NASA
Reference
Publication
1261

June 1991

Atlas of Wide-Field-of-View Outgoing Longwave Radiation Derived From Nimbus 7 Earth Radiation Budget Data Set—November 1985 to October 1987

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Atlas of Wide-Field-of-View Outgoing Longwave Radiation Derived From Nimbus 7 Earth Radiation Budget Data Set—November 1985 to October 1987

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Office of Management

Scientific and Technical Information Program

Introduction

The Earth's radiation balance is an important factor in climate change. One important parameter in this balance is how the Earth's outgoing longwave radiation (OLR) is changing on a regional, zonal, and global scale in the spatial domain and on a monthly, annual, and interannual scale in the time domain. To focus on long-term climate processes, one requires a long time series (>20 years) of high-quality measurements of OLR.

For the past 20 years radiometers aboard satellites have provided comprehensive measurements of OLR. In 1975, the first of two satellite experiments using new concepts for measuring the Earth's radiation budget began. These new experiments were the Earth radiation budget (ERB) experiments (Smith et al. 1977; Jacobowitz et al. 1979, 1984) that flew on the polar orbiting Nimbus 6 and Nimbus 7 satellites.

The ERB experiments were launched into nearly circular Sun-synchronous Earth orbits. The ERB instrument package included two Earth-viewing, wide-field-of-view (WFOV) radiometers, one of which measured total (TOT) irradiance and the other of which measured shortwave (SW) irradiance. The difference between the two (TOT − SW) is the OLR. These WFOV radiometers viewed the entire Earth's disk from the satellites, which had altitudes of almost 1000 km and Equator crossing times near 12:00 a.m. (noon) and 12:00 p.m. (midnight). The SW channel had a spectral range of 0.2 to 3.8 μm, and the total channel measured the irradiance from 0.2 to 50+ μm.

The first of the ERB experiments was on the Nimbus 6 satellite and was launched in June 1975. The second experiment was launched on the Nimbus 7 satellite in November 1978. The combined OLR record from the ERB instruments from Nimbus 6 and Nimbus 7 spanned the time period from July 1975 to October 1987, with a 4-month gap (July 1978 to October 1978). Atlases of a 10-year time series of monthly averaged OLR data were published in two NASA Reference Publications (Bess and Smith 1987a, 1987b). Since that time, the next 2 years (minus May 1986) of OLR data for Nimbus 7 from the Nimbus 7 Project have been received. This paper is an atlas of the 23 months of monthly averaged OLR results from Nimbus 7 estimated at the top of the atmosphere (denoted by TOA and defined herein to be at an altitude of 30 km) and spanning the time period from November 1985 to October 1987.

The purpose of this atlas is to document all the WFOV OLR results from the 2 years of Nimbus 7 operation in a form that facilitates analysis of the Earth's radiation field. The results contained in this atlas were derived with a deconvolution (i.e., a resolution enhancement) technique that represented the WFOV monthly averaged OLR as an expression of spherical harmonic coefficients (Smith and Green 1981). Tables of these coefficients and monthly averaged contour maps of OLR results for 2 years are included.

The results documented in this atlas are important for a number of reasons. One reason relates to the data, which are both broadband and WFOV. Because the measurements are broadband, the ERB radiometers offer some significant advantages over the instruments aboard the National Oceanic and Atmospheric Administration (NOAA) operational-type polar orbiting satellites. The NOAA instruments measure upwelling radiation in the narrow spectral regions (0.5 to 0.7 μm in the visible region and 10.5 to 12.5 μm in the infrared region). Winston et al. (1979) published an atlas that documented 4 years of OLR results from the scanning radiometer on the NOAA operational satellites. Janowiak et al. (1985) also published an atlas of OLR results derived from NOAA operational satellite data that covered the time period from June 1974 to November 1983. The primary disadvantage of measurements made by NOAA operational satellites is that they are made in narrow spectral regions that must then be empirically corrected to estimate the broadband OLR. The primary advantage of these measurements is their very high spatial resolution compared with the WFOV radiometer, which is limited to large scales.

The WFOV instrument is well suited for measuring large-scale features since its field of view is such that the instrument measures all incident radiation from horizon to horizon. Herein lies one of its advantages because the measured radiation is integrated over a broad variation of angles, and thus it is less sensitive to directional models than the data measured with narrow-field-of-view radiometers. Also, because of their mechanical simplicity, fixed-WFOV radiometers typically have much greater longevity than scanning radiometers.

In addition to the data being broadband and WFOV, the method of representing the data using spherical harmonics is important. The spherical harmonic coefficient data set for each month represents a condensation of the OLR field. Some of these coefficients have a physical interpretation attached to them. These coefficients may be analyzed individually or in combination to study different aspects of the radiation field. The Nimbus 7 results from this atlas and the 10-year data set already published give a 12-year time series of OLR that will be very useful for doing monthly, annual, and interannual studies of

OLR on large spatial scales. The last 3 years of the data set also give a 3-year overlap with the current Earth Radiation Budget Experiment (ERBE) data set that will be used to intercompare the two data sets.

Data Processing and Analysis

The 2 years of ERB WFOV irradiance data from the Nimbus 7 satellite covering the time period from November 1985 to October 1987 were supplied by the Nimbus 7 Project at the NASA Goddard Space Flight Center. Because of operational constraints on the Nimbus 7 satellite, ERB measurements were not taken during the time period from April 10 to June 23, 1986. Thus, no monthly radiation budget data exist for May 1986, and data for April and June 1986 are limited to the first 9 days for April and the last week for June. Therefore, the monthly average fields for April and June 1986 should not be treated as equivalent to monthly averages in other years. Only OLR data are documented in this atlas.

The nominal duty cycle of the ERB radiometer was 3 days on followed by 1 day off. When the radiometer was turned on, measurements were taken at 4-sec intervals along the orbit track. The data have been reduced in volume by averaging four consecutive measurements, resulting in one averaged value every 16 sec.

Although the Nimbus 7 ERB radiometer was initially constrained to operate on a duty cycle of 3 days on and 1 day off, this constraint was relaxed in September 1983 because of the failure of other experiments. The ERB radiometer operated without interruption most of the time except for short periods in the summer and fall of 1984 when the constraint was in effect. However, the absence of a continuous daily data set did not seriously constrain monthly averaged WFOV data because the data were smoothed in the averaging process over 1 month and over the large spatial area of the WFOV radiometer. Green and Smith (1978) looked at the temporal variation over six duty cycles of 2 days each for 1 month of Nimbus 6 data. Their results showed very little change from one duty cycle to another on a global and zonal scale. Small changes occurred for some regions. The other inherent sampling bias characteristic of all Sun-synchronous polar orbiting satellites is that they measure OLR at only two local times. Because of this sampling bias, diurnal variations cannot be studied in detail.

The Nimbus 6 and 7 ERB tapes were processed by taking daily measurements and averaging over 1 month and over a grid system of 5° increments in latitude and 5° or greater in longitude. This grid system formed an igloo-type grid of near-equal-area regions that were symmetrical about the Equator, with 3 grid boxes between 85° and 90° latitude increasing to 72 grid boxes near the equatorial region (Bess and Smith 1987a, 1987b).

Some corrections and editing had to be made to the ERB WFOV measurements before they were suitable for data analysis. Sun contamination is a problem that occurs near sunrise and sunset with the WFOV radiometer because the field of view is larger than the Earth's disk, and hence it views the Sun directly. Measurements were eliminated when the solar zenith angle at nadir (or subsatellite) point was between 99° and 123°. This was the range of angles used by other investigators when analyzing Nimbus 7 ERB WFOV data (Kyle et al. 1984). With the range of solar zenith angles specified by the Nimbus 7 investigators, it was found that another possible source of error in OLR measurements, caused by a thermal transient in SW measurements, was eliminated.

The measurements were then time- and space-averaged to obtain regional monthly averages, and a deconvolution (resolution enhancement) technique was applied to represent the radiant exitance at the TOA by a truncated series of spherical harmonics. The deconvolution technique takes advantage of the fact that spherical harmonics are the eigenfunctions of the measurement operator and reduces the radiant exitance field from satellite altitude to the TOA by dividing by the appropriate eigenvalues. All the results in this atlas are based on the deconvolution technique (Smith and Green 1981; Bess, Green, and Smith 1981).

The governing equation from which the monthly averaged harmonic coefficients were produced is

$$M(\theta,\phi,t) = \sum_{n=0}^{N} \sum_{m=0}^{n} N_n^m P_n^m(\cos\theta)\,[C_n^m(t)\cos(m\phi) + S_n^m(t)\sin(m\phi)]$$

where $M(\theta,\phi,t)$ is OLR at the TOA, θ is the colatitude, ϕ is the longitude, t is the time, and P_n^m is the associated Legendre polynomial of degree n and order m. The terms $C_n^m(t)$ and $S_n^m(t)$ are the cosine and sine real spherical harmonic coefficients, and the normalizing factor is

$$N_n^m = [(2n+1)(n-m)!(2-\delta_0^m)/(n+m)!]^{1/2}$$

where δ_0^m is the Kronecker delta function.

Discussion of Results

Included in this atlas are tables of spherical harmonic coefficients and associated global contour maps of 23 months of Nimbus 7 ERB WFOV outgoing longwave radiation results. It is not the intent in this atlas to present an in-depth analysis of the data but to compile and document the spherical harmonic coefficients and the associated contour maps that can then be used for many kinds of valuable analyses.

Each table in this atlas contains a set of spherical harmonic coefficients for 1 month of mean values. Results are for a spherical harmonic expansion truncated to the 12th degree. For such a 12th-degree expansion, 169 coefficients are required to specify the radiation field. The coefficients above the stair-step line are the 78 sine terms. With the exception of the first column, the coefficients below the stair-step line are the 78 cosine terms. The first column contains the 13 zonal terms. The sine and cosine terms represent the nonaxisymmetric terms and give a measure of longitudinal variation. The format of the tables makes it very easy to select any coefficient. The superscript m is the longitudinal wave number or order and n represents the degree of the spherical harmonic. Thus, in the first column, which represents the zonal terms, m is 0 and n ranges from 0 to 12. Physical interpretations can be associated with some of the zonal terms. Thus, C_0^0 is the global average, C_1^0 is a measure of Northern and Southern Hemisphere difference, and C_2^0 is a measure of Equator-to-pole gradient. Over 80 percent of the degree variance has been shown to be in the zonal terms (Smith and Bess 1983). This variance is because at large scales, Earth-emitted radiation is strongly dependent on latitude.

The monthly averaged spherical harmonic data sets can be used in a variety of ways to study the OLR on regional, zonal, and global scales in the spatial domain and on monthly, annual, and interannual scales in the time domain. One application is to model the global radiation field. The advantage of a spherical harmonic representation is that it represents large data sets with relatively few parameters. Another advantage is that it provides a mathematical structure that permits one to separately study the latitudinal variations using the zonal and the longitudinal variations and wave properties using tesseral coefficients. In short, spherical harmonic representation allows the radiation field to be broken up into its component parts, which can then be studied separately or in various combinations. For example, the coefficients are well suited for time series analysis, spatial spectra studies, and parameterization studies (Smith and Bess 1983; Short et al. 1984).

In this atlas each spherical harmonic coefficient set has a companion monthly averaged global contour map of OLR. The OLR less than 240 W/m^2 is shown as dotted contour lines. The contour interval is 10 W/m^2, and highs and lows are shown. These contour maps give a "quick look" of how the OLR varies over monthly, annual, and interannual time scales. The associated sets of harmonic coefficients and contour maps form a valuable data set for studying many different aspects of our changing climate.

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May 3, 1991

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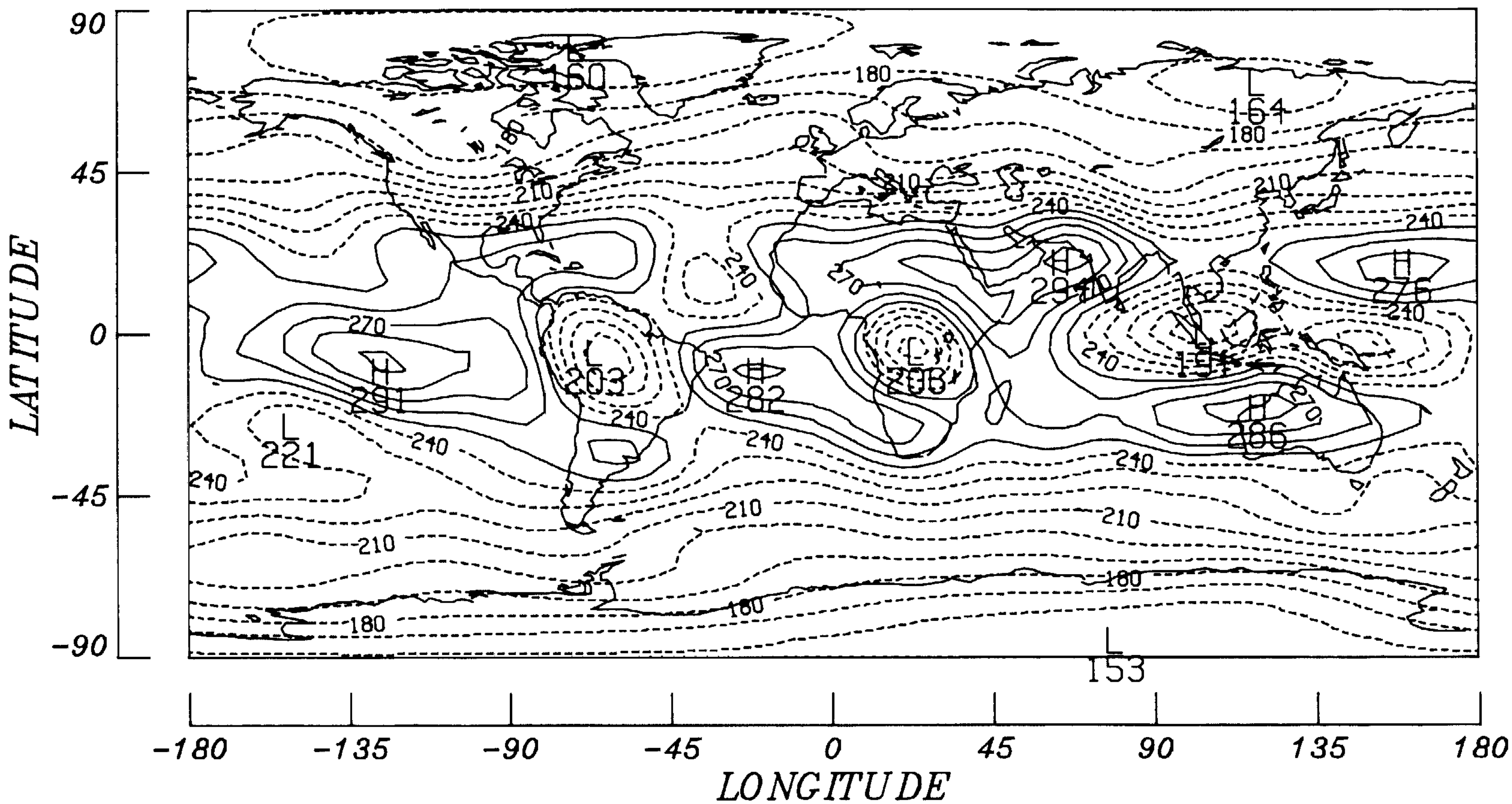
November 1985

C_n^m / S_n^m

		12	11	10	9	8	7	6	5	4	3	2	1	m/n
0	230.791	.584	.169	-.377	.008	-.008	-.035	-.445	-.659	.002	1.088	-.158	-.335	12
1	-4.515	1.702	.120	-.100	-.619	.343	.211	.065	.512	-.586	-.543	-.451	1.460	11
2	-25.984	1.534	.442	.187	-.514	.207	.443	-.233	.837	-.104	-.925	1.018	1.876	10
3	-.235	-.847	2.147	.770	-.076	-.997	-.358	-.701	-1.235	1.244	1.294	.596	-2.817	9
4	-4.508	1.141	.505	-2.732	.087	.025	-.604	.377	-1.406	-.688	1.339	-1.179	-.370	8
5	3.146	-.983	.370	-1.652	-.473	.621	.596	.122	2.069	-1.358	-1.951	.472	2.900	7
6	4.637	.298	1.950	2.671	.019	1.323	1.462	-.065	.796	2.426	-2.475	2.552	1.316	6
7	.213	.996	.651	-.100	-.215	.566	.503	.318	-3.106	-.845	1.183	-.733	-3.495	5
8	-4.349	-.721	-.722	-1.595	-1.446	-.616	.770	.304	1.387	-3.048	.635	-3.748	1.095	4
9	-.601	.026	-.520	.378	.025	.048	.376	-.792	-.639	.698	1.693	1.447	.801	3
10	1.653	.189	.539	.650	1.297	.384	-.095	-.627	-1.406	-.324	-.399	4.202	.561	2
11	1.237	-.808	-.233	-.971	.424	.542	-.166	.289	.073	-.836	.085	-.022	-1.182	1
12	-.246	-.054	.252	.396	.040	-.025	-.400	.778	.799	.421	-.291	-.003	.192	
n/m	0	1	2	3	4	5	6	7	8	9	10	11	12	

November 1985

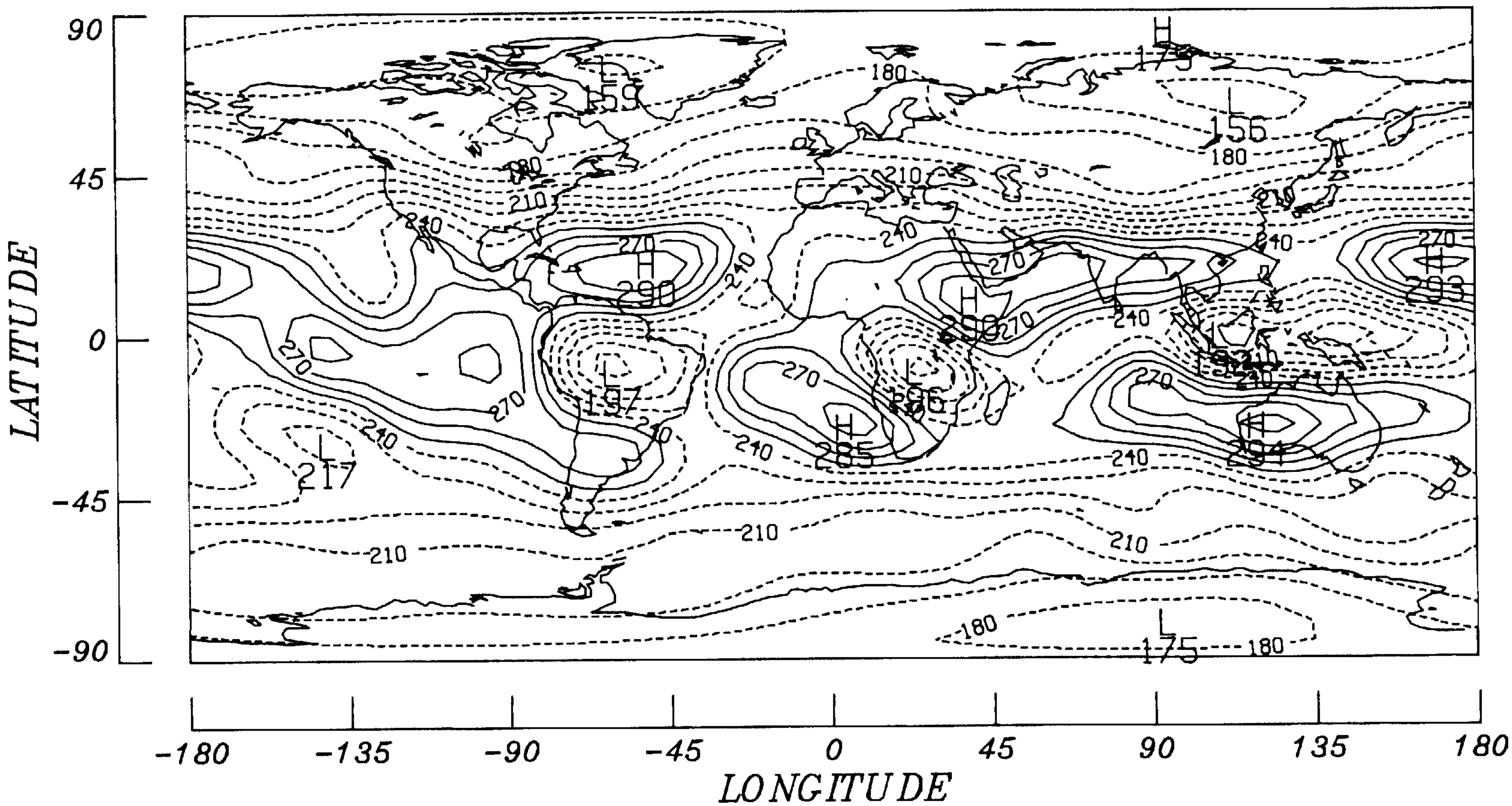


December 1985

C_n^m (lower-left, n by row at left, m by column at bottom) and S_n^m (upper-right, n by row at right, m by column at top)

	S: m = 12	11	10	9	8	7	6	5	4	3	2	1	m / n
0	229.790	.982	-.410	-.275	-.044	-.141	.304	-.189	-.374	.318	1.383	-.394	.127	12
1	-7.864	.341	-.234	-.700	.015	.715	-.623	.400	1.184	-1.040	.770	-.203	1.254	11
2	-24.743	1.008	-.702	.289	-.369	.483	-.087	-.420	.307	-.621	-1.481	1.816	1.876	10
3	-2.390	-.101	2.372	-.273	.866	-.393	.041	-.875	-.999	2.178	.128	.411	-2.637	9
4	-2.937	.402	2.273	-4.154	2.707	-.464	.323	.787	-.700	-.647	1.198	-2.870	-.787	8
5	4.441	-.303	.634	-.412	-1.809	-.192	-.107	.306	1.532	-2.634	-1.423	-.016	2.461	7
6	6.483	.730	1.136	4.885	-.614	-1.362	.223	-.364	1.460	1.390	-1.039	4.413	1.126	6
7	-1.896	.027	.091	.191	1.179	.028	.033	1.105	-1.129	.610	1.598	.268	-2.705	5
8	-4.613	-1.165	-.642	-2.783	-.567	.212	1.632	.418	1.685	-1.801	-.310	-3.956	1.086	4
9	1.315	1.030	-.359	-.446	-.285	.260	-.755	-.601	-.881	.695	.114	1.735	.514	3
10	2.179	.950	.528	.185	1.391	-.254	-.571	-.533	-1.260	.155	-.144	2.499	-.614	2
11	.271	-1.024	-.108	.441	.335	.051	.930	-.392	.225	.216	.996	-.167	-1.848	1
12	-.525	-.412	.100	1.223	-.446	.033	-.277	-.027	.478	.043	.291	.539	.457	
n / m	0	1	2	3	4	5	6	7	8	9	10	11	12	

December 1985

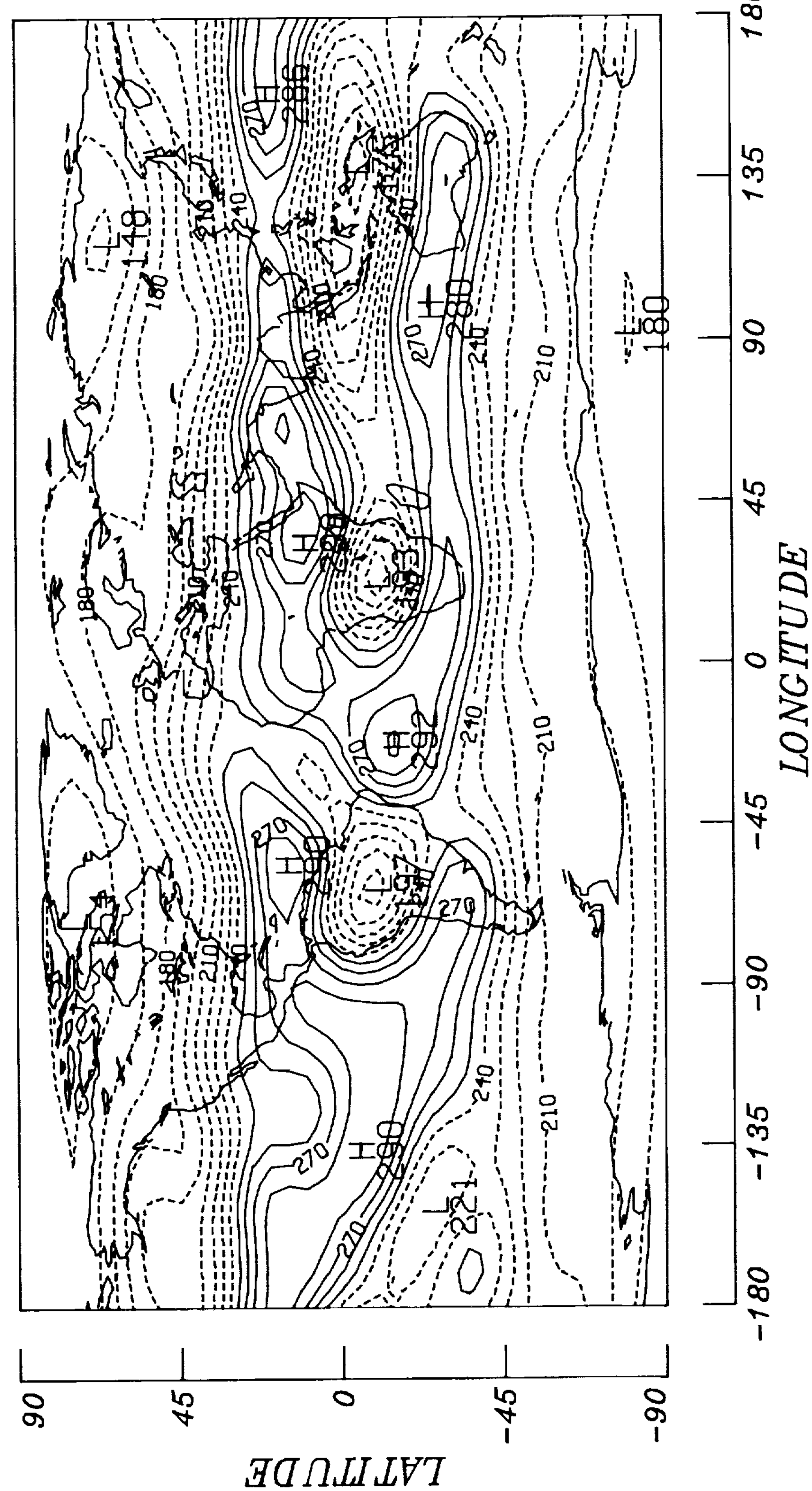


January 1986

C_n^m (lower left, rows n = 0–12, columns m = 0–12 per bottom axis) / S_n^m (upper right, rows n = 12–1 per right axis, columns m = 12–1 per top axis)

		12	11	10	9	8	7	6	5	4	3	2	1	m/n
0	230.798	.538	-.080	-.181	.647	-.048	-.702	-.770	.092	.170	.985	-.837	-.332	12
1	-8.873	2.319	.340	-.521	.124	.109	-.466	.422	1.080	-.743	1.248	-.317	.406	11
2	-25.780	-.118	.851	.220	-.651	.550	1.168	.224	.244	-.572	-1.675	1.405	2.185	10
3	-3.947	-1.317	3.082	.507	-.535	-.892	-.230	-1.129	-1.070	2.652	-.049	.649	-1.980	9
4	-3.960	1.456	1.055	-3.395	1.798	-.289	.259	.590	-1.179	-.271	2.161	-1.788	-1.588	8
5	6.691	.267	.112	-.187	-1.180	-.201	.115	.999	.554	-3.414	-1.808	.354	2.833	7
6	7.779	-.488	2.109	3.683	-.095	.263	-.390	-.358	.581	1.113	-2.463	4.472	2.321	6
7	-4.957	.202	.125	-.287	1.271	-.004	-.087	1.434	-2.646	.945	1.757	.481	-3.844	5
8	-4.510	-.310	-.869	-2.136	-.341	-1.191	.343	.972	.806	-2.567	-.007	-4.232	-.217	4
9	2.821	1.072	.307	-.362	.019	-.114	-.468	-.519	-.475	.087	-.755	1.471	3.317	3
10	1.297	1.346	1.089	.456	1.355	.666	-.138	-.359	-.782	-.004	.260	5.239	.094	2
11	.386	-.727	-.198	.129	-.456	.073	.224	-.062	.185	.088	.387	.173	-4.738	1
12	.109	-1.371	-.409	.338	-.539	.244	-.506	.171	-.006	.435	.434	.159	.261	
n/m	0	1	2	3	4	5	6	7	8	9	10	11	12	

January 1986

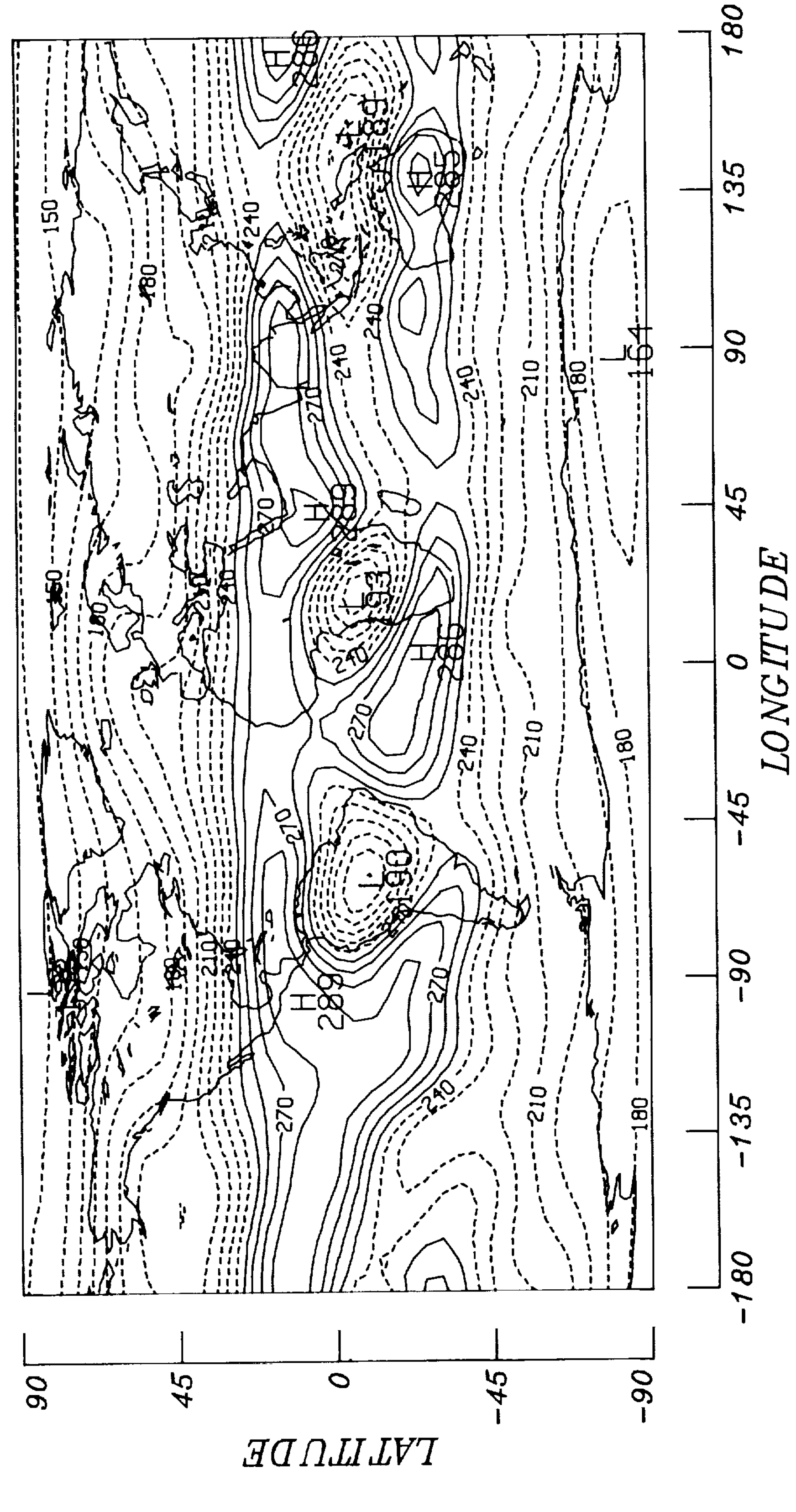


February 1986

C_n^m / S_n^m

	12	11	10	9	8	7	6	5	4	3	2	1	m/n
0	230.164	.399	-.434	-.379	-.239	-.813	.262	-.135	-.143	-.142	.554	-.977	-.104	12
1	-8.826	1.188	.734	.131	-.025	.846	-.001	.286	.342	-.771	.805	-.524	.195	11
2	-27.662	.252	-.742	-.253	-.287	.746	-.292	-.806	.790	-.026	-.579	1.519	1.897	10
3	-2.952	-.535	1.216	.834	-.017	-.985	-.136	-.238	-.457	1.892	.807	.546	-.837	9
4	-3.944	.277	3.004	-2.484	3.258	.158	.957	.944	-1.453	-.629	.115	-2.262	-.868	8
5	6.342	-1.309	1.374	-.458	-1.488	-1.964	-.853	-.400	1.159	-2.278	-2.774	.459	.651	7
6	4.553	-.140	.688	3.708	.070	-.422	-.310	-1.011	1.519	1.166	-.857	4.032	1.369	6
7	-6.267	1.287	.261	-.333	.338	1.132	.618	.387	-3.096	.974	2.447	-.464	-2.195	5
8	-5.650	.482	.527	-1.616	-.915	-.033	.255	.079	1.198	-3.424	-1.212	-4.214	.832	4
9	3.115	-.013	-.175	.499	.612	-.394	-.242	-.696	-.266	-.128	-1.655	1.375	1.509	3
10	1.541	-.402	.813	.598	1.801	.423	.128	-.293	-1.035	-.054	.285	4.555	-.609	2
11	-.908	-.465	-.252	-.434	-.517	.214	-.122	.291	.672	-.200	-.635	-.057	-3.214	1
12	-.081	.159	-.544	.605	-.127	.336	-.165	-.119	.068	.318	.632	.538	-.049	
n/m	0	1	2	3	4	5	6	7	8	9	10	11	12	

February 1986

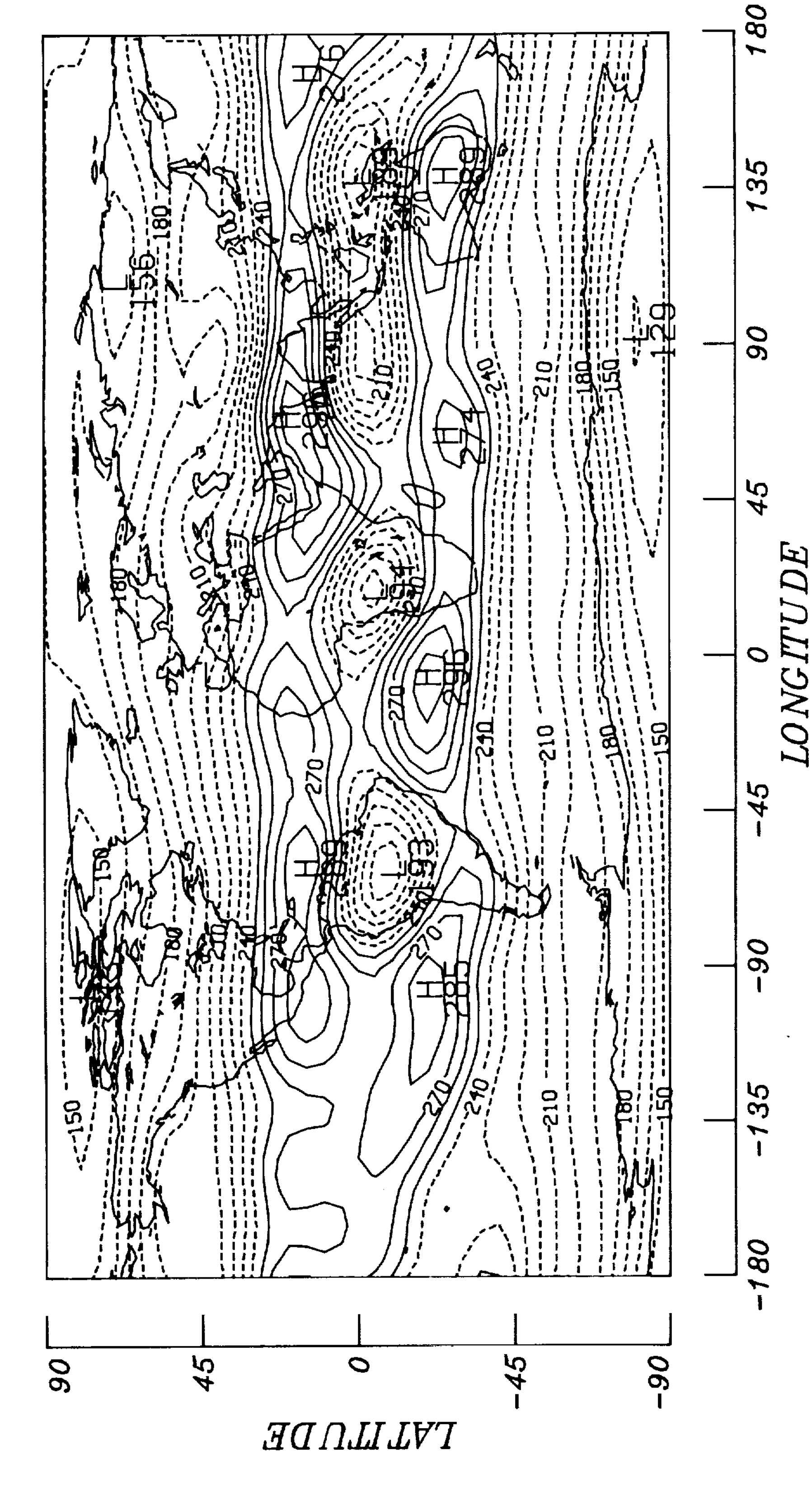


March 1986

C_n^m / S_n^m

n \ m		12	11	10	9	8	7	6	5	4	3	2	1	m / n
0	230.593	.335	.126	-.303	-.344	-.085	-.098	.025	.027	-.207	.448	-.696	1.210	12
1	-5.042	.904	.159	-.257	-.343	.183	.033	-.075	.269	-.300	1.050	-.627	.930	11
2	-28.217	1.046	.187	-.030	.190	-.001	.134	-.580	.695	.008	-1.030	1.125	1.716	10
3	-.320	.264	.649	.505	-.277	-1.236	-.590	-.210	-.752	.488	.058	.881	-2.306	9
4	-7.283	.134	1.290	-2.415	.338	-.507	.055	.850	-1.930	.558	1.265	-1.454	-.463	8
5	5.484	-1.691	1.465	.187	-.340	-1.293	.328	-.029	.862	-.692	-1.720	-.238	1.252	7
6	6.292	.170	2.006	4.068	.002	-1.035	.453	-1.573	.974	.617	-.508	3.293	2.499	6
7	-3.847	1.849	-.785	-1.285	-.239	1.292	-.082	.724	-3.680	1.112	1.927	.774	-2.438	5
8	-7.088	-.826	-.980	-2.293	-.476	-.173	-.256	.105	.538	-3.622	-.565	-2.353	1.527	4
9	3.147	-.498	1.028	1.496	-.313	-1.410	-.218	-.581	-.687	-.083	.140	.902	1.778	3
10	3.336	1.755	1.644	.177	.720	.038	.492	-.214	-.774	-.419	.191	3.610	-.263	2
11	.113	-.027	-.897	-1.278	.766	.235	.054	.389	.603	-.167	-.050	.088	-3.563	1
12	-.521	-.913	-.735	.780	-.280	.422	-.536	.217	.296	.341	.738	-.083	.583	
n / m	0	1	2	3	4	5	6	7	8	9	10	11	12	

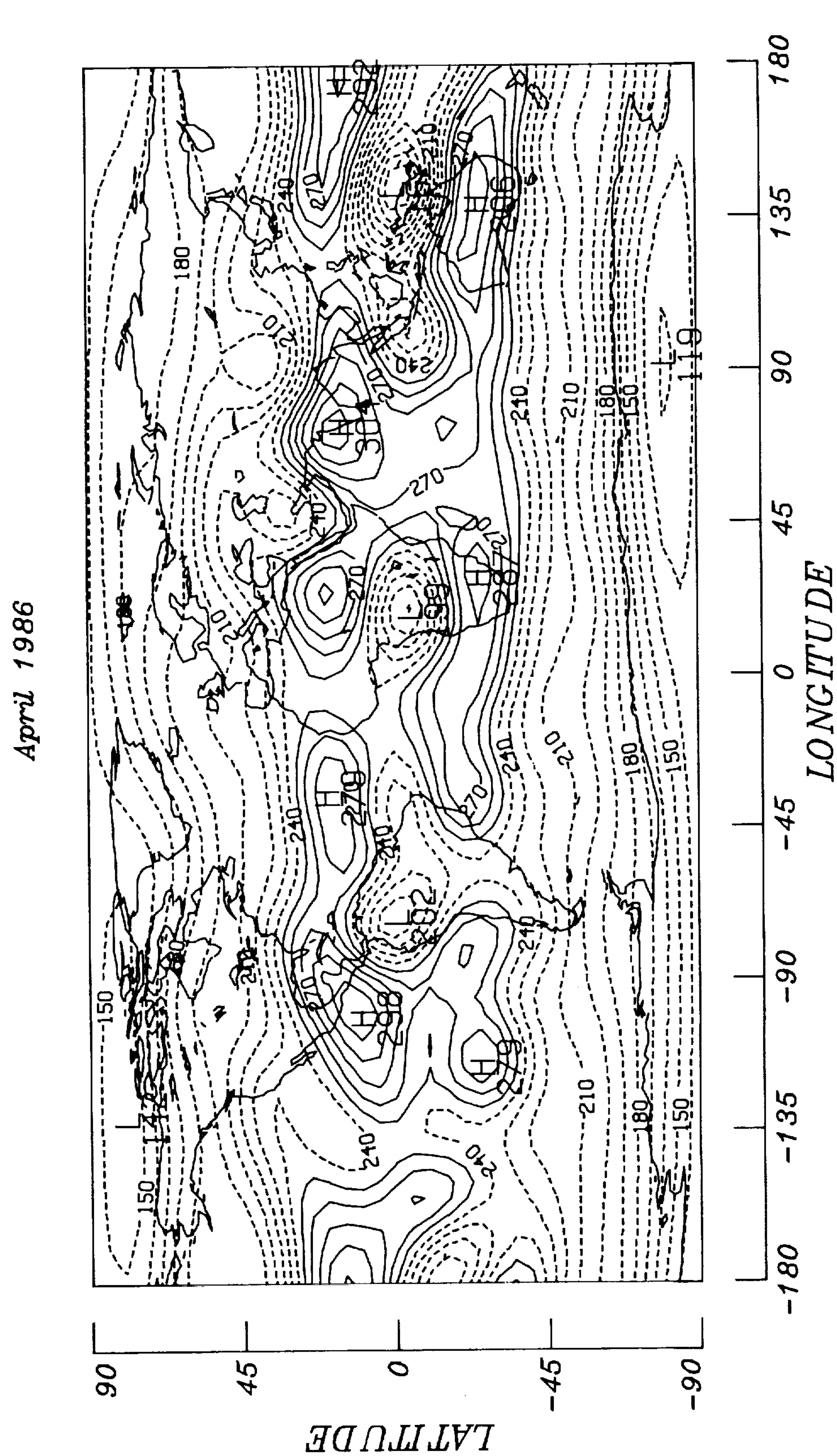
March 1986



April 1986

C_n^m S_n^m

	12	11	10	9	8	7	6	5	4	3	2	1	m/n
0	230.995	.147	.195	-1.035	-.682	-.300	-.203	.468	-1.203	-.243	.448	-.884	.654	12
1	-1.384	2.689	.577	.269	-.171	-.801	-.416	-.406	.278	.386	.026	-.106	.879	11
2	-27.646	1.452	-2.152	-.237	-1.511	1.099	.433	-.950	1.391	-.419	-.960	1.793	2.038	10
3	1.837	-.001	.508	-1.131	-.512	-.056	.244	-.820	-1.138	-.942	1.426	.199	-1.362	9
4	-7.838	2.173	1.791	-2.006	2.062	-1.847	.312	.218	-2.228	-.330	1.632	-3.248	-.216	8
5	4.004	.590	-.911	1.028	1.230	-1.190	1.129	1.501	1.248	-.036	-3.062	-.661	.854	7
6	4.664	-1.571	-.455	3.106	-1.798	-.336	-.290	2.196	.915	1.235	-.231	3.841	2.363	6
7	-3.477	.339	.332	-.981	-2.060	1.197	-.403	-.059	-2.293	.199	3.618	.714	-1.966	5
8	-6.871	1.281	1.051	-1.686	.176	2.116	-1.256	-.943	-.732	-3.043	-.004	-1.951	2.915	4
9	3.408	-.493	.210	.825	1.005	-1.195	.139	-1.685	-.279	1.430	-.496	1.187	.063	3
10	2.628	.208	.730	-.243	.486	-1.855	1.983	-.434	-1.270	-1.766	-.544	4.014	-.986	2
11	-.958	1.012	-.504	.131	.773	.112	.300	.180	-.265	.130	-.111	.190	.800	1
12	-.169	.077	-.335	1.521	.571	.786	-1.030	.553	.505	.886	1.387	.294	.767	
n/m	0	1	2	3	4	5	6	7	8	9	10	11	12	


April 1986
LATITUDE
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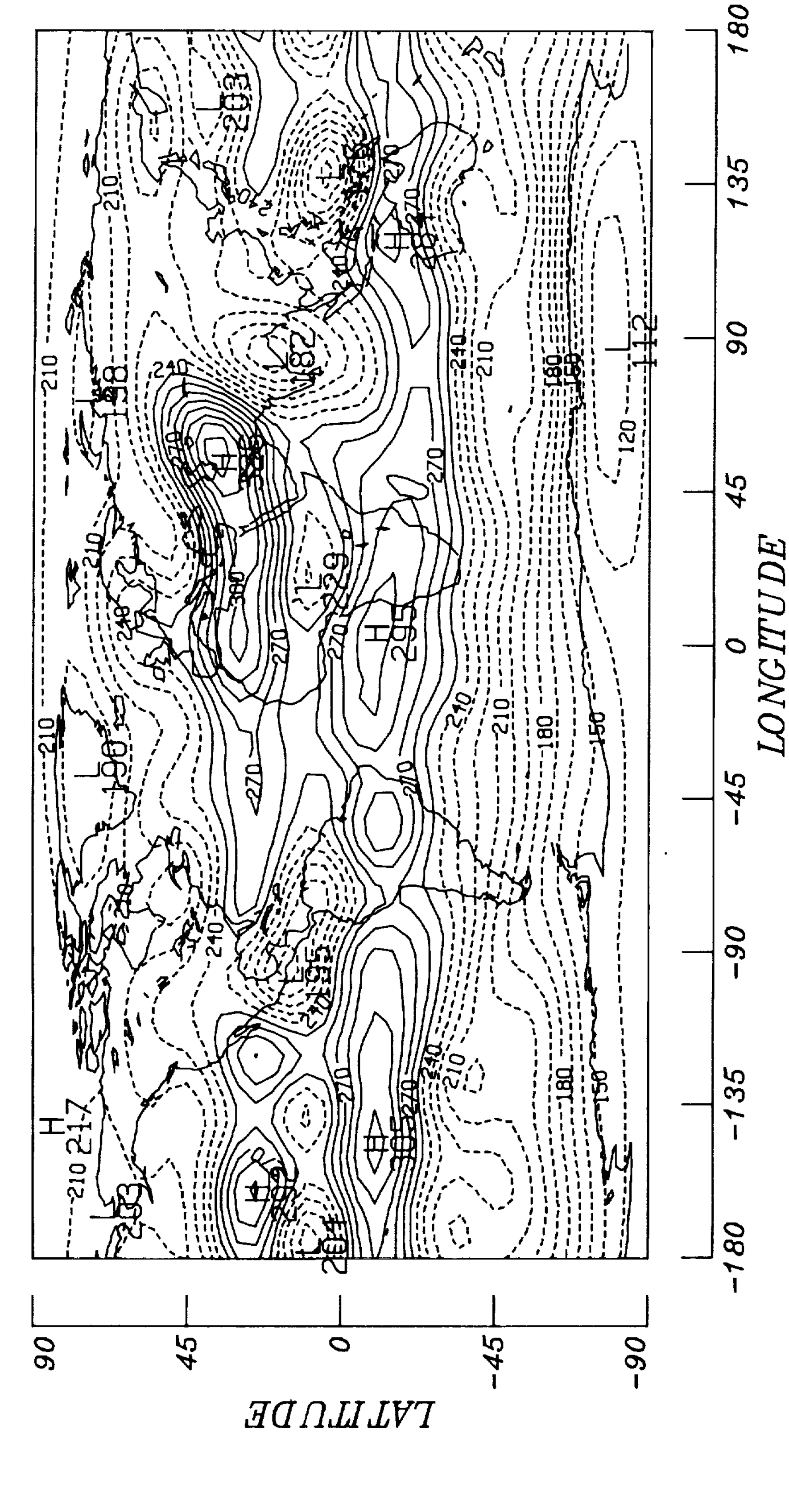
June 1986

C_n^m (lower left, n = row label at left, m = column label at bottom); S_n^m (upper right, n = row label at right, m = column label at top)

		12	11	10	9	8	7	6	5	4	3	2	1	m/n
0	234.829	.509	.439	-1.134	-.107	-.136	1.104	.969	.474	.320	-.082	-.504	-1.063	12
1	10.011	5.956	.779	-1.010	-.495	.648	1.027	-.410	1.423	2.091	.633	1.131	.081	11
2	-25.157	3.647	5.436	-.823	.046	1.136	.474	.486	1.661	.070	1.079	1.683	2.035	10
3	9.067	-.253	2.532	1.296	-.433	1.637	-.677	1.298	-.527	-1.709	.730	.637	-1.178	9
4	-5.930	.399	-.527	-1.095	-2.328	-.003	-.250	.924	-1.137	-1.619	.217	-.669	-1.016	8
5	-4.905	-3.677	-3.045	-1.549	-2.269	-1.270	1.293	.012	-.990	-.933	-2.122	-2.114	-.854	7
6	2.791	-.789	-.396	.558	-.466	.006	2.085	-1.235	-1.020	-.349	.998	-.117	.778	6
7	7.459	.097	.142	1.431	.945	1.382	2.544	2.808	-.654	-.767	2.169	-.101	-2.706	5
8	-3.553	-.924	1.432	.188	1.013	.559	.326	.176	-1.788	-.713	-.103	.677	2.263	4
9	-5.584	2.321	1.821	.807	1.136	-.133	1.379	.635	-1.240	.760	-.252	2.848	3.142	3
10	1.756	1.174	.489	.952	-.621	.577	.737	-.143	-.437	.692	-.564	4.660	-.179	2
11	2.259	-1.635	-2.368	-.282	-.712	.421	-.337	.905	.843	-.044	.278	.009	-1.550	1
12	1.889	-1.161	.238	.044	1.208	.456	.073	1.154	.186	-.600	.817	.635	.692	
n/m	0	1	2	3	4	5	6	7	8	9	10	11	12	

June 1986

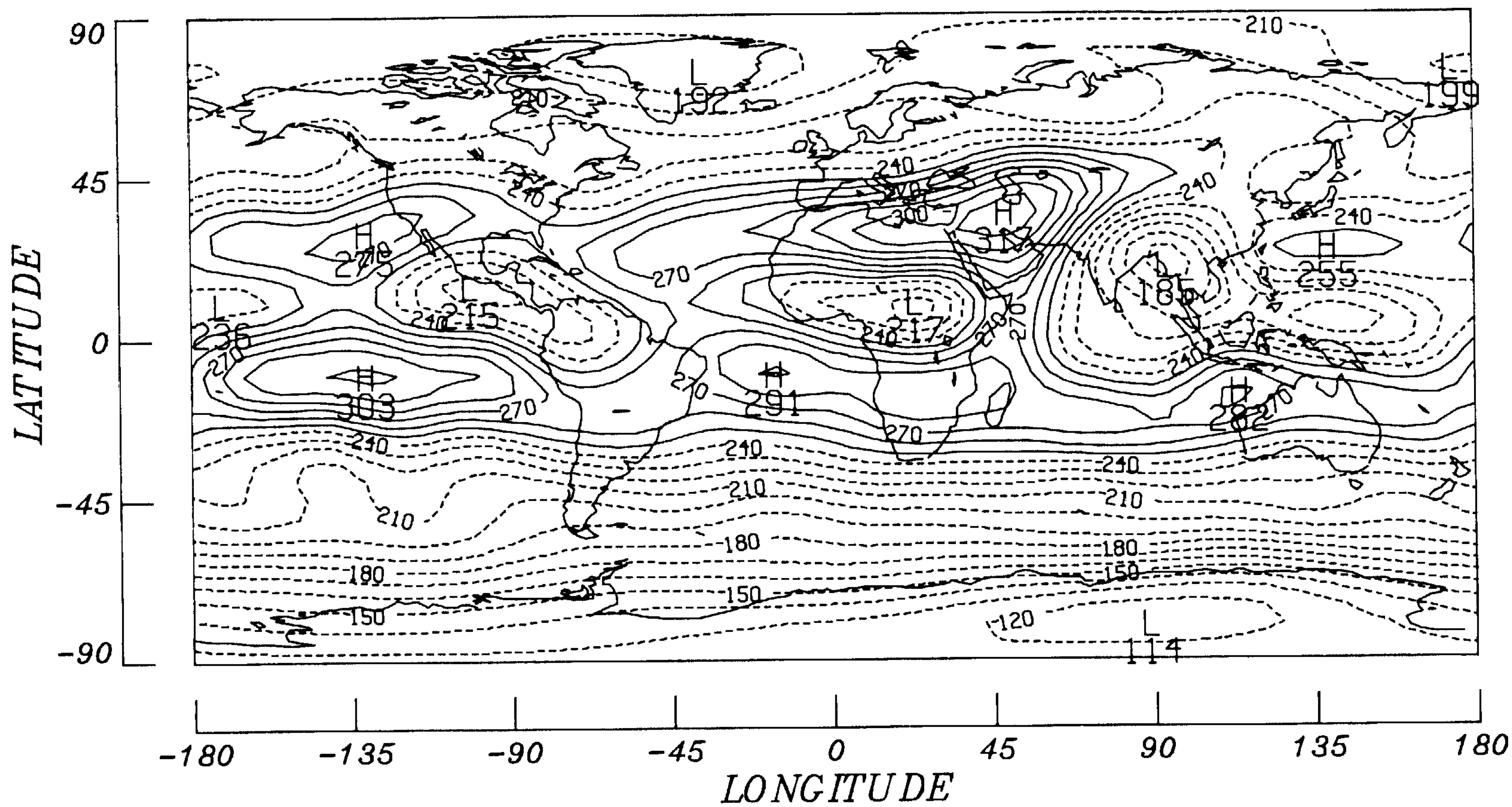


July 1986

C_n^m (lower left: rows n, columns m from bottom header) / S_n^m (upper right: rows n from right column, columns m from top header)

		12	11	10	9	8	7	6	5	4	3	2	1	m/n
0	235.606	-.329	-.393	-.254	-.576	.351	.058	.019	-.555	.071	-.306	.119	-.228	12
1	12.000	4.566	· .135	.313	-.236	.221	-.246	-.669	.322	1.516	-.054	.514	.708	11
2	-24.822	3.832	3.520	.664	.446	.620	-.014	.132	.984	.913	.714	1.476	1.978	10
3	8.326	-.342	2.037	-.317	-.055	.314	-.086	.095	-.811	-.143	1.585	1.182	-.241	9
4	-7.678	-.410	-1.469	-1.446	-4.391	.256	.633	.572	-.973	-.933	-.531	-1.088	-.873	8
5	-5.305	-3.097	-2.892	-.788	-3.146	-1.109	.657	-.172	.800	-.272	-2.165	-2.848	.173	7
6	3.749	-1.331	-.975	1.966	-.041	.587	1.531	-.816	-1.401	-.191	.130	.410	1.002	6
7	7.448	.856	-.438	1.075	.969	.279	.986	.722	-2.052	-.854	2.143	.180	-3.320	5
8	-2.937	.018	1.130	-1.596	.744	-.517	.776	.168	.471	-.348	.681	.234	3.537	4
9	-3.730	1.190	1.525	.173	.228	-1.004	-.364	-.171	.450	.084	-.655	2.304	3.814	3
10	.859	.670	.427	1.906	-.736	.398	-.116	.387	-.573	-.047	-.565	5.366	-.185	2
11	.513	-1.015	-1.927	.478	-.840	.732	.048	.510	-.379	.190	-.192	-.490	-2.368	1
12	.847	.234	-.718	-.382	.147	.027	-.002	.082	.313	-.087	-.161	-.096	-.126	
n/m	0	1	2	3	4	5	6	7	8	9	10	11	12	

July 1986



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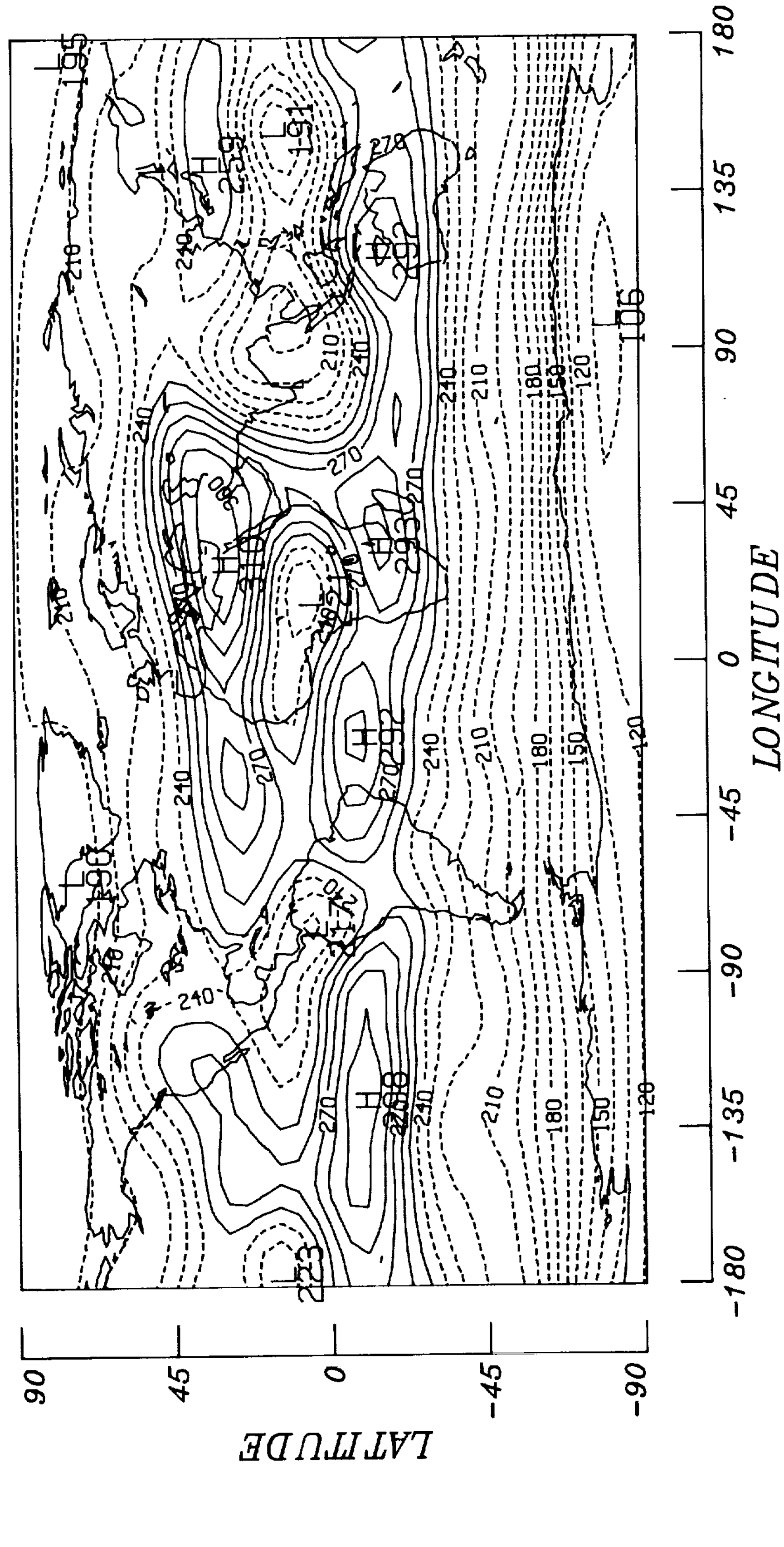
L 192
L 199
H 255
L 185
H 282
L 114
L 217
H 291
H 303
L 215
L 236

August 1986

C_n^m (left, rows n, columns m along bottom) and S_n^m (right, rows n along right side, columns m along top)

n \ m (C)		12	11	10	9	8	7	6	5	4	3	2	1	m \ n (S)
0	235.882	-.163	.166	-.363	-.399	-.153	-.178	.086	-.347	-.306	.332	.912	-.738	12
1	10.677	4.060	.468	-.367	.254	.069	.017	-.134	.266	.606	.163	.277	-.211	11
2	-25.416	4.469	3.489	-.128	.757	.593	-.060	.127	.457	.506	.698	-.100	2.204	10
3	8.757	-.822	1.548	-.141	.438	-.012	.109	-.098	-.261	-.012	.316	-.253	-.636	9
4	-8.471	-1.825	-.933	-1.319	-4.676	-.500	.455	.222	.093	-1.643	-.738	-.464	.378	8
5	-5.630	-2.423	-2.064	-.399	-3.273	-1.663	1.173	-.247	1.243	-.946	-.940	-.884	1.276	7
6	1.690	.612	.057	2.033	.091	.231	1.453	-.164	-.123	.143	1.120	.749	-.157	6
7	8.131	1.538	-.947	.077	.268	.138	.977	.528	-3.151	-.044	2.929	-.614	-4.111	5
8	-1.592	.057	.182	-.896	.026	-.649	-.198	.587	.545	-.640	-.148	-.362	4.143	4
9	-3.981	-.210	1.643	.145	.431	-.909	.105	-.574	.172	.149	.217	2.920	3.051	3
10	.122	-.066	1.599	1.377	.075	.080	.511	-.129	-.774	-.576	-.267	4.952	-.618	2
11	.537	.258	-.622	.454	-.752	-.078	.257	.744	-.558	-.039	.015	-.227	-1.248	1
12	1.084	.574	-.907	-.475	.224	-.451	-.207	.011	.098	-.070	.548	.136	.355	
n / m	0	1	2	3	4	5	6	7	8	9	10	11	12	

August 1986

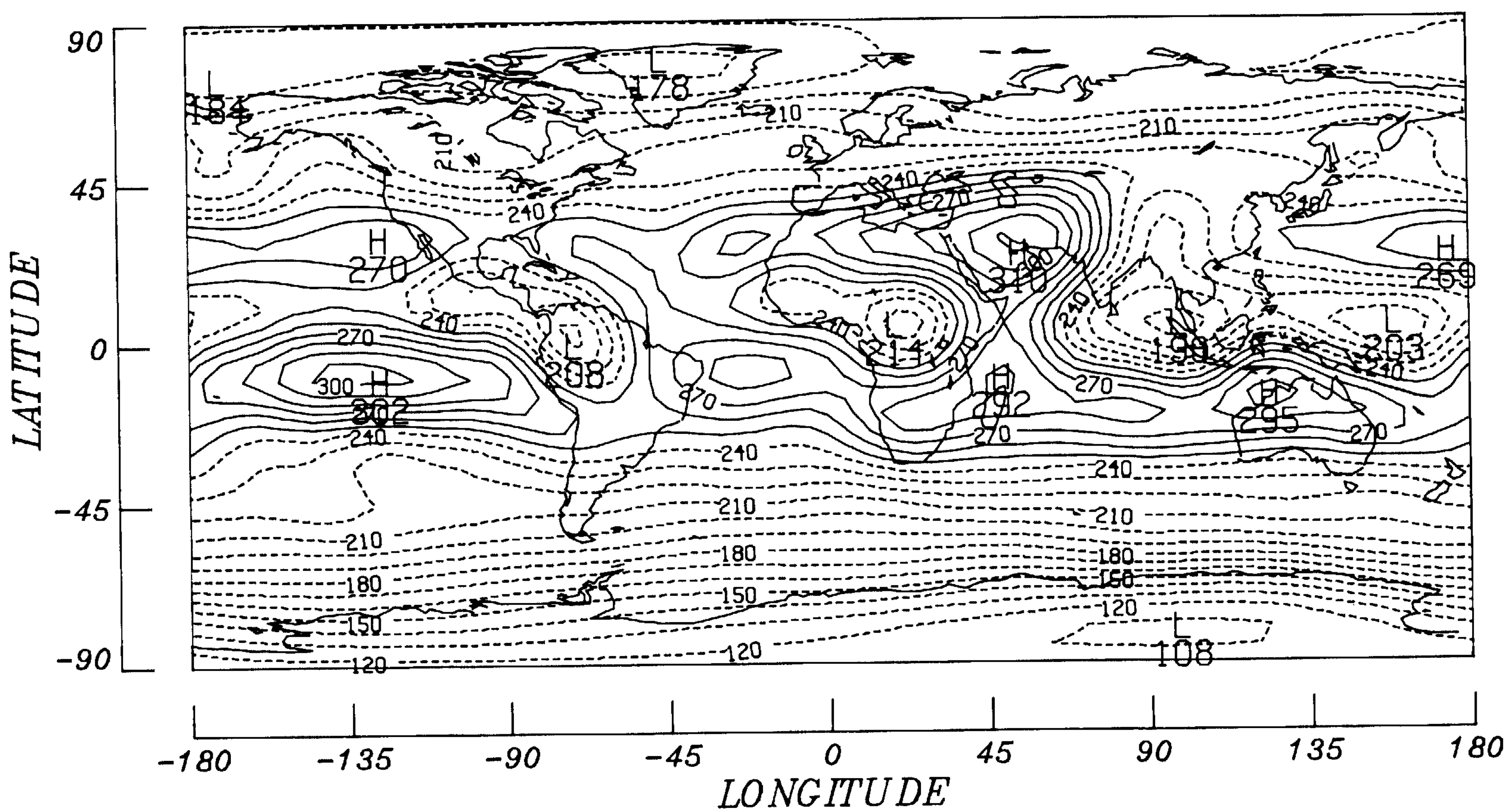


September 1986

C_n^m (lower left, rows n = 0–12 at left, columns m = 0–12 at bottom) and S_n^m (upper right, rows n = 12–1 at right, columns m = 12–1 at top)

		12	11	10	9	8	7	6	5	4	3	2	1	m/n
0	234.823	.362	.431	-.094	-.073	-.478	.127	-.163	-.529	-.408	.484	.288	.342	12
1	7.666	2.485	.236	-.032	.152	-.217	.065	-.447	1.114	-.378	.225	-.311	1.095	11
2	-26.818	3.310	2.156	.462	.003	.236	.223	-.126	1.167	.306	.270	1.349	1.855	10
3	7.024	-1.664	1.663	-.731	.179	.447	.331	.194	-.897	.594	1.201	1.354	-1.739	9
4	-9.472	-.504	-.195	-1.822	-5.069	.184	.446	-.738	-.617	-.681	-.303	-.716	-.395	8
5	-3.671	-1.739	-1.363	-1.404	-2.407	-.732	1.016	-.585	1.618	-.425	-2.460	-1.475	1.643	7
6	3.331	.345	.124	2.487	.726	.420	1.486	.082	-.357	.671	-.016	.741	.050	6
7	6.648	.598	.417	2.029	.051	.989	1.716	.383	-3.434	-1.128	1.887	-1.005	-4.769	5
8	-3.653	-.660	.464	-1.175	-.690	.342	-.081	.423	1.304	-1.915	.205	-1.360	2.602	4
9	-3.729	.731	.234	-.471	.013	-.145	-.132	-1.028	-.396	.299	-.355	2.386	2.260	3
10	1.293	.685	.724	1.115	.309	.092	.181	-.558	-1.484	-.130	-.541	5.354	-.171	2
11	1.666	-.389	-1.092	.194	-.118	.297	-.427	.404	-.212	-.354	.022	-.557	.067	1
12	.825	-.342	-.840	-.186	.360	-.122	-.395	.545	.456	.232	.313	.296	.516	
n/m	0	1	2	3	4	5	6	7	8	9	10	11	12	

September 1986

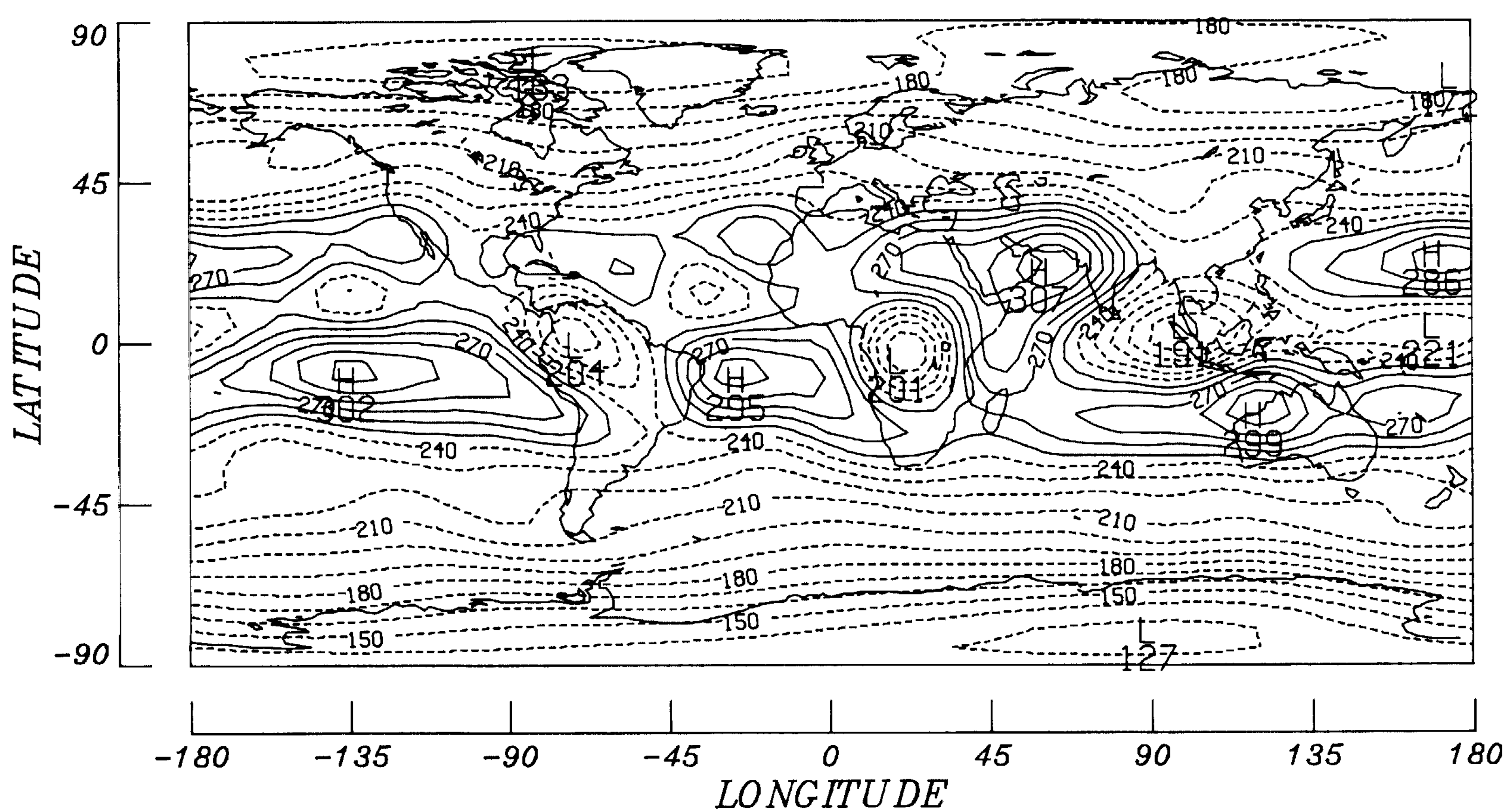


October 1986

C_n^m (lower left, rows n, columns m at bottom) / S_n^m (upper right, rows n at right, columns m at top)

n \ m (C)		12	11	10	9	8	7	6	5	4	3	2	1	m / n (S)
0	232.669	.426	.625	-.732	-.050	-.015	-.116	-.096	-.667	-.450	.504	-.485	.054	12
1	2.726	.225	.466	-.858	-.054	.285	-.124	.918	.623	-.321	-.829	-.871	1.360	11
2	-27.990	2.565	1.883	.629	-.593	.068	.383	.152	.902	.863	-.838	1.323	1.818	10
3	2.221	-.486	2.003	-.035	.361	-.302	.347	-1.194	-1.296	1.045	1.246	.632	-2.036	9
4	-7.204	-.425	-.433	-2.550	-2.331	-.443	-.679	.145	-.990	-1.061	1.383	-.678	-.966	8
5	-.947	-.540	-.879	-.959	-1.363	.365	.589	.819	1.943	-.725	-1.218	.840	2.702	7
6	3.584	.905	1.279	3.745	1.137	.548	1.629	-.374	.047	1.767	-1.316	1.392	2.295	6
7	4.706	-.176	.222	1.370	.145	.232	.599	.944	-3.802	-.959	1.176	-1.210	-3.365	5
8	-4.734	-1.284	.001	-.817	-1.000	-.333	.282	.212	.708	-4.516	.601	-1.469	.897	4
9	-2.589	.697	.269	-1.276	.329	-.550	.013	-1.772	-.864	.950	.526	2.943	.720	3
10	2.545	1.302	.518	-.131	1.543	.183	-.113	-.797	-1.382	-.898	-.171	4.523	.396	2
11	1.780	-.689	-1.181	-.075	.029	.232	.624	.711	-.182	-.380	-.399	-.055	-.477	1
12	.513	-.408	-.205	.133	-.815	-.266	.097	.487	.693	.561	-.165	-.434	.324	
n / m	0	1	2	3	4	5	6	7	8	9	10	11	12	

October 1986

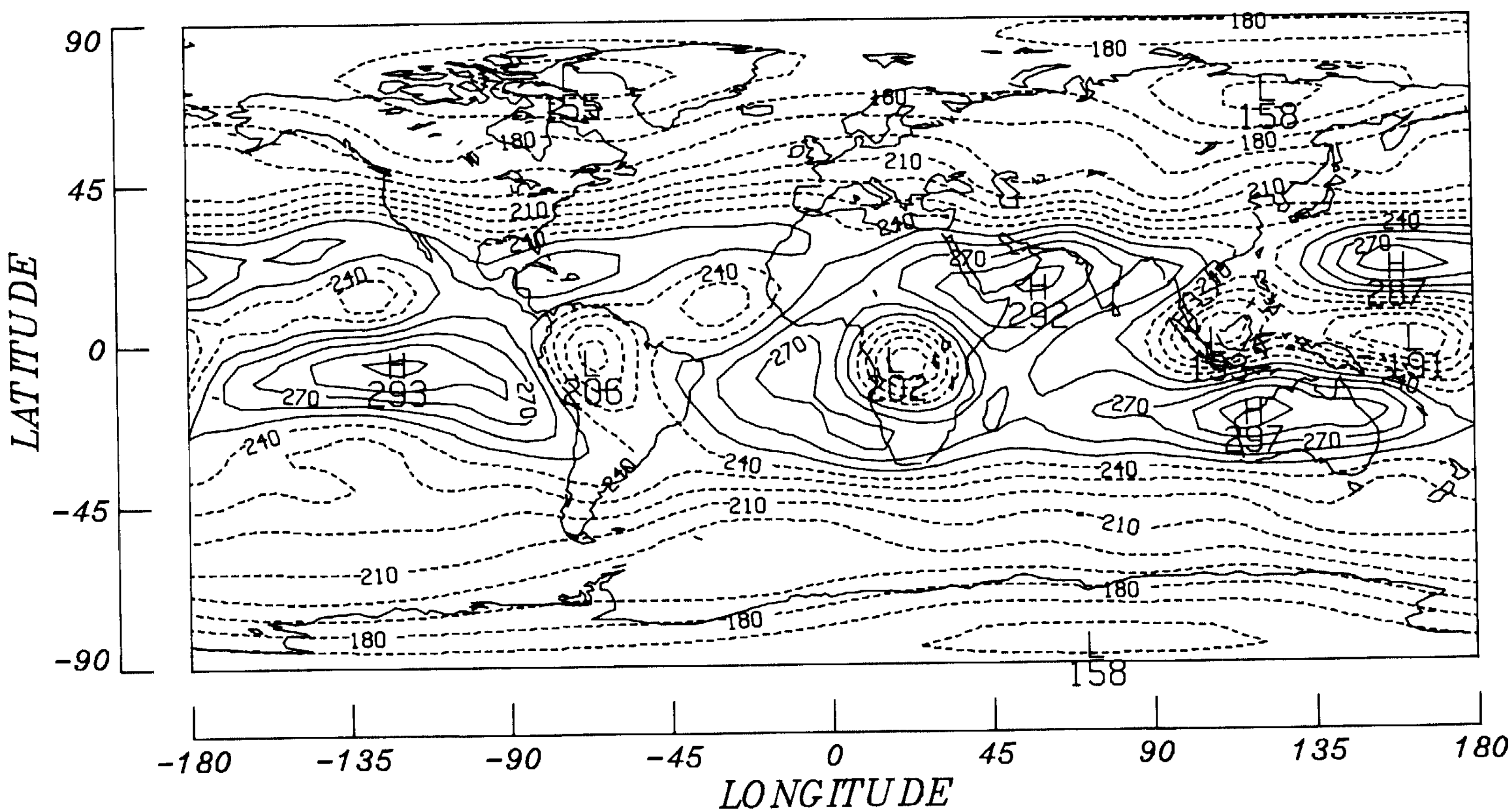


November 1986

C_n^m S_n^m

		12	11	10	9	8	7	6	5	4	3	2	1	m/n
0	230.718	.827	-.255	-.132	-.512	-.513	.281	-.180	-.277	-.565	.684	-.589	-.198	12
1	-4.867	1.006	-.330	-.762	-.267	-.008	-.321	.134	.242	-.552	-1.412	-.063	1.532	11
2	-25.781	2.249	-.381	.092	.219	.099	.385	.525	.466	.186	-1.368	1.658	2.062	10
3	.032	-1.632	2.154	.581	-.189	-.269	.495	-.236	-.649	1.158	1.490	.450	-2.936	9
4	-4.658	.578	2.660	-2.922	.374	-.192	-.177	-.369	-1.411	-.713	1.925	-1.704	-1.469	8
5	1.438	.233	.505	-.555	-.524	1.249	-.606	-.060	1.766	-.799	-1.637	.713	2.538	7
6	6.021	1.037	.104	3.252	-.110	.244	-.094	.569	1.703	1.694	-1.987	3.637	2.044	6
7	1.844	-.782	.267	.565	-.644	.176	.046	.875	-2.883	-.548	1.135	-.949	-2.526	5
8	-4.996	-2.121	.219	-2.193	-.539	.009	-.148	.113	1.782	-2.860	-.013	-2.626	1.519	4
9	-.529	1.367	-.460	-1.491	1.409	-.004	-.185	-.789	-.328	1.103	.549	2.023	.287	3
10	1.828	1.473	.379	-.052	1.214	.020	.463	-.265	-1.519	-.887	-.073	4.271	-.272	2
11	1.539	-1.281	-.011	.595	-.471	.175	.027	-.528	.086	-.493	.315	-.380	.390	1
12	.482	-.744	-.067	.501	-.077	.169	-.618	-.240	.803	.743	.661	.118	.126	
n/m	0	1	2	3	4	5	6	7	8	9	10	11	12	

November 1986

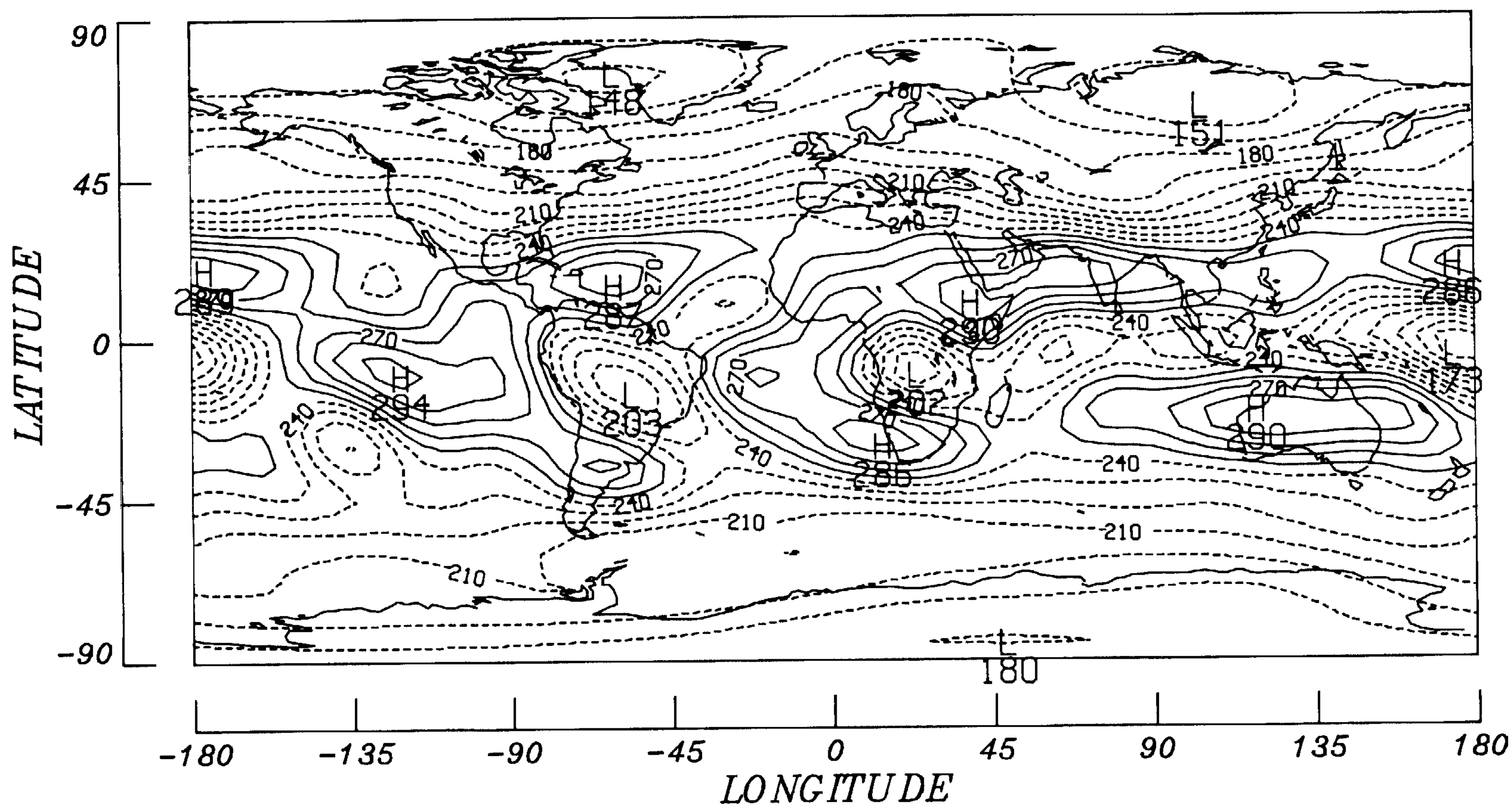


December 1986

C_n^m (lower left, rows n = 0–12, columns m from bottom labels) and S_n^m (upper right, rows n from right labels, columns m from top labels)

		12	11	10	9	8	7	6	5	4	3	2	1	m/n
0	230.919	.467	-.485	-.789	-.296	-.391	-.387	.057	.201	.276	1.413	-.099	-.692	12
1	-8.977	.702	.614	-.167	.442	.620	-.324	.713	-.169	-1.195	.390	.220	1.000	11
2	-25.181	1.165	-.603	.686	-.009	.141	.314	-.428	.347	-.947	-1.607	.859	2.166	10
3	-2.958	-2.020	2.144	4.268	.073	-.580	-.177	-1.007	-.321	2.886	.603	.313	-2.413	9
4	-3.734	-.027	4.059	-3.377	.293	-.963	-.029	.669	-.989	-.390	1.296	-1.098	-.914	8
5	4.218	.928	.612	-2.922	-1.757	1.158	-.736	.420	1.303	-3.007	-1.404	.903	2.931	7
6	6.676	.815	-.779	4.968	.835	-.468	-.359	.043	.325	1.294	-.158	2.878	1.545	6
7	-2.310	-1.024	.174	1.945	.114	-.257	1.083	1.123	-2.142	1.606	1.833	-.449	-2.786	5
8	-4.414	-1.298	.758	-3.025	-1.392	.016	1.023	-.080	.476	-.304	-1.307	-1.808	.558	4
9	1.593	1.759	-.055	-1.323	1.099	.226	-1.081	-.586	.892	1.326	1.200	1.694	.084	3
10	1.957	.863	1.127	.192	1.705	-.203	-.412	-.395	-1.539	-.995	-.298	1.138	-.376	2
11	.691	-1.540	.245	.608	-1.012	-.107	.607	.519	.223	-.116	.288	.368	-1.105	1
12	-.527	.096	-.810	1.383	-.586	.155	.086	.280	.588	.396	.186	.155	.013	
n/m	0	1	2	3	4	5	6	7	8	9	10	11	12	

December 1986

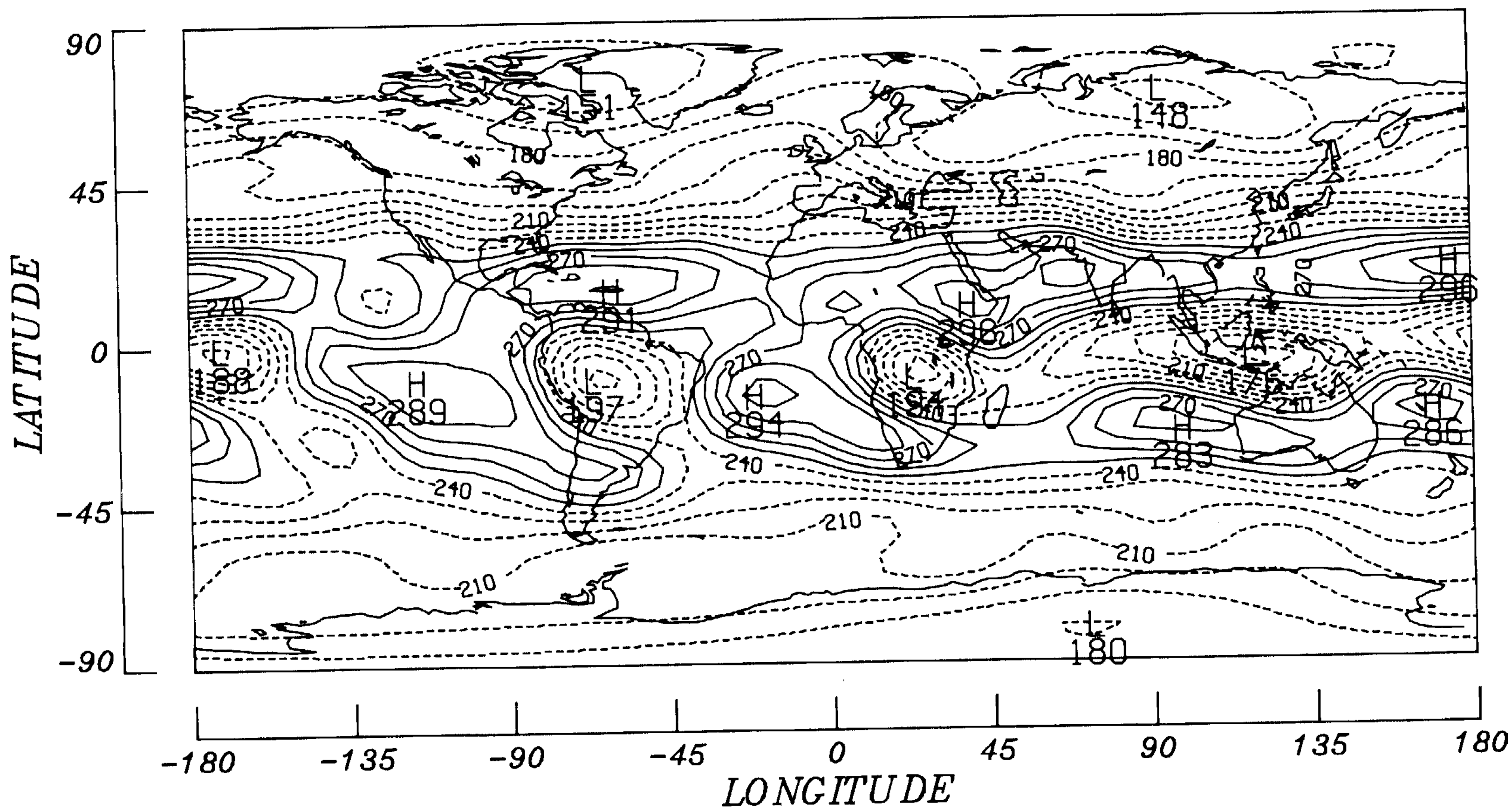


January 1987

C_n^m (lower left, columns m = 0–12 at bottom, rows n at left) and S_n^m (upper right, columns m = 12–1 at top, rows n at right)

		12	11	10	9	8	7	6	5	4	3	2	1	m/n
0	231.567	.592	-.273	-.306	-.110	-.312	-.012	-.147	-.181	.216	1.183	-1.116	-.878	12
1	-10.020	2.437	.680	-.435	-.104	.547	-.070	.752	.506	-1.115	1.382	-.292	.371	11
2	-25.812	.646	1.014	.250	-.356	.701	.507	-.623	-.146	-.672	-1.193	1.465	2.943	10
3	-3.550	-2.617	1.681	.923	.368	-.335	-.402	-1.159	-.371	2.928	-.286	1.339	-1.601	9
4	-3.640	.137	1.211	-2.604	2.161	-.188	-.061	1.145	-.015	-1.205	1.054	-1.065	-1.232	8
5	6.652	1.615	1.441	-1.414	-2.871	.477	.820	.838	.374	-3.879	-.835	-1.070	3.020	7
6	8.308	.510	1.161	3.976	.833	.581	-.694	-1.550	-.083	2.464	-1.876	2.357	2.040	6
7	-4.799	-1.206	-.403	1.196	1.882	-.256	.378	1.571	-.607	1.642	.440	.767	-3.554	5
8	-6.400	-.606	.799	-1.811	-1.552	-.285	1.147	.059	1.161	-4.467	-.369	-2.069	-1.566	4
9	2.768	1.411	.446	-.808	.250	.794	-.131	-1.113	-.206	.576	1.668	.593	1.155	3
10	2.724	.835	.023	-.125	2.795	.090	-.167	.204	-1.061	-.255	.273	2.260	.056	2
11	.238	-1.463	-.109	1.122	-.726	-.700	.410	.701	.347	.031	.471	-.259	-3.064	1
12	-.821	-.350	.484	1.019	-1.553	.590	-.561	-.106	.336	.368	.108	.578	.209	
n/m	0	1	2	3	4	5	6	7	8	9	10	11	12	

January 1987

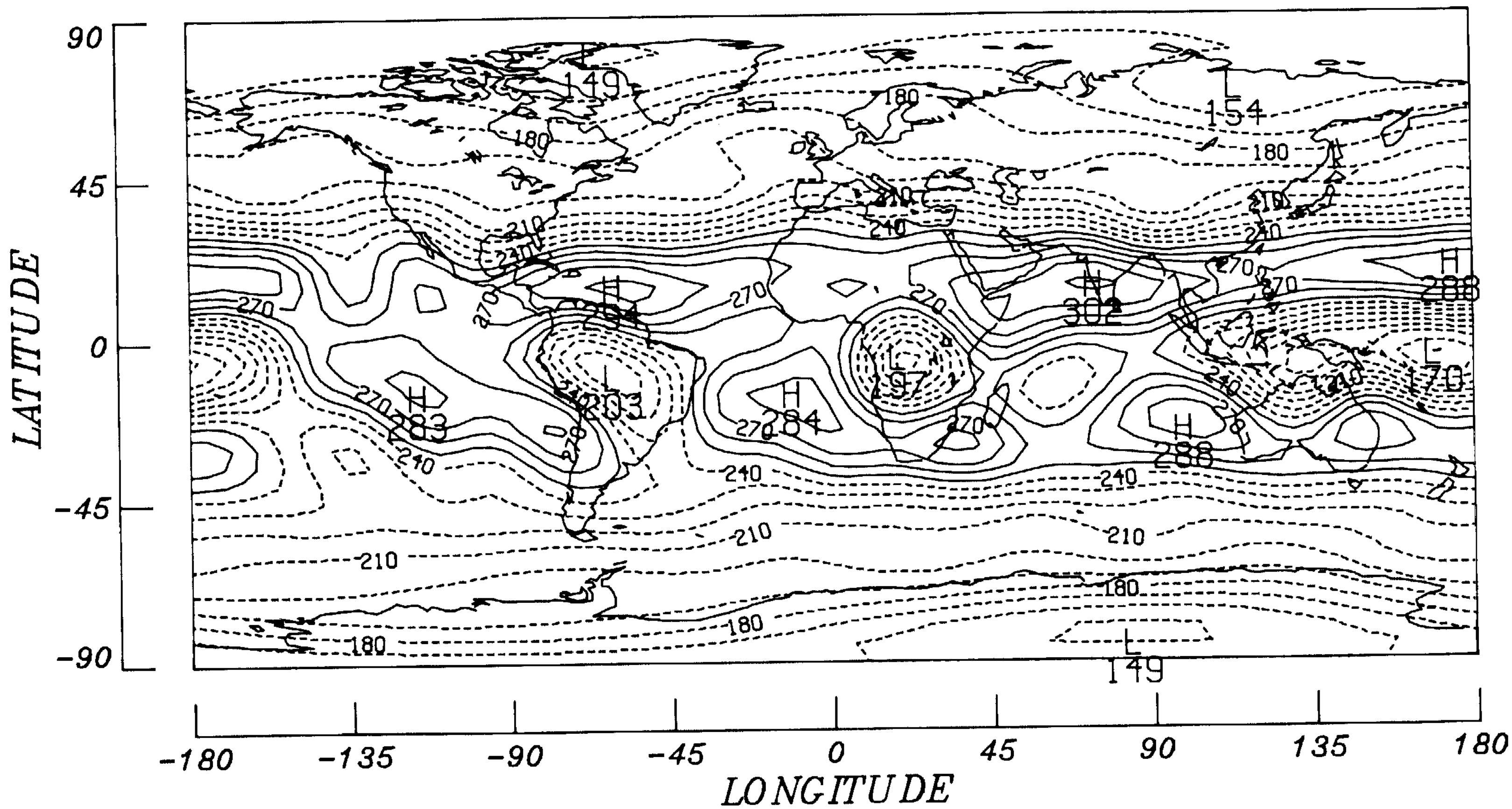


February 1987

C_n^m (rows n = 0–12 at left, columns m = 0–12 at bottom); S_n^m (columns m = 12–1 at top, rows n = 12–1 at right)

		12	11	10	9	8	7	6	5	4	3	2	1	m/n
0	230.783	.394	.397	-.193	-.564	-.804	.038	-.103	-.594	-.108	.829	-.653	.565	12
1	-7.765	4.426	.459	-.719	.040	.242	.644	.157	.351	-.719	.516	-.293	-.845	11
2	-27.465	.136	-2.338	.214	.162	.550	-.138	.159	.153	-.396	-1.223	1.500	2.288	10
3	-2.615	-2.752	1.882	1.496	.205	-1.068	-1.203	-1.421	-.168	1.307	.239	1.413	-.524	9
4	-4.888	2.218	4.200	-2.164	1.237	.408	.587	.094	-.400	-.681	.962	-1.177	-1.165	8
5	7.747	2.051	-.556	-1.463	-1.855	-.052	-1.069	1.726	.448	-1.990	-2.561	-1.177	1.773	7
6	5.618	-.426	-1.922	4.034	.928	.495	-.666	-1.775	.351	1.572	-.829	2.853	2.497	6
7	-6.068	-.902	.326	.847	.756	-.246	1.710	1.675	-1.150	.374	2.882	1.201	-3.389	5
8	-6.181	.200	1.409	-2.548	-1.323	.057	.715	-.552	.933	-2.821	-.630	-2.174	-.141	4
9	3.744	.666	.240	-.376	.540	.174	-.583	-1.138	-.454	1.478	-2.012	.353	.074	3
10	2.280	-.024	.700	1.223	1.422	-.173	.545	.095	-1.722	-.481	.842	2.877	.222	2
11	-.140	-.752	-.668	.284	-.761	-.189	-.045	.227	.400	.375	-.737	-.446	-.668	1
12	-.487	-.162	-.685	.132	-.615	.265	-.991	-.017	1.071	.003	.894	-.041	.586	
n/m	0	1	2	3	4	5	6	7	8	9	10	11	12	

February 1987

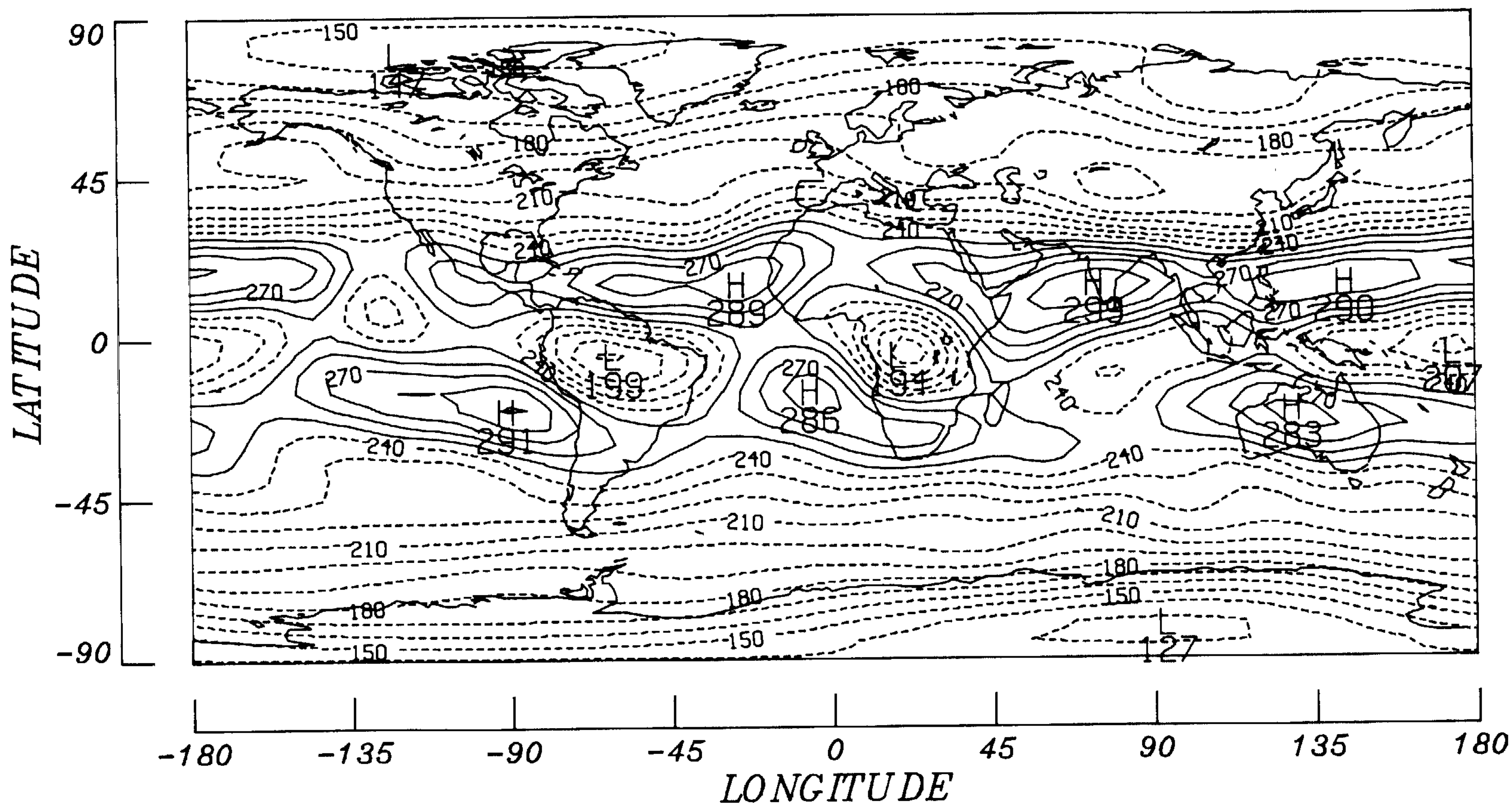


March 1987

C_n^m / S_n^m

		12	11	10	9	8	7	6	5	4	3	2	1	m/n
0	229.136	.648	-.166	-.545	-.202	.383	.346	.048	-.334	-.419	1.396	-1.044	.487	12
1	-5.904	.591	-.232	.188	-.099	.183	.103	.901	.179	-.449	.429	-1.252	-.597	11
2	-29.359	1.503	.328	.434	.260	.381	.003	-.417	.425	.167	-.865	1.333	1.762	10
3	.318	.044	1.192	1.309	.304	-.868	-.726	-1.439	-.831	.615	.714	2.261	-.471	9
4	-5.398	.356	3.115	-1.991	-.275	-.866	-.569	.483	-1.025	-.765	.063	-.269	-1.045	8
5	5.819	-.102	.298	-1.279	-.580	.970	-.044	.786	1.533	-.543	-2.121	-1.254	-.585	7
6	4.139	.592	-.996	3.479	1.068	.015	.063	-.805	.593	1.712	.422	1.534	3.622	6
7	-3.761	-.086	-.156	.070	.653	.352	-.558	.737	-3.729	-.902	1.342	.927	.549	5
8	-7.122	-.632	1.695	-3.196	-.994	.171	.161	-.010	.599	-2.602	-1.961	-.163	.021	4
9	2.675	1.220	.525	.152	-.613	.248	.539	-.515	-1.020	.177	.015	.224	-2.131	3
10	4.193	.631	.564	1.365	.714	.049	.441	.475	-.403	-.820	-.097	.244	.628	2
11	-.136	-.981	-.873	-.689	.437	-.177	-.358	.587	.430	-.511	.136	-.097	.011	1
12	-1.314	-.196	-.486	.167	-.356	.474	-.558	-.499	.508	.506	.180	-.325	.297	
n/m	0	1	2	3	4	5	6	7	8	9	10	11	12	

March 1987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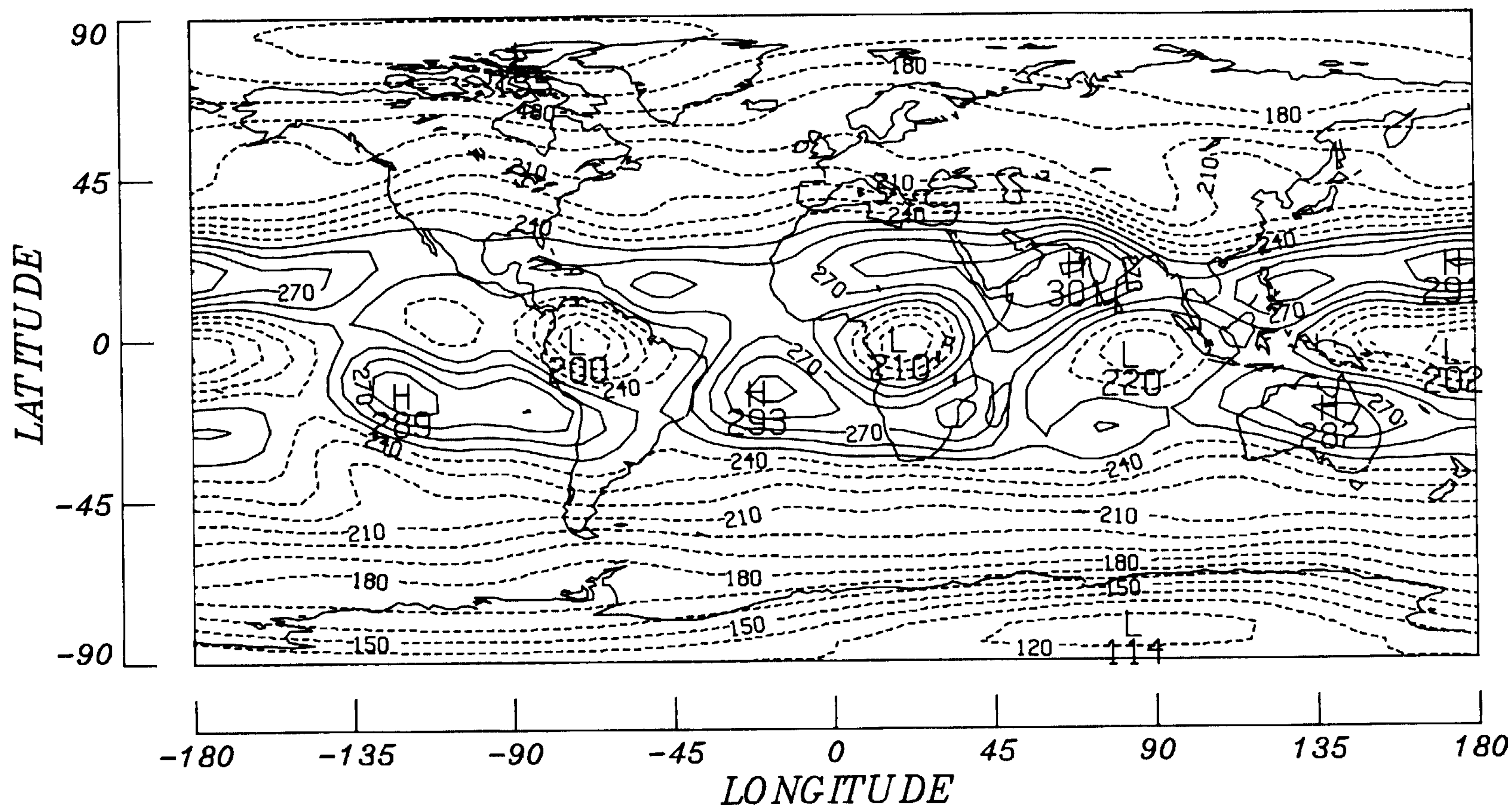
April 1987

C_n^m / S_n^m

		12	11	10	9	8	7	6	5	4	3	2	1	m/n
0	230.634	.399	-.239	.059	-.670	.067	-.189	.145	.138	-.735	.288	-.990	.476	12
1	-.272	2.874	.799	-.216	-.070	.342	.474	.590	.715	-.324	.103	-.658	-.390	11
2	-29.563	.829	.925	.093	.178	.216	-.307	-.533	.023	.267	-.147	.872	2.069	10
3	2.118	-1.330	.179	1.929	-.454	-.291	-.494	-.855	-1.166	1.022	1.155	1.319	-.898	9
4	-6.119	.969	.743	-1.369	-2.047	-.285	1.647	1.375	-.794	-.145	-.574	.412	-.568	8
5	3.860	.452	-.872	-1.765	-.504	.045	.461	.917	1.191	-.658	-2.320	-.314	-.145	7
6	4.907	-.919	-.831	3.256	1.584	.623	.913	-.776	.376	.752	1.184	.087	3.826	6
7	-1.860	-.106	.686	1.783	-.170	.503	.994	-.061	-3.155	.128	2.007	-.876	-.131	5
8	-7.194	.895	1.788	-2.322	-1.211	-.784	-.206	.224	1.037	-2.983	-.554	.245	-.501	4
9	1.203	.617	-.147	-.472	.251	-.720	-.048	-.771	.351	.731	.957	1.545	-1.851	3
10	3.971	.212	.101	.605	.849	.022	.311	-.168	-.902	-.741	-.537	1.300	.701	2
11	-.092	-.945	-.133	-.181	-.135	-.106	.044	1.305	-.091	.171	.011	-.015	.663	1
12	-1.418	-.020	.199	.708	.277	.455	-.267	.538	.134	.341	.844	-.183	-.015	
n/m	0	1	2	3	4	5	6	7	8	9	10	11	12	

April 1987

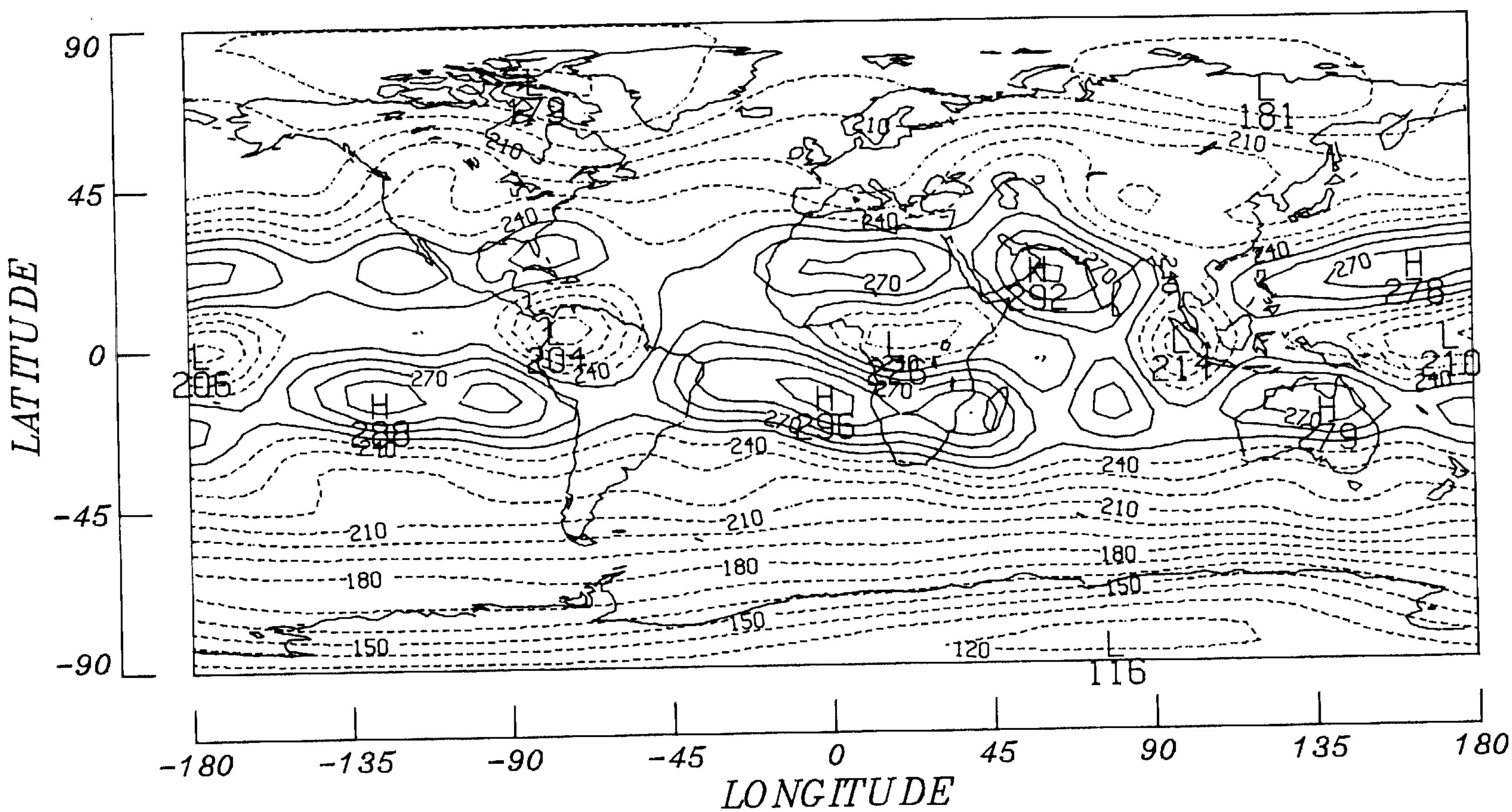


May 1987

C_n^m (lower left, rows n, columns m along bottom) / S_n^m (upper right, rows n at right, columns m along top)

n \ m		12	11	10	9	8	7	6	5	4	3	2	1	m / n
0	231.789	-.791	-.647	-.207	-.173	.024	.222	.395	-.296	.164	.221	-.403	-.127	12
1	5.495	3.182	.291	-.788	.064	.116	.067	.401	.443	-.192	-.724	-.639	.172	11
2	-26.587	.957	.652	.456	-.066	1.457	-.398	-.180	-.027	-.248	-.373	.155	2.446	10
3	4.969	-.658	.089	1.518	-.439	.506	-.815	-.774	-.791	-.447	1.565	.364	-1.301	9
4	-5.862	1.700	-.382	-1.450	-1.103	-.810	.604	-.802	-.582	-1.144	-.201	1.240	-2.108	8
5	-.204	.363	-.992	-2.383	-.073	.805	.762	.233	-.086	-.037	-2.251	-.066	.028	7
6	4.065	-1.639	-.643	1.687	1.040	.626	-.125	1.240	-.101	1.093	.277	-.170	3.070	6
7	2.035	-.569	.413	1.502	-.245	-.484	1.072	-.723	-1.668	-1.572	1.717	.583	-1.888	5
8	-5.364	.651	2.001	-.765	-1.299	-.286	.696	.454	.561	-3.671	-.292	.844	1.179	4
9	-1.006	.496	.940	.016	.201	-.624	.371	-.125	-1.327	.898	.201	1.275	-.293	3
10	4.026	.085	.290	.547	.947	-.786	-.448	-.327	.005	-.543	-.012	2.242	.445	2
11	1.429	-.798	-.004	-.891	.418	.257	.249	.637	-.051	.081	-.795	-.437	.288	1
12	-1.588	.471	.270	.060	.529	.063	.057	.388	-.147	.296	.116	.050	.357	
n / m	0	1	2	3	4	5	6	7	8	9	10	11	12	

May 1987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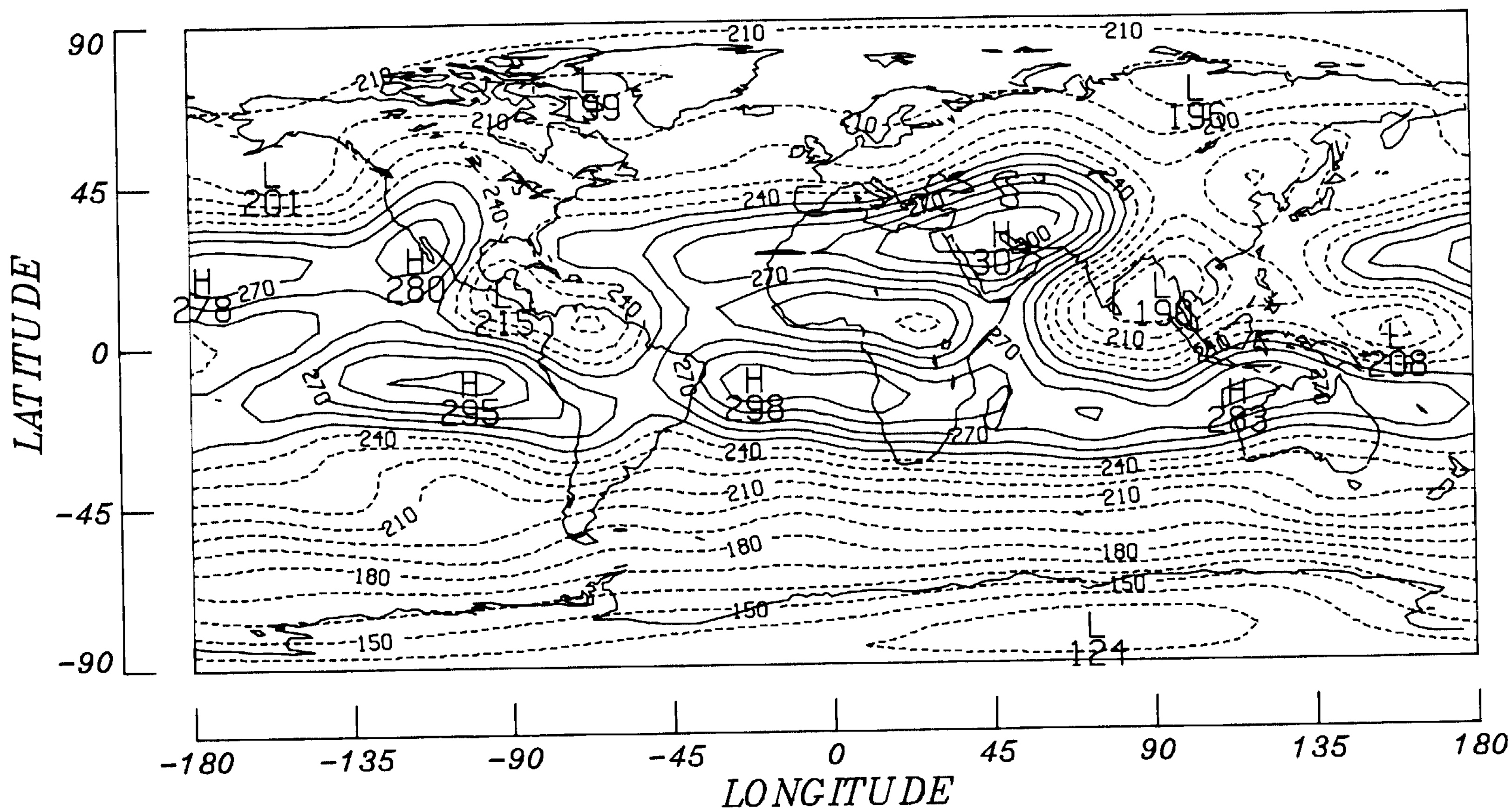
June 1987

C_n^m (lower left, n rows 0–12 / m columns 0–12 along bottom) and S_n^m (upper right, m columns 12–1 along top / n rows 12–1 at right)

n \ m (C)	0	1	2	3	4	5	6	7	8	9	10	11	12	
		12	11	10	9	8	7	6	5	4	3	2	1	m / n (S)
0	234.425	-.118	-.660	-.106	-.087	-.131	-.129	.045	-.274	.058	-.101	-.314	-.569	12
1	9.702	4.585	.184	-.222	.156	-.702	.448	-.312	.337	-.173	-.777	.143	-.096	11
2	-25.812	3.199	3.801	.557	.050	-.148	.253	.278	-.150	-.333	.118	1.040	1.405	10
3	6.829	-1.743	1.873	1.048	.450	.343	-.192	.294	-1.283	.300	.652	.635	-.683	9
4	-5.512	.527	-2.048	-1.453	-2.850	.824	-.468	.157	-1.230	-.941	-.419	.085	-.360	8
5	-3.704	-1.558	-3.855	-2.692	-2.611	-1.920	.487	.533	.481	-.602	-.054	-.782	.518	7
6	5.151	-2.222	-.944	1.932	.572	-1.214	1.320	-.206	-.411	-.789	.615	-.738	-.542	6
7	6.218	.384	1.980	2.289	.941	.678	1.497	-.124	-2.463	-1.856	1.072	-1.225	-3.801	5
8	-3.650	.997	2.540	-1.358	-.954	-.279	.535	.243	-.026	-1.881	.525	.886	3.081	4
9	-3.391	.206	.659	-.768	-.233	-.718	.754	-.520	-.251	.297	1.267	3.266	2.465	3
10	1.712	.087	-.345	.795	.354	-.157	.609	-.023	-1.426	.141	.125	5.504	-.763	2
11	1.605	-1.378	-.949	-.568	-.712	.160	.410	-.065	-.513	.289	.349	-.609	-1.668	1
12	.338	-.063	.577	-.478	.464	.534	-.254	.137	.634	.113	.555	-.513	-.253	

June 1987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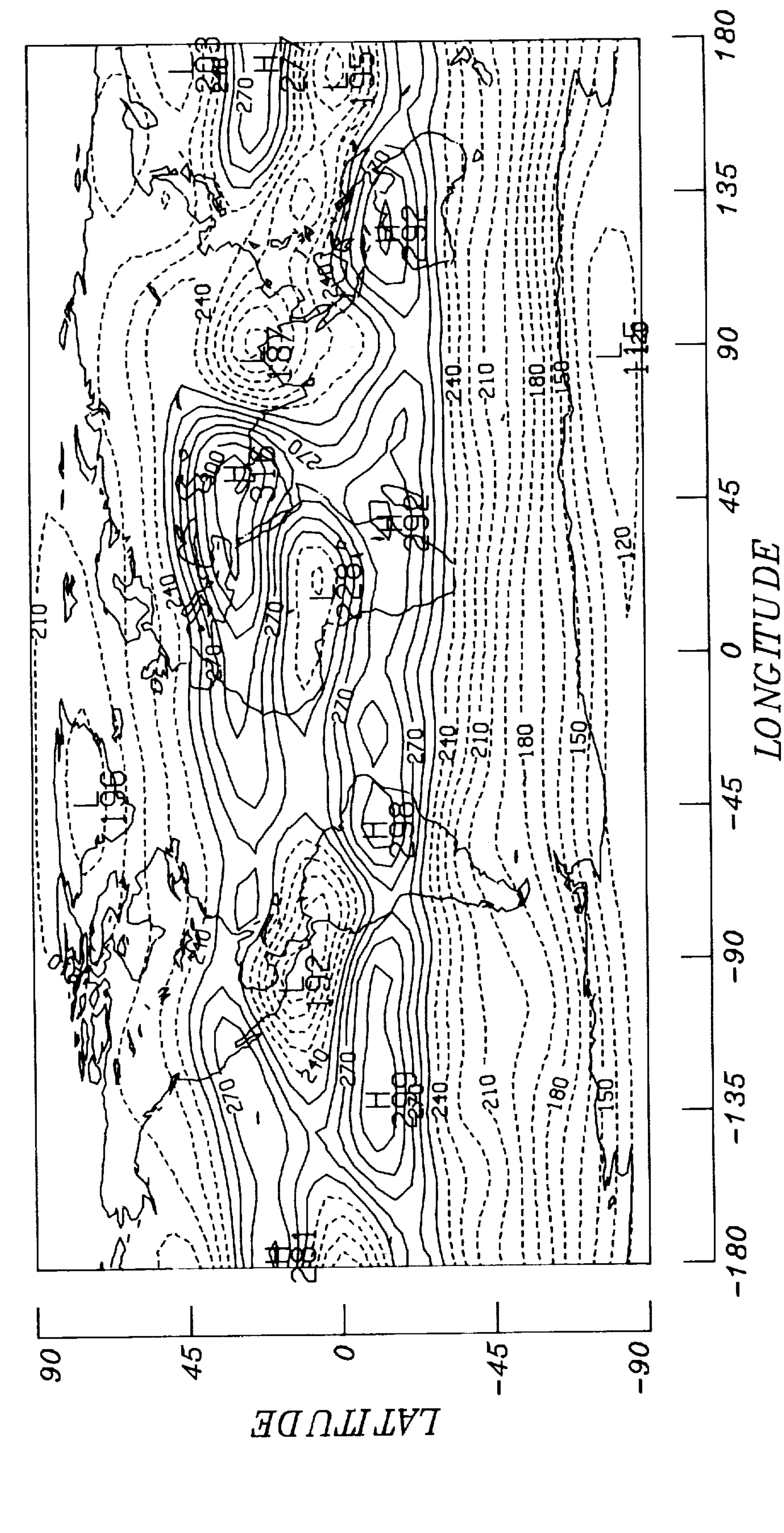
July 1987

C_n^m (lower-left, rows n = 0–12, columns m = 0–12 along bottom) / S_n^m (upper-right, columns m = 12–1 along top, rows n = 12–1 along right)

		12	11	10	9	8	7	6	5	4	3	2	1	m/n
0	236.040	.345	-.803	-.627	-.698	-.303	-.254	-.093	-.059	-.557	-.477	.209	-1.010	12
1	12.533	5.037	.186	-.033	-.001	-.213	-.419	-.416	.772	.017	.580	.226	.207	11
2	-25.992	3.941	2.965	.583	.005	.908	-.145	-.063	.799	.134	1.512	1.083	1.822	10
3	8.554	-1.463	2.656	.488	-.628	1.103	.243	.532	-.289	.107	.875	.059	.055	9
4	-6.648	.276	-.290	-2.318	-5.803	.172	.259	-.420	-.449	-.532	-1.718	-.201	-1.637	8
5	-4.868	-1.347	-4.117	-1.053	-2.103	-.257	1.078	-1.138	-.128	.227	-2.027	-.738	-.530	7
6	4.731	-2.952	-2.975	2.664	1.087	.111	.983	-.358	.140	-.528	.100	-.338	2.170	6
7	7.374	-1.318	1.994	1.723	-.411	-.115	1.316	1.052	-1.877	-1.064	2.719	-1.269	-2.129	5
8	-3.852	.819	2.679	-1.521	.244	-.411	.106	.340	-.349	-1.505	.579	1.419	2.382	4
9	-4.100	1.417	.253	-1.551	1.186	-.534	-.105	-.590	-.903	.061	-.689	3.222	1.448	3
10	1.192	.133	-.484	.903	.488	-.321	-.702	.164	-.788	-.081	-.050	5.348	-.465	2
11	1.249	-1.001	-1.324	1.136	-1.081	.320	-.333	1.057	-.254	-.142	.298	-.798	-.184	1
12	.304	.250	.111	-.312	.360	.719	.045	.253	-.080	-.256	.311	-.103	-.048	
n/m	0	1	2	3	4	5	6	7	8	9	10	11	12	

July 1987

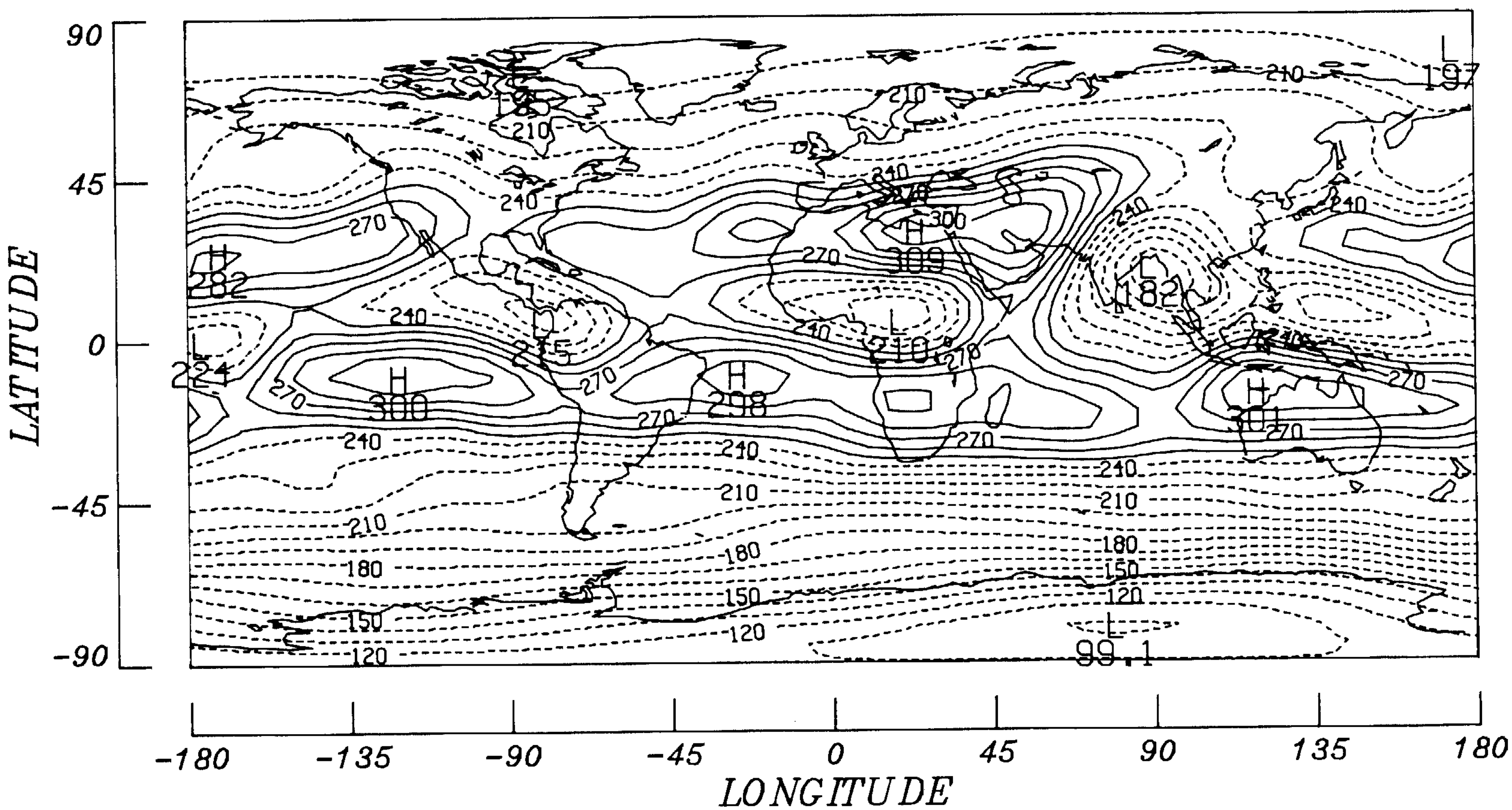


August 1987

C_n^m (lower-left, rows n, columns m from bottom header) / S_n^m (upper-right, rows n from right column, columns m from top header)

n \ m		12	11	10	9	8	7	6	5	4	3	2	1	m/n
0	236.154	-.291	-.492	-.093	-.435	-.134	-.380	-.008	-.420	.002	-.046	-.261	-.470	12
1	10.984	3.116	.279	.111	-.469	.502	-.610	.259	.161	.580	-.450	-.198	-.372	11
2	-26.798	3.425	2.817	.437	.088	1.018	-.426	.289	.181	.682	.554	1.454	1.634	10
3	9.620	-.896	2.106	-.705	.086	.820	.021	.283	-.115	-.003	1.300	-.329	-.440	9
4	-9.159	.390	-.156	-2.409	-5.039	-.512	-.157	.141	-.110	-1.210	-.979	-.858	-.623	8
5	-5.501	-1.438	-3.061	-.976	-2.211	-1.214	1.159	-.411	.106	-.950	-2.769	-.418	.404	7
6	4.272	-2.192	-2.312	2.761	.674	-.019	1.888	-.534	-1.231	.179	.095	-.577	.676	6
7	7.559	.080	.830	1.261	.344	1.015	1.233	.549	-2.065	-.325	1.022	-.917	-3.639	5
8	-4.266	.794	2.440	-1.389	.177	.225	.469	.171	.127	-1.476	.089	1.108	5.007	4
9	-4.446	1.116	.676	-.966	.655	-.319	-.307	-.930	-.250	-.115	.628	3.309	2.189	3
10	1.298	.847	-.350	1.760	.094	-.017	-.326	-.520	-.826	-.129	-.084	3.409	-.615	2
11	1.591	-1.208	-1.060	1.027	-.894	.227	.283	.186	-.810	-.579	.011	-.701	-1.248	1
12	.318	.068	.040	-.978	-.029	.379	.249	.370	.103	-.354	-.088	-.037	.362	
n/m	0	1	2	3	4	5	6	7	8	9	10	11	12	

August 1987



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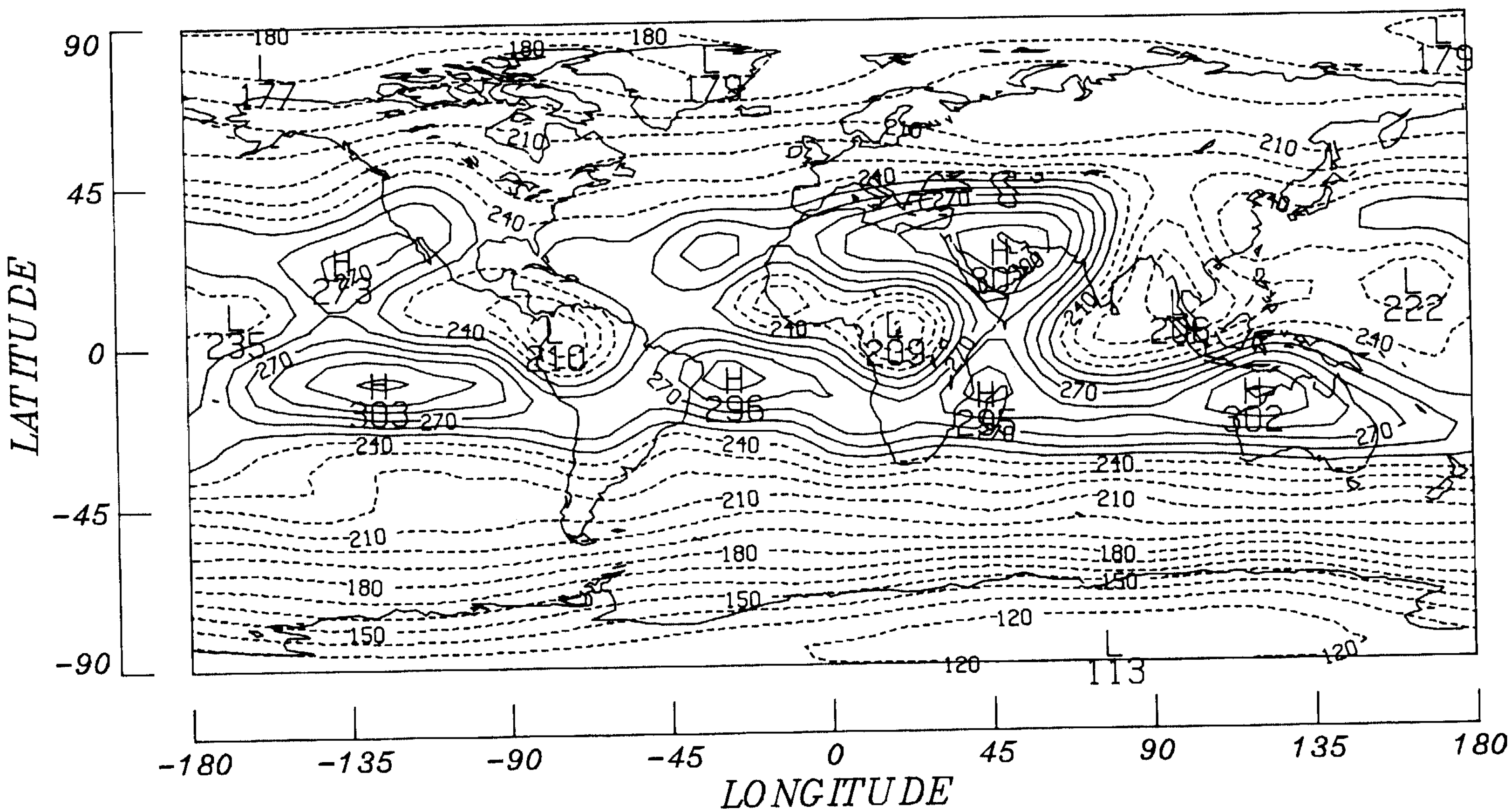
September 1987

C_n^m / S_n^m

		12	11	10	9	8	7	6	5	4	3	2	1	m/n
0	234.769	.161	-.189	.268	-.260	-.445	-.100	.019	-.758	-.745	.838	.554	-.860	12
1	7.402	2.157	.458	.191	.090	-.230	-.264	.157	.417	.267	.228	-.321	-.245	11
2	-28.082	3.644	1.092	1.115	-.187	.461	-.164	-.098	.894	.840	-.289	.176	2.119	10
3	6.686	-.832	1.567	.436	.396	.472	.447	.016	-.058	.540	.581	.806	-.456	9
4	-8.659	-.836	-.198	-1.852	-5.740	.159	.990	.552	-.272	-.975	.152	.444	.019	8
5	-4.107	-1.433	-1.381	-.883	-2.189	-.806	.792	.392	1.203	-.761	-1.360	-.750	1.921	7
6	3.828	.140	-.531	2.628	1.535	-.280	1.605	-.408	-.029	.654	.076	-.163	1.022	6
7	6.460	1.275	.357	1.175	.846	.749	.980	1.176	-2.725	-1.250	2.002	-1.890	-3.833	5
8	-3.283	.653	-.473	-1.695	-.170	-1.041	.829	-.319	1.171	-1.830	.548	.180	2.659	4
9	-3.314	-1.080	-.140	-.170	.631	-1.140	-.019	-1.037	-.105	.401	.145	3.545	.527	3
10	.897	-.156	1.085	1.028	.375	.492	.017	-.225	-1.338	-.005	.108	4.244	-.596	2
11	.572	.454	-.853	-.459	-.818	.372	.269	.634	-.626	.024	.458	.262	-.003	1
12	-.002	.340	-1.023	-.860	.586	-.374	-.160	.100	.293	.537	.472	-.145	.454	
n/m	0	1	2	3	4	5	6	7	8	9	10	11	12	

September 1987



October 1987

C_n^m (lower left, m = bottom row) / S_n^m (upper right, m = top row)

n		12	11	10	9	8	7	6	5	4	3	2	1	m / n
0	232.791	.530	-.294	-.309	-.217	.302	-.342	-.342	-.450	.095	.714	.011	.350	12
1	2.355	.275	.379	-.076	.068	.725	-.185	.098	.246	-.823	-.817	-.184	1.075	11
2	-27.633	1.813	.996	1.042	-.317	-.071	.507	-.276	.536	-.321	-.175	.406	1.214	10
3	2.954	-.703	1.661	2.384	.243	-1.376	.515	-.221	-.758	1.529	1.103	-.008	-2.838	9
4	-6.832	.578	.283	-1.787	-3.040	-1.194	.975	1.089	-1.086	-.701	.298	.049	-.593	8
5	-.665	.132	-.362	-2.164	-1.108	-1.895	1.265	.062	1.475	-1.114	-1.070	1.594	2.544	7
6	4.931	.107	.437	2.326	.776	-.276	1.033	-.215	1.193	1.101	.046	1.147	1.767	6
7	3.907	-.239	.680	1.156	-.481	.854	.814	1.105	-3.254	-1.068	1.751	-.949	-3.310	5
8	-5.364	-.346	.284	-1.600	-1.669	-.901	-.494	.400	1.625	-2.474	.134	-.745	1.044	4
9	-2.553	-.124	-.506	-1.239	.195	-1.253	-.484	-1.169	-.124	.909	1.019	2.242	.015	3
10	2.750	-.518	.608	.851	1.124	.232	.021	-.527	-1.093	-.643	-.370	3.005	-.598	2
11	2.100	-.996	-.535	.002	-.193	.154	.516	.089	.234	-.940	-.355	-.731	-.194	1
12	-.172	.432	-.335	-.587	.185	.033	.336	.091	.559	.448	-.260	-.217	.307	
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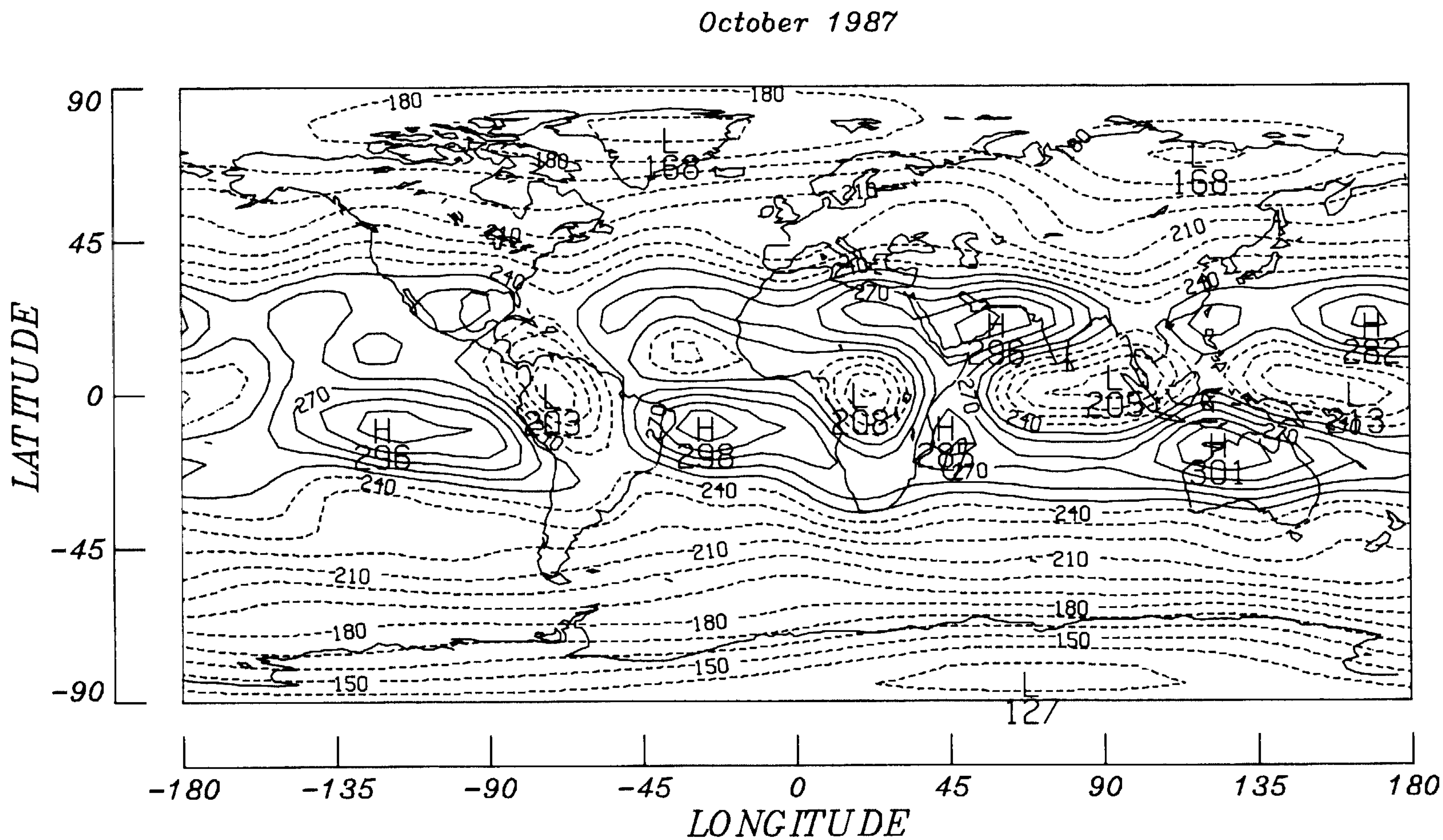
October 1987
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NASA National Aeronautics and Space Administration

Report Documentation Page

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
NASA RP-1261		

4. Title and Subtitle	5. Report Date
Atlas of Wide-Field-of-View Outgoing Longwave Radiation Derived From Nimbus 7 Earth Radiation Budget Data Set—November 1985 to October 1987	June 1991
	6. Performing Organization Code
7. Author(s)	8. Performing Organization Report No.
T. Dale Bess and G. Louis Smith	L-16934
9. Performing Organization Name and Address	10. Work Unit No.
NASA Langley Research Center Hampton, VA 23665-5225	665-45-30-01
	11. Contract or Grant No.
12. Sponsoring Agency Name and Address	13. Type of Report and Period Covered
National Aeronautics and Space Administration Washington, DC 20546-0001	Reference Publication
	14. Sponsoring Agency Code

15. Supplementary Notes

Nimbus 6 and Nimbus 7 data for July 1975 to October 1985 are presented in NASA RP-1185 and NASA RP-1186, 1987.

16. Abstract

An atlas of monthly outgoing longwave radiation global contour maps and associated spherical harmonic coefficients is presented. The atlas contains 23 months of data from November 1985 to October 1987. The data were derived from the second Earth Radiation Budget (ERB) package, which was flown on the Nimbus 7 Sun-synchronous satellite in 1978. This data set is a companion set and extension to similar atlases that documented 10 years of outgoing longwave radiation results from Nimbus 6 and Nimbus 7 satellites. This atlas and the companion atlases give a data set covering a 12-year time period and will be very useful in studying different aspects of our changing climate. The data set also provides a 3-year overlap with the current Earth Radiation Budget Experiment (ERBE).

17. Key Words (Suggested by Author(s))	18. Distribution Statement
Earth radiation budget, Variability Longwave outgoing radiation, Time series Nimbus 7, Broadband Deconvolution Spherical harmonics Wide field of view	Unclassified—Unlimited Subject Category 47

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	52	A04

NASA FORM 1626 OCT 86 NASA-Langley, 1991

For sale by the National Technical Information Service, Springfield, Virginia 22161-2171