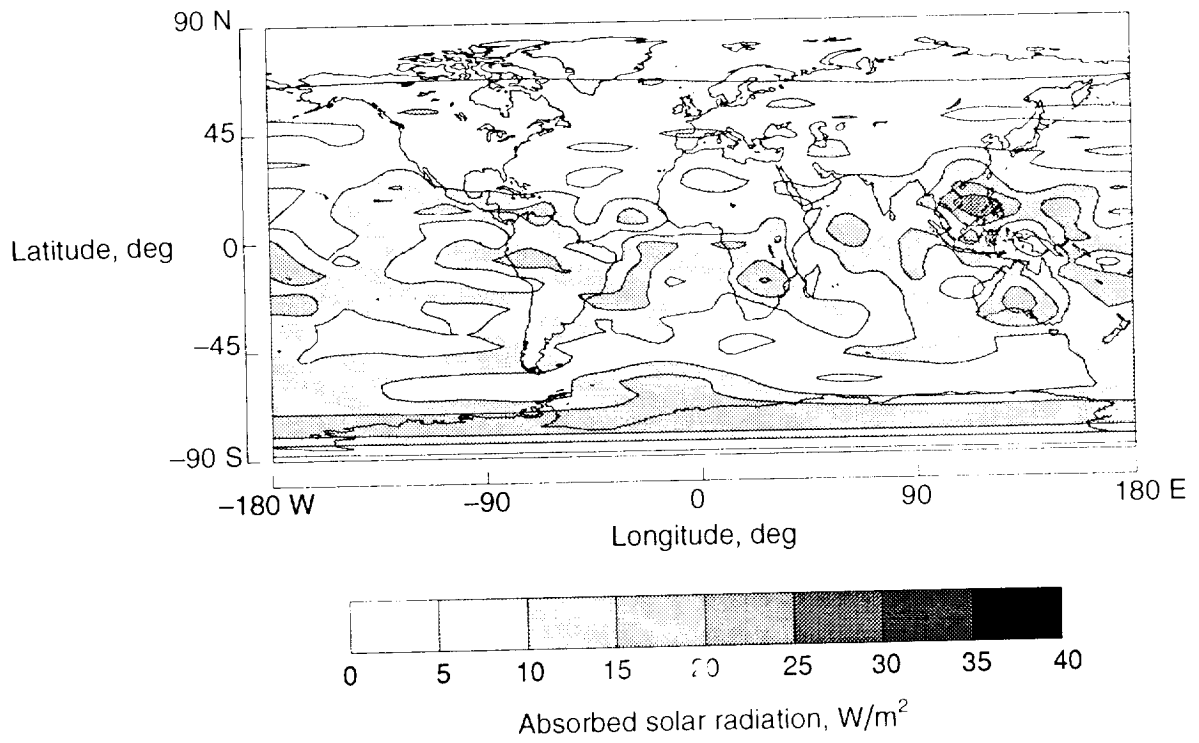


Figure 10. Standard deviation of absorbed solar radiation about monthly mean for October.

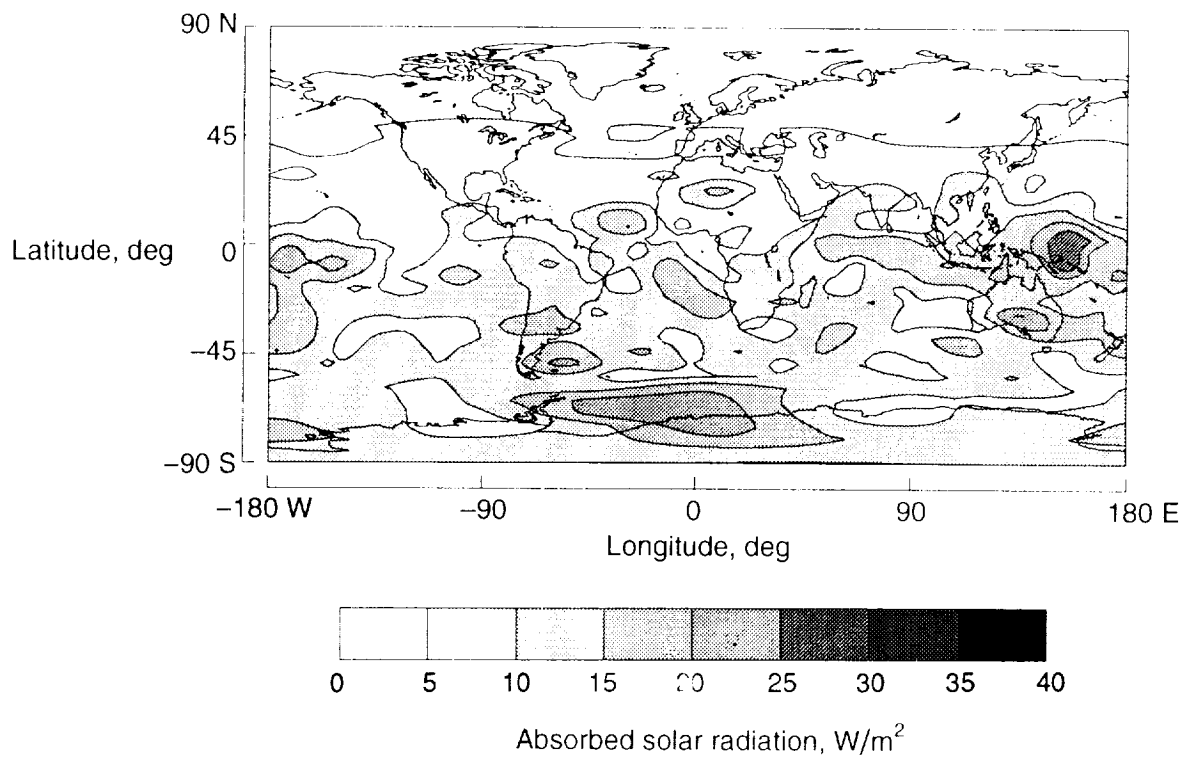


Figure 11. Standard deviation of absorbed solar radiation about monthly mean for November.

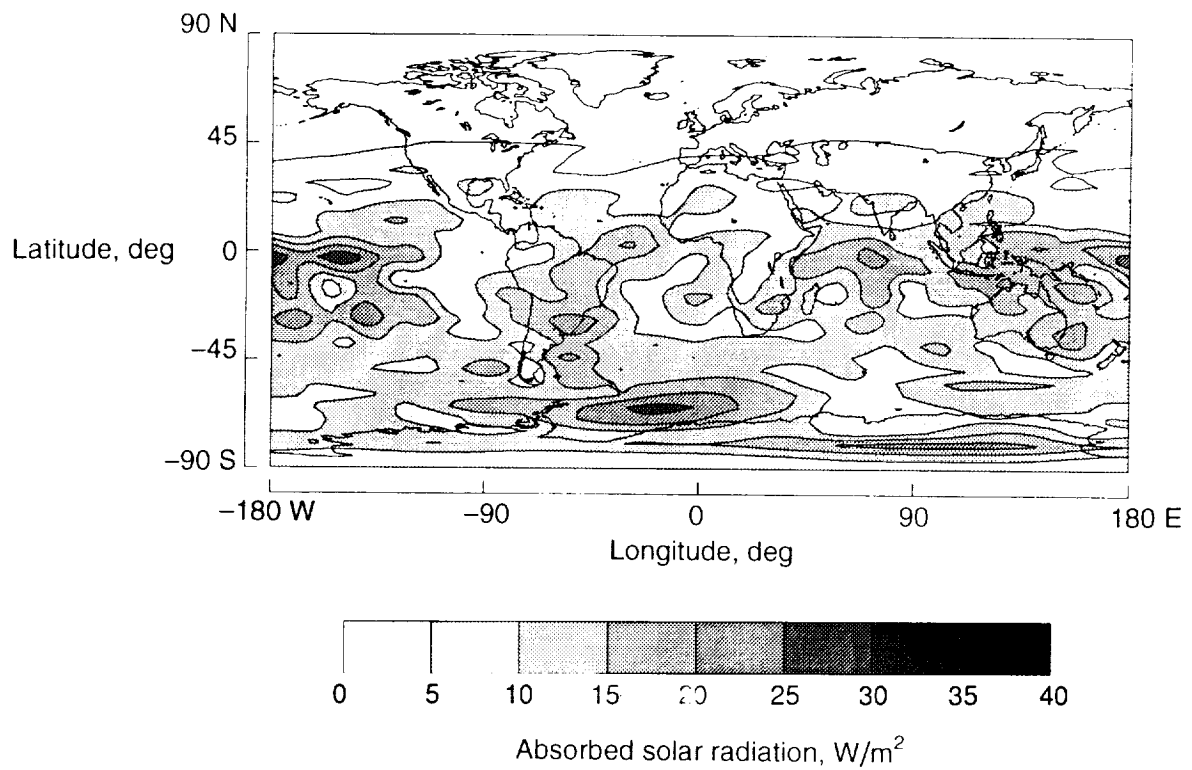
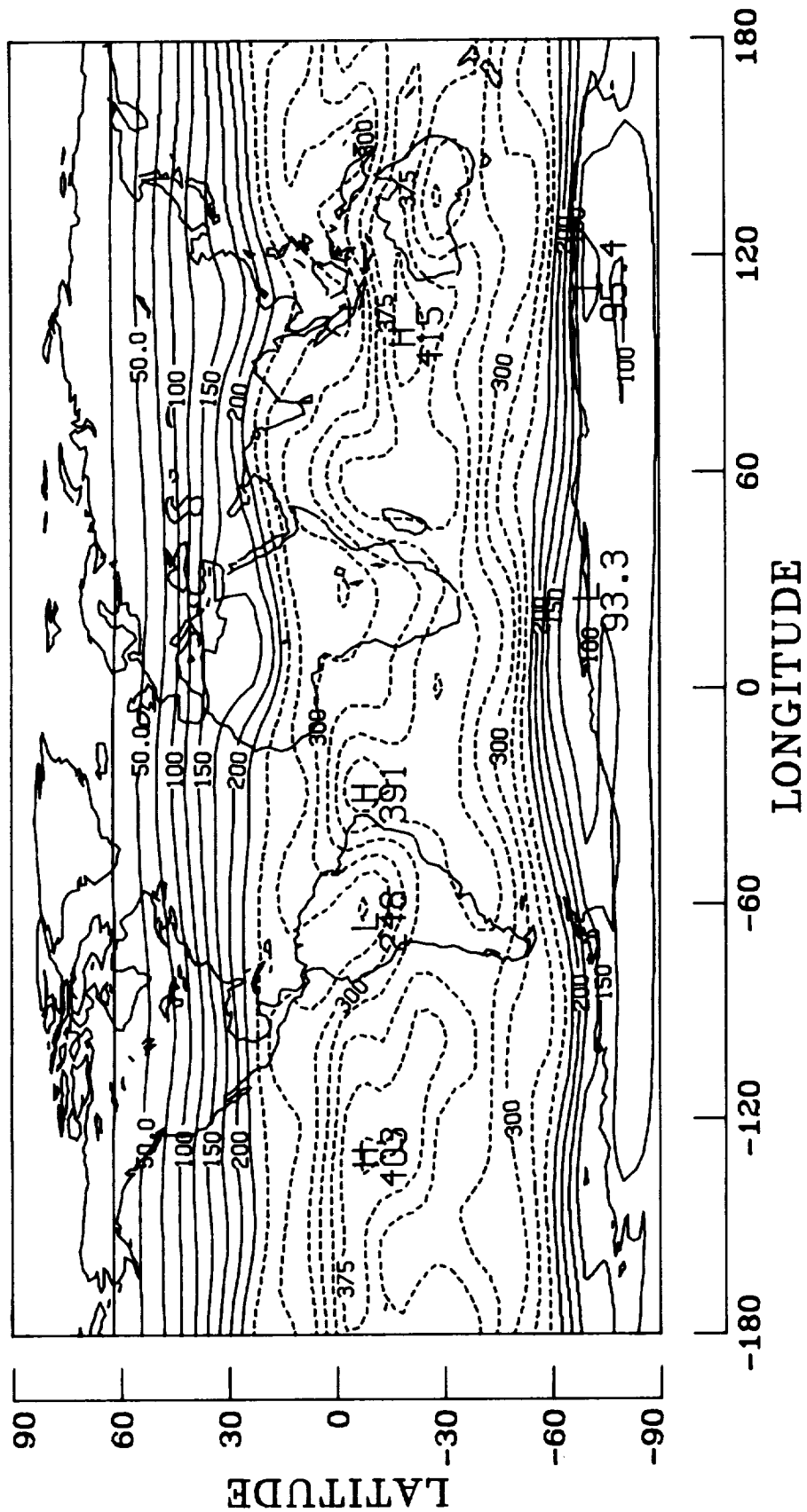


Figure 12. Standard deviation of absorbed solar radiation about monthly mean for December.

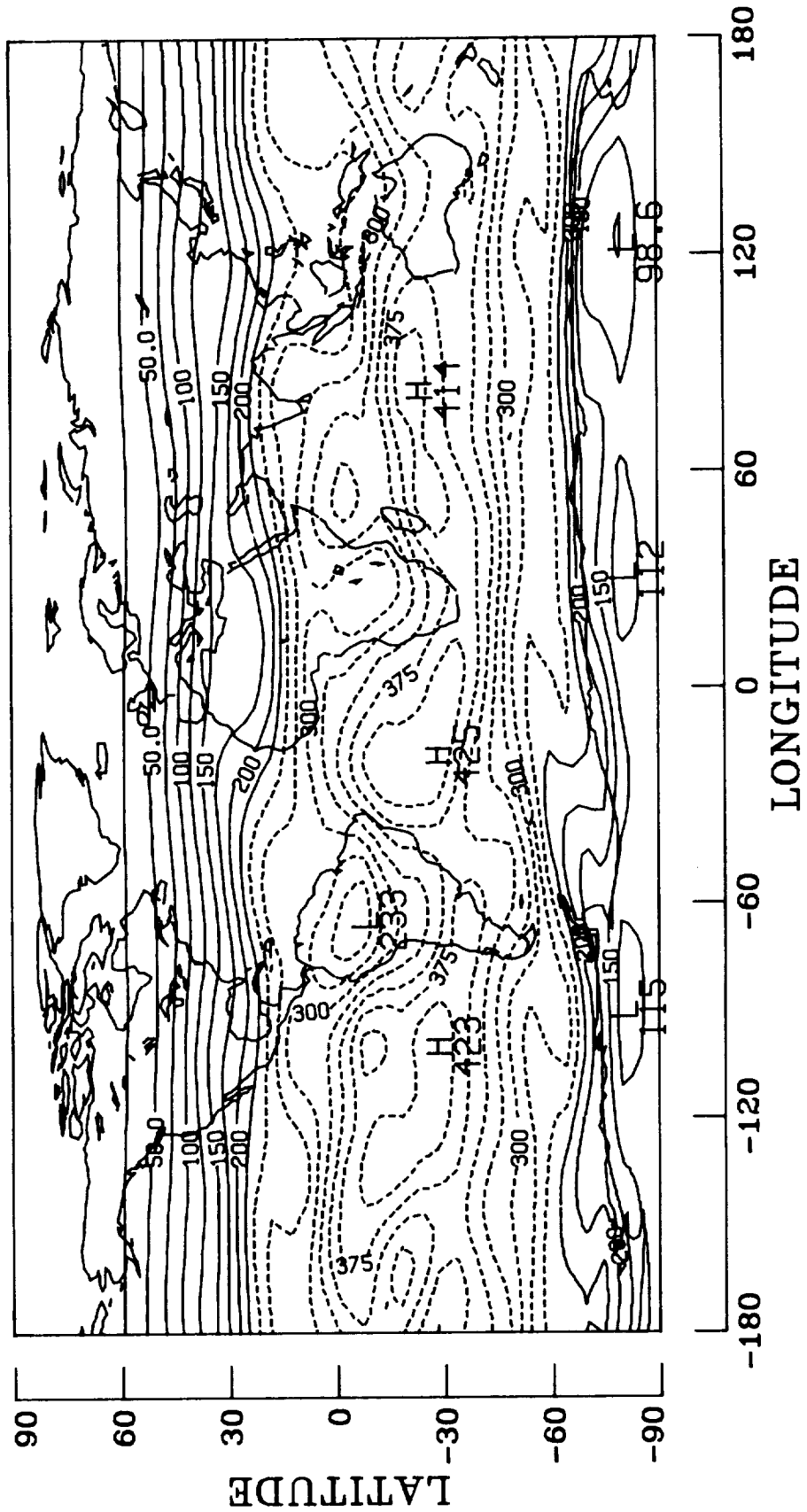
Absorbed Solar W/m^2

November 1985



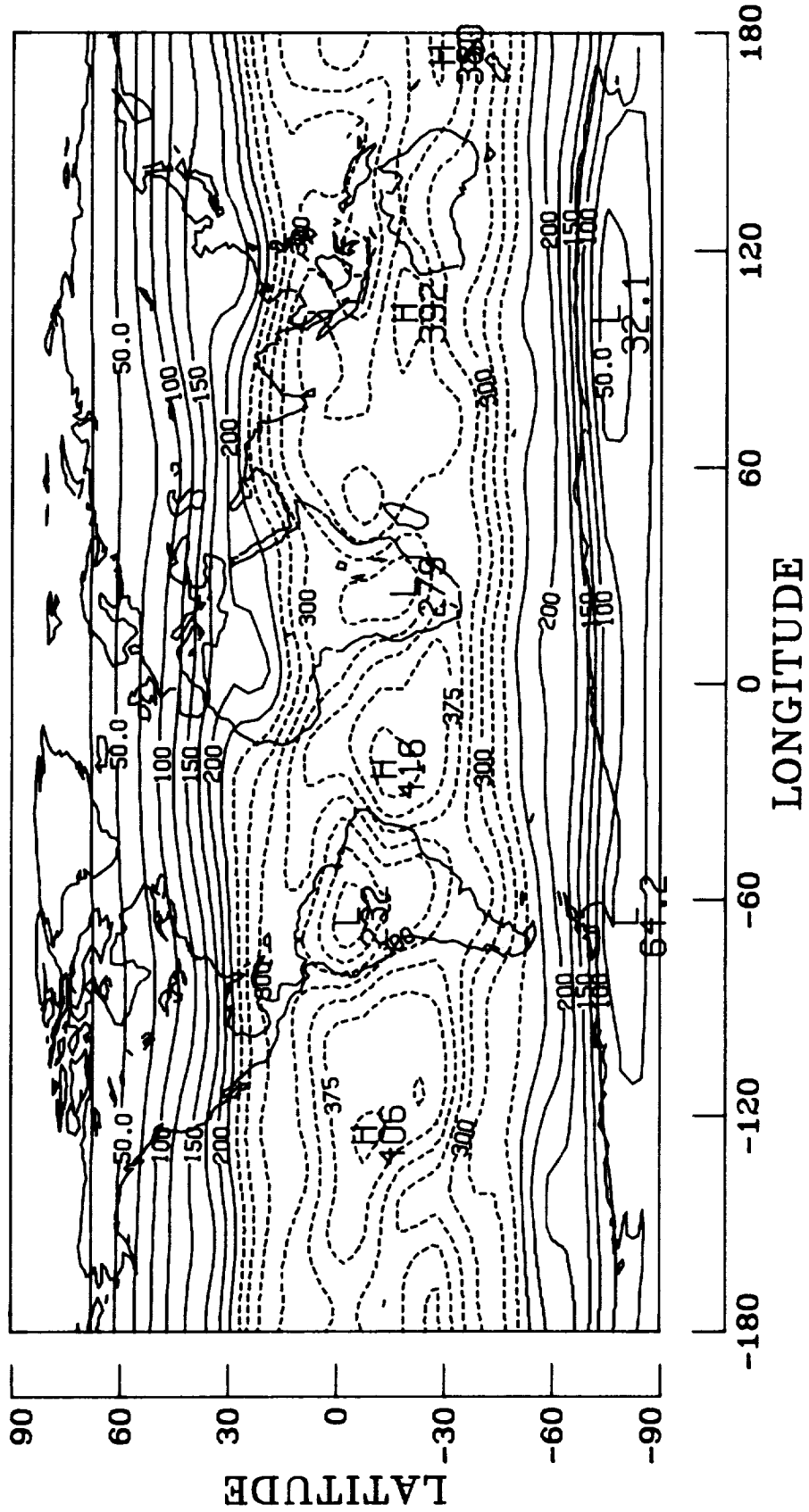
Absorbed Solar W/m^2

January 1986



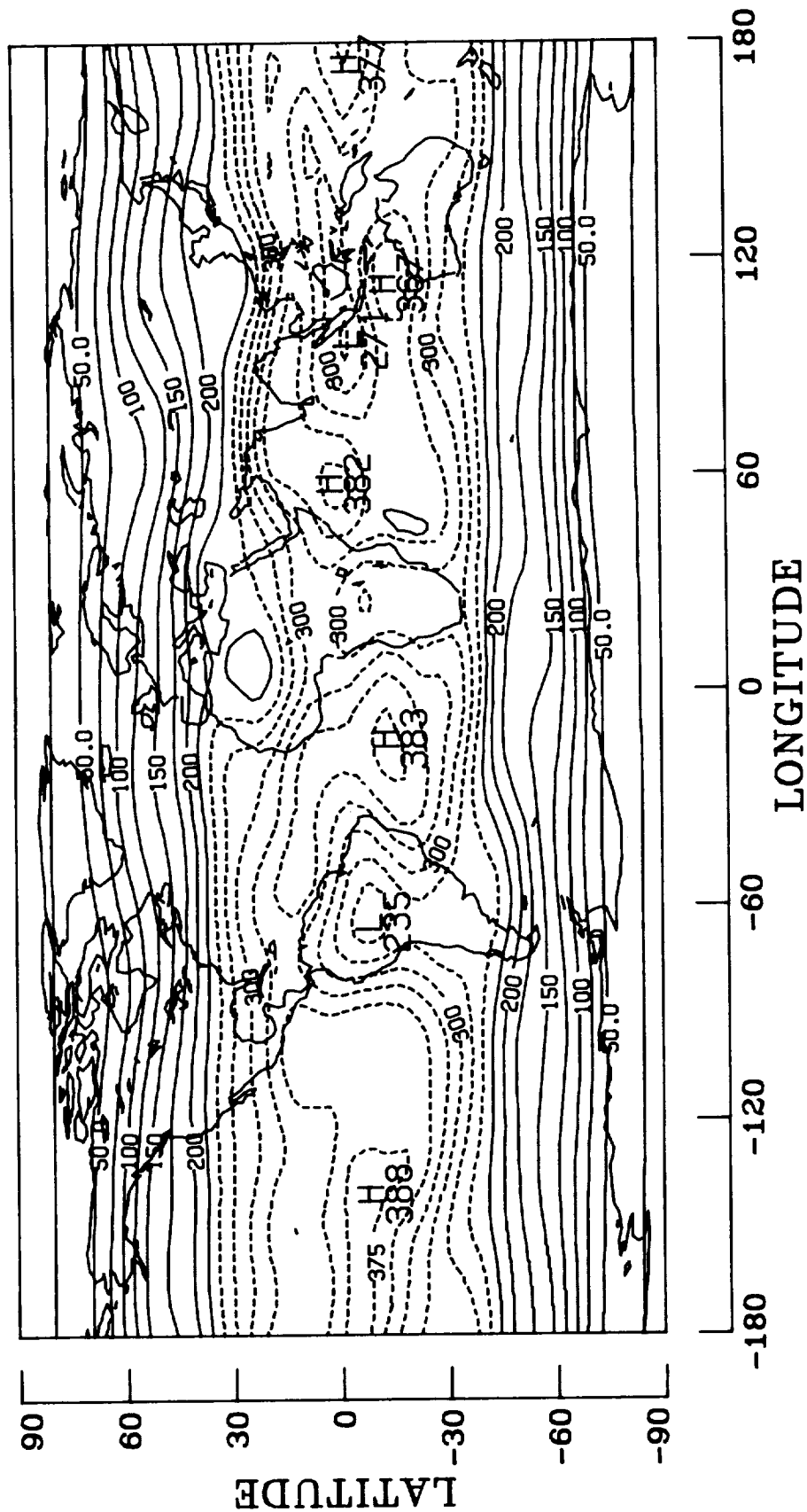
Absorbed Solar W/m^2

February 1986

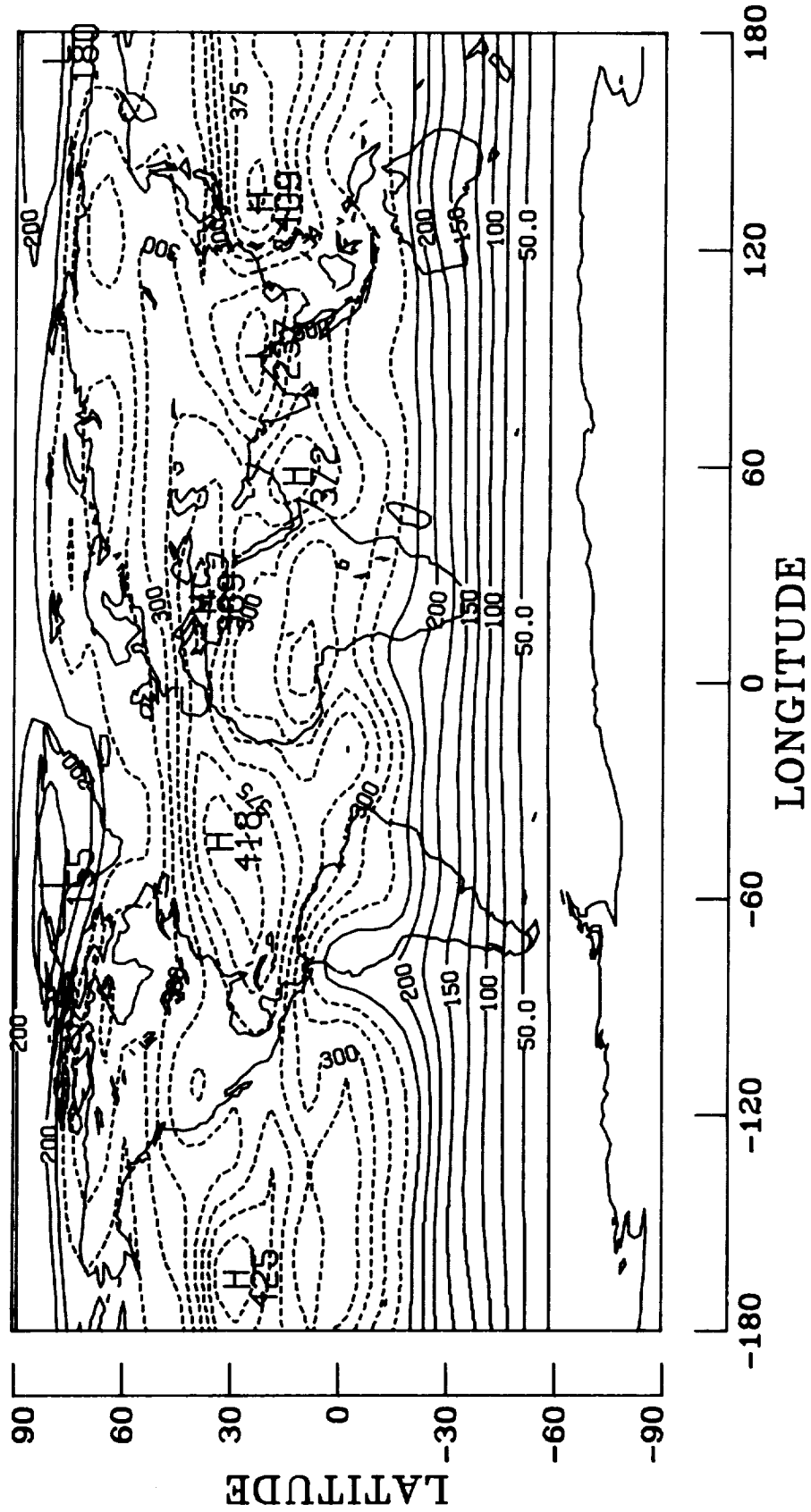


Absorbed Solar W/m^2

March 1986

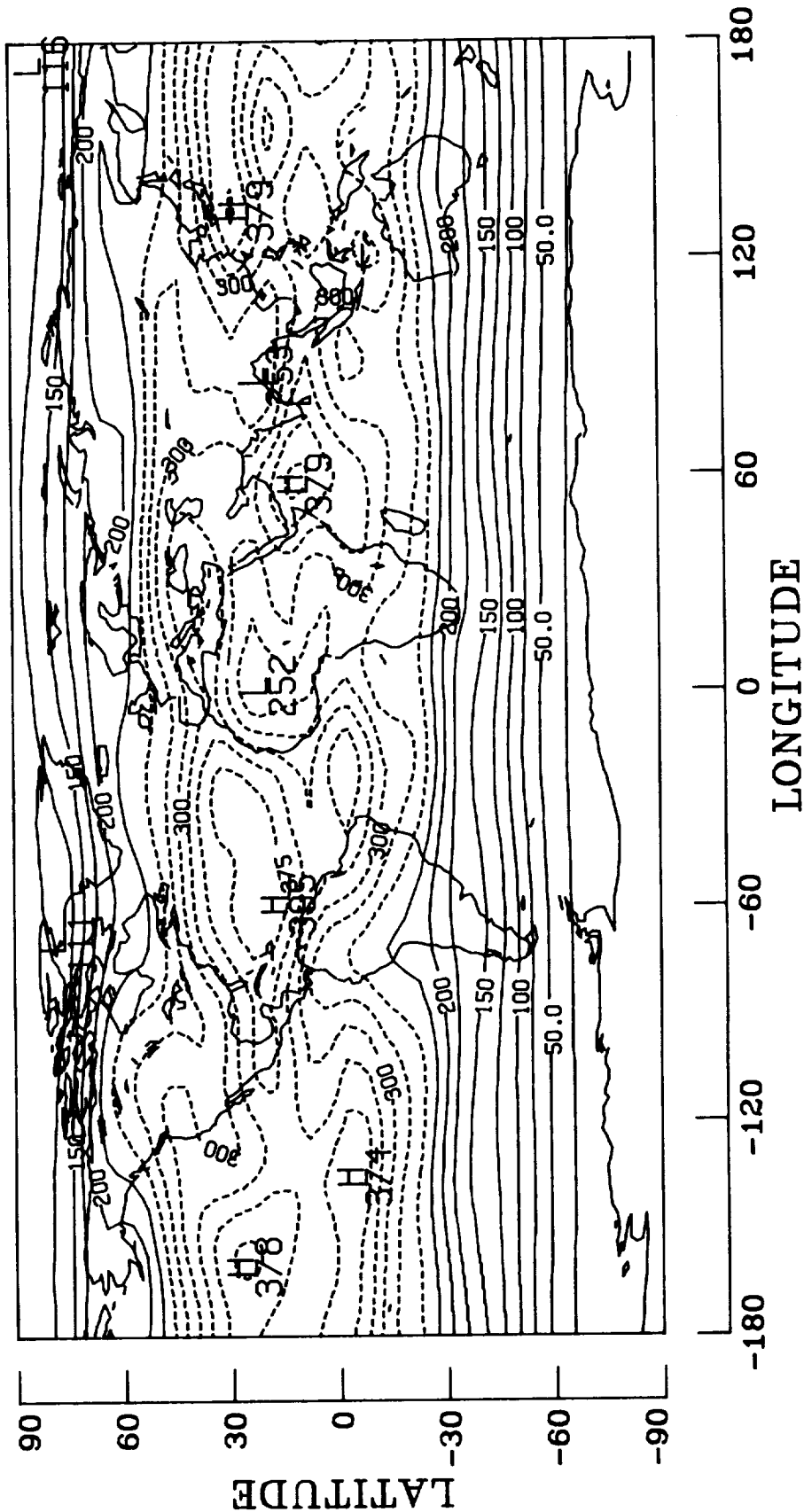


Absorbed Solar W/m^2 July 1986

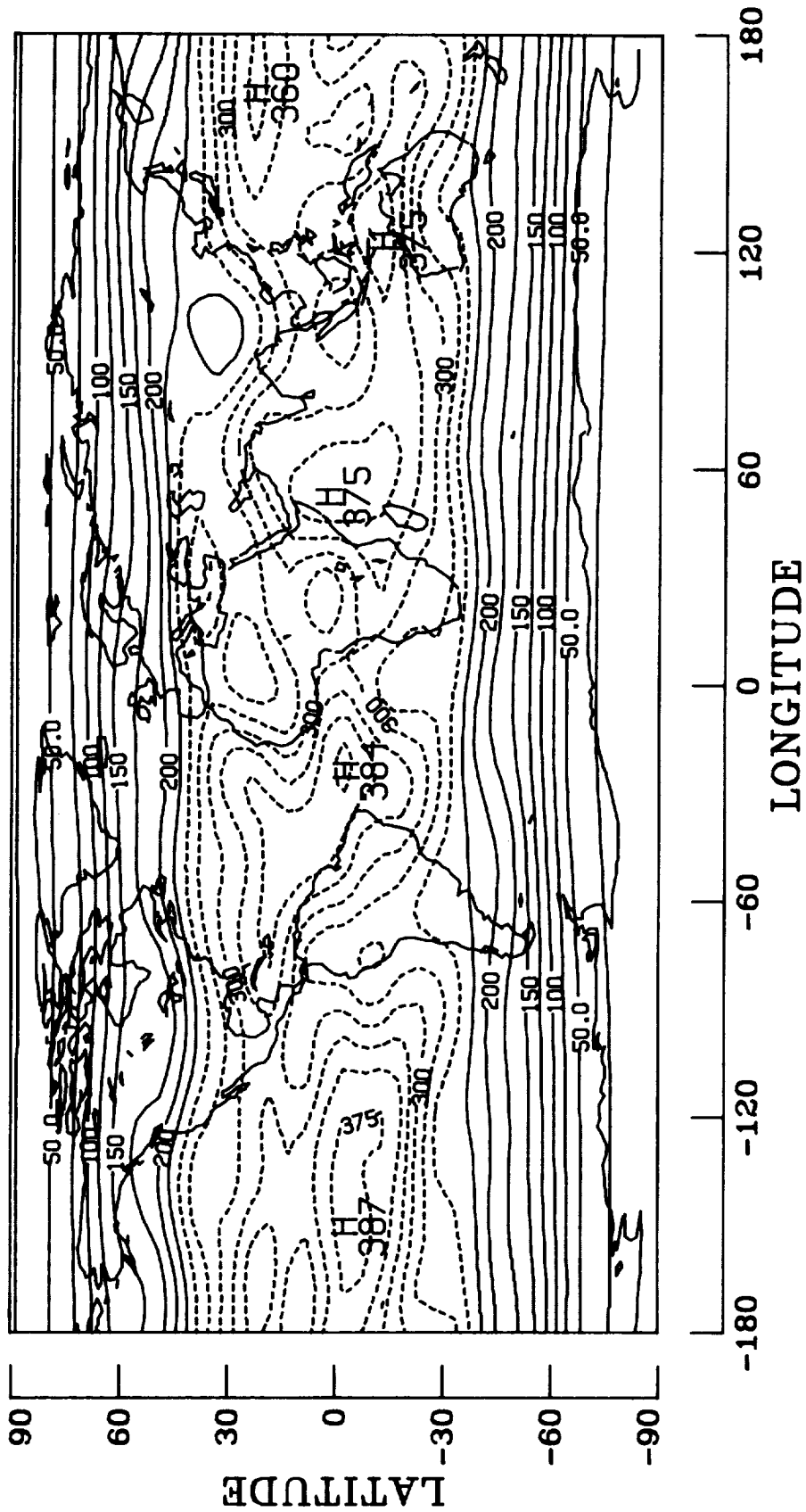


Absorbed Solar W/m^2

August 1986

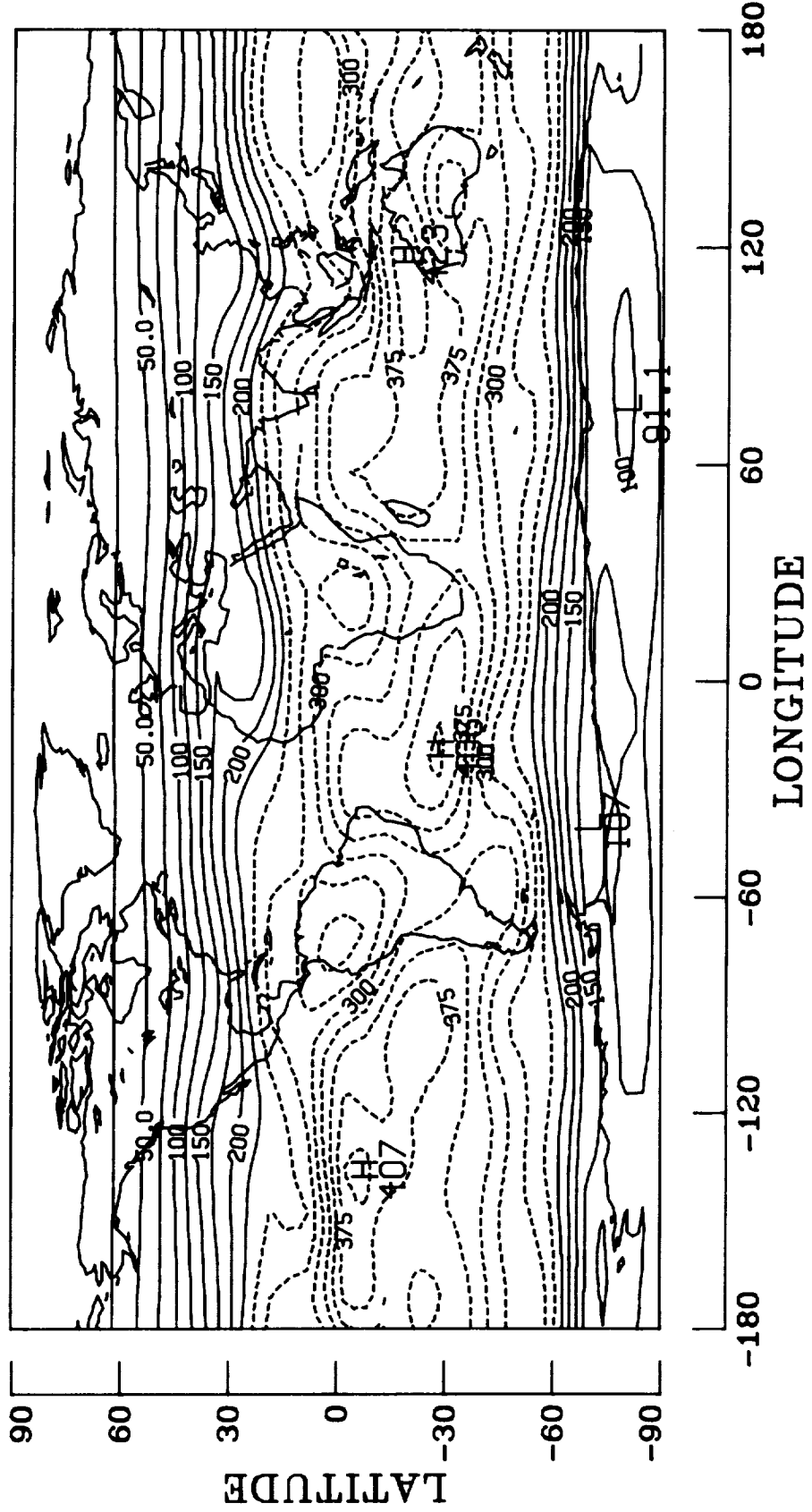


Absorbed Solar W/m^2 September 1986



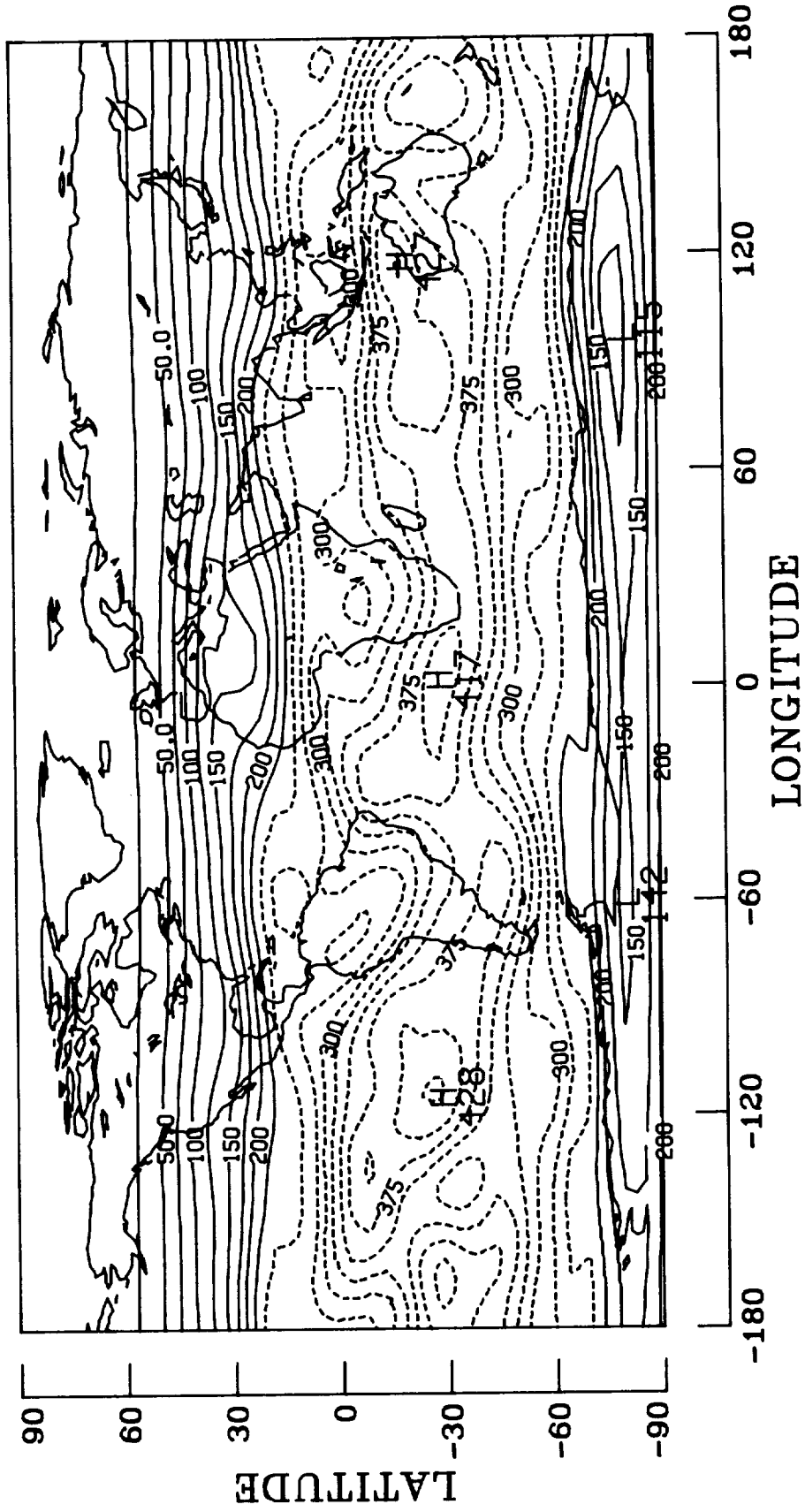
Absorbed Solar W/m^2

November 1986



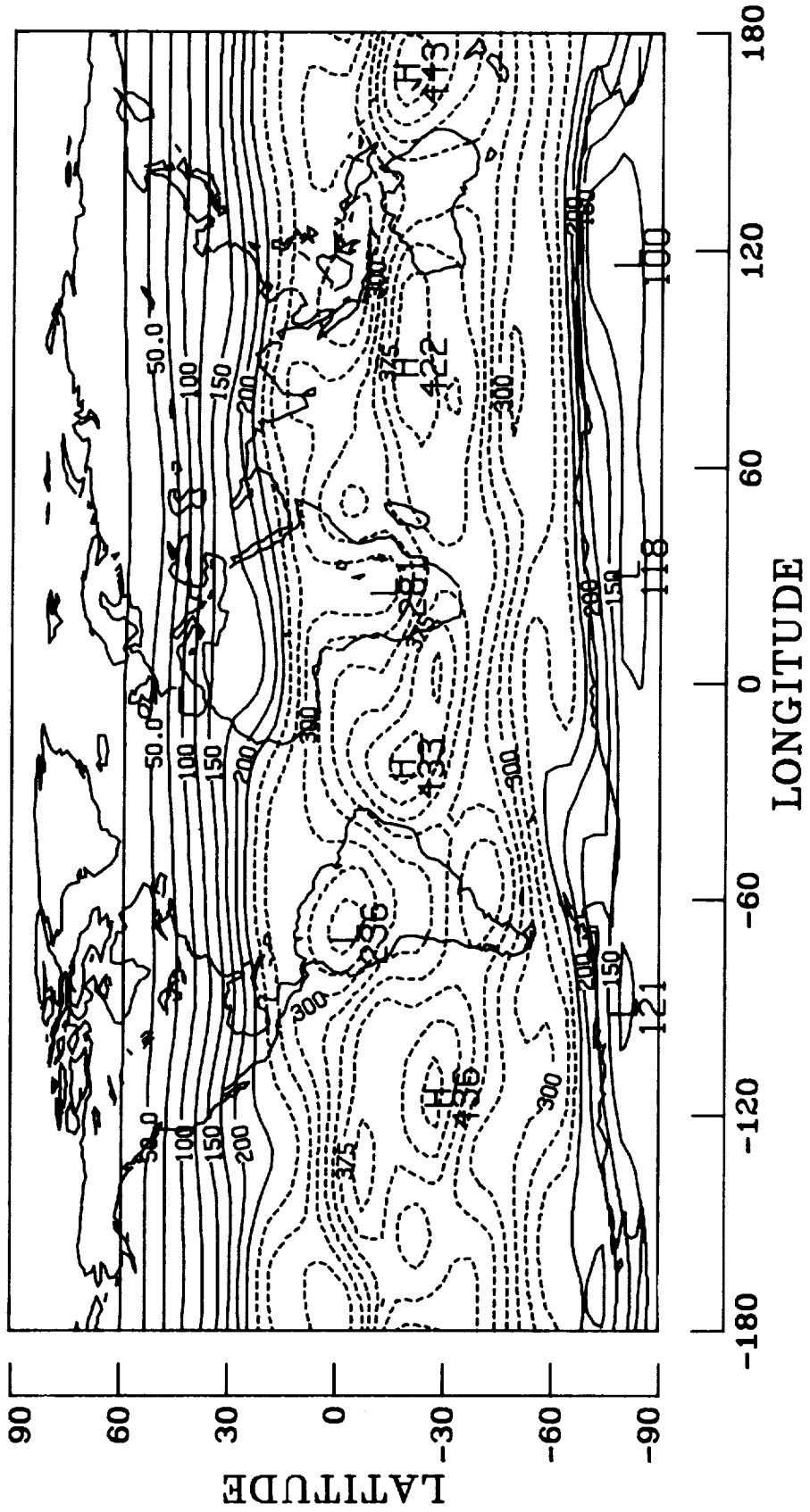
Absorbed Solar W/m^2

December 1986



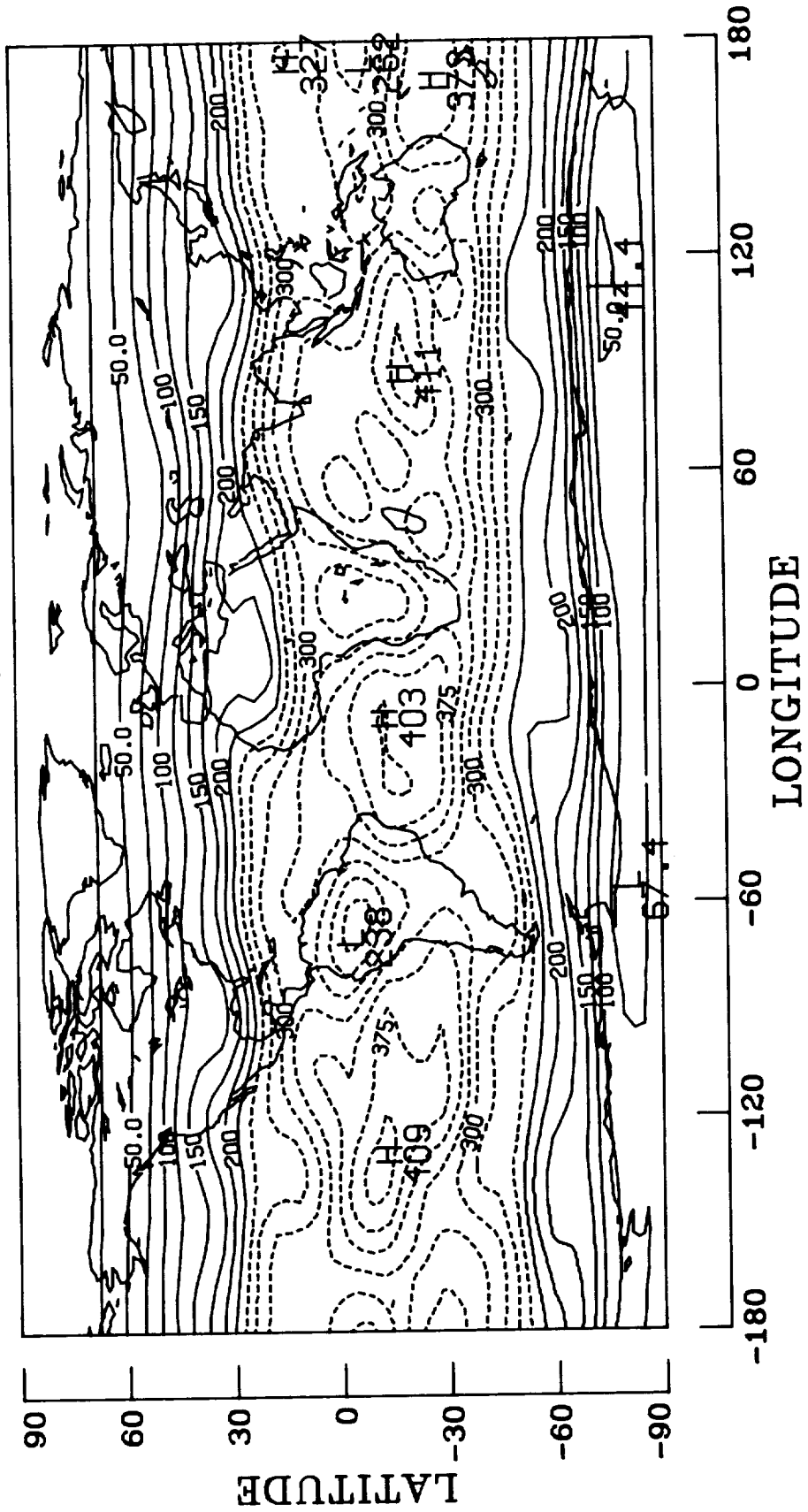
Absorbed Solar W/m^2

January 1987



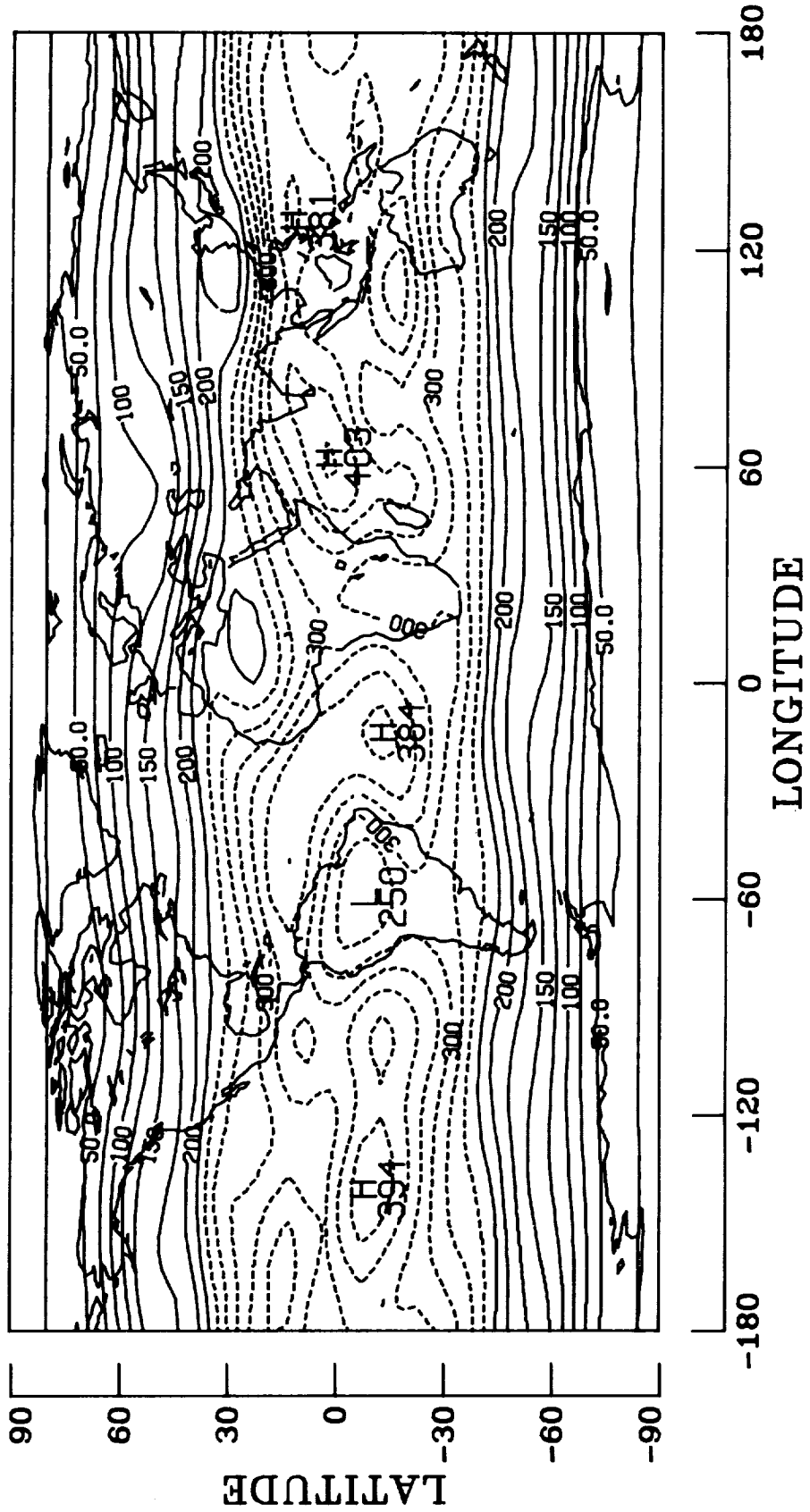
Absorbed Solar W/m^2

February 1987



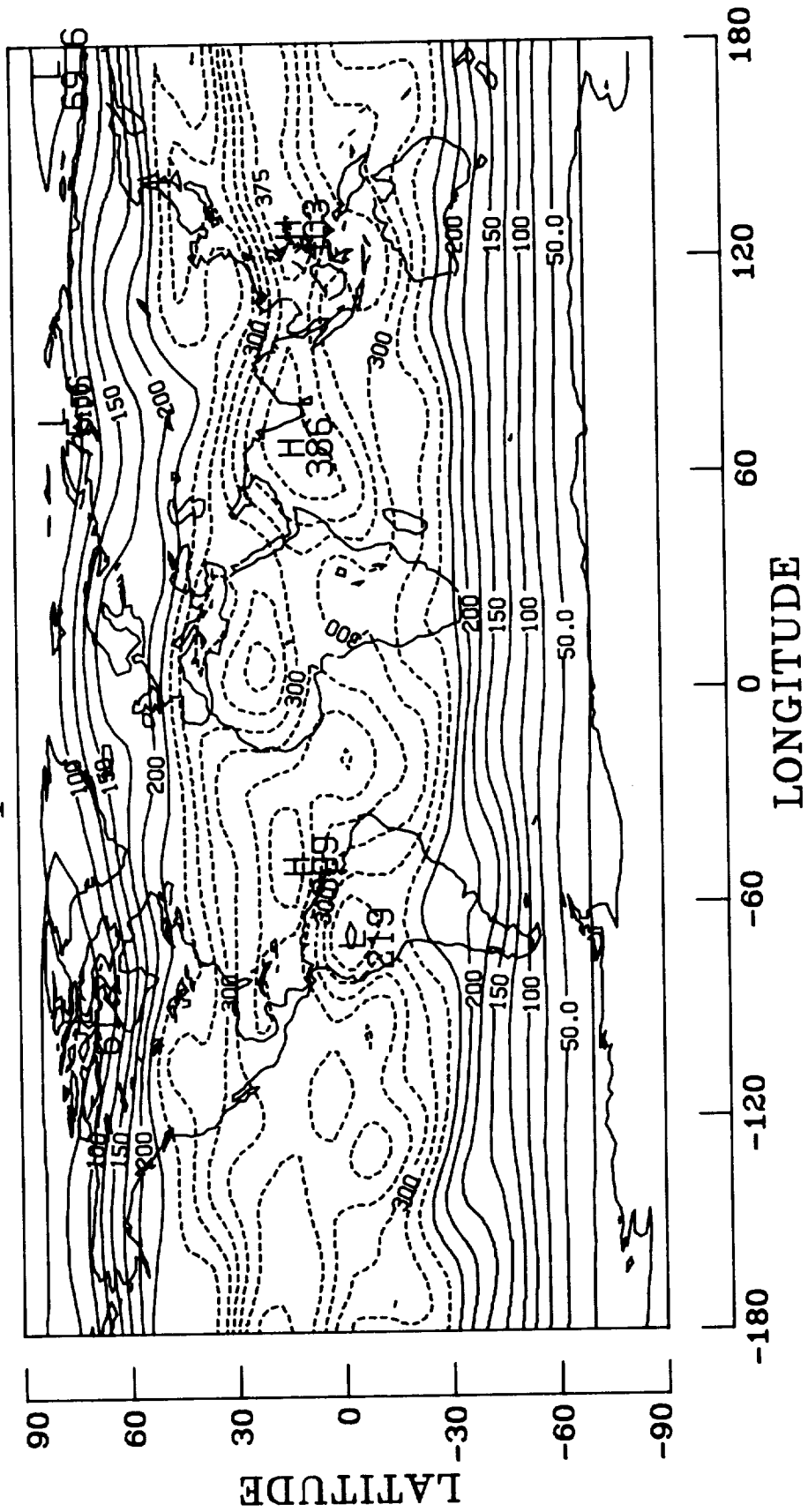
Absorbed Solar W/m^2

March 1987



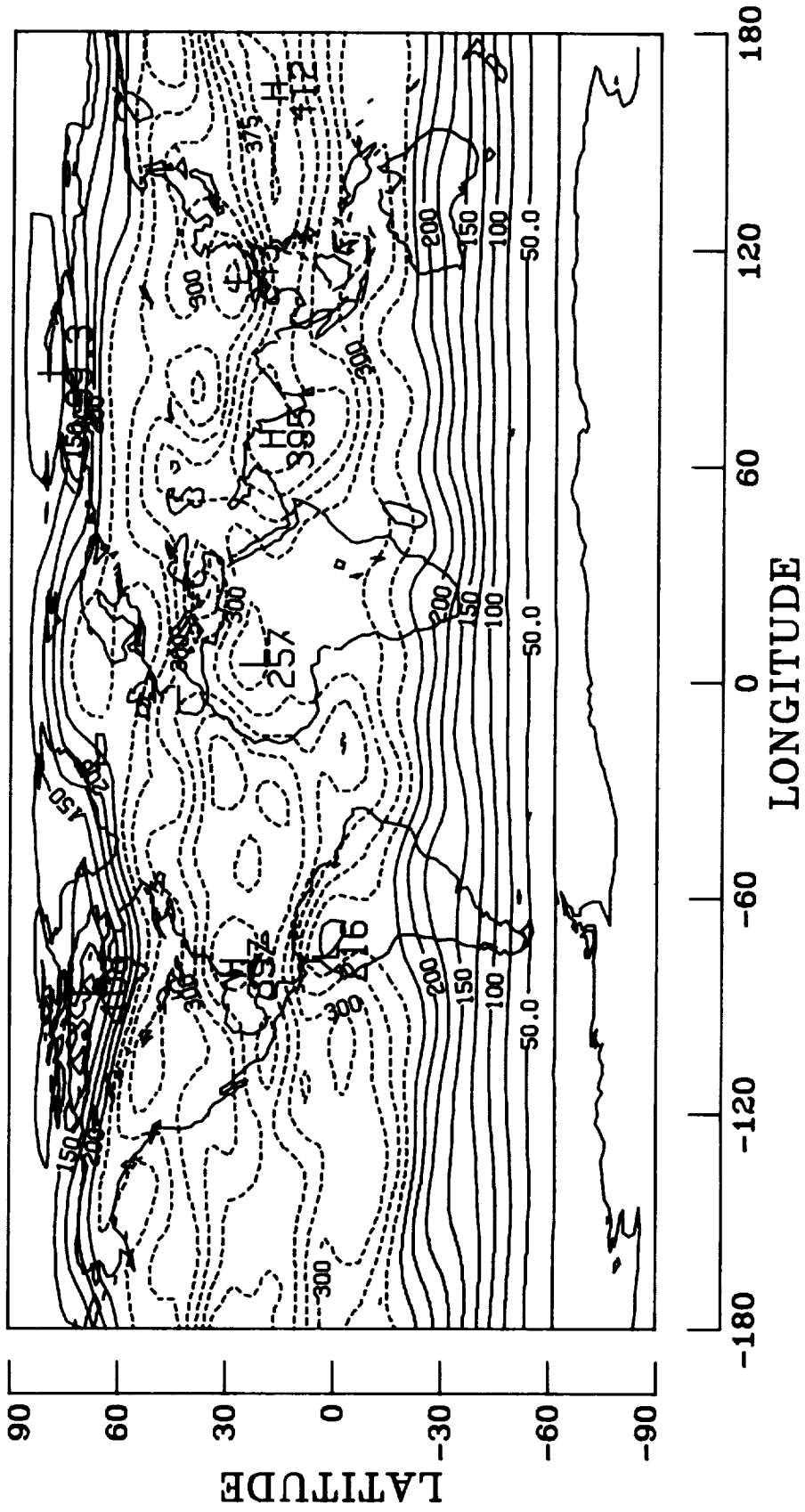
Absorbed Solar W/m^2

April 1987



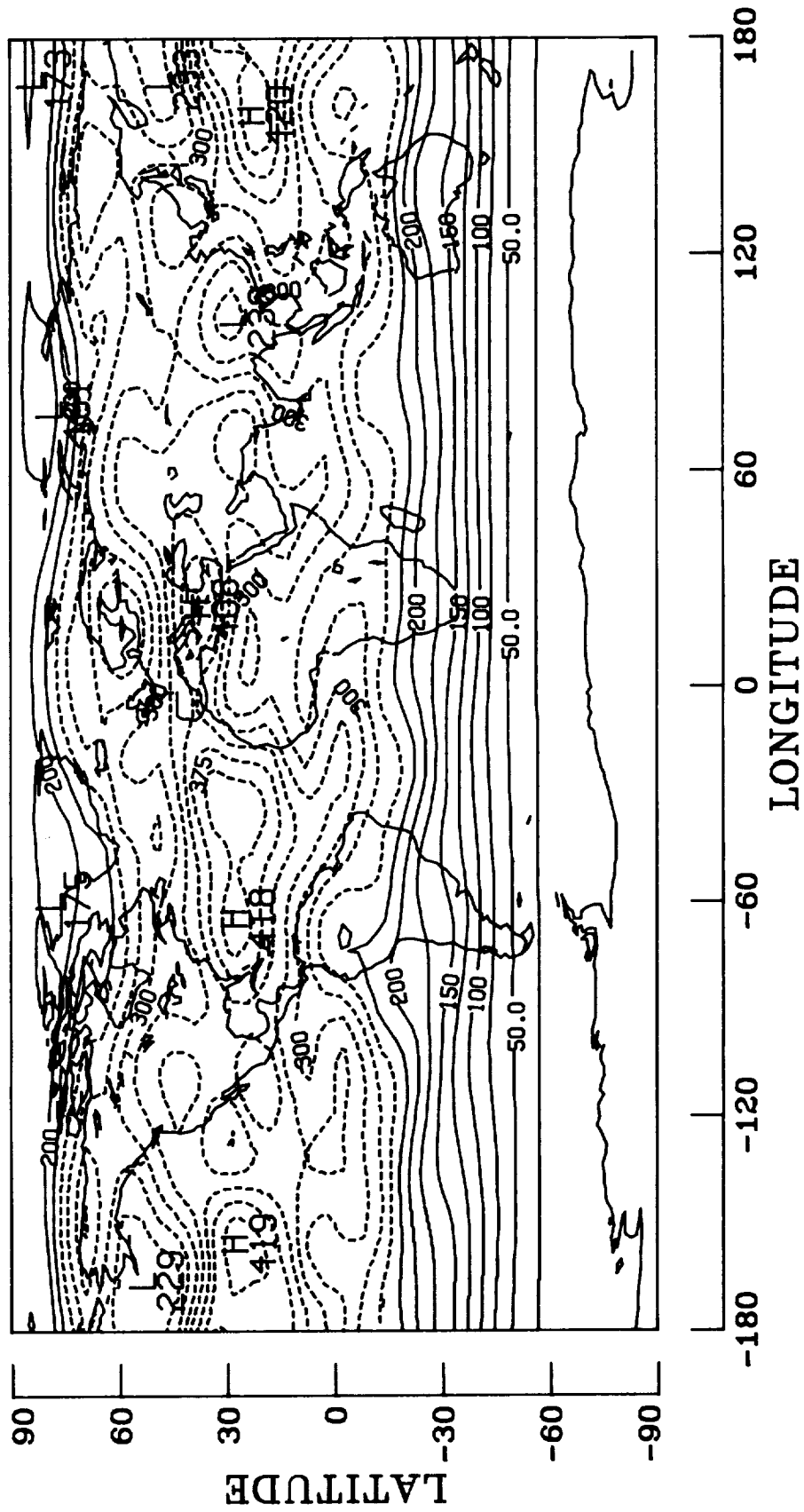
Absorbed Solar W/m^2

May 1987



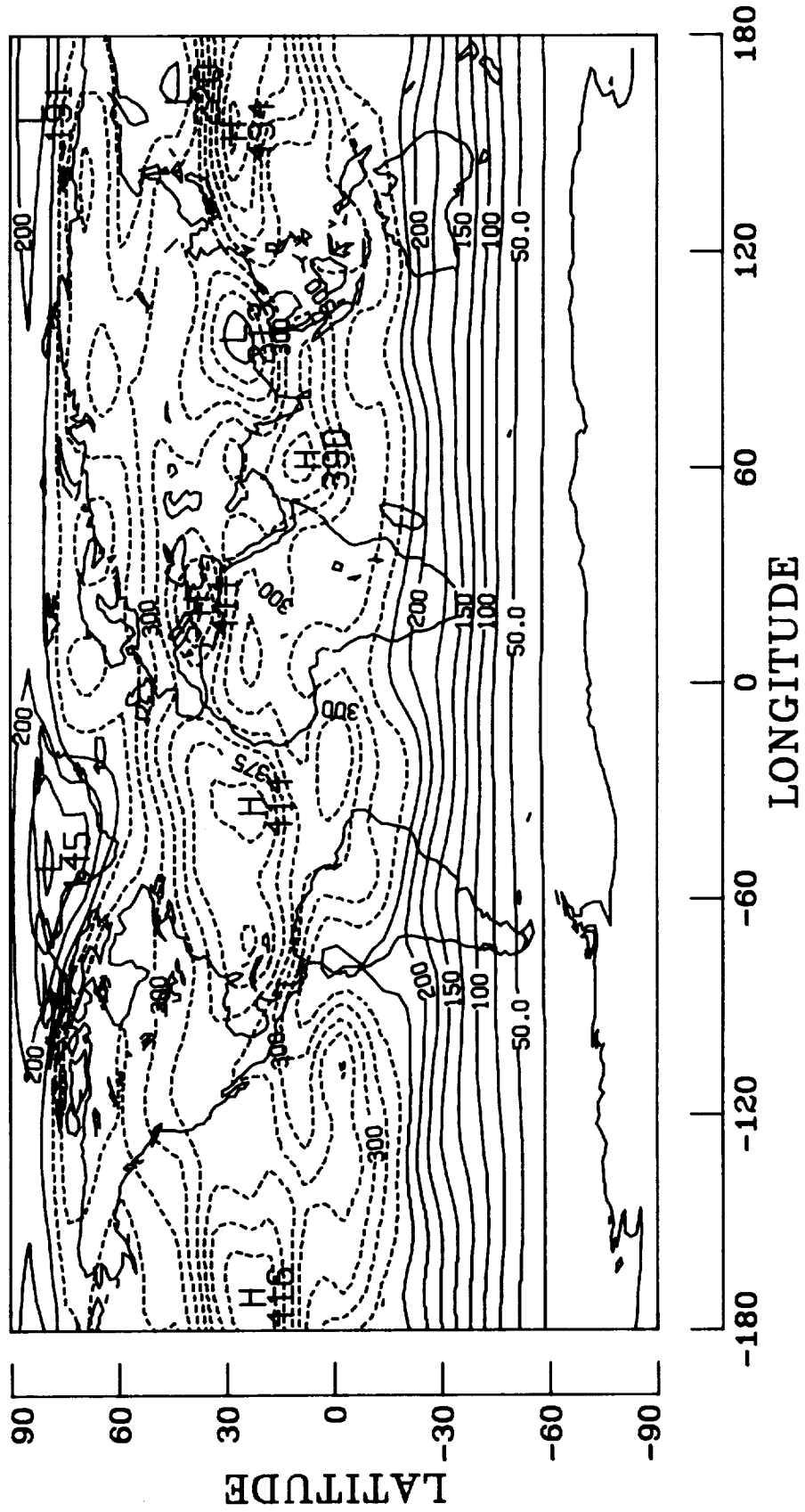
Absorbed Solar W/m^2

June 1987

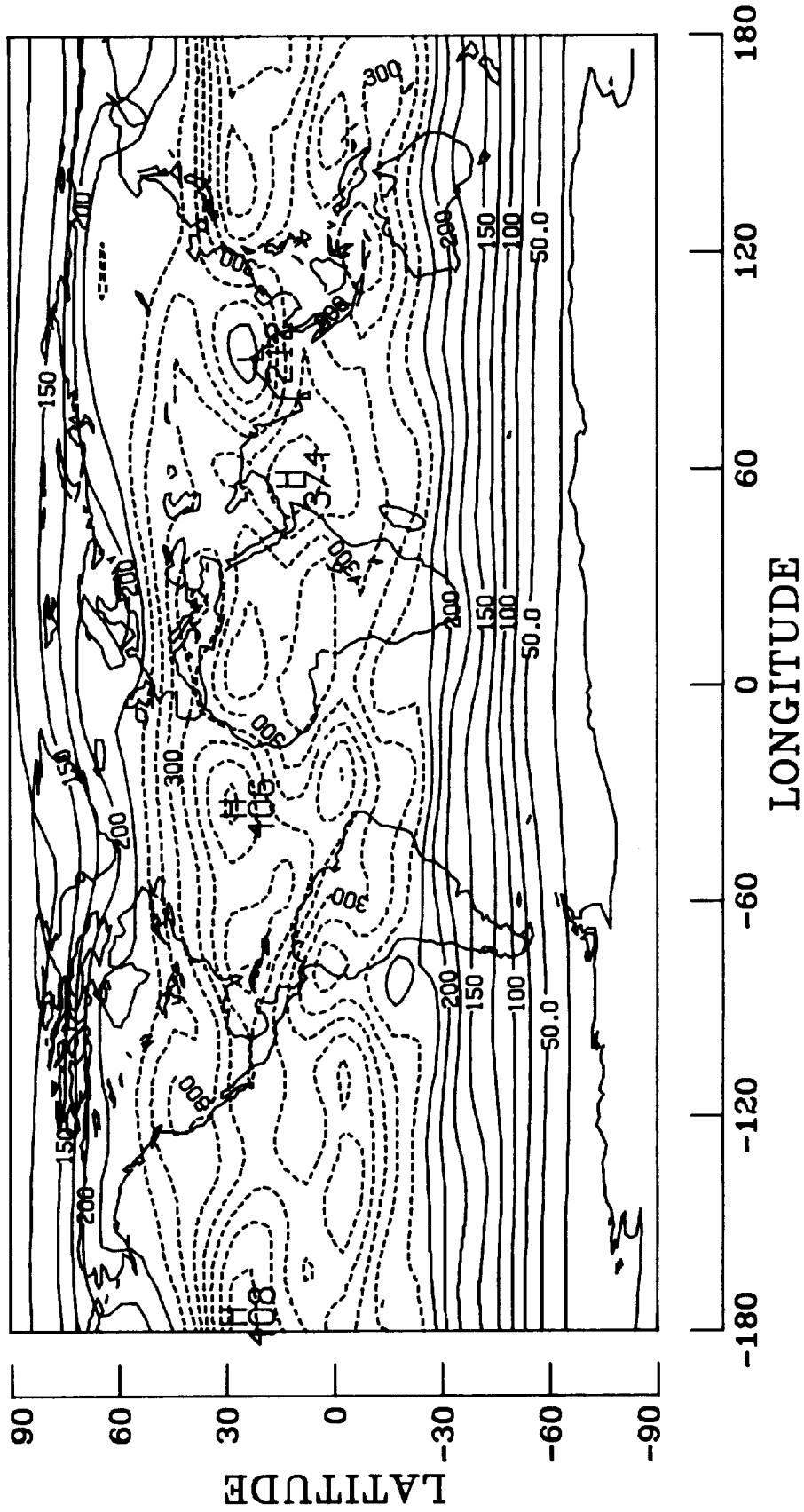


Absorbed Solar W/m^2

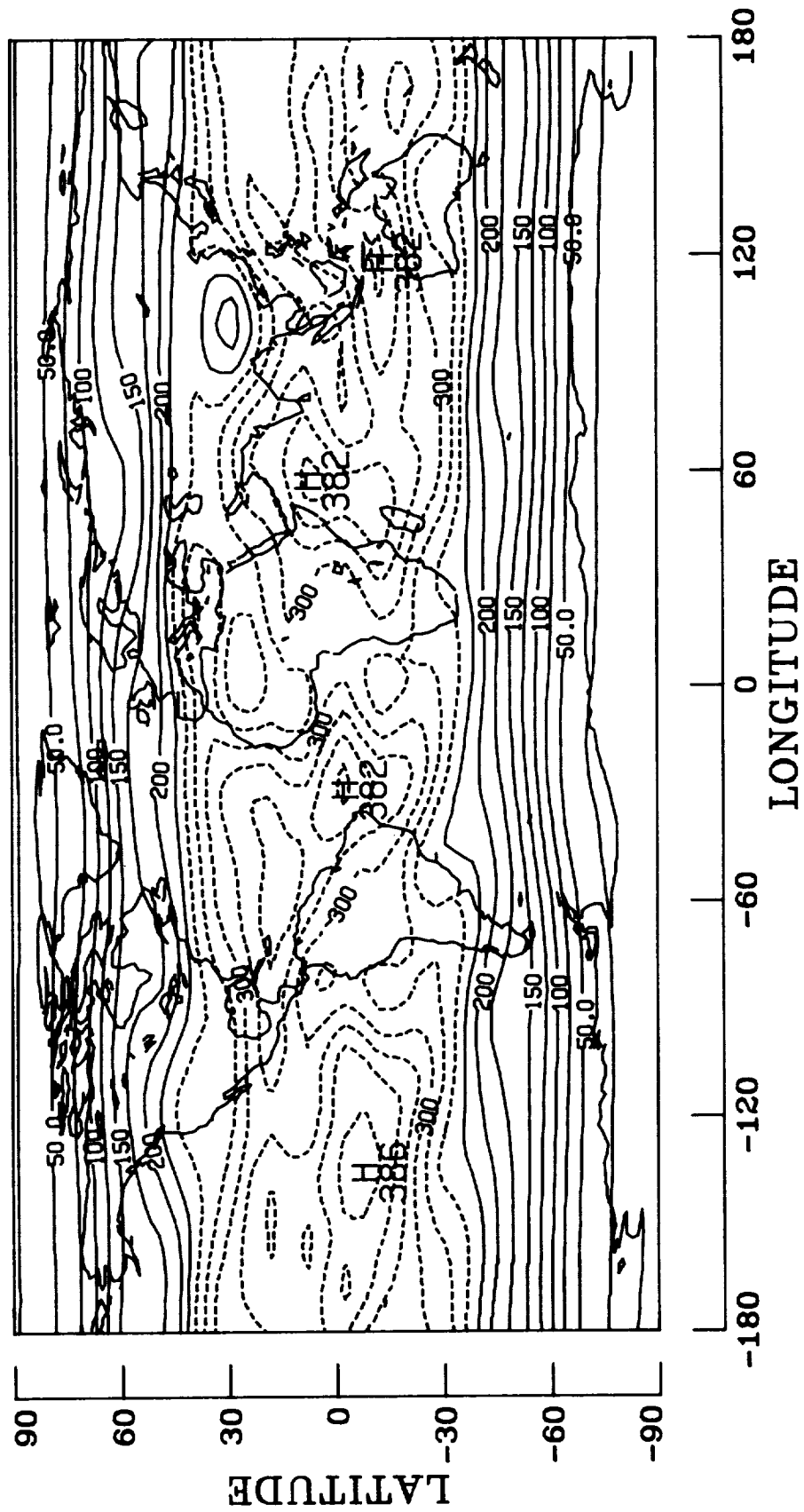
July 1987



Absorbed Solar W/m^2 August 1987

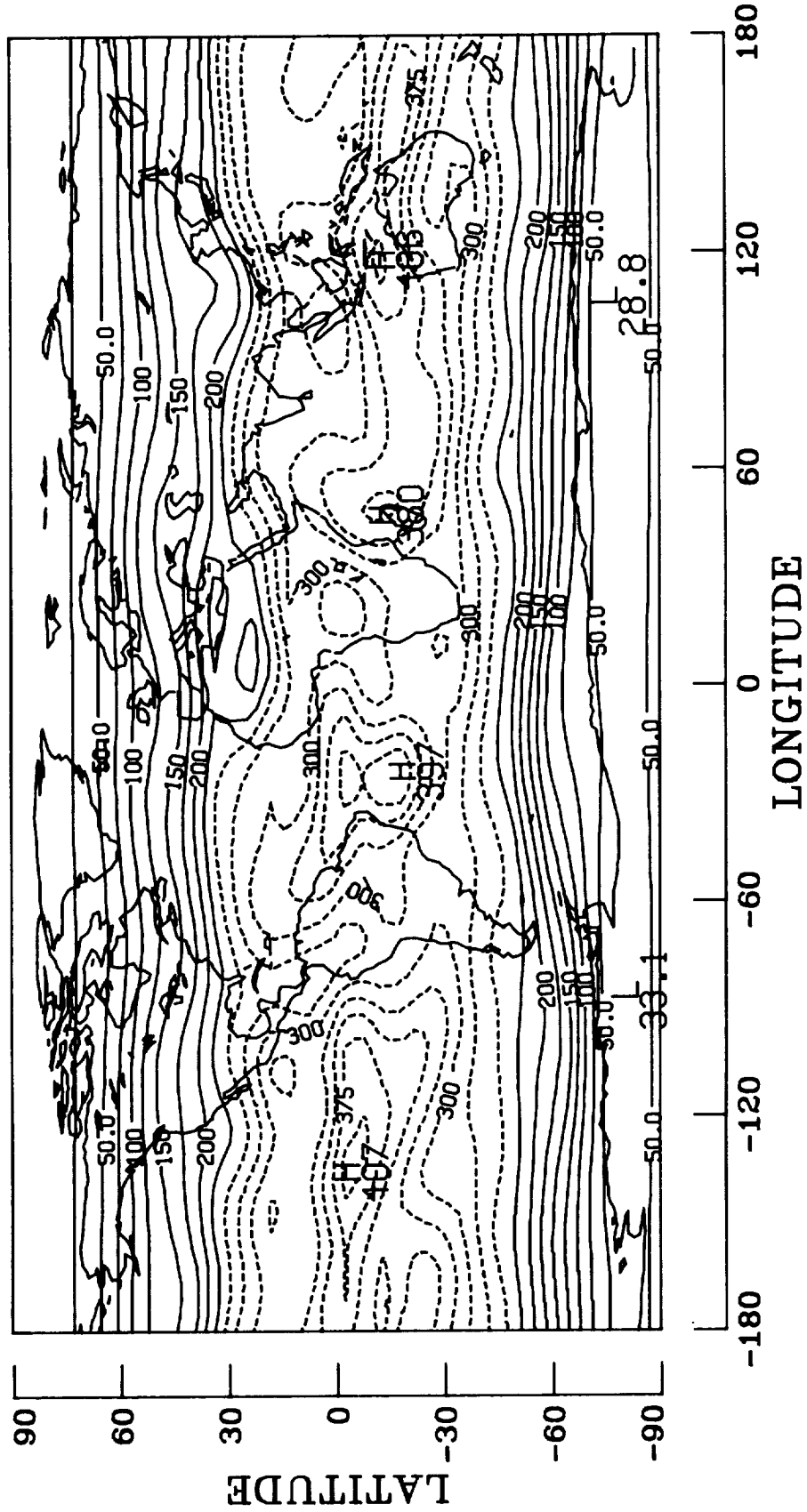


Absorbed Solar W/m^2 September 1987

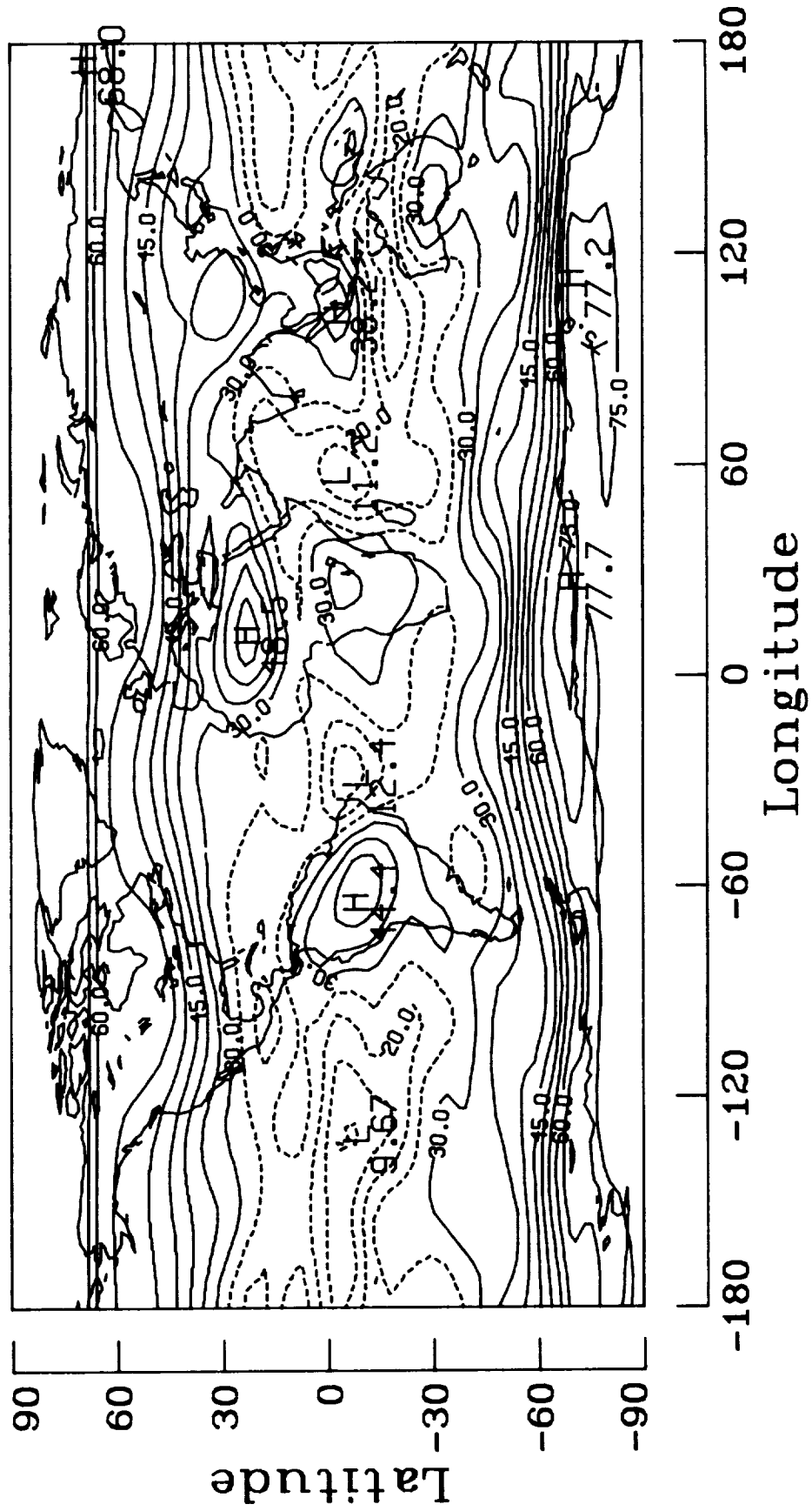


Absorbed Solar W/m^2

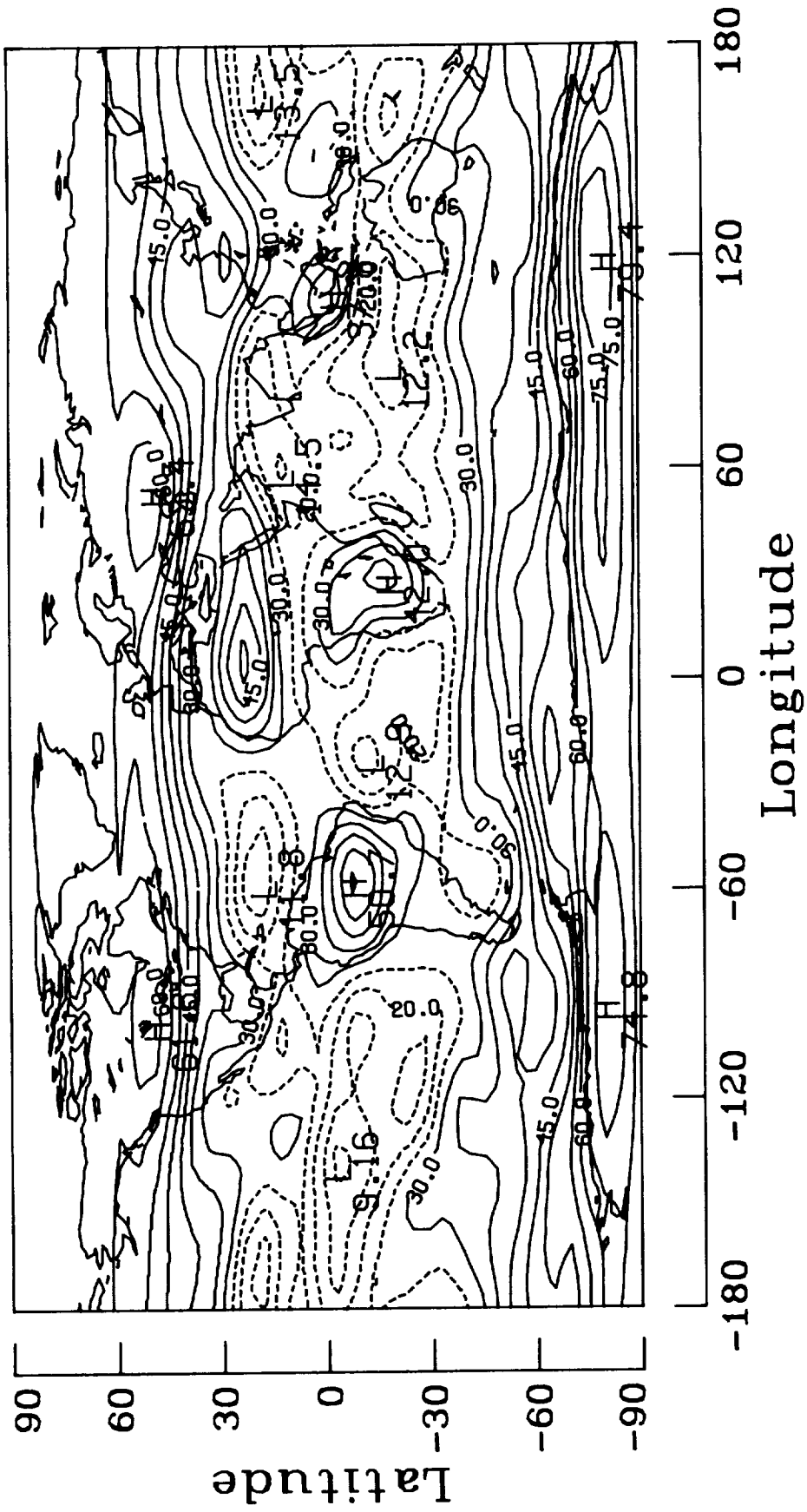
October 1987



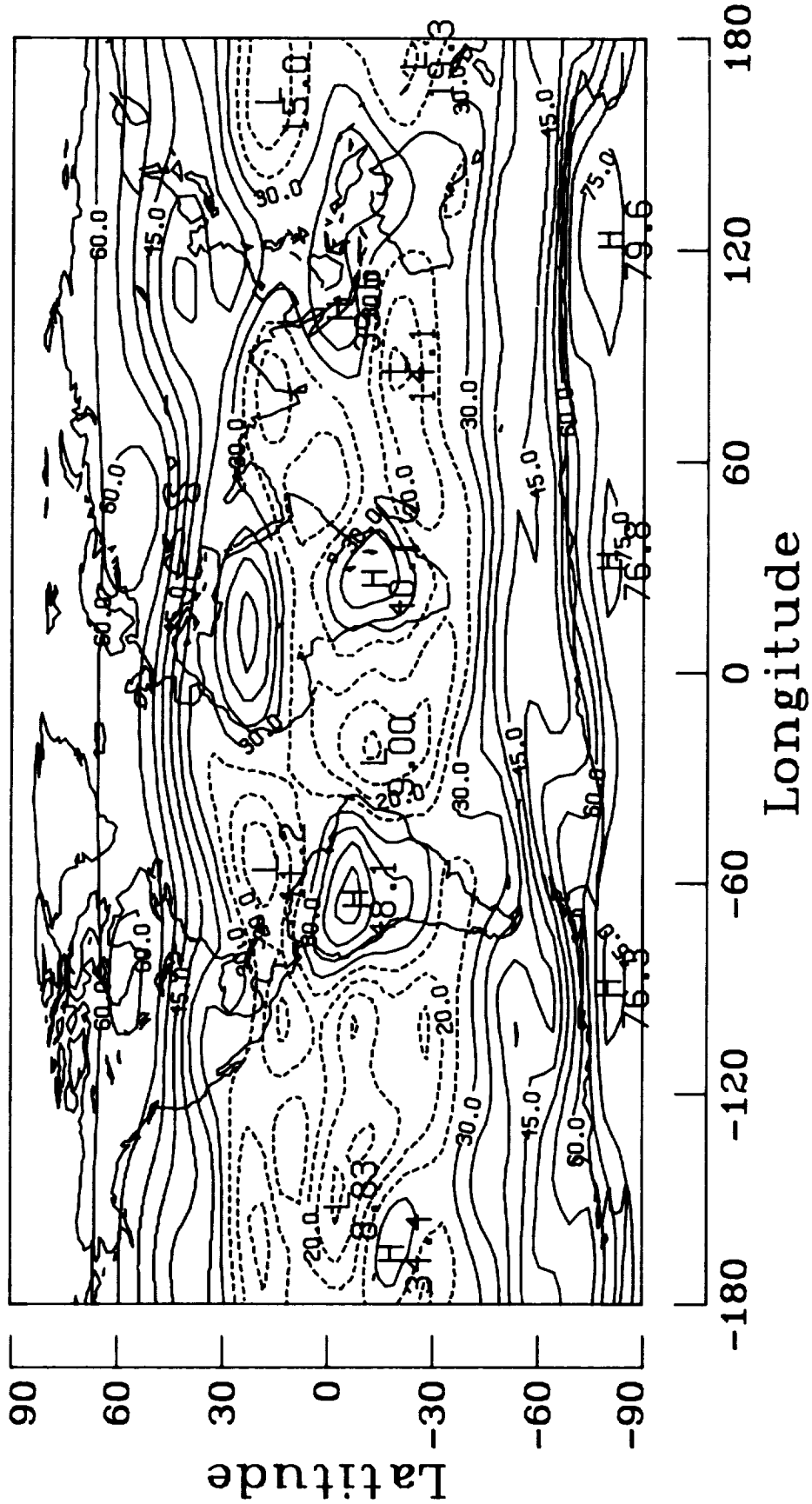
Albedo % November 1985



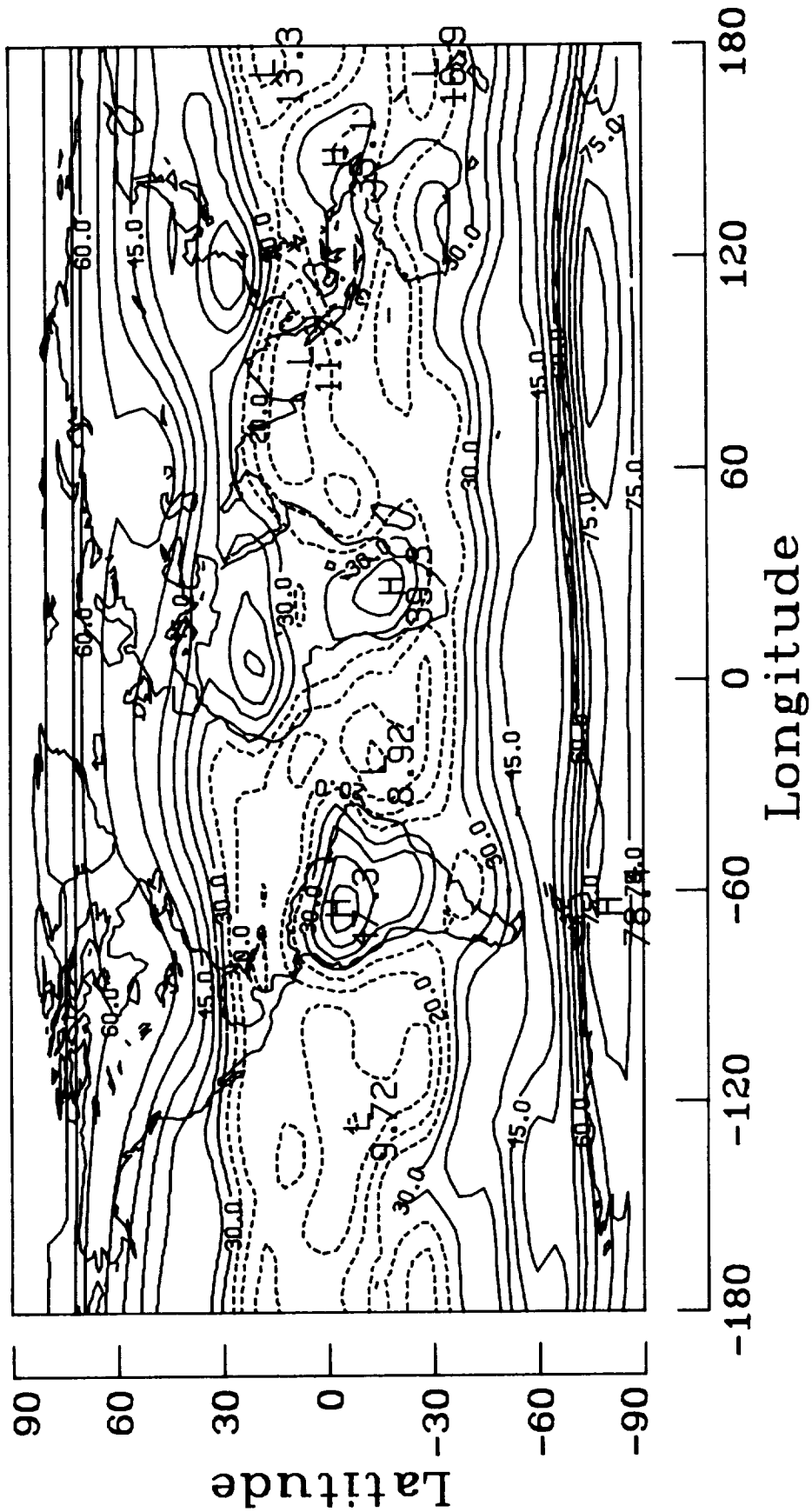
Albedo % December 1985



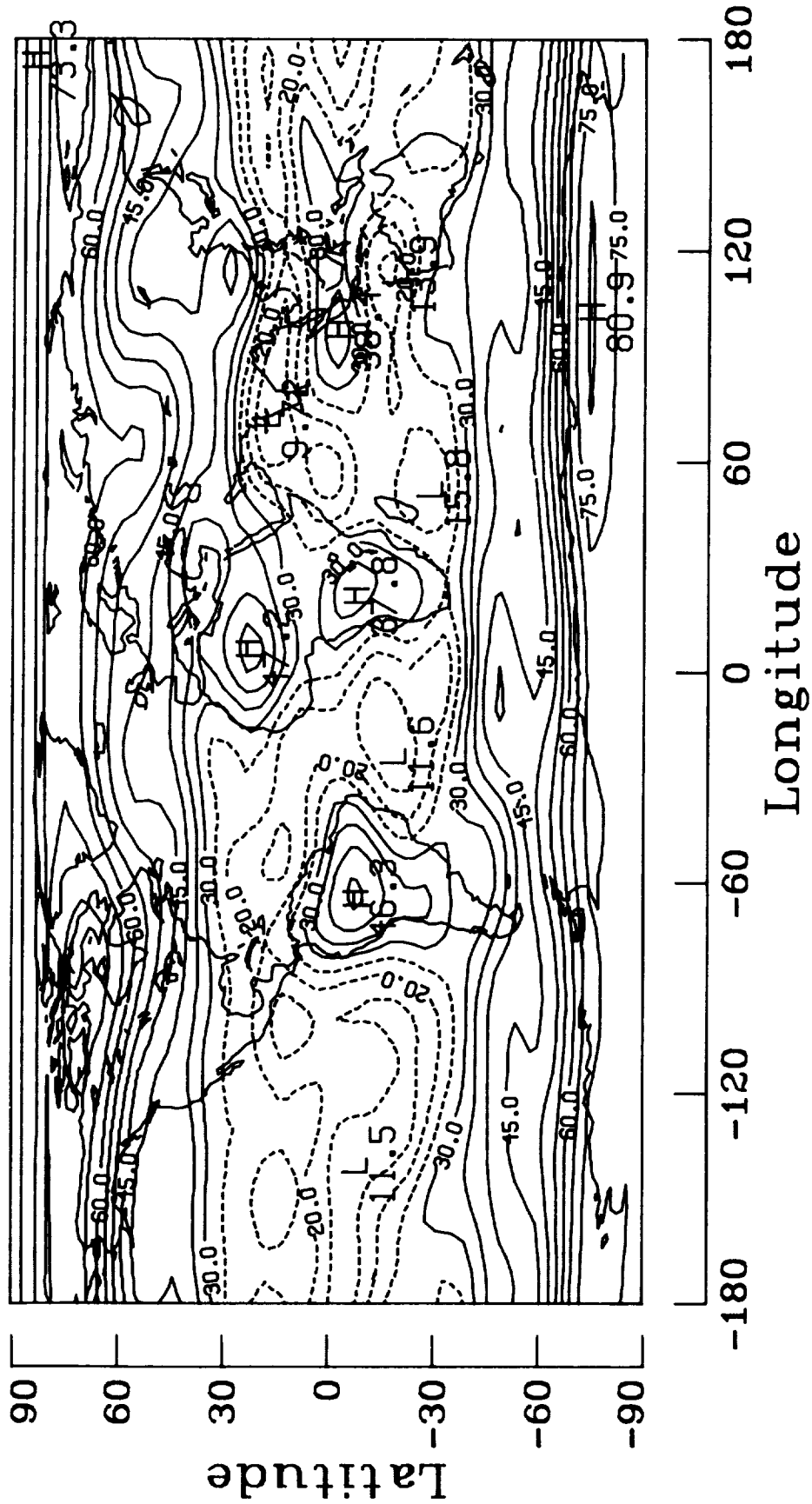
Albedo % January 1986



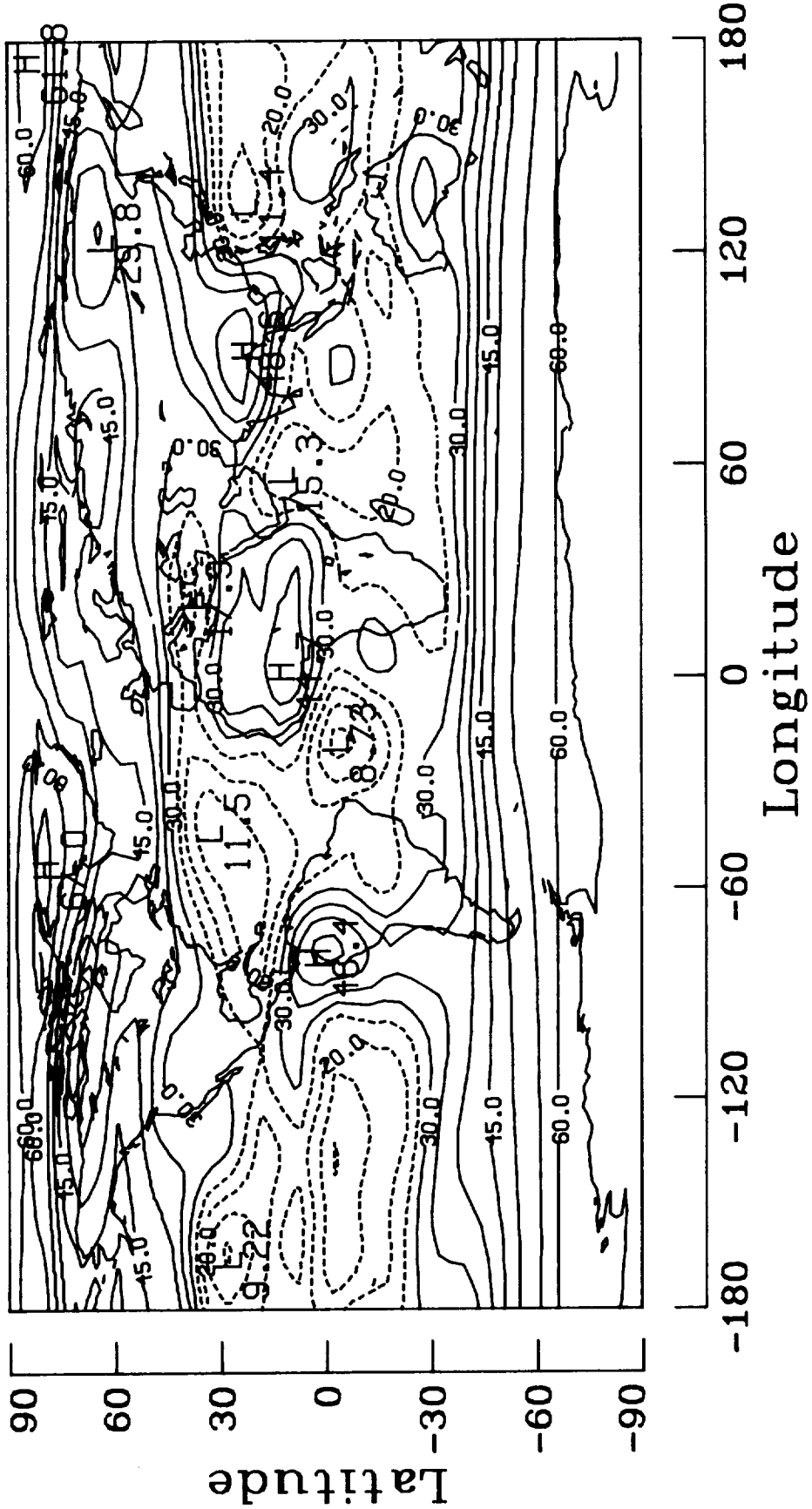
Albedo % February 1986



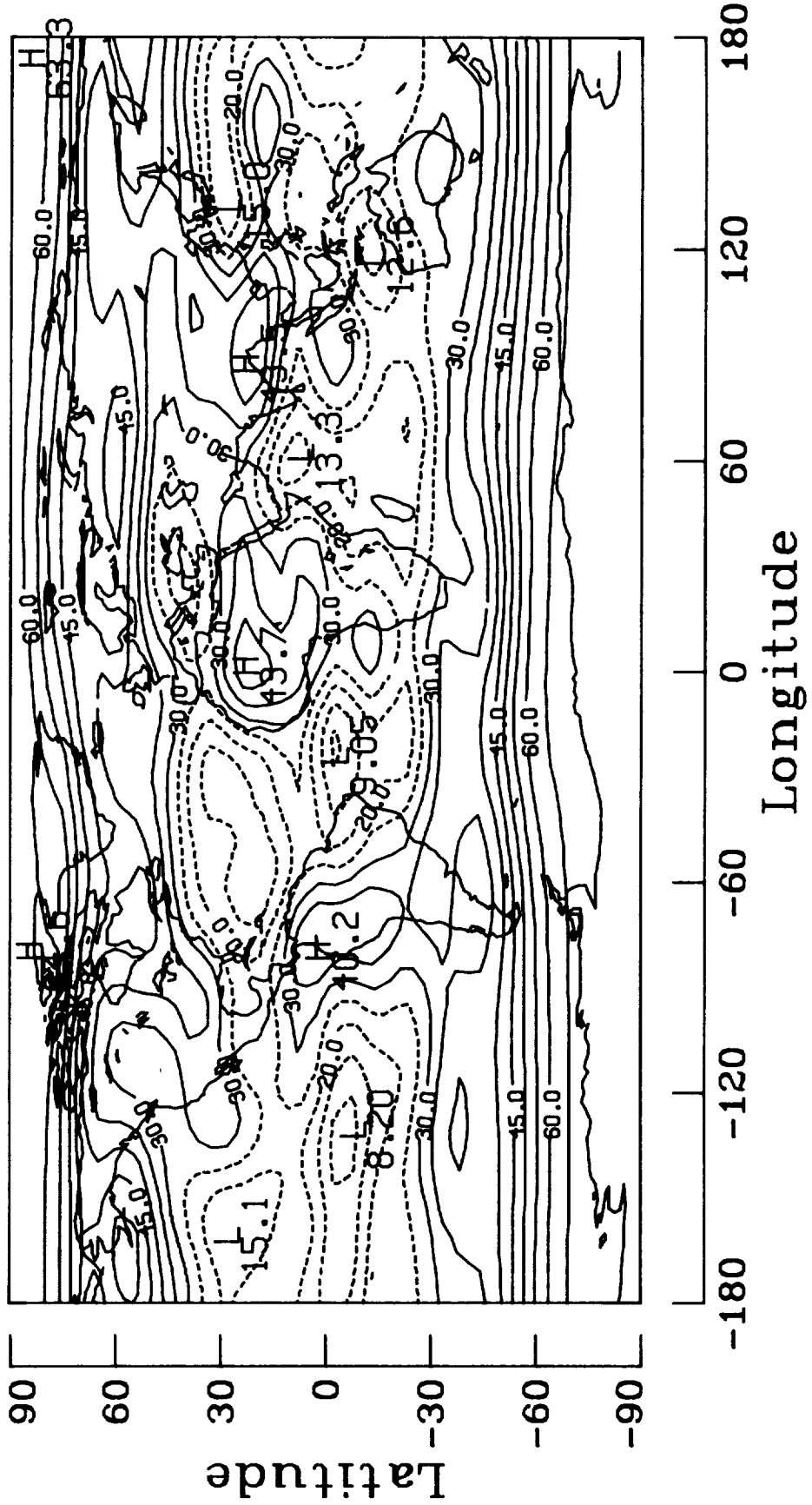
Albedo % March 1986



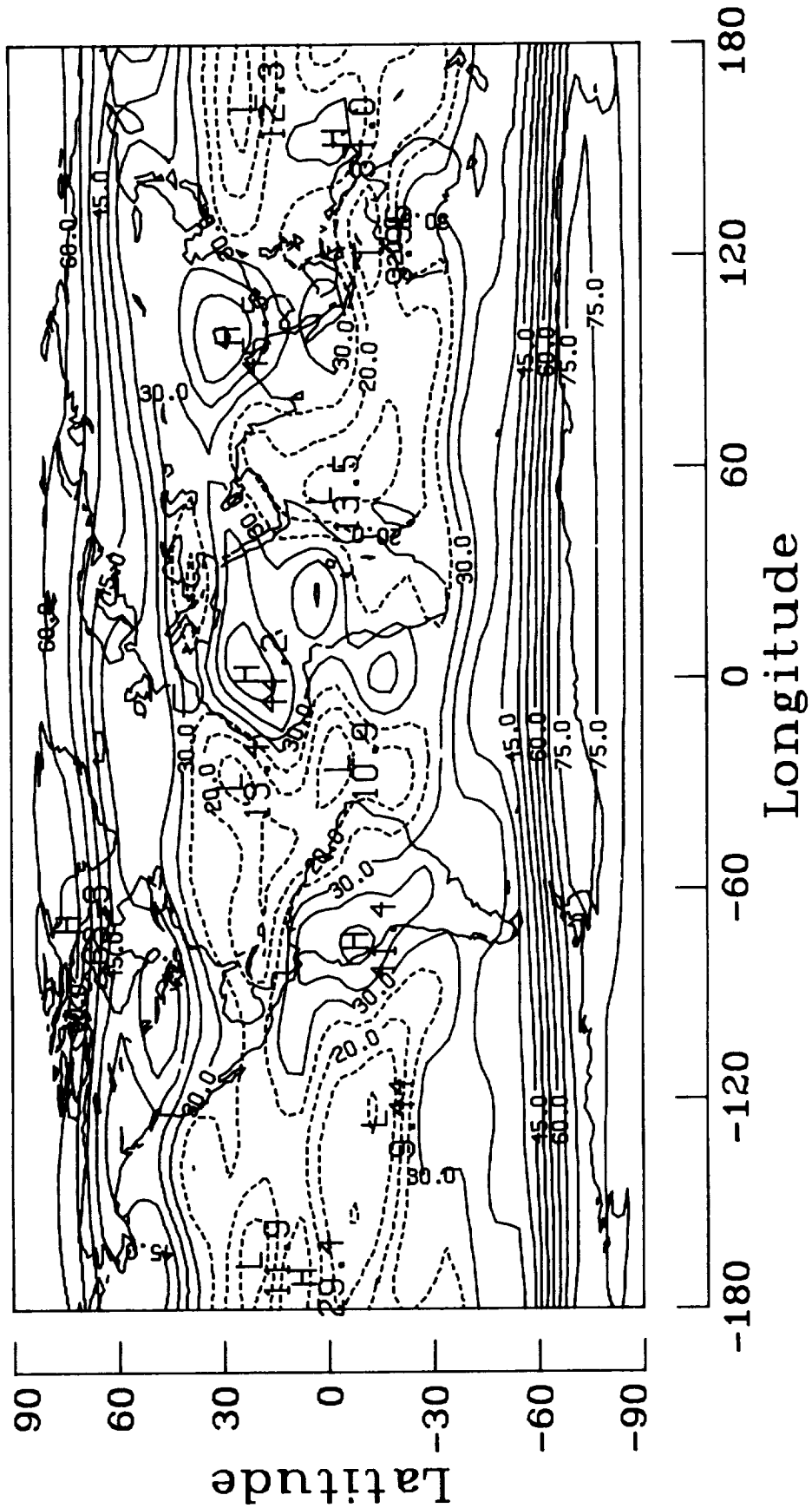
Albedo % July 1986



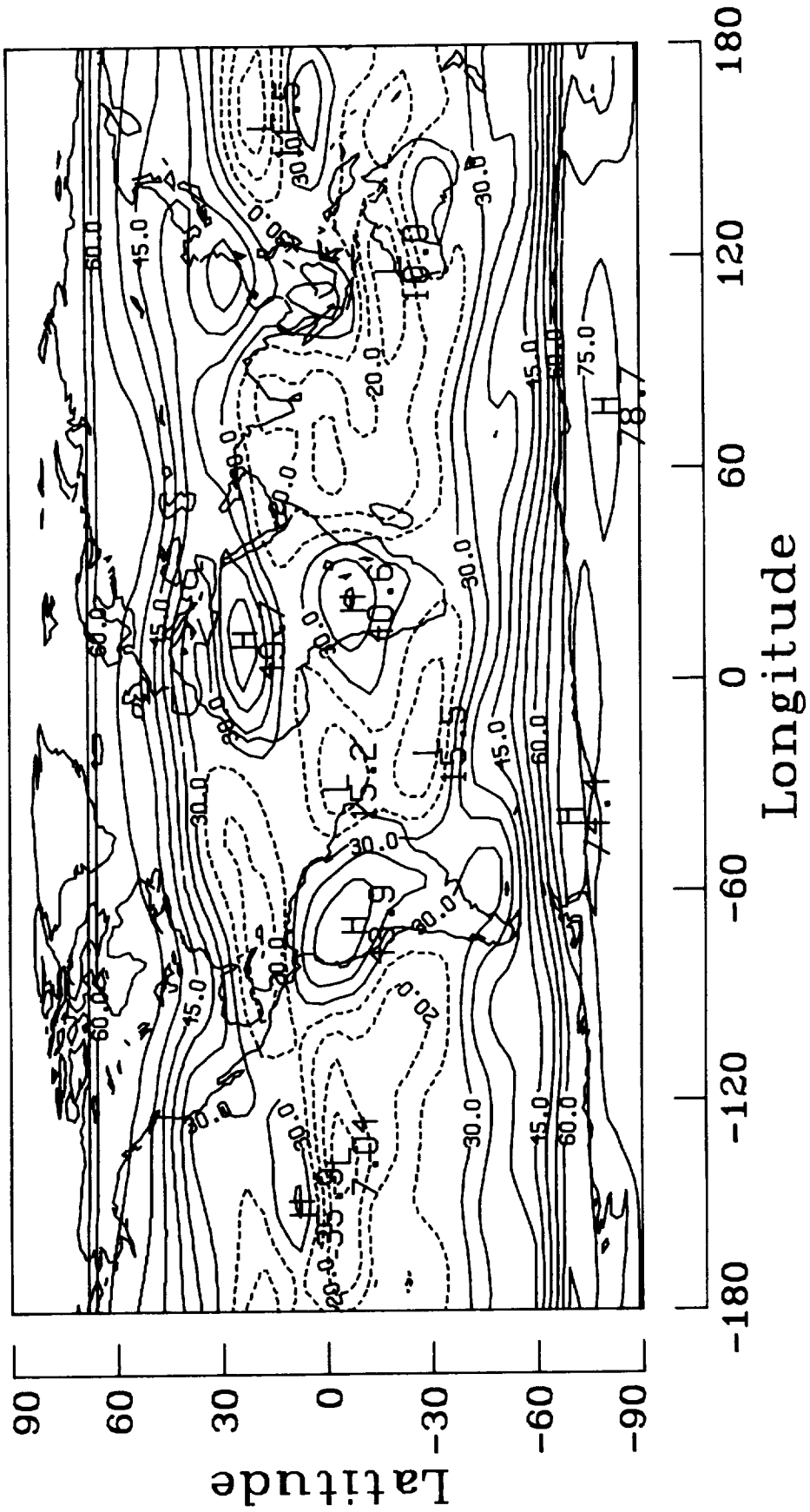
Albedo % August 1986



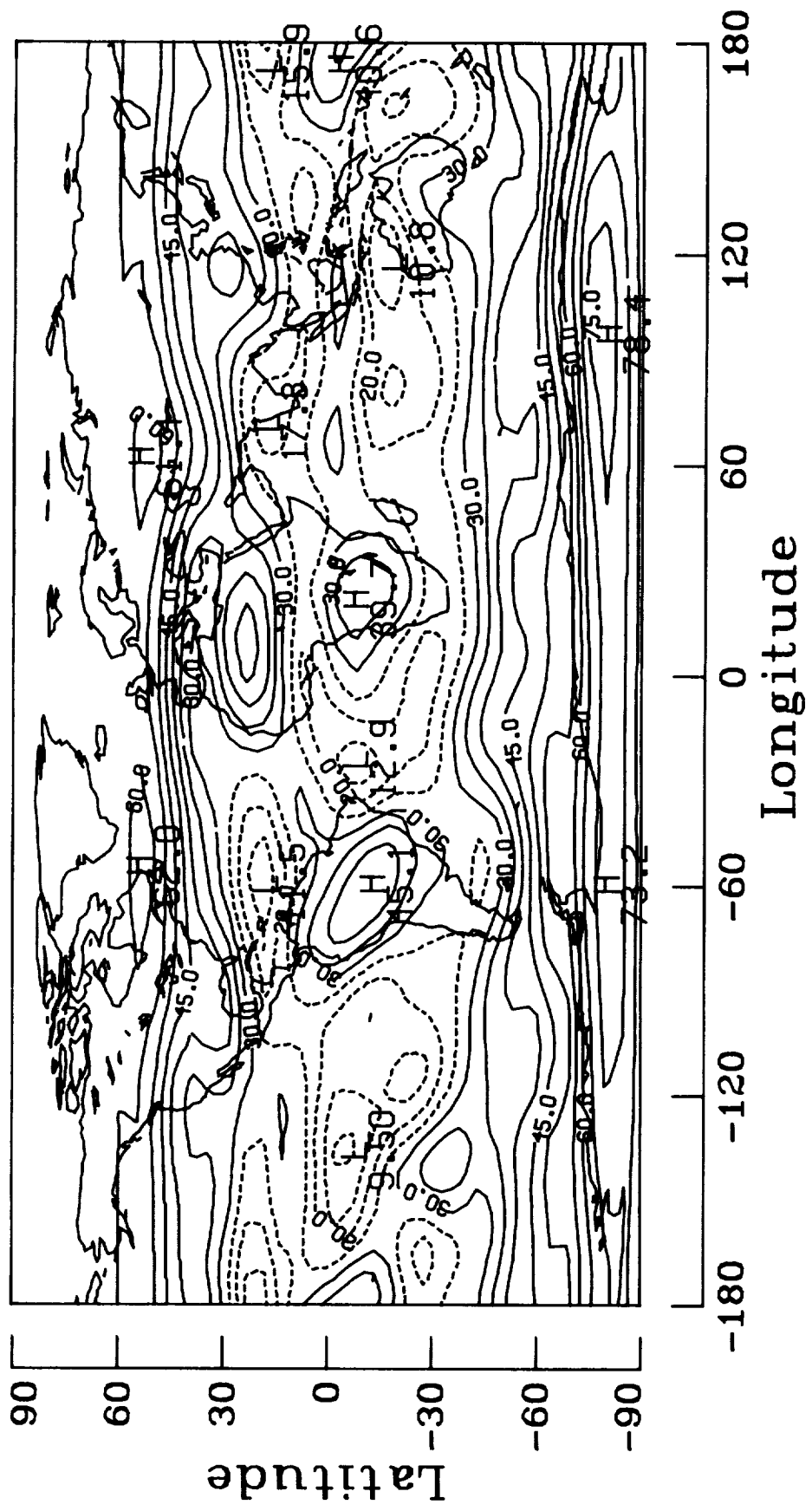
Albedo % September 1986



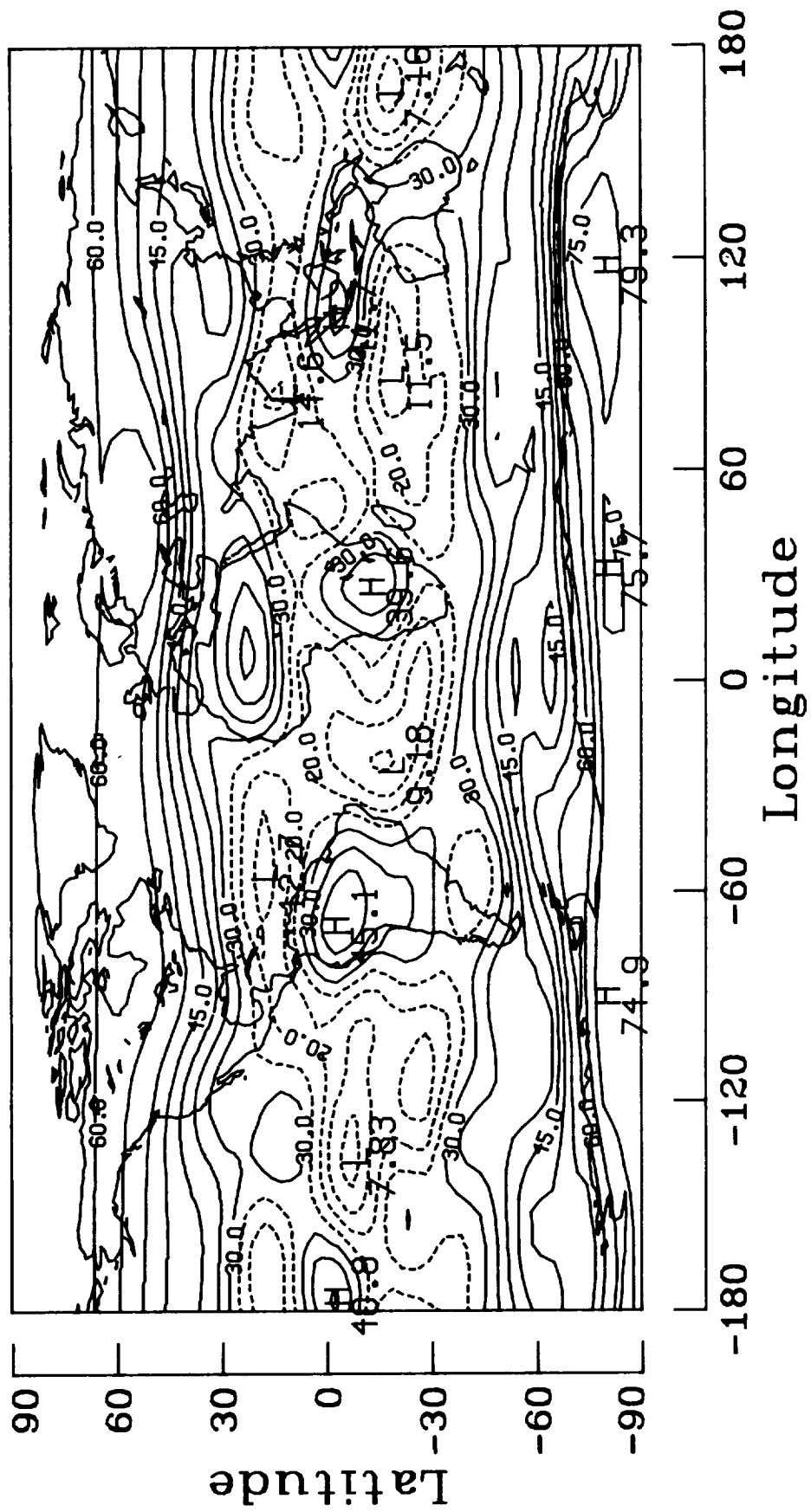
Albedo % November 1986



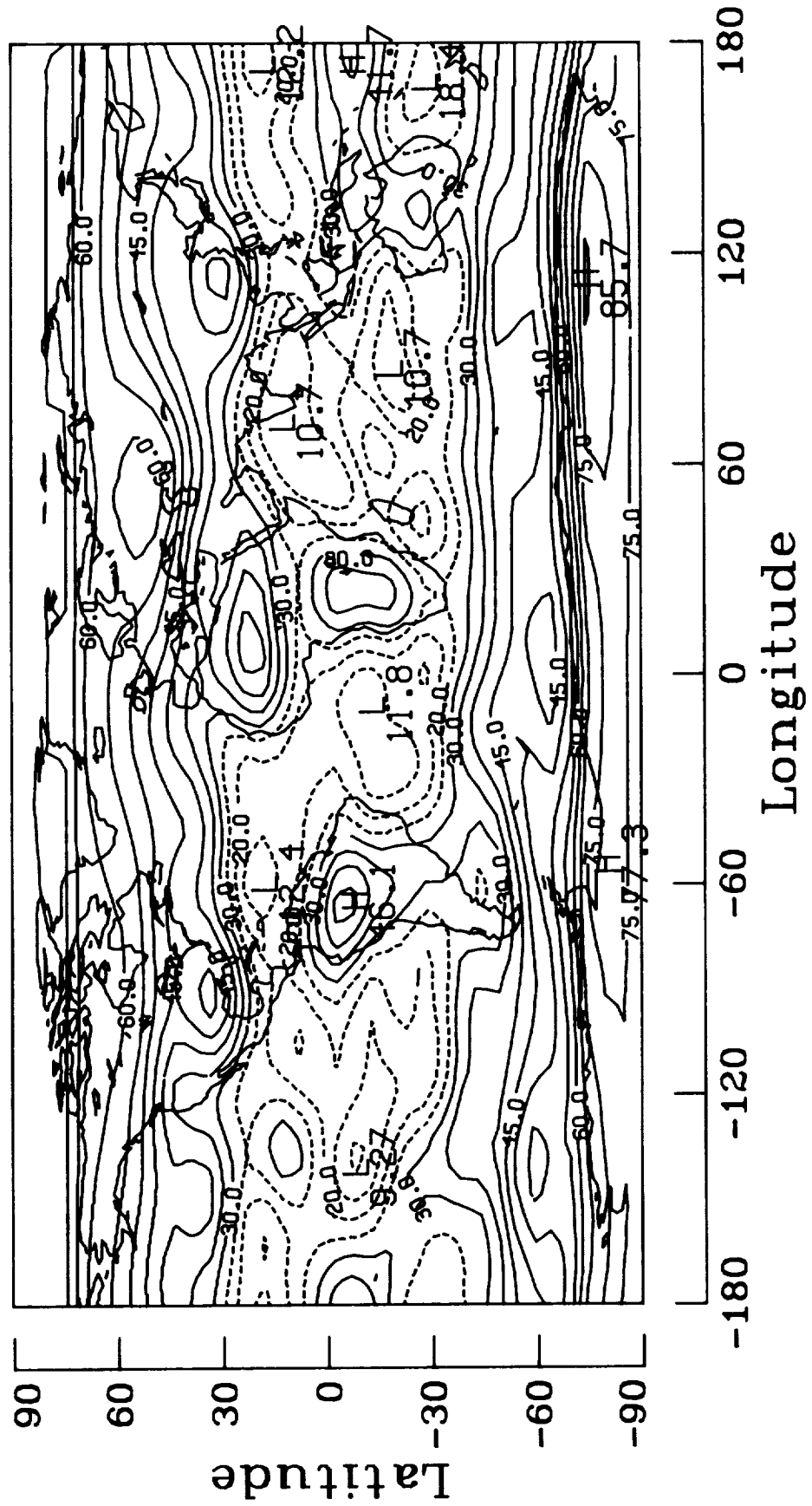
Albedo % December 1986



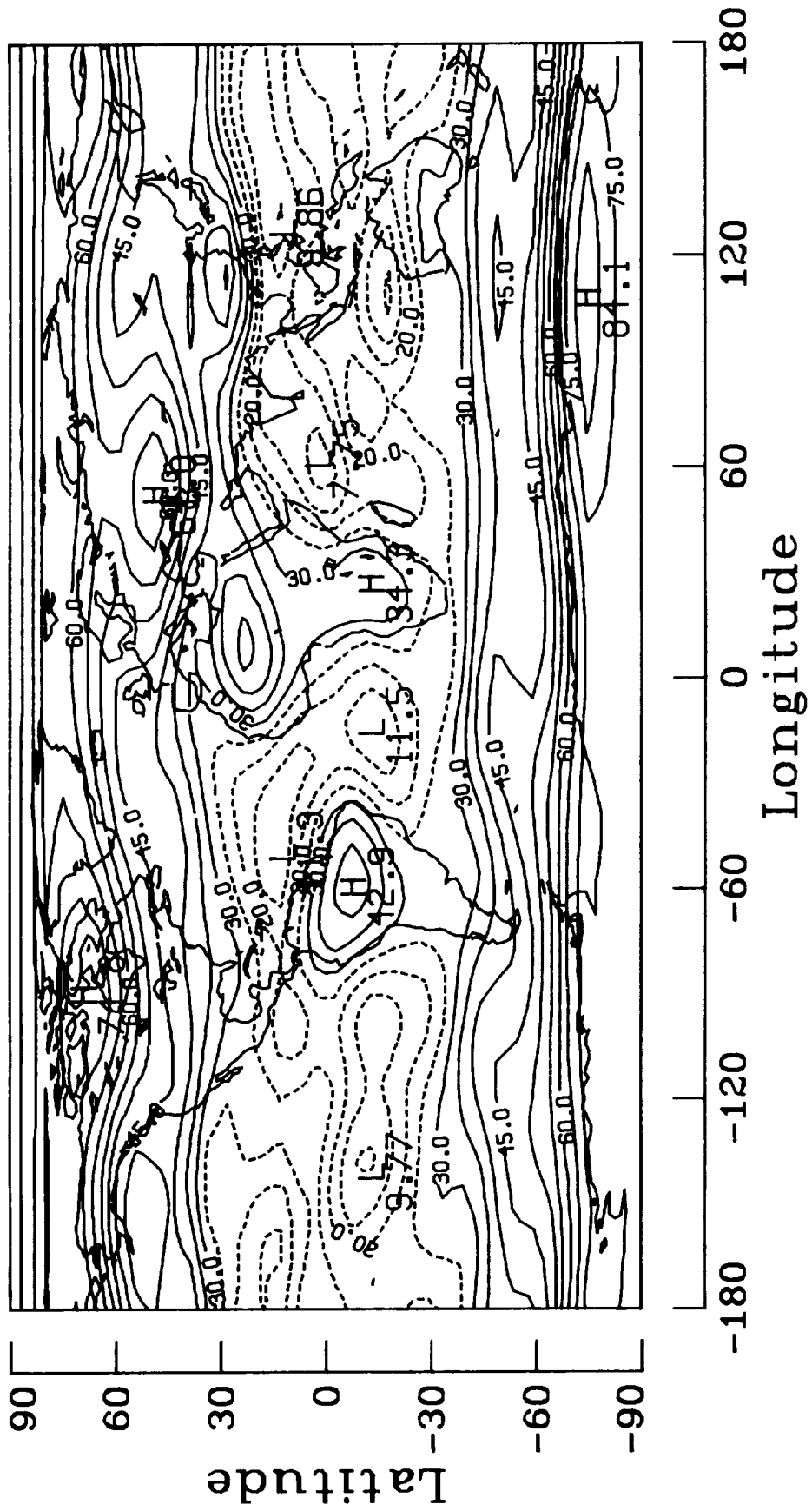
Albedo % January 1987



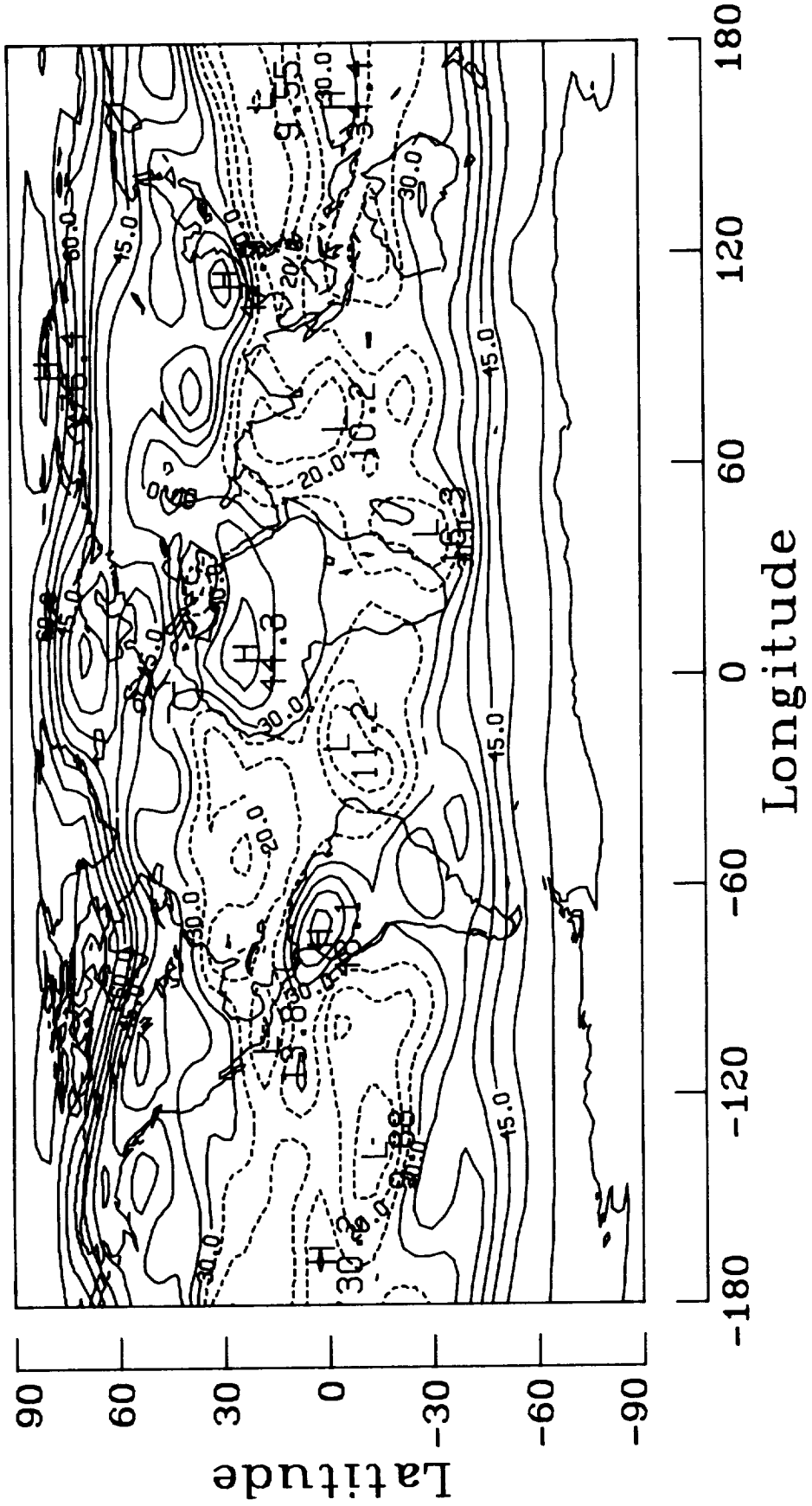
Albedo % February 1987



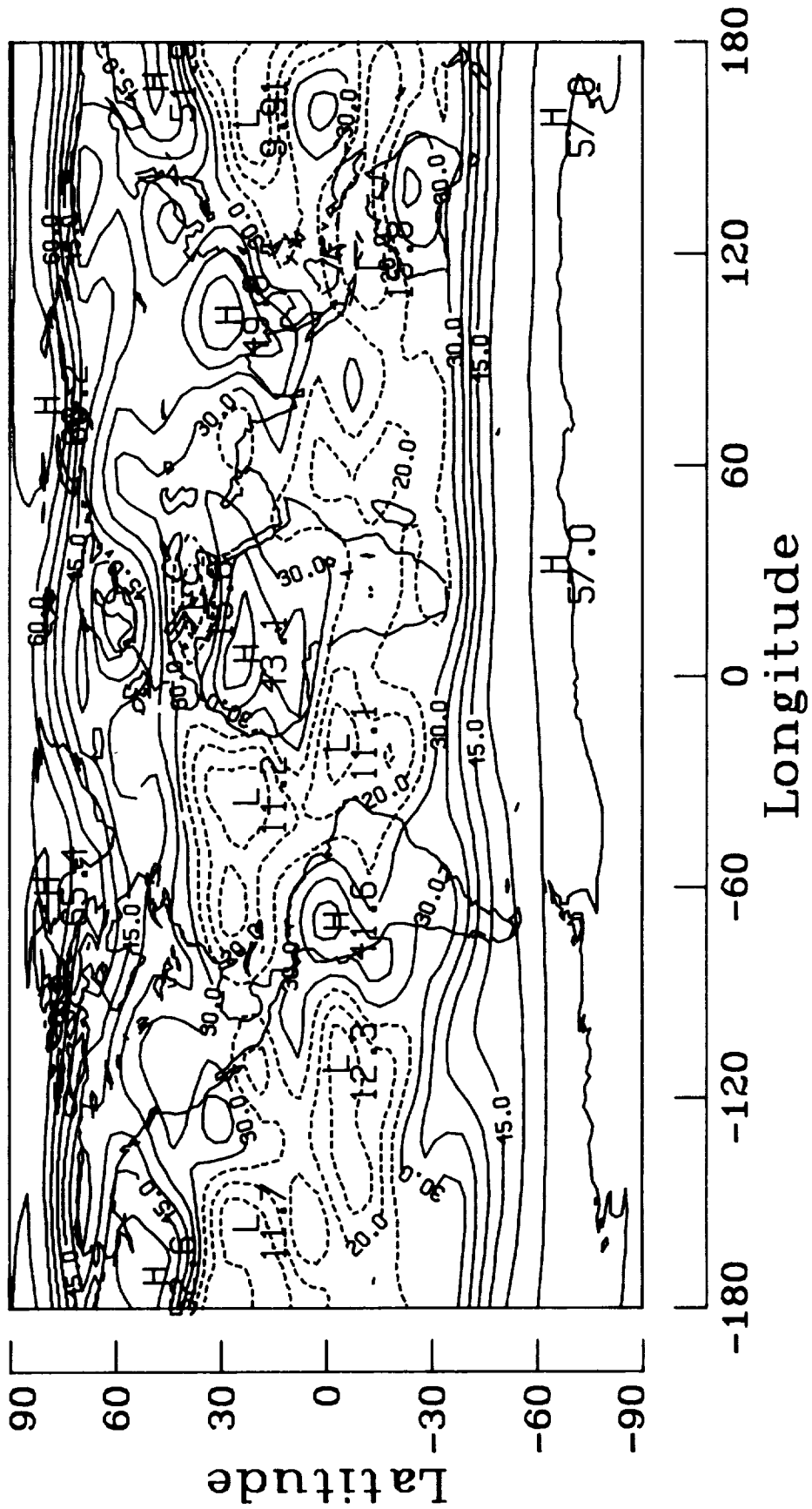
Albedo % March 1987



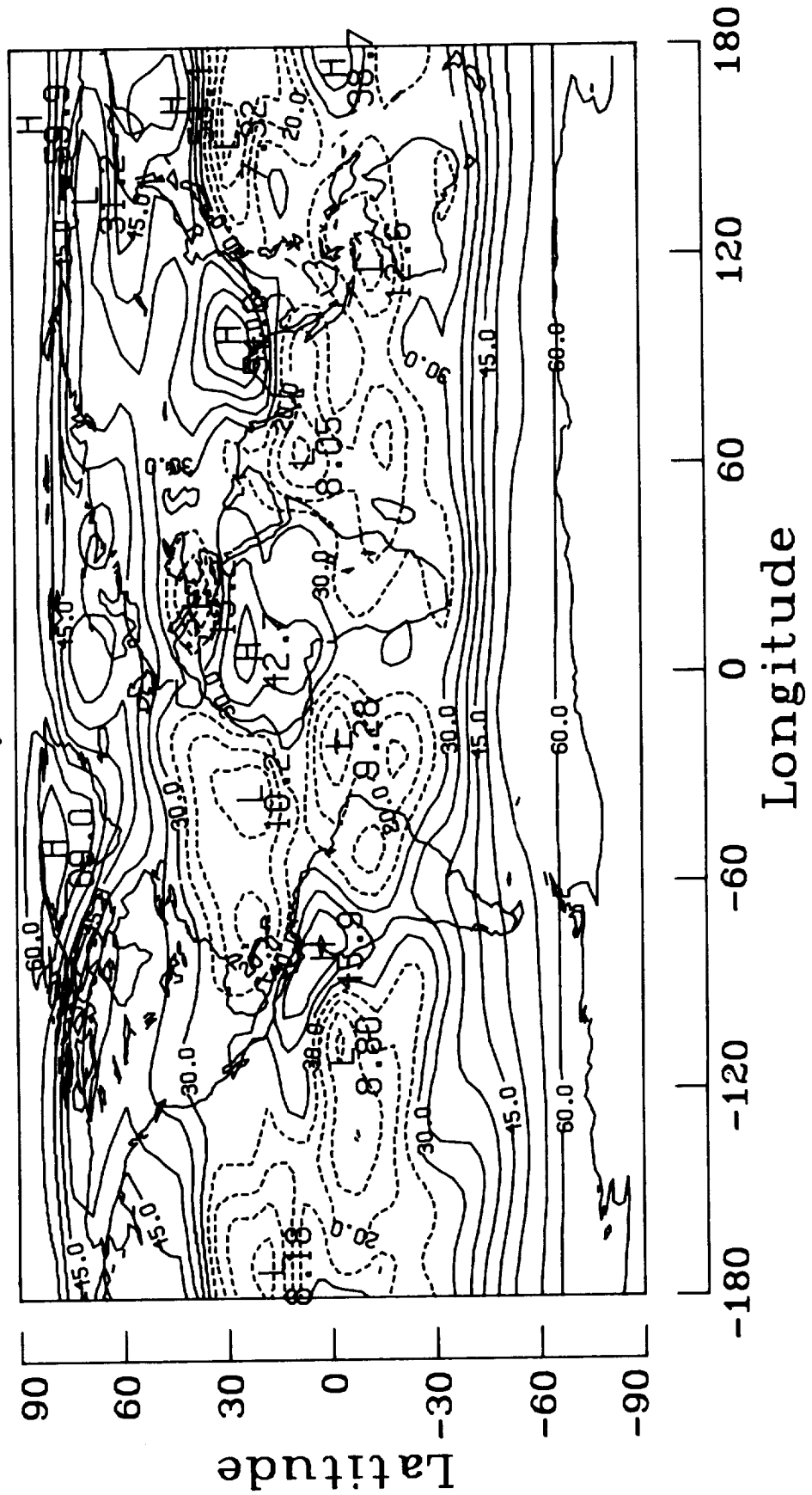
Albedo % May 1987



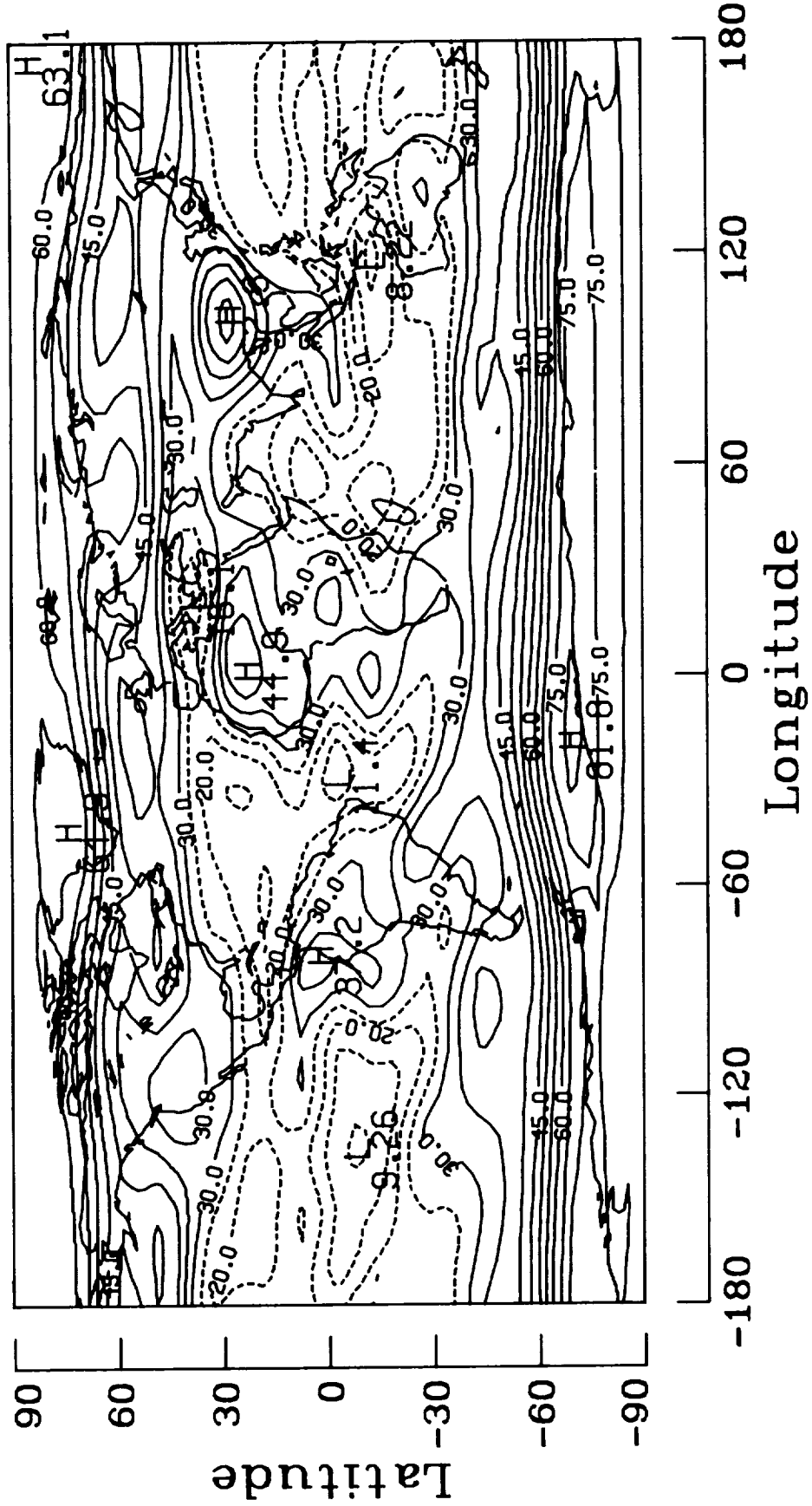
Albedo % June 1987



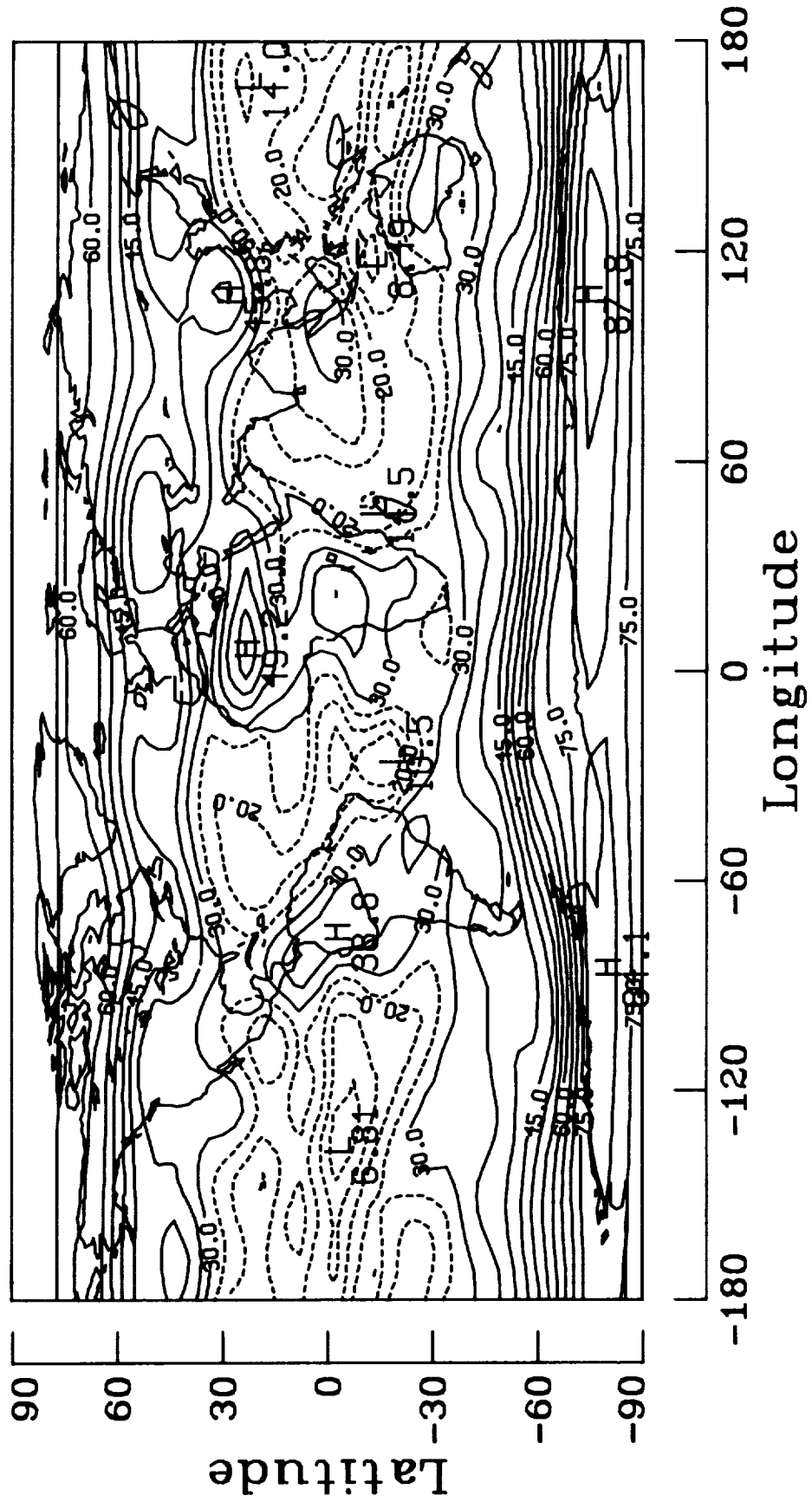
Albedo % July 1987



Albedo % September 1987



Albedo % October 1987





REPORT DOCUMENTATION PAGE			Form Approved OMB No. 0704-0188	
Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302, and to the Office of Management and Budget, Paperwork Reduction Project (0704-0188), Washington, DC 20503.				
1. AGENCY USE ONLY (Leave blank)	2. REPORT DATE October 1992	3. REPORT TYPE AND DATES COVERED Reference Publication		
4. TITLE AND SUBTITLE Atlas of Albedo and Absorbed Solar Radiation Derived From Nimbus 7 Earth Radiation Budget Data Set November 1985 to October 1987		5. FUNDING NUMBERS WU 578-12-26-70		
6. AUTHOR(S) G. Louis Smith, David Rutan, and T. Dale Bess				
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) NASA Langley Research Center Hampton, VA 23681-0001		8. PERFORMING ORGANIZATION REPORT NUMBER L-17107		
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES) National Aeronautics and Space Administration Washington, DC 20546-0001		10. SPONSORING/MONITORING AGENCY REPORT NUMBER NASA RP-1281		
11. SUPPLEMENTARY NOTES Smith and Bess: Langley Research Center, Hampton, VA; Rutan: Lockheed Engineering & Sciences Co., Hampton, VA. Atlas of Nimbus 6 data for July 1975 to May 1978 is presented in NASA RP-1230, 1990; atlas of Nimbus 7 data for Nov. 1978 to Oct. 1985 is presented in NASA RP-1231, 1990.				
12a. DISTRIBUTION/AVAILABILITY STATEMENT Unclassified - Unlimited Subject Category 47		12b. DISTRIBUTION CODE		
13. ABSTRACT (Maximum 200 words) An atlas of monthly mean global contour maps of albedo and absorbed solar radiation is presented for 21 months from November 1985 to October 1987. These data were retrieved from measurements made by the shortwave wide-field-of-view radiometer of the Earth Radiation Budget (ERB) instrument aboard the Nimbus 7 spacecraft. Profiles of zonal mean albedos and absorbed solar radiation were tabulated. These geographical distributions are provided as a resource for researchers studying the radiation budget of the Earth. The El Niño/Southern Oscillation event of 1986-1987 is included in this data set. This atlas of albedo and absorbed solar radiation extends to 12 years the period covered by two similar atlases: NASA RP-1230 (July 1975 to October 1978) and NASA RP-1231 (November 1978 to October 1985). These three compilations complement the atlases of outgoing longwave radiation by Bess and Smith in NASA RP-1185, RP-1186, and RP-1261, which were also based on the Nimbus 6 and 7 ERB data.				
14. SUBJECT TERMS Earth radiation budget; Albedo; Nimbus 7; Wide-field-of-view radiometer; Shortwave radiation; Satellite radiation measurements		15. NUMBER OF PAGES 55		
		16. PRICE CODE A04		
17. SECURITY CLASSIFICATION OF REPORT Unclassified	18. SECURITY CLASSIFICATION OF THIS PAGE Unclassified	19. SECURITY CLASSIFICATION OF ABSTRACT	20. LIMITATION OF ABSTRACT	

National Aeronautics and
Space Administration
ATTN:
Washington, D.C.
20546-0001
Business
For Private Use. \$300

BULK RATE
POSTAGE & FEES PAID
NASA
Permit No. G-27



POSTMASTER: If Undeliverable (Section 158
Postal Manual) Do Not Return

