NOAA Atlas NESDIS 47

WORLD OCEAN DATABASE 2001
Volume 6: Temporal Distribution of pH, Alkalinity, pCO_2 and tCO_2 Data

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Silver Spring, MD
March 2002

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This publication should be cited as:

P. P. Murphy, M. E. Conkright, T. P. Boyer, J. I. Antonov, O. K. Baranova, H. E. Garcia, R. Gelfeld, D. Johnson, R. A. Locarnini, T. D. O'Brien, I. Smolyar, C. Stephens, 2002: *World Ocean Database 2001, Volume 6: Temporal Distribution of pH, Alkalinity, pCO_2 and tCO_2 Data.* S. Levitus, Ed., NOAA Atlas NESDIS 47, U.S. Government Printing Office, Wash., D.C., 235 pp., CD-ROMs.

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PREFACE

The oceanographic databases described by this atlas series greatly expands on the *World Ocean Database 1998* (WOD98) product. We have expanded these earlier databases to include data from new instrument types such as profiling floats and new variables such as pCO_2 and TCO_2. Previous oceanographic databases including the NODC/WDC profile archives, and products derived from these databases, have proven to be of great utility to the international oceanographic, climate research, and operational environmental forecasting communities. In particular, the objectively analyzed fields of temperature and salinity derived from these databases have been used in a variety of ways. These include use as boundary and/or initial conditions in numerical ocean circulation models, for verification of numerical simulations of the ocean, as a form of "sea truth" for satellite measurements such as altimetric observations of sea surface height, and for planning oceanographic expeditions. Increasingly nutrient fields are being used to initialize and/or verify biogeochemical models of the world ocean. The databases, and products based on these databases, are critical for support of international assessment programs such as the Intergovernmental Program on Climate Change (IPCC) of the United Nations.

It is well known that the amount of carbon dioxide in the earth's atmosphere will most likely double during the next century compared to CO_2 levels that occurred at the beginning of the Industrial Revolution. Regardless of one's scientific and/or political view of a possible "enhanced greenhouse warming" due to the increase of carbon dioxide, it is necessary that the international scientific community have access to the most complete historical oceanographic databases possible in order to study this problem, as well as other scientific and environmental problems.

The production of oceanographic databases is a major undertaking. Such work benefits from the input of many individuals and organizations. We have tried to structure the data sets in such a way as to encourage feedback from experts around the world who have knowledge that can improve the data and metadata contents of the database. It is only with such feedback that high quality global ocean databases can be prepared. Just as with scientific theories and numerical models of the ocean and atmosphere, the development of global ocean databases is not carried out in one giant step, but proceeds in an incremental fashion.

In the acknowledgment section of this publication we have expressed our view that creation of global ocean databases is only possible through the cooperation of scientists, data managers, and scientific administrators throughout the international community. I thank my colleagues at the Ocean Climate Laboratory of NODC for their dedication to the project leading to publication of this atlas series. Their commitment has made this database possible. It is my belief that the development and management of national and international oceanographic data archives is best performed by scientists who are actively working with the data.

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March 2002

Acknowledgments

This work was made possible by a grant from the NOAA Climate and Global Change Program which enabled the establishment of a research group, the Ocean Climate Laboratory (OCL), at the National Oceanographic Data Center. The purpose of the OCL is to prepare research quality oceanographic databases, as well as to compute objective analyses of, and diagnostic studies based on, these databases.

The data made available as part of this atlas include a part of the oceanographic data archives maintained by NODC/WDC as well as data acquired as a result of the IODE/IOC "Global Oceanographic Data Archaeology and Rescue" (GODAR) project. At NODC/WDC, "data archaeology and rescue" projects are supported with funding from the NOAA Environmental Science Data and Information Management (ESDIM) Program and NOAA Climate and Global Change Program. The majority of funding for these efforts is now provided by the ESDIM program. Support for this work from joint NASA/NOAA and DOE/NOAA Global Change data management programs is appreciated. Support for some of the regional IOC/GODAR meetings was provided by the MAST program of the European Union.

We acknowledge the scientists, technicians, and programmers who have submitted data to national and regional data centers as well as the managers and staff at the various data centers. Our database allows for the storage of metadata including information about Principal Investigators to recognize their efforts.

The OCL expresses thanks to those who provided comments and helped develop an improved *World Ocean Database 2001* (WOD01) product. In particular, Dr. Steve Worley of NCAR, and Steve Hankin of PMEL for testing the CD-ROMs prior to distribution. Roy Lowry (BODC) and Tom Whitworth (TAMU) for suggestions. Any errors in WOD01 are the responsibility of the Ocean Climate Laboratory.

Ervin Godfrey Trammell and Charlotte Sazama of the NODC International Data Exchange Team helped locate data in the WDC archives for digitization. We thank Mike Chepurin, Igor Minin, Dan Smolyar, Alexandra Grodsky, and Carla Forgy of the OCL for their work in data digitization and their assistance in quality control of the data and metadata in WOD01. Renee Tatusko identified many missing metadata. The OCL acknowledges the help received over the last several years from colleagues in other NODC divisions. Francis Mitchell helped with all the code lists and accessions, Melanie Hamilton supplied GTSPP data.

Declassification of naval oceanographic data by various navies is acknowledged. The Intergovernmental Oceanographic Commission has requested such declassification efforts in recent years.

World Ocean Database 2001, Volume 6: Temporal Distribution of pH, Alkalinity, pCO_2 and tCO_2 Data

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ABSTRACT

This atlas describes a collection of scientifically quality controlled pH, alkalinity, pCO_2 and tCO_2 data. Yearly distributions for individual years of all pH, alkalinity, pCO_2 and tCO_2 data in the database are presented to provide information on the state of ocean OSD profile and surface observations.

1. INTRODUCTION

Ocean Station Data (OSD) has historically referred to measurements made from a stationary research ship using reversing thermometers to measure temperature and making measurements of other variables such as salinity, oxygen, nutrients, chlorophyll, *etc.* on seawater samples gathered using special bottles. The two most commonly used bottles are the Nansen and Nisken bottles. Data that are in the OSD files are frequently referred to as "bottle data" and the entire collection of data from these file may be alternatively referred to as the "Bottle Data File". WOD01 includes measurements of temperature, salinity, oxygen, nitrate, phosphate, silicate, pH, alkalinity, chlorophyll and plankton. Surface-only data are from underway or ship of opportunity.

2. pH, ALKALINITY, pCO_2 and tCO_2 DISTRIBUTIONS

Figure 1 shows the number of OSD pH profiles contained in WOD01 for the world ocean as a function of year. Figures 2 and 3 show the time series of OSD pH profiles for the southern and northern hemispheres respectively. Figure 4 shows the distribution of OSD pH profiles contained in WOD01 for the world ocean. There are a total of 130,987 OSD pH profiles for the entire world ocean with 18,859 profiles (14.4%) measured in the southern hemisphere and 112,128 profiles (85.6%) measured in the northern hemisphere. Table 1 provides the number of OSD pH profiles included in WOD01 for the world ocean as a function of year. Table 2 and 3 show the number of OSD pH profiles for the southern and northern hemispheres respectively. The geographic distribution of OSD pH profiles for individual years for 1904-1999 are shown in Appendix A, Figures A1-A83.

Figure 5 shows the number of OSD alkalinity profiles contained in WOD01 for the world ocean as a function of year. Figures 6 and 7 show the time series of OSD alkalinity profiles for the southern and northern hemispheres respectively. Figure 8 shows the distribution of OSD alkalinity profiles contained in WOD01 for the world ocean. There are a total of 22,292 OSD alkalinity profiles for the

entire world ocean with 3,249 profiles (13.7%) measured in the southern hemisphere and 19,243 profiles (86.3%) measured in the northern hemisphere. Table 4 provides the number of OSD alkalinity profiles included in WOD01 for the world ocean as a function of year. Table 5 and 6 show the number of OSD alkalinity profiles for the southern and northern hemispheres respectively. The geographic distribution of OSD alkalinity profiles for individual years for 1921-1999 are shown in Appendix B, Figures B1-B65.

Figure 9 shows the number of OSD pCO_2 profiles contained in WOD01 for the world ocean as a function of year. Figures 10 and 11 show the time series of OSD pCO_2 profiles for the southern and northern hemispheres respectively. Figure 12 shows the distribution of OSD pCO_2 profiles contained in WOD01 for the world ocean. There are a total of 2,159 OSD pCO_2 profiles for the entire world ocean with 1,458 profiles (67.5%) measured in the southern hemisphere and 701 profiles (32.5%) measured in the northern hemisphere. Table 7 provides the number of OSD pCO_2 profiles included in WOD01 for the world ocean as a function of year. Table 8 and 9 show the number of OSD pCO_2 profiles for the southern and northern hemispheres respectively. The geographic distribution of OSD pCO_2 profiles for individual years for 1967-1997 are shown in Appendix C, Figures C1-C13.

Figure 13 shows the number of OSD tCO_2 profiles contained in WOD01 for the world ocean as a function of year. Figures 14 and 15 show the time series of OSD tCO_2 profiles for the southern and northern hemispheres respectively. Figure 16 shows the distribution of OSD tCO_2 profiles contained in WOD01 for the world ocean. There are a total of 6,018 OSD tCO_2 profiles for the entire world Ocean with 3,602 profiles (59.9%) measured in the southern hemisphere and 2,416 profiles (40.1%) measured in the northern hemisphere. Table 10 provides the number of OSD tCO_2 profiles included in WOD01 for the world ocean as a function of year. Table 11 and 12 show the number of OSD tCO_2 profiles for the southern and northern hemispheres respectively. The geographic distribution of OSD tCO_2 profiles for individual years for 1958-1998 are shown in Appendix D, Figures D1-D28.

Figure 17 shows the number of Surface-only pCO_2 profiles contained in WOD01 for the world ocean as a function of year. Figures 18 and 19 show the time series of Surface-only pCO_2 profiles for the southern and northern hemispheres respectively. Figure 20 shows the distribution of Surface-only pCO_2 profiles contained in WOD01 for the world ocean. There are a total of 37,124 Surface-only pCO_2 profiles for the entire world ocean with 1,623 profiles (4.3%) measured in the southern hemisphere and 35,501 profiles (95.6%) measured in the northern hemisphere. Table 13 provides the number of Surface-only pCO_2 profiles included in WOD01 for the world ocean as a function of year. Table 14 and 15 show the number of Surface-only pCO_2 profiles for the southern and northern hemispheres respectively. The geographic distribution of Surface-only pCO_2 profiles for individual years for 1991-1995 are shown in Appendix E, Figures E1-E3.

Most profiles have been made in the northern hemisphere, but the southern hemisphere coverage has been increased due to international data archaeology and rescue efforts and the World Ocean Database project (Levitus *et al.* 1994, 2002).

Table 1 The number of OSD pH profiles in WOD01 as a function of year for the World Ocean. The total number of profiles = 130,987

YEAR	PROFILE	YEAR	PROFILE	YEAR	PROFILE	YEAR	PROFILE
1904	2	1928	416	1952	136	1976	4271
1905	0	1929	510	1953	369	1977	4404
1906	0	1930	636	1954	688	1978	3502
1907	0	1931	533	1955	1102	1979	3551
1908	0	1932	1061	1956	871	1980	3755
1909	0	1933	1165	1957	1230	1981	3184
1910	27	1934	998	1958	1744	1982	3471
1911	0	1935	635	1959	1657	1983	4150
1912	0	1936	746	1960	1252	1984	2591
1913	19	1937	652	1961	1167	1985	2556
1914	67	1938	815	1962	1310	1986	2287
1915	0	1939	388	1963	2390	1987	3039
1916	0	1940	458	1964	2566	1988	2489
1917	0	1941	792	1965	3842	1989	1723
1918	0	1942	18	1966	3039	1990	2818
1919	0	1943	159	1967	3004	1991	2295
1920	0	1944	73	1968	3299	1992	1109
1921	73	1945	38	1969	4019	1993	1293
1922	167	1946	84	1970	3769	1994	1687
1923	130	1947	139	1971	4866	1995	1467
1924	102	1948	285	1972	4629	1996	1131
1925	284	1949	482	1973	4156	1997	984
1926	335	1950	684	1974	3394	1998	880
1927	337	1951	452	1975	3624	1999	465

Table 2 The number of OSD pH profiles in WOD01 as a function of year for the southern hemisphere. The total number of profiles = 18,859

YEAR	PROFILE	YEAR	PROFILE	YEAR	PROFILE	YEAR	PROFILE
1925	93	1944	10	1963	1027	1982	220
1926	189	1945	0	1964	520	1983	353
1927	73	1946	0	1965	962	1984	373
1928	77	1947	7	1966	297	1985	350
1929	212	1948	79	1967	376	1986	402
1930	349	1949	63	1968	442	1987	180
1931	156	1950	54	1969	859	1988	114
1932	99	1951	111	1970	679	1989	82
1933	1	1952	0	1971	697	1990	16
1934	12	1953	0	1972	781	1991	68
1935	0	1954	141	1973	630	1992	75
1936	232	1955	178	1974	293	1993	101
1937	70	1956	290	1975	450	1994	431
1938	166	1957	550	1976	478	1995	104
1939	57	1958	472	1977	759	1996	224
1940	42	1959	293	1978	132	1997	3
1941	0	1960	341	1979	309	1998	12
1942	18	1961	288	1980	336		
1943	0	1962	542	1981	459		

Table 3 The number of OSD pH profiles in WOD01 as a function of year for the northern hemisphere. The total number of profiles = 112,128

YEAR	PROFILE	YEAR	PROFILE	YEAR	PROFILE	YEAR	PROFILE
1904	2	1928	339	1952	136	1976	3793
1905	0	1929	298	1953	369	1977	3645
1906	0	1930	287	1954	547	1978	3370
1907	0	1931	377	1955	924	1979	3242
1908	0	1932	962	1956	581	1980	3419
1909	0	1933	1164	1957	680	1981	2725
1910	27	1934	986	1958	1272	1982	3251
1911	0	1935	635	1959	1364	1983	3797
1912	0	1936	514	1960	911	1984	2218
1913	19	1937	582	1961	879	1985	2206
1914	67	1938	649	1962	768	1986	1885
1915	0	1939	331	1963	1363	1987	2859
1916	0	1940	416	1964	2046	1988	2375
1917	0	1941	792	1965	2880	1989	1641
1918	0	1942	0	1966	2742	1990	2802
1919	0	1943	159	1967	2628	1991	2227
1920	0	1944	63	1968	2857	1992	1034
1921	73	1945	38	1969	3160	1993	1192
1922	167	1946	84	1970	3090	1994	1256
1923	130	1947	132	1971	4169	1995	1363
1924	102	1948	206	1972	3848	1996	907
1925	191	1949	419	1973	3526	1997	981
1926	146	1950	630	1974	3101	1998	868
1927	264	1951	341	1975	3174	1999	465

Table 4 The number of OSD alkalinity profiles in WOD01 as a function of year for the World Ocean. The total number of profiles = 22,492

YEAR	PROFILE	YEAR	PROFILE	YEAR	PROFILE	YEAR	PROFILE
1921	55	1941	72	1961	173	1981	255
1922	0	1942	0	1962	88	1982	306
1923	0	1943	29	1963	94	1983	587
1924	0	1944	0	1964	62	1984	360
1925	27	1945	4	1965	121	1985	345
1926	0	1946	0	1966	221	1986	622
1927	4	1947	0	1967	150	1987	513
1928	0	1948	158	1968	62	1988	637
1929	20	1949	90	1969	295	1989	707
1930	25	1950	115	1970	437	1990	959
1931	15	1951	299	1971	158	1991	1486
1932	41	1952	184	1972	229	1992	777
1933	34	1953	397	1973	555	1993	846
1934	0	1954	342	1974	242	1994	981
1935	10	1955	388	1975	590	1995	1370
1936	0	1956	178	1976	1246	1996	524
1937	0	1957	370	1977	770	1997	453
1938	75	1958	478	1978	391	1998	187
1939	0	1959	333	1979	467	1999	3
1940	0	1960	310	1980	170		

Table 5 The number of OSD alkalinity profiles in WOD01 as a function of year for the southern hemisphere. The total number of profiles = 3,249

YEAR	PROFILE	YEAR	PROFILE	YEAR	PROFILE	YEAR	PROFILE
1954	1	1965	73	1976	198	1987	69
1955	0	1966	91	1977	48	1988	136
1956	0	1967	7	1978	26	1989	140
1957	184	1968	7	1979	31	1990	0
1958	259	1969	18	1980	3	1991	47
1959	85	1970	19	1981	26	1992	135
1960	120	1971	2	1982	15	1993	79
1961	67	1972	18	1983	31	1994	386
1962	46	1973	23	1984	55	1995	401
1963	41	1974	77	1985	24	1996	166
1964	19	1975	56	1986	20		

Table 6 The number of OSD alkalinity profiles in WOD01 as a function of year for the northern hemisphere. The total number of profiles = 19,243

YEAR	PROFILE	YEAR	PROFILE	YEAR	PROFILE	YEAR	PROFILE
1921	55	1941	72	1961	106	1981	229
1922	0	1942	0	1962	42	1982	291
1923	0	1943	29	1963	53	1983	556
1924	0	1944	0	1964	43	1984	305
1925	27	1945	4	1965	48	1985	321
1926	0	1946	0	1966	130	1986	602
1927	4	1947	0	1967	143	1987	444
1928	0	1948	158	1968	55	1988	501
1929	20	1949	90	1969	277	1989	567
1930	25	1950	115	1970	418	1990	959
1931	15	1951	299	1971	156	1991	1439
1932	41	1952	184	1972	211	1992	642
1933	34	1953	397	1973	532	1993	767
1934	0	1954	341	1974	165	1994	595
1935	10	1955	388	1975	534	1995	969
1936	0	1956	178	1976	1048	1996	358
1937	0	1957	186	1977	722	1997	453
1938	75	1958	219	1978	365	1998	187
1939	0	1959	248	1979	436	1999	3
1940	0	1960	190	1980	167		

Table 7 The number of OSD pCO_2 profiles in WOD01 as a function of year for the World Ocean. The total number of profiles = 2,159

YEAR	PROFILE	YEAR	PROFILE	YEAR	PROFILE	YEAR	PROFILE	YEAR	PROFILE
1967	55	1974	0	1981	0	1988	109	1995	47
1968	0	1975	0	1982	0	1989	430	1996	168
1969	0	1976	0	1983	0	1990	114	1997	76
1970	0	1977	0	1984	12	1991	127		
1971	0	1978	0	1985	0	1992	326		
1972	0	1979	0	1986	0	1993	277		
1973	0	1980	0	1987	38	1994	380		

Table 8 The number of OSD pCO_2 profiles in WOD01 as a function of year for the southern hemisphere. The total number of profiles = 1,458

YEAR	PROFILE	YEAR	PROFILE	YEAR	PROFILE
1984	12	1989	155	1994	313
1985	0	1990	82	1995	0
1986	0	1991	122	1996	168
1987	27	1992	267		
1988	100	1993	212		

Table 9 The number of OSD pCO_2 profiles in WOD01 as a function of year for the northern hemisphere. The total number of profiles = 701

YEAR	PROFILE	YEAR	PROFILE	YEAR	PROFILE	YEAR	PROFILE	YEAR	PROFILE
1967	55	1974	0	1981	0	1988	9	1995	47
1968	0	1975	0	1982	0	1989	275	1996	0
1969	0	1976	0	1983	0	1990	32	1997	76
1970	0	1977	0	1984	0	1991	5		
1971	0	1978	0	1985	0	1992	59		
1972	0	1979	0	1986	0	1993	65		
1973	0	1980	0	1987	11	1994	67		

Table 10 The number of OSD tCO_2 profiles in WOD01 as a function of year for the World Ocean. The total number of profiles = 6,018

YEAR	PROFILE	YEAR	PROFILE	YEAR	PROFILE	YEAR	PROFILE	YEAR	PROFILE
1958	80	1967	0	1976	0	1985	0	1994	849
1959	27	1968	0	1977	7	1986	4	1995	956
1960	16	1969	0	1978	35	1987	53	1996	351
1961	0	1970	0	1979	0	1988	144	1997	229
1962	289	1971	0	1980	0	1989	214	1998	3
1963	363	1972	33	1981	0	1990	214		
1964	17	1973	58	1982	0	1991	417		
1965	59	1974	42	1983	18	1992	609		
1966	126	1975	0	1984	34	1993	771		

Table 11 The number of OSD tCO_2 profiles in WOD01 as a function of year for the southern hemisphere. The total number of profiles = 3,602

YEAR	PROFILE	YEAR	PROFILE	YEAR	PROFILE	YEAR	PROFILE	YEAR	PROFILE
1958	80	1967	0	1976	0	1985	0	1994	572
1959	27	1968	0	1977	0	1986	0	1995	304
1960	16	1969	0	1978	26	1987	40	1996	208
1961	0	1970	0	1979	0	1988	128		
1962	289	1971	0	1980	0	1989	154		
1963	363	1972	17	1981	0	1990	127		
1964	17	1973	19	1982	0	1991	187		
1965	59	1974	36	1983	0	1992	372		
1966	55	1975	0	1984	14	1993	492		

Table 12 The number of OSD tCO_2 profiles in WOD01 as a function of year for the northern hemisphere. The total number of profiles = 2,416

YEAR	PROFILE	YEAR	PROFILE	YEAR	PROFILE	YEAR	PROFILE	YEAR	PROFILE
1966	71	1973	39	1980	0	1987	0	1994	277
1967	0	1974	6	1981	0	1988	16	1995	652
1968	0	1975	0	1982	0	1989	60	1996	143
1969	0	1976	0	1983	18	1990	87	1997	229
1970	0	1977	7	1984	20	1991	230	1998	3
1971	0	1978	9	1985	0	1992	237		
1972	16	1979	0	1986	4	1993	279		

Table 13 The number of Surface-only pCO_2 data in WOD01 as a function of year for the World Ocean. The total number of observations = 37,124

YEAR	OBSERVATIONS
1991	2097
1992	4905
1993	0
1994	0
1995	30122

Table 14 The number of Surface-only pCO_2 data in WOD01 as a function of year for the southern hemisphere. The total number of observations = 1,623

YEAR	OBSERVATIONS
1991	0
1992	1623
1993	0
1994	0
1995	0

Table 15 The number of Surface-only pCO_2 data in WOD01 as a function of year for the northern hemisphere. The total number of observations = 35,501

YEAR	OBSERVATIONS
1991	2097
1992	3282
1993	0
1994	0
1995	30122

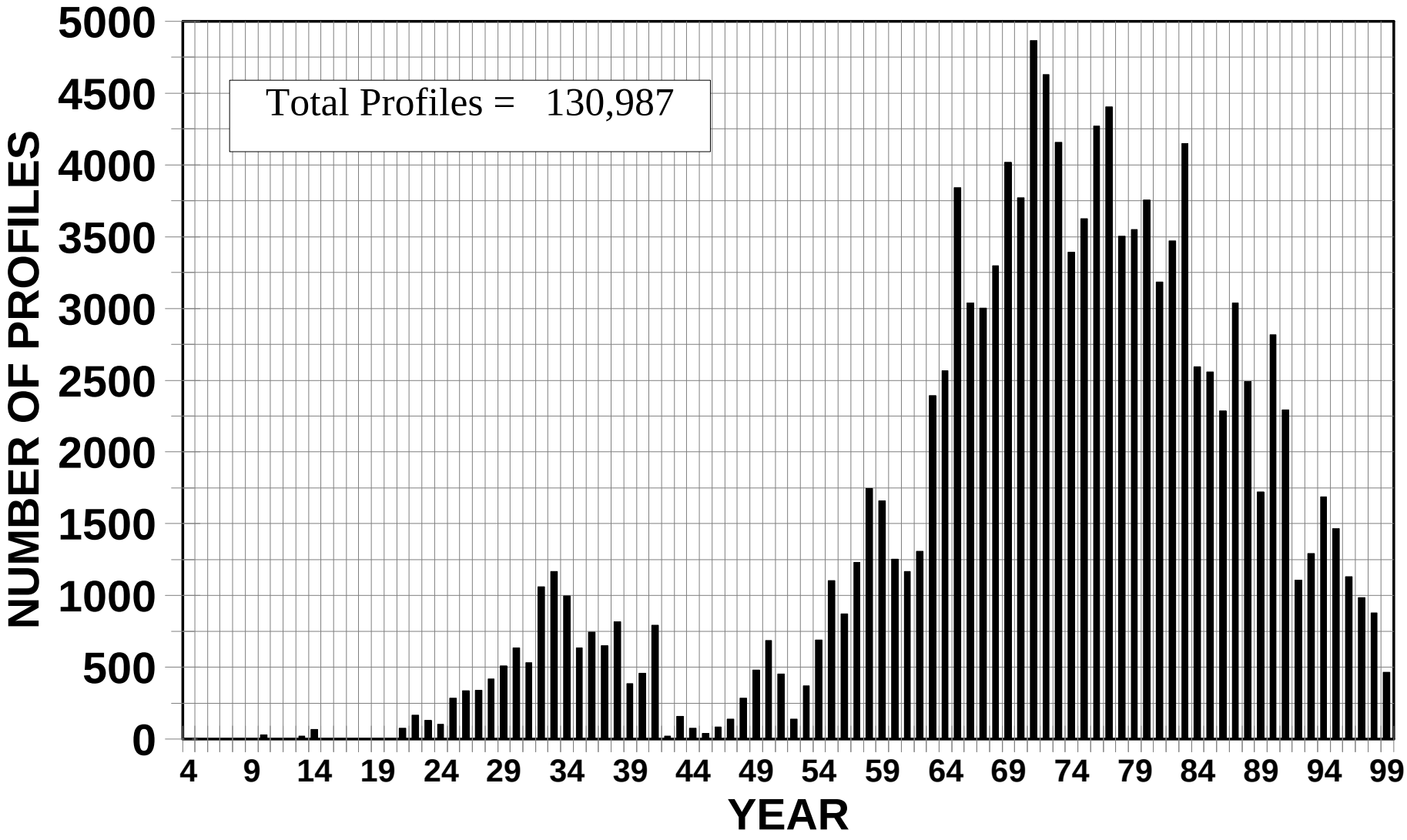

Fig. 1 Time series of Ocean Station Data (OSD) pH profiles in WOD01 as a function of year for the World Ocean.

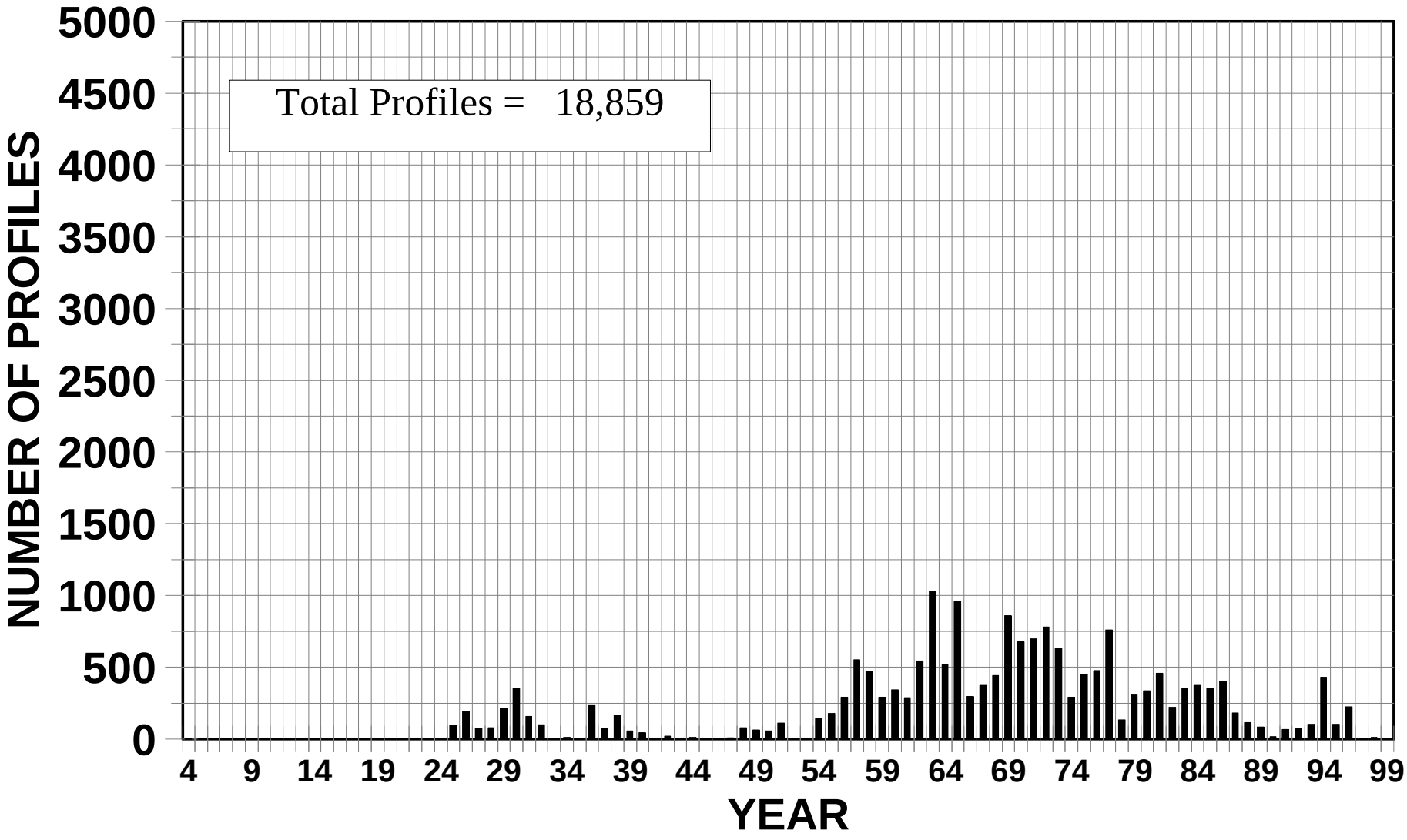

Fig. 2 **Time series of Ocean Station Data (OSD) pH profiles in WOD01 as a function of year for the southern hemisphere.**

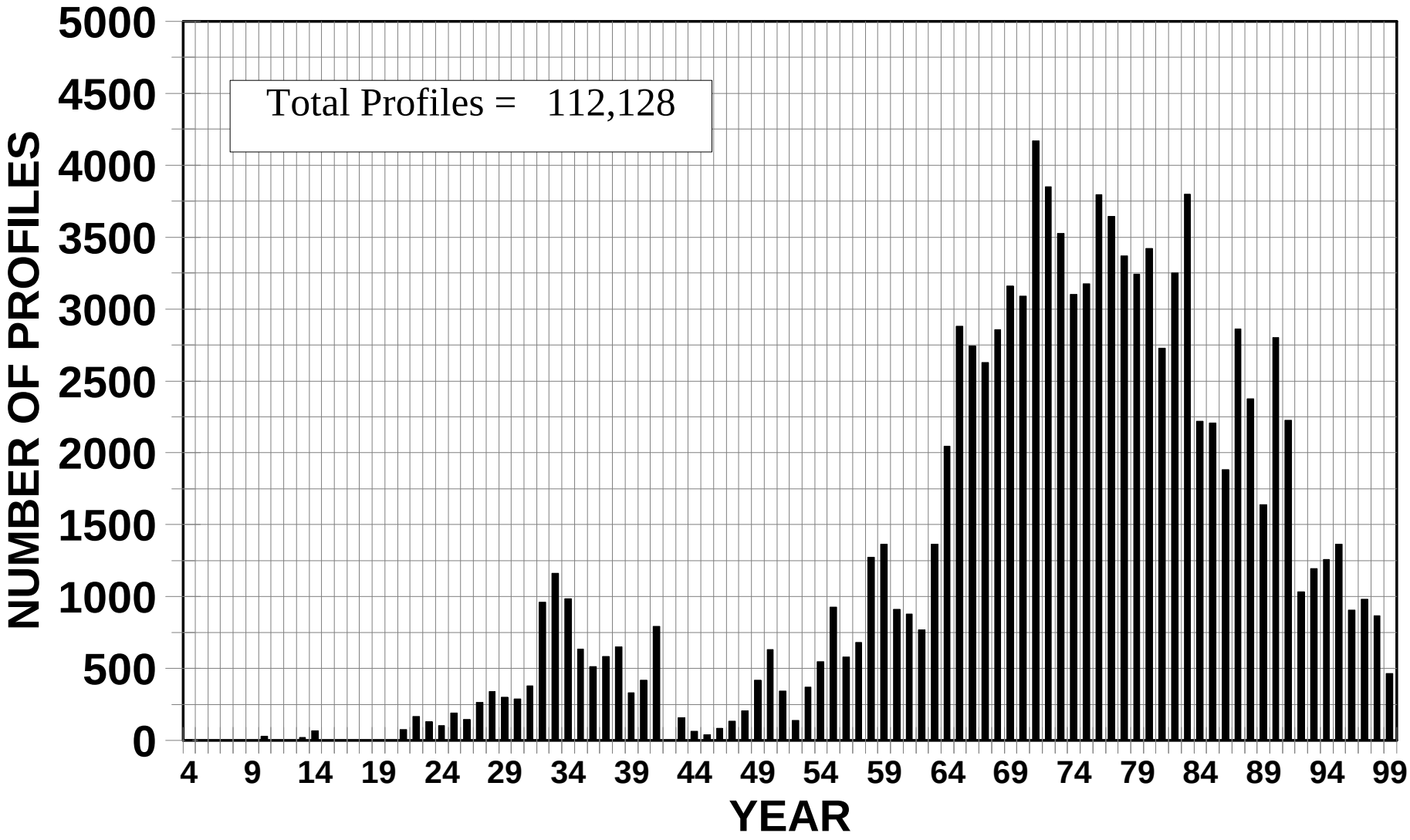

Fig. 3 **Time series of Ocean Station Data (OSD) pH profiles in WOD01 as a function of year for the northern hemisphere.**

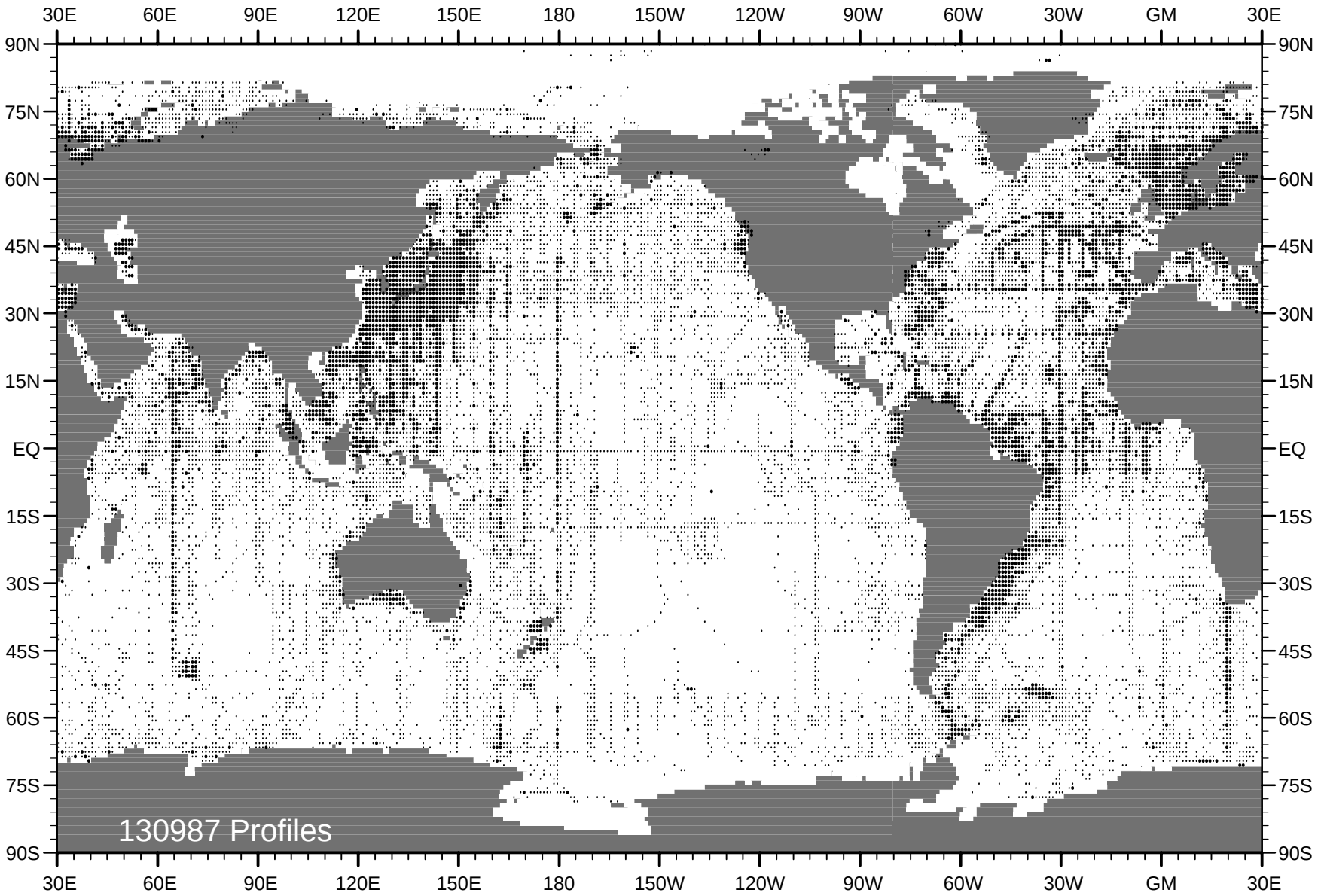

Fig. 4 Distribution of all Ocean Station Data (OSD) pH in WOD01.
Dots show location of 1-degree squares containing any data.

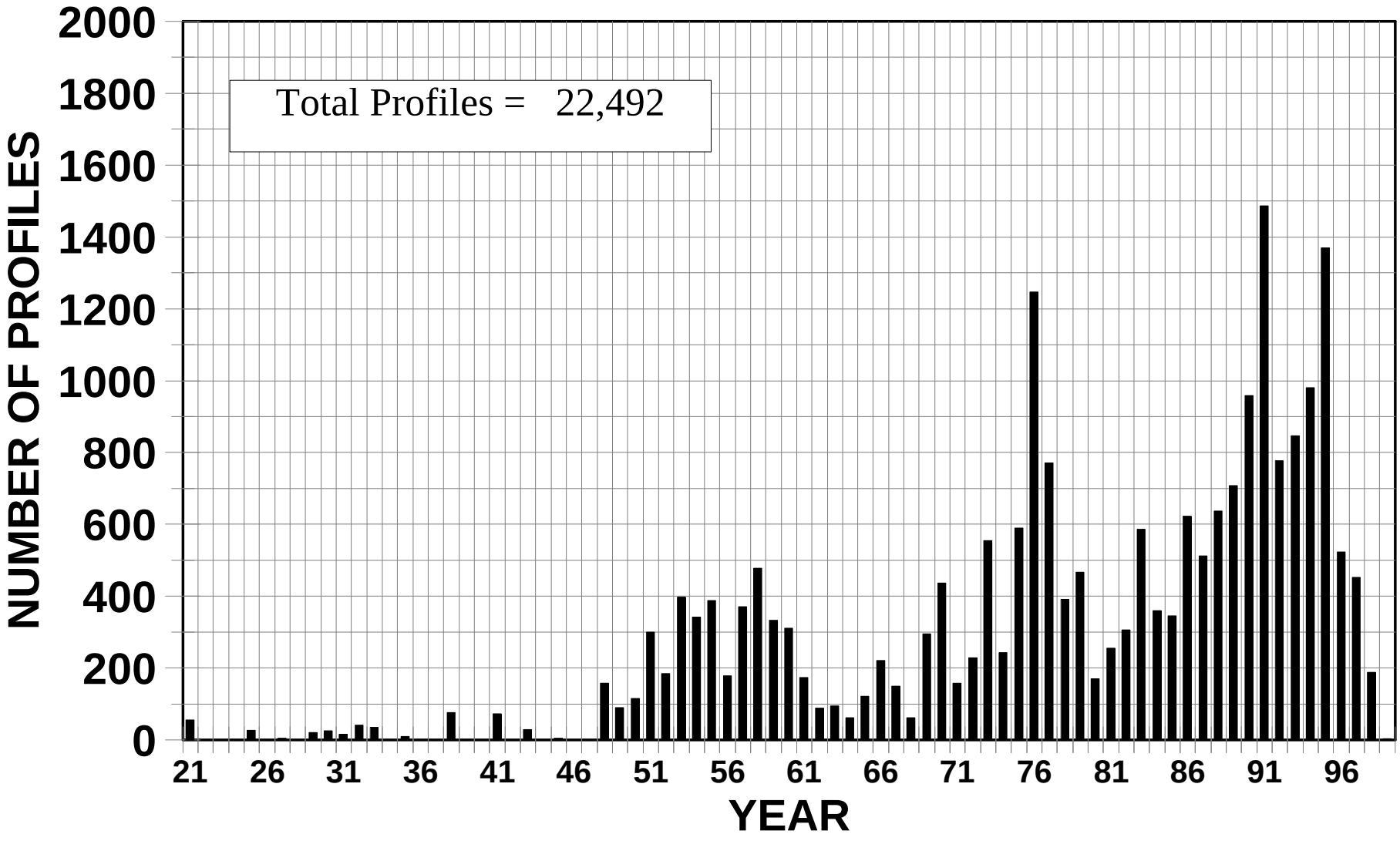

Fig. 5 **Time series of Ocean Station Data (OSD) alkalinity profiles in WOD01 as a function of year for the World Ocean.**

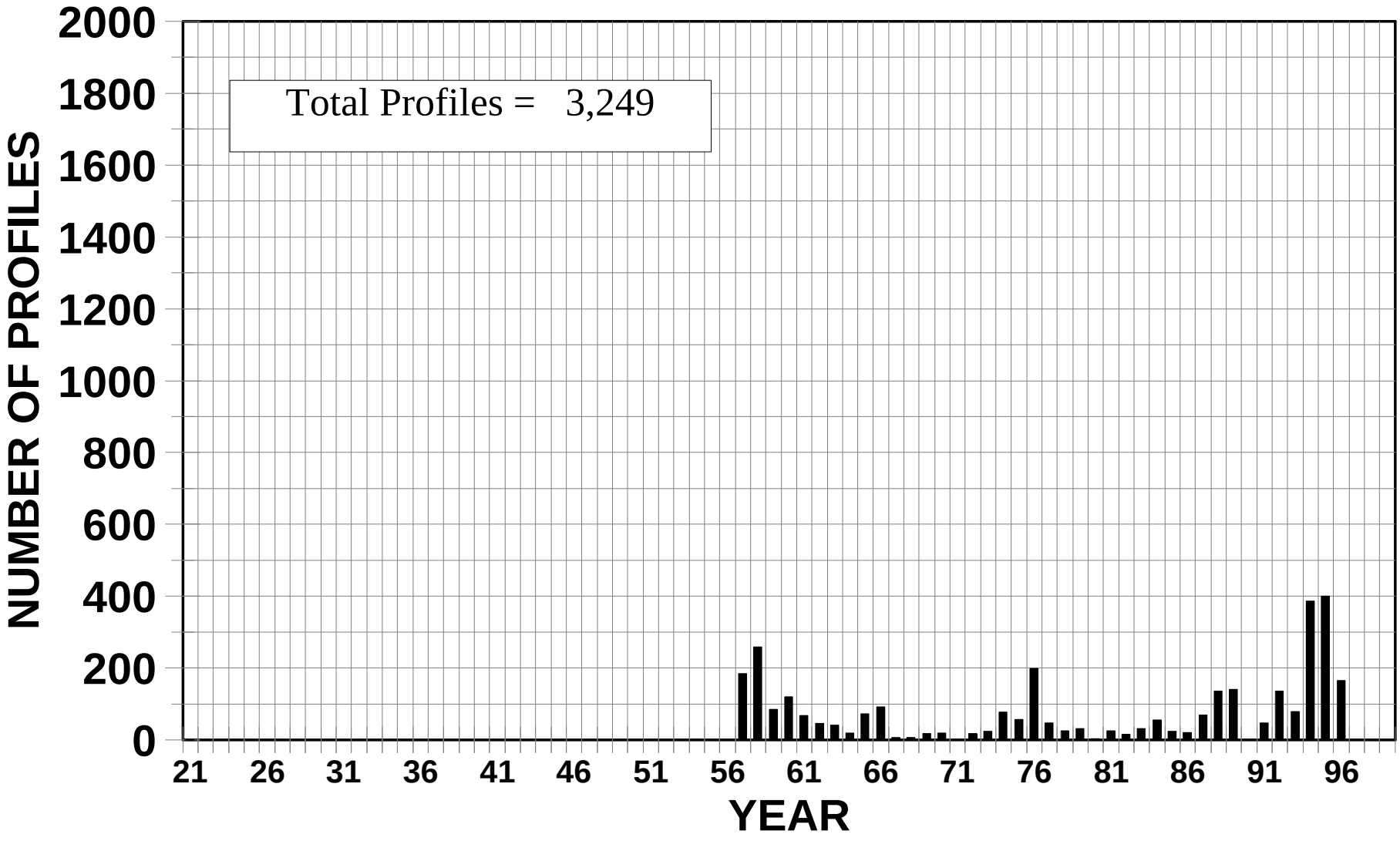

Fig.6 Time series of Ocean Station Data (OSD) alkalinity profiles in WOD01 as a function of year for the southern hemisphere.

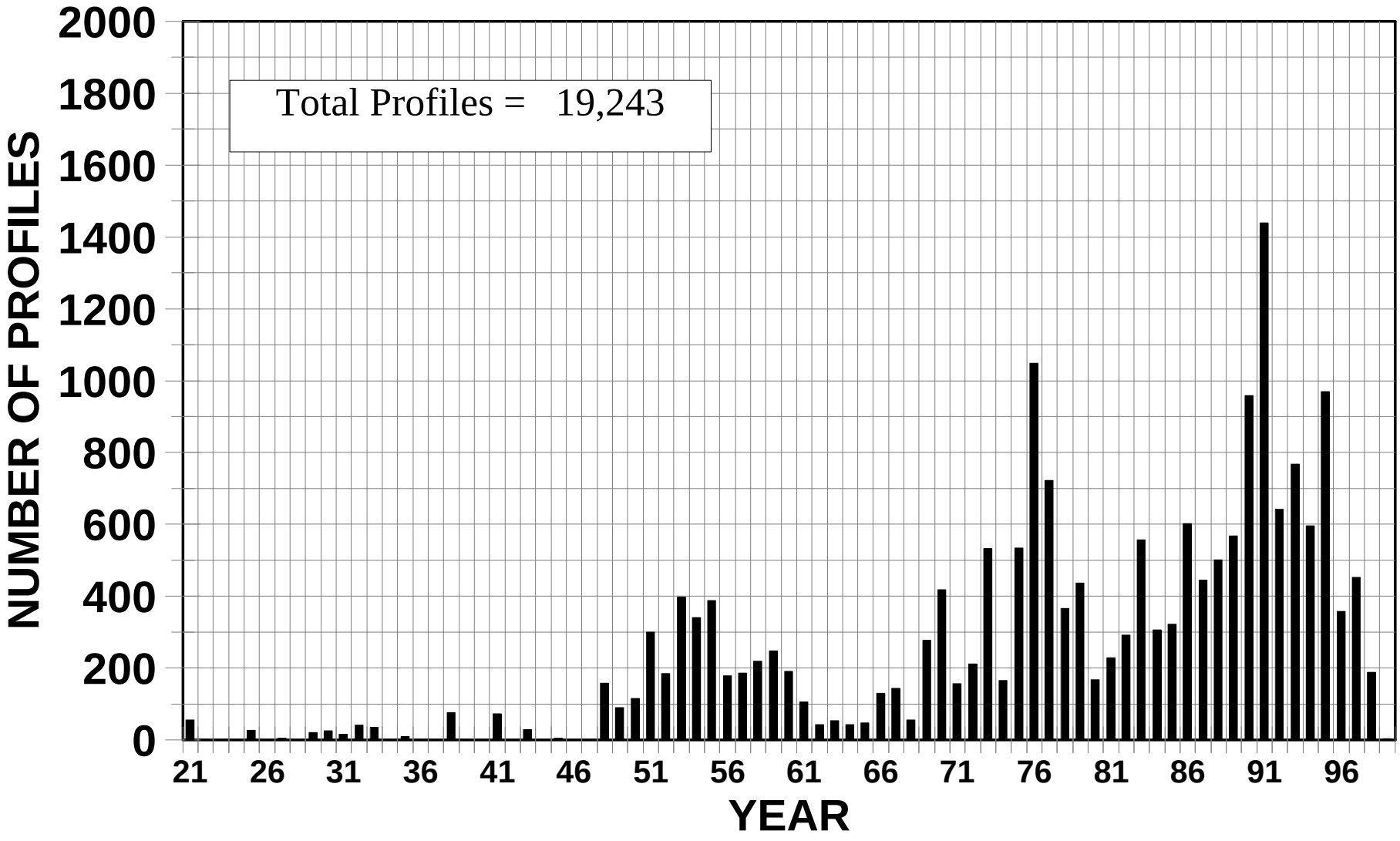

Fig. 7 **Time series of Ocean Station Data (OSD) alkalinity profiles in WOD01 as a function of year for the northern hemisphere.**

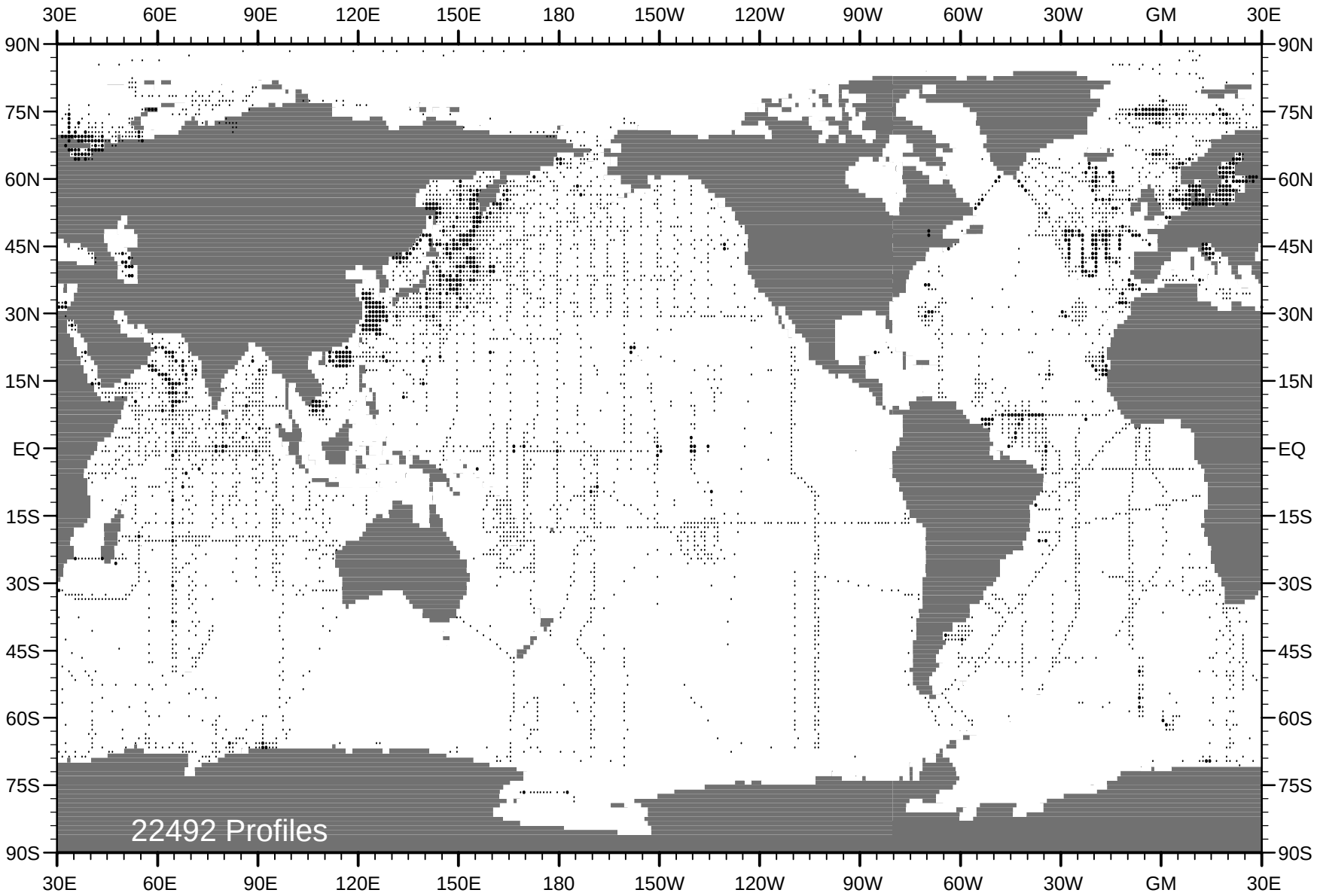

Fig. 8 Distribution of all Ocean Station Data (OSD) alkalinity in WOD01.
Dots show location of 1-degree squares containing any data.

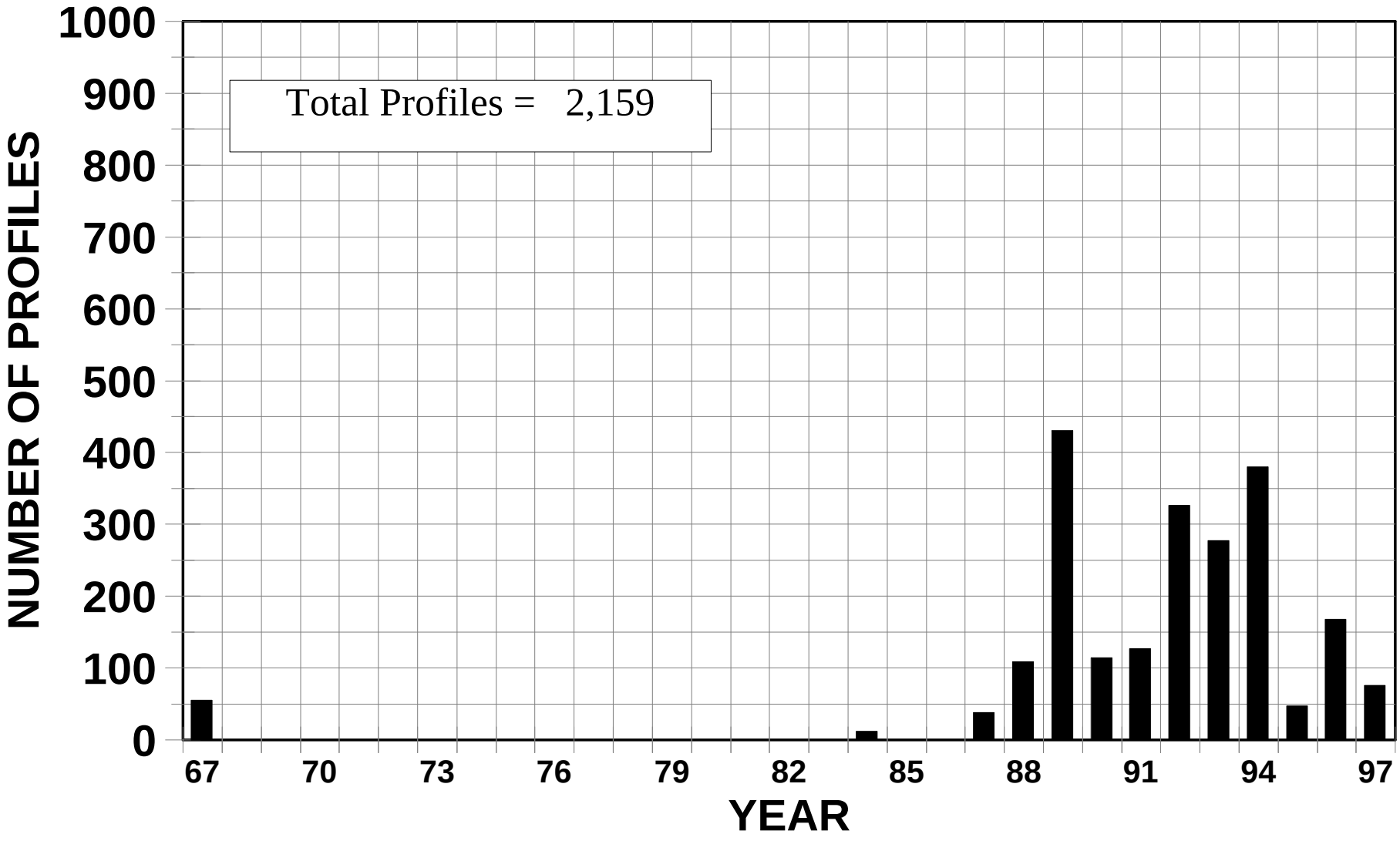

Fig. 9 Time series of Ocean Station Data (OSD) pCO2 profiles in WOD01 as a function of year for the World Ocean.

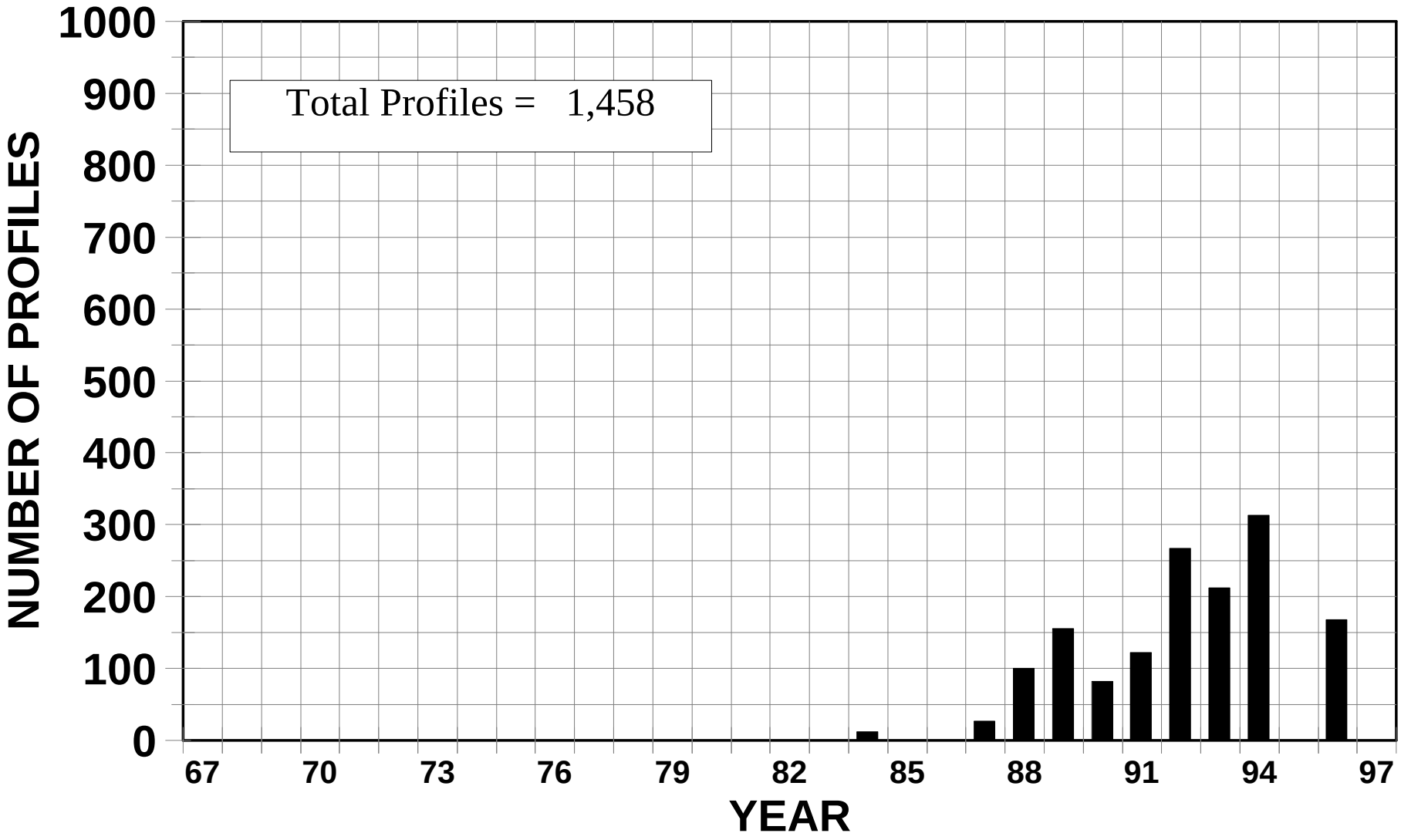

Fig. 10 Time series of Ocean Station Data (OSD) pCO2 profiles in WOD01 as a function of year for the southern hemisphere.

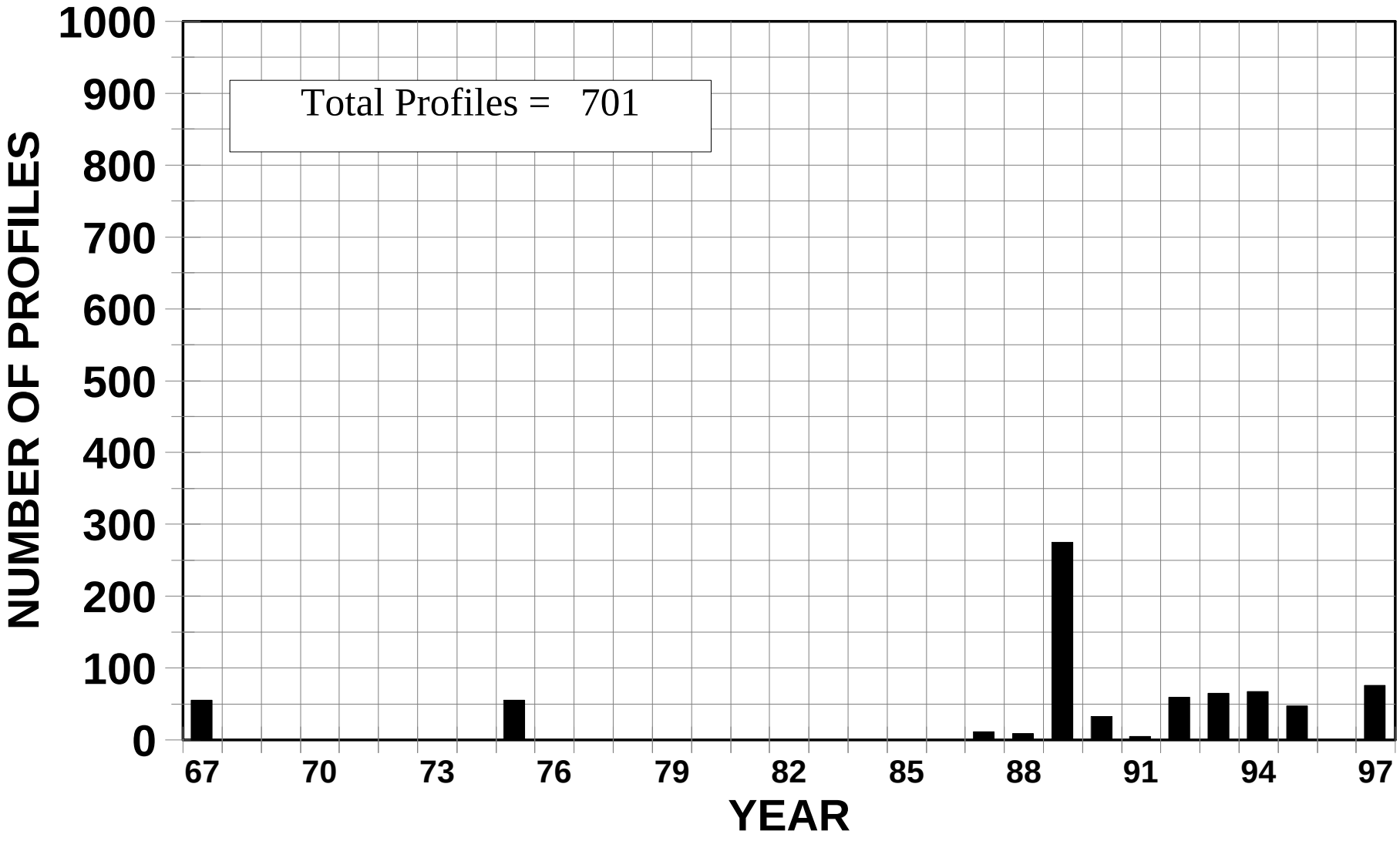

Fig. 11 Time series of Ocean Station Data (OSD) pCO2 profiles in WOD01 as a function of year for the northern hemisphere.

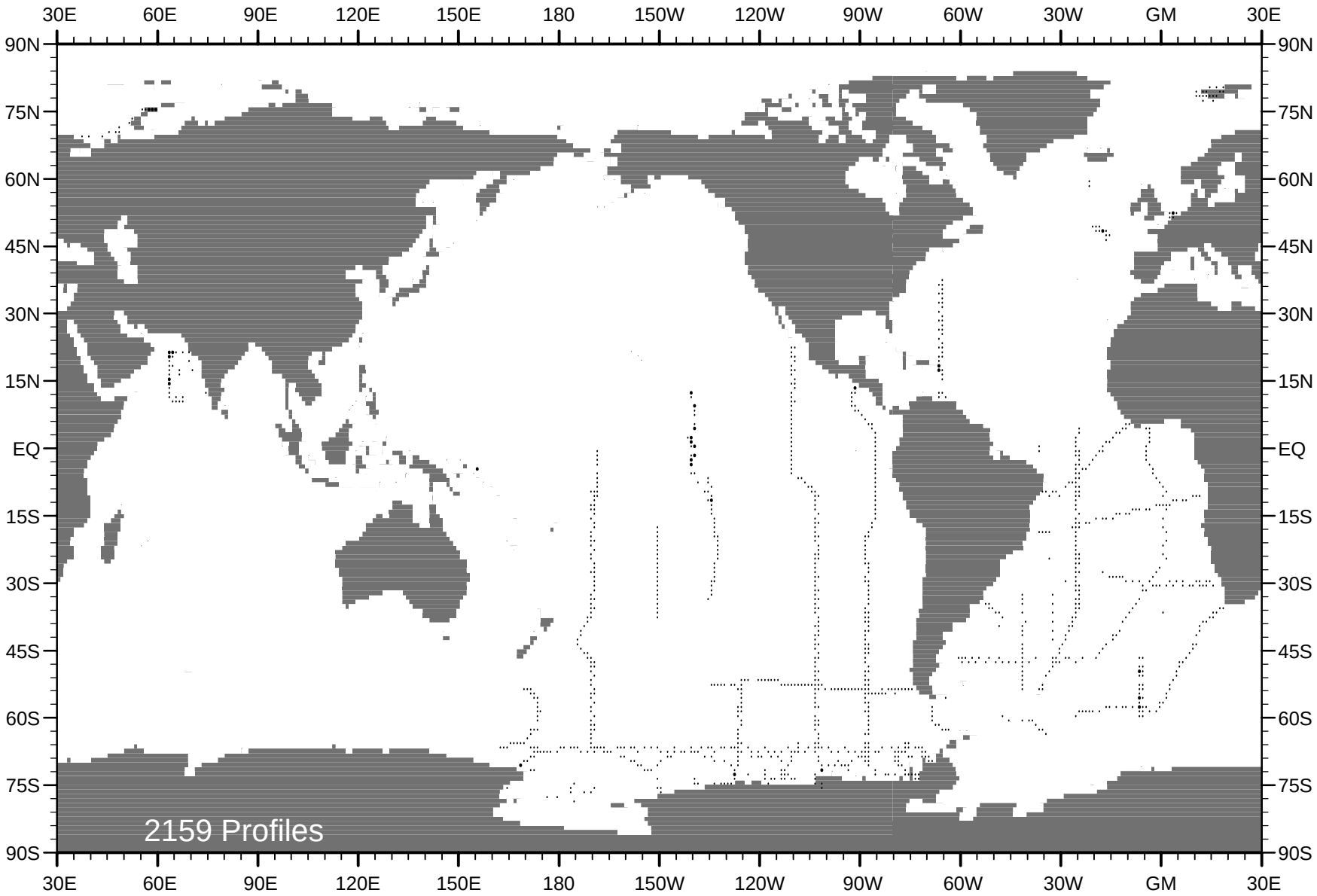

Fig. 12 Distribution of all Ocean Station Data (OSD) pCO_2 in WOD01.
Dots show location of 1-degree squares containing any data.

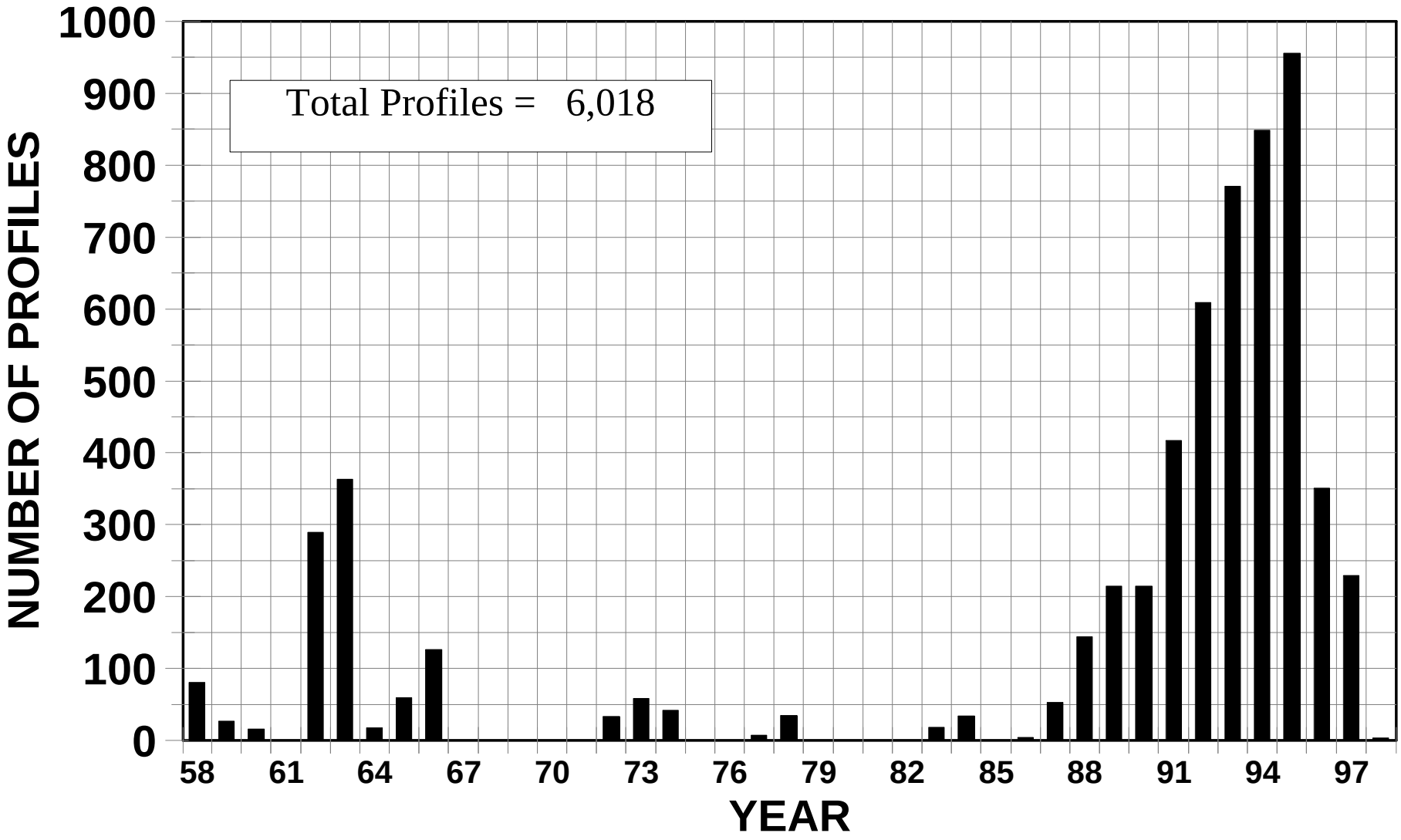

Fig. 13 Time series of Ocean Station Data (OSD) tCO2 profiles in WOD01 as a function of year for the World Ocean.

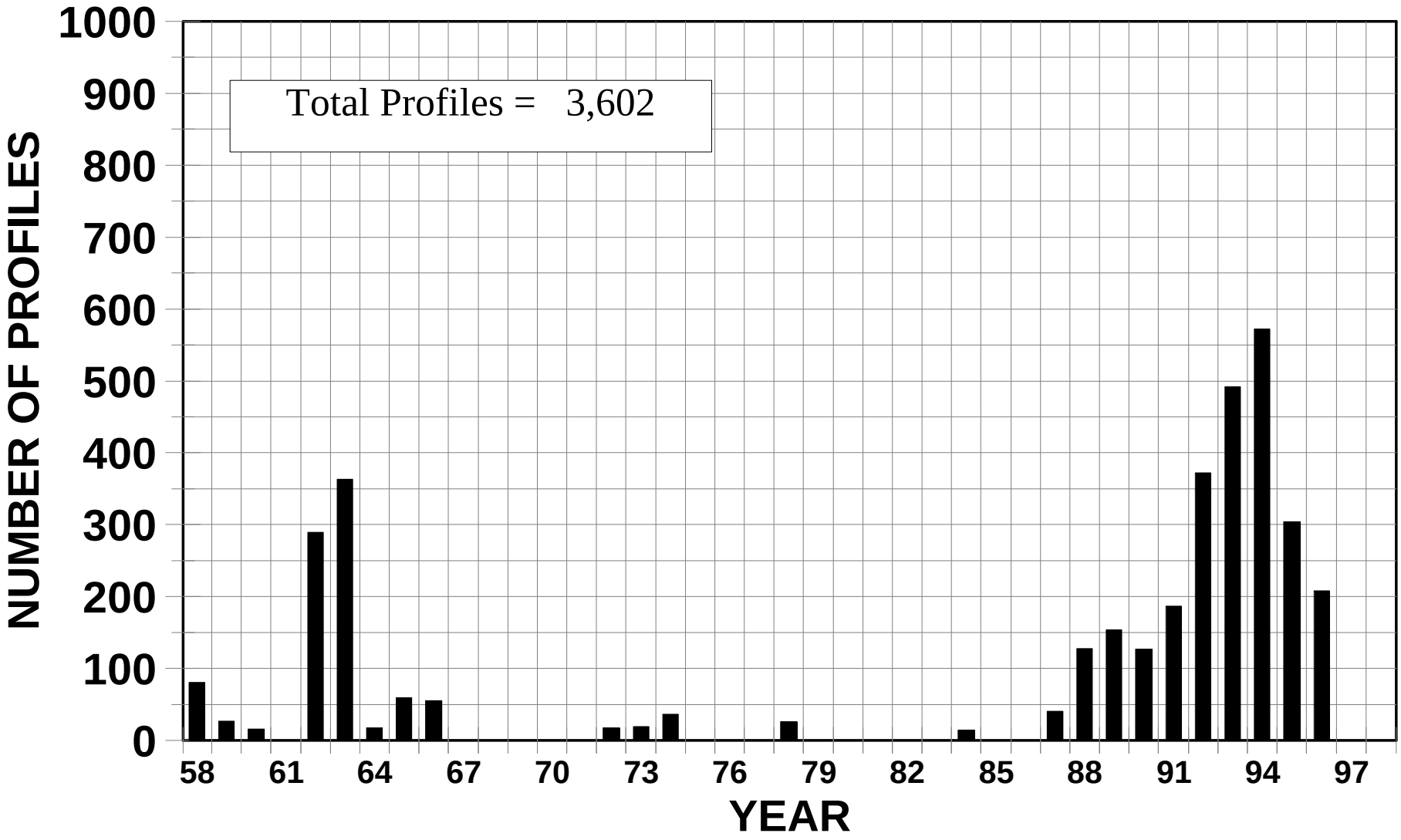

Fig. 14 Time series of Ocean Station Data (OSD) tCO2 profiles in WOD01 as a function of year for the southern hemisphere.

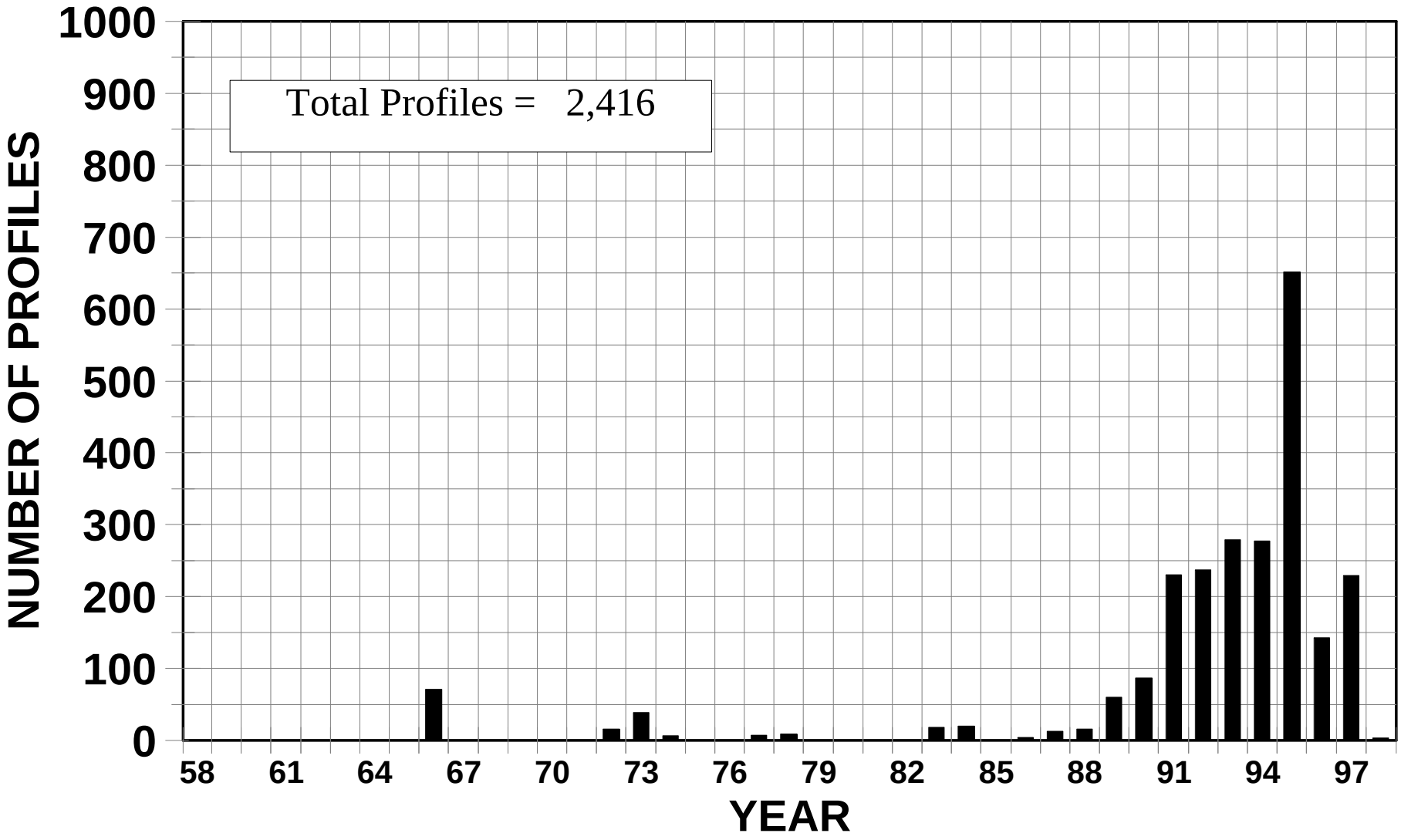

Fig. 15 Time series of Ocean Station Data (OSD) tCO2 profiles in WOD01 as a function of year for the northern hemisphere.

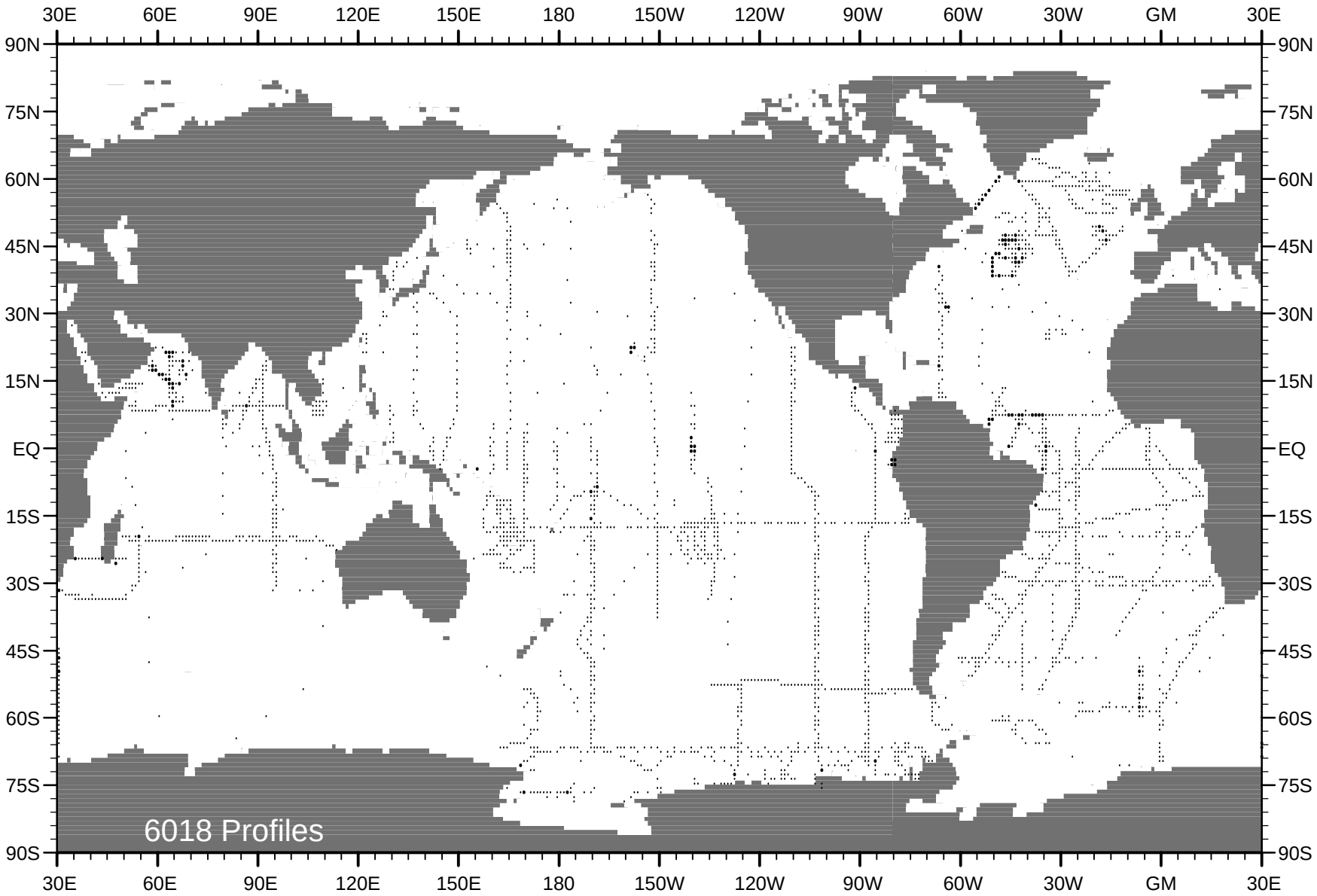

Fig. 16 Distribution of all Ocean Station Data (OSD) tCO_2 in WOD01.
Dots show location of 1-degree squares containing any data.

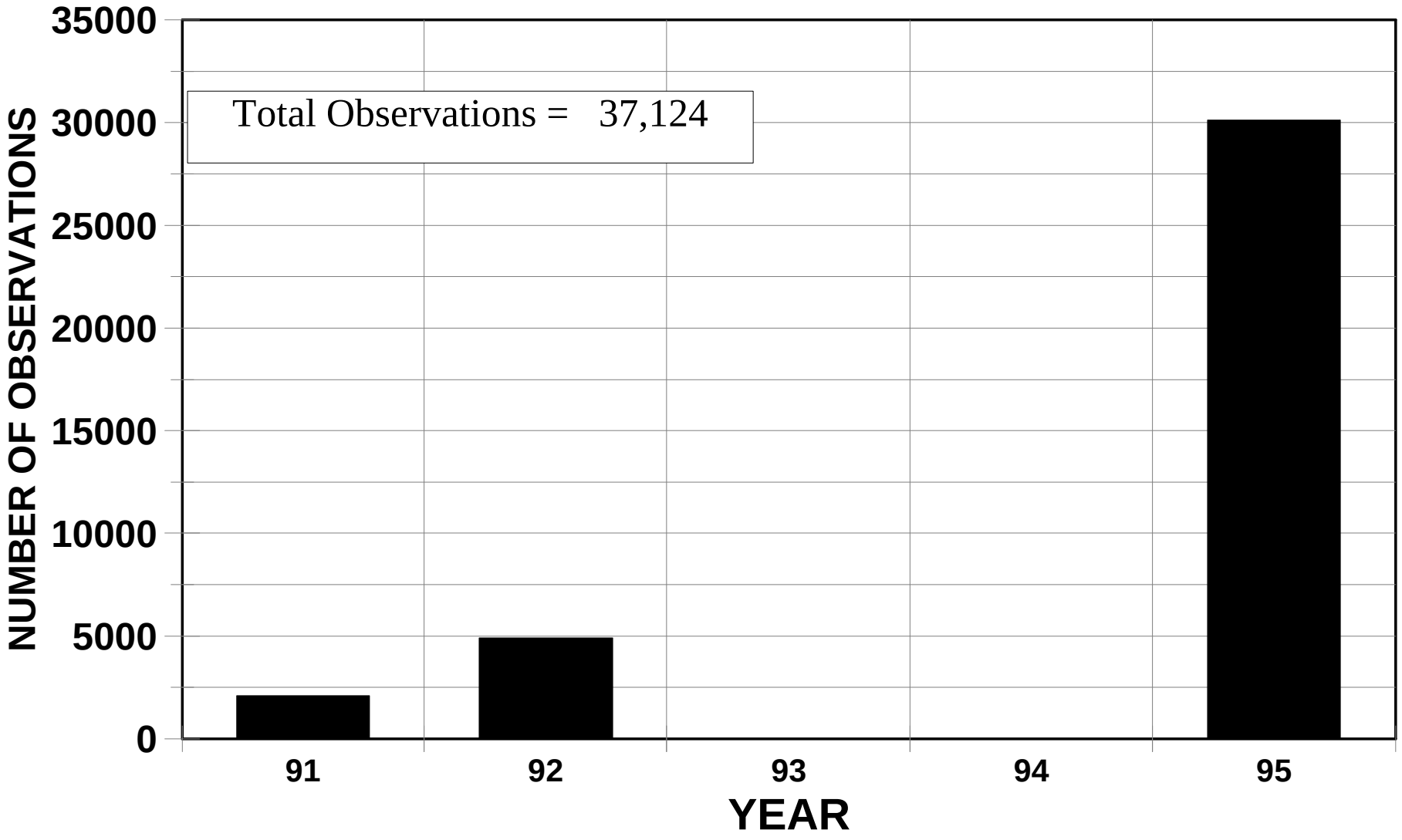

Fig. 17 Time series of Surface-only (SURF) pCO2 data in WOD01 as a function of year for the World Ocean.

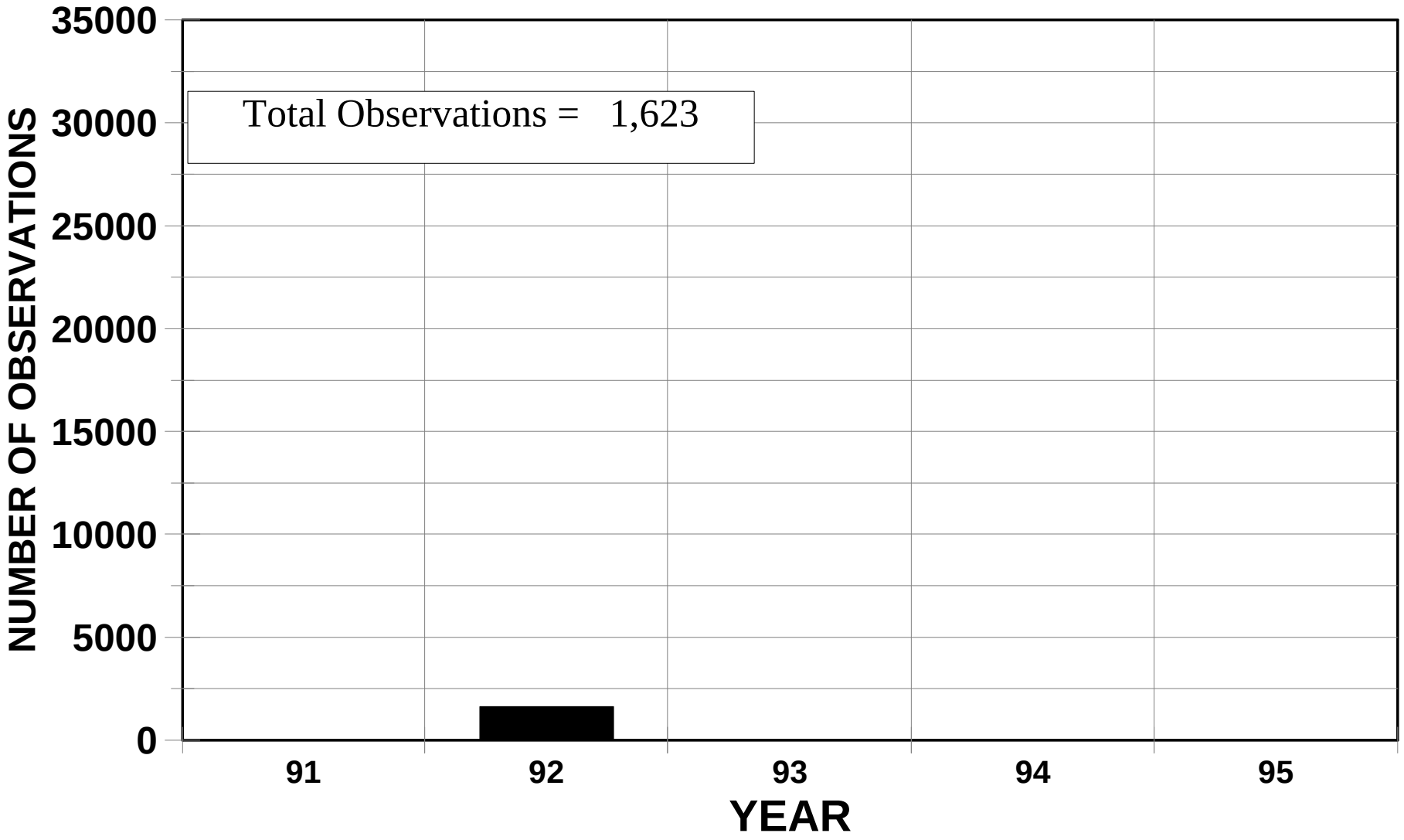

Fig. 18 Time series of Surface-only (SURF) pCO2 data in WOD01 as a function of year for the southern hemisphere.

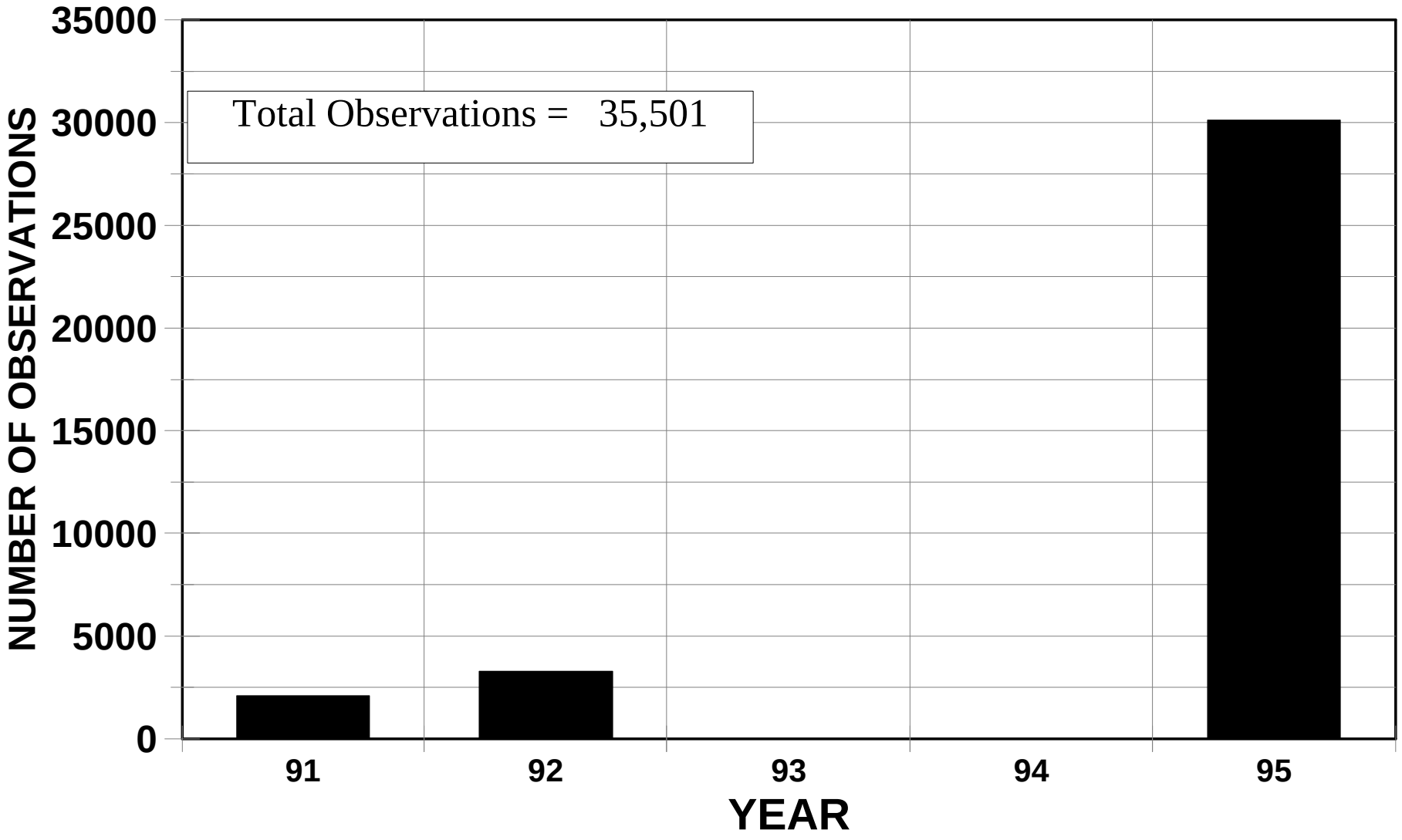

Fig. 19 Time series of Surface-only (SURF) pCO2 data in WOD01 as a function of year for the northern hemisphere.

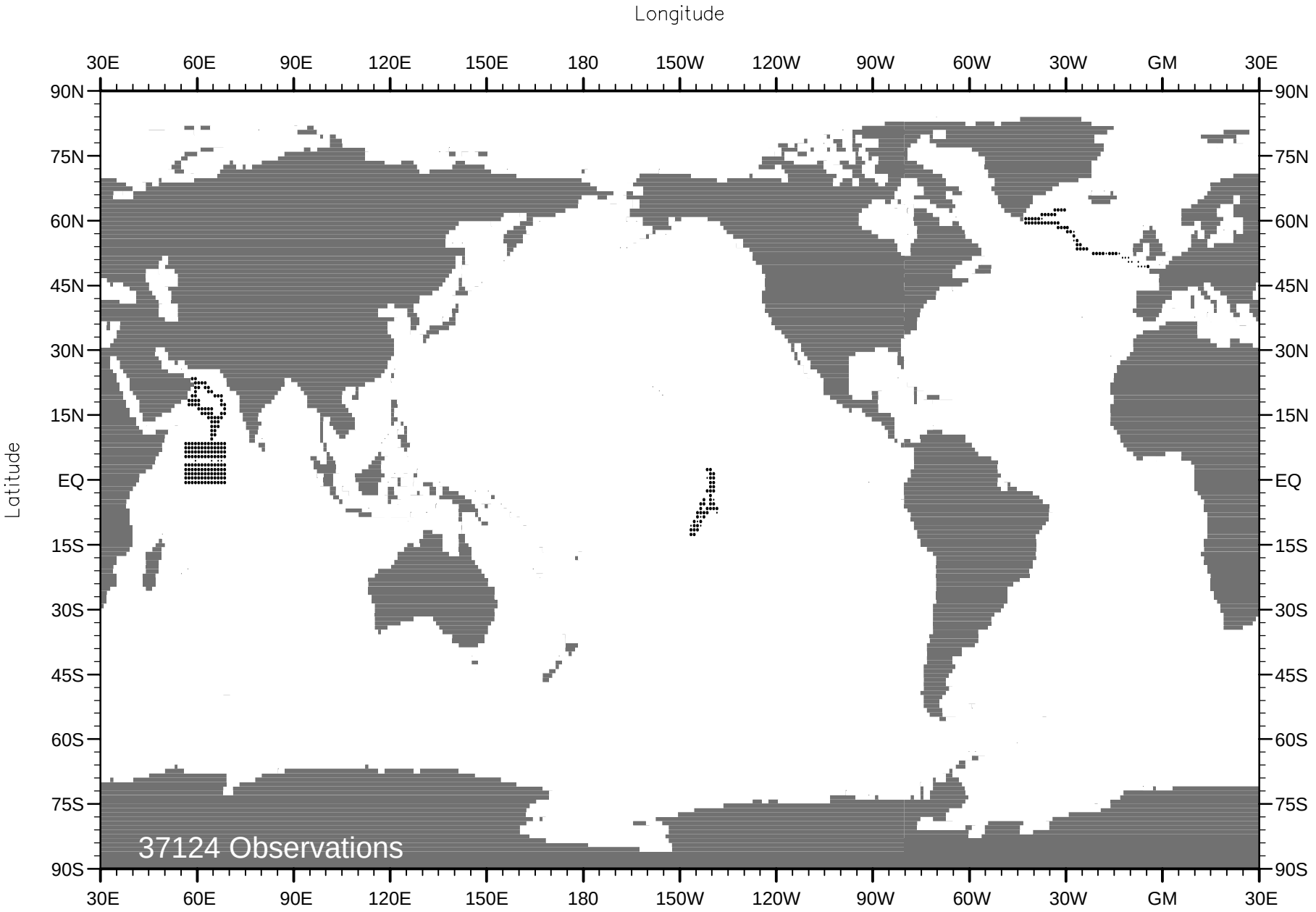

Fig. 20 Distribution of all Surface-only (SURF) pCO_2 data in WOD01.
Dots show location of 1-degree squares containing any data.

3. BIBLIOGRAPHY

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Levitus, S., R. Gelfeld, M. Conkright, T.P. Boyer, D. Johnson, I. Smolyar, C. Jones, G. Trammell, R. Moffatt, T. O'Brien, O. Baranova, C. Forgy, 2002: *Results of the NODC and IOC Oceanographic Data Archaeology and Rescue Projects*. In preparation.

4. APPENDIX A: DISTRIBUTIONS FOR INDIVIDUAL YEARS OF ALL OCEAN STATION DATA (OSD) pH PROFILES IN WOD01

This appendix contains yearly distributions of all OSD pH profiles contained in WOD01. These maps provide some history of the observational progress of the field of oceanography. They also serve as indicators of whether or not a particular data set from a scientist or institution is part of the NODC/WDC-A archive. The exchange of information provided by the publication of such maps has provided us with valuable information about deficiencies in the database. The locations of all WOD01 OSD pH profiles are plotted including stations that may be erroneously located over land. However, WOD01 contains some stations from various lakes so care should be exercised in the use of these stations and the determination as to whether they represent errors in locations.

For all figures in Appendix A, a small dot indicates a one-degree square containing from one to four stations and a large dot indicates five or more stations.

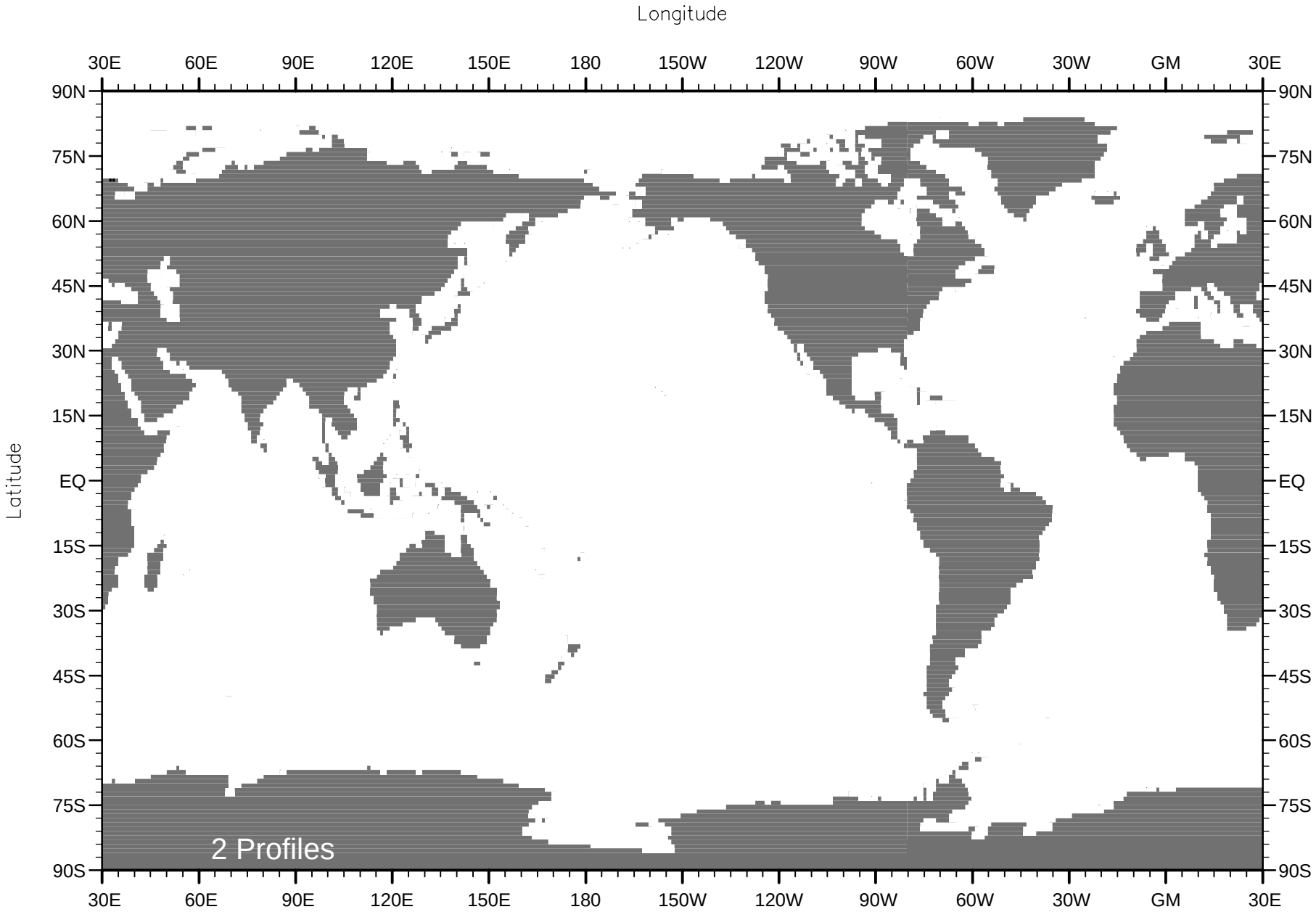


Fig. A1 Distribution of all Ocean Station Data (OSD) pH profiles in WOD01 for year 1904 .

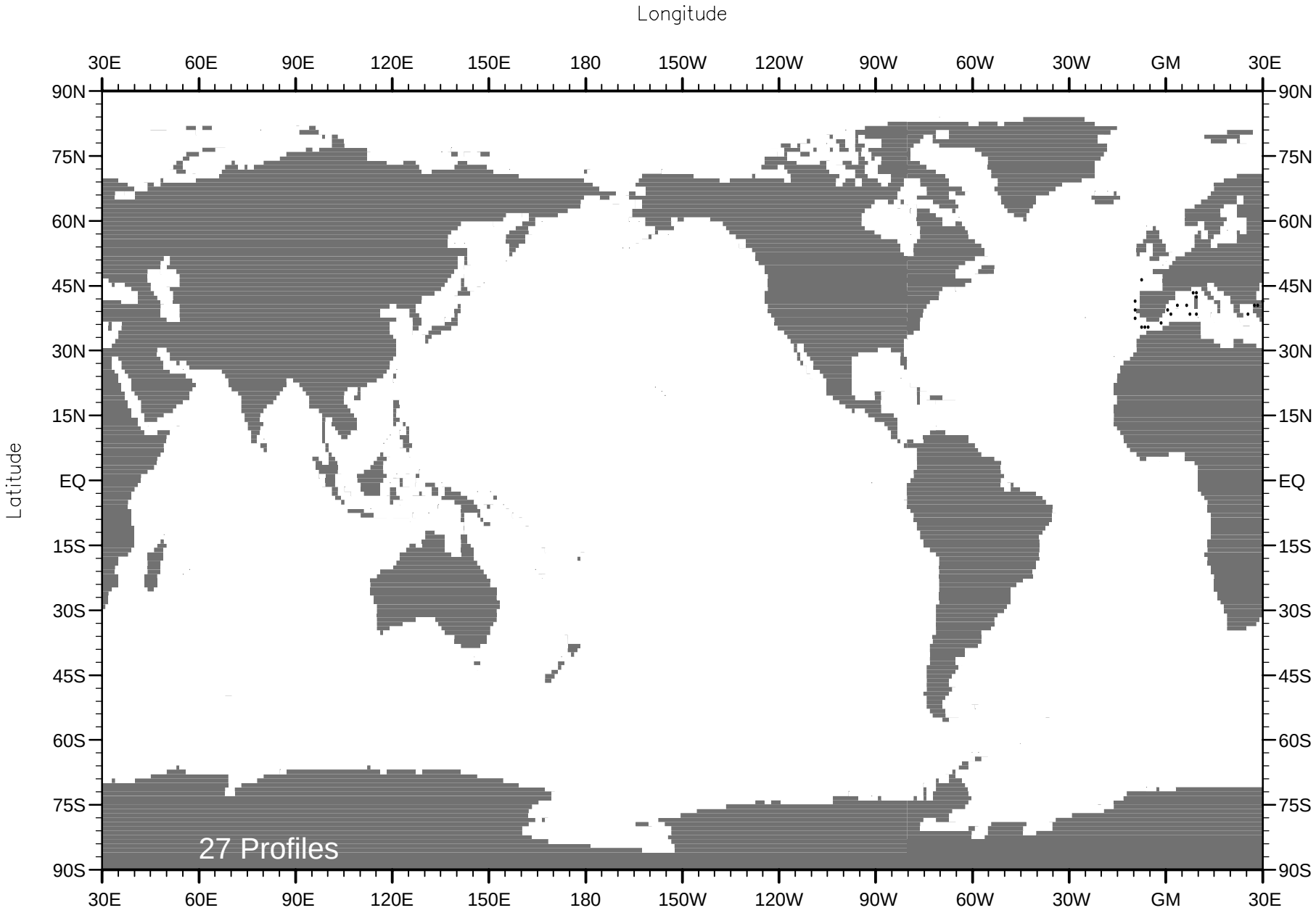


Fig. A2 Distribution of all Ocean Station Data (OSD) pH profiles in WOD01 for year 1910 .

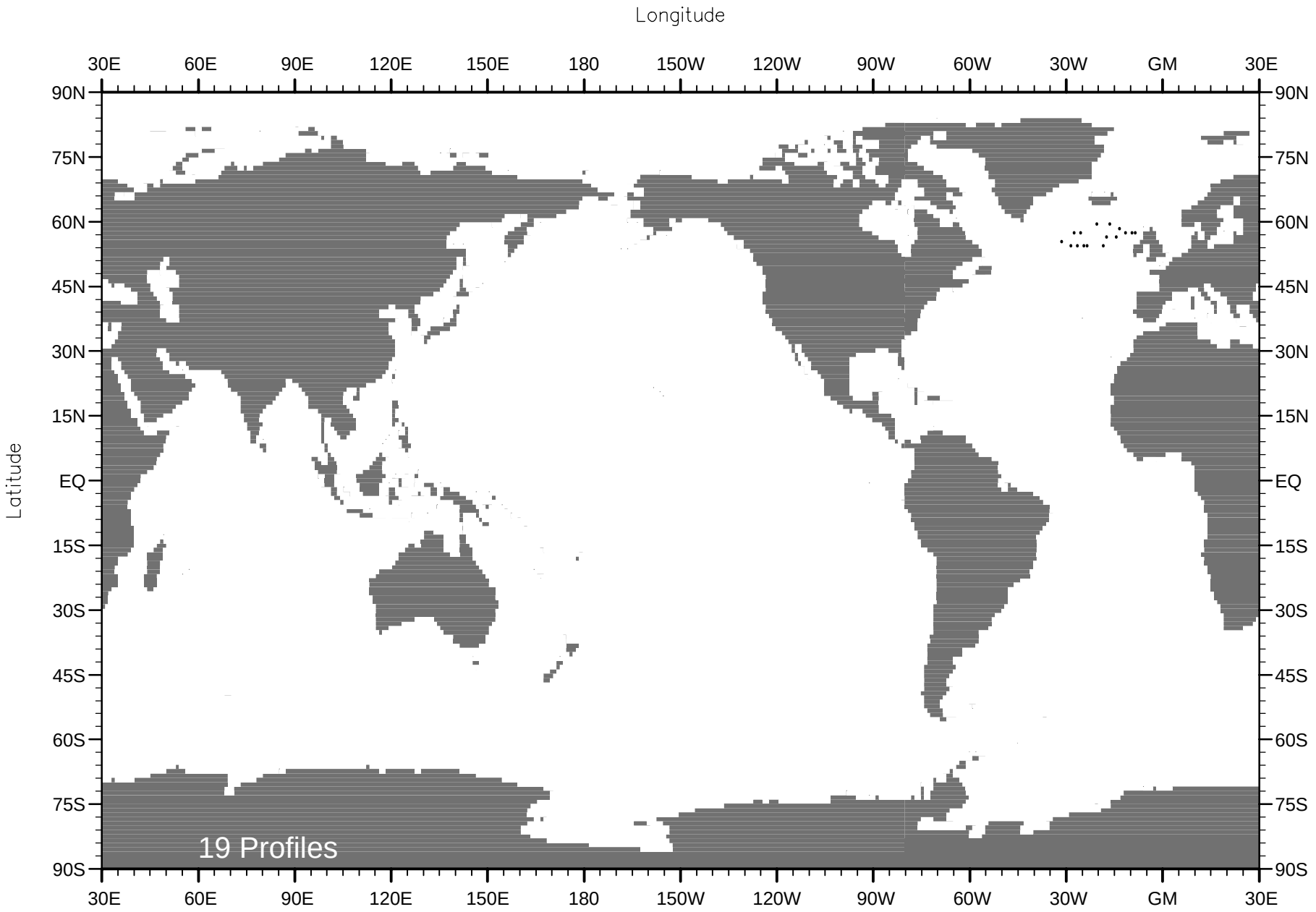


Fig. A3 Distribution of all Ocean Station Data (OSD) pH profiles in WOD01 for year 1913 .

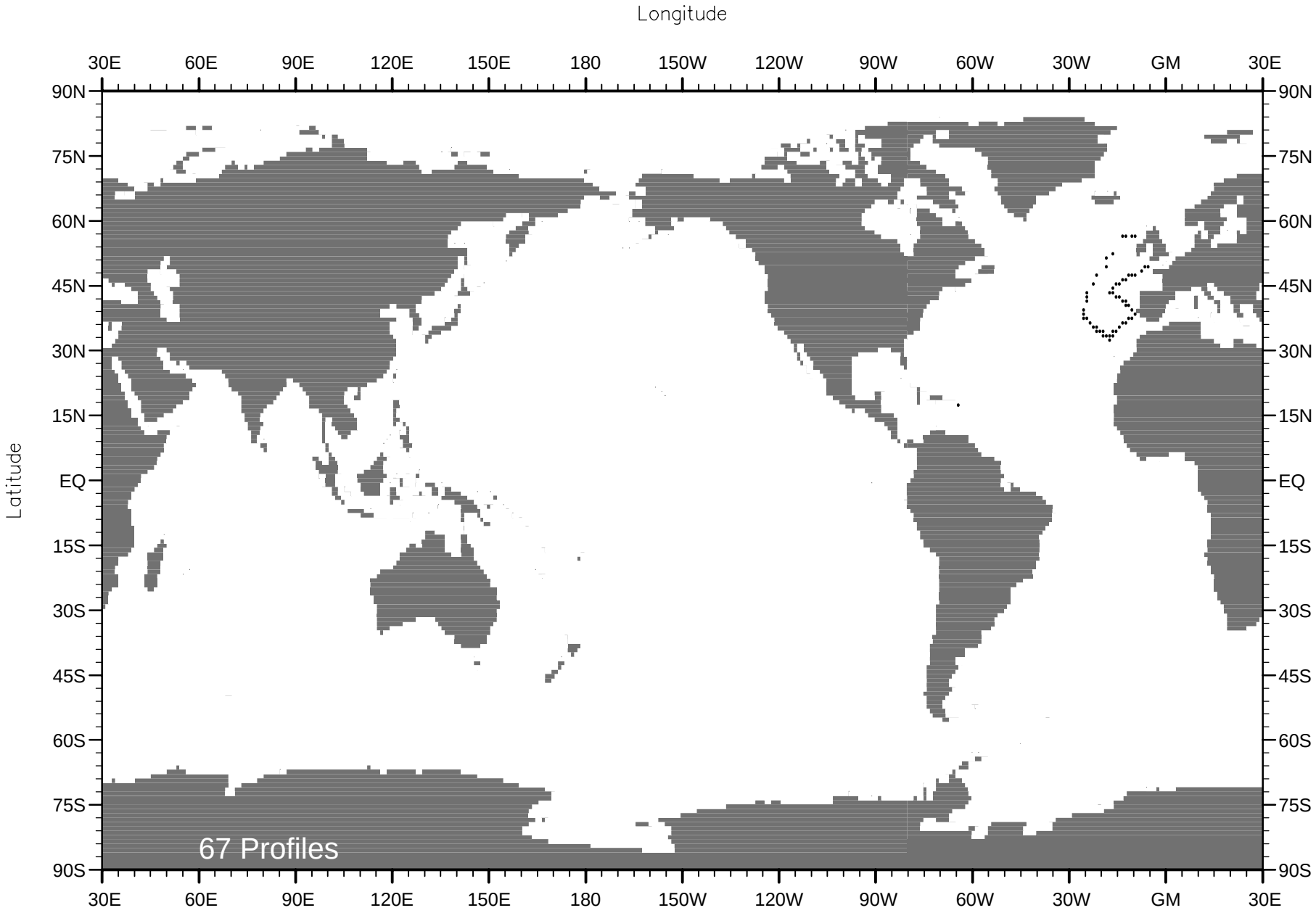


Fig. A4 Distribution of all Ocean Station Data (OSD) pH profiles in WOD01 for year 1914 .

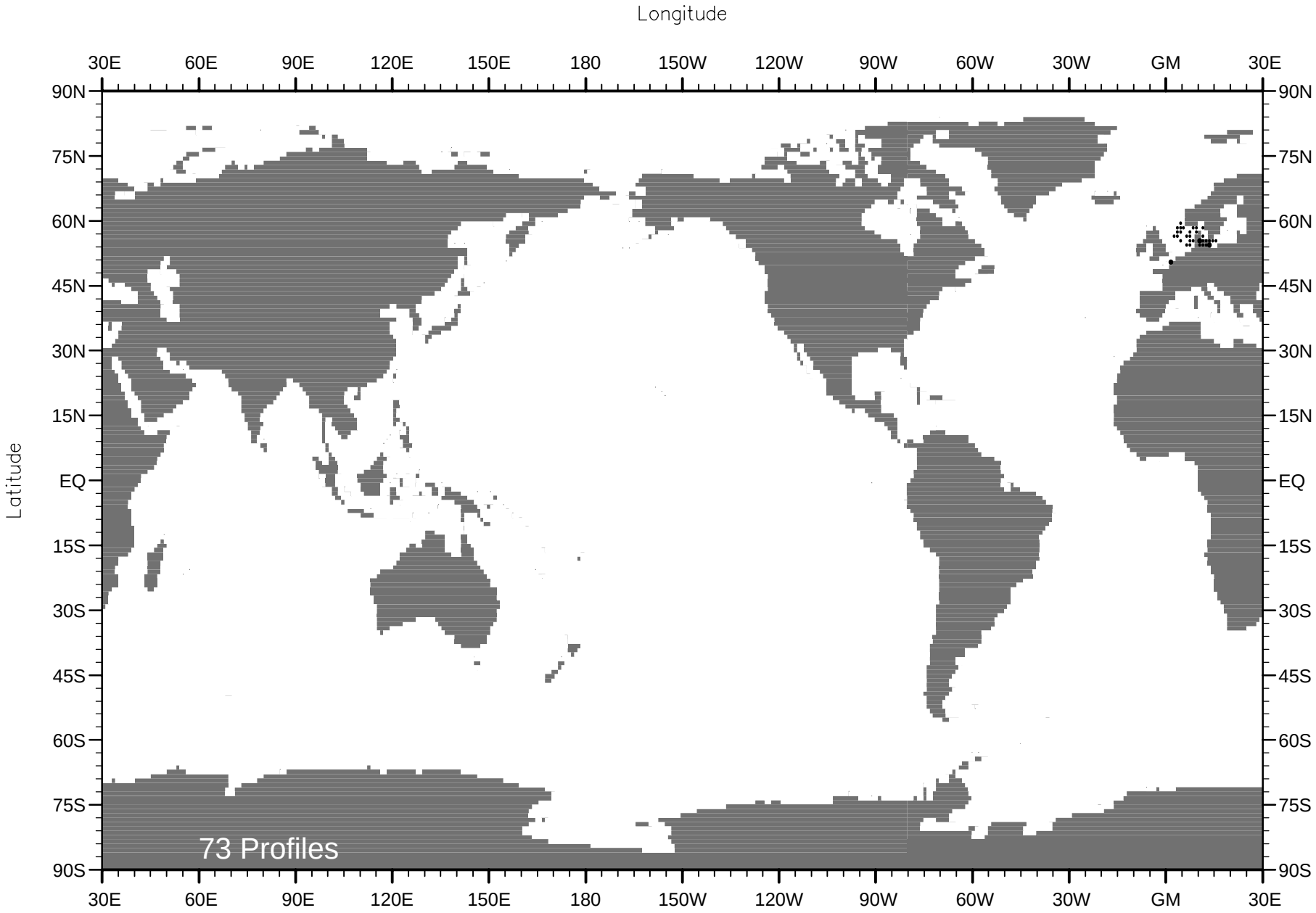


Fig. A5 Distribution of all Ocean Station Data (OSD) pH profiles in WOD01 for year 1921 .

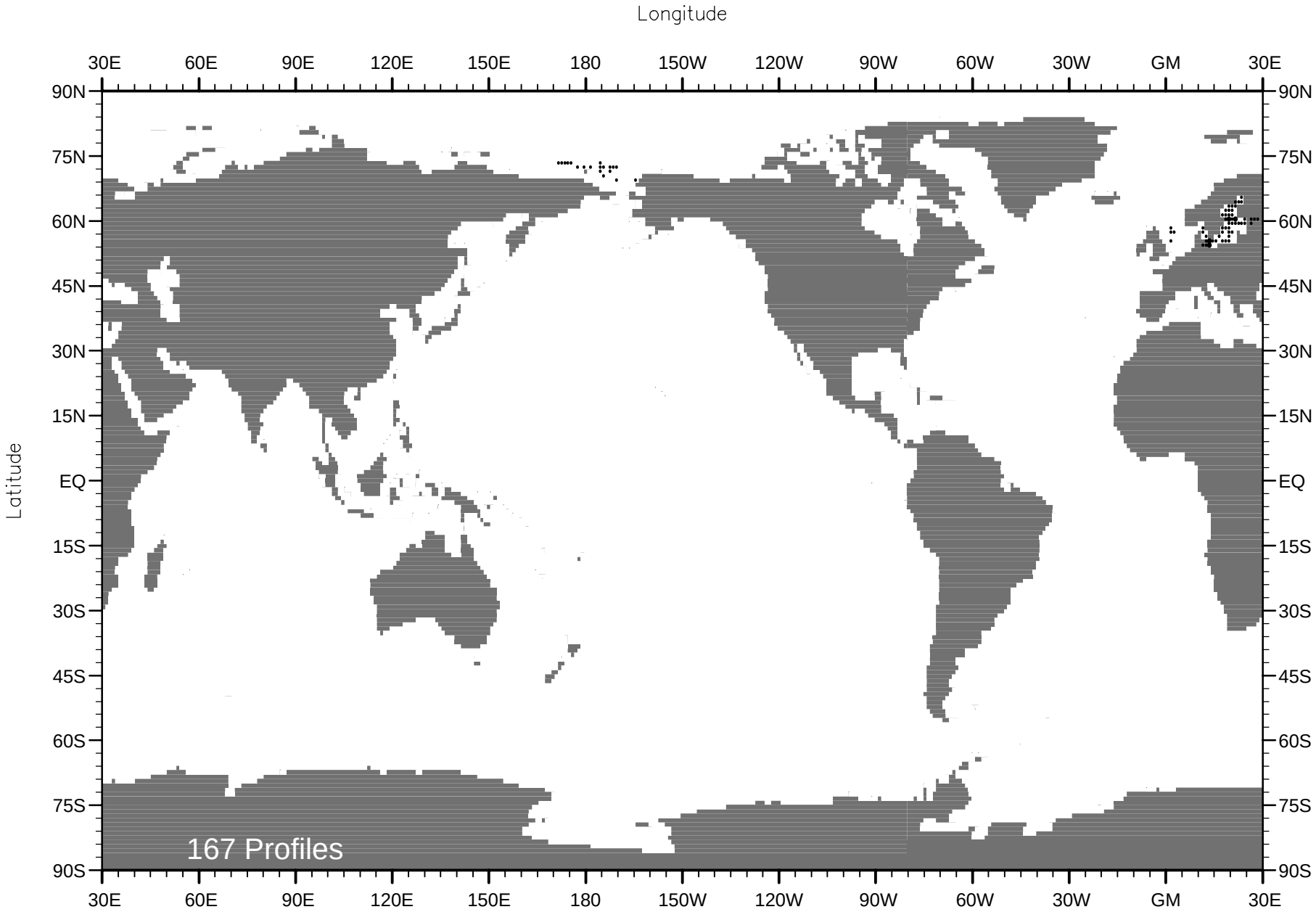


Fig. A6 Distribution of all Ocean Station Data (OSD) pH profiles in WOD01 for year 1922 .

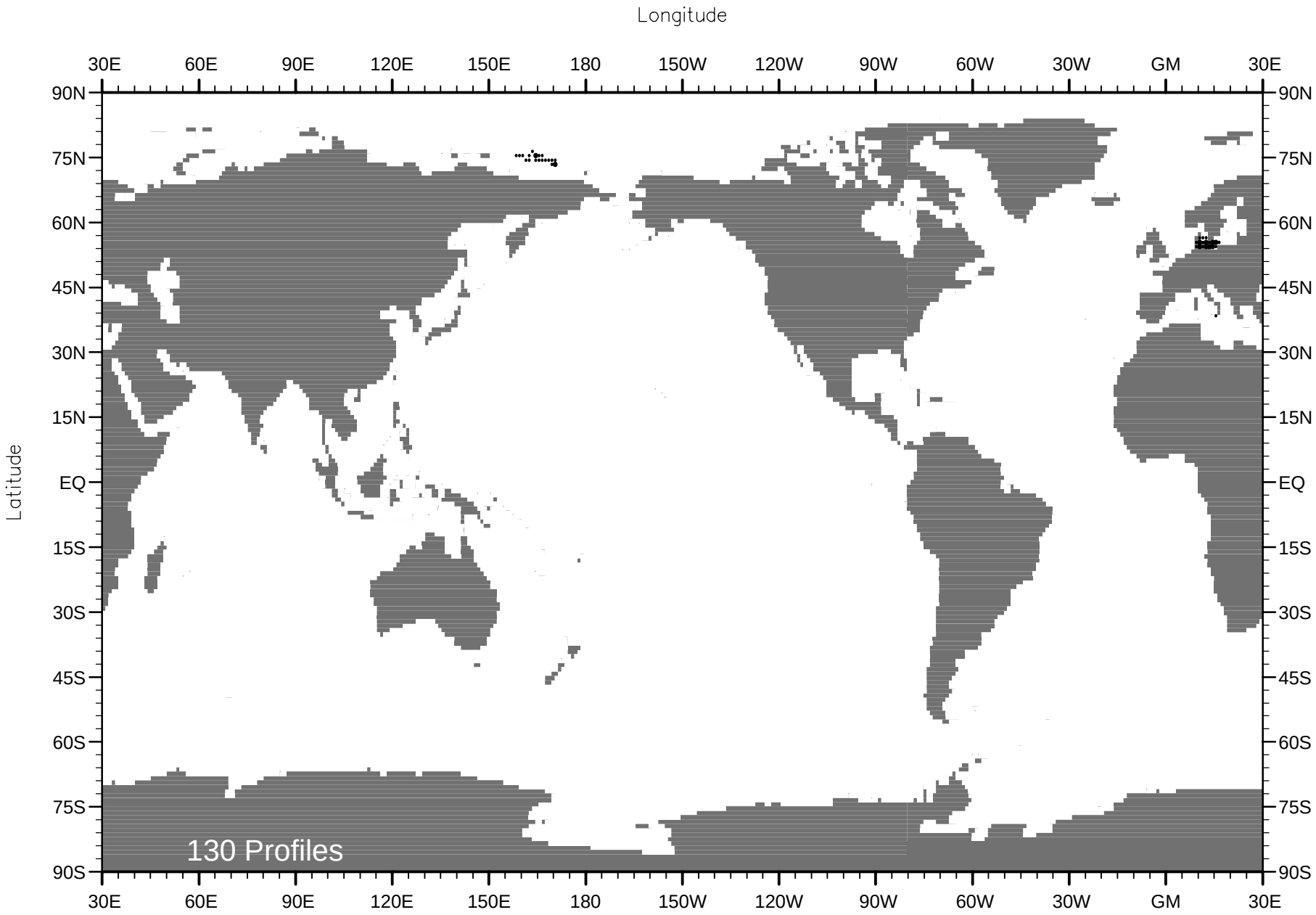


Fig. A7 Distribution of all Ocean Station Data (OSD) pH profiles in WOD01 for year 1923 .

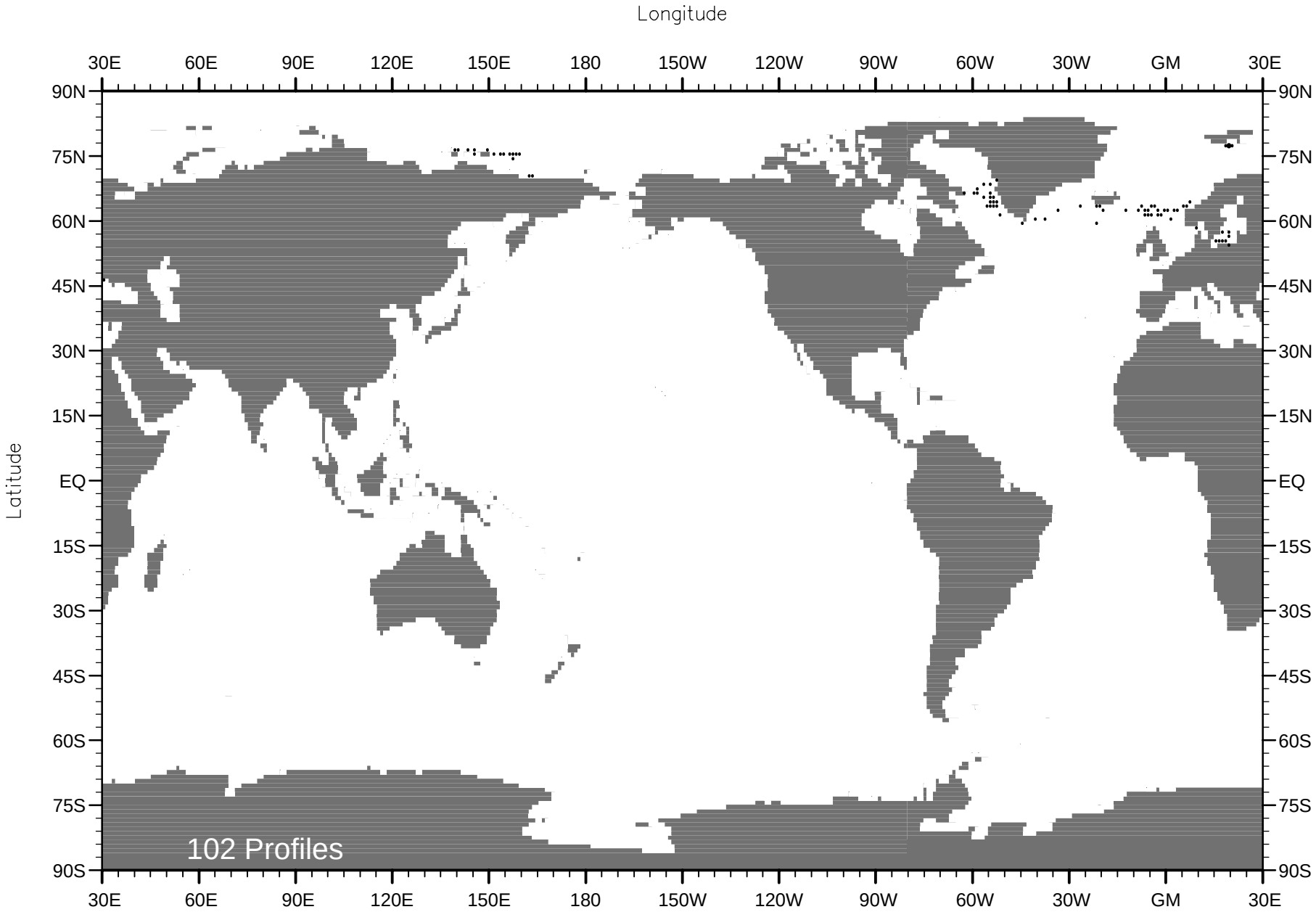


Fig. A8 Distribution of all Ocean Station Data (OSD) pH profiles in WOD01 for year 1924 .

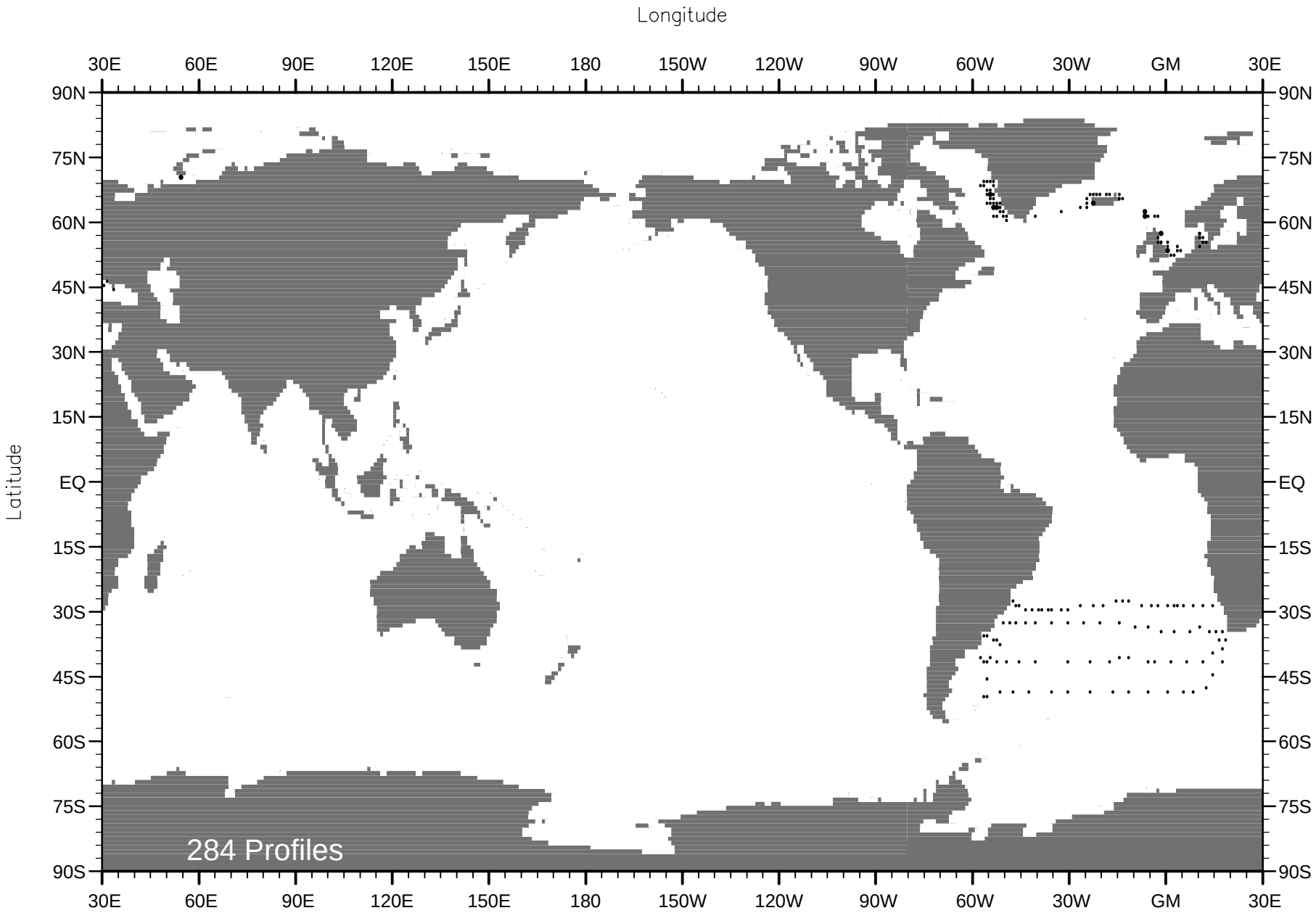


Fig. A9 Distribution of all Ocean Station Data (OSD) pH profiles in WOD01 for year 1925 .

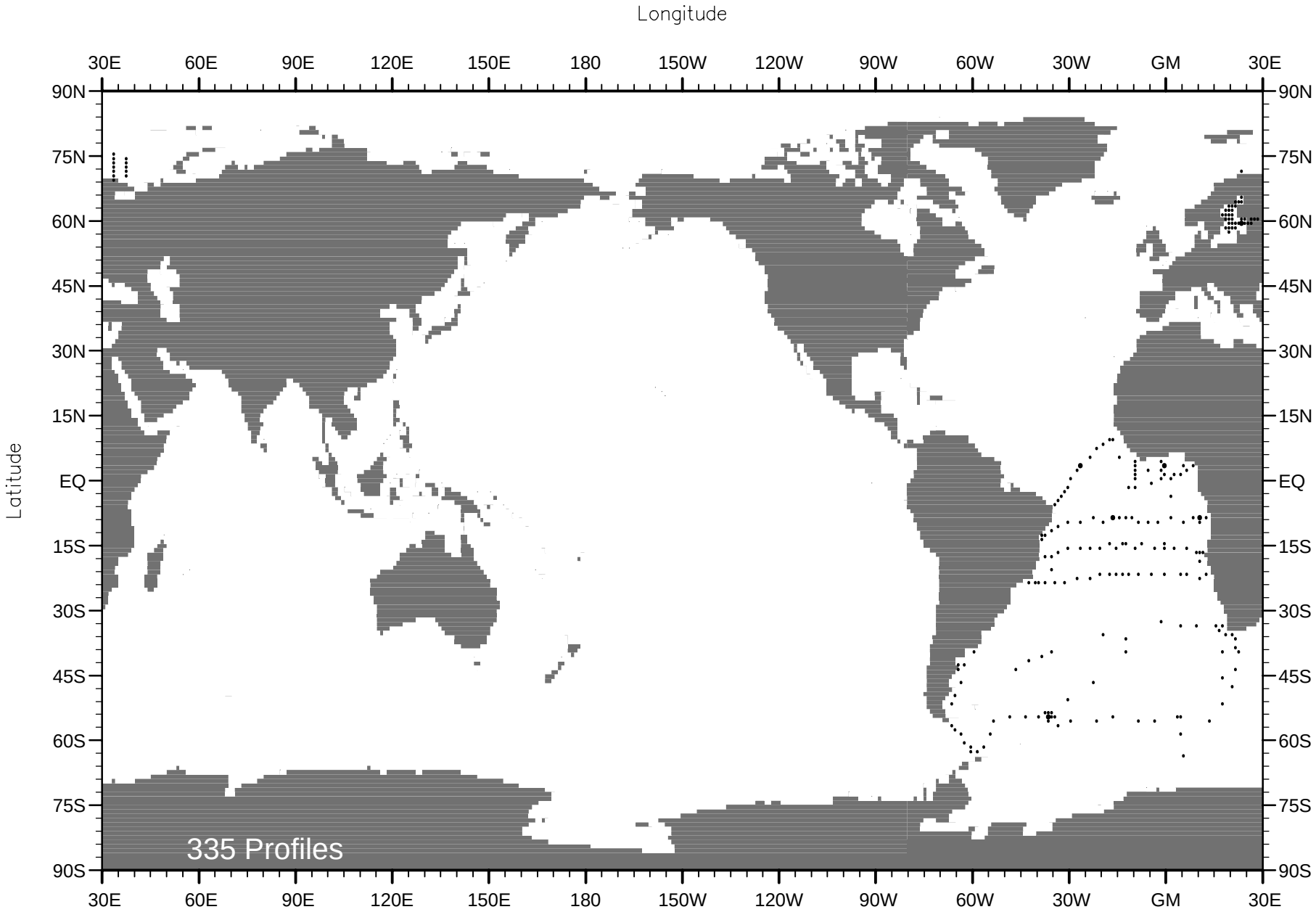


Fig. A10 Distribution of all Ocean Station Data (OSD) pH profiles in WOD01 for year 1926 .

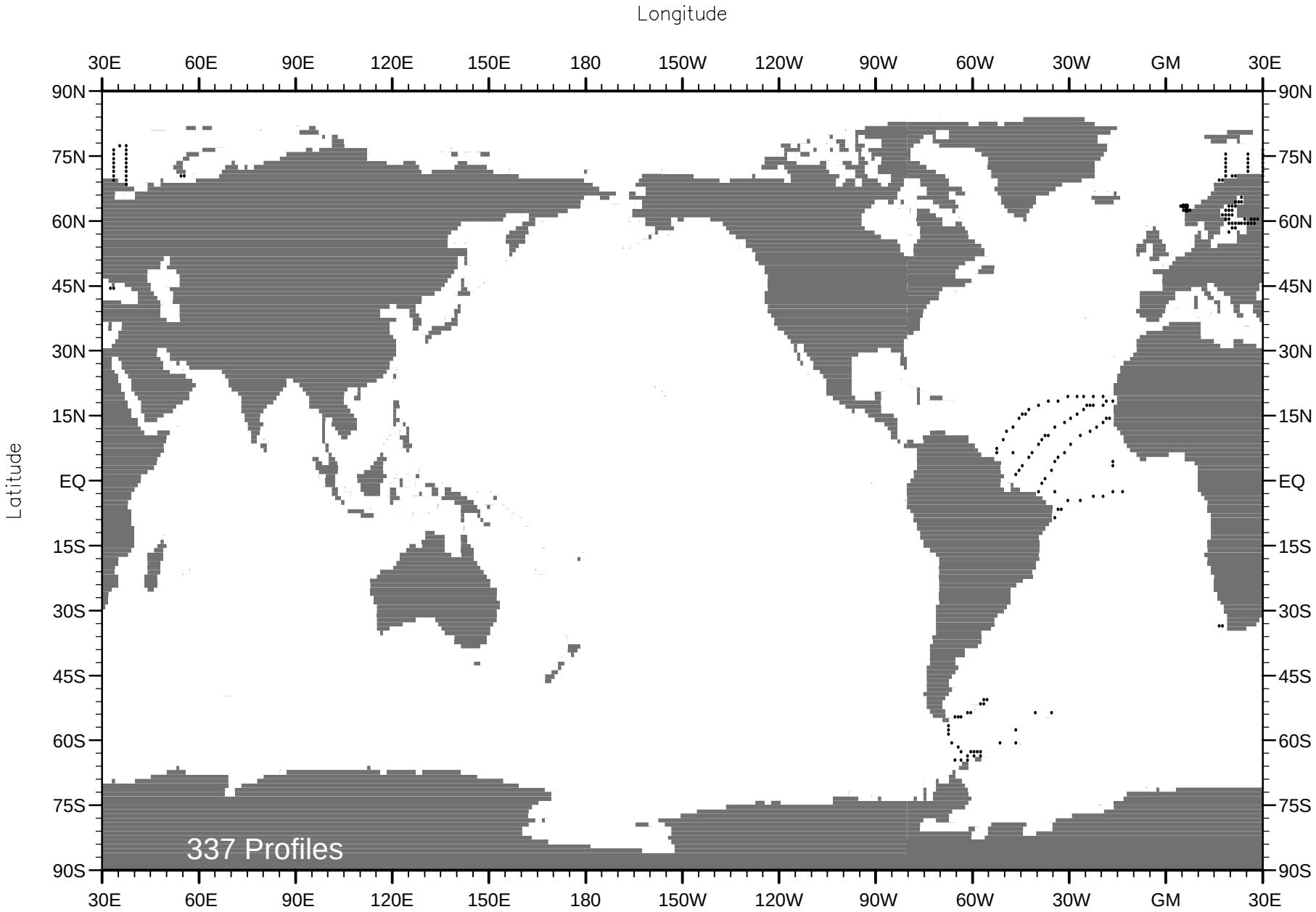


Fig. A11 Distribution of all Ocean Station Data (OSD) pH profiles in WOD01 for year 1927 .

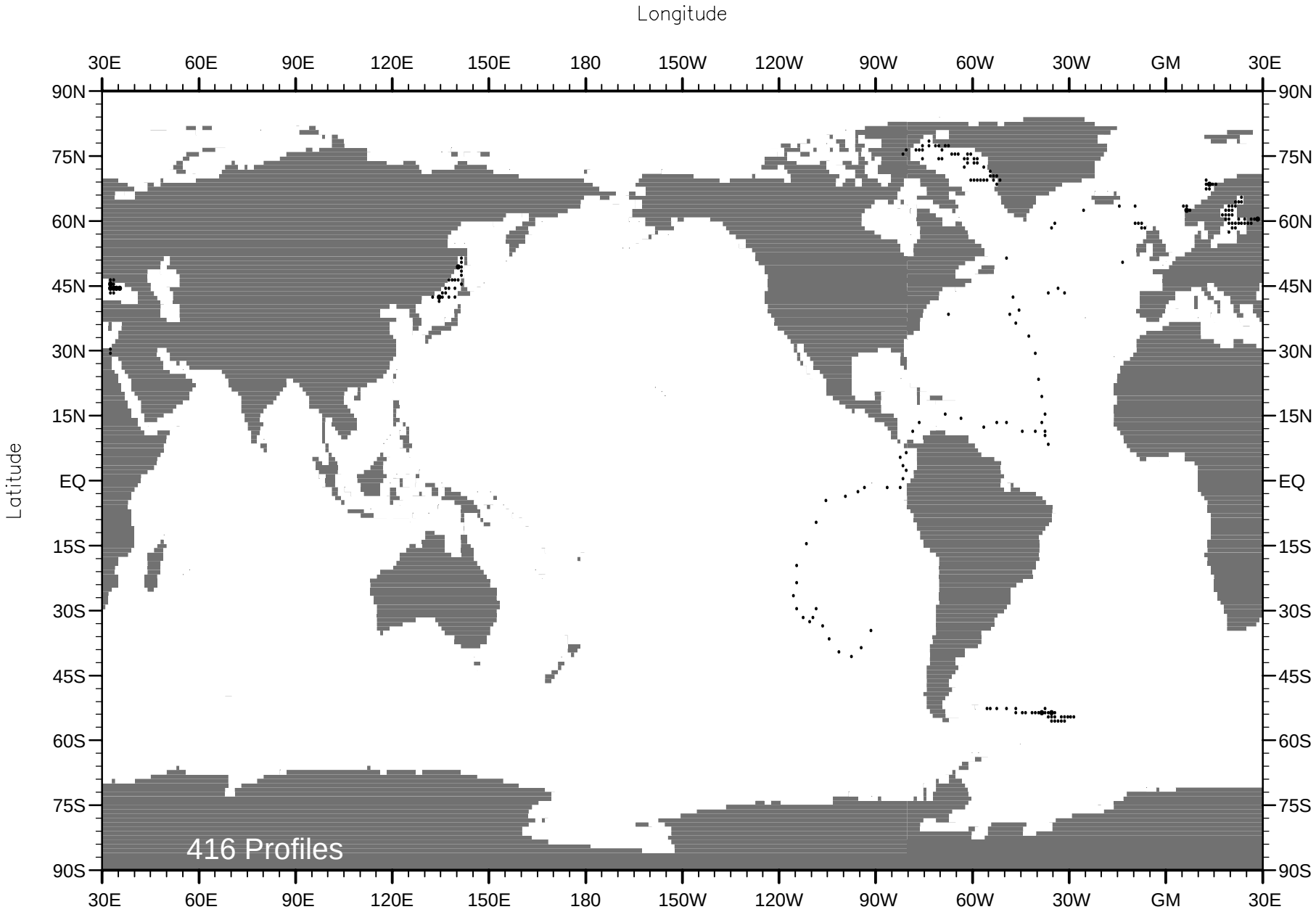


Fig. A12 Distribution of all Ocean Station Data (OSD) pH profiles in WOD01 for year 1928 .

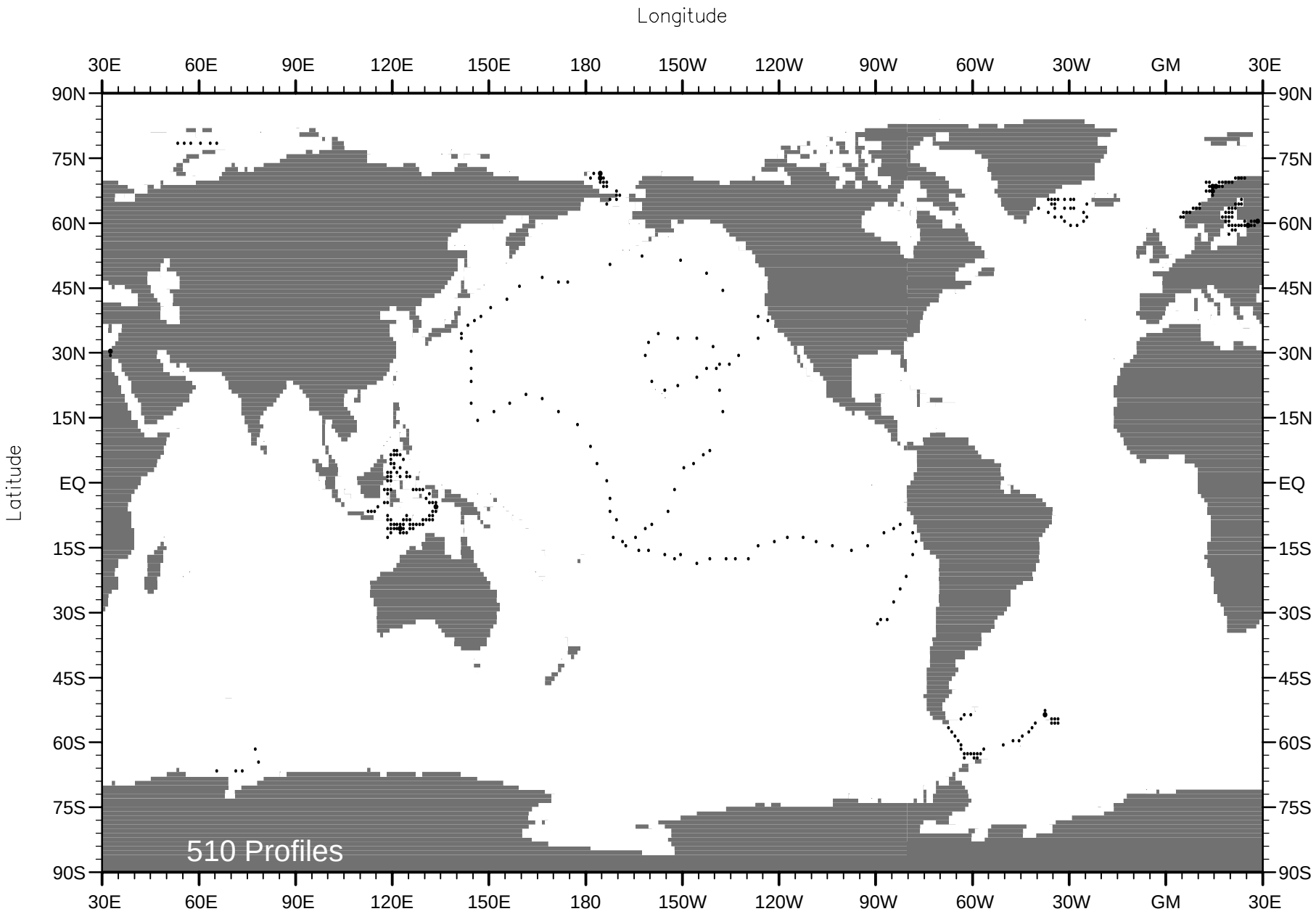


Fig. A13 Distribution of all Ocean Station Data (OSD) pH profiles in WOD01 for year 1929 .

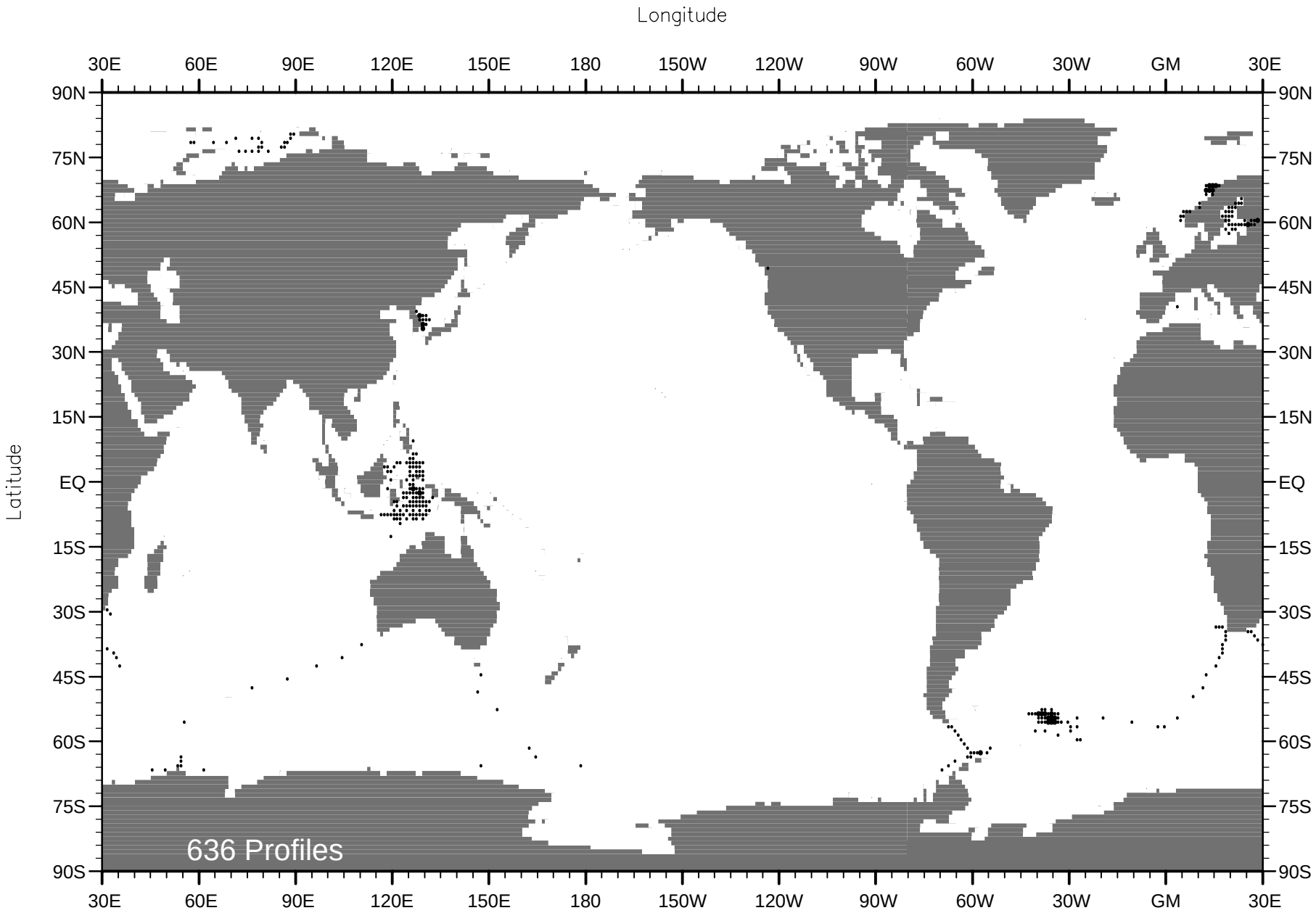


Fig. A14 Distribution of all Ocean Station Data (OSD) pH profiles in WOD01 for year 1930 .

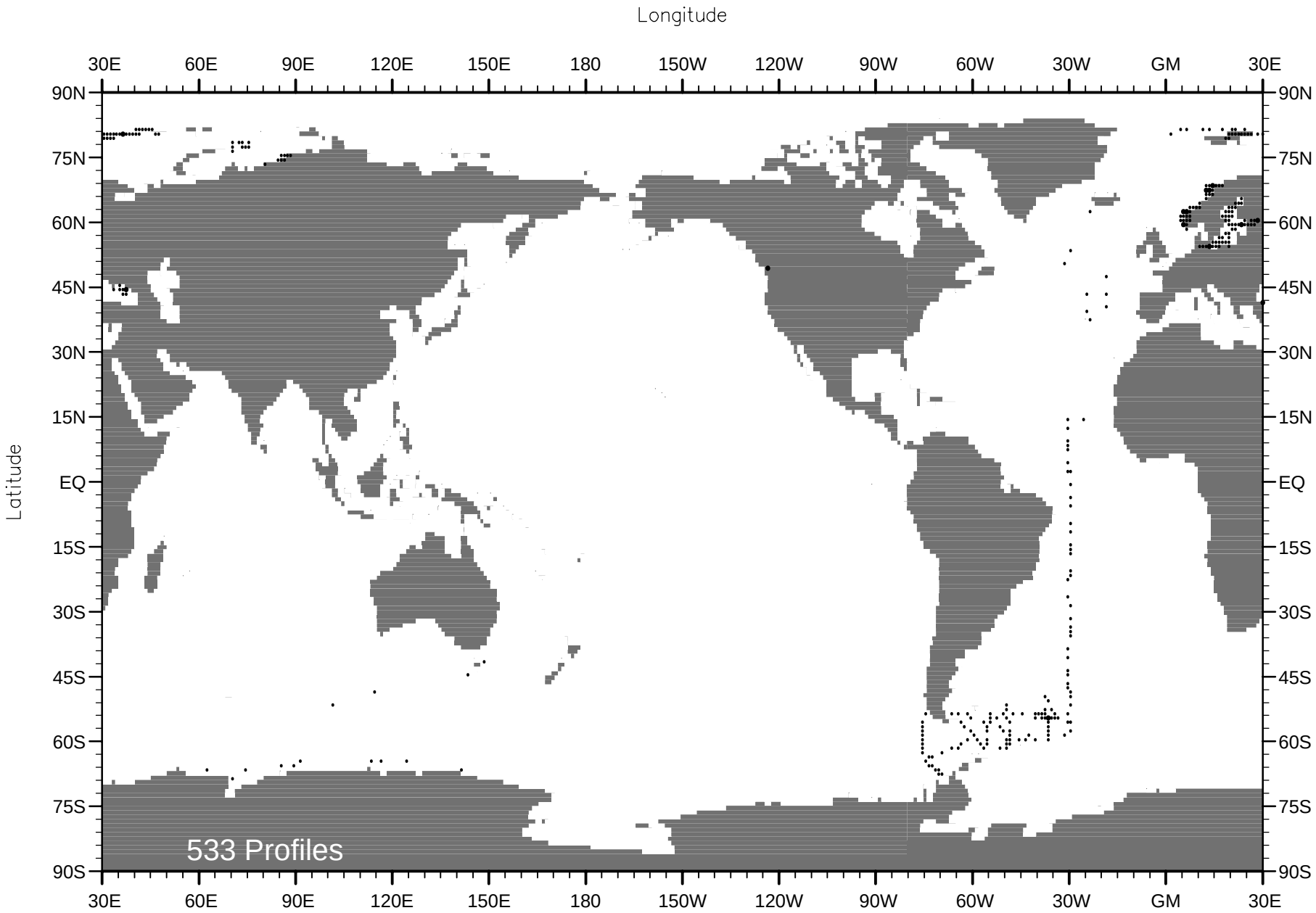


Fig. A15 Distribution of all Ocean Station Data (OSD) pH profiles in WOD01 for year 1931 .

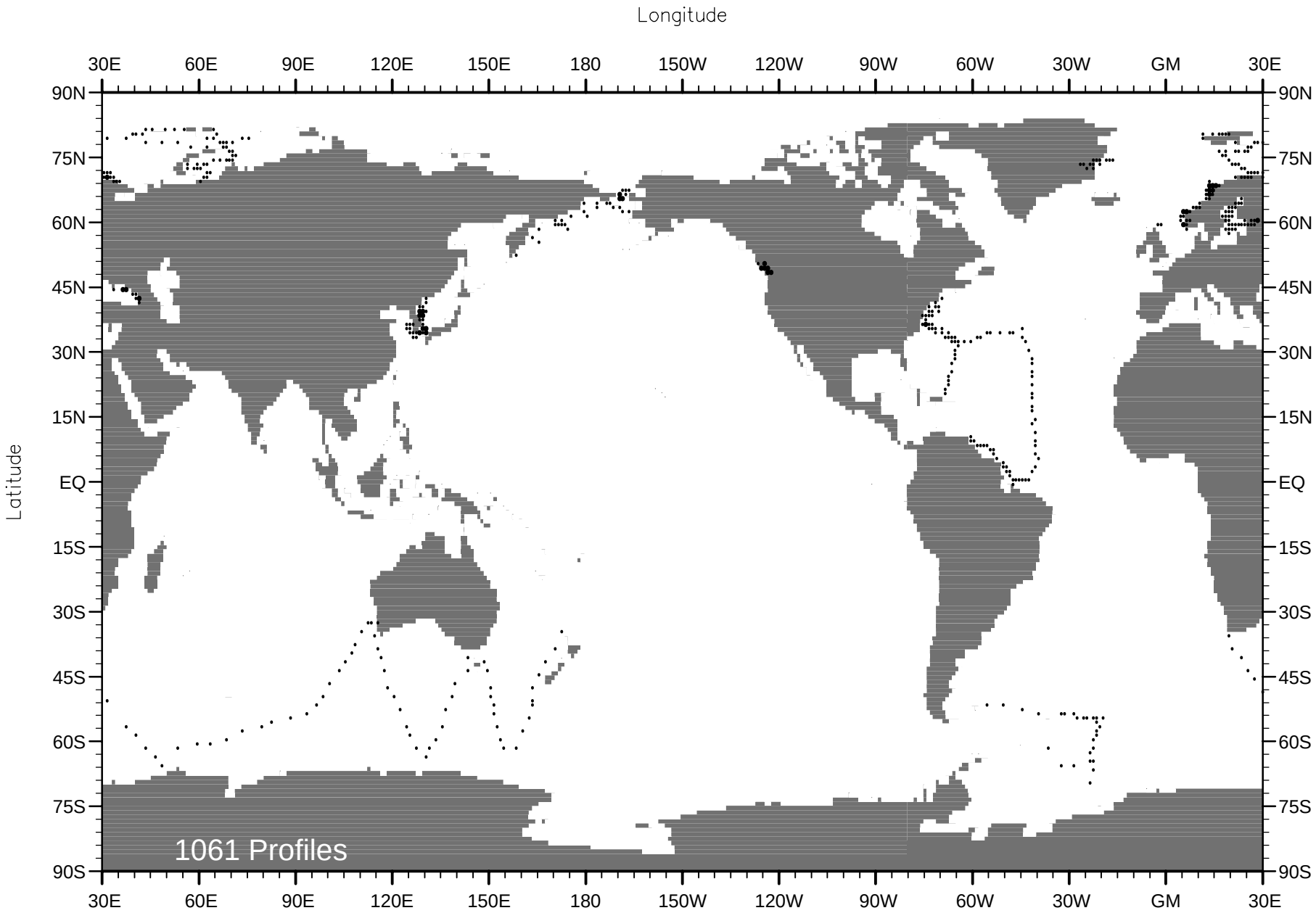


Fig. A16 Distribution of all Ocean Station Data (OSD) pH profiles in WOD01 for year 1932 .

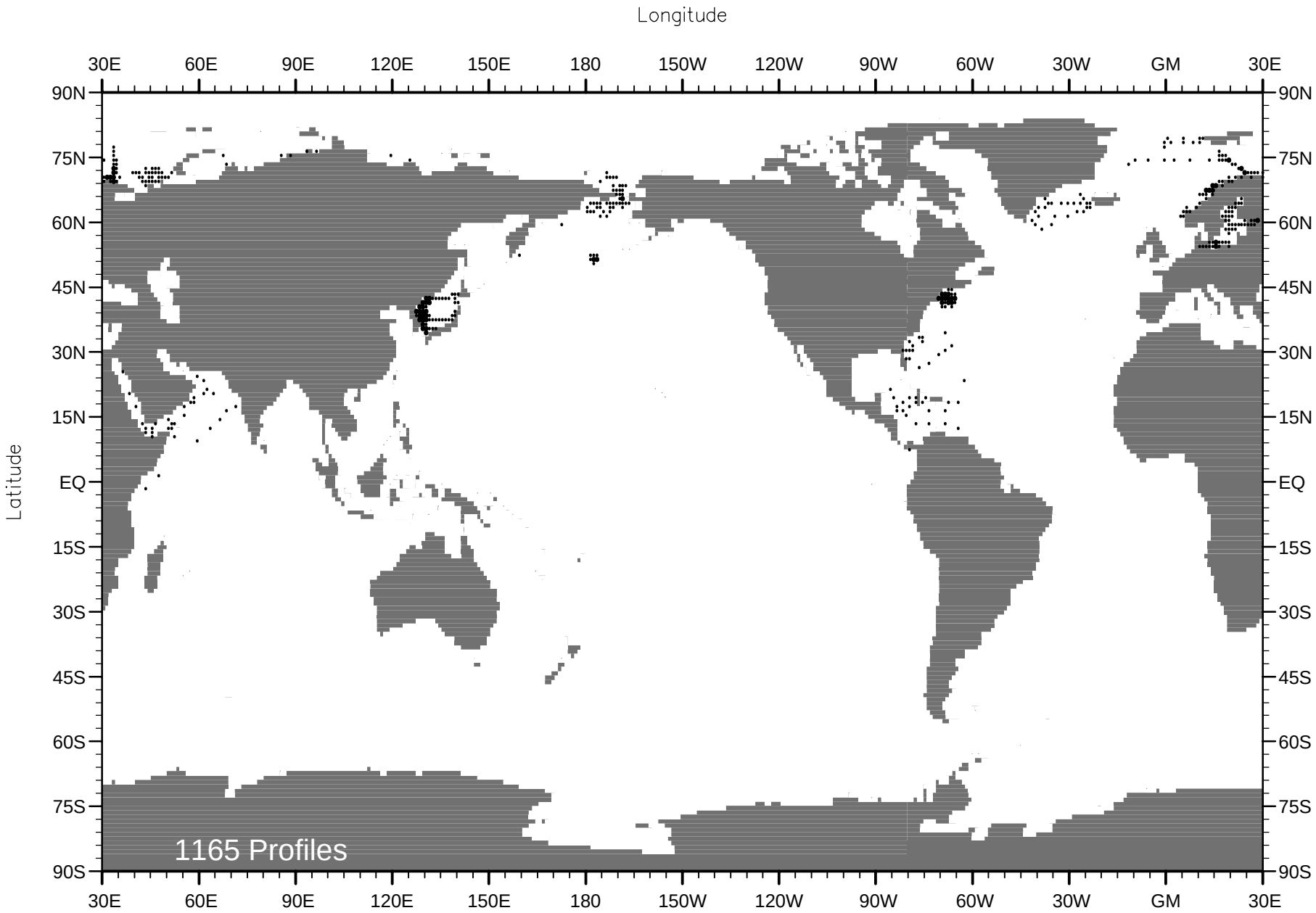


Fig. A17 Distribution of all Ocean Station Data (OSD) pH profiles in WOD01 for year 1933 .

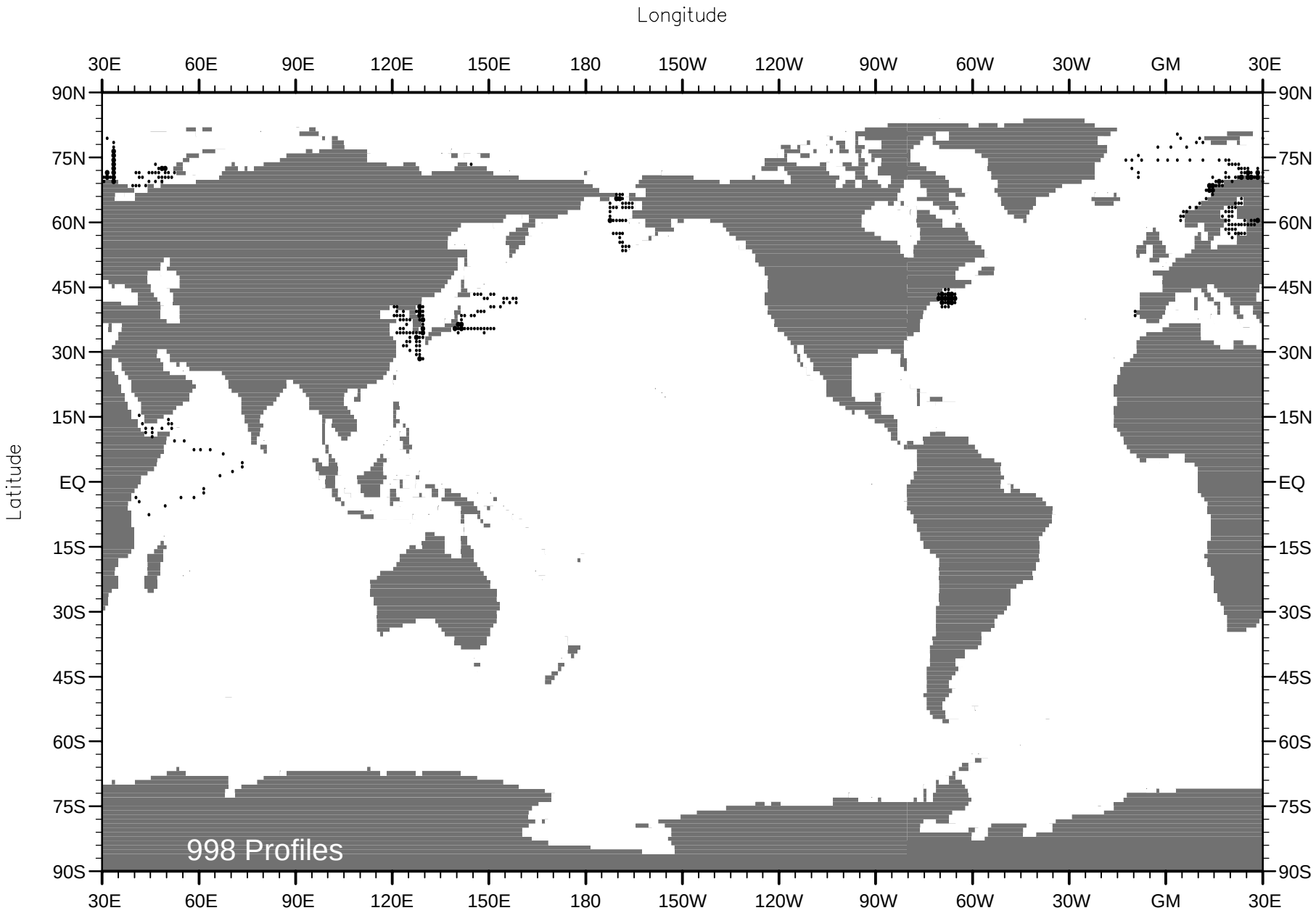


Fig. A18 Distribution of all Ocean Station Data (OSD) pH profiles in WOD01 for year 1934 .

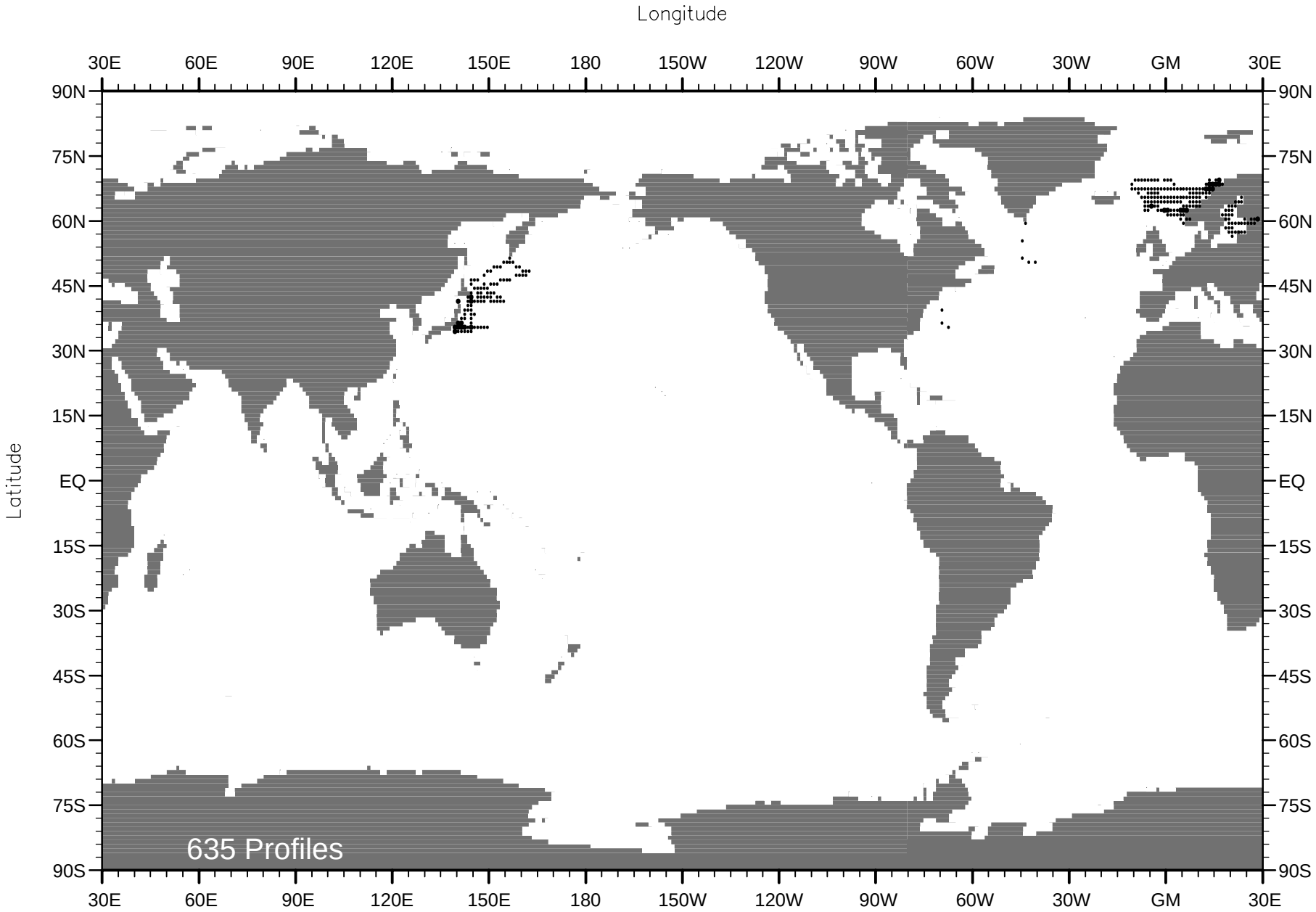


Fig. A19 Distribution of all Ocean Station Data (OSD) pH profiles in WOD01 for year 1935 .

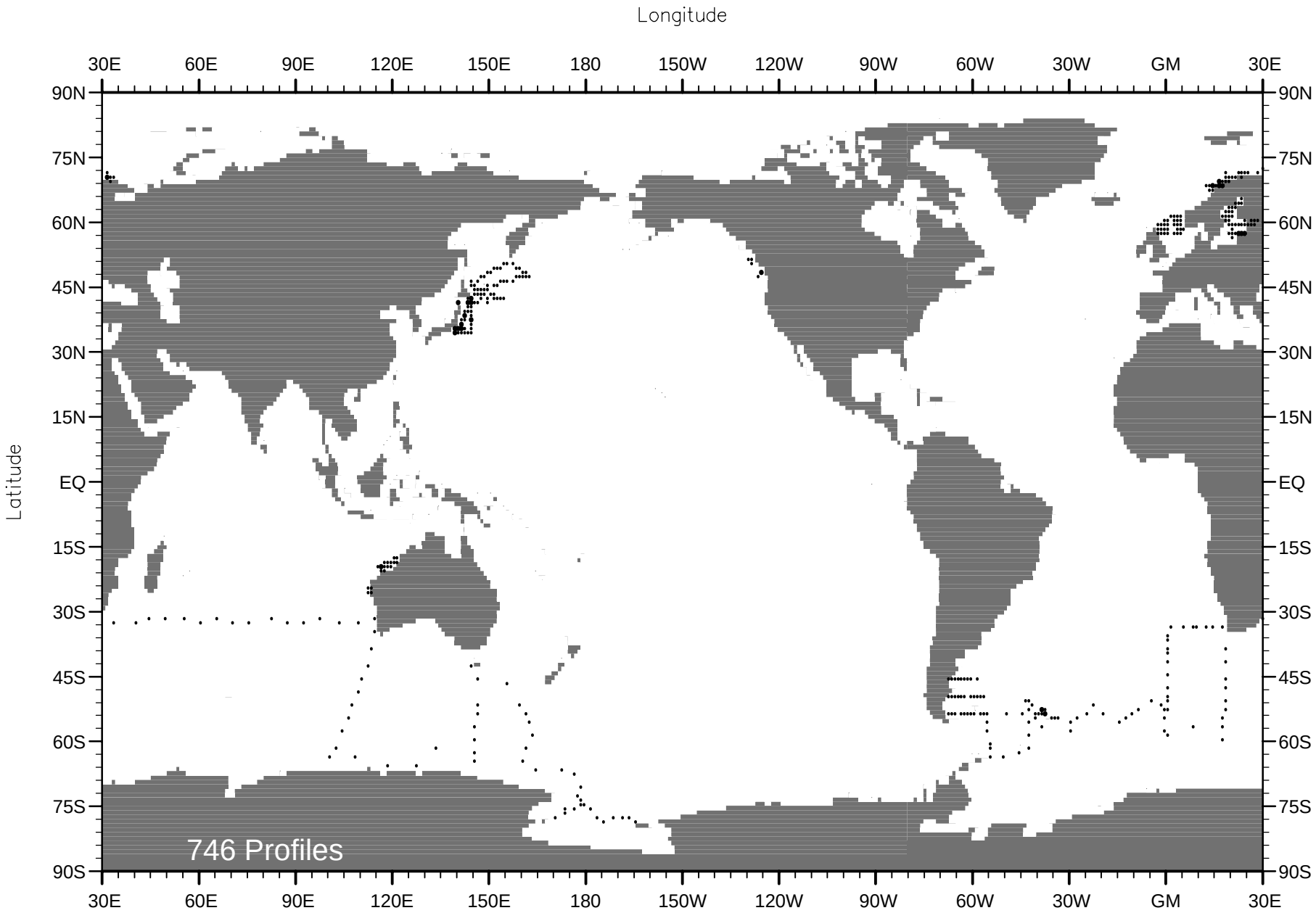


Fig. A20 Distribution of all Ocean Station Data (OSD) pH profiles in WOD01 for year 1936 .

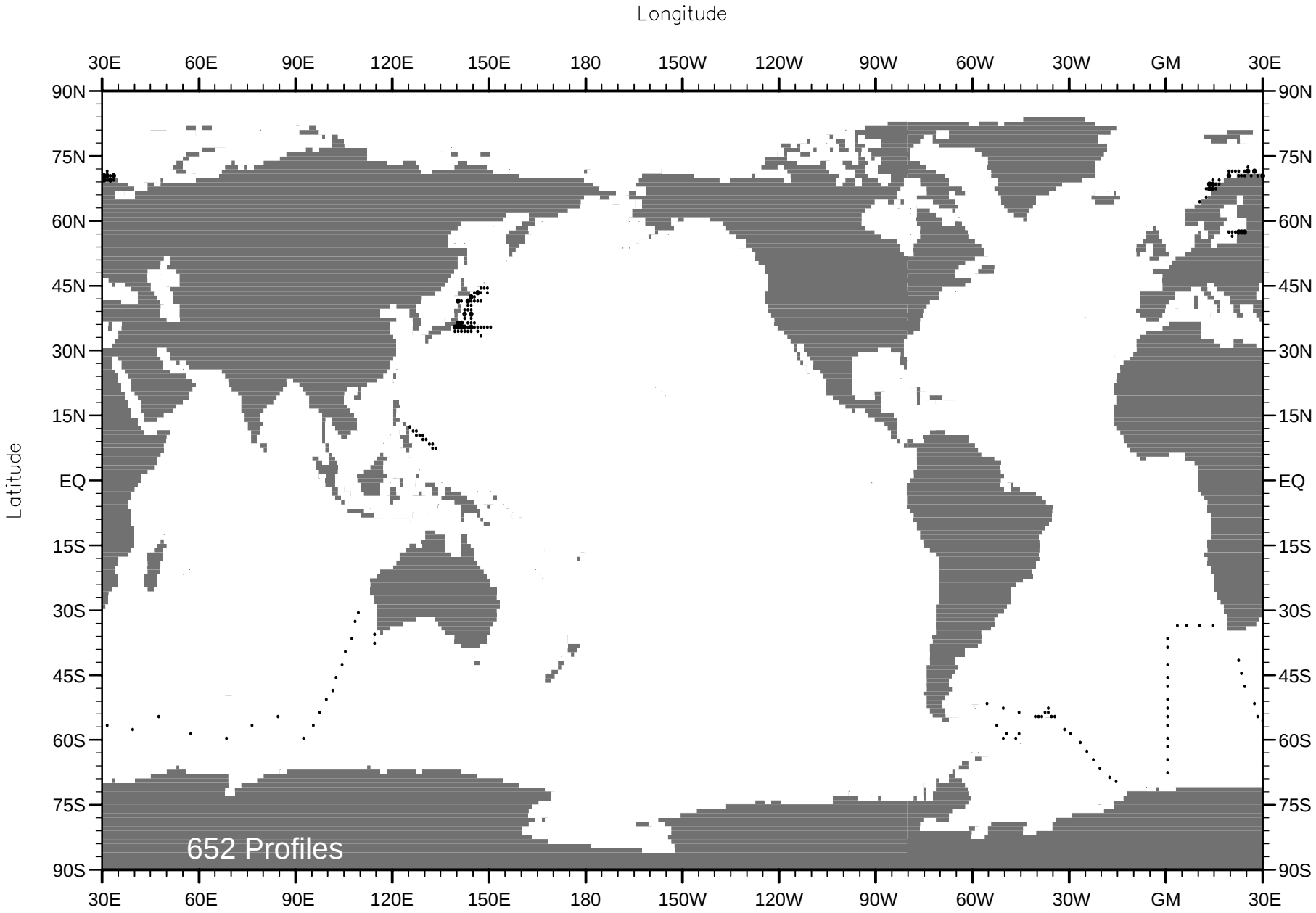


Fig. A21 Distribution of all Ocean Station Data (OSD) pH profiles in WOD01 for year 1937 .

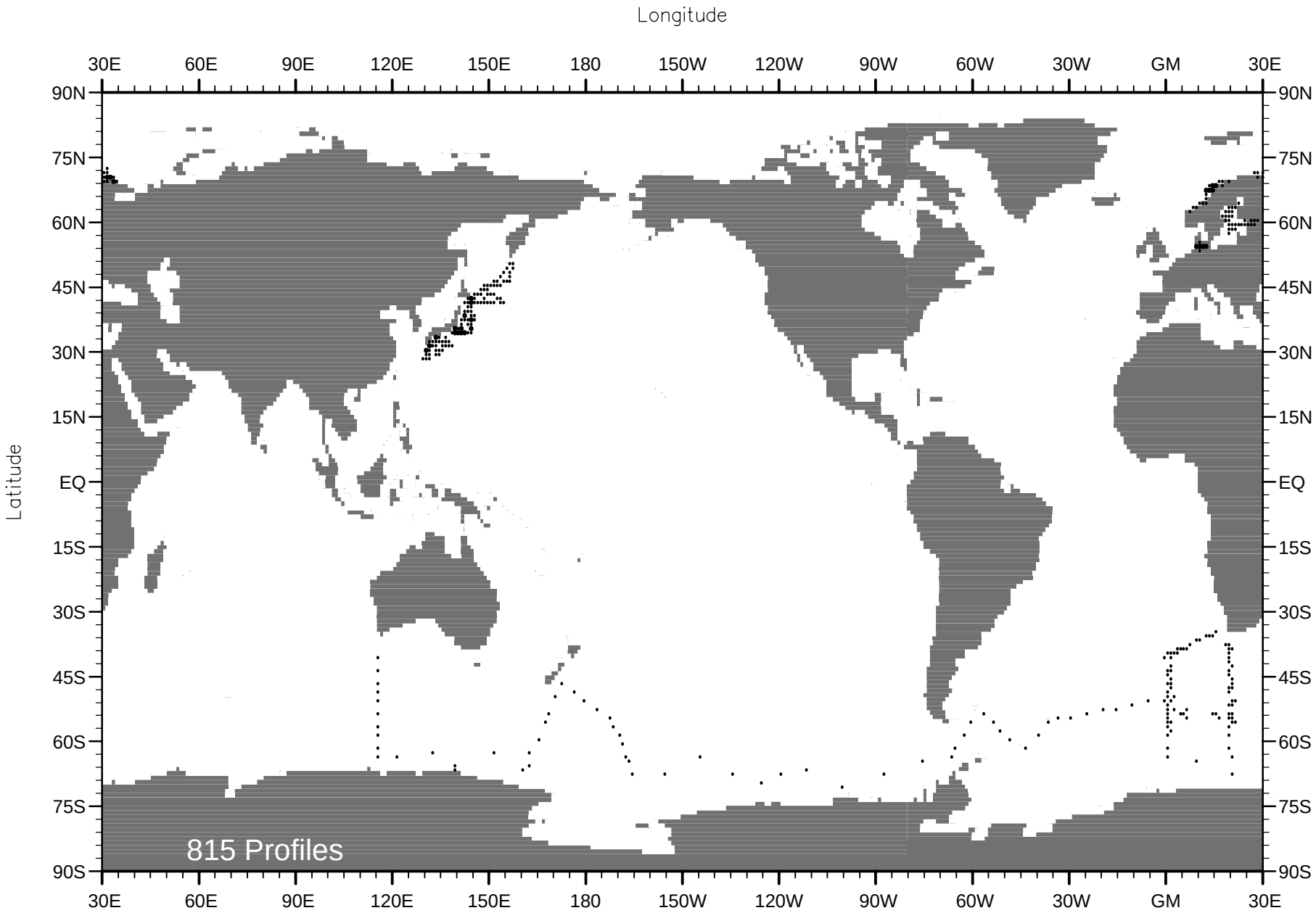


Fig. A22 Distribution of all Ocean Station Data (OSD) pH profiles in WOD01 for year 1938 .

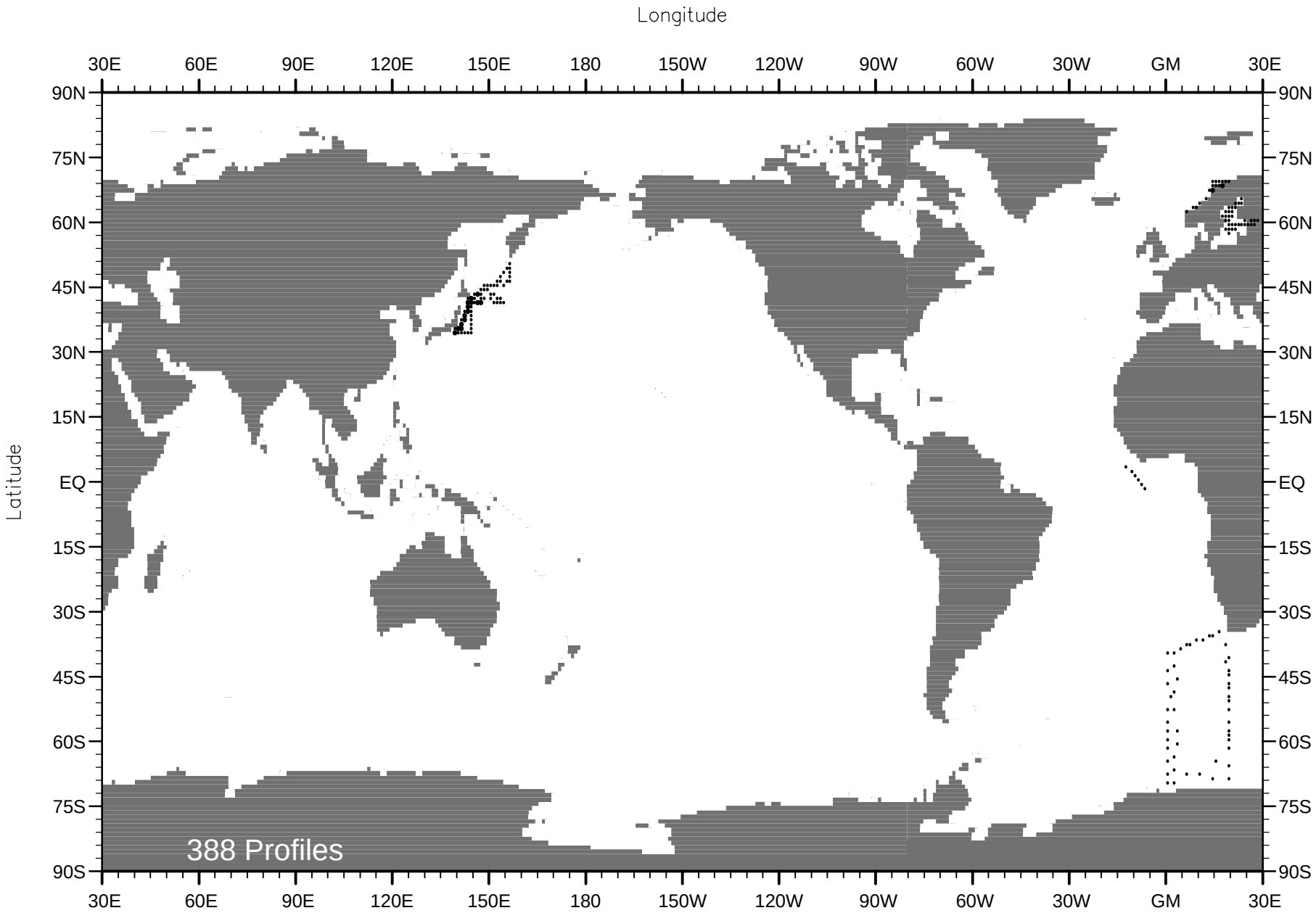


Fig. A23 Distribution of all Ocean Station Data (OSD) pH profiles in WOD01 for year 1939 .

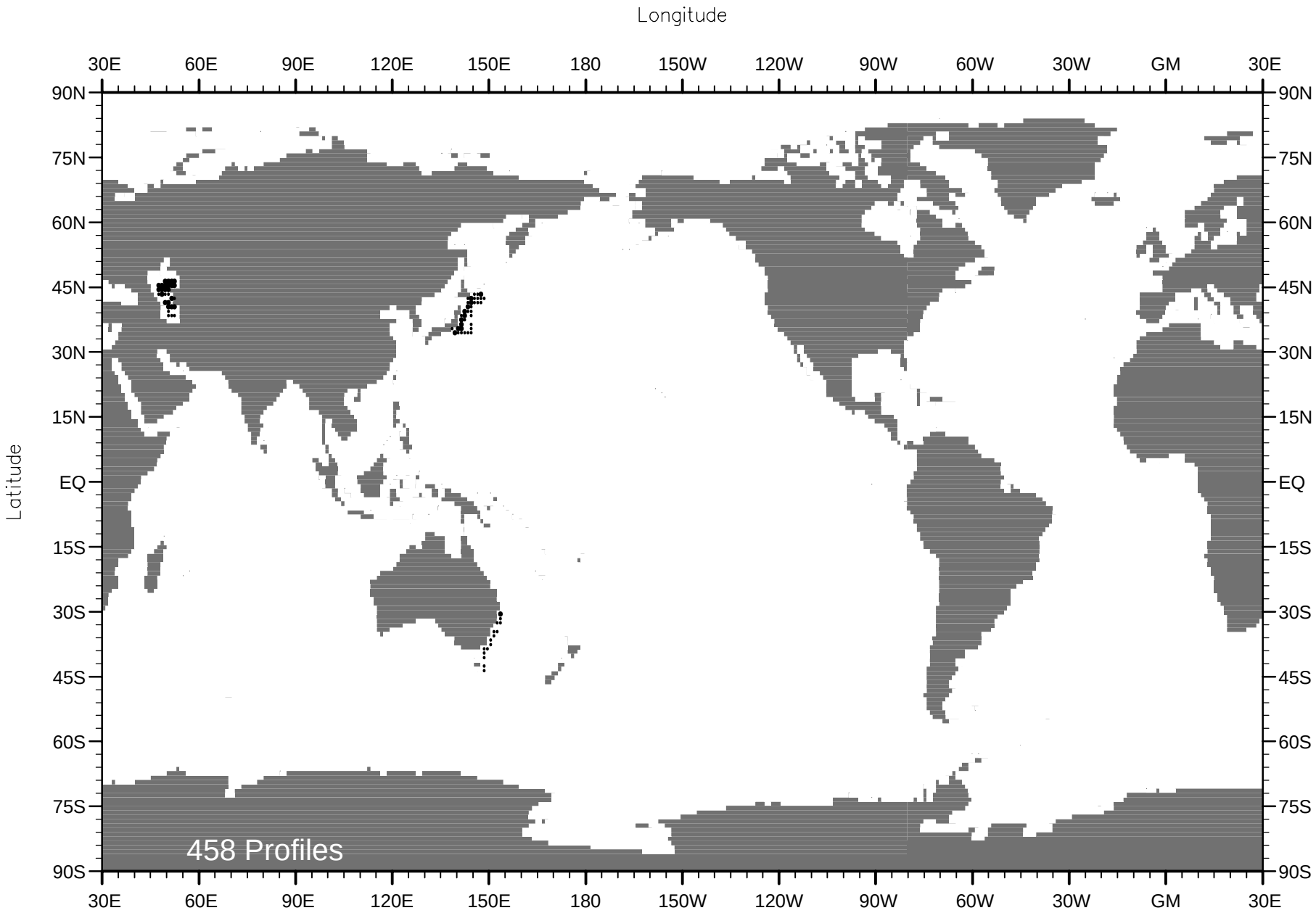


Fig. A24 Distribution of all Ocean Station Data (OSD) pH profiles in WOD01 for year 1940 .

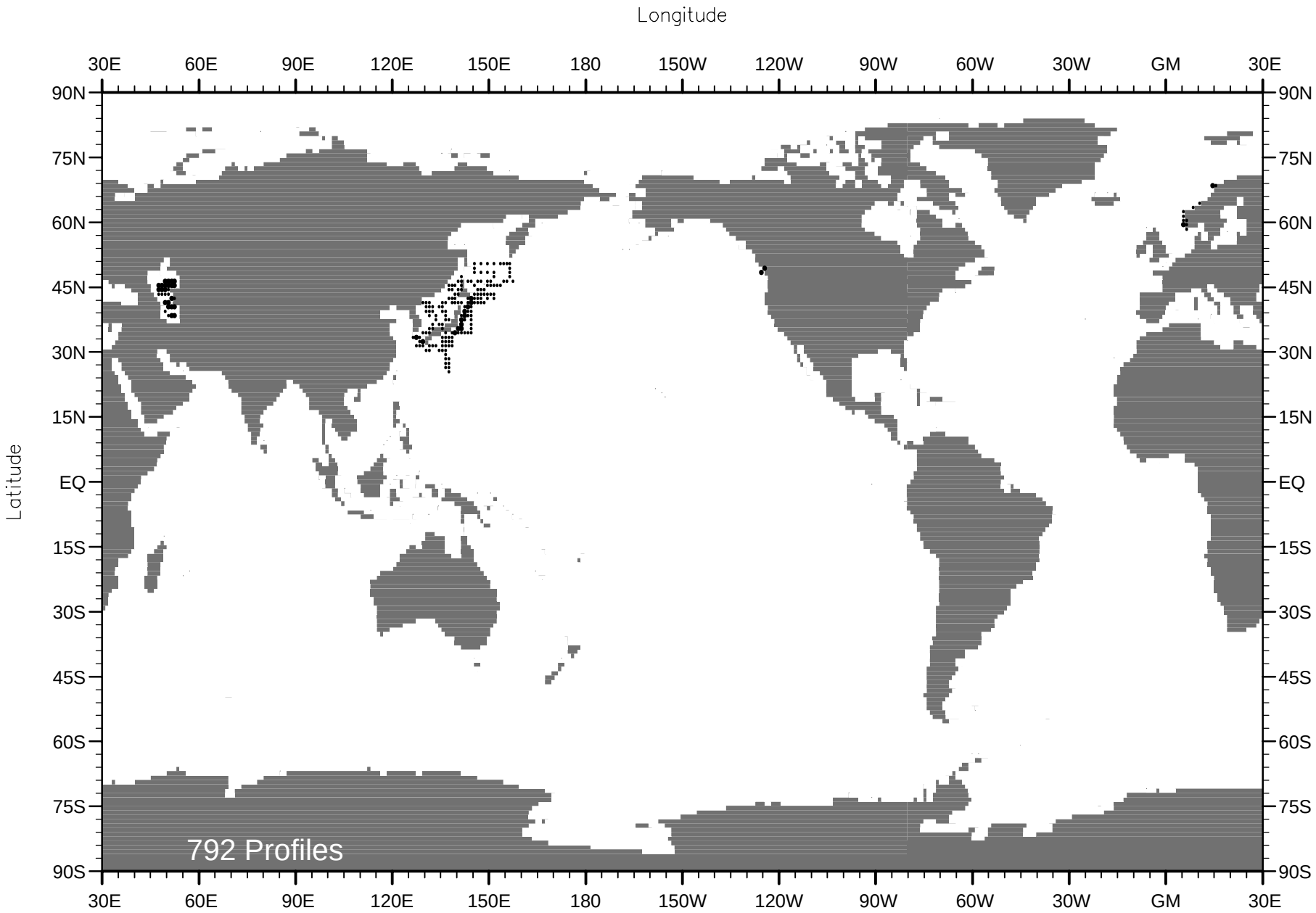


Fig. A25 Distribution of all Ocean Station Data (OSD) pH profiles in WOD01 for year 1941 .

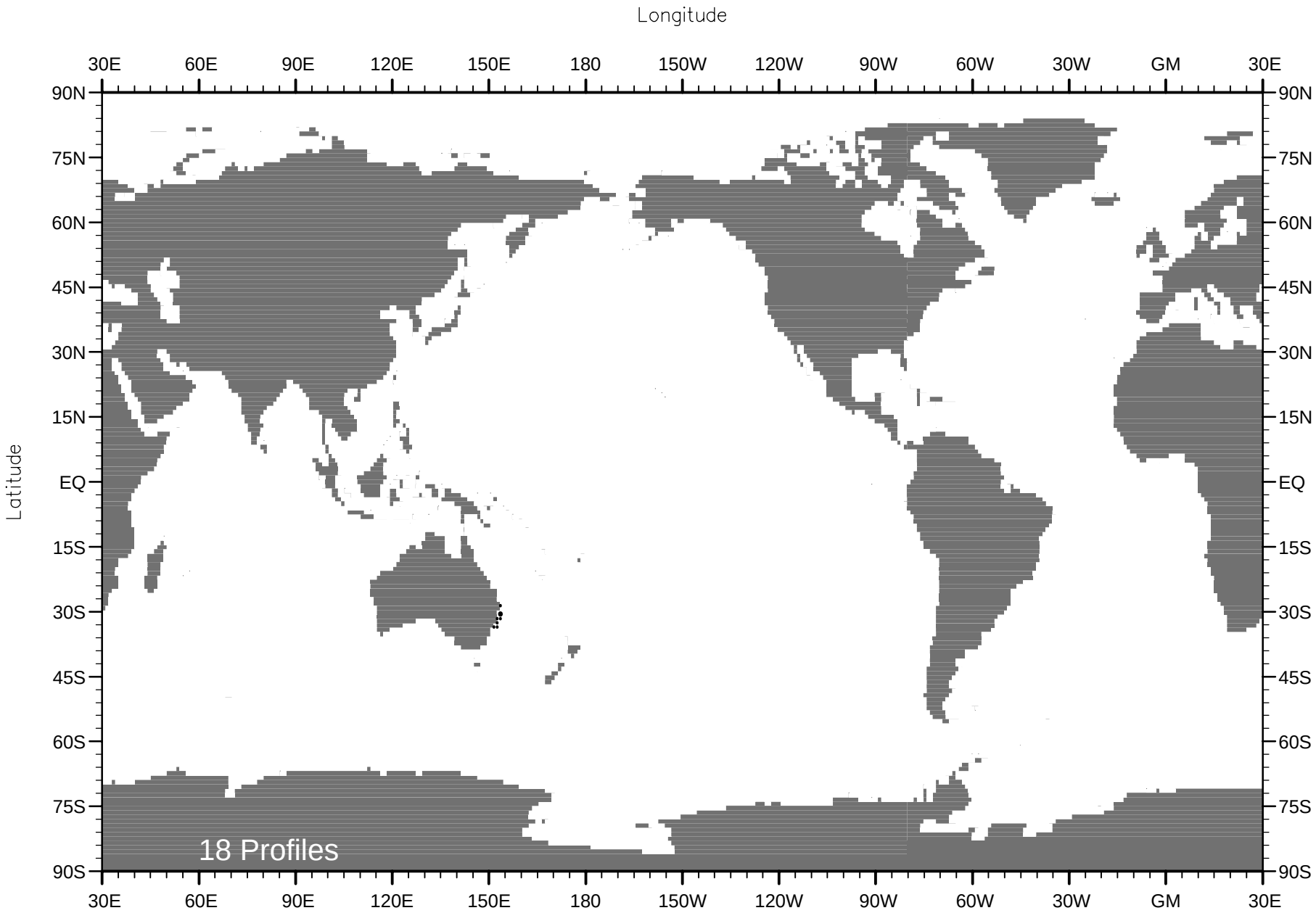


Fig. A26 Distribution of all Ocean Station Data (OSD) pH profiles in WOD01 for year 1942 .

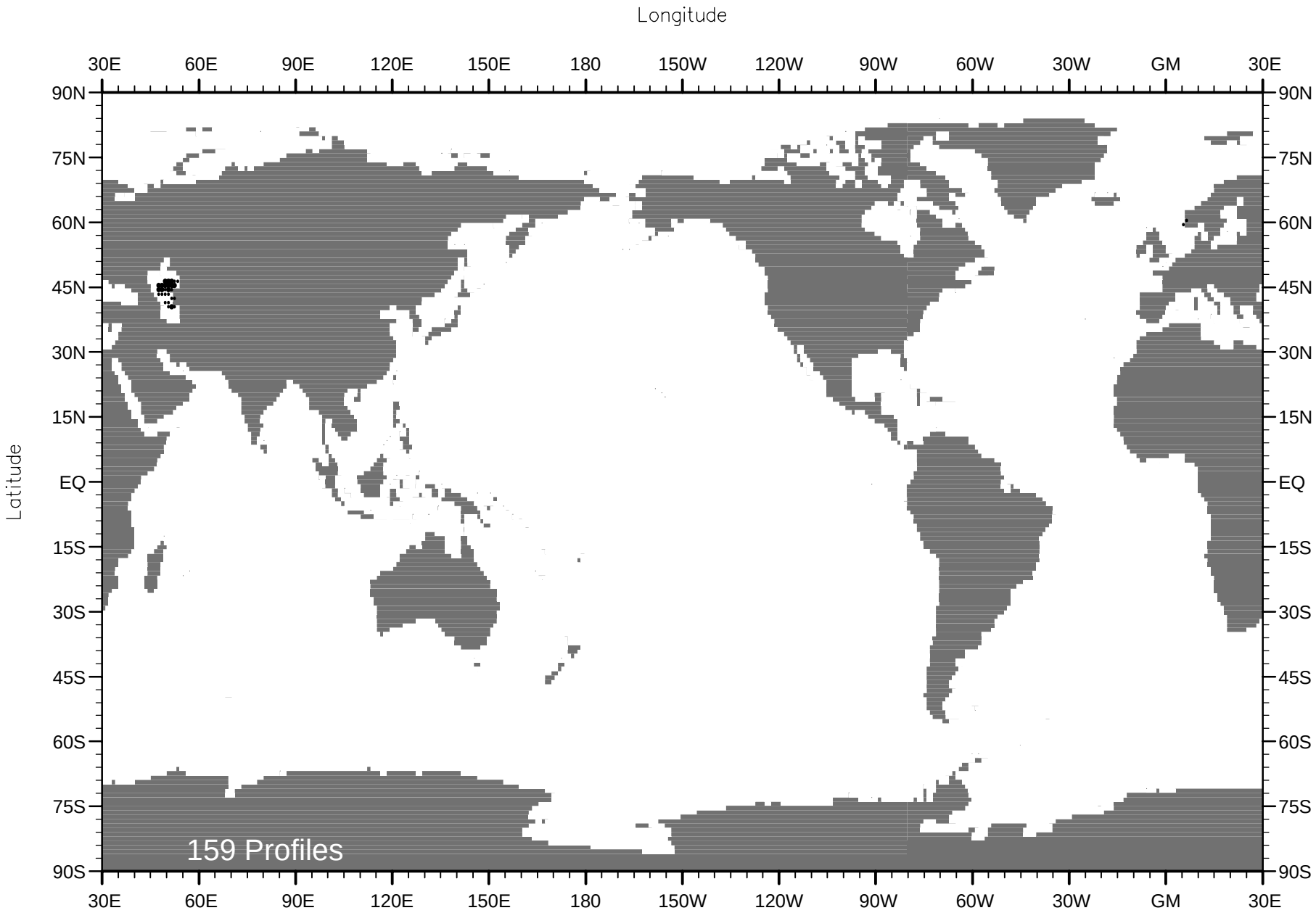


Fig. A27 Distribution of all Ocean Station Data (OSD) pH profiles in WOD01 for year 1943 .

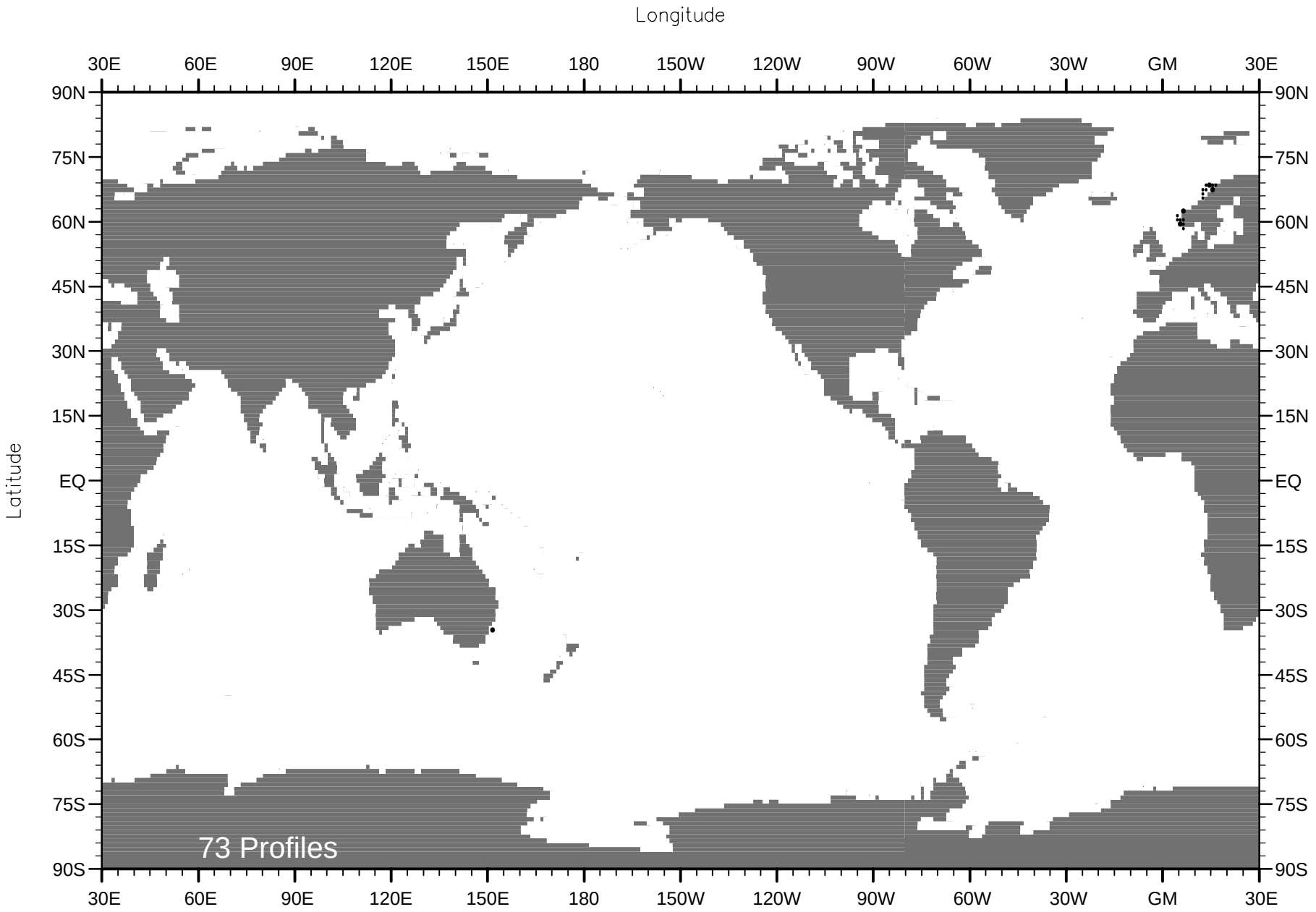


Fig. A28 Distribution of all Ocean Station Data (OSD) pH profiles in WOD01 for year 1944 .

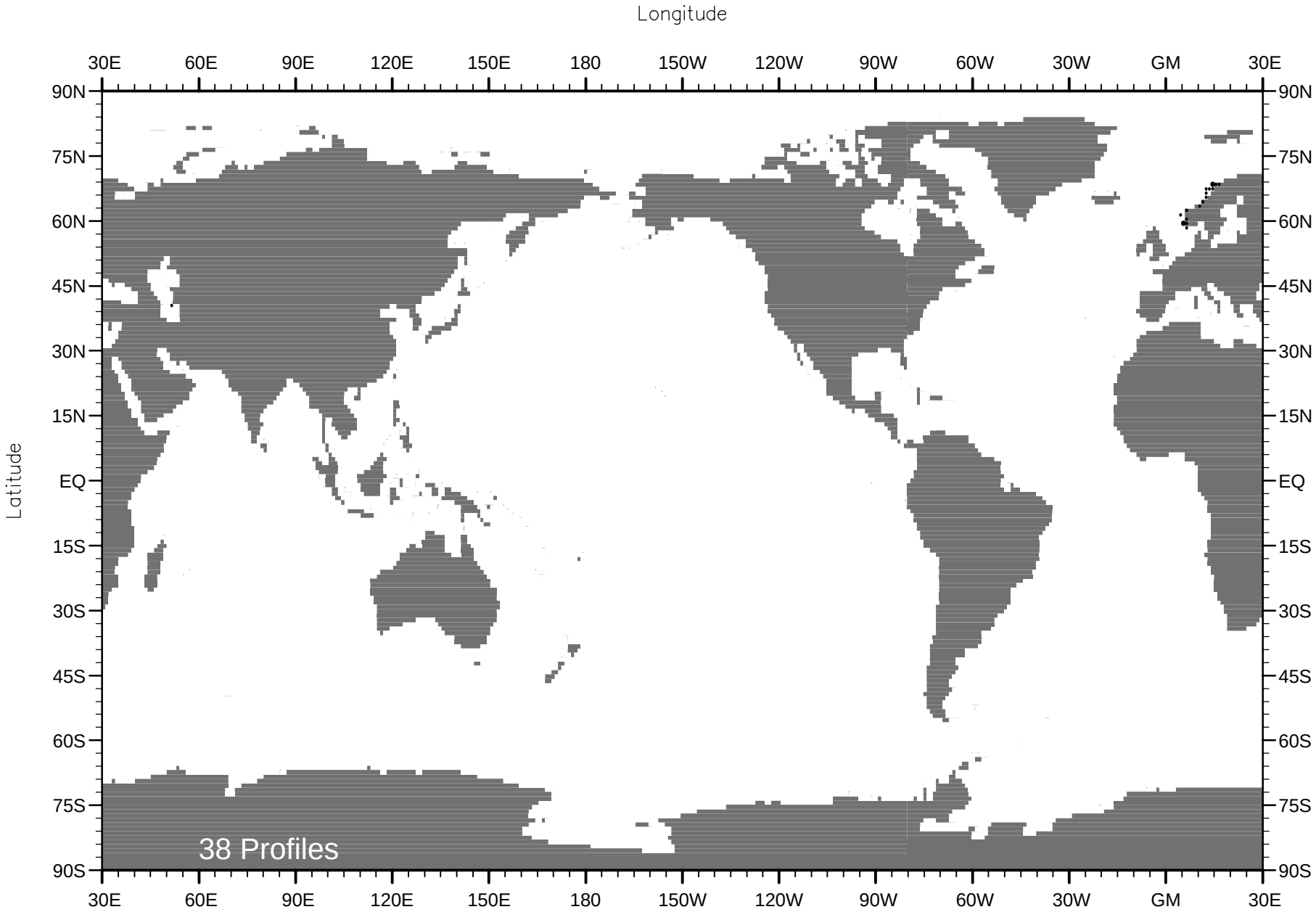


Fig. A29 Distribution of all Ocean Station Data (OSD) pH profiles in WOD01 for year 1945 .

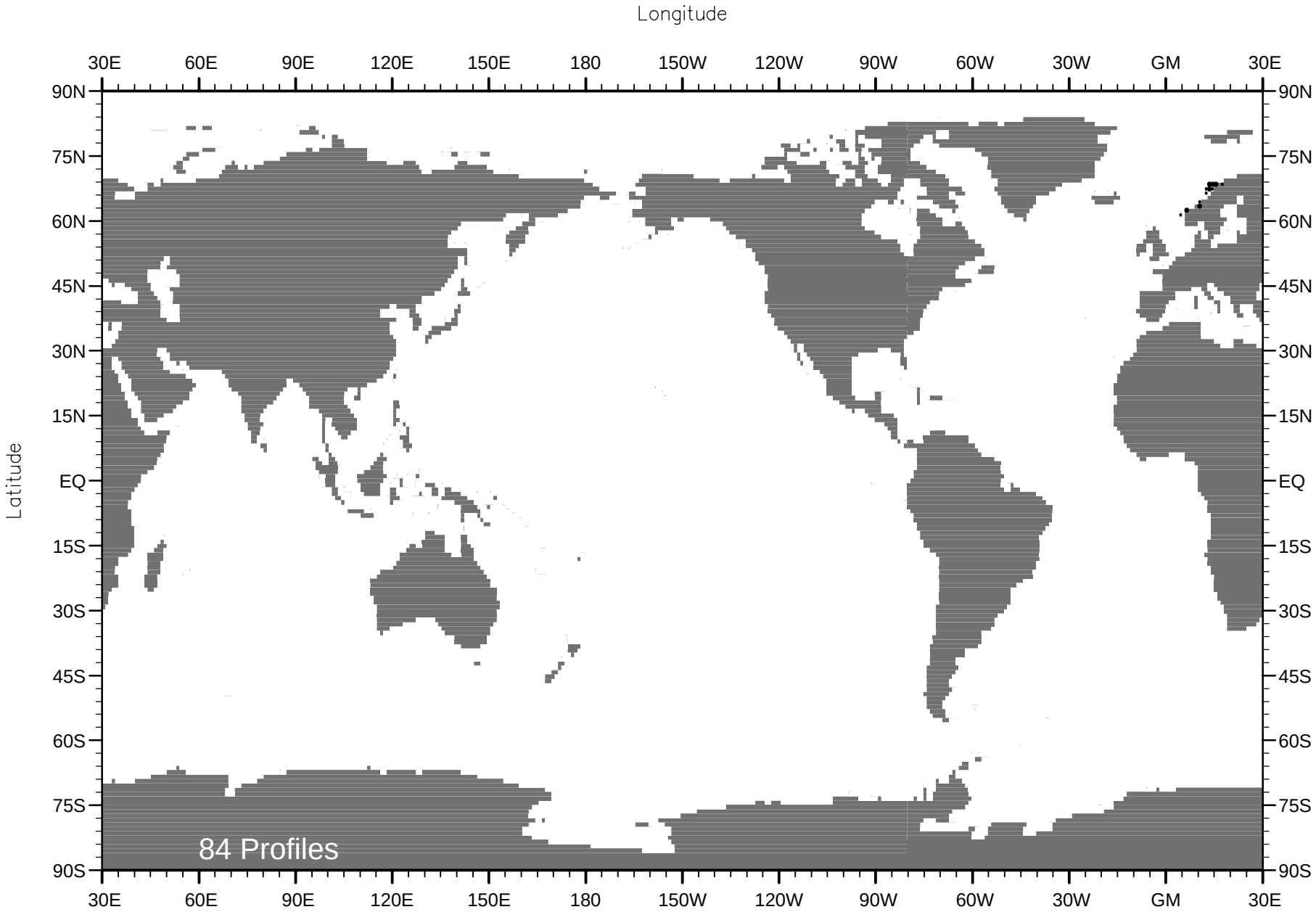


Fig. A30 Distribution of all Ocean Station Data (OSD) pH profiles in WOD01 for year 1946 .

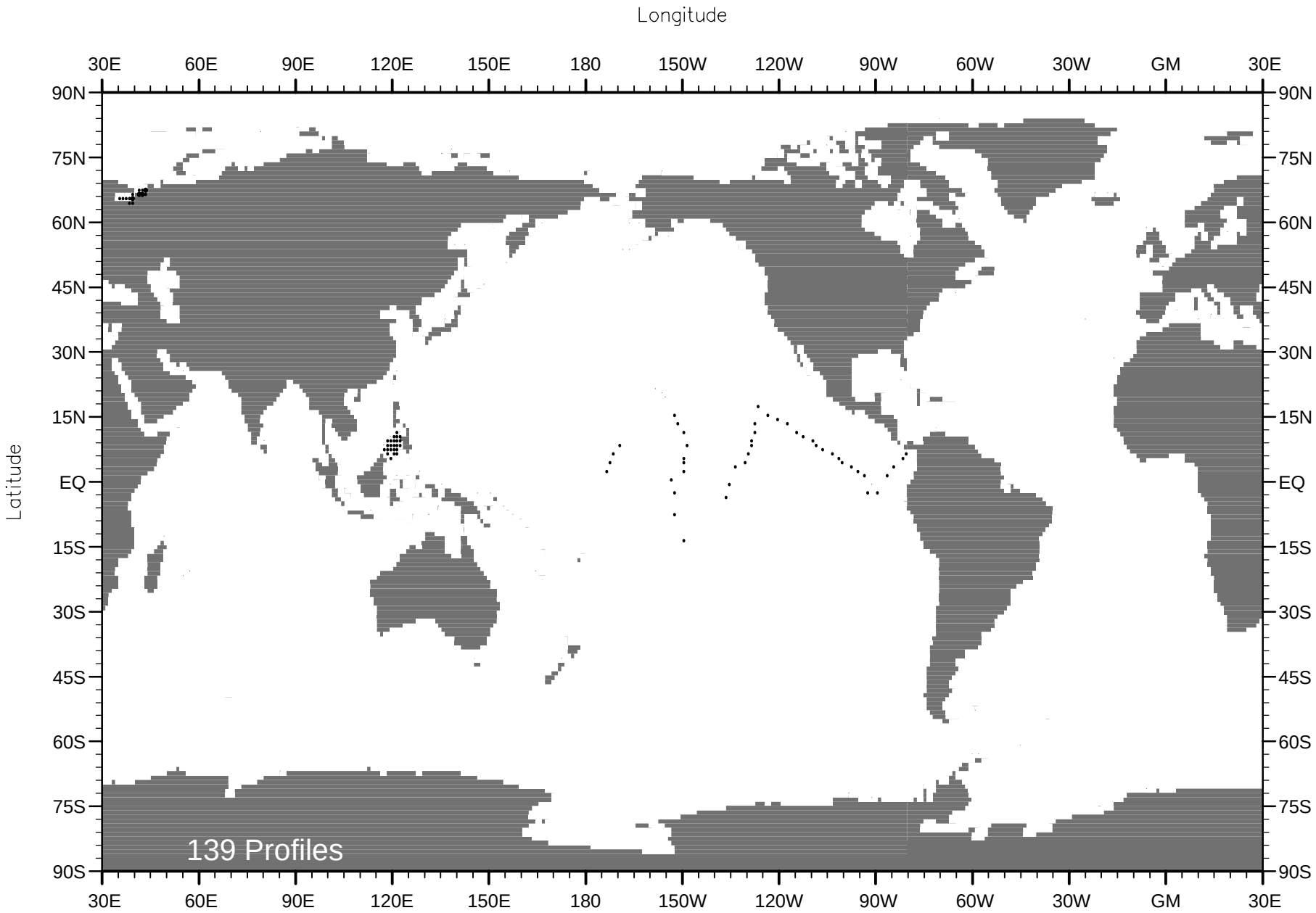


Fig. A31 Distribution of all Ocean Station Data (OSD) pH profiles in WOD01 for year 1947 .

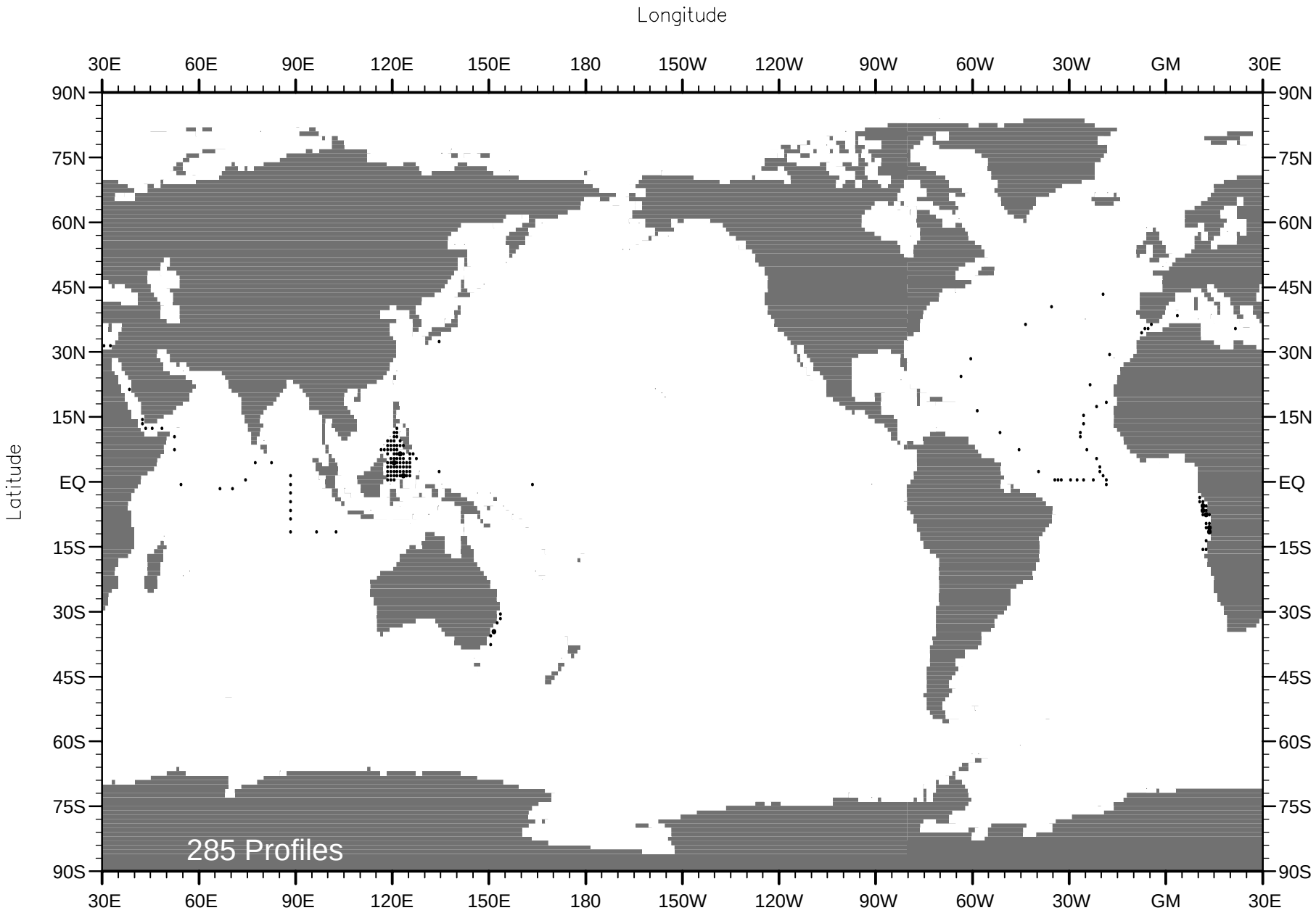


Fig. A32 Distribution of all Ocean Station Data (OSD) pH profiles in WOD01 for year 1948 .

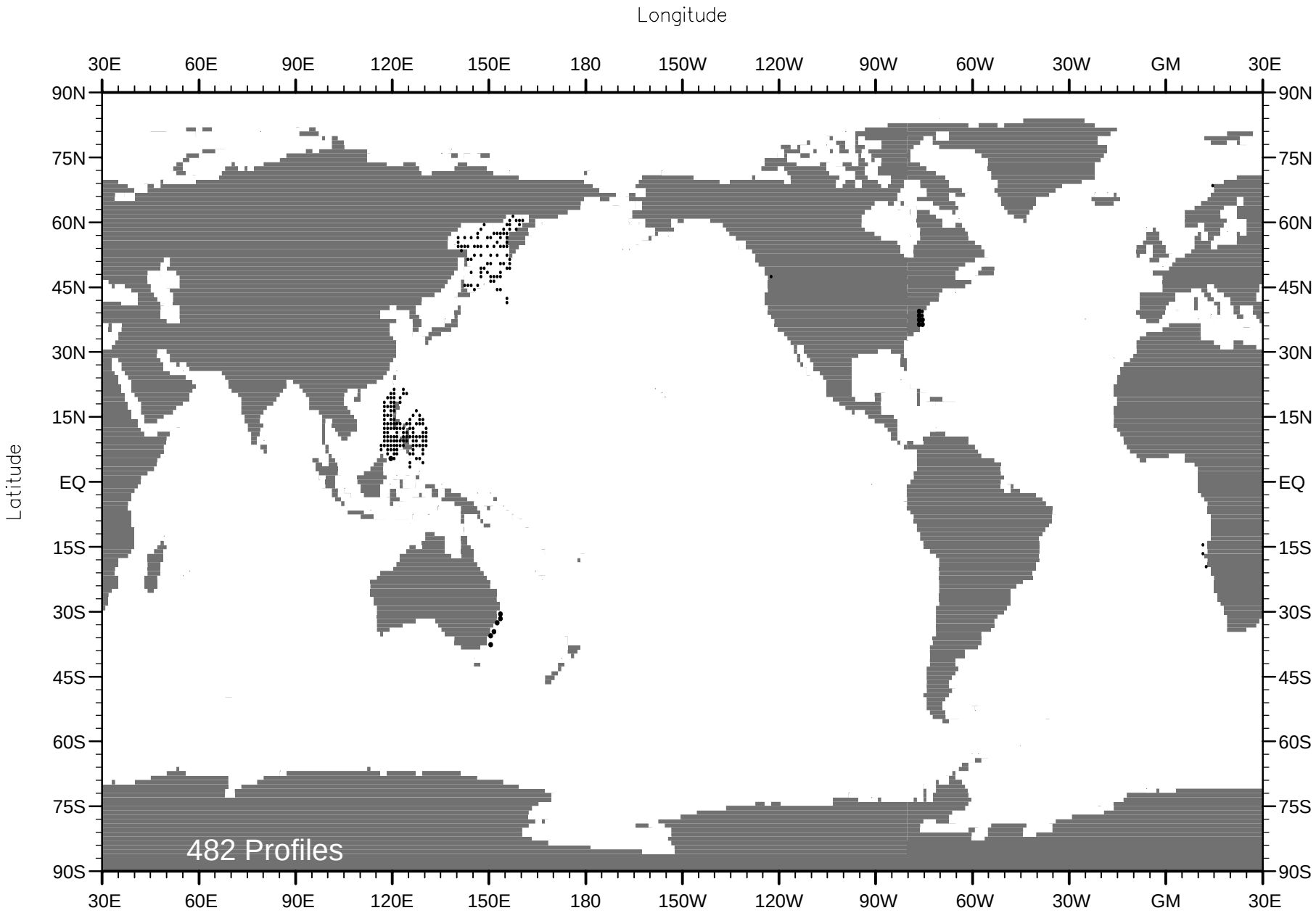


Fig. A33 Distribution of all Ocean Station Data (OSD) pH profiles in WOD01 for year 1949 .

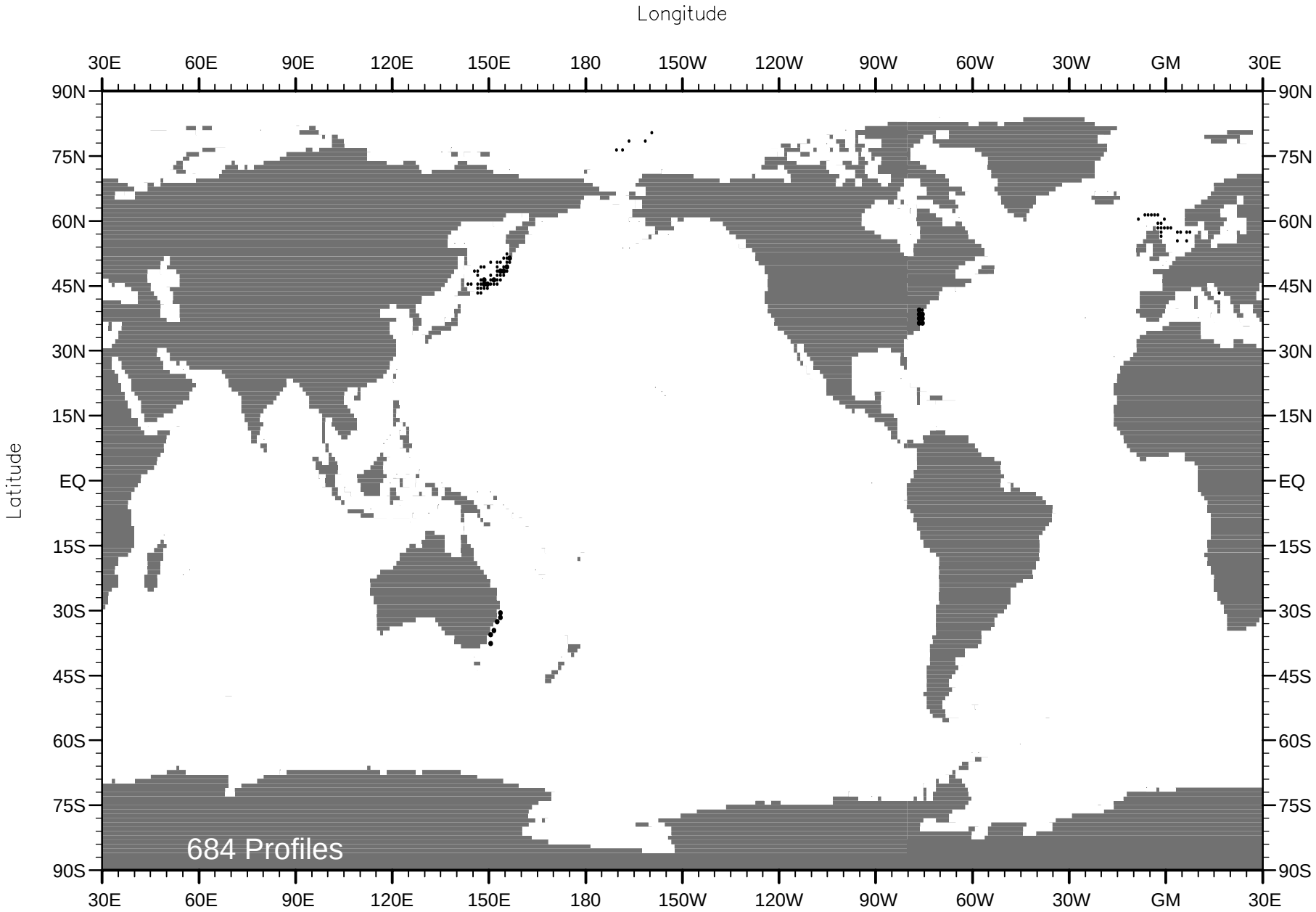


Fig. A34 Distribution of all Ocean Station Data (OSD) pH profiles in WOD01 for year 1950 .

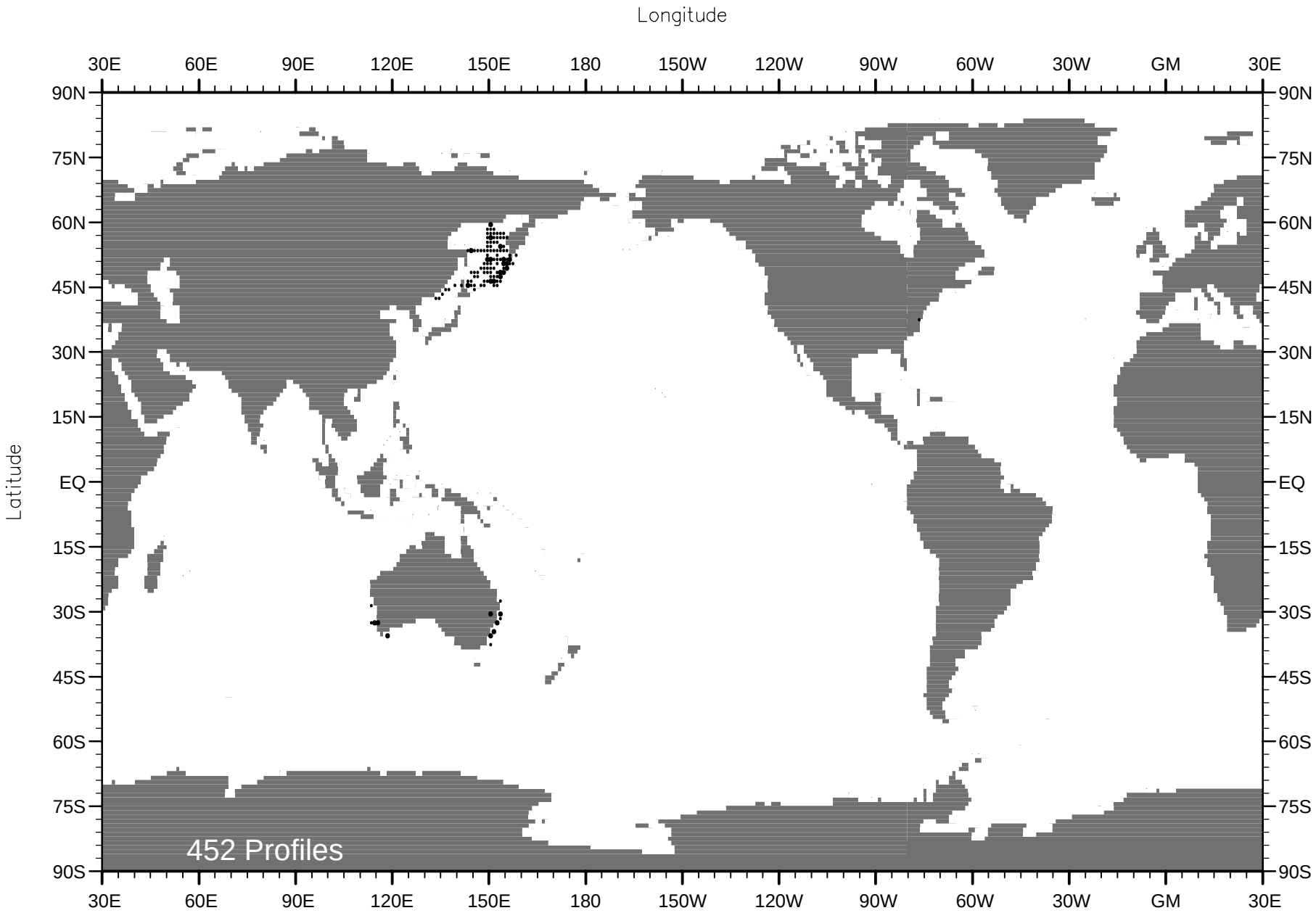


Fig. A35 Distribution of all Ocean Station Data (OSD) pH profiles in WOD01 for year 1951 .

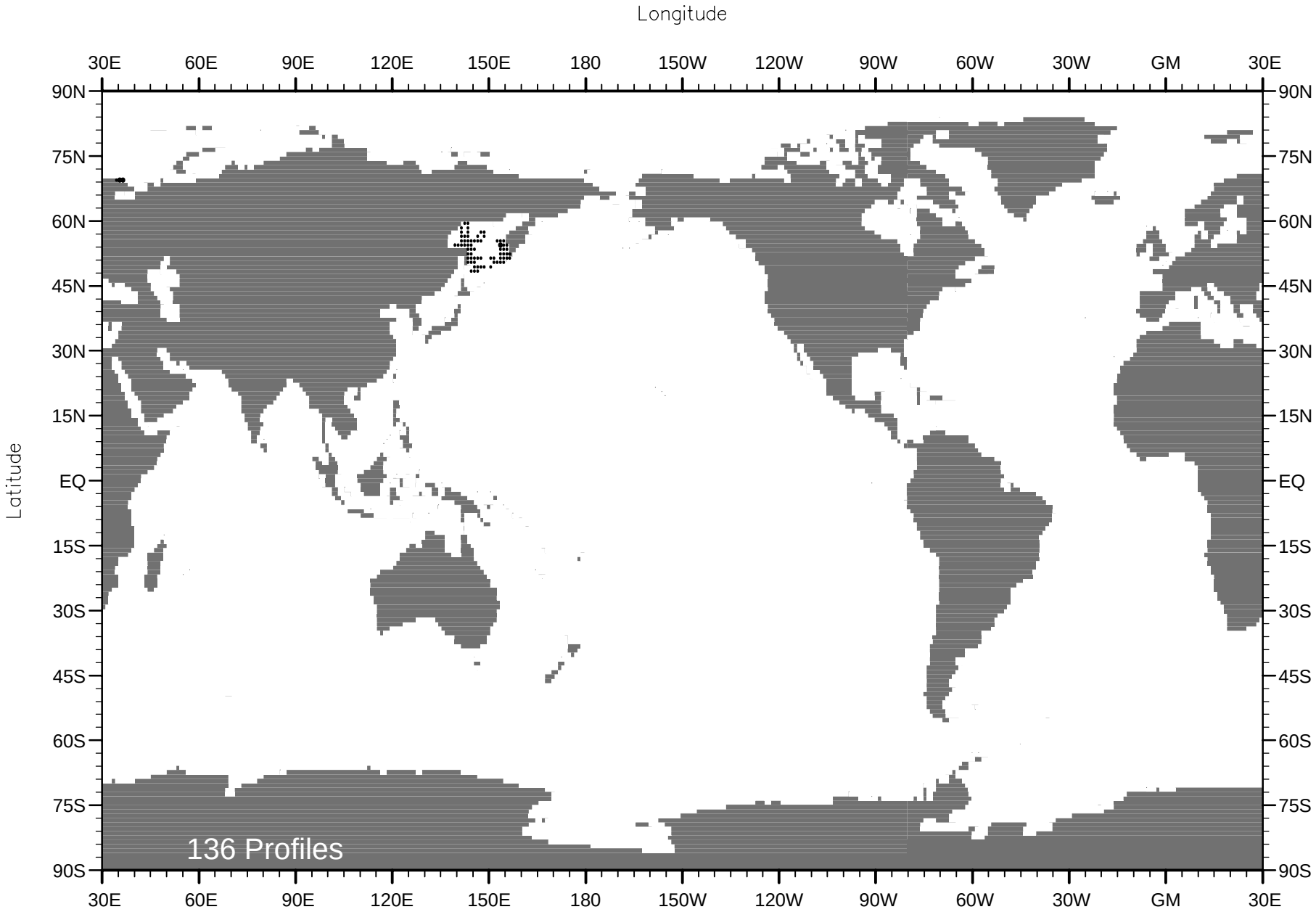


Fig. A36 Distribution of all Ocean Station Data (OSD) pH profiles in WOD01 for year 1952 .

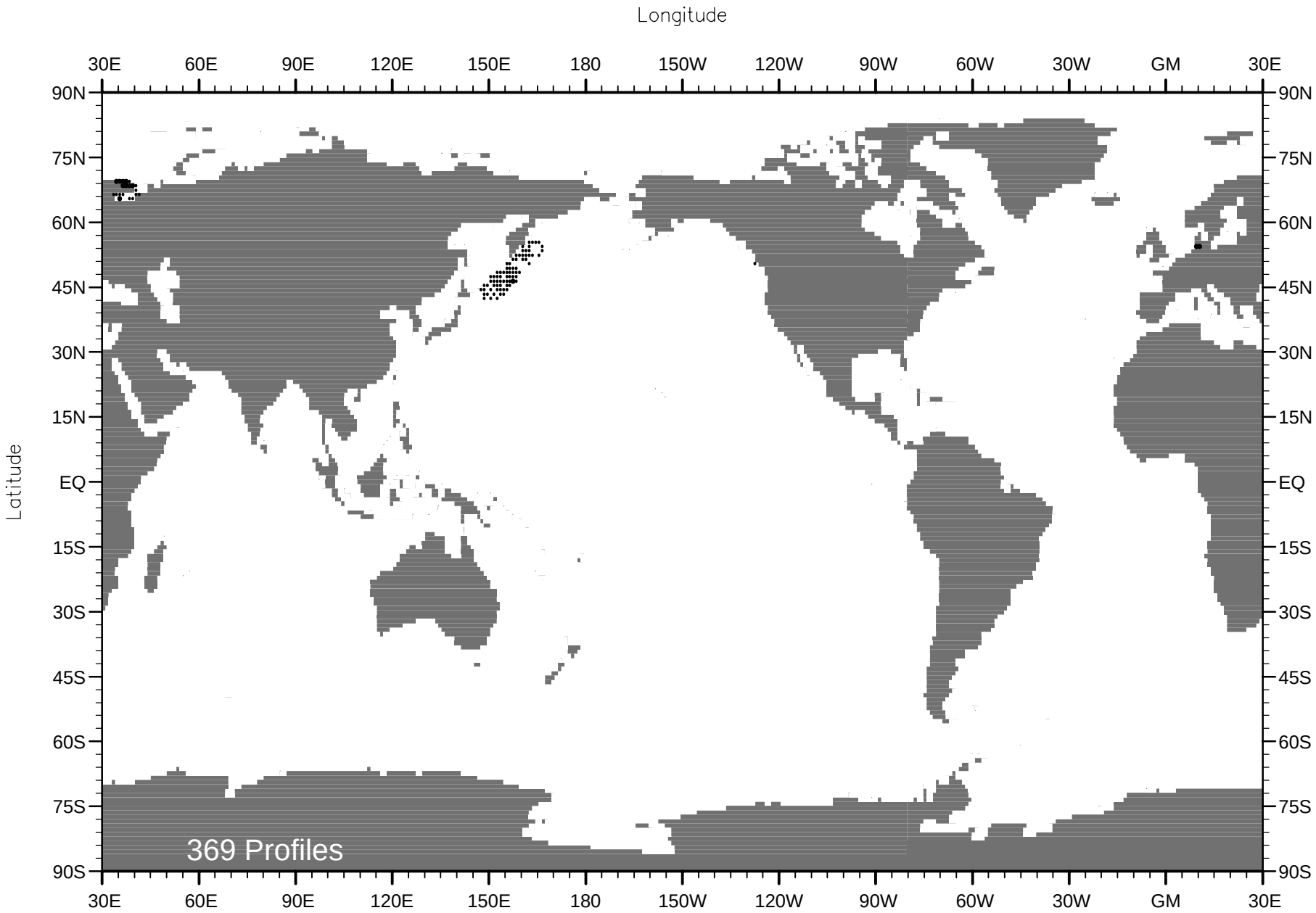


Fig. A37 Distribution of all Ocean Station Data (OSD) pH profiles in WOD01 for year 1953 .

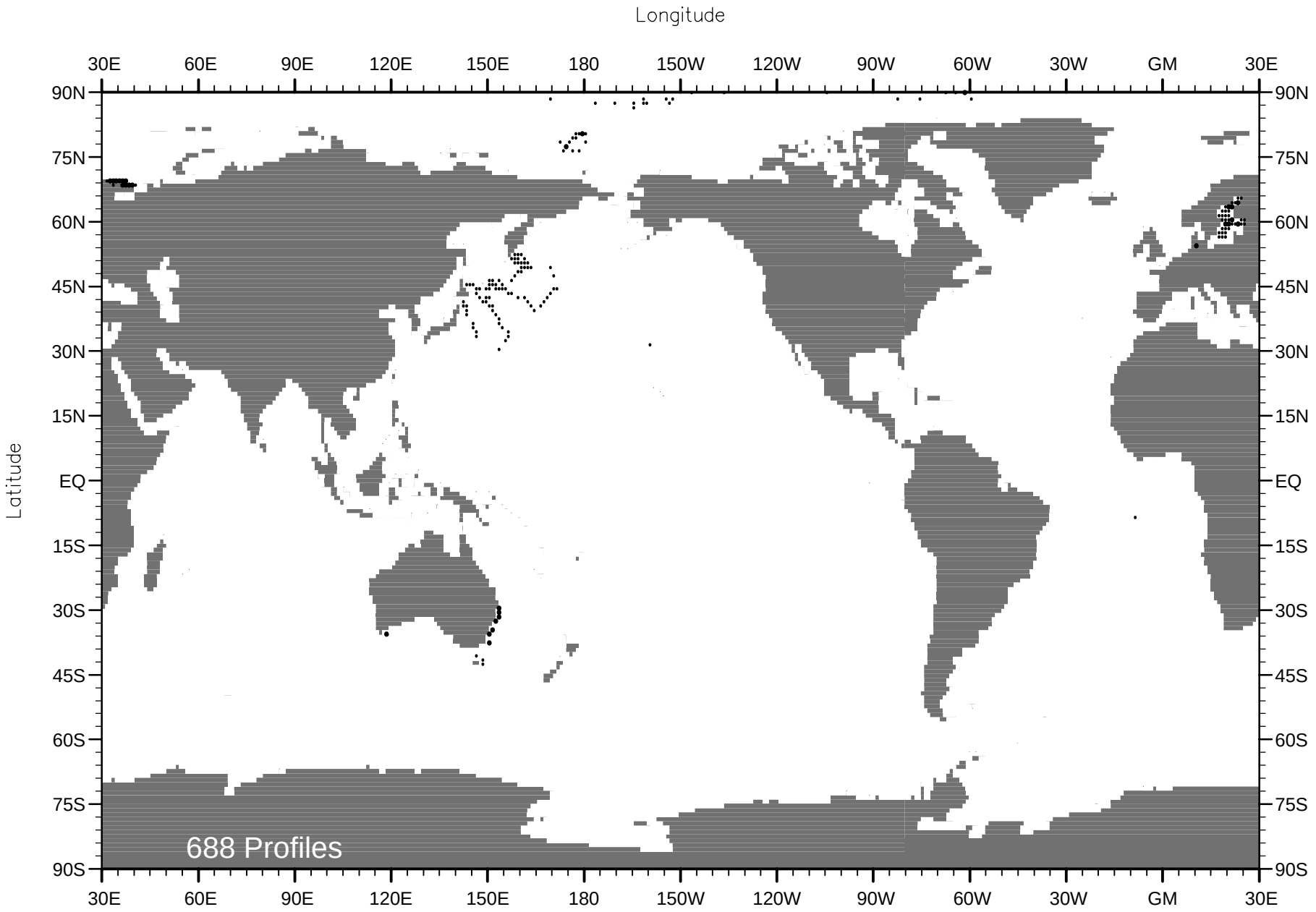


Fig. A38 Distribution of all Ocean Station Data (OSD) pH profiles in WOD01 for year 1954 .

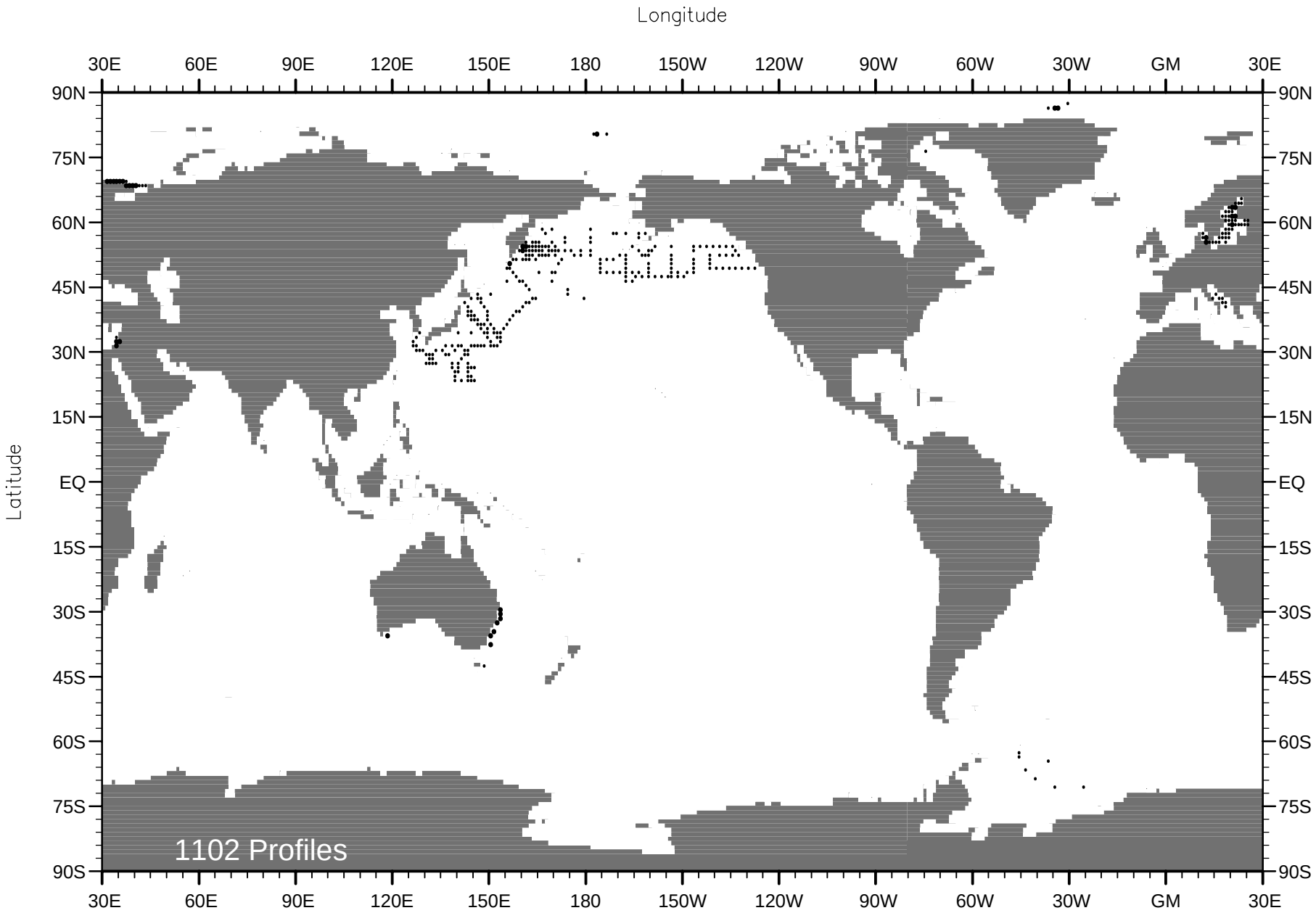


Fig. A39 Distribution of all Ocean Station Data (OSD) pH profiles in WOD01 for year 1955 .

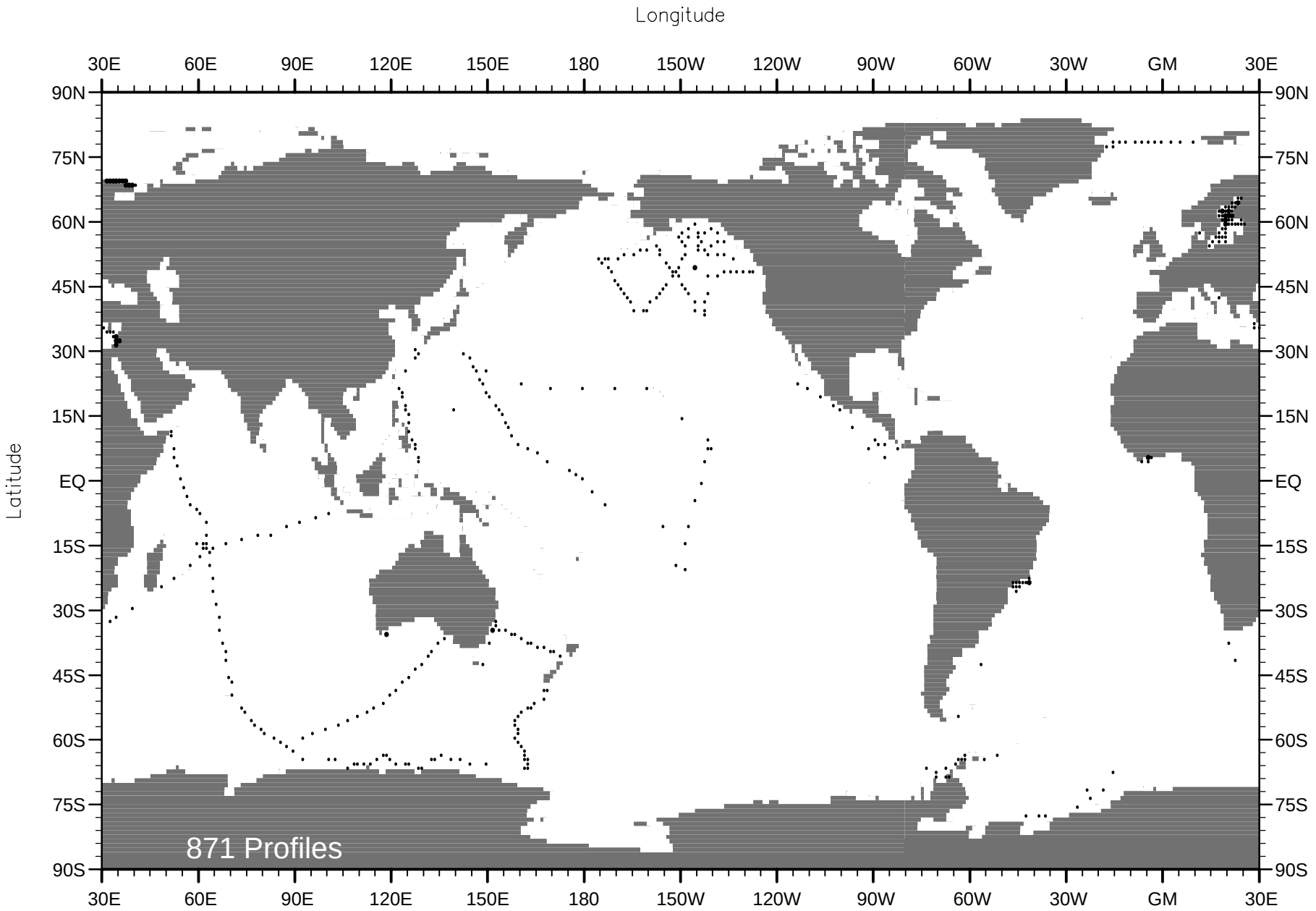


Fig. A40 Distribution of all Ocean Station Data (OSD) pH profiles in WOD01 for year 1956 .

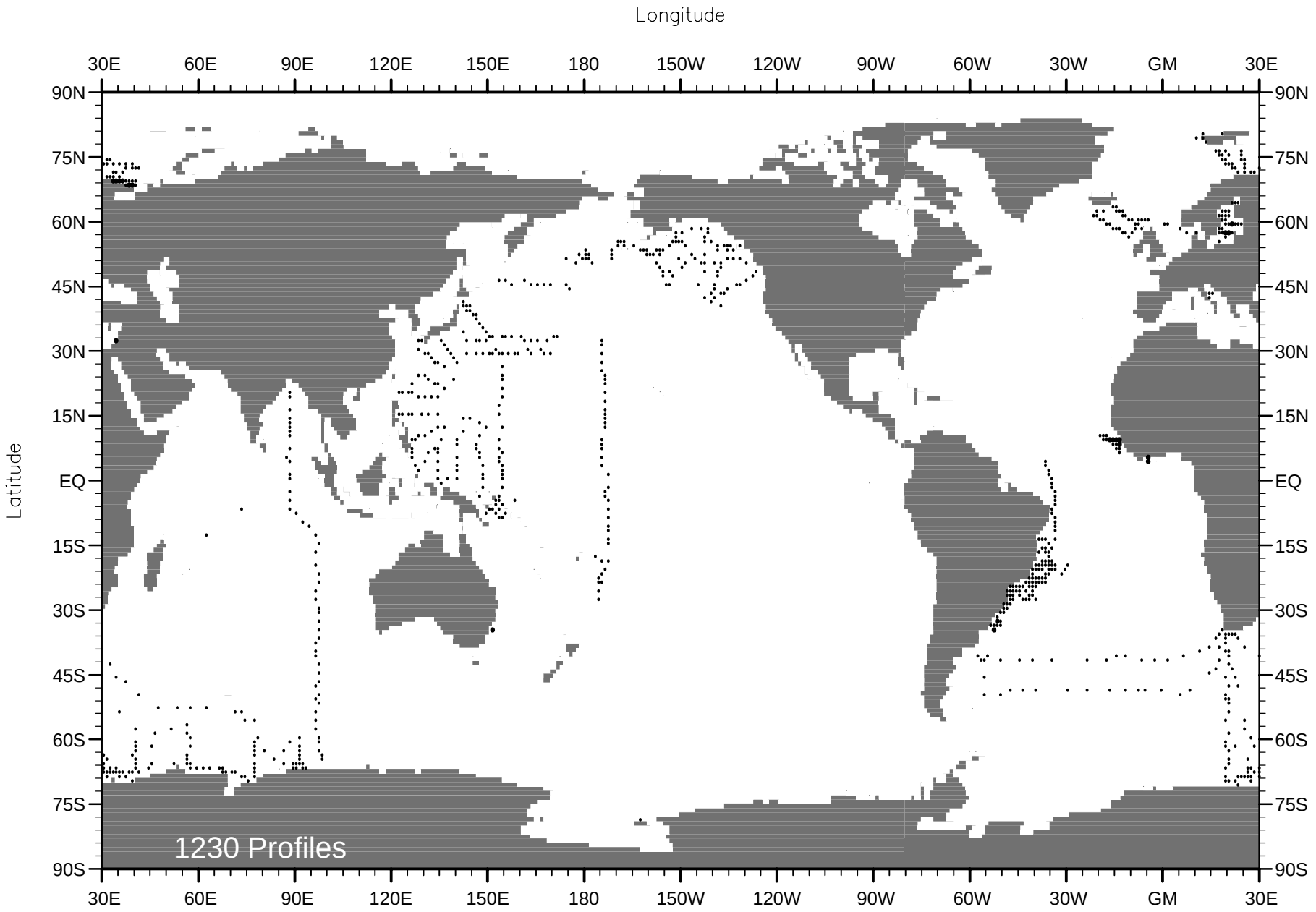


Fig. A41 Distribution of all Ocean Station Data (OSD) pH profiles in WOD01 for year 1957 .

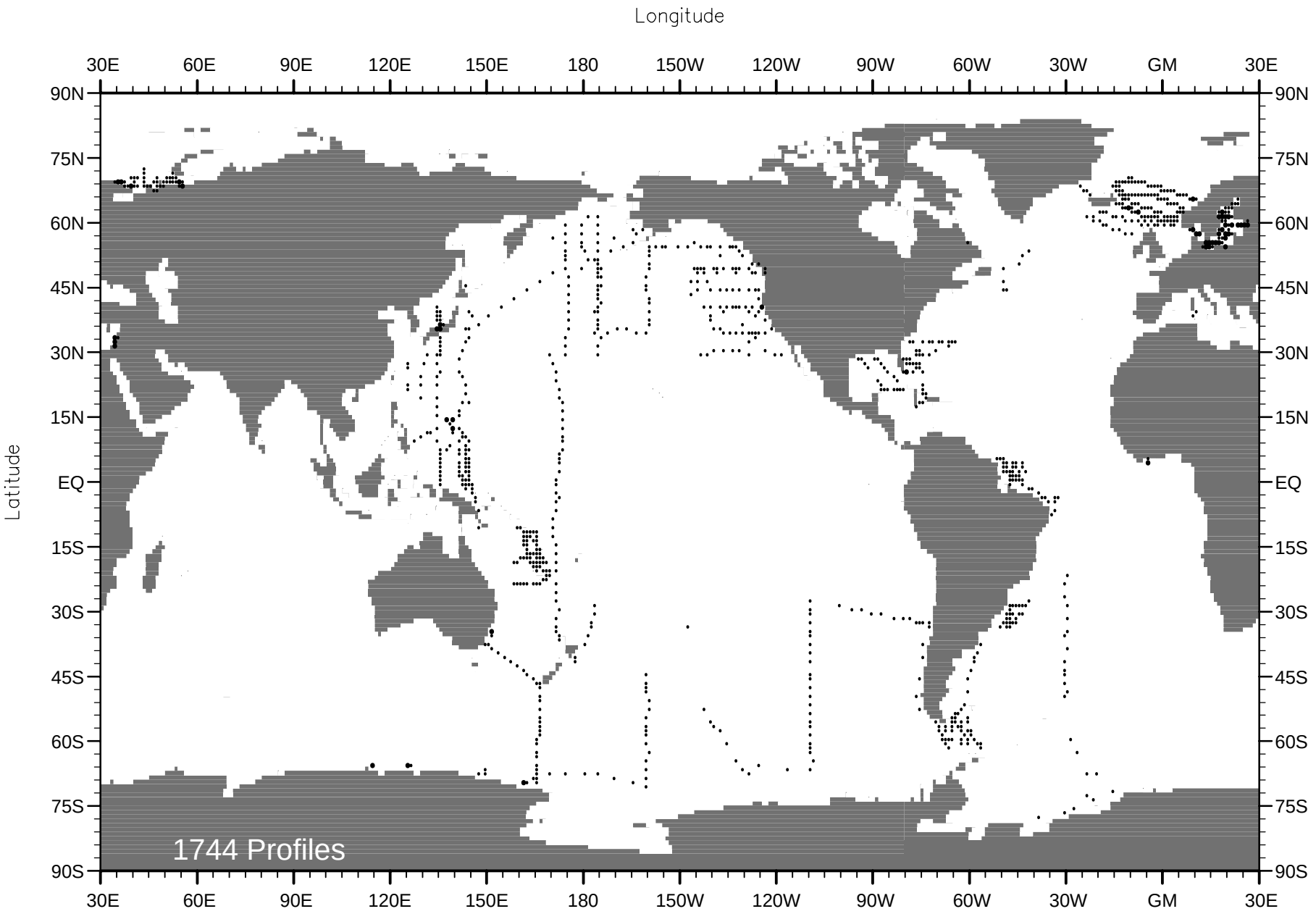


Fig. A42 Distribution of all Ocean Station Data (OSD) pH profiles in WOD01 for year 1958 .

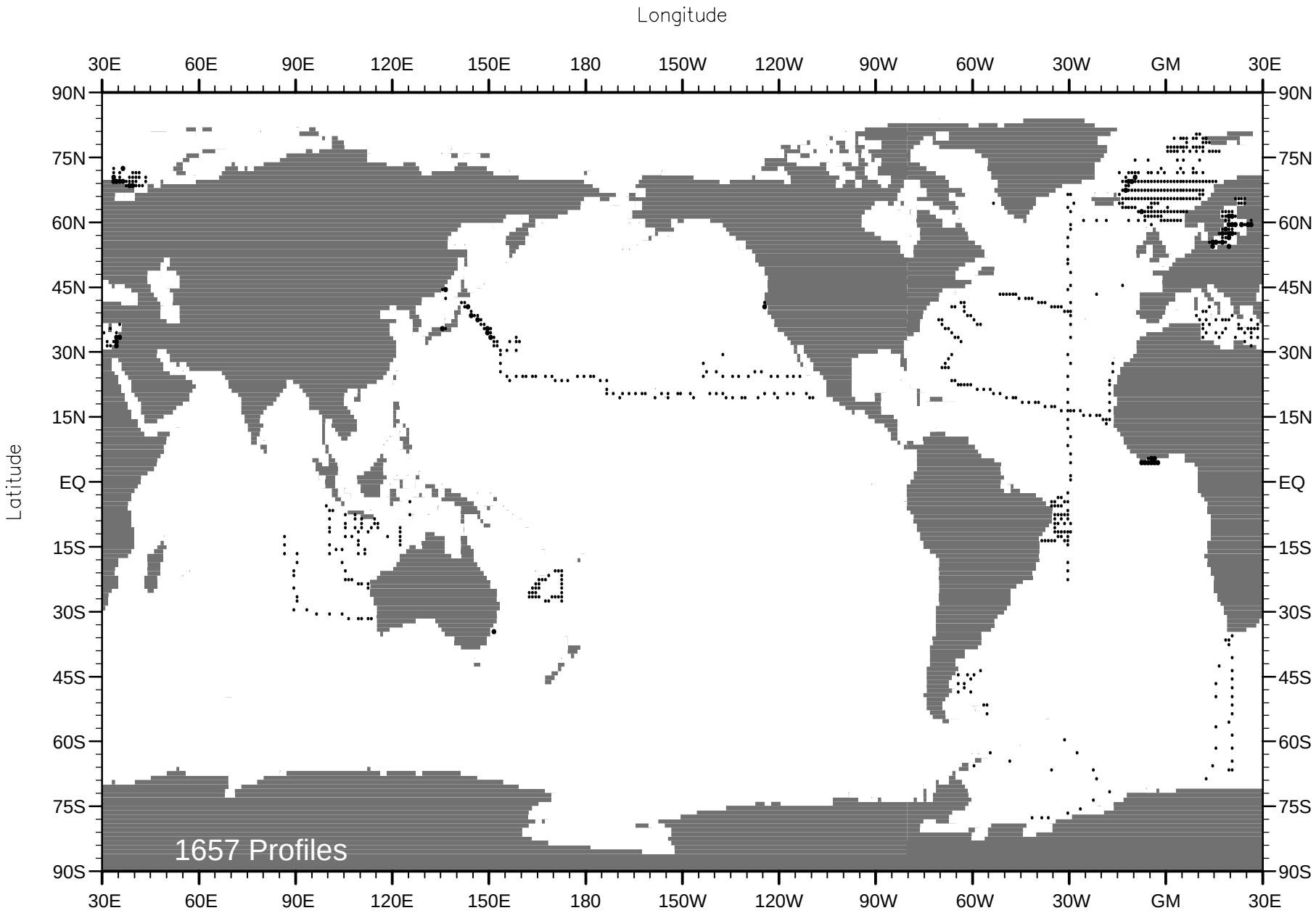


Fig. A43 Distribution of all Ocean Station Data (OSD) pH profiles in WOD01 for year 1959 .

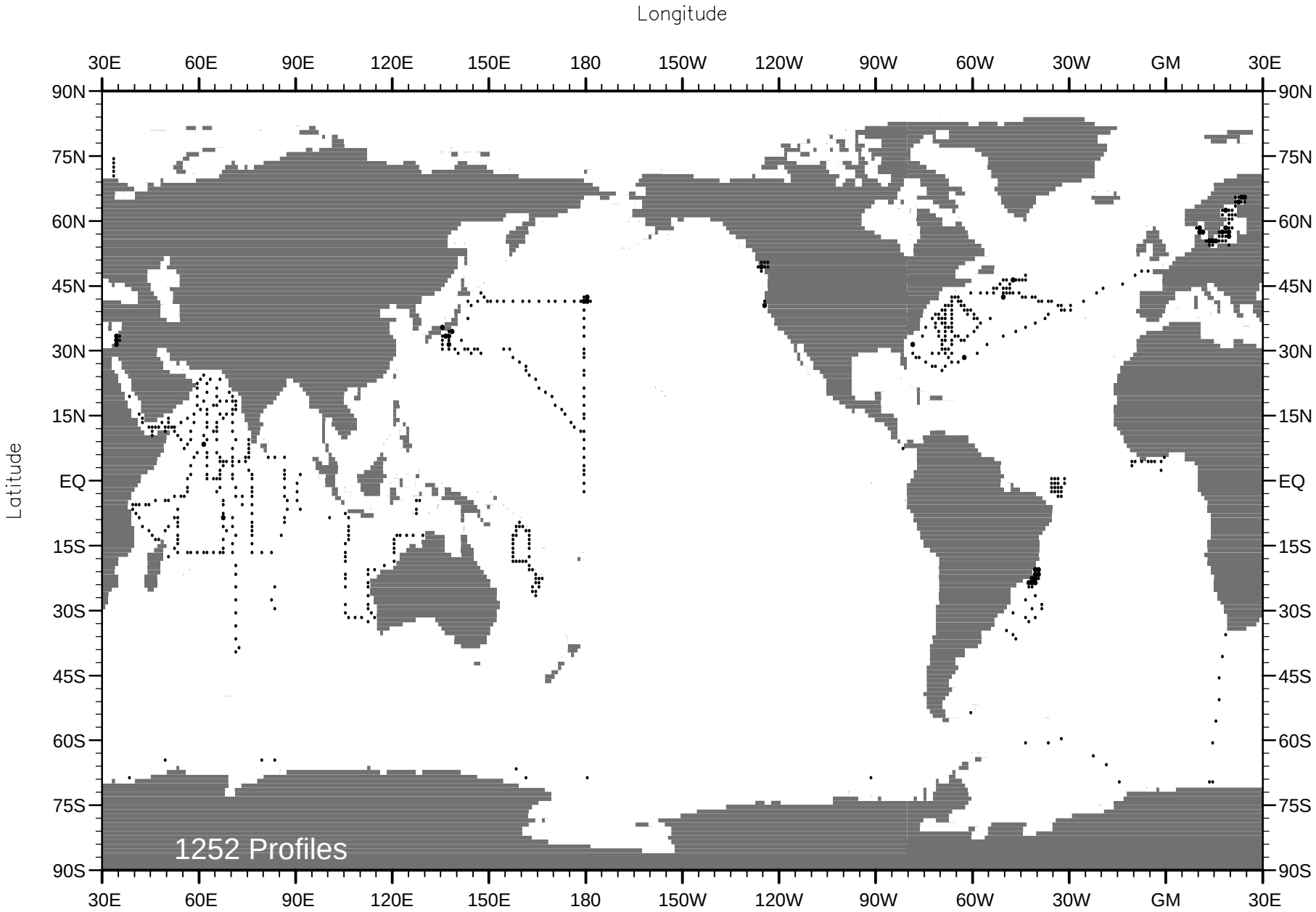


Fig. A44 Distribution of all Ocean Station Data (OSD) pH profiles in WOD01 for year 1960 .

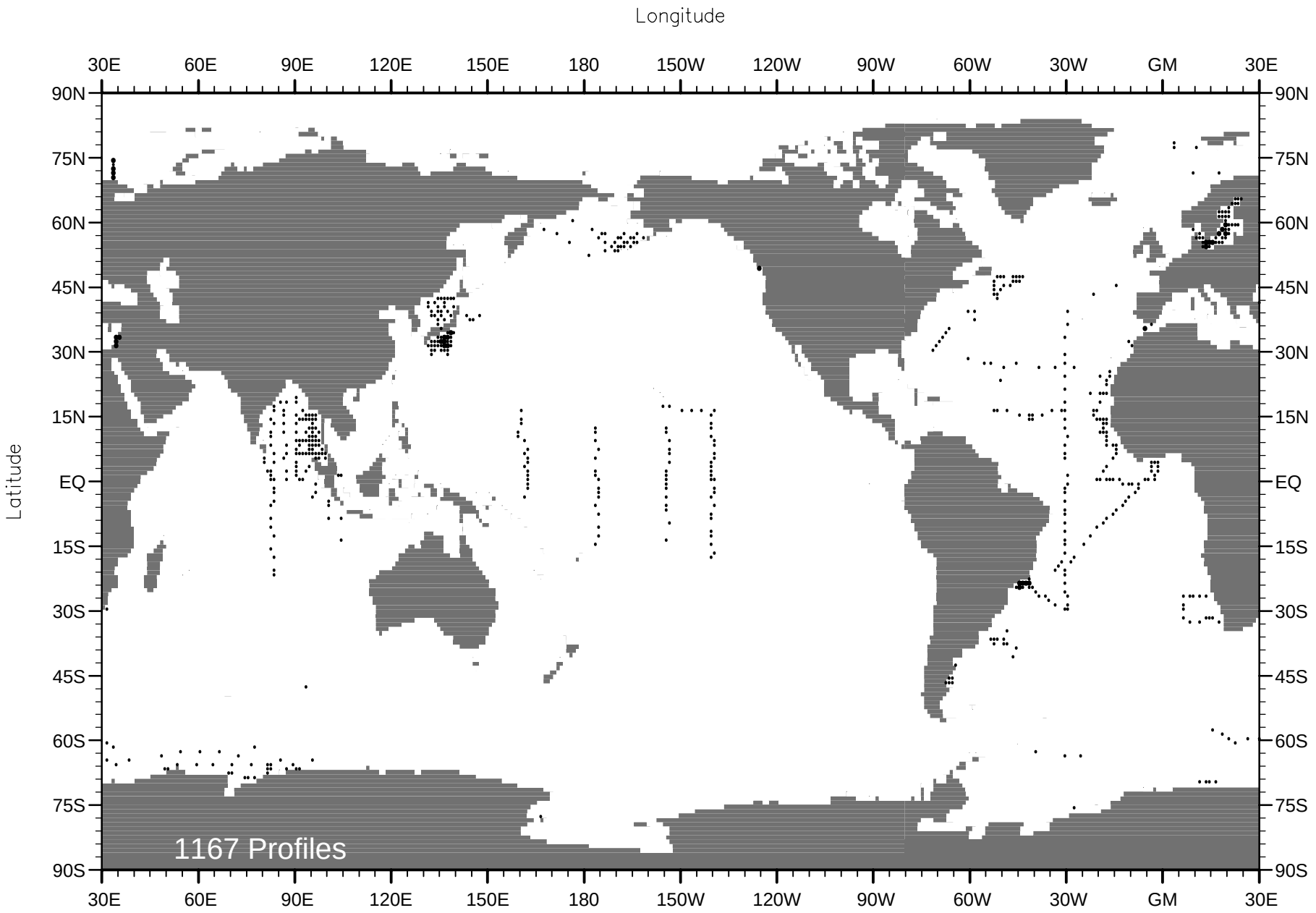


Fig. A45 Distribution of all Ocean Station Data (OSD) pH profiles in WOD01 for year 1961 .

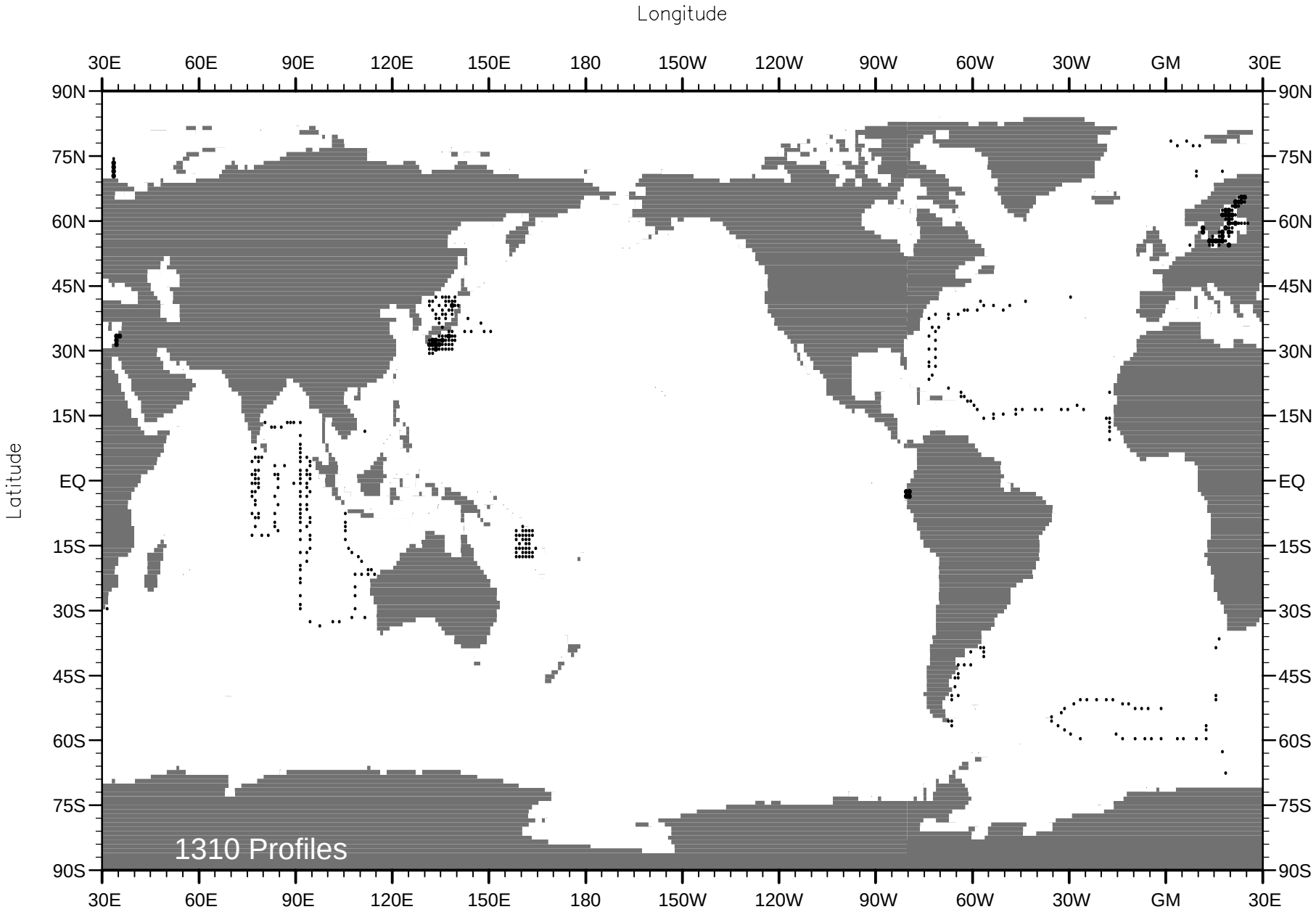


Fig. A46 Distribution of all Ocean Station Data (OSD) pH profiles in WOD01 for year 1962 .

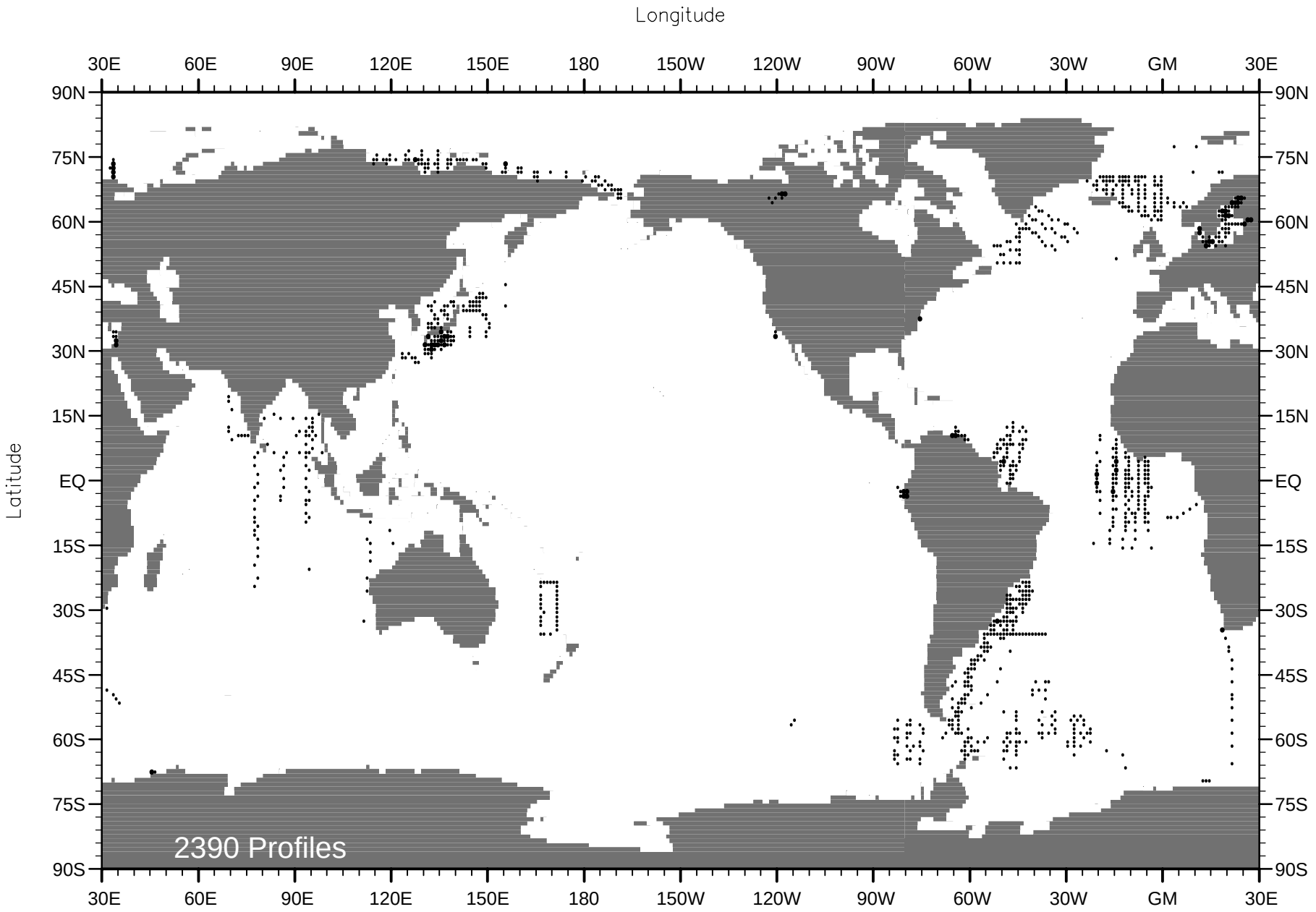


Fig. A47 Distribution of all Ocean Station Data (OSD) pH profiles in WOD01 for year 1963 .

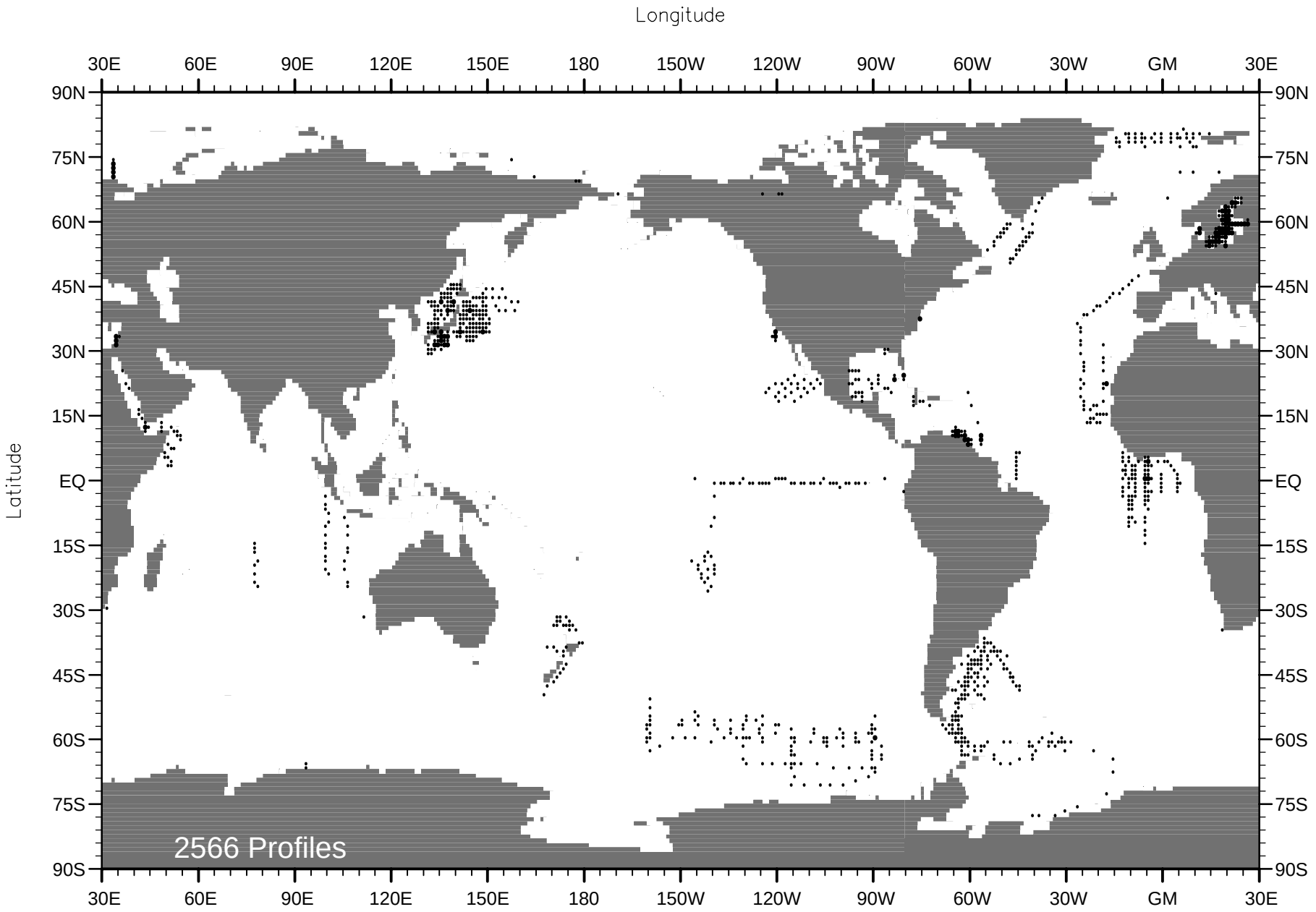


Fig. A48 Distribution of all Ocean Station Data (OSD) pH profiles in WOD01 for year 1964 .

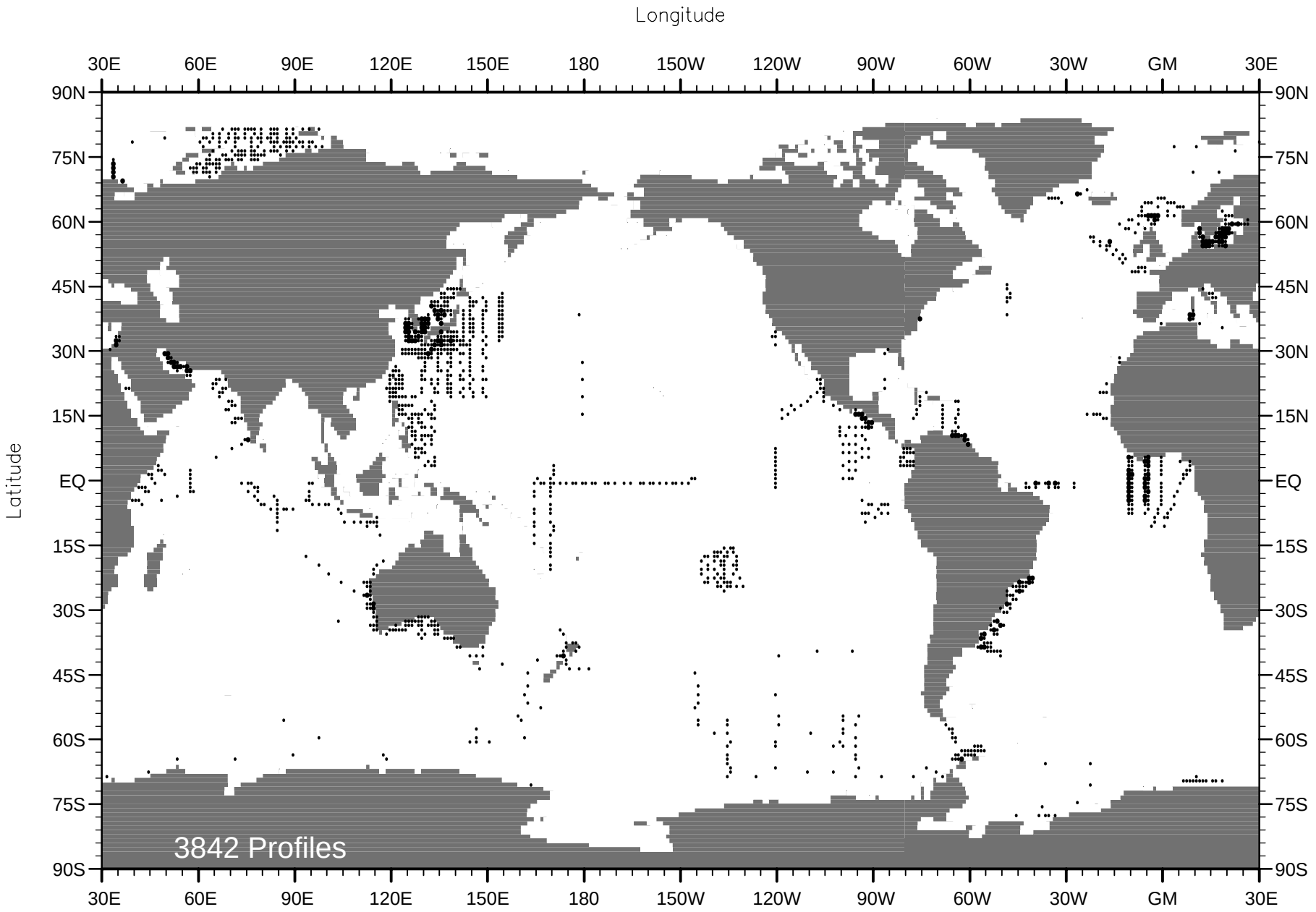


Fig. A49 Distribution of all Ocean Station Data (OSD) pH profiles in WOD01 for year 1965 .

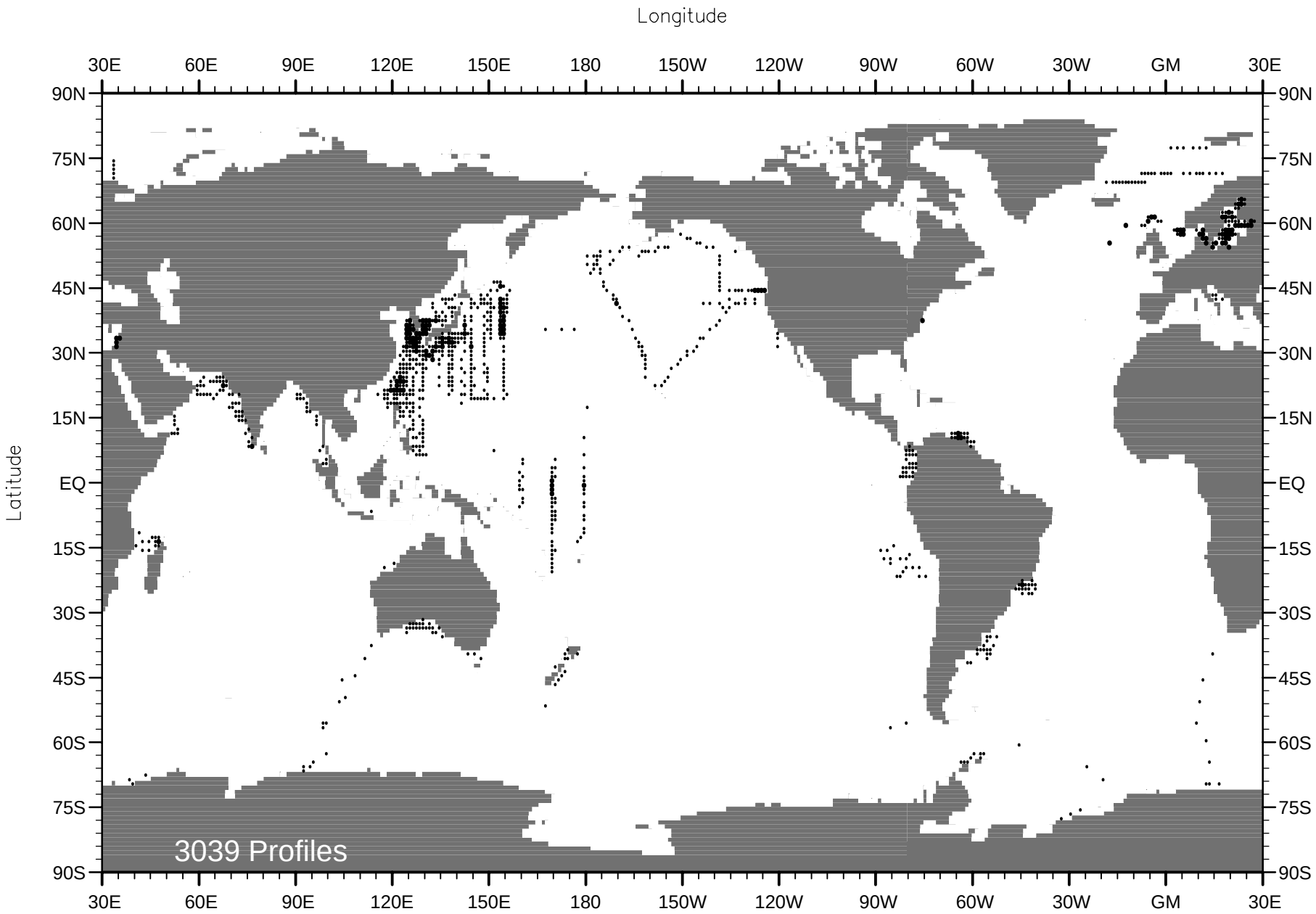


Fig. A50 Distribution of all Ocean Station Data (OSD) pH profiles in WOD01 for year 1966 .

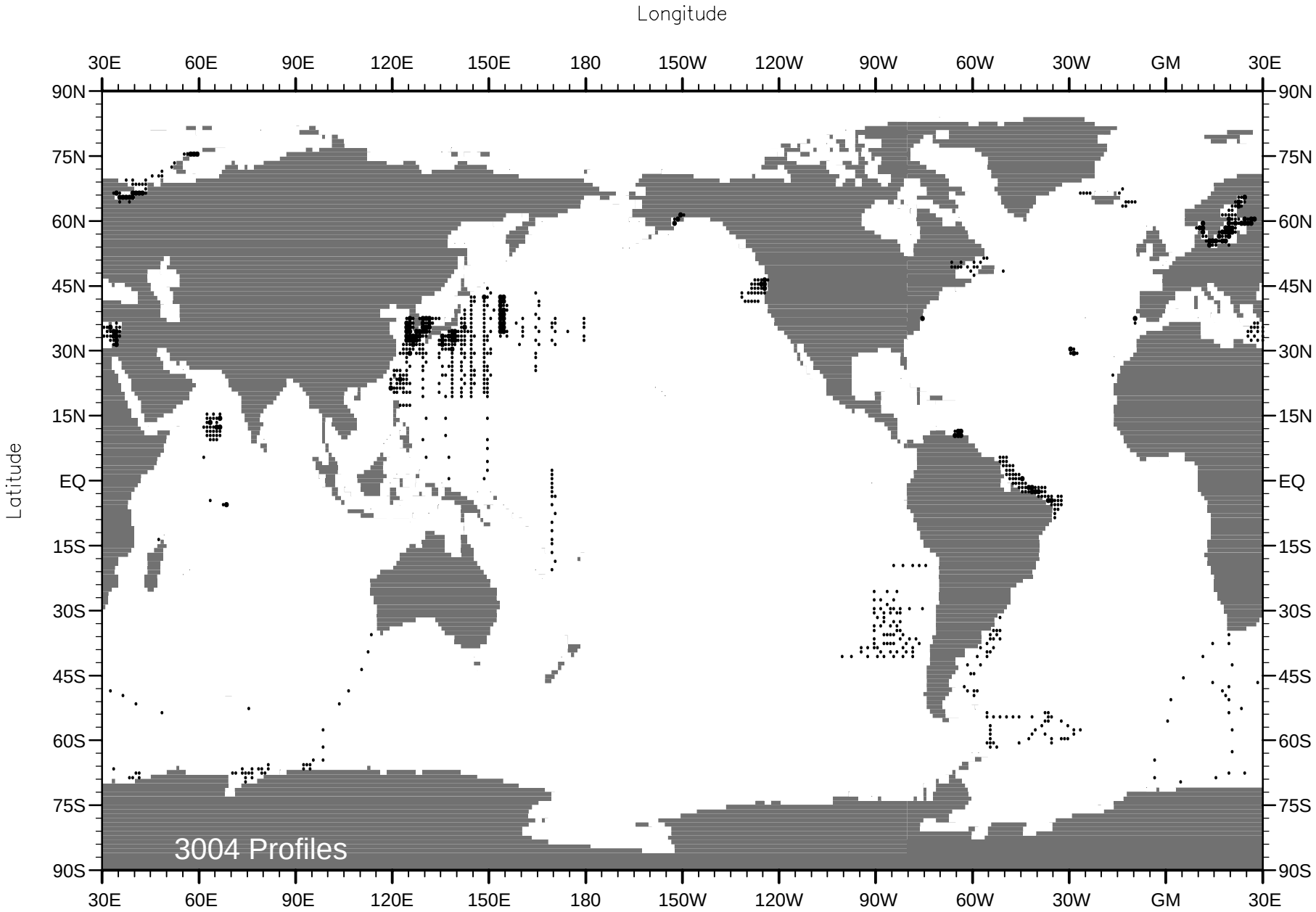


Fig. A51 Distribution of all Ocean Station Data (OSD) pH profiles in WOD01 for year 1967 .

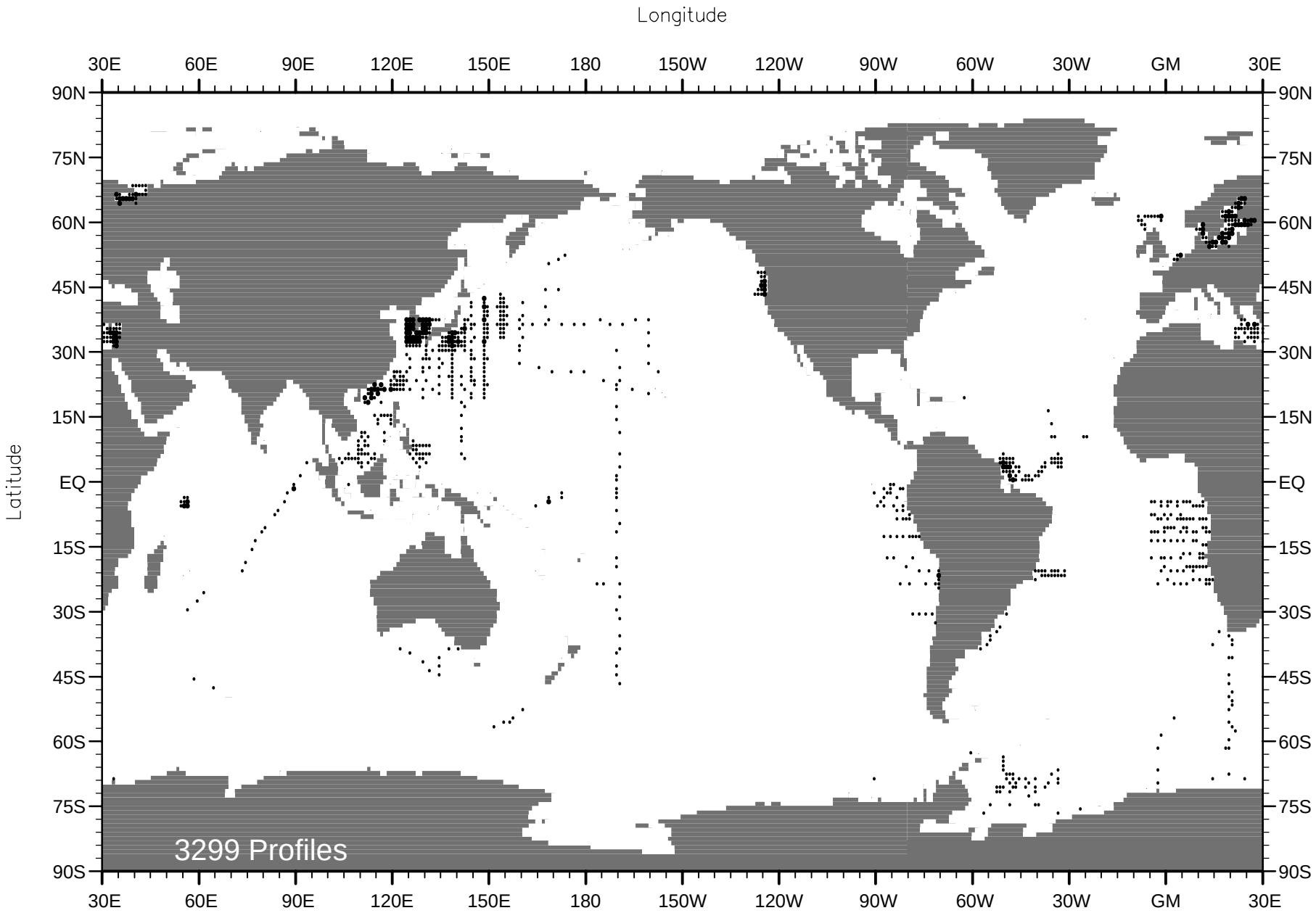


Fig. A52 Distribution of all Ocean Station Data (OSD) pH profiles in WOD01 for year 1968 .

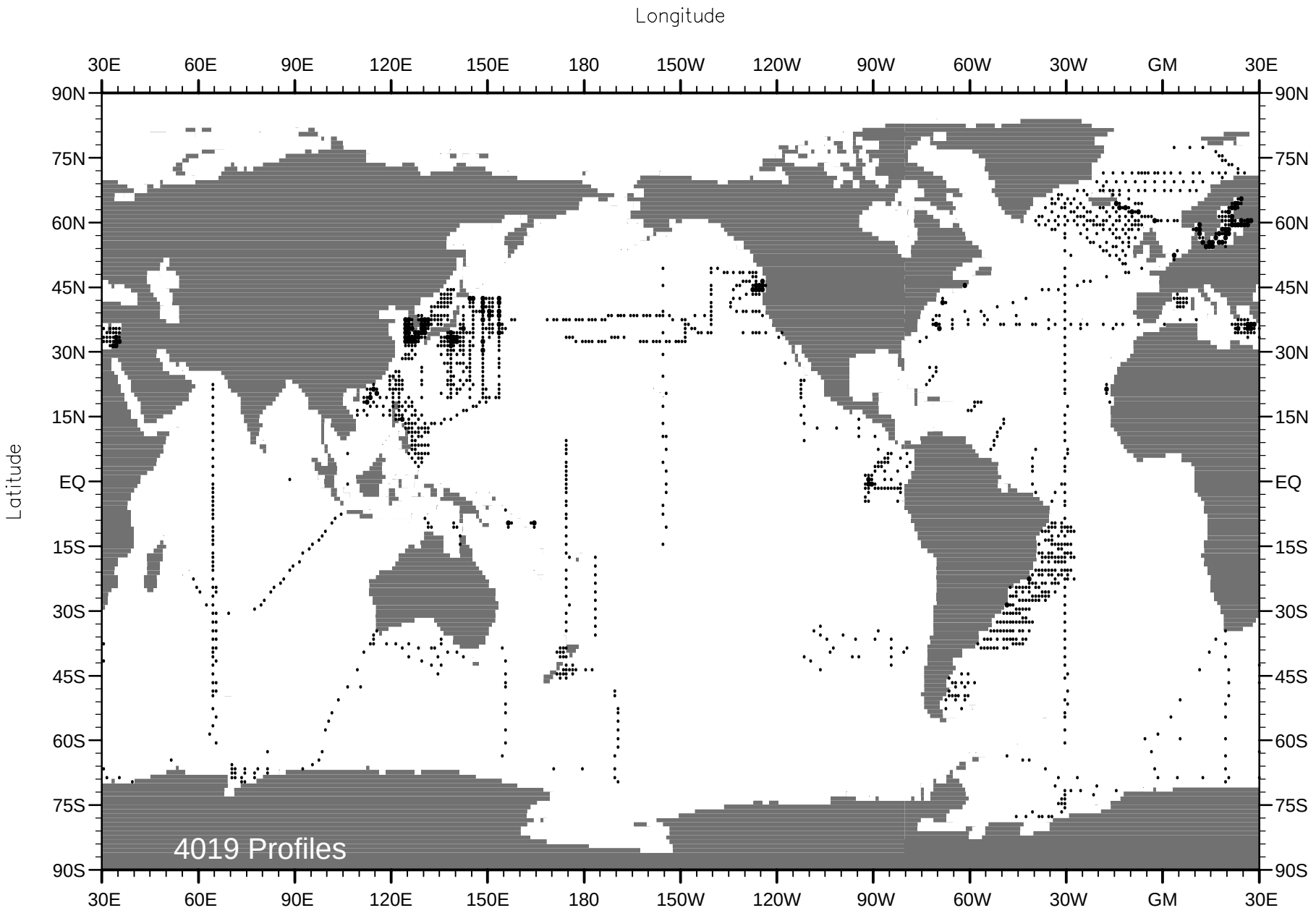


Fig. A53 Distribution of all Ocean Station Data (OSD) pH profiles in WOD01 for year 1969 .

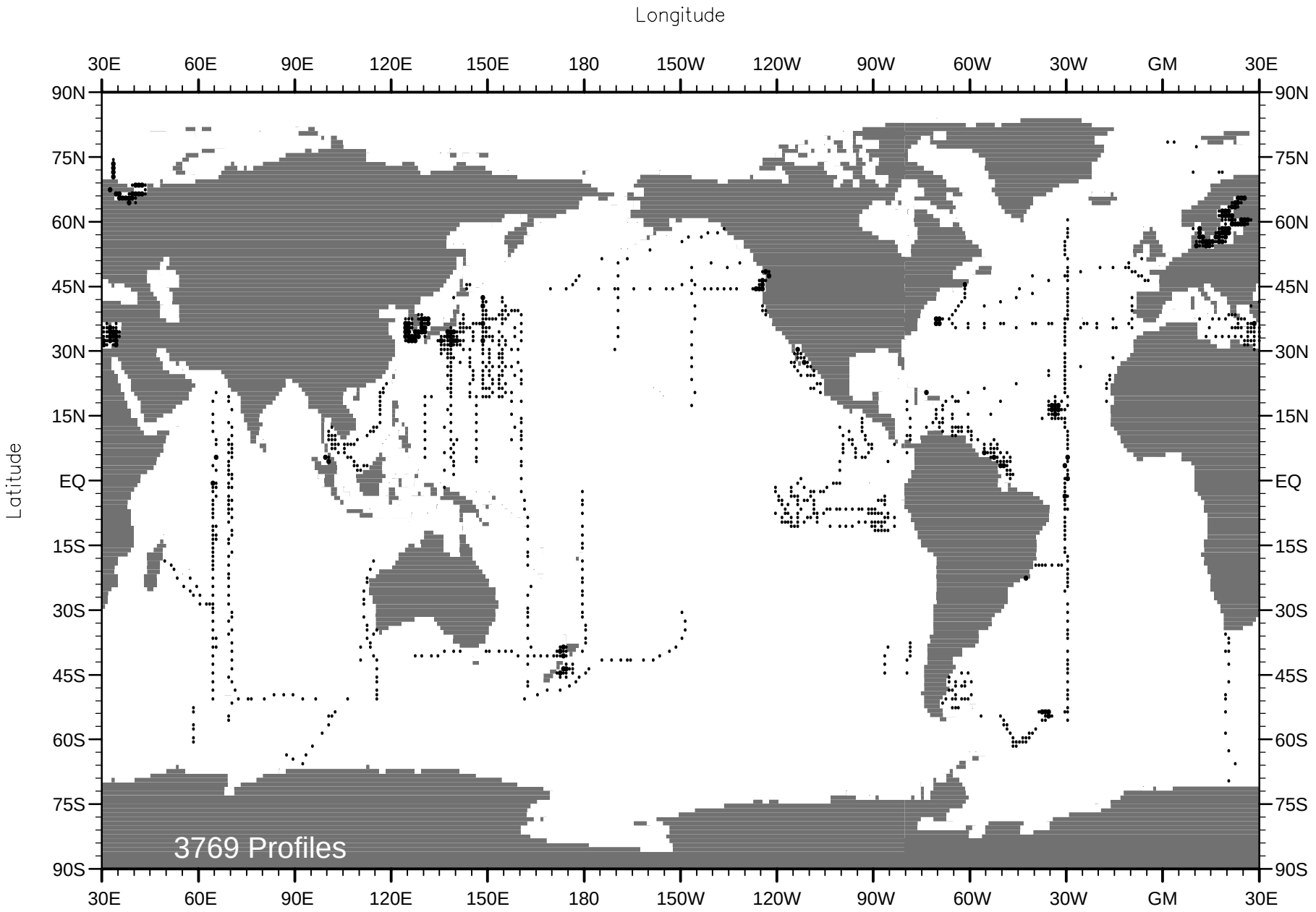


Fig. A54 Distribution of all Ocean Station Data (OSD) pH profiles in WOD01 for year 1970 .

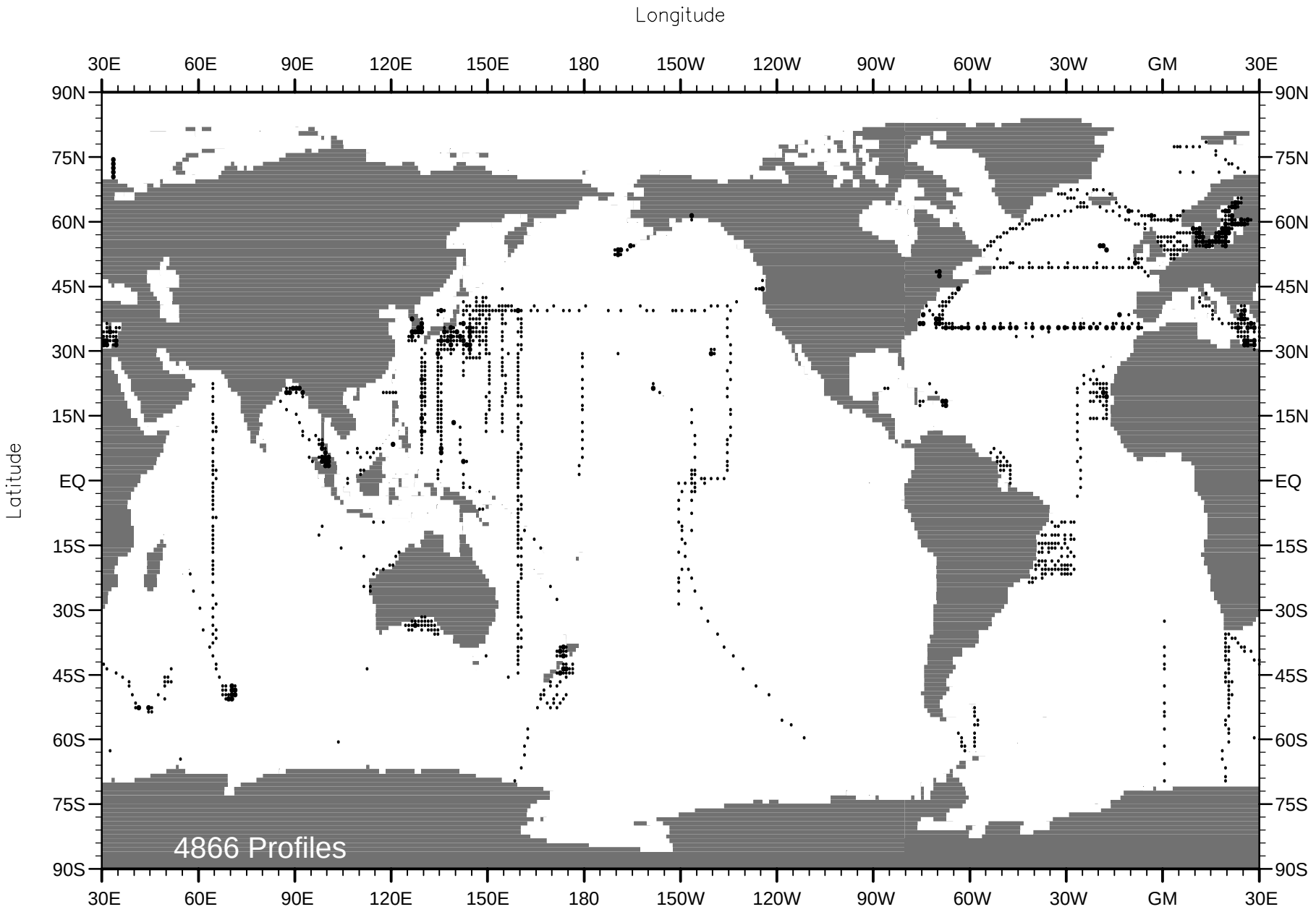


Fig. A55 Distribution of all Ocean Station Data (OSD) pH profiles in WOD01 for year 1971 .

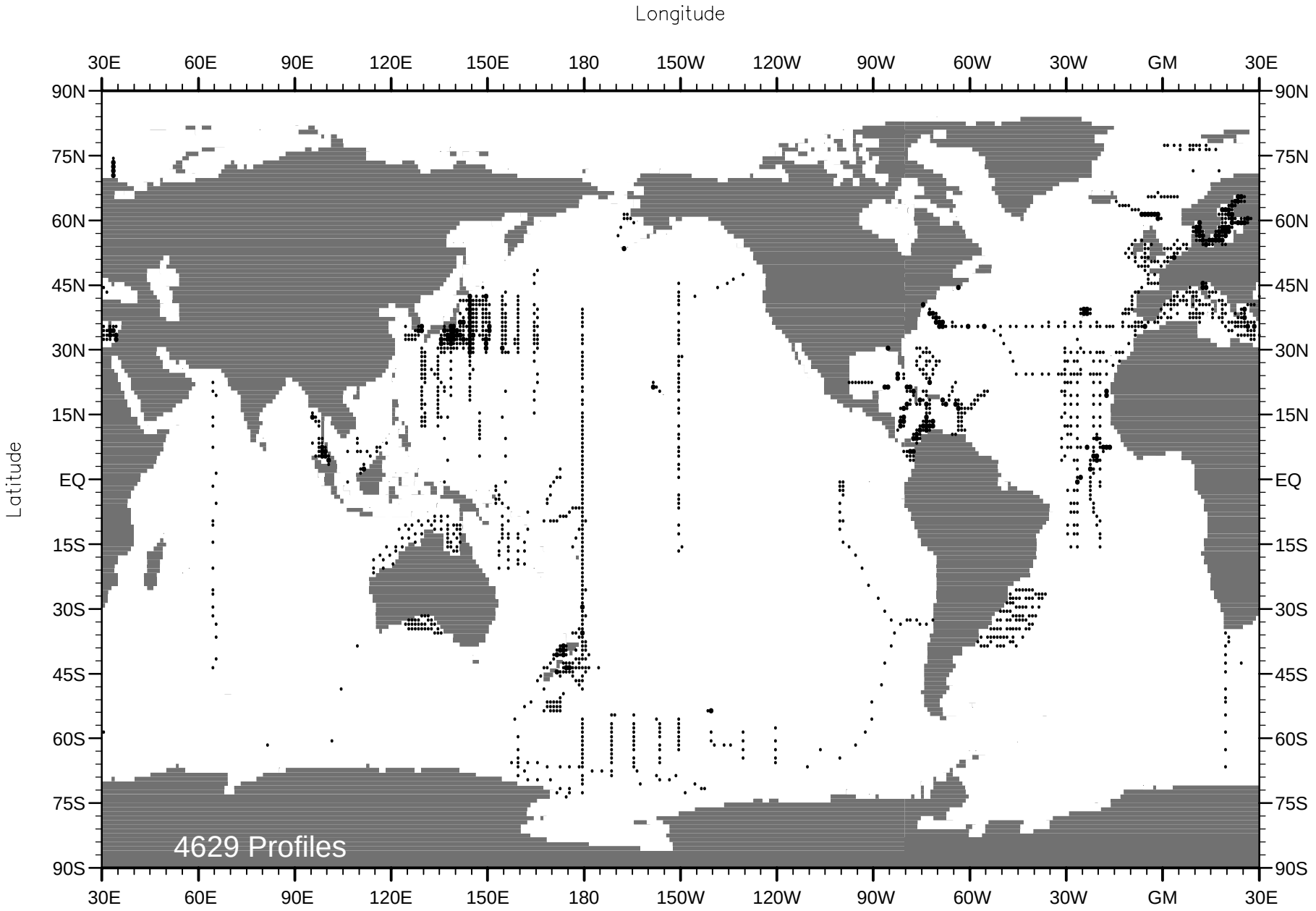


Fig. A56 Distribution of all Ocean Station Data (OSD) pH profiles in WOD01 for year 1972 .

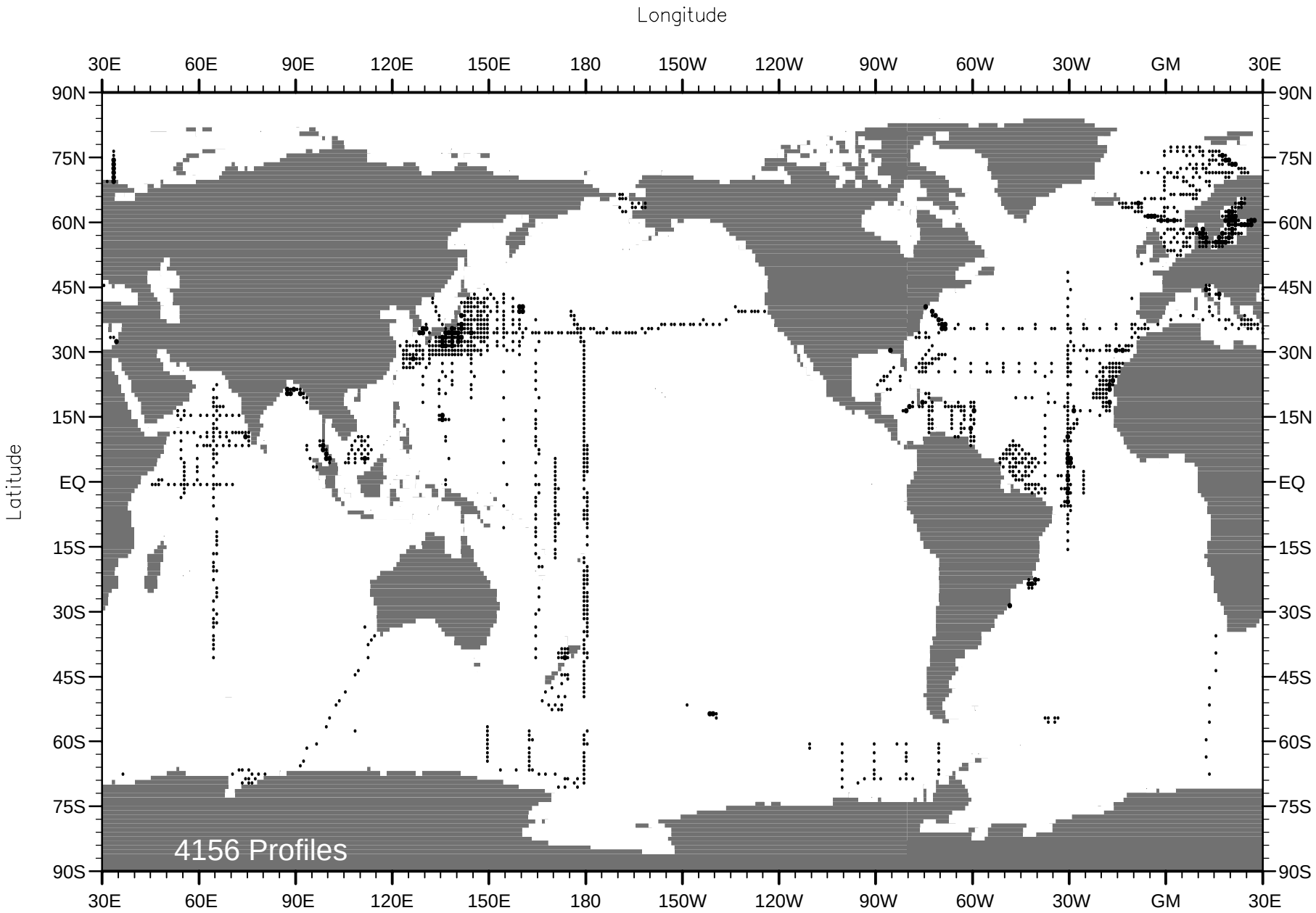


Fig. A57 Distribution of all Ocean Station Data (OSD) pH profiles in WOD01 for year 1973 .

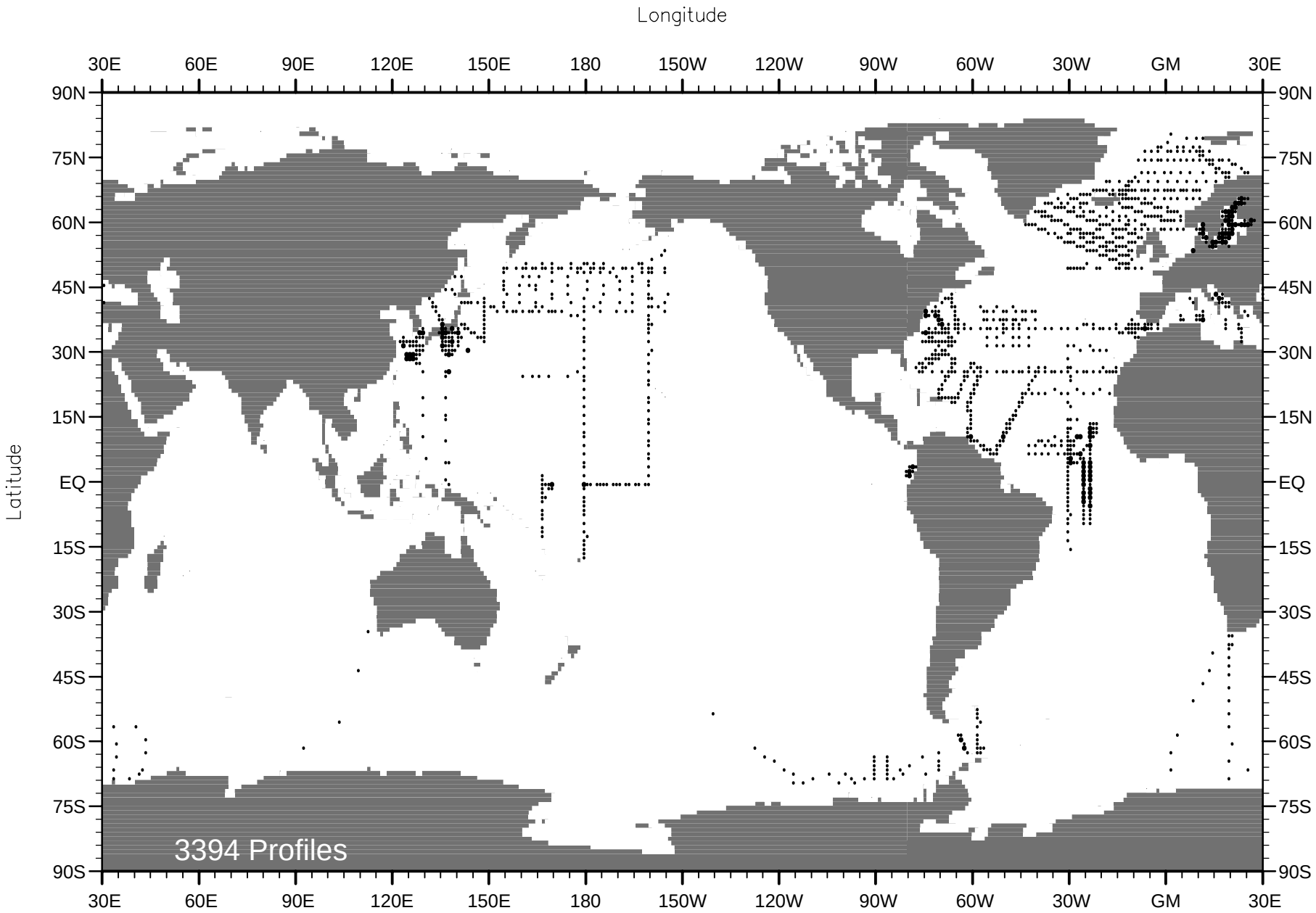


Fig. A58 Distribution of all Ocean Station Data (OSD) pH profiles in WOD01 for year 1974 .

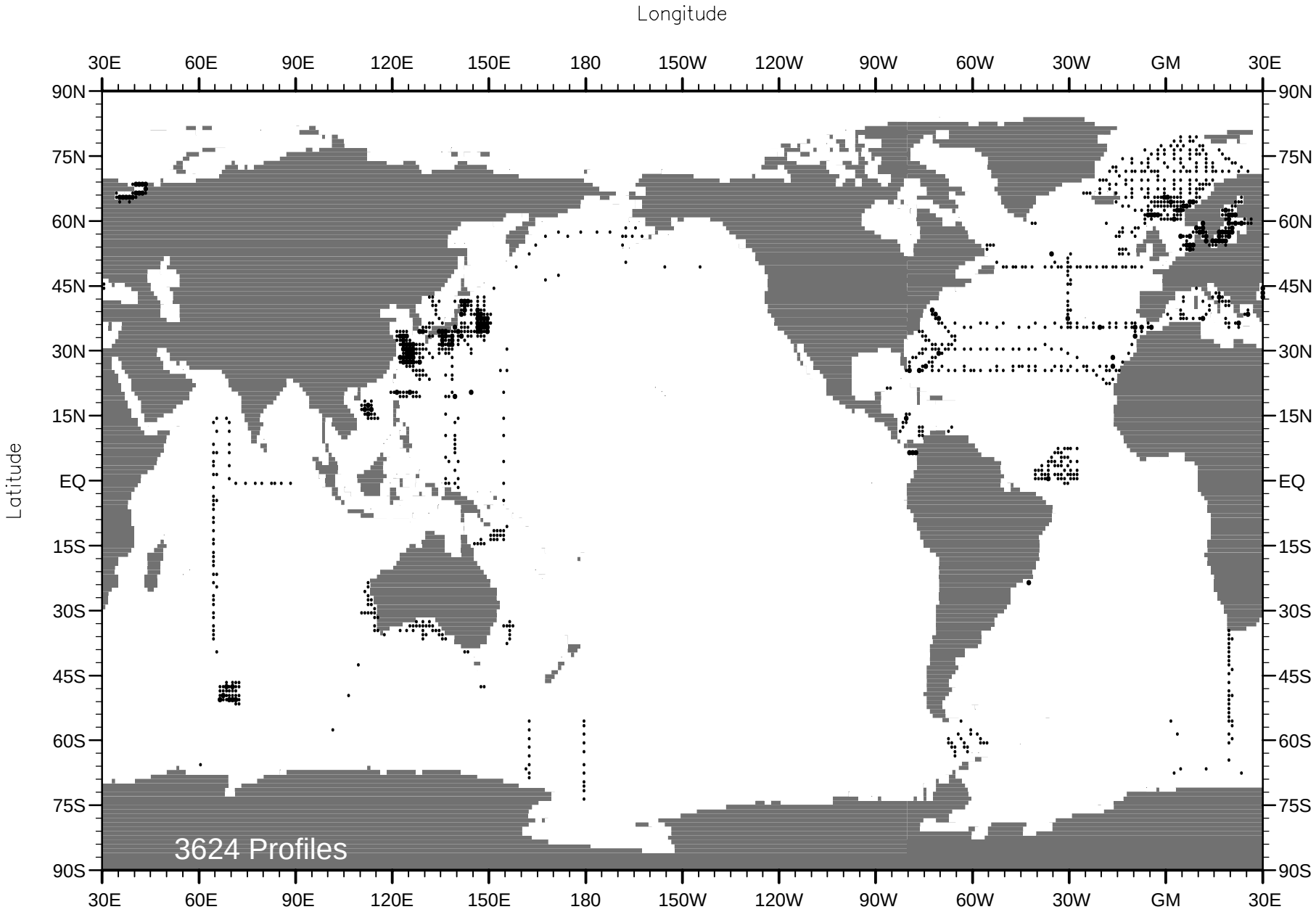


Fig. A59 Distribution of all Ocean Station Data (OSD) pH profiles in WOD01 for year 1975 .

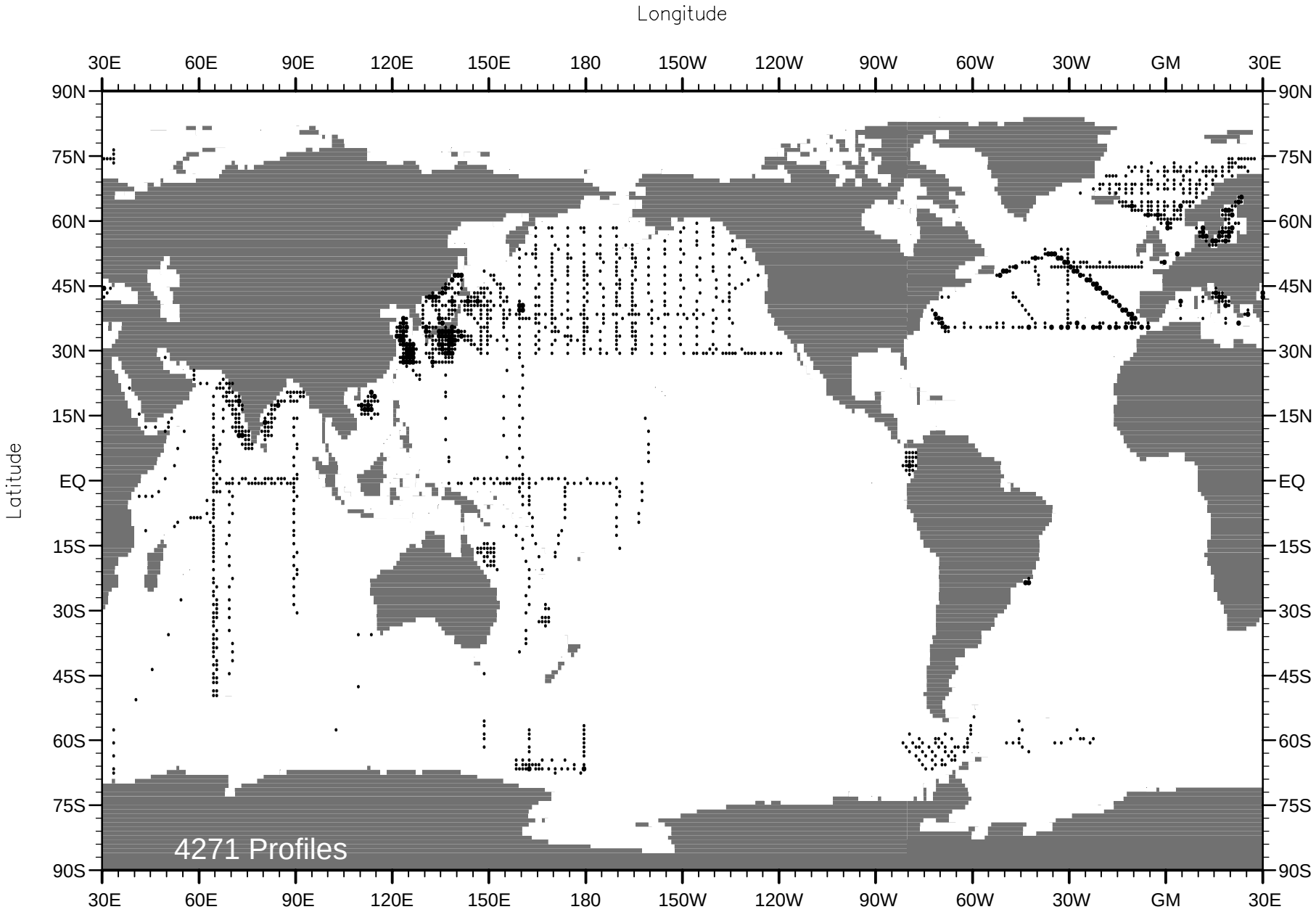


Fig. A60 Distribution of all Ocean Station Data (OSD) pH profiles in WOD01 for year 1976 .

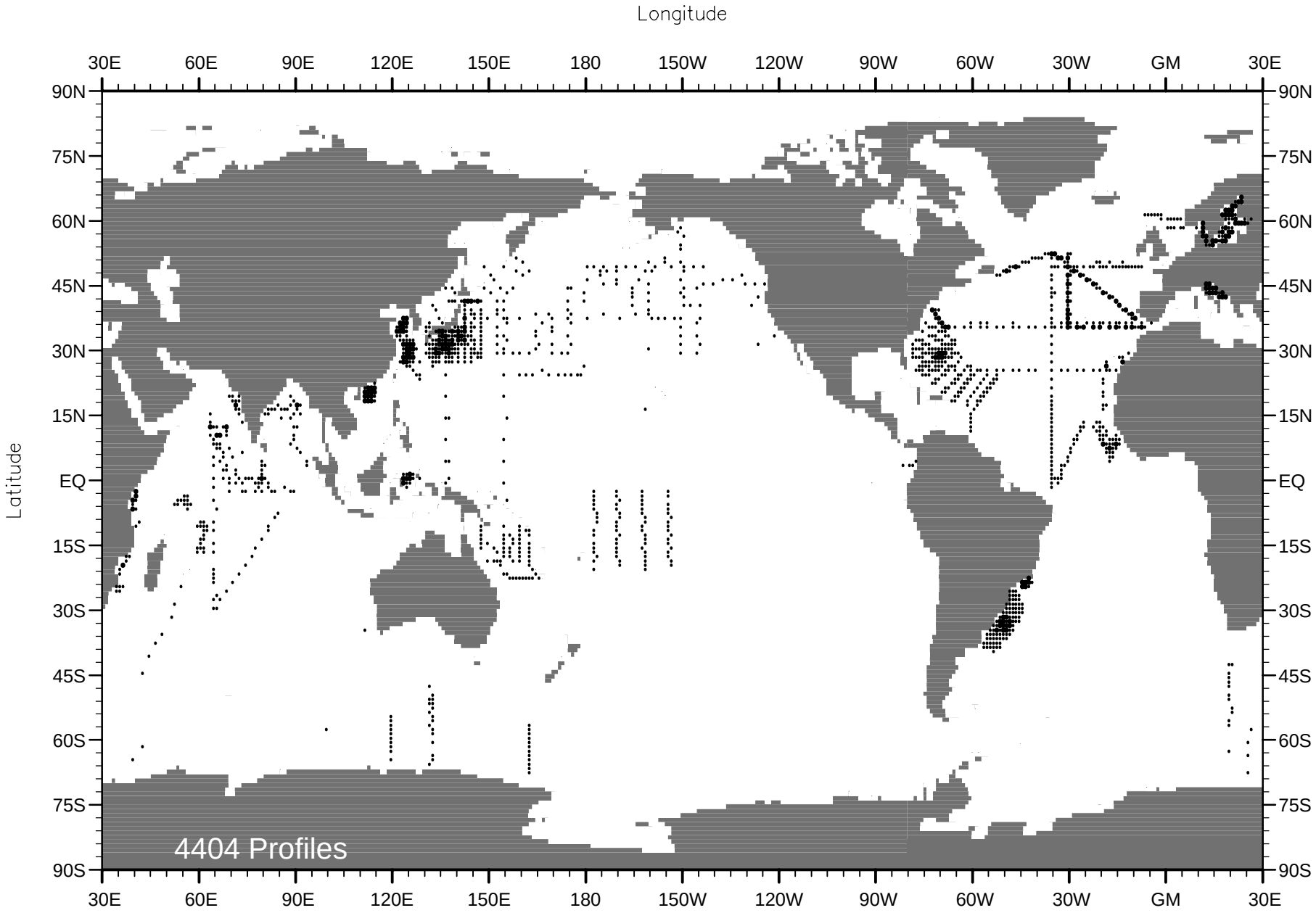


Fig. A61 Distribution of all Ocean Station Data (OSD) pH profiles in WOD01 for year 1977 .

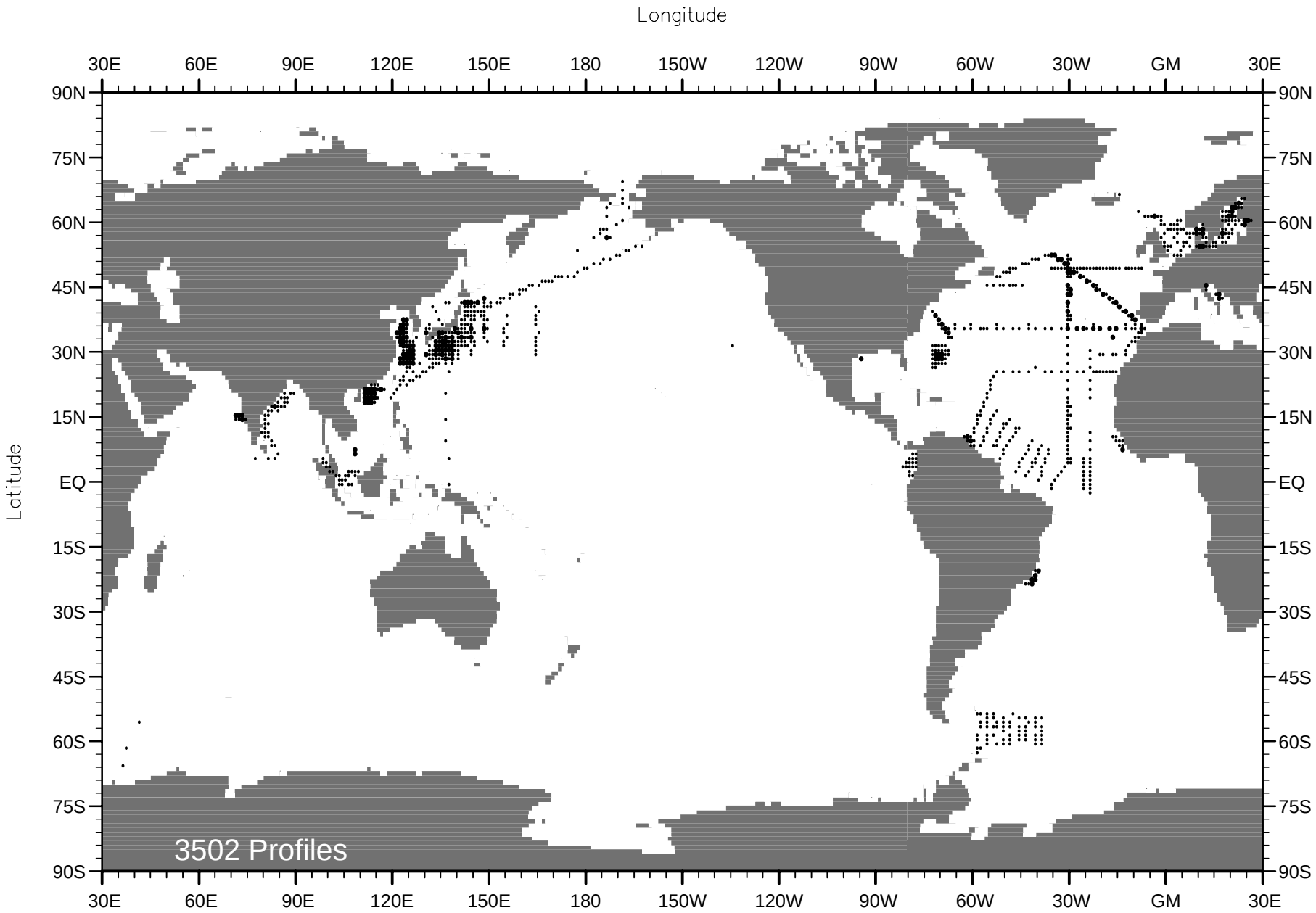


Fig. A62 Distribution of all Ocean Station Data (OSD) pH profiles in WOD01 for year 1978 .

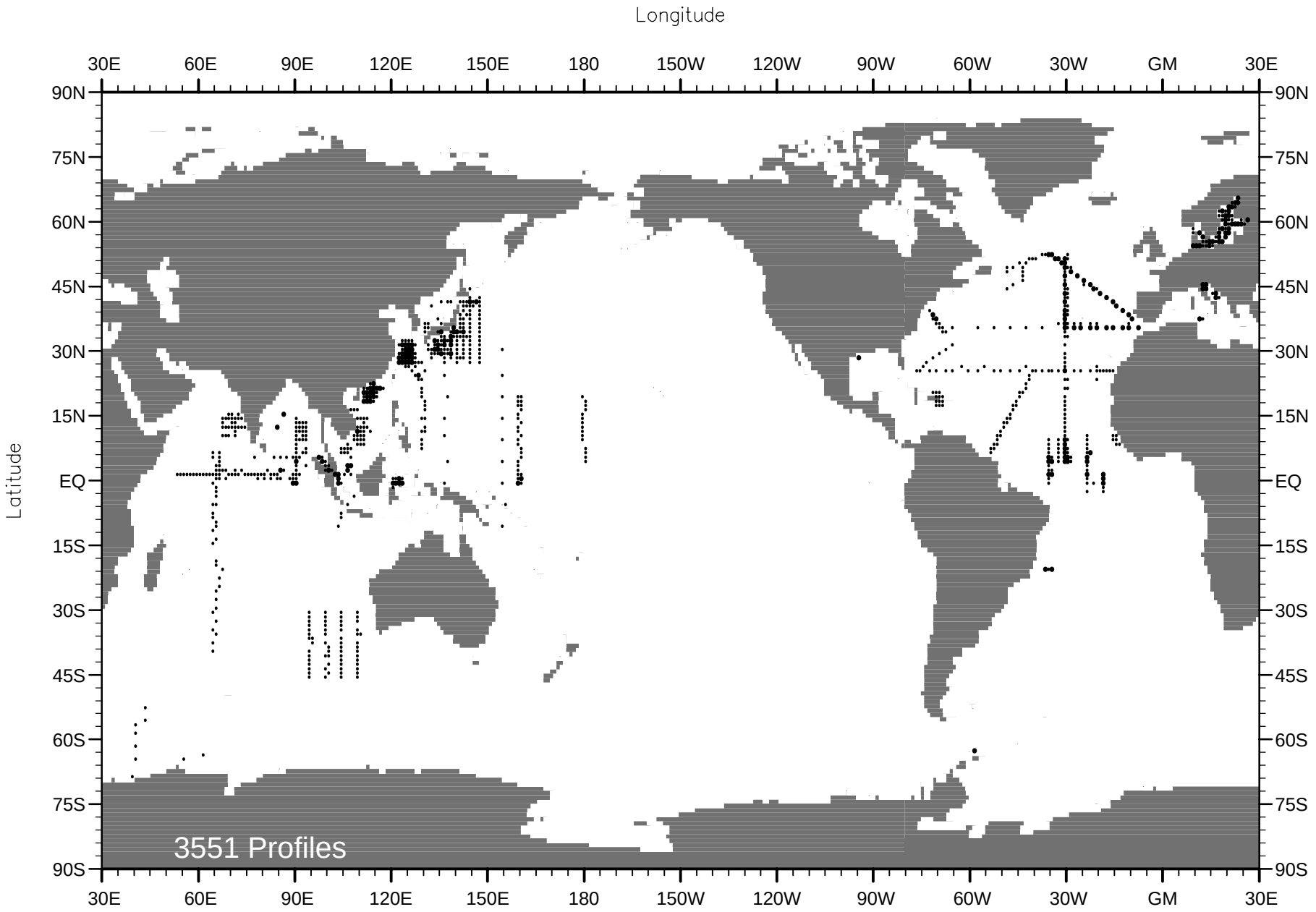


Fig. A63 Distribution of all Ocean Station Data (OSD) pH profiles in WOD01 for year 1979 .

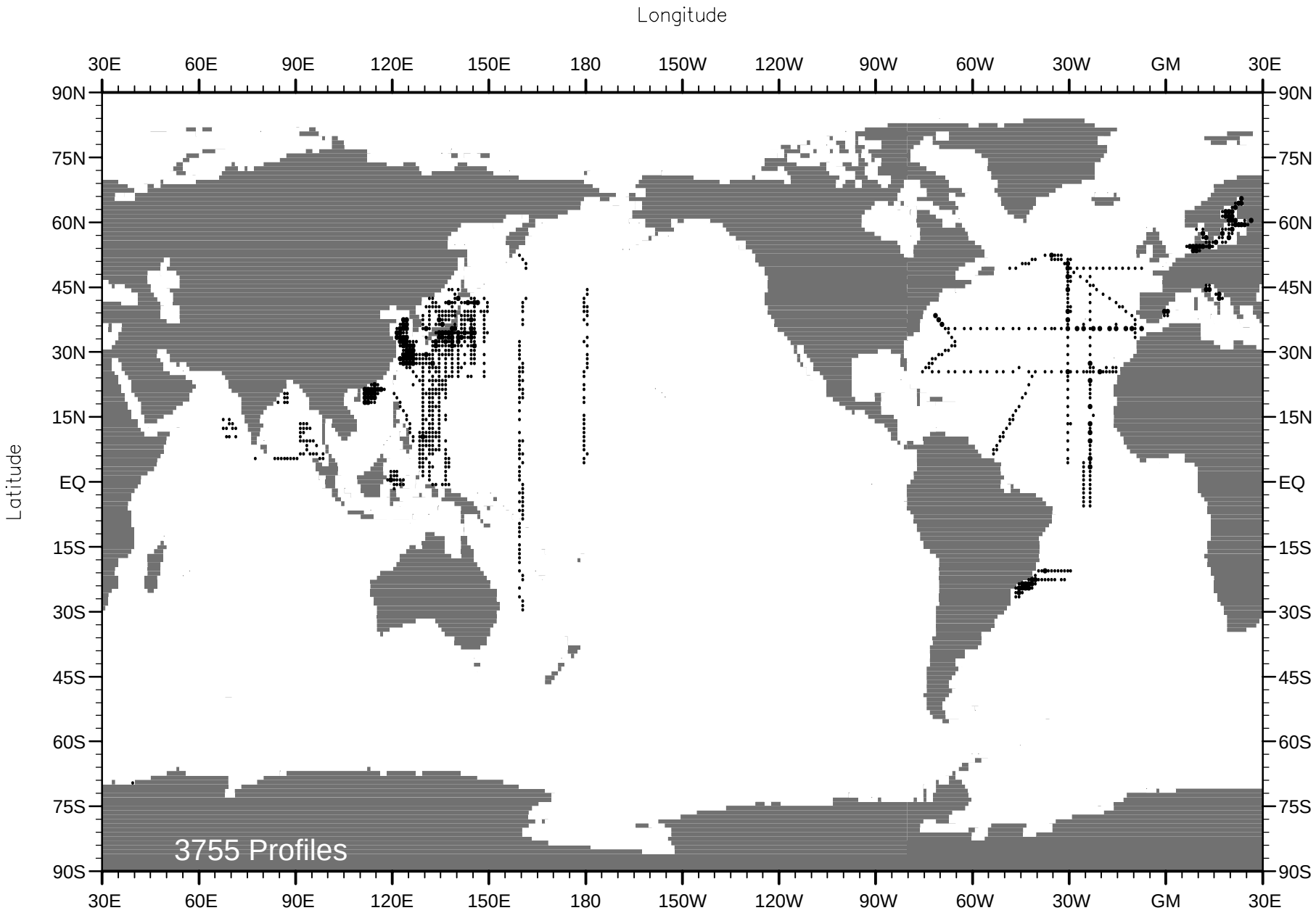


Fig. A64 Distribution of all Ocean Station Data (OSD) pH profiles in WOD01 for year 1980 .

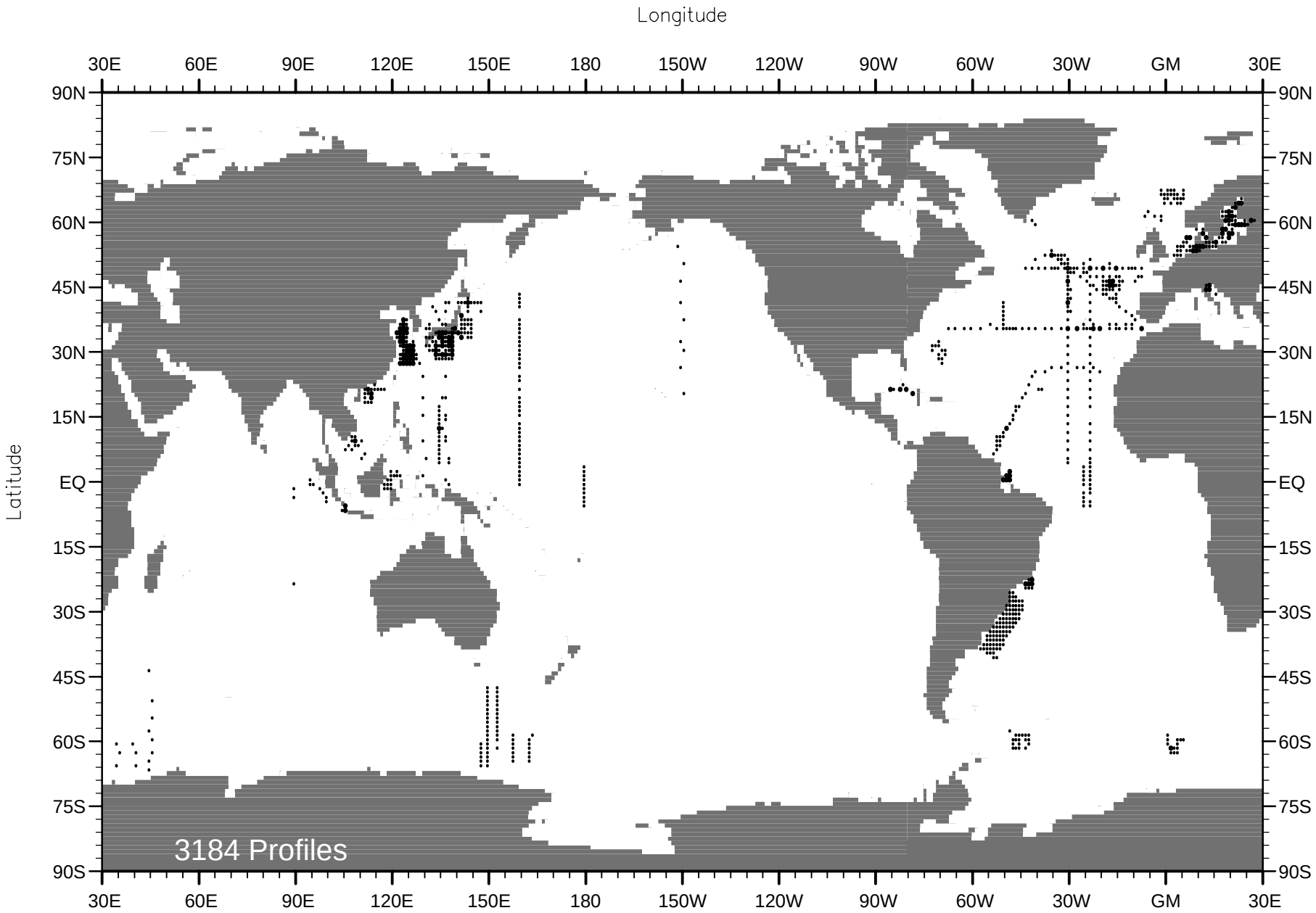


Fig. A65 Distribution of all Ocean Station Data (OSD) pH profiles in WOD01 for year 1981 .

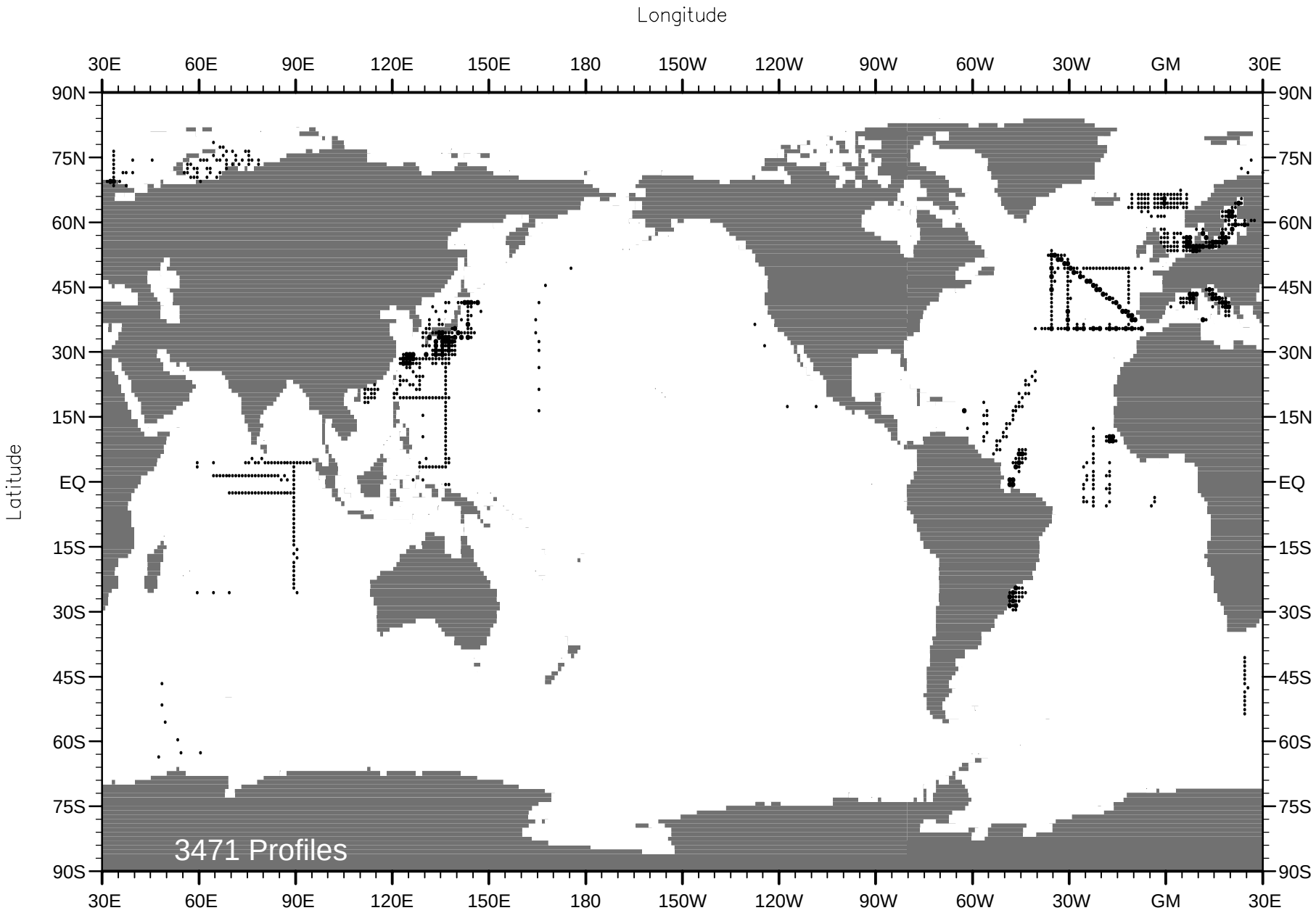


Fig. A66 Distribution of all Ocean Station Data (OSD) pH profiles in WOD01 for year 1982 .

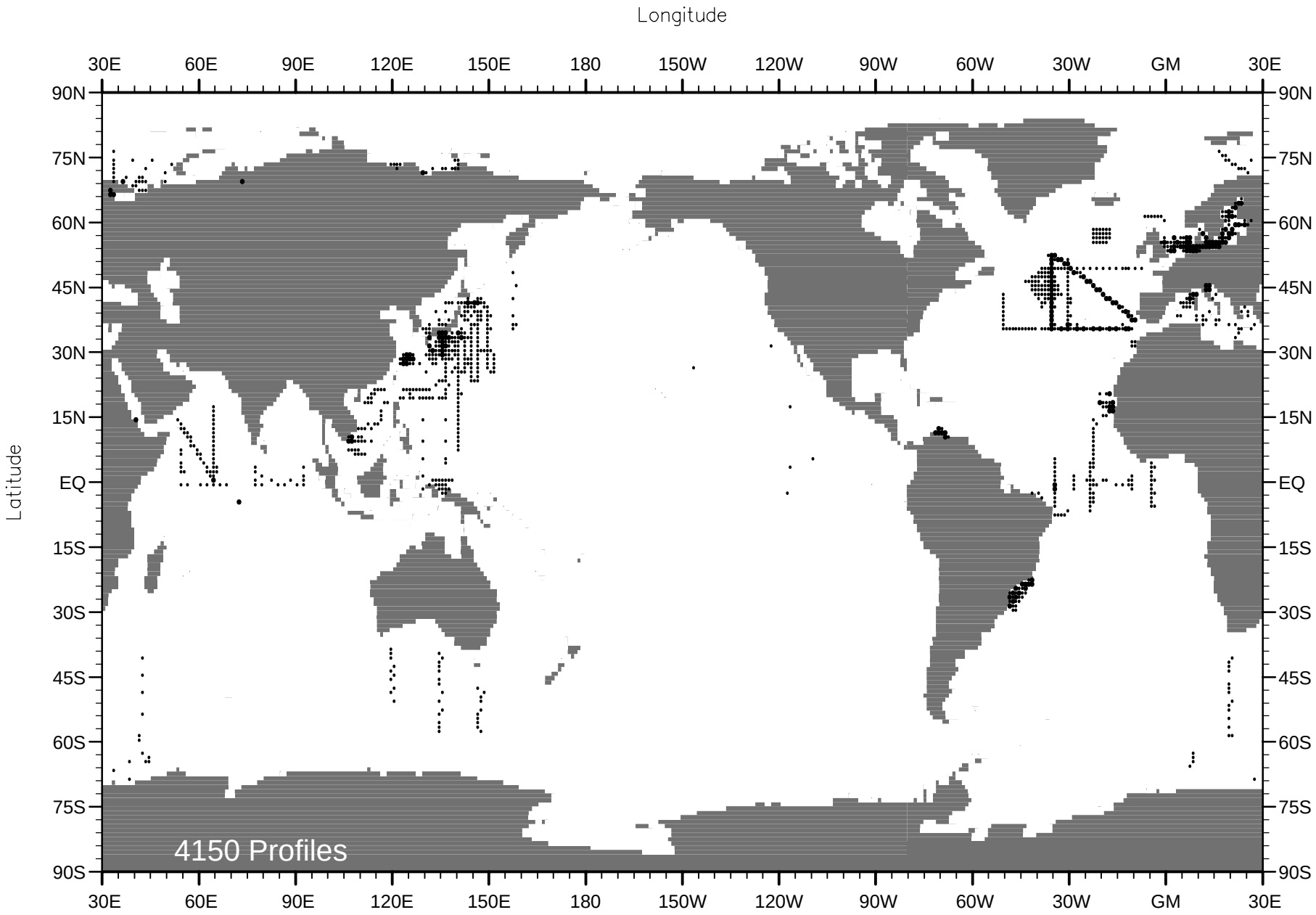


Fig. A67 Distribution of all Ocean Station Data (OSD) pH profiles in WOD01 for year 1983 .

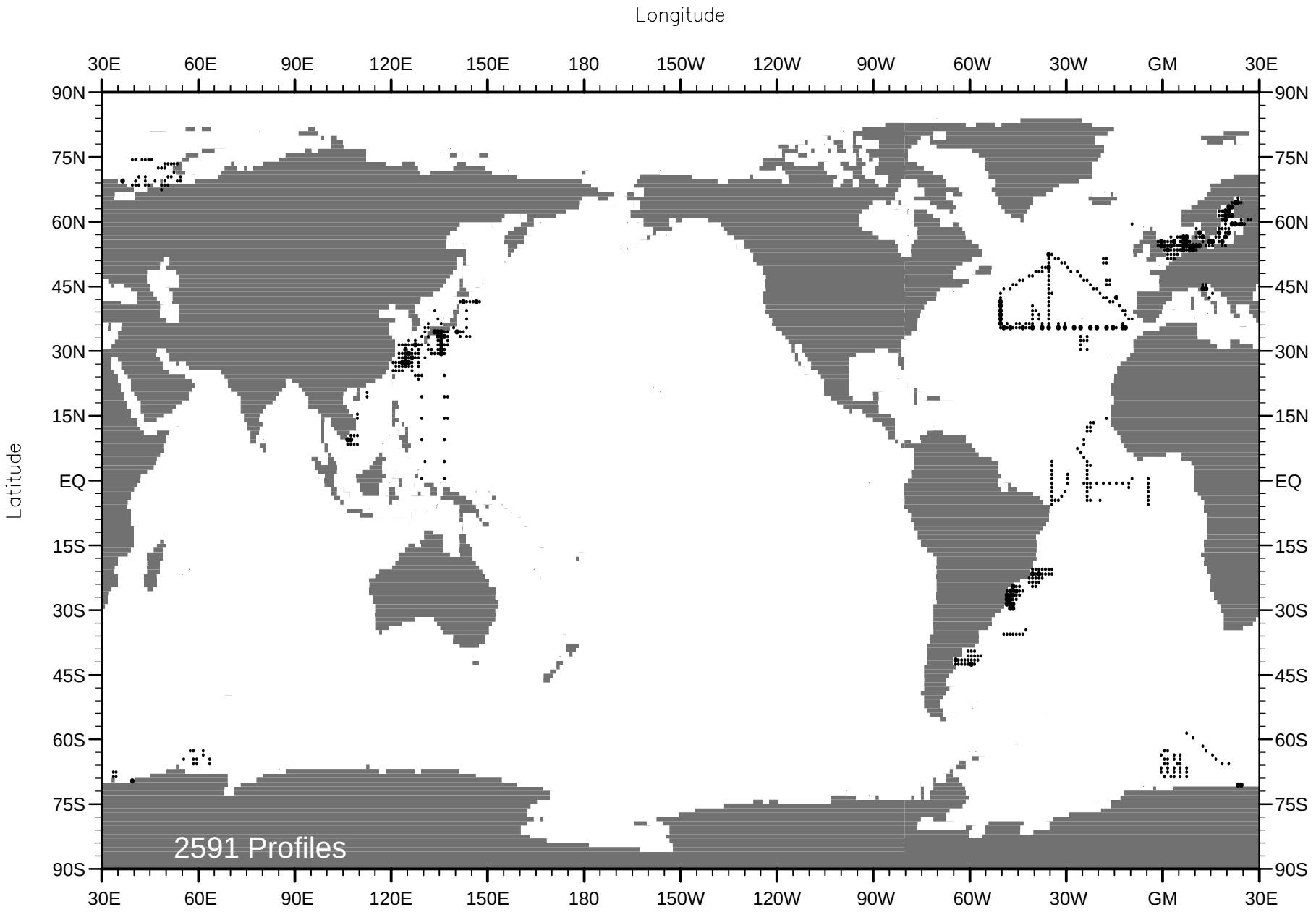


Fig. A68 Distribution of all Ocean Station Data (OSD) pH profiles in WOD01 for year 1984 .

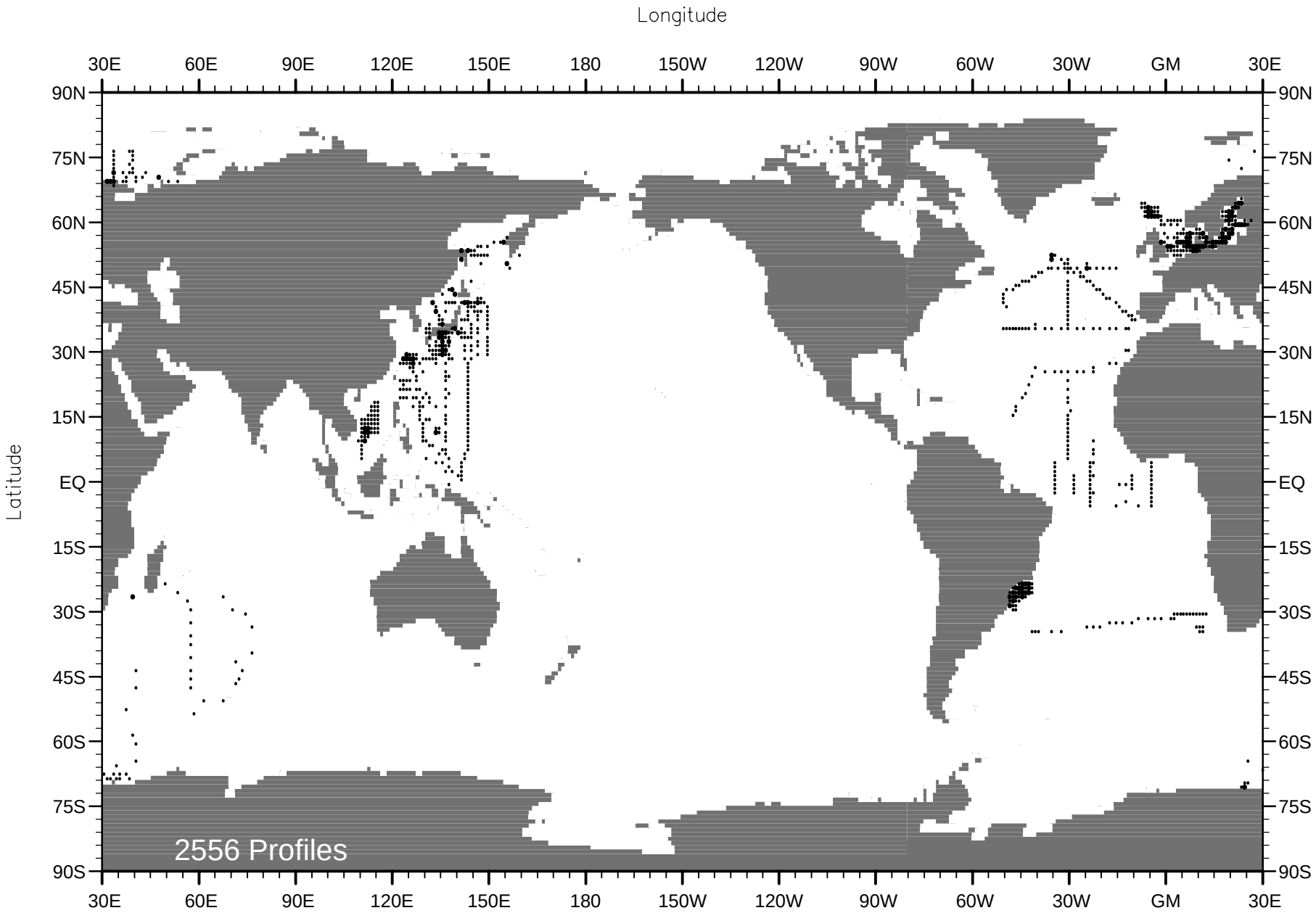


Fig. A69 Distribution of all Ocean Station Data (OSD) pH profiles in WOD01 for year 1985 .

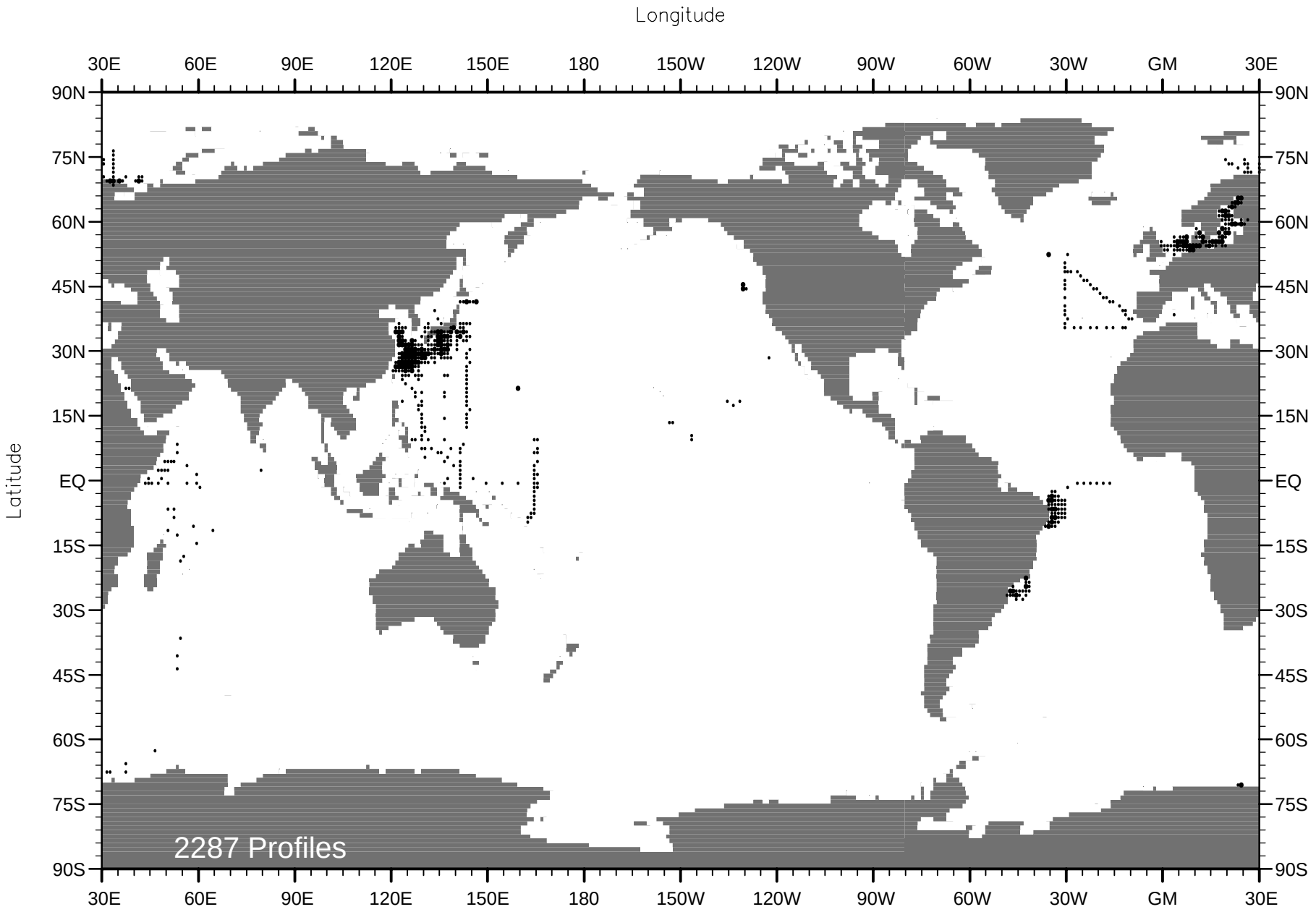


Fig. A70 Distribution of all Ocean Station Data (OSD) pH profiles in WOD01 for year 1986 .

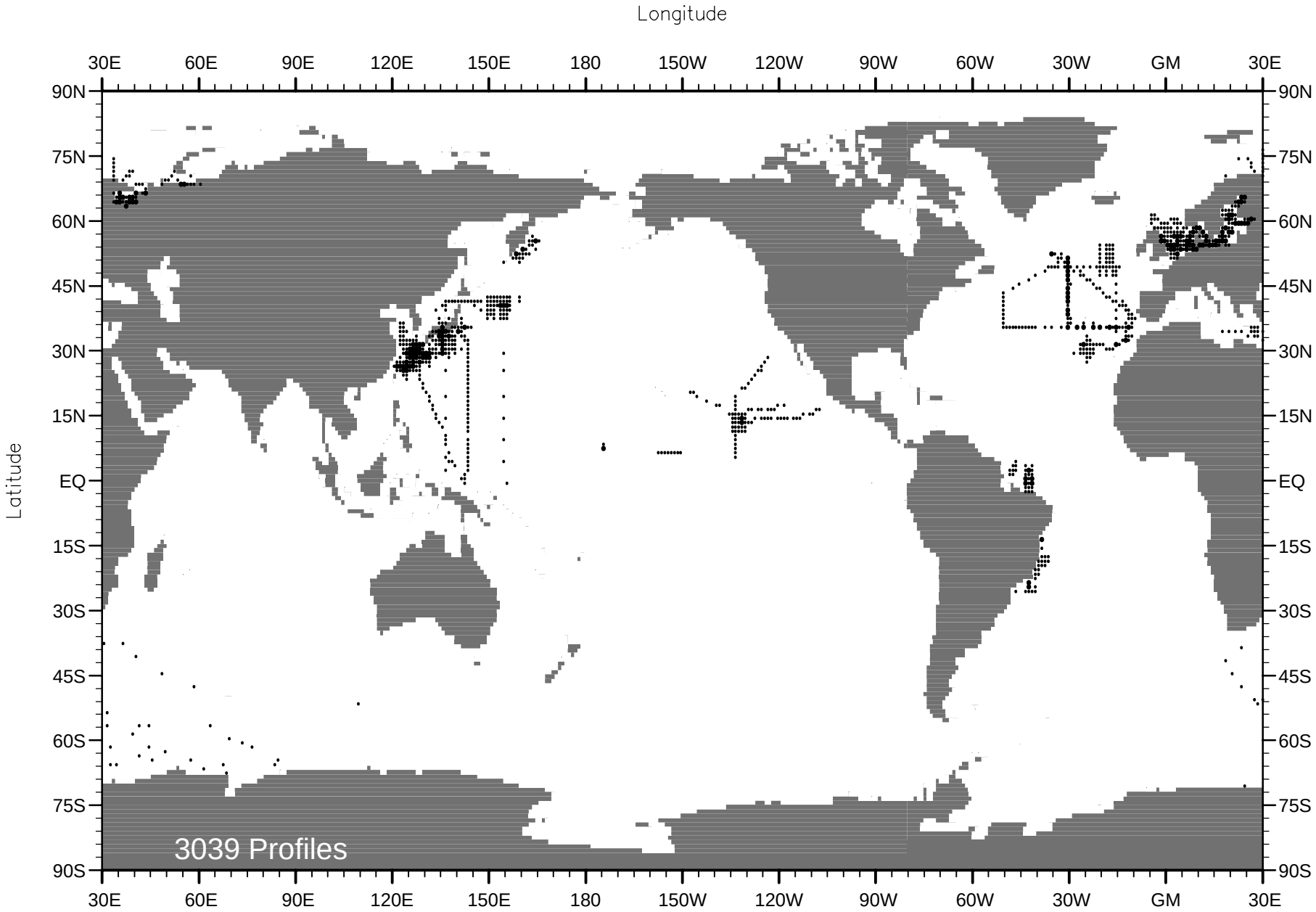


Fig. A71 Distribution of all Ocean Station Data (OSD) pH profiles in WOD01 for year 1987 .

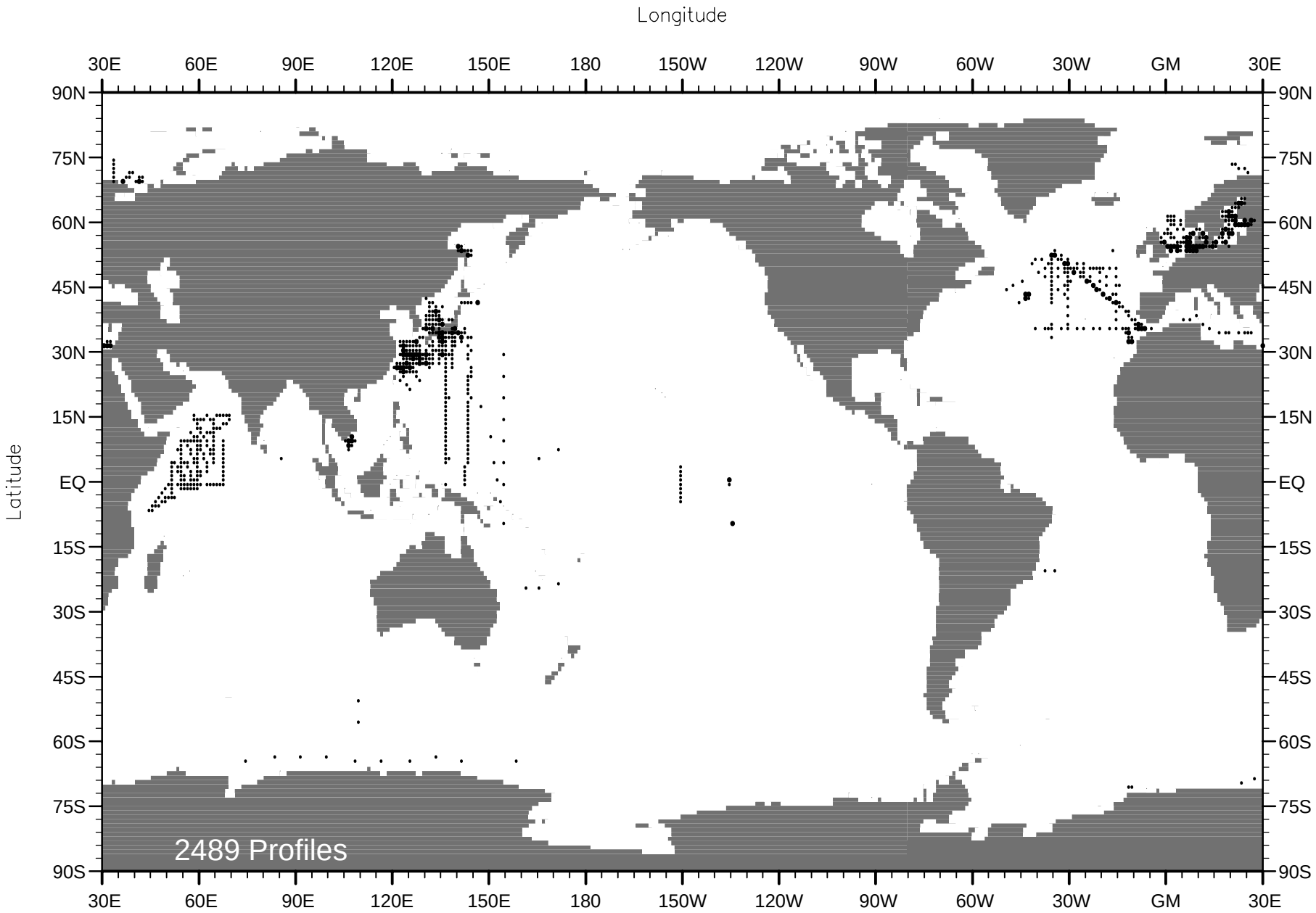


Fig. A72 Distribution of all Ocean Station Data (OSD) pH profiles in WOD01 for year 1988 .

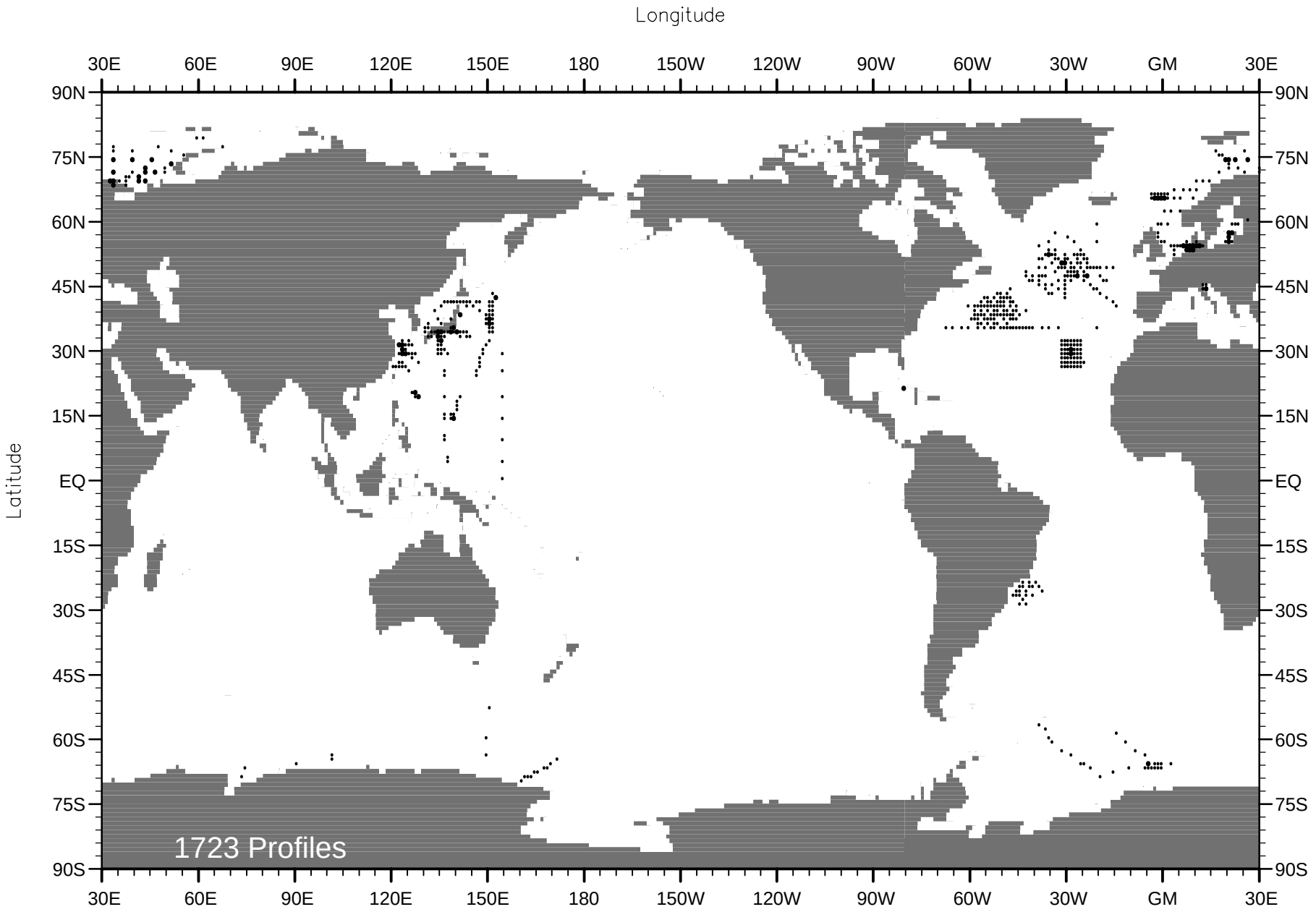


Fig. A73 Distribution of all Ocean Station Data (OSD) pH profiles in WOD01 for year 1989 .

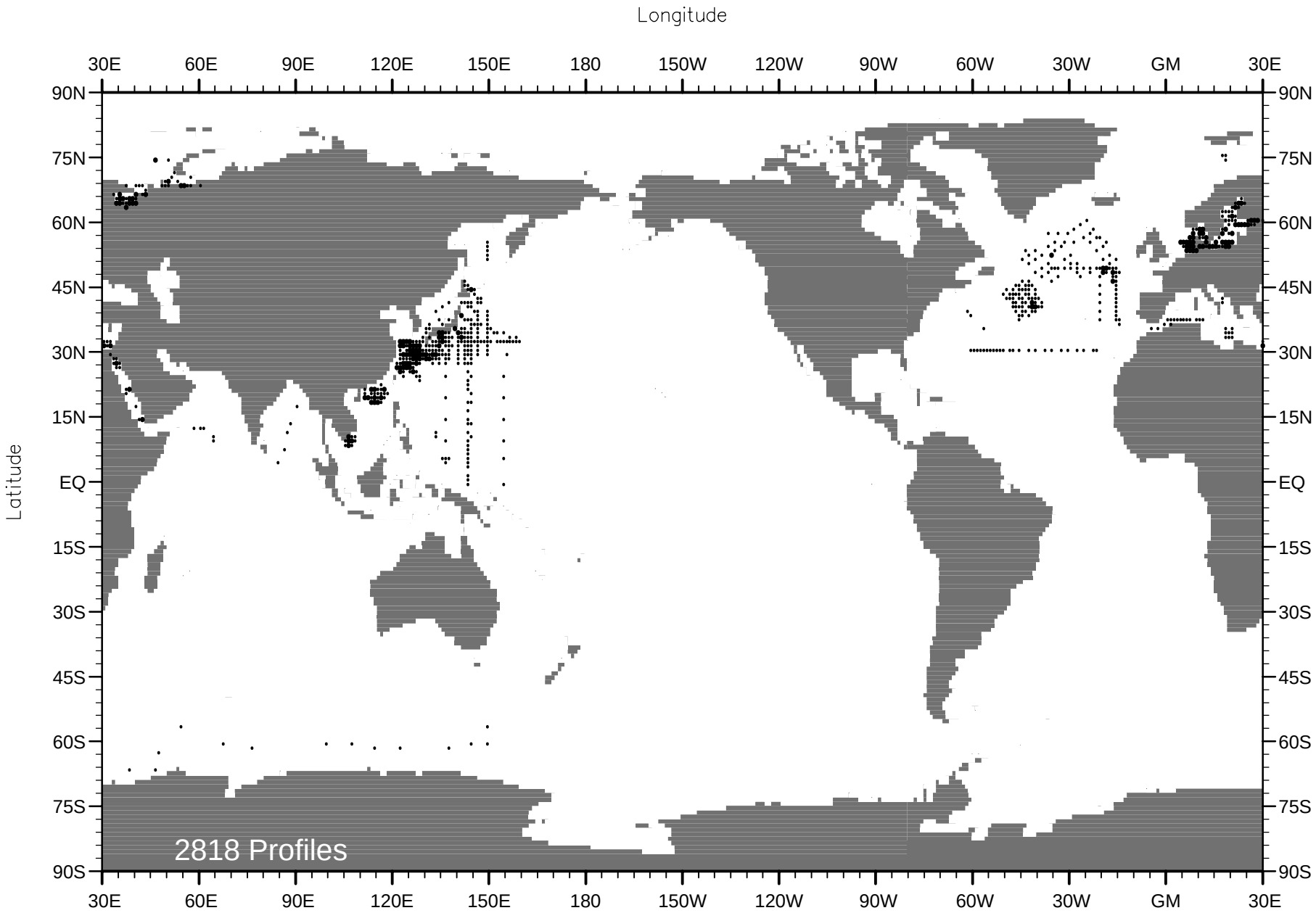


Fig. A74 Distribution of all Ocean Station Data (OSD) pH profiles in WOD01 for year 1990 .

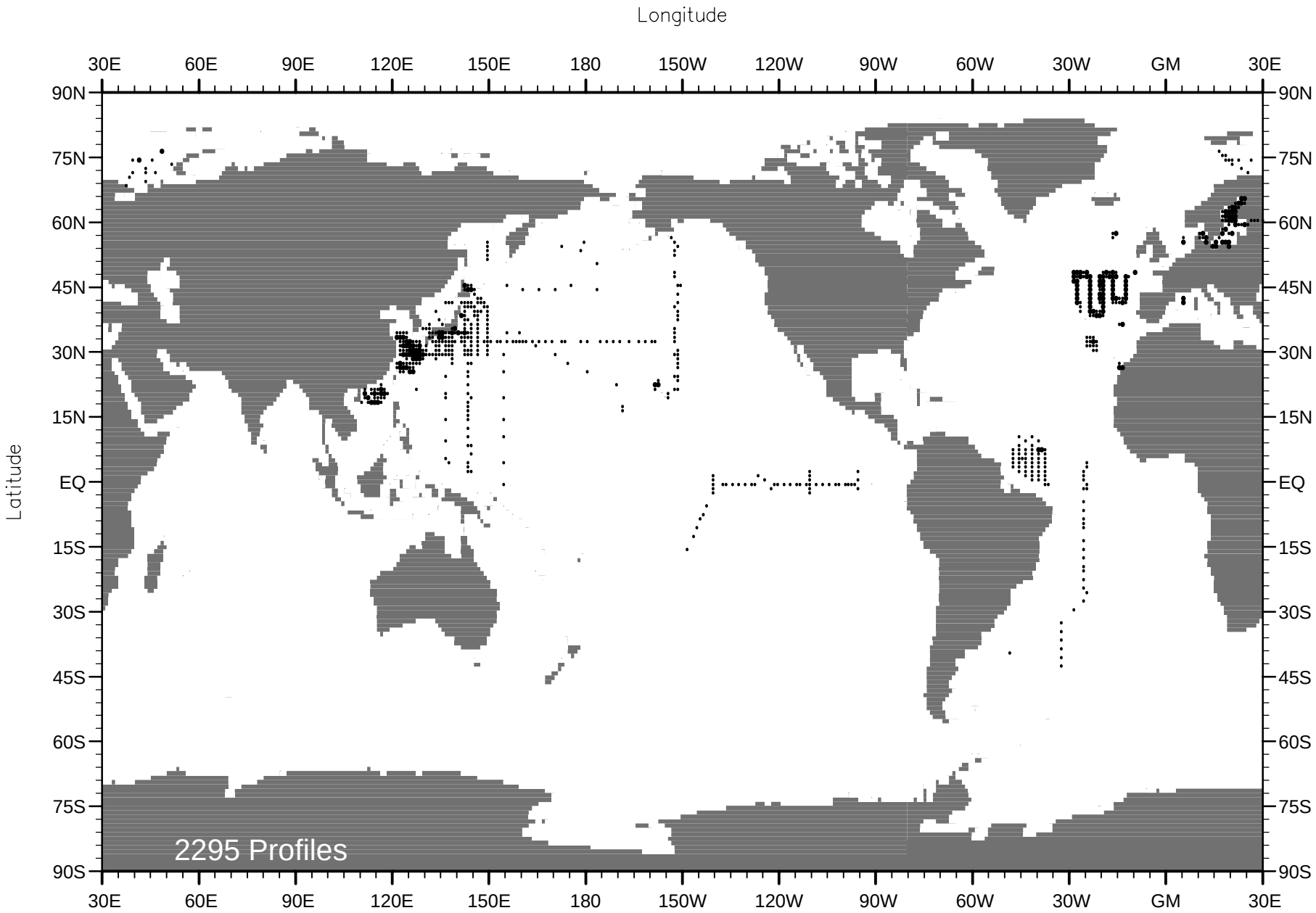


Fig. A75 Distribution of all Ocean Station Data (OSD) pH profiles in WOD01 for year 1991 .

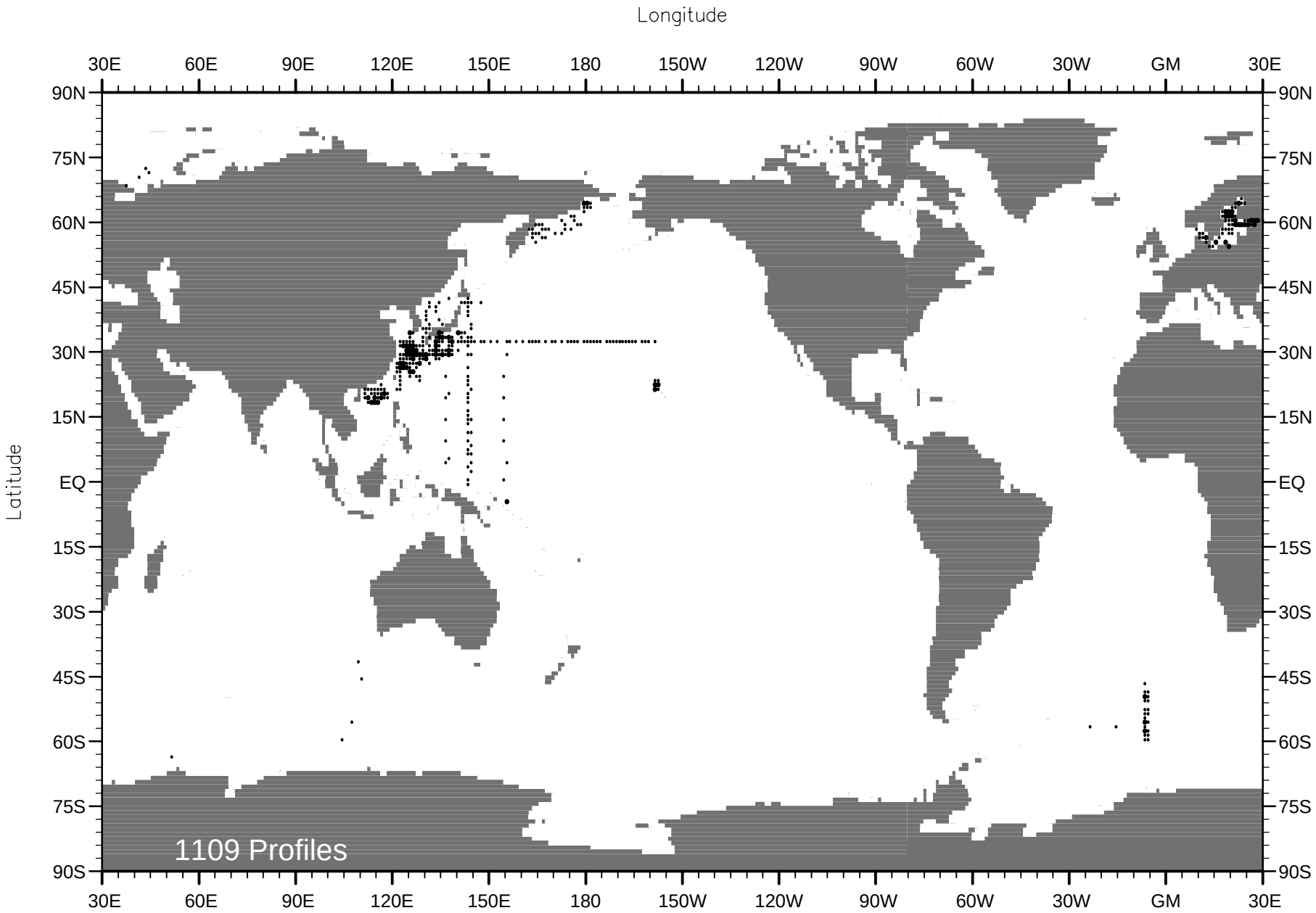


Fig. A76 Distribution of all Ocean Station Data (OSD) pH profiles in WOD01 for year 1992 .

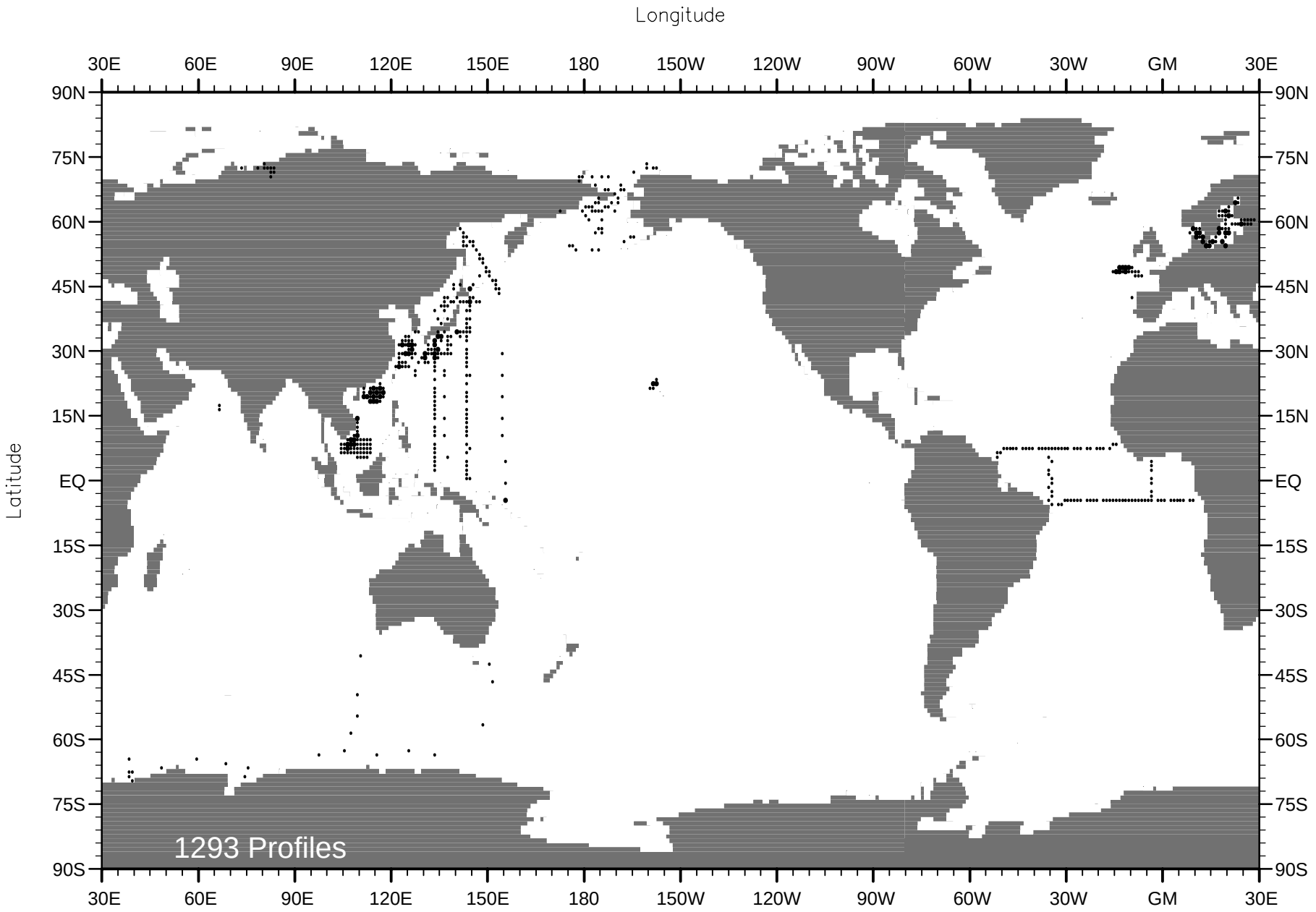


Fig. A77 Distribution of all Ocean Station Data (OSD) pH profiles in WOD01 for year 1993 .

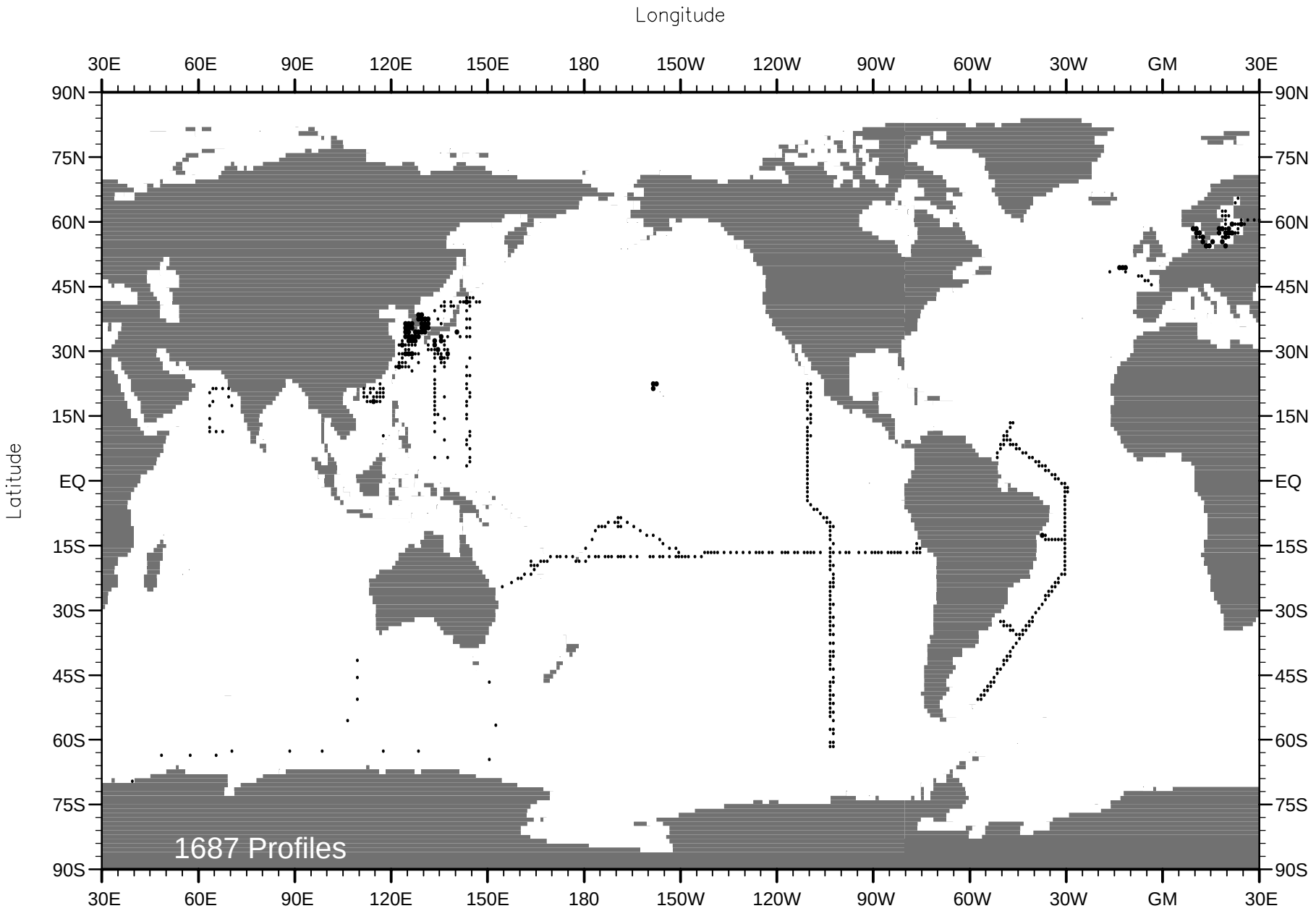


Fig. A78 Distribution of all Ocean Station Data (OSD) pH profiles in WOD01 for year 1994 .

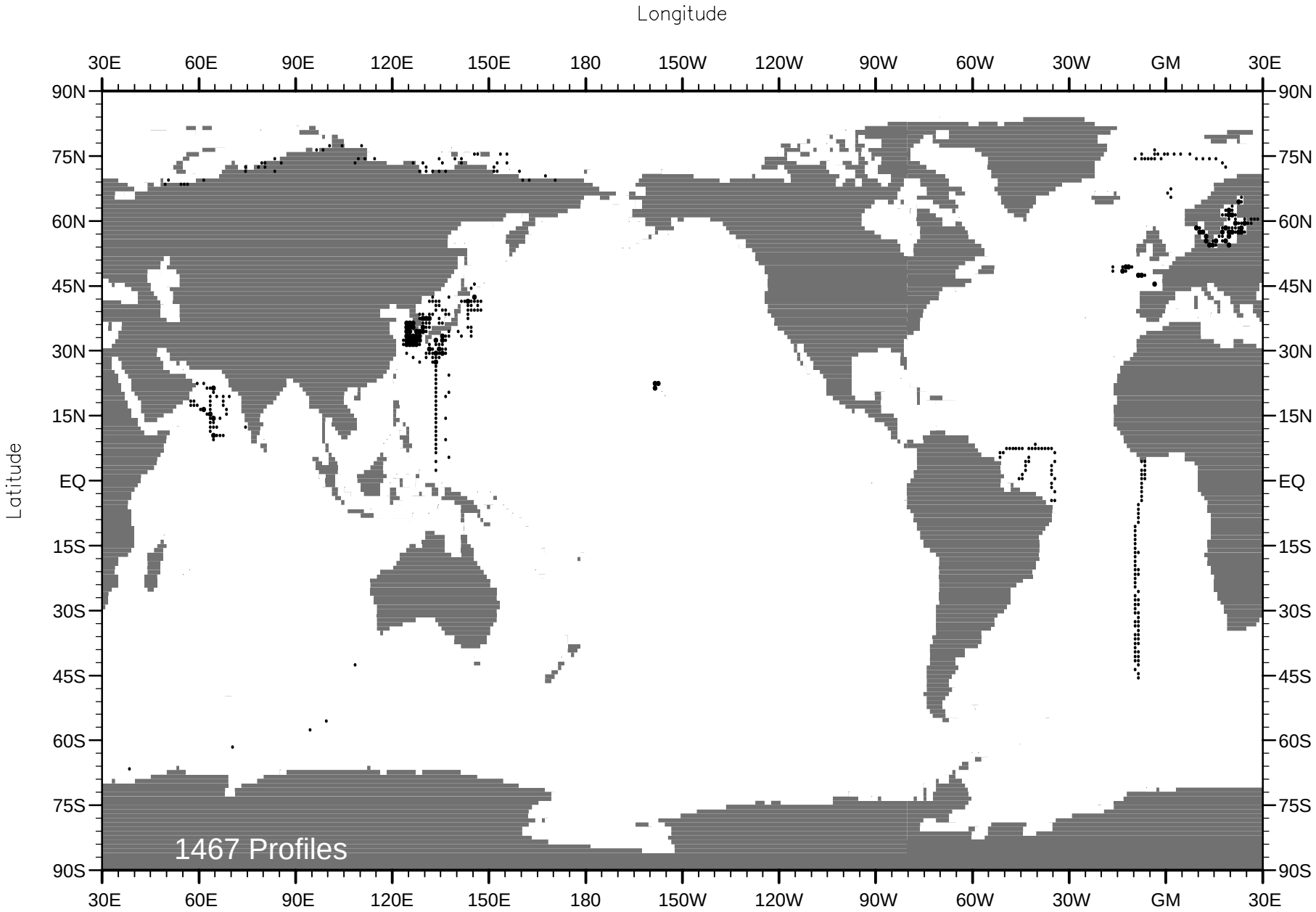


Fig. A79 Distribution of all Ocean Station Data (OSD) pH profiles in WOD01 for year 1995 .

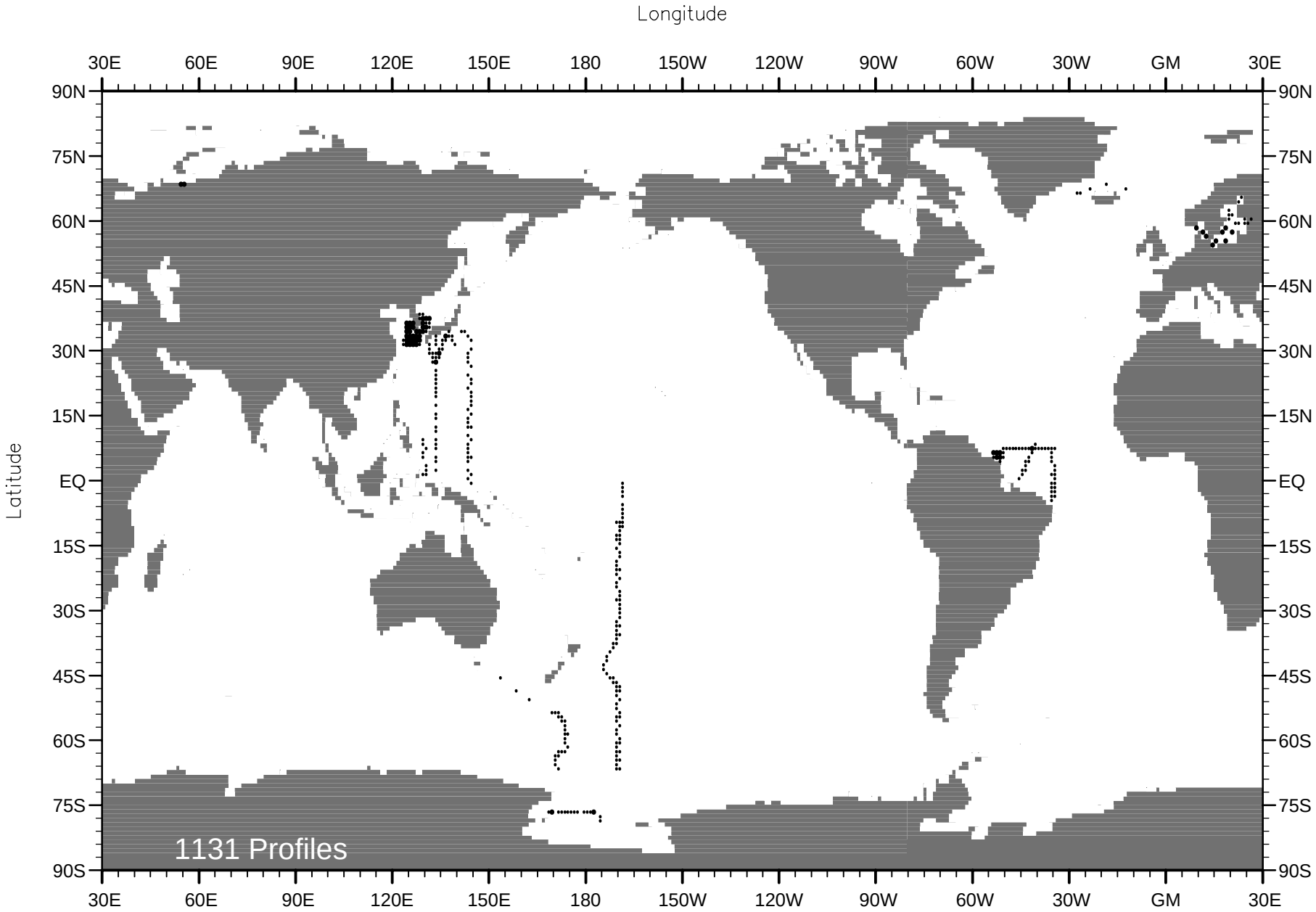


Fig. A80 Distribution of all Ocean Station Data (OSD) pH profiles in WOD01 for year 1996 .

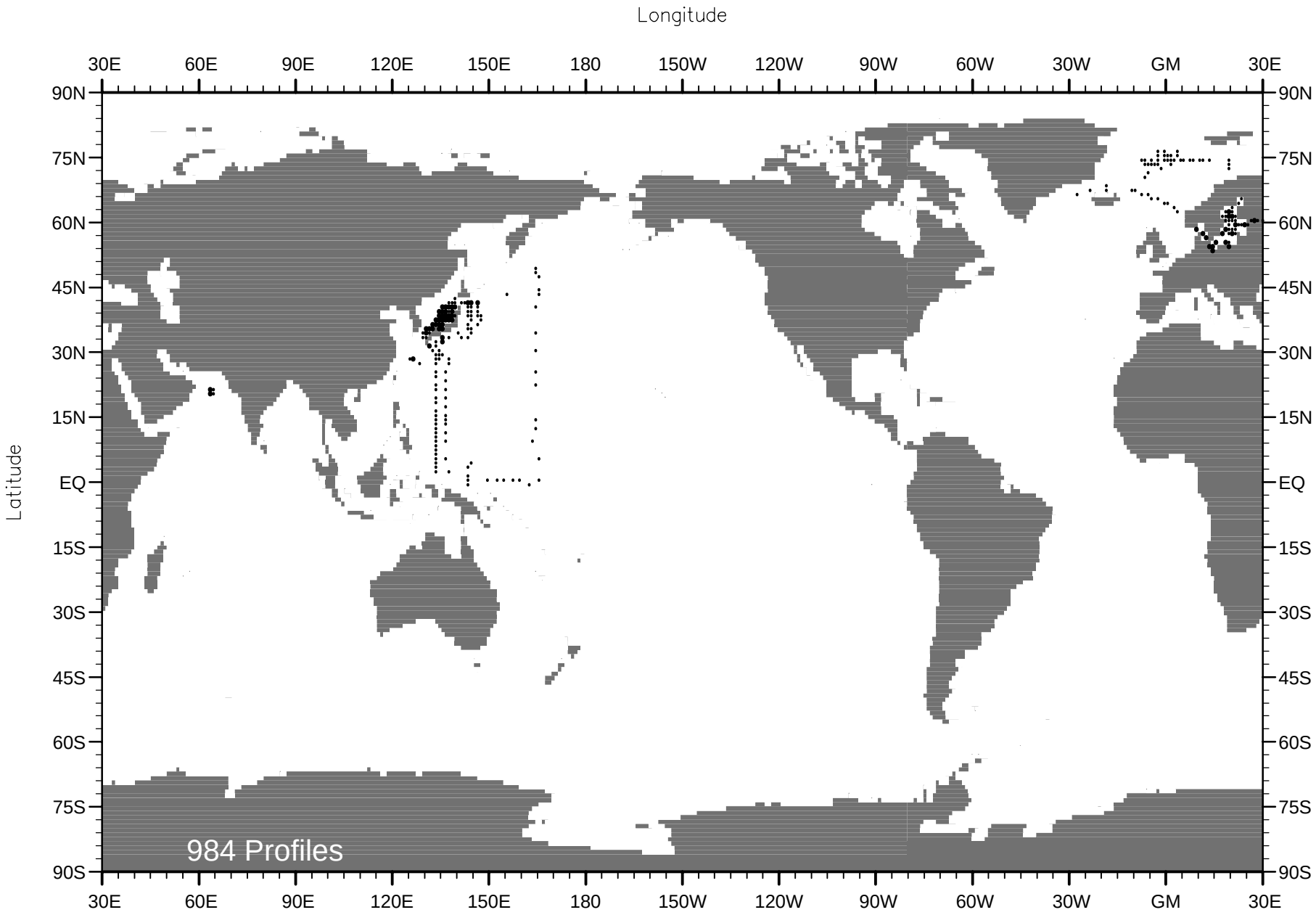


Fig. A81 Distribution of all Ocean Station Data (OSD) pH profiles in WOD01 for year 1997 .

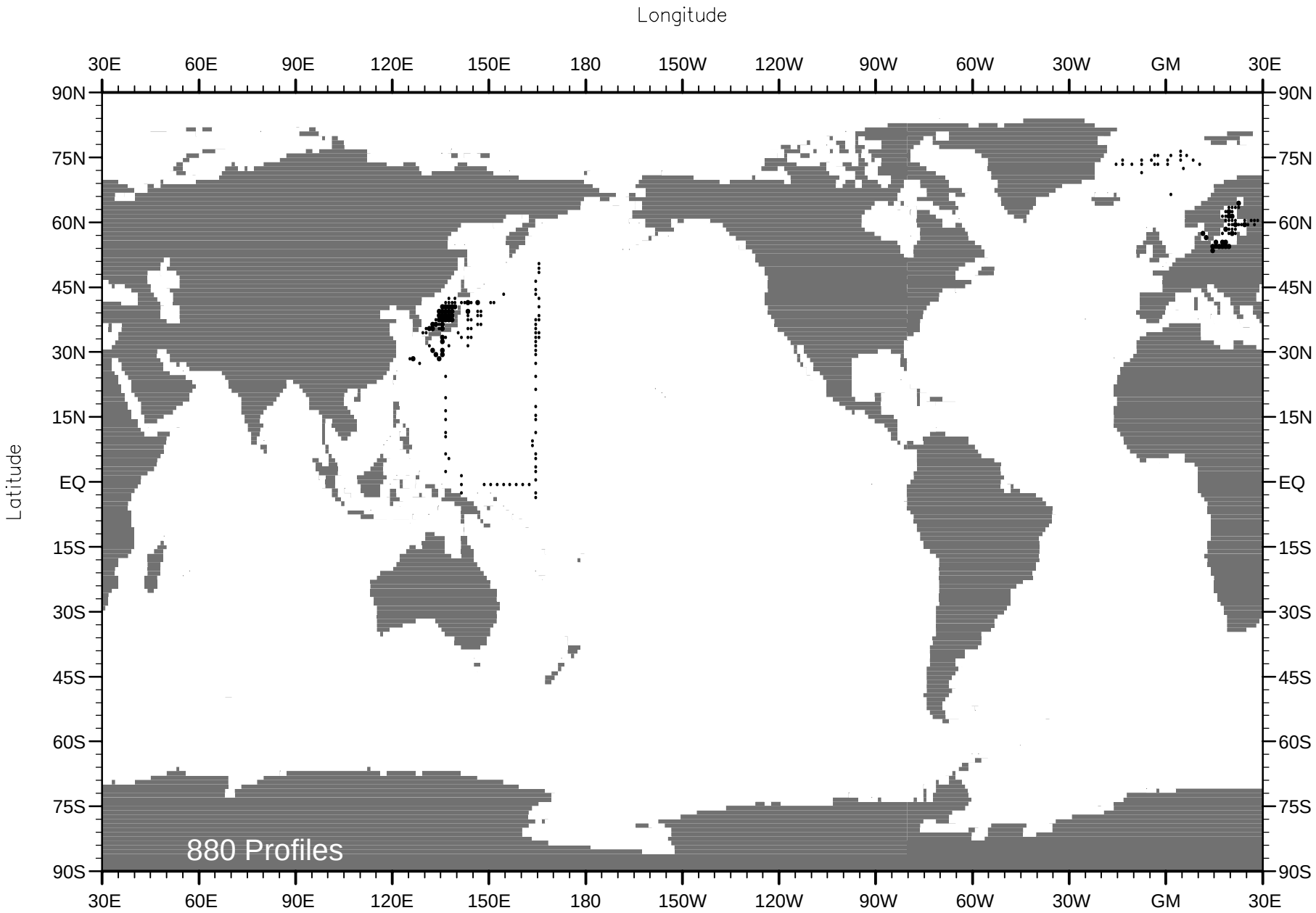


Fig. A82 Distribution of all Ocean Station Data (OSD) pH profiles in WOD01 for year 1998 .

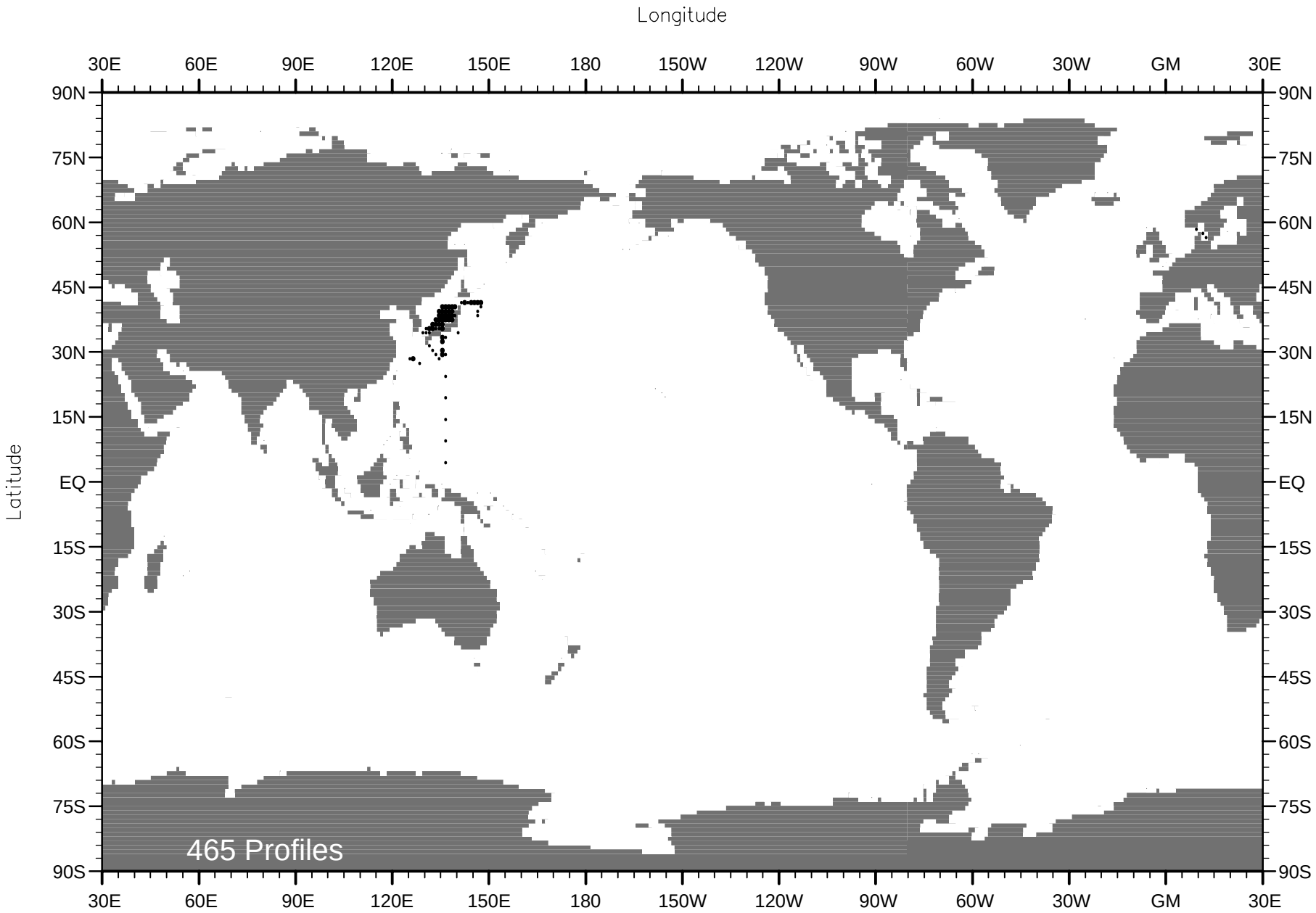


Fig. A83 Distribution of all Ocean Station Data (OSD) pH profiles in WOD01 for year 1999 .

5. APPENDIX B: DISTRIBUTIONS FOR INDIVIDUAL YEARS OF ALL OCEAN STATION DATA (OSD) ALKALINITY PROFILES IN WOD01

This appendix contains yearly distributions of all OSD alkalinity profiles contained in WOD01. These maps provide some history of the observational progress of the field of oceanography. They also serve as indicators of whether or not a particular data set from a scientist or institution is part of the NODC/WDC-A archive. The exchange of information provided by the publication of such maps has provided us with valuable information about deficiencies in the database. The locations of all WOD01 OSD alkalinity profiles are plotted including stations that may be erroneously located over land. However, WOD01 contains some stations from various lakes so care should be exercised in the use of these stations and the determination as to whether they represent errors in locations.

For all figures in Appendix B, a small dot indicates a one-degree square containing from one to four stations and a large dot indicates five or more stations.

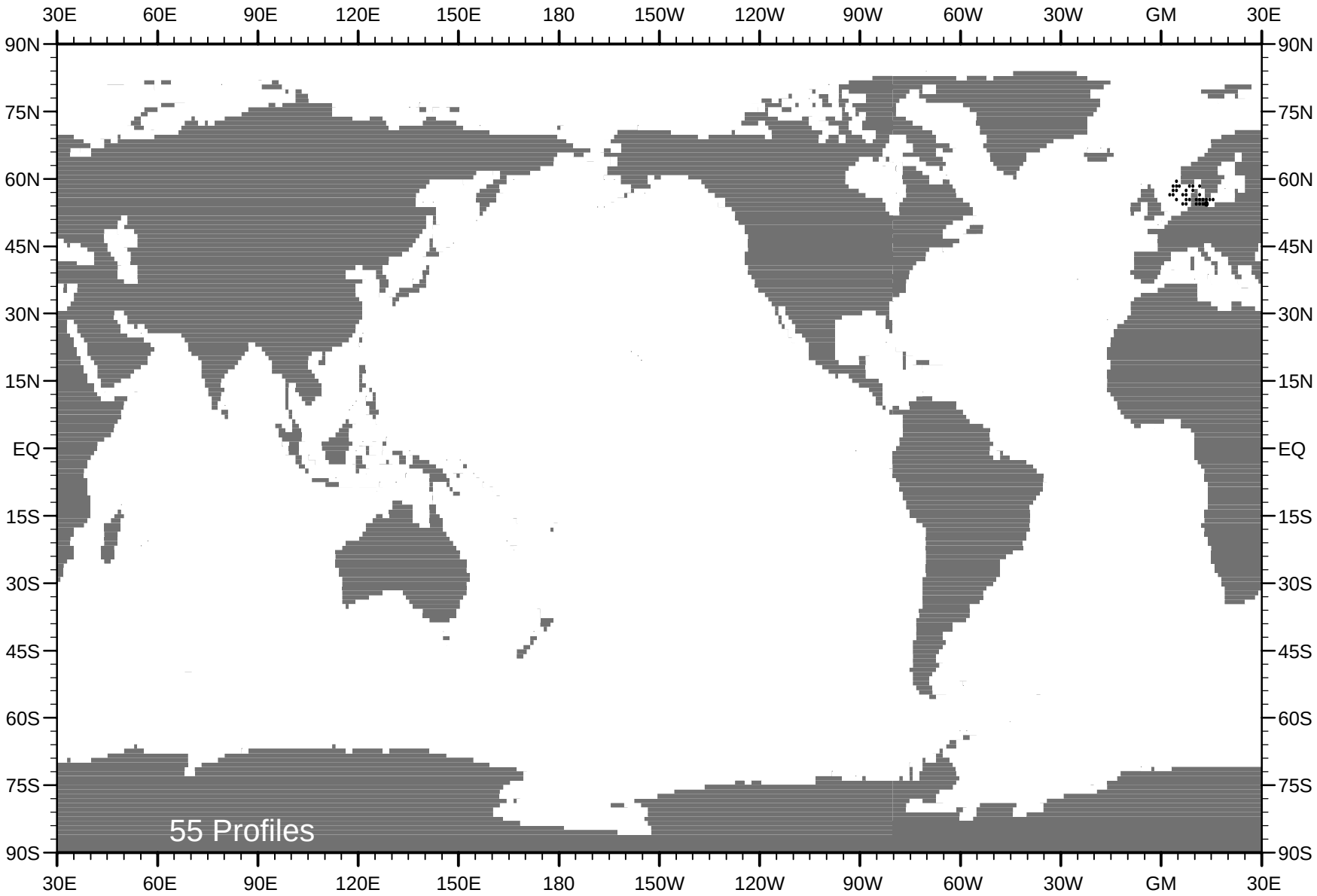


Fig. B1 Distribution of all Ocean Station Data (OSD) alkalinity profiles in WOD01 for year 1921 .

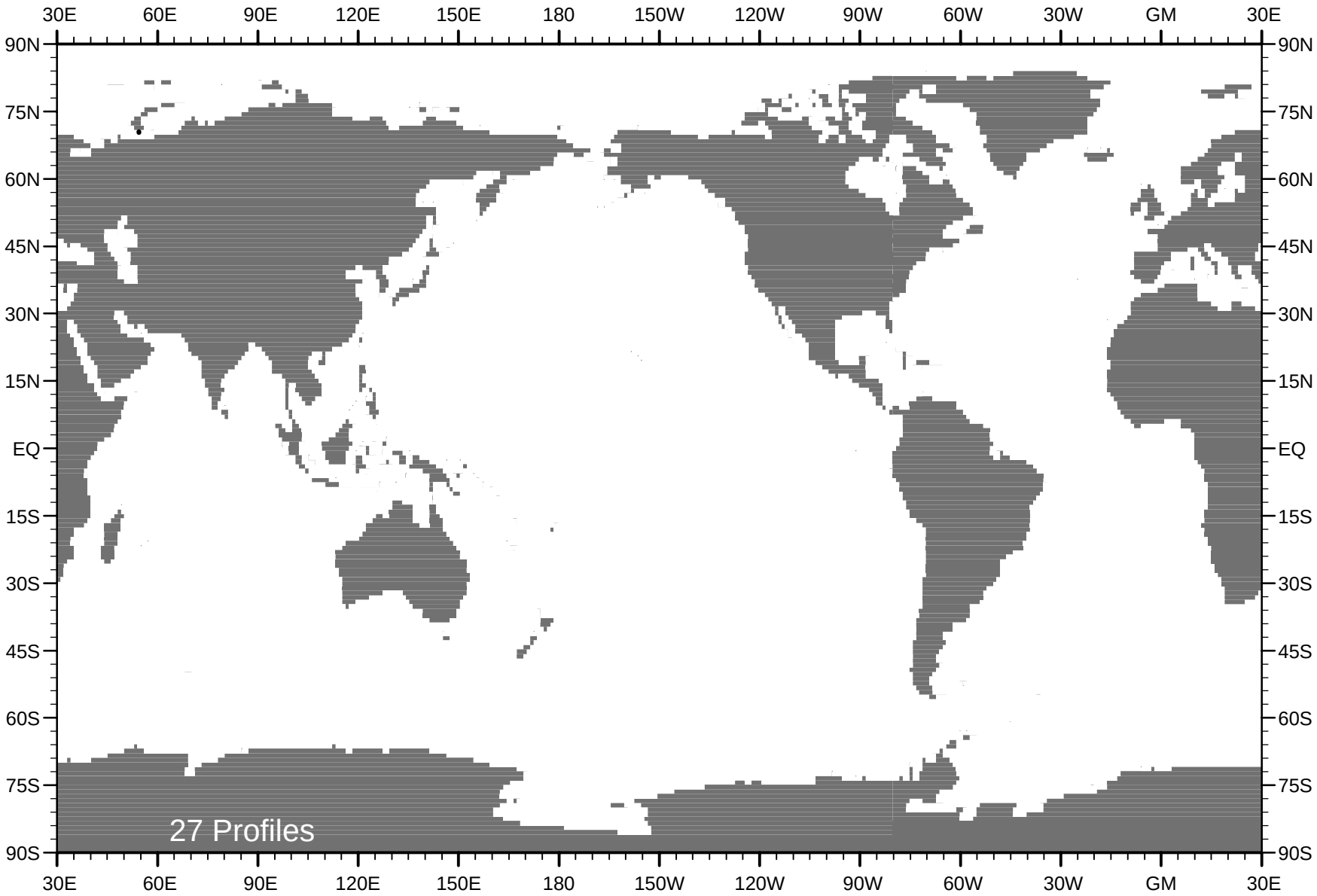


Fig. B2 Distribution of all Ocean Station Data (OSD) alkalinity profiles in WOD01 for year 1925 .

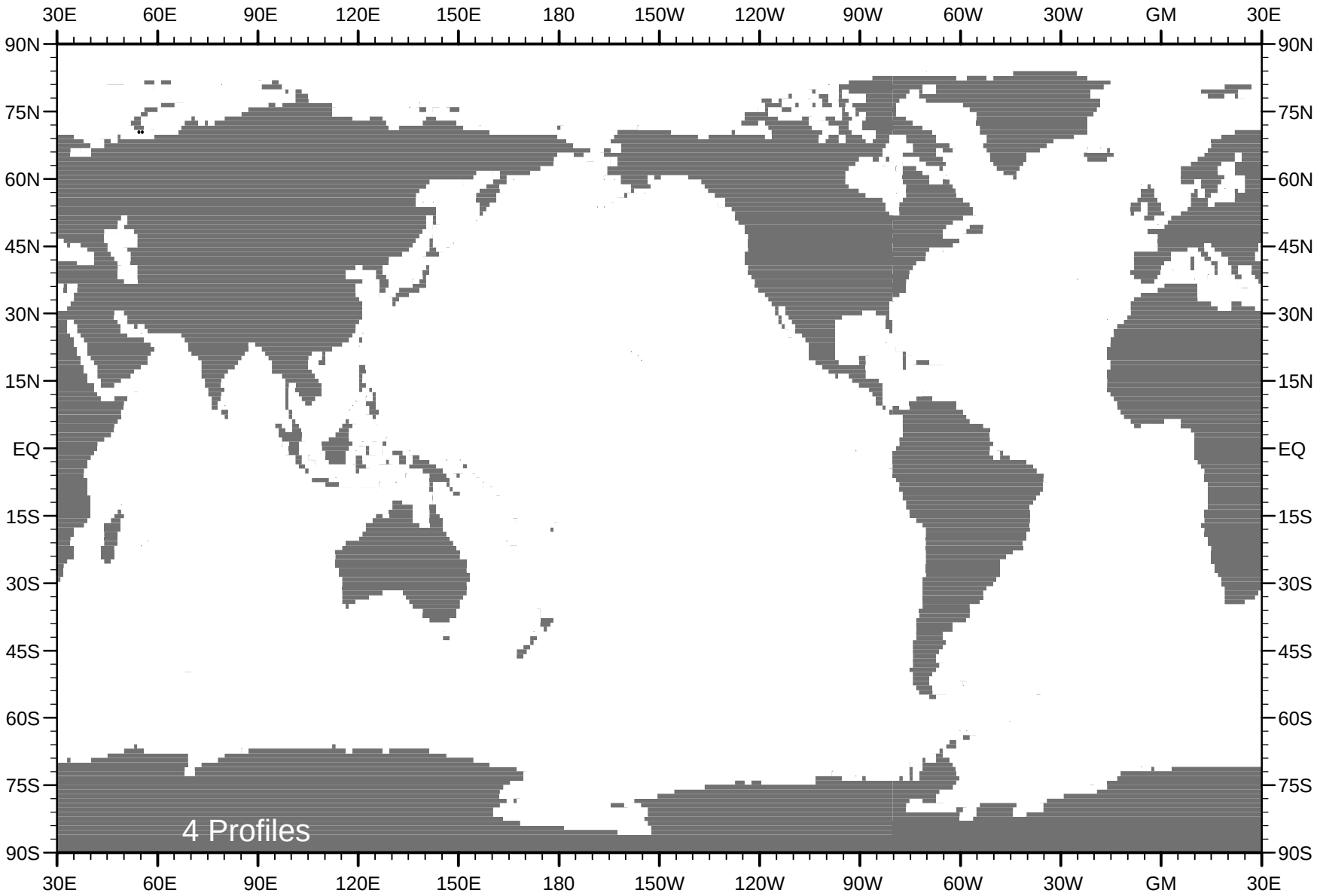


Fig. B3 Distribution of all Ocean Station Data (OSD) alkalinity profiles in WOD01 for year 1927 .

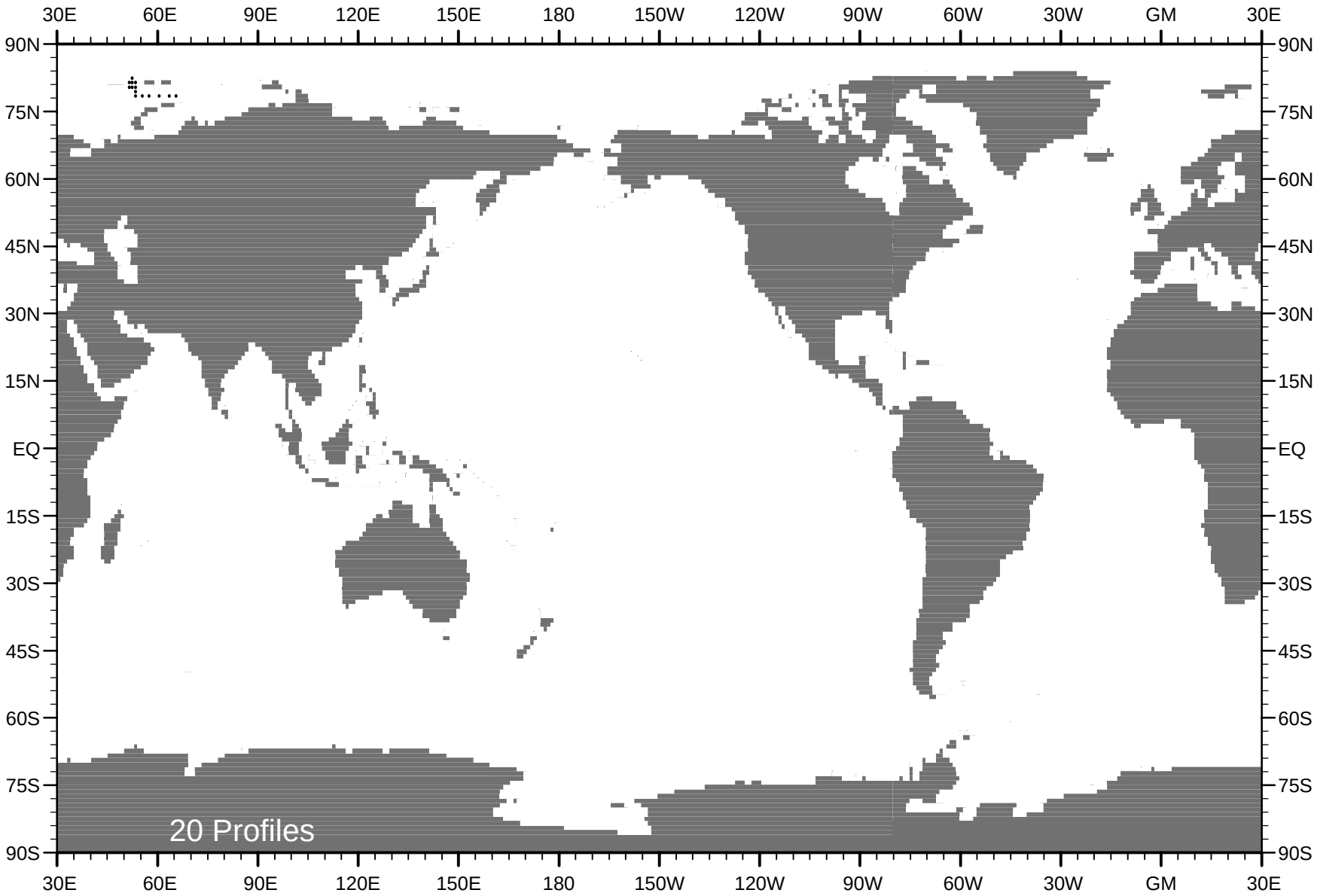


Fig. B4 Distribution of all Ocean Station Data (OSD) alkalinity profiles in WOD01 for year 1929 .

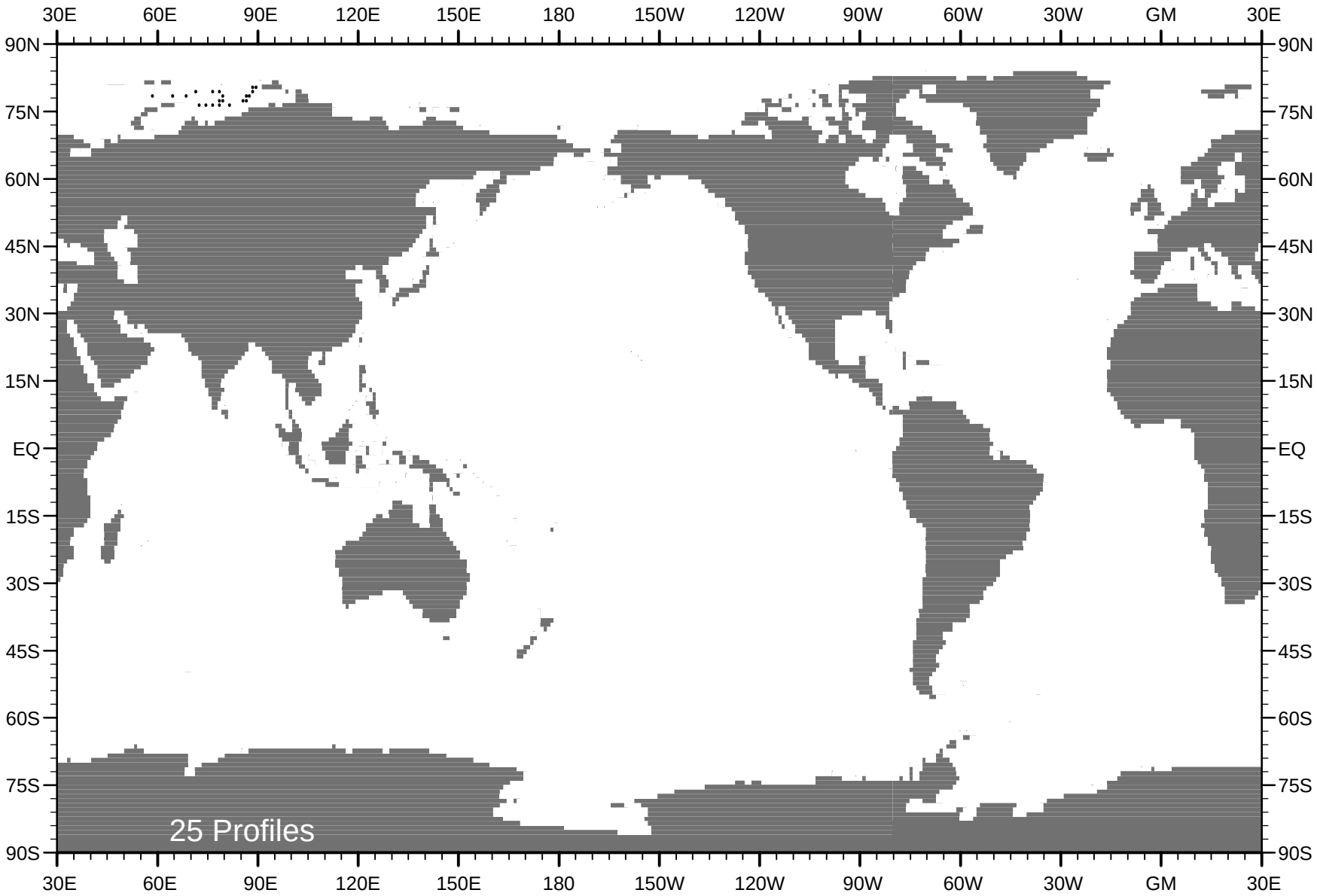


Fig. B5 Distribution of all Ocean Station Data (OSD) alkalinity profiles in WOD01 for year 1930 .

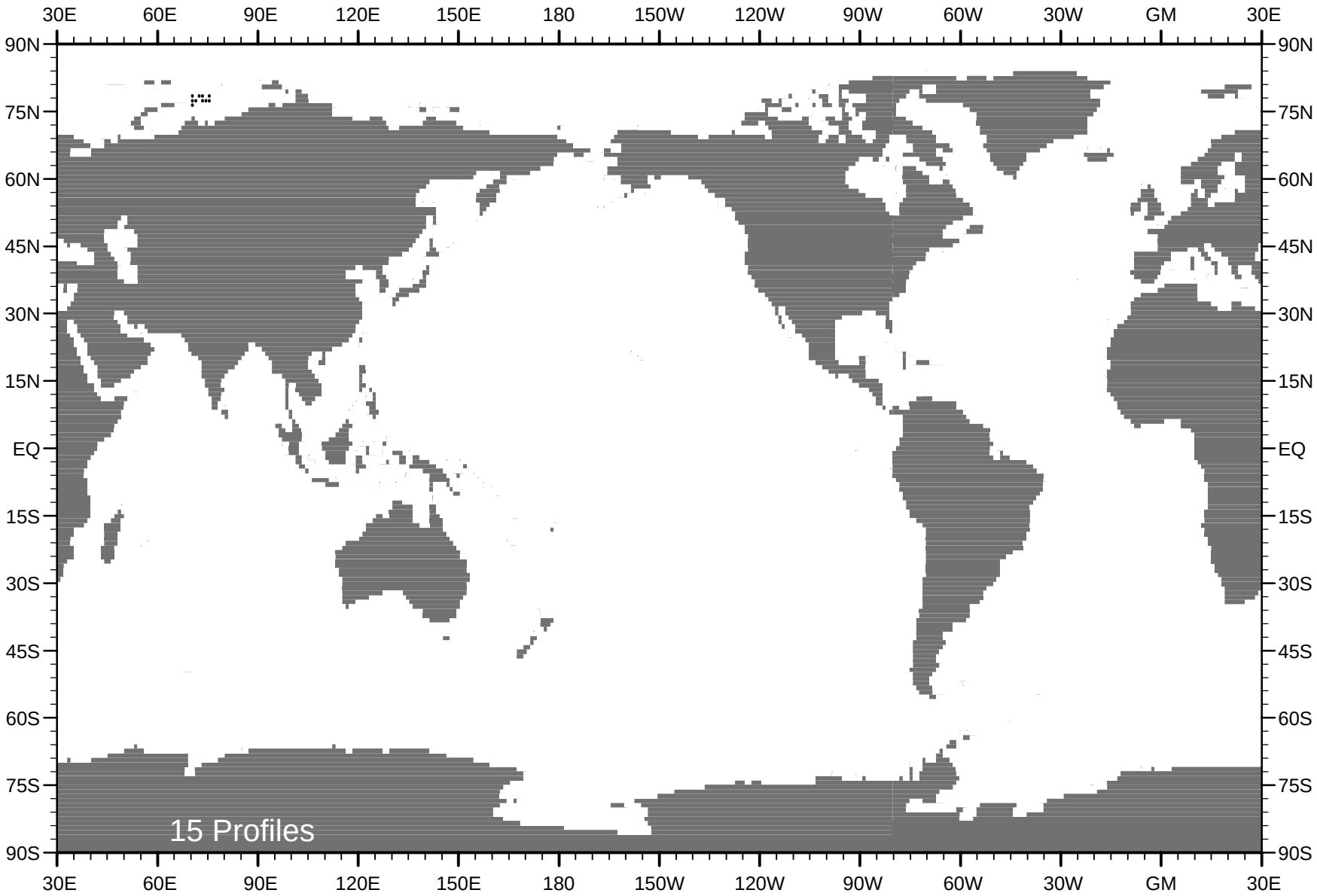


Fig. B6 Distribution of all Ocean Station Data (OSD) alkalinity profiles in WOD01 for year 1931 .

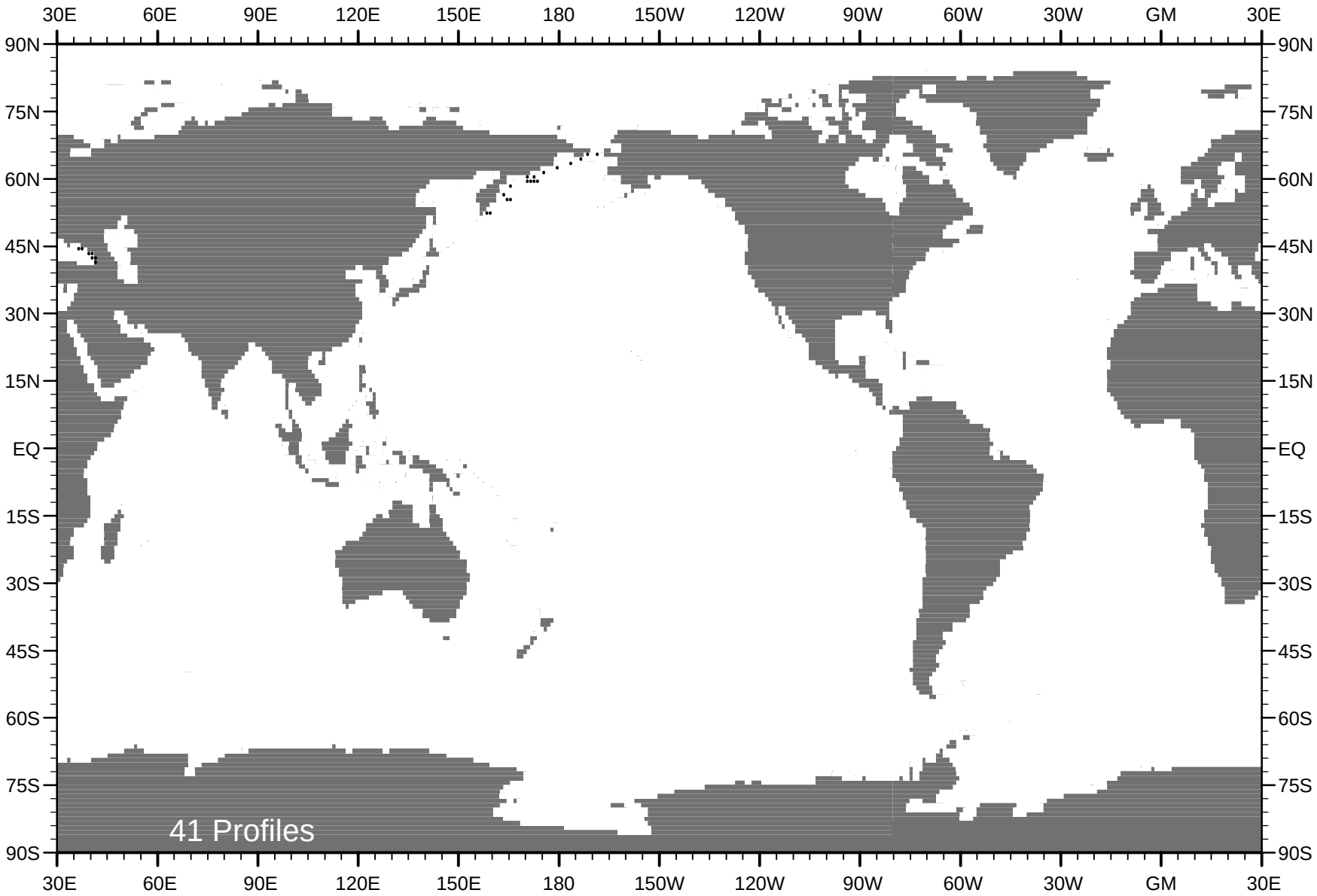


Fig. B7 Distribution of all Ocean Station Data (OSD) alkalinity profiles in WOD01 for year 1932 .

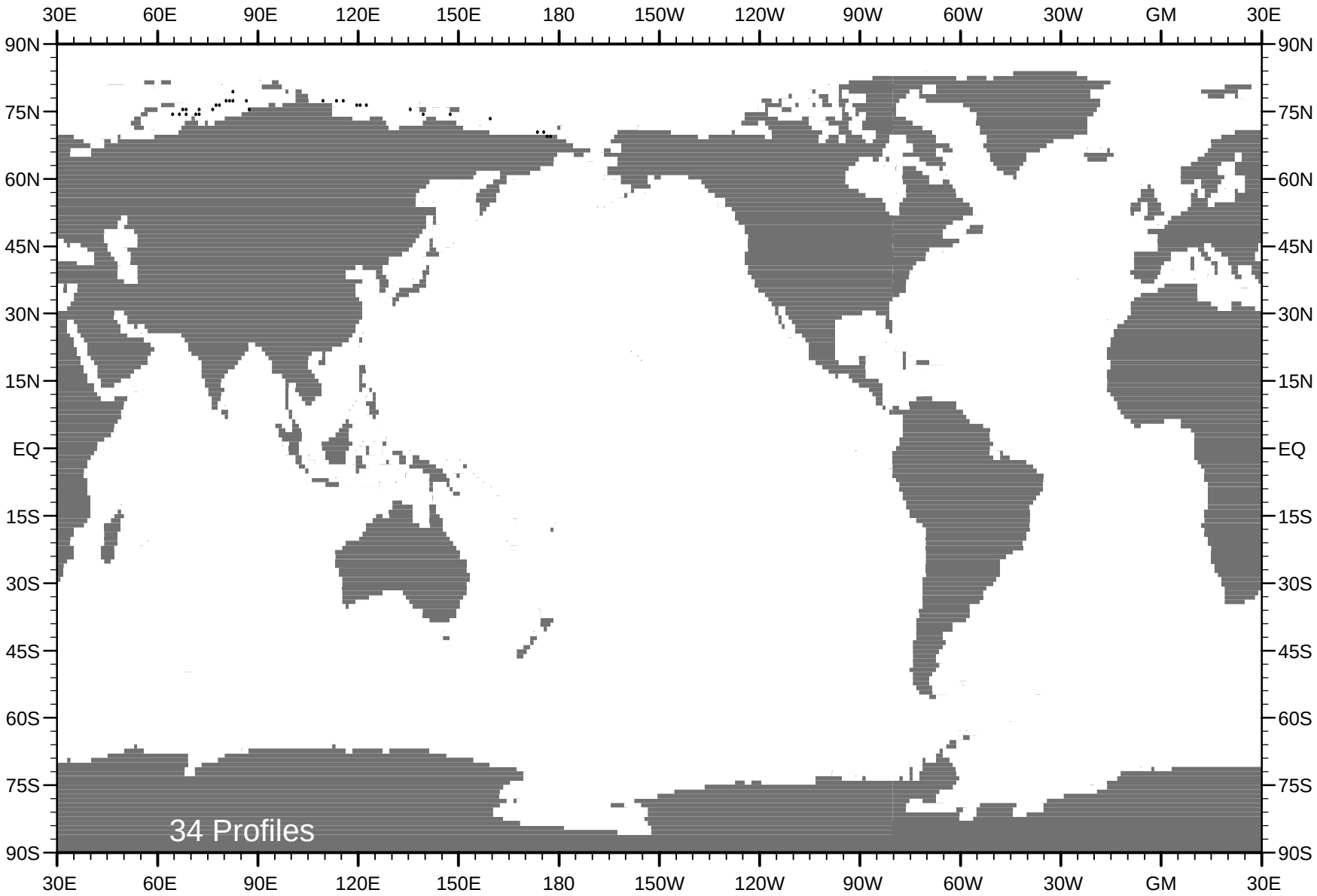


Fig. B8 Distribution of all Ocean Station Data (OSD) alkalinity profiles in WOD01 for year 1933 .

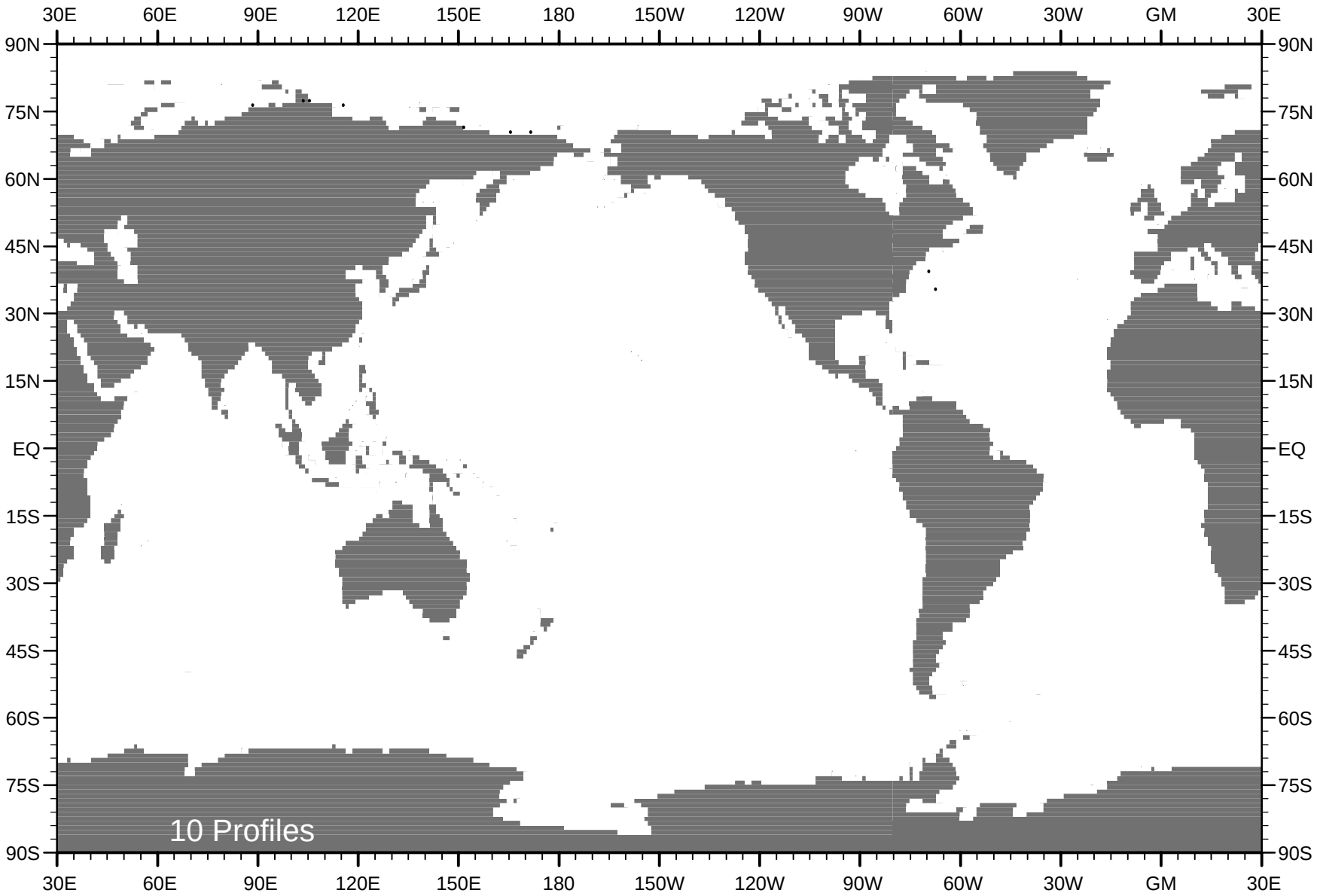


Fig. B9 Distribution of all Ocean Station Data (OSD) alkalinity profiles in WOD01 for year 1935 .

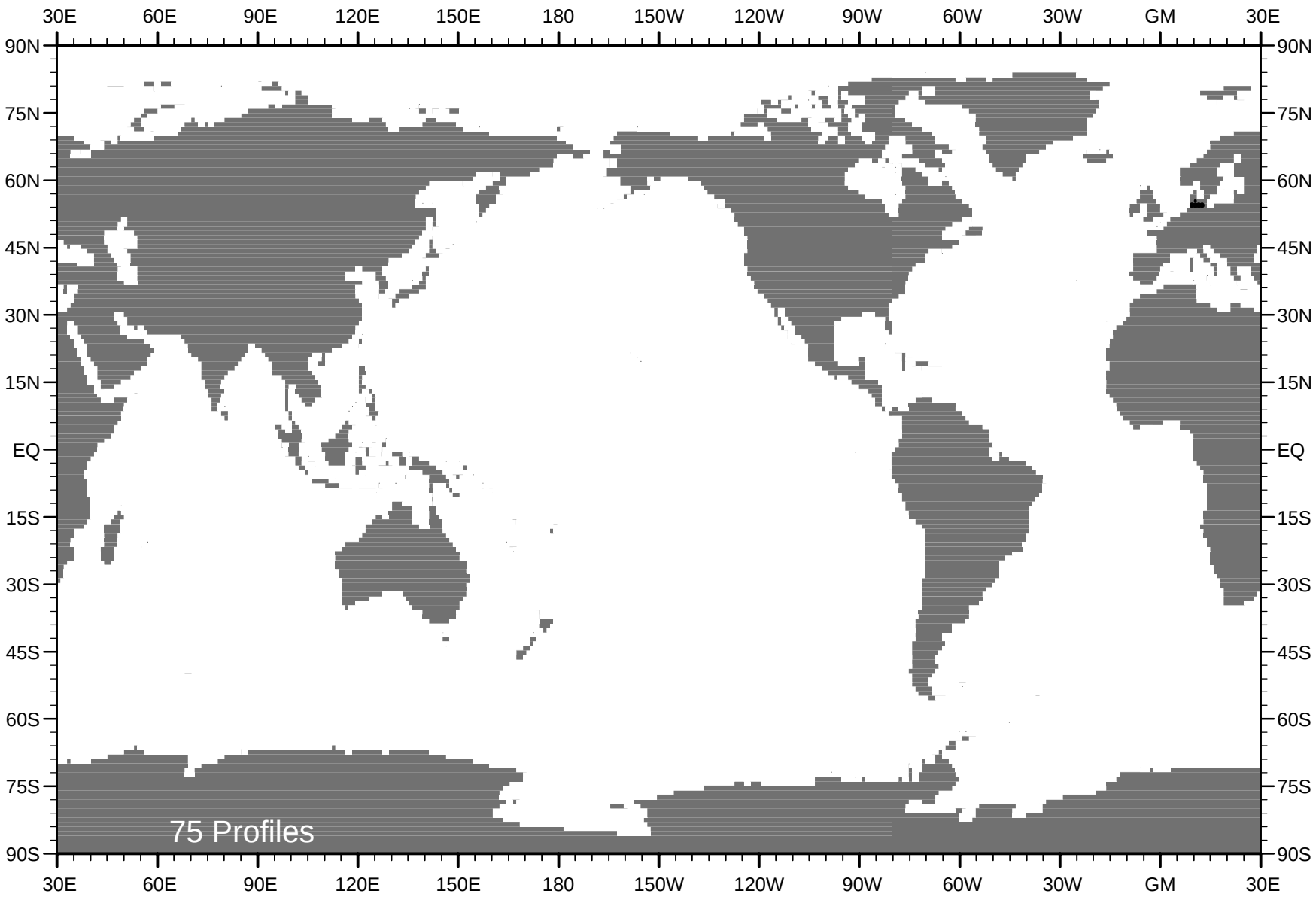


Fig. B10 Distribution of all Ocean Station Data (OSD) alkalinity profiles in WOD01 for year 1938 .

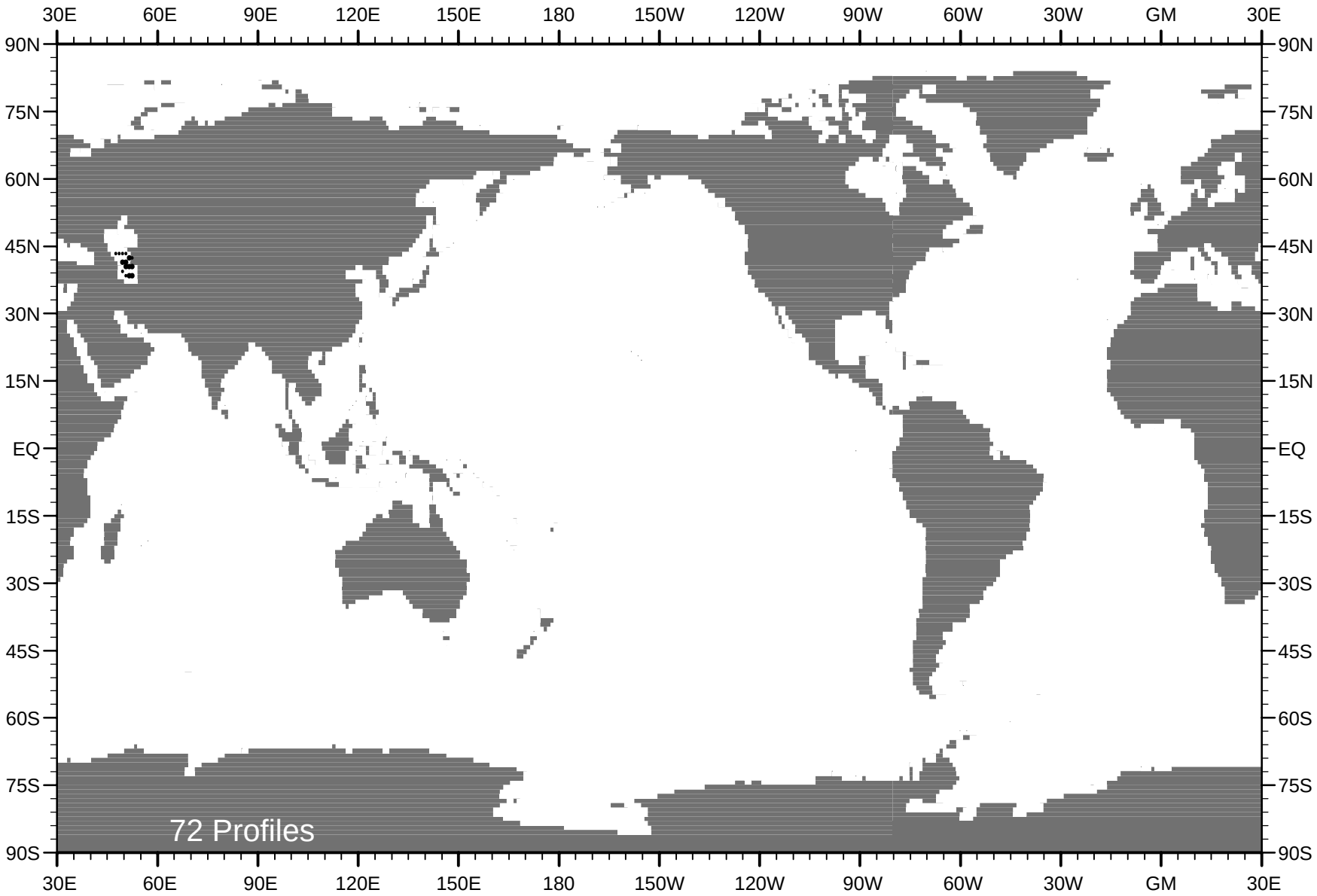


Fig. B11 Distribution of all Ocean Station Data (OSD) alkalinity profiles in WOD01 for year 1941 .

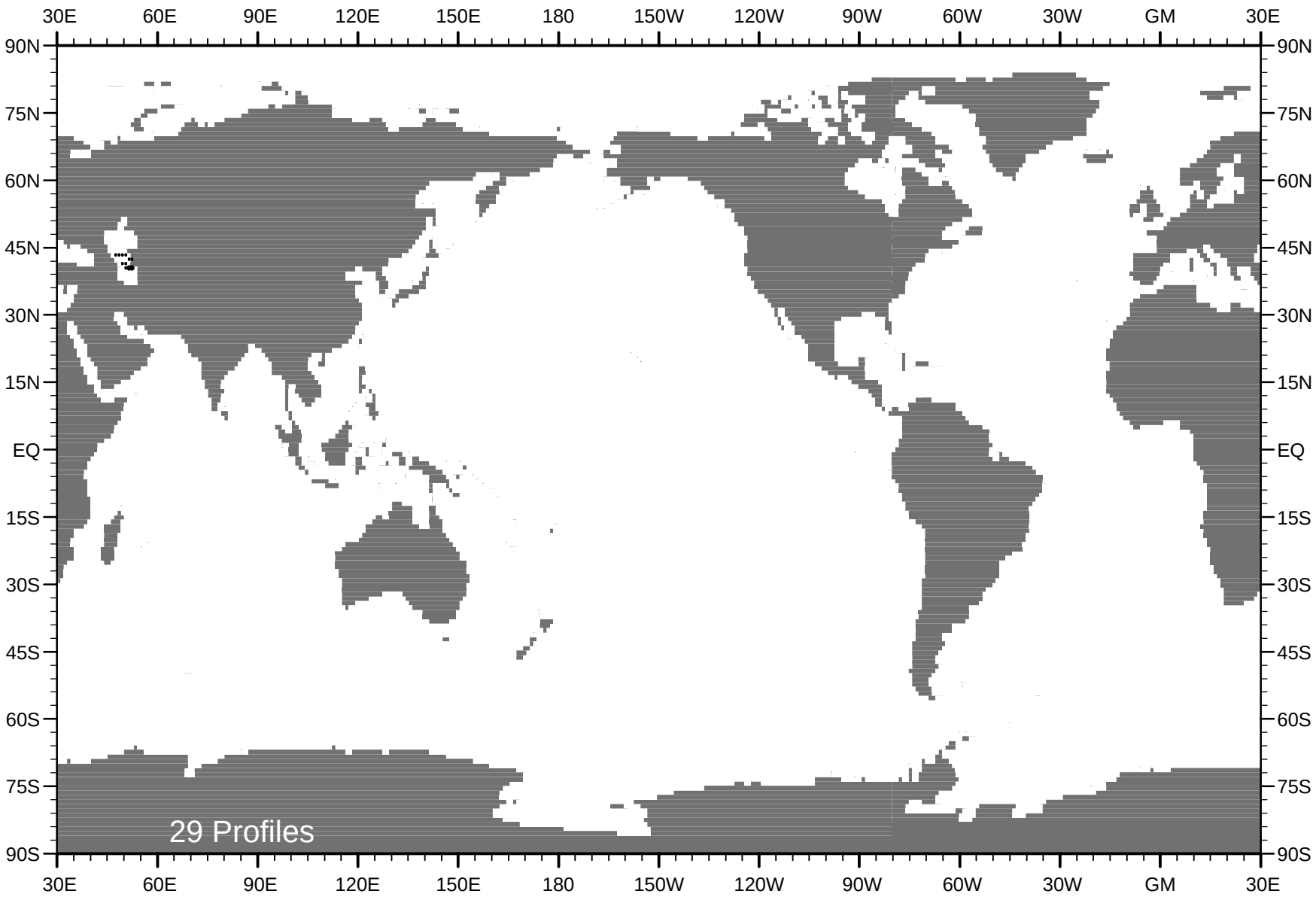


Fig. B12 Distribution of all Ocean Station Data (OSD) alkalinity profiles in WOD01 for year 1943 .

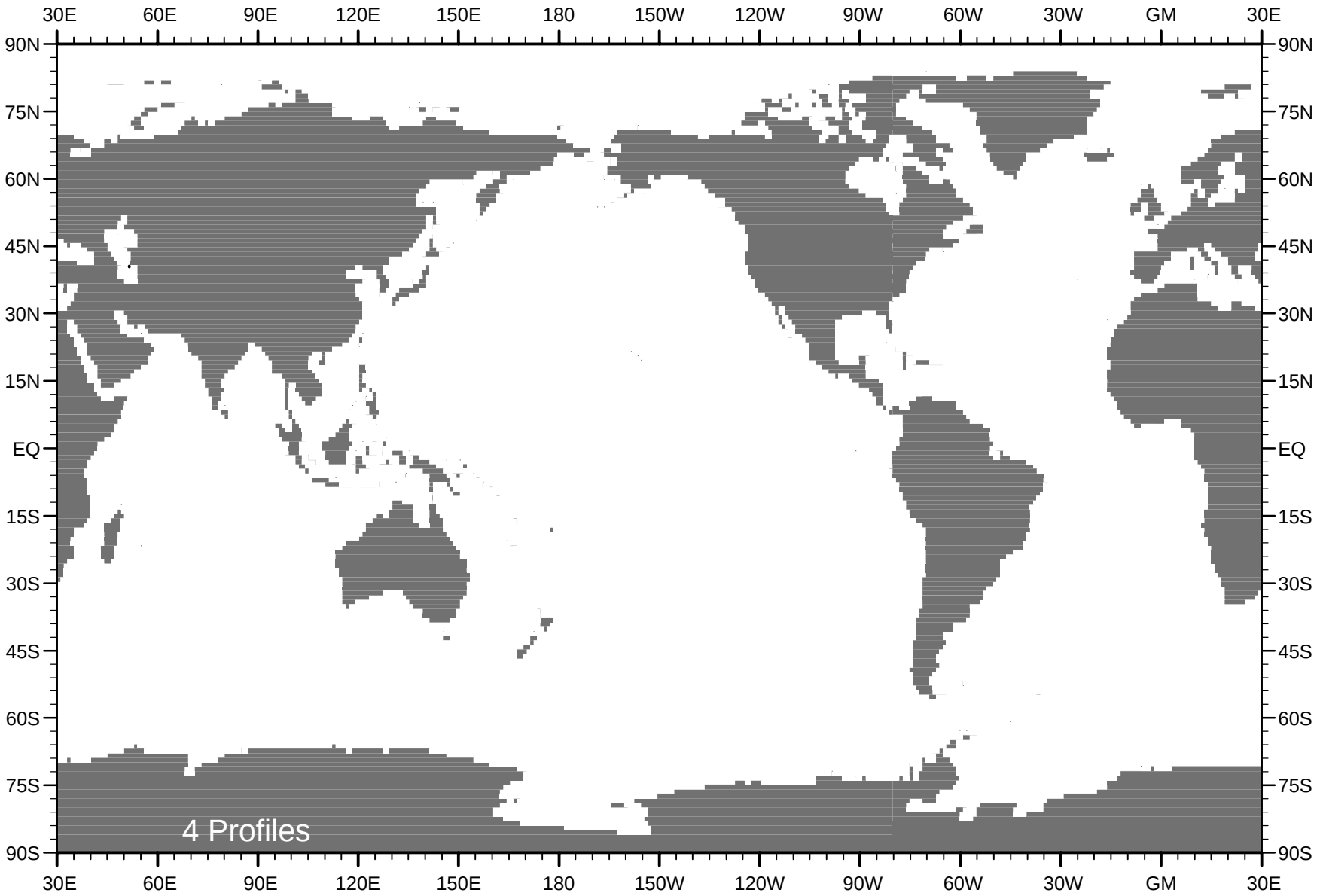


Fig. B13 Distribution of all Ocean Station Data (OSD) alkalinity profiles in WOD01 for year 1945 .

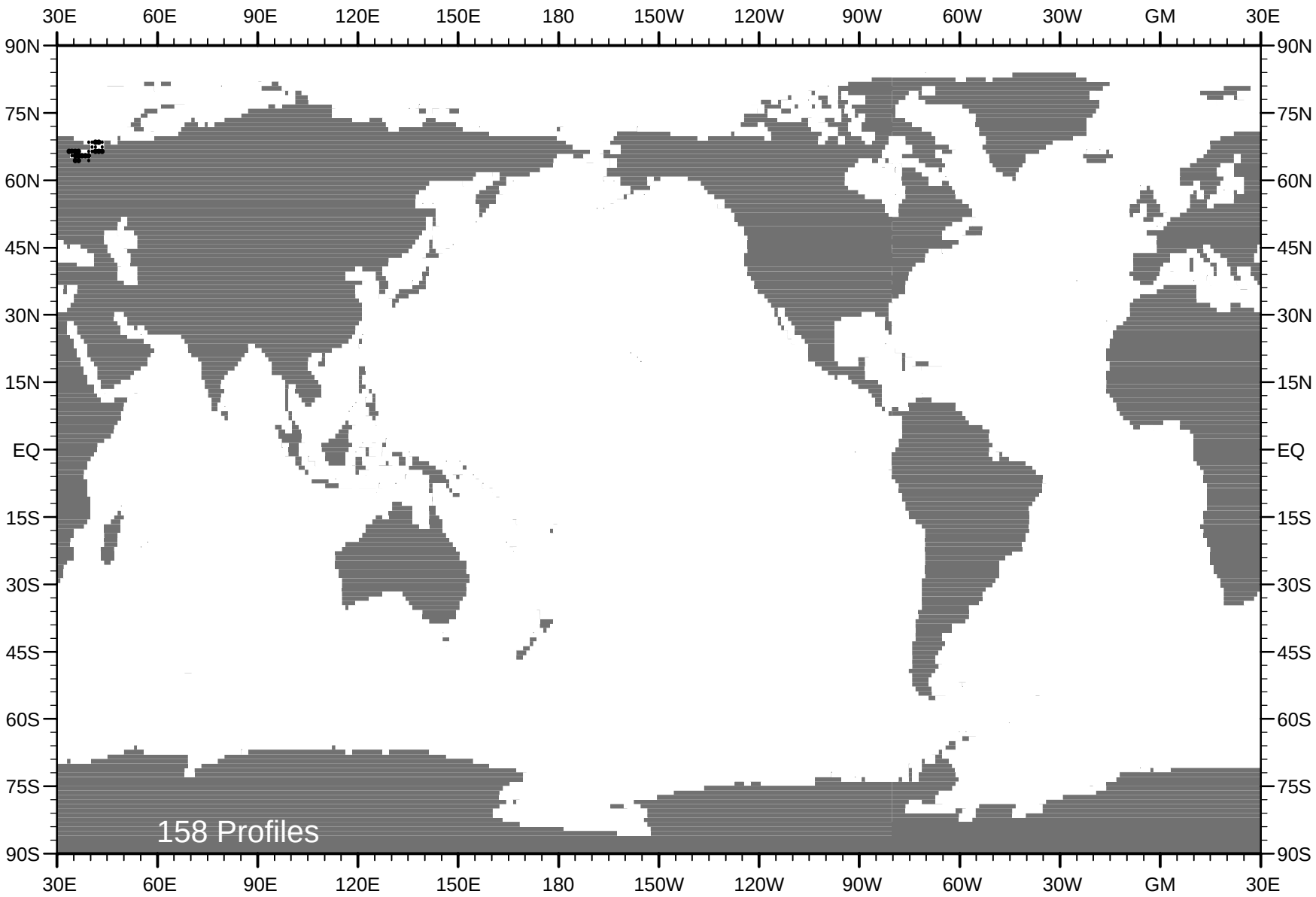


Fig. B14 Distribution of all Ocean Station Data (OSD) alkalinity profiles in WOD01 for year 1948 .

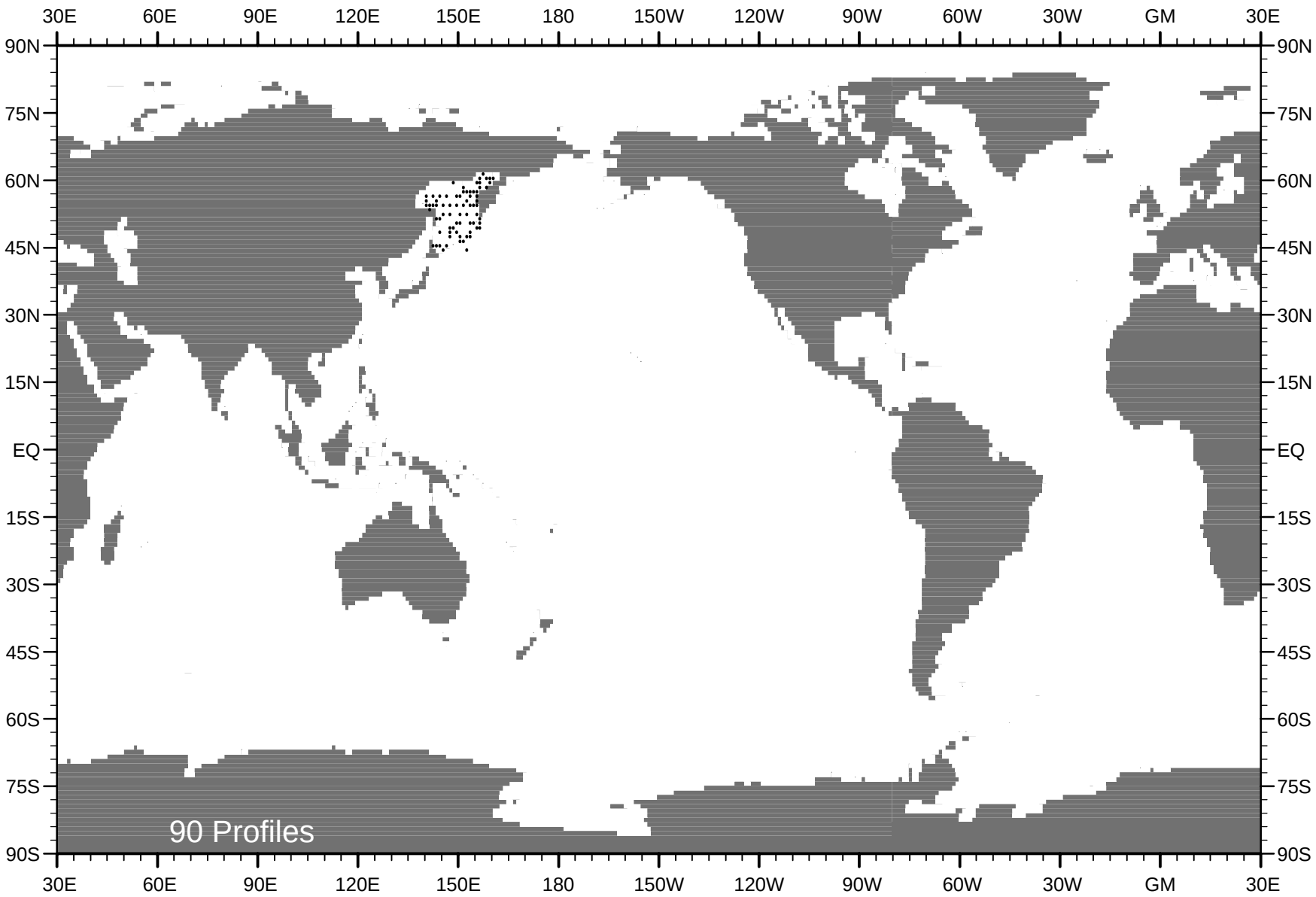


Fig. B15 Distribution of all Ocean Station Data (OSD) alkalinity profiles in WOD01 for year 1949 .

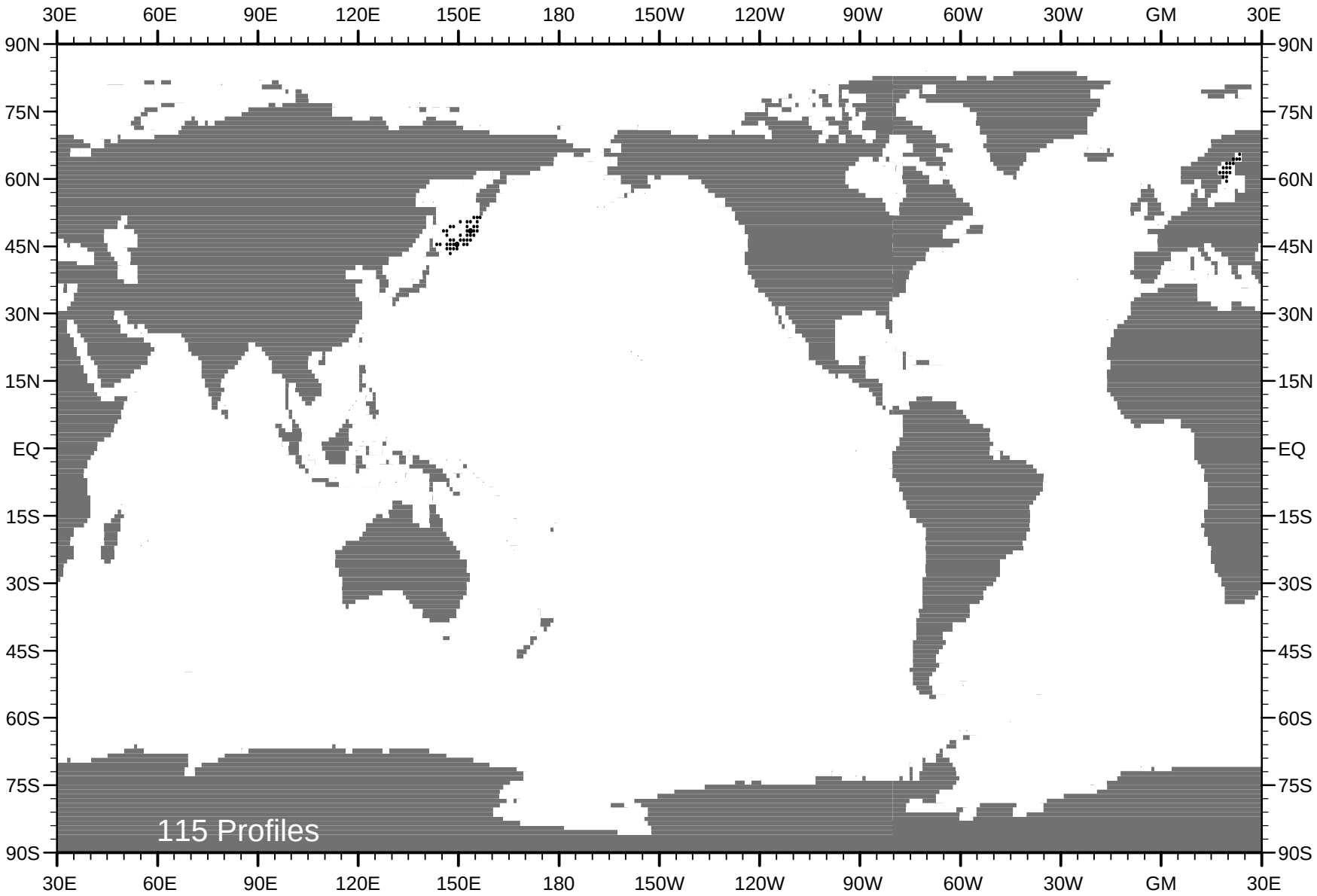


Fig. B16 Distribution of all Ocean Station Data (OSD) alkalinity profiles in WOD01 for year 1950 .

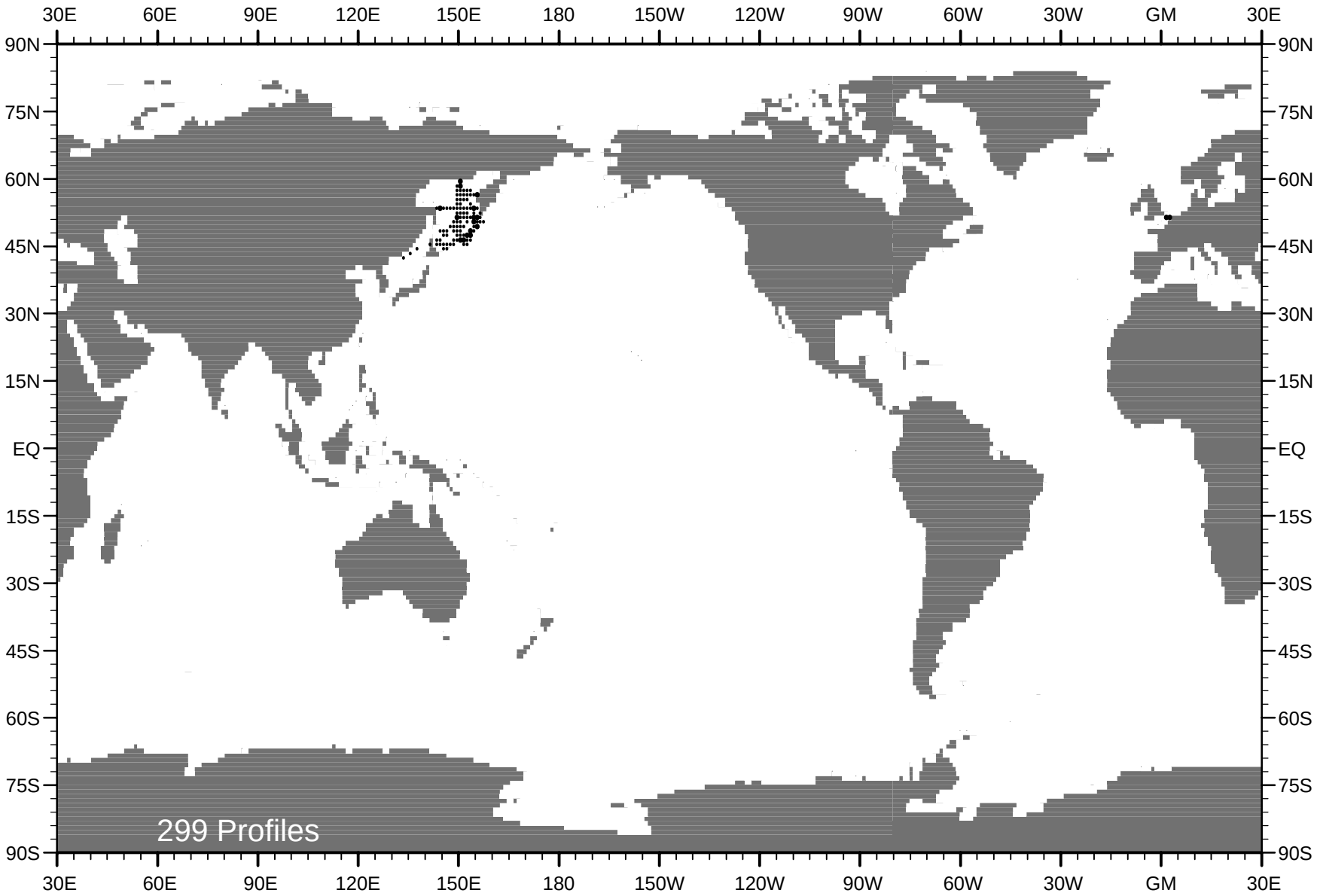


Fig. B17 Distribution of all Ocean Station Data (OSD) alkalinity profiles in WOD01 for year 1951 .

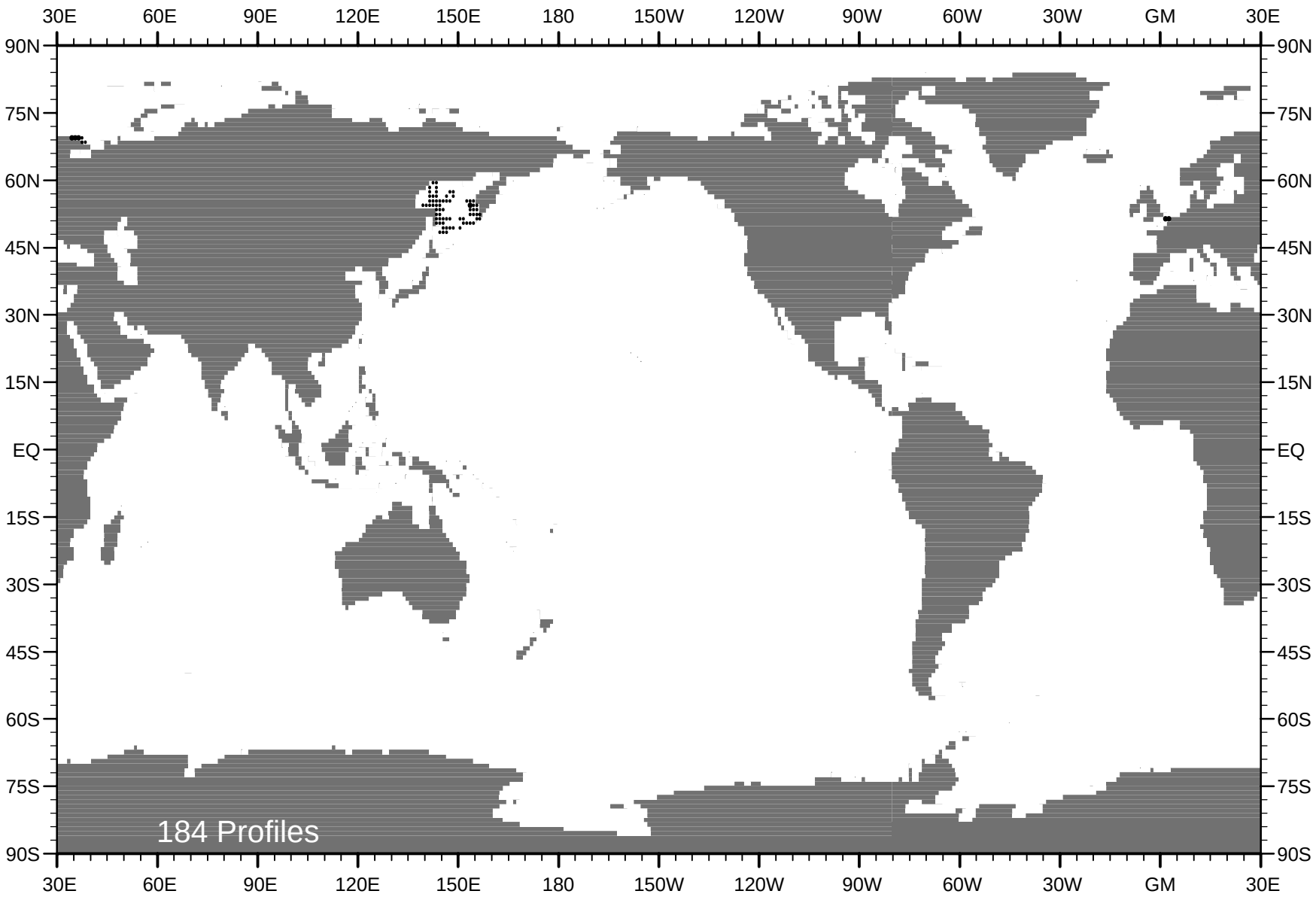


Fig. B18 Distribution of all Ocean Station Data (OSD) alkalinity profiles in WOD01 for year 1952 .

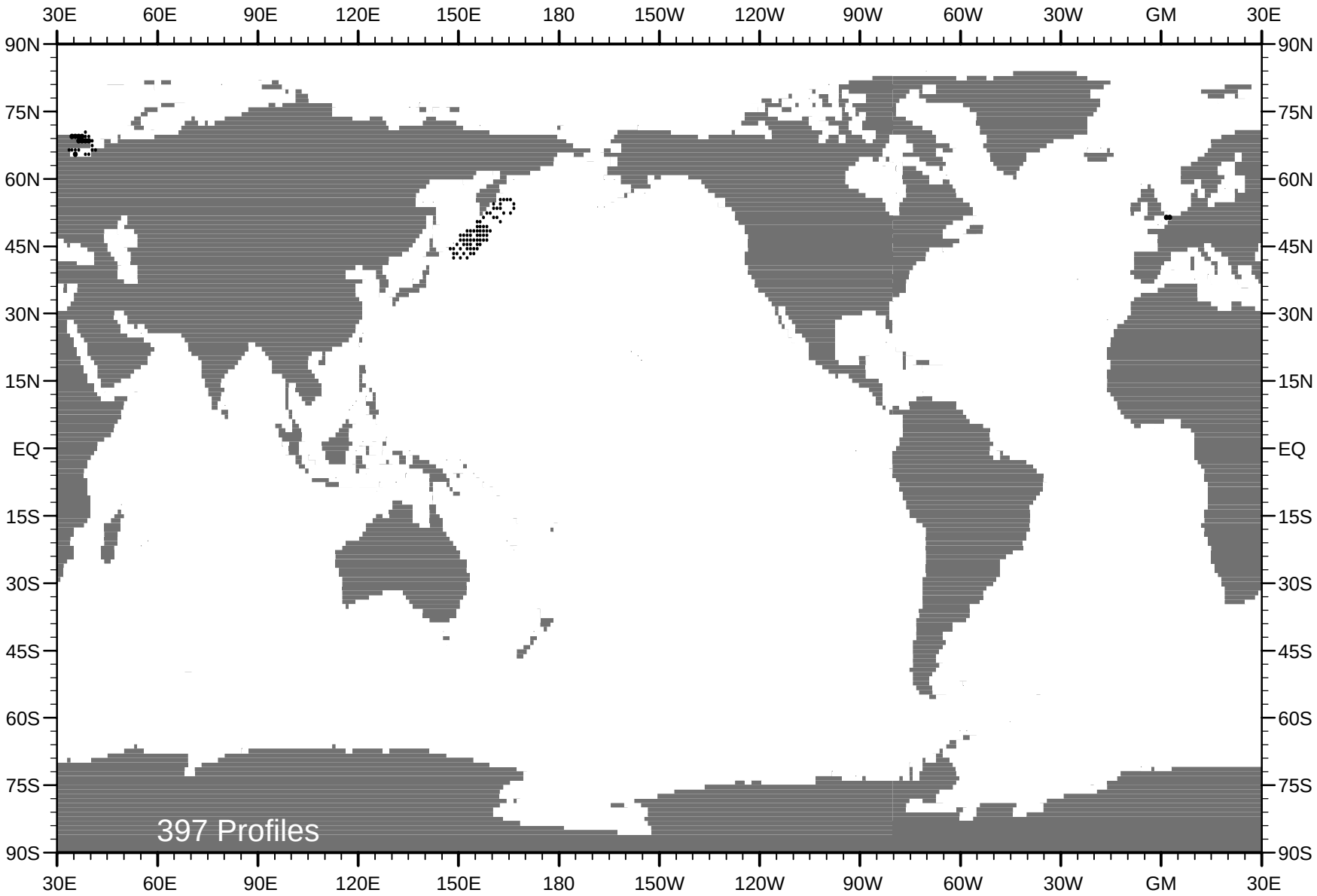


Fig. B19 Distribution of all Ocean Station Data (OSD) alkalinity profiles in WOD01 for year 1953 .

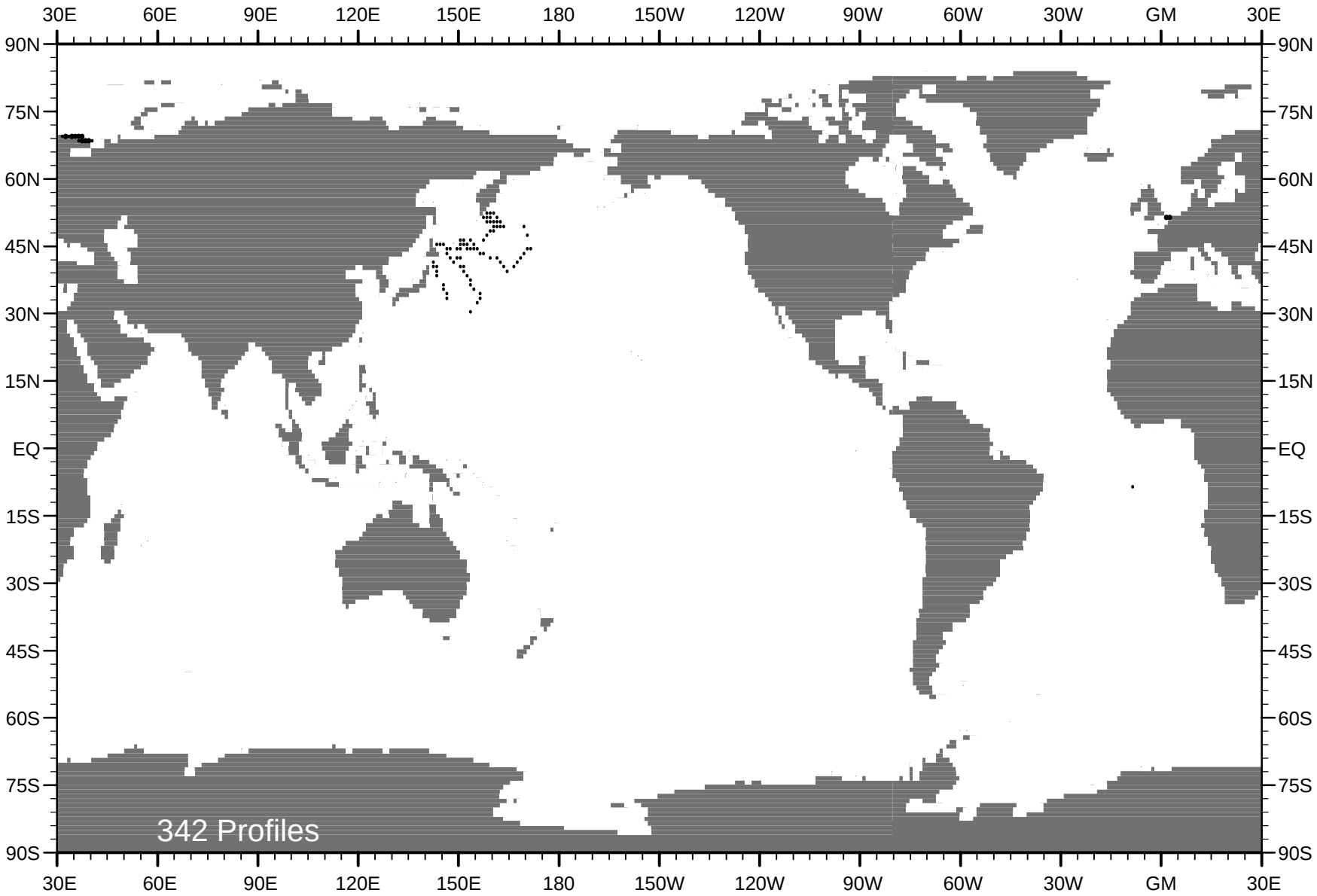


Fig. B20 Distribution of all Ocean Station Data (OSD) alkalinity profiles in WOD01 for year 1954 .

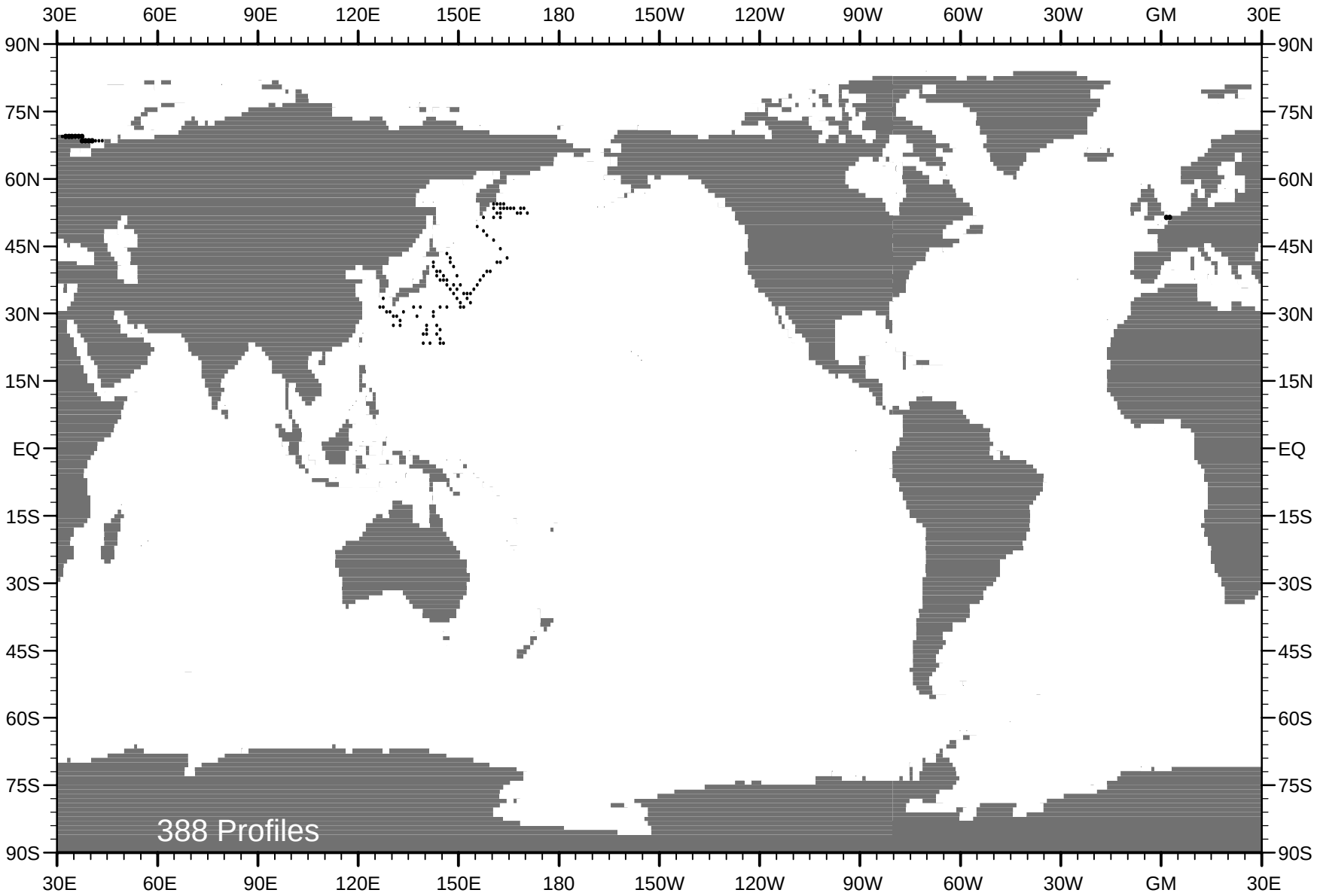


Fig. B21 Distribution of all Ocean Station Data (OSD) alkalinity profiles in WOD01 for year 1955 .

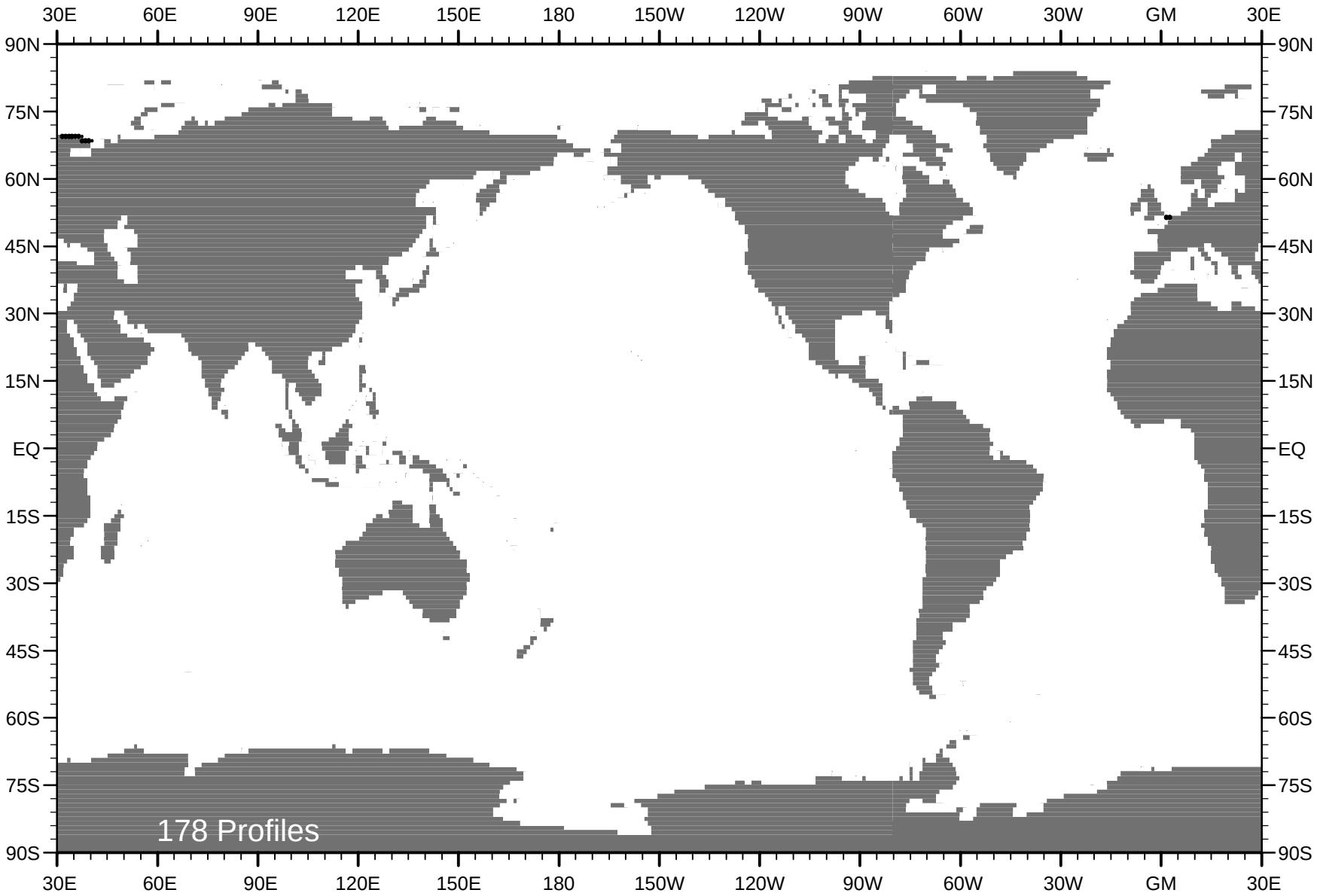


Fig. B22 Distribution of all Ocean Station Data (OSD) alkalinity profiles in WOD01 for year 1956 .

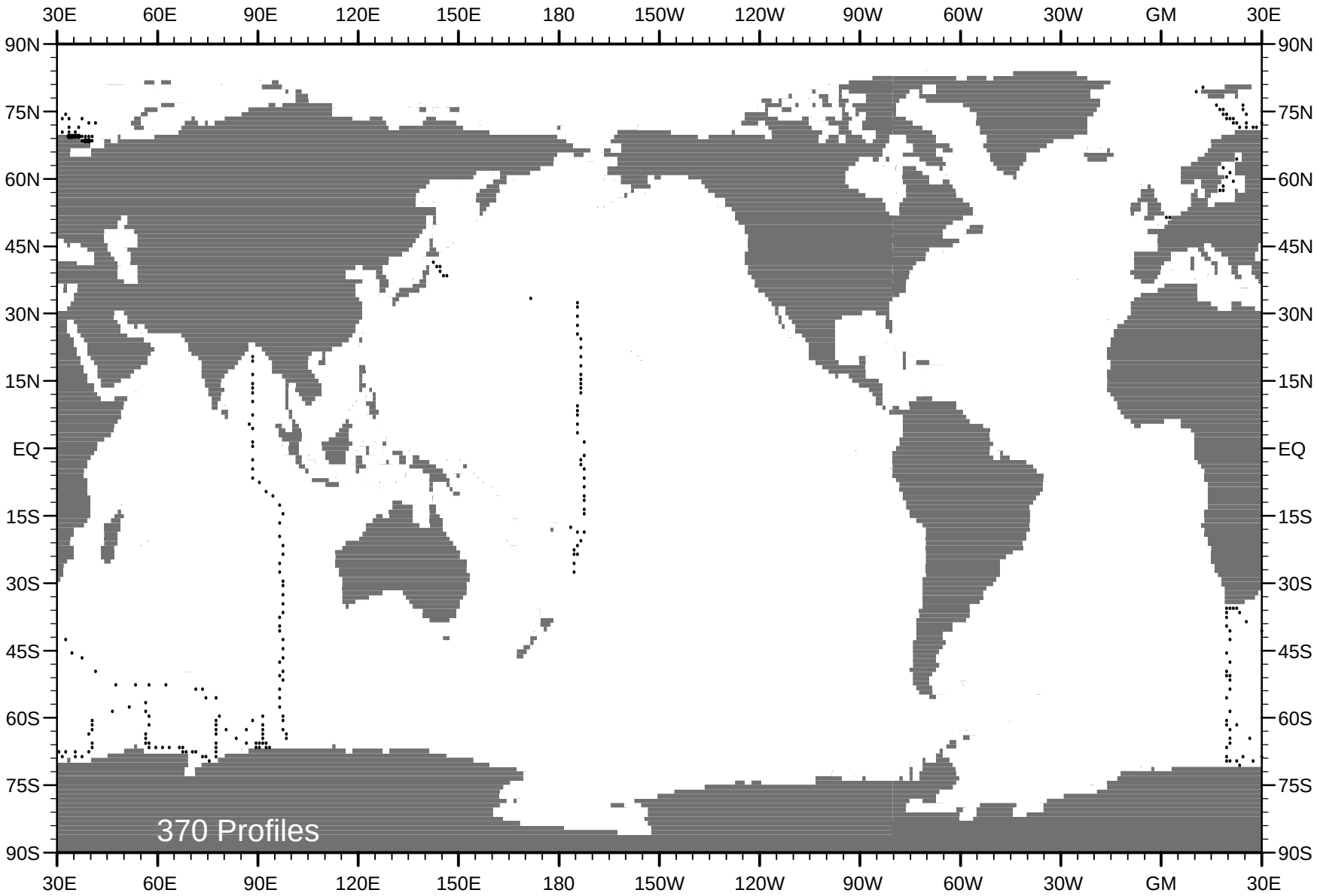


Fig. B23 Distribution of all Ocean Station Data (OSD) alkalinity profiles in WOD01 for year 1957 .

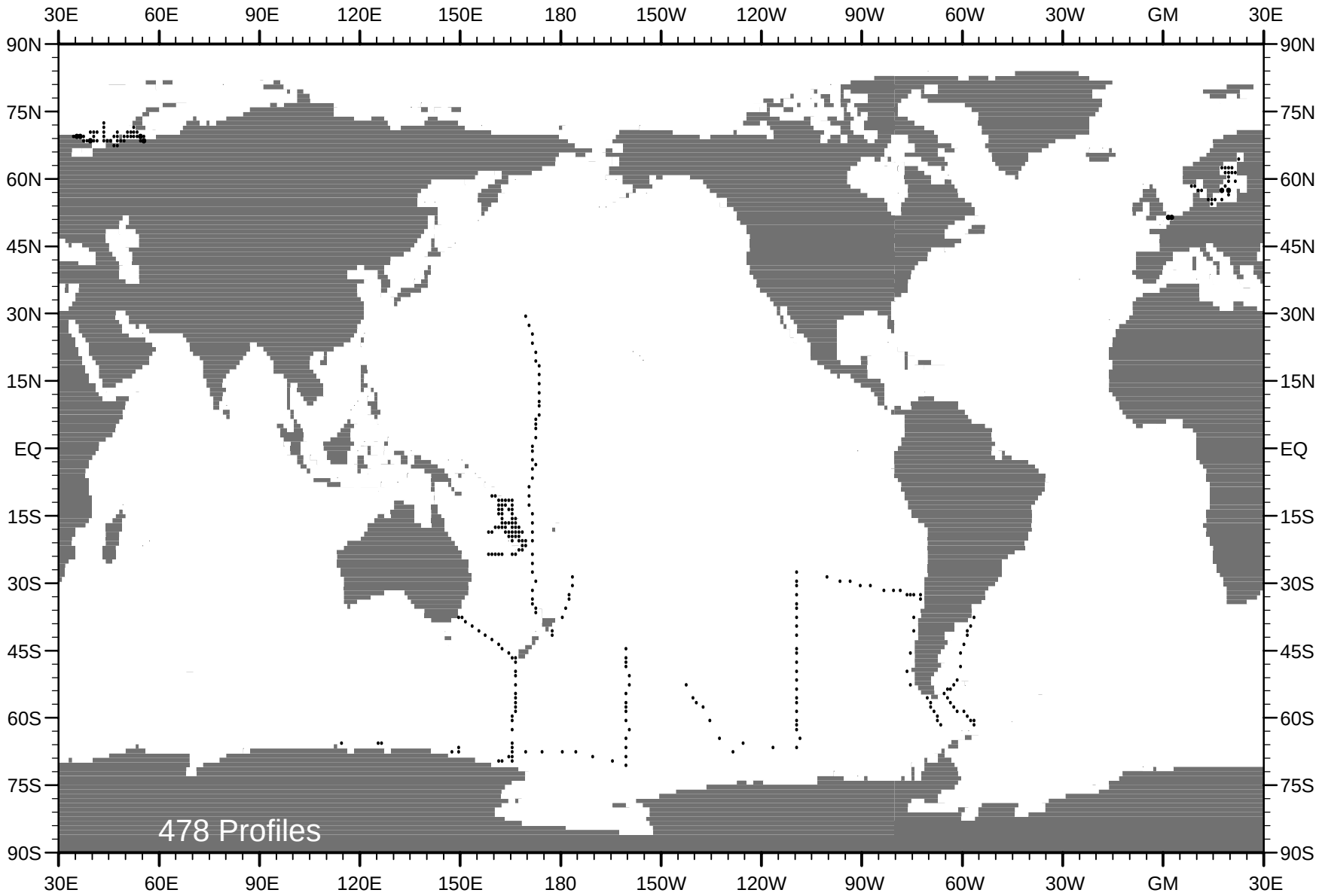


Fig. B24 Distribution of all Ocean Station Data (OSD) alkalinity profiles in WOD01 for year 1958 .

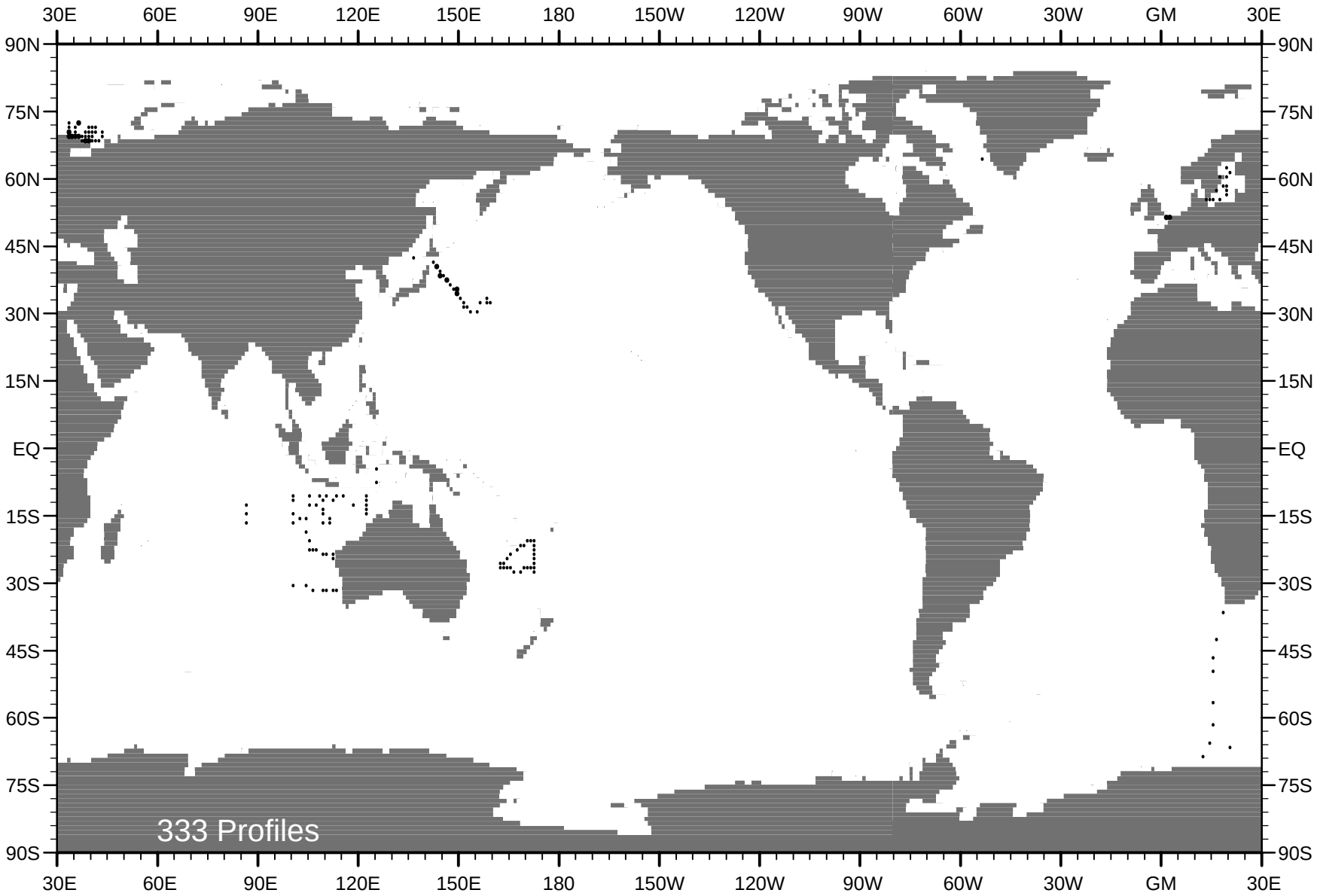


Fig. B25 Distribution of all Ocean Station Data (OSD) alkalinity profiles in WOD01 for year 1959 .

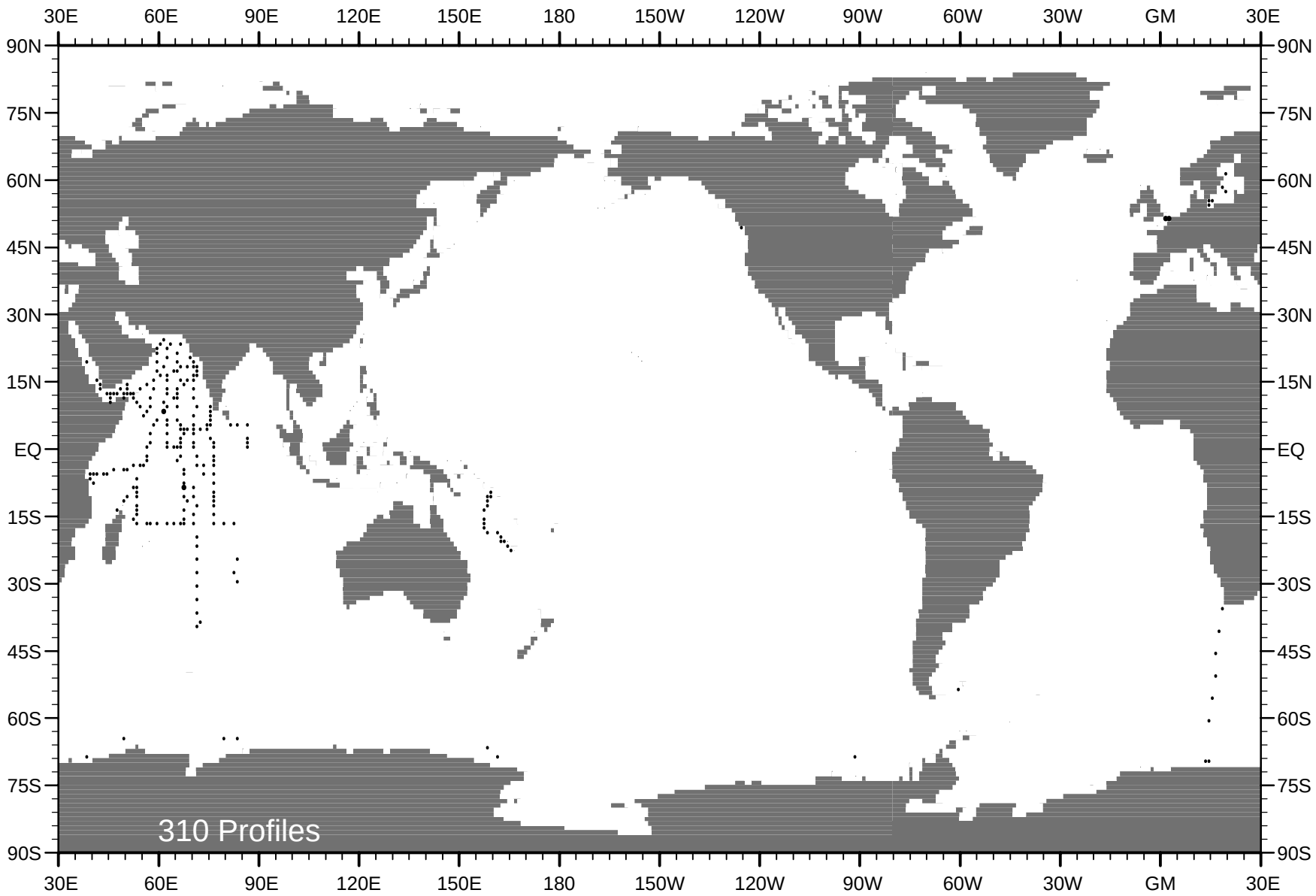


Fig. B26 Distribution of all Ocean Station Data (OSD) alkalinity profiles in WOD01 for year 1960 .

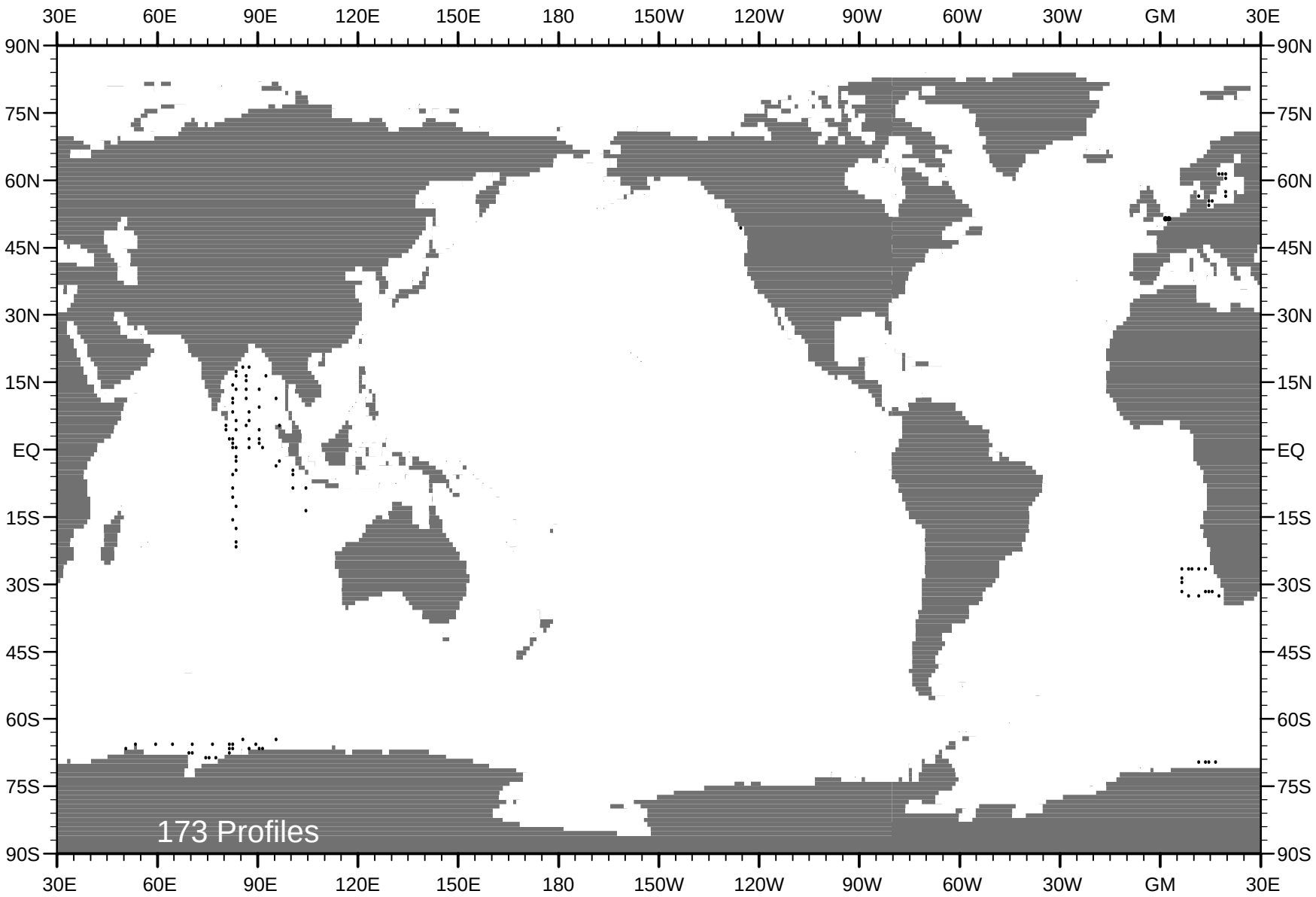


Fig. B27 Distribution of all Ocean Station Data (OSD) alkalinity profiles in WOD01 for year 1961 .

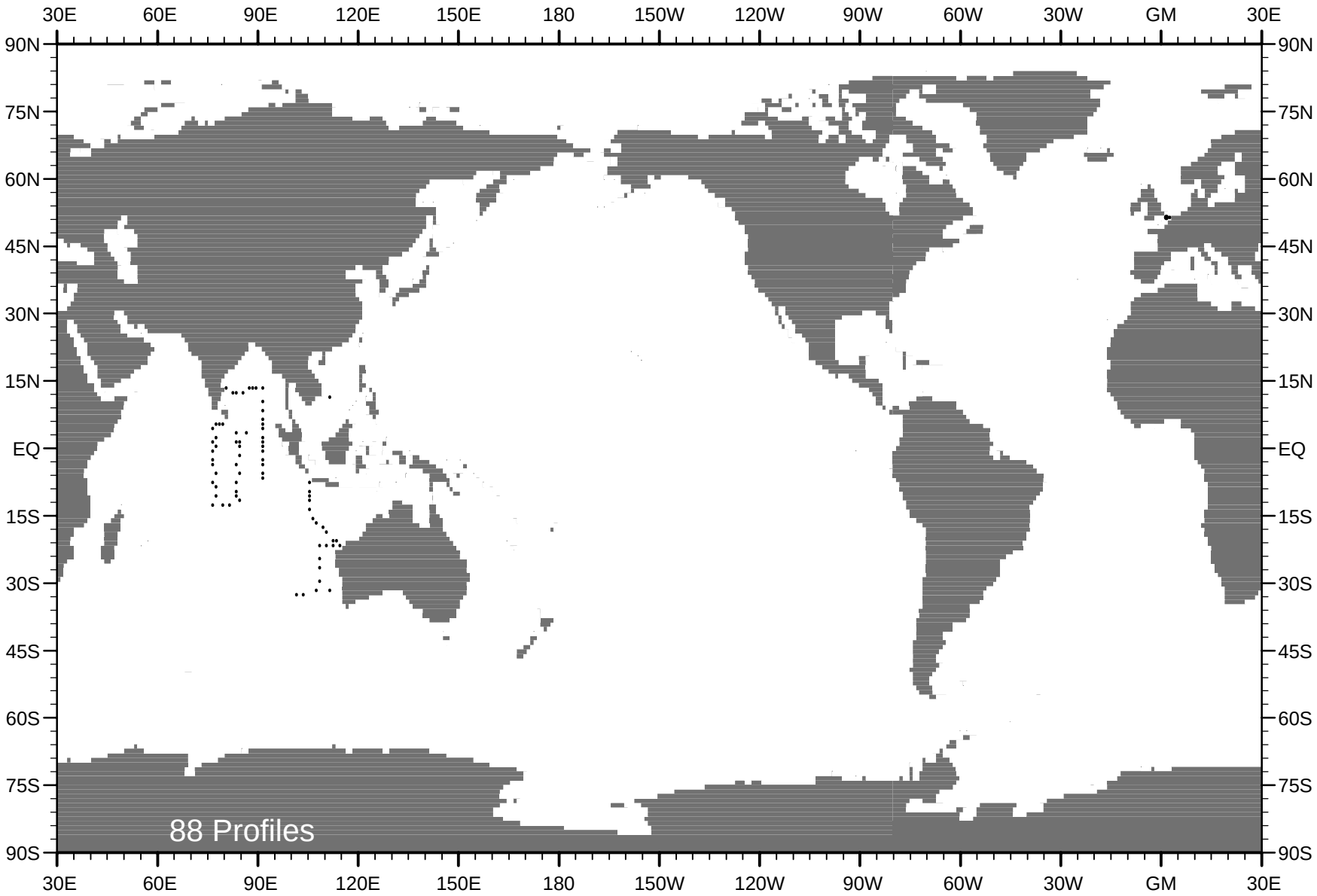


Fig. B28 Distribution of all Ocean Station Data (OSD) alkalinity profiles in WOD01 for year 1962 .

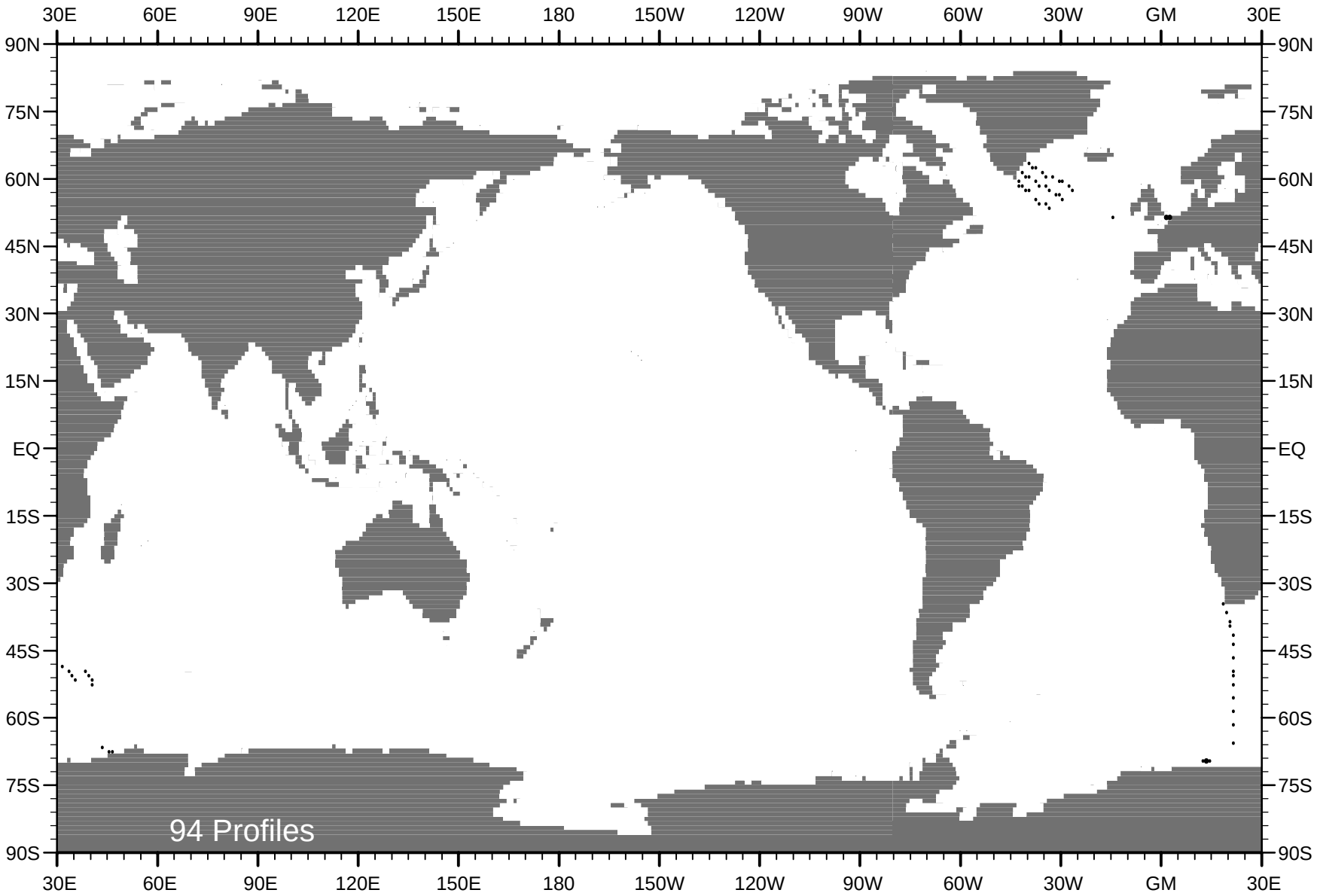


Fig. B29 Distribution of all Ocean Station Data (OSD) alkalinity profiles in WOD01 for year 1963 .

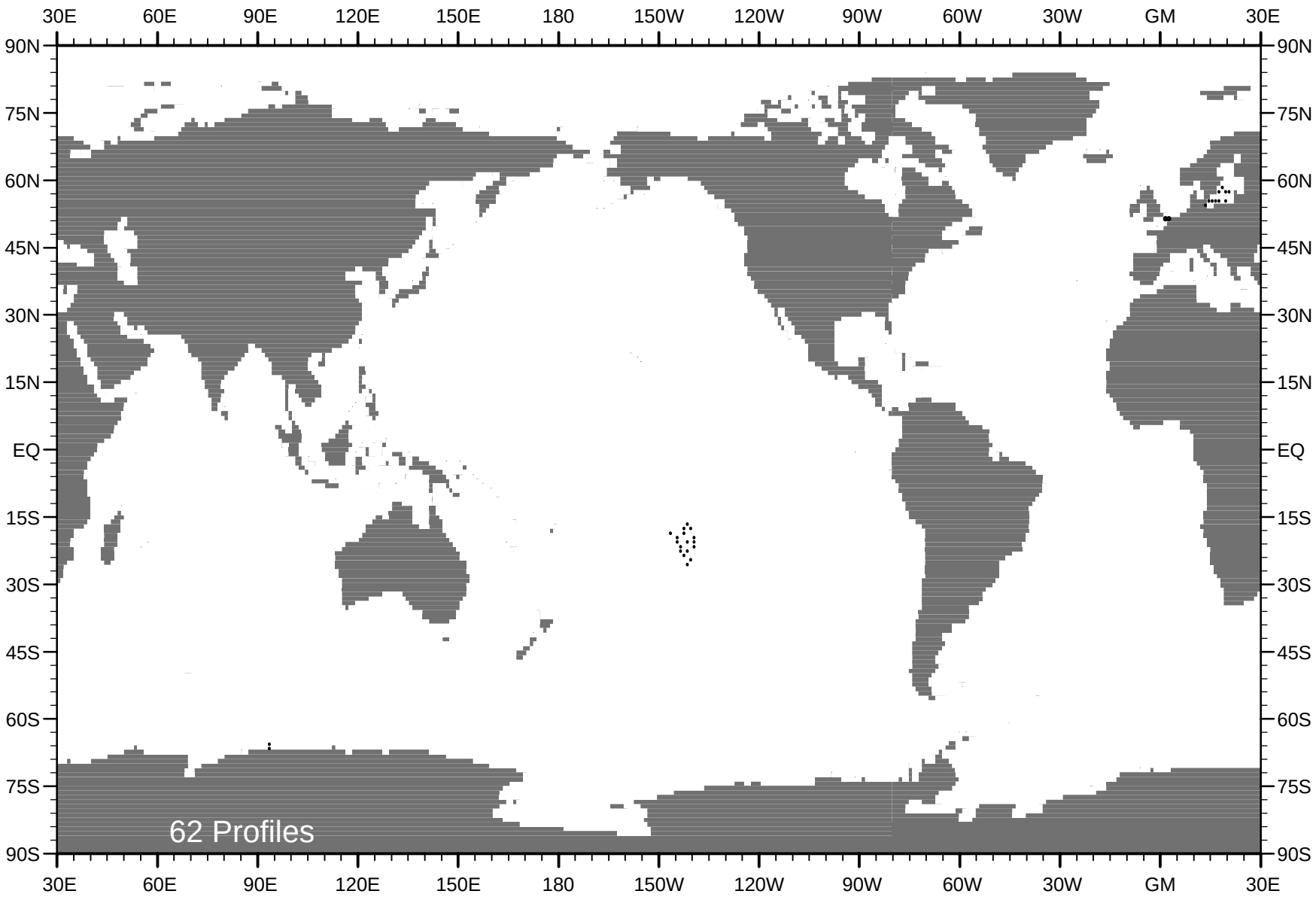


Fig. B30 Distribution of all Ocean Station Data (OSD) alkalinity profiles in WOD01 for year 1964 .

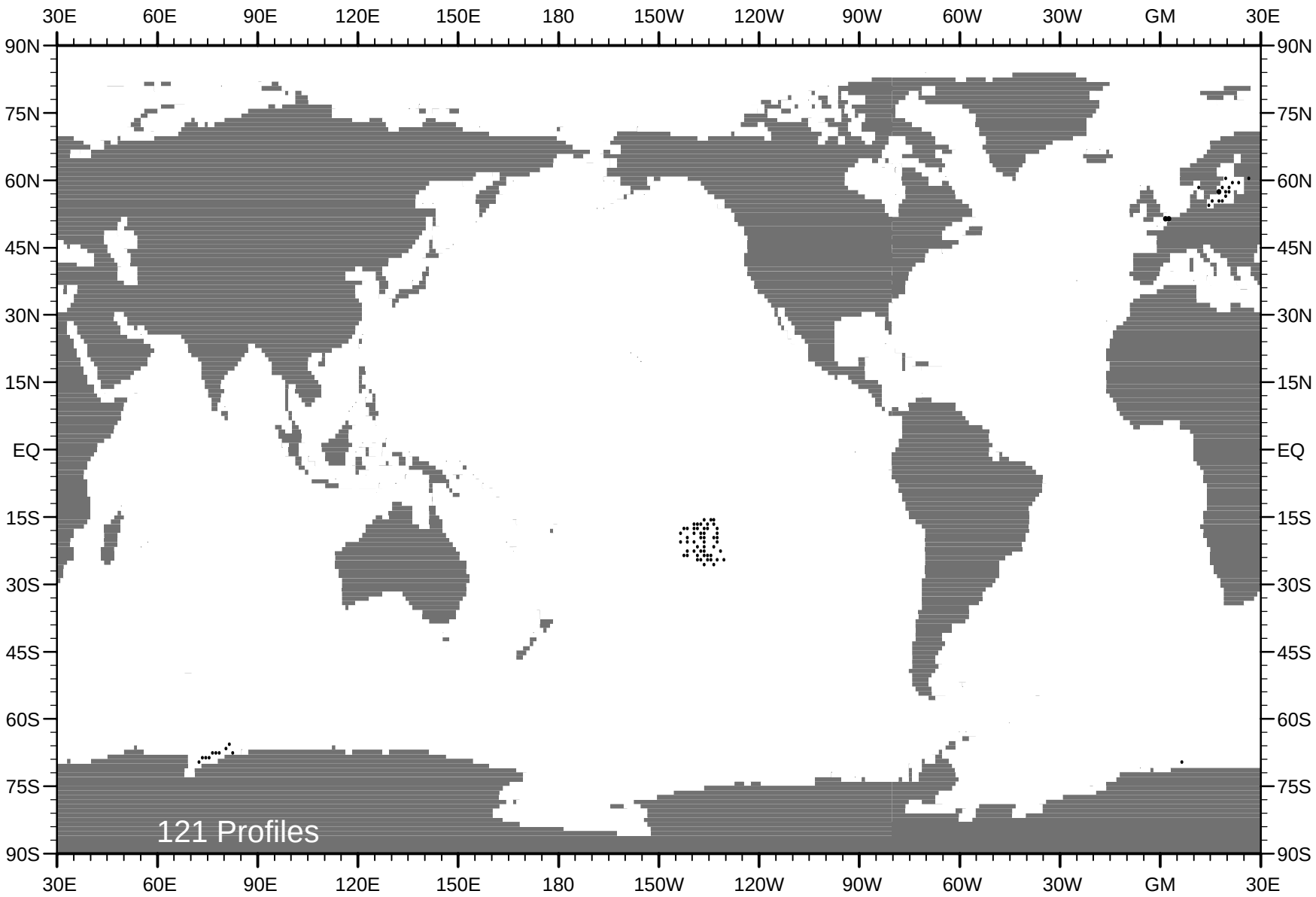


Fig. B31 Distribution of all Ocean Station Data (OSD) alkalinity profiles in WOD01 for year 1965 .

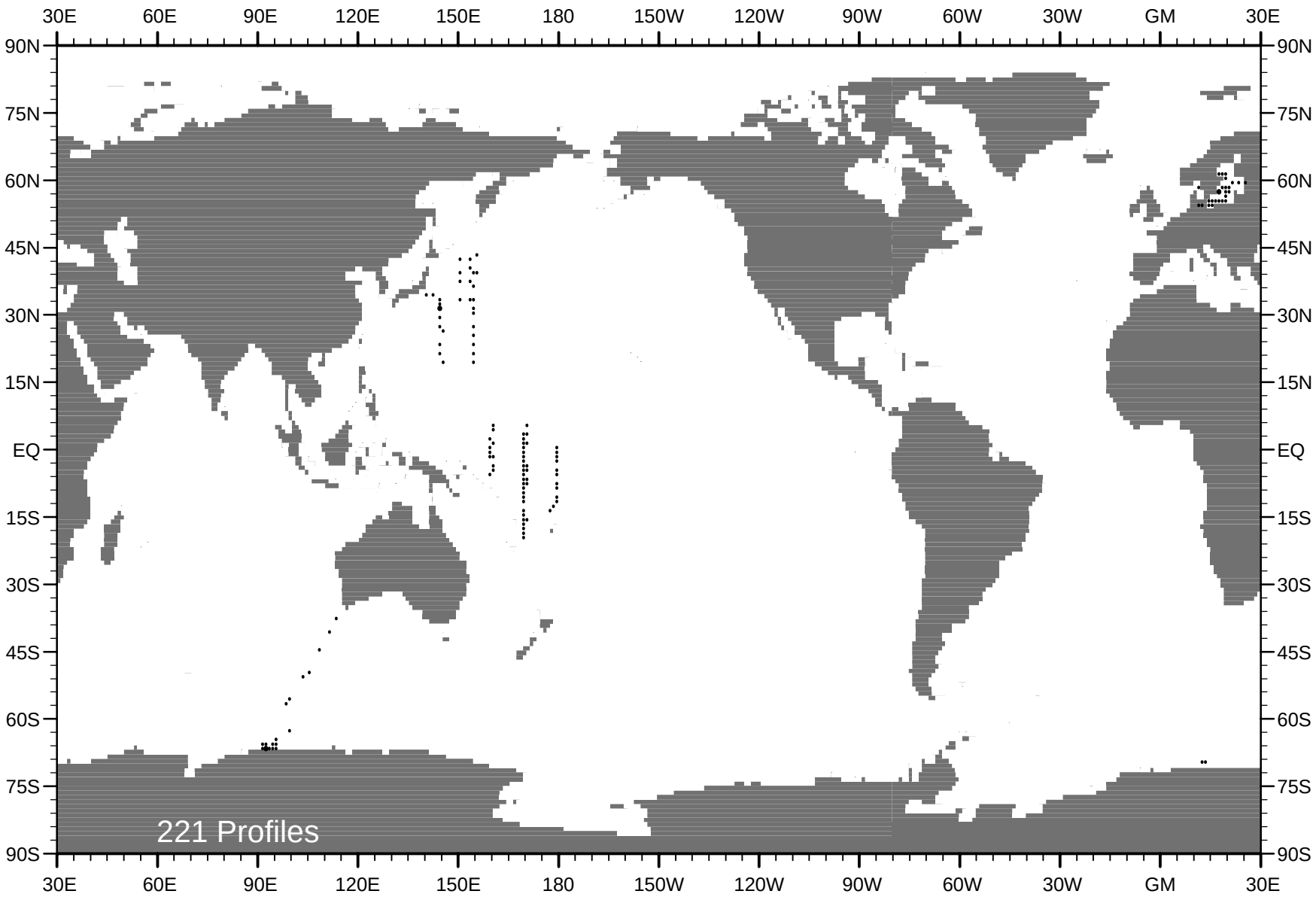


Fig. B32 Distribution of all Ocean Station Data (OSD) alkalinity profiles in WOD01 for year 1966 .

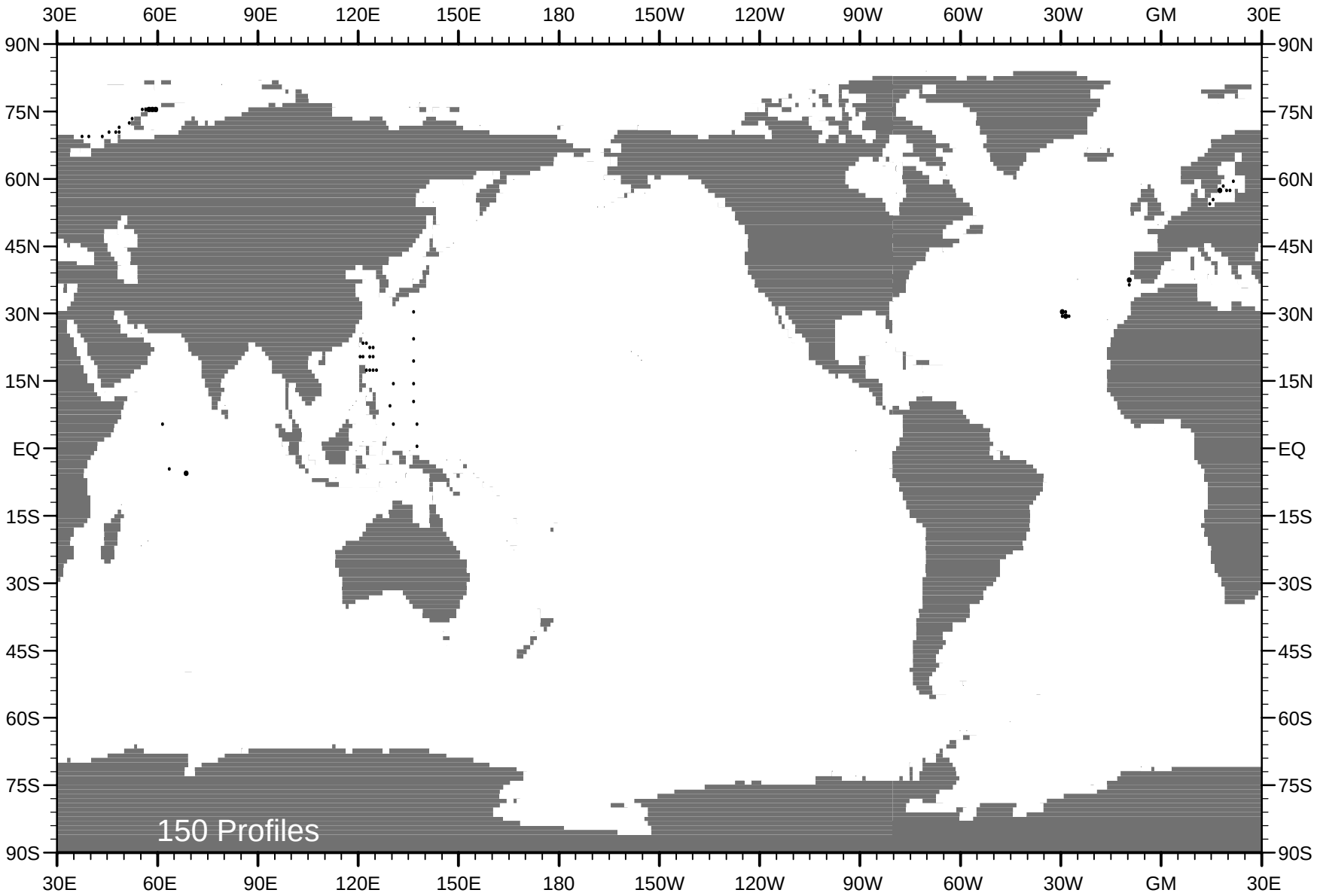


Fig. B33 Distribution of all Ocean Station Data (OSD) alkalinity profiles in WOD01 for year 1967 .

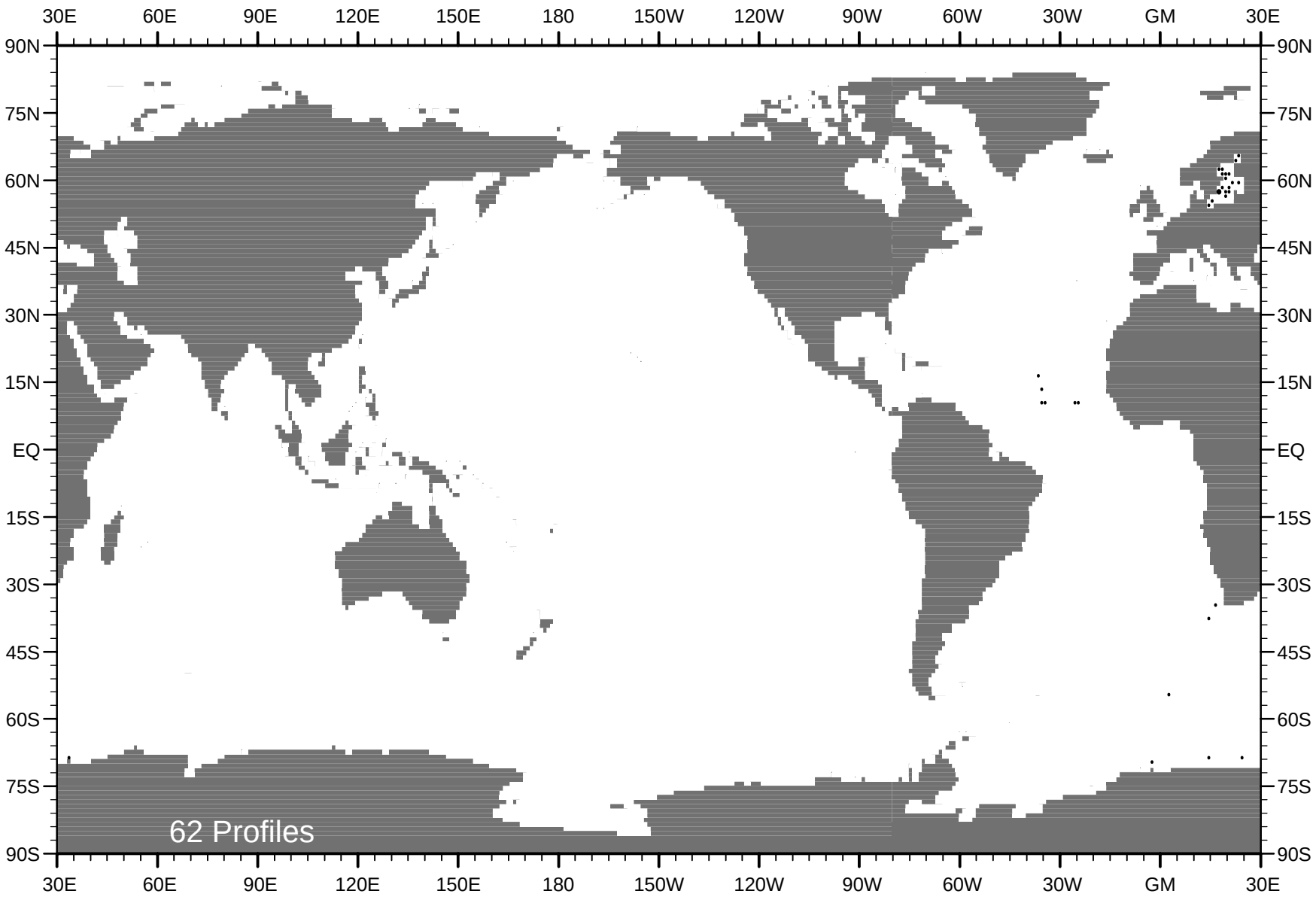


Fig. B34 Distribution of all Ocean Station Data (OSD) alkalinity profiles in WOD01 for year 1968 .

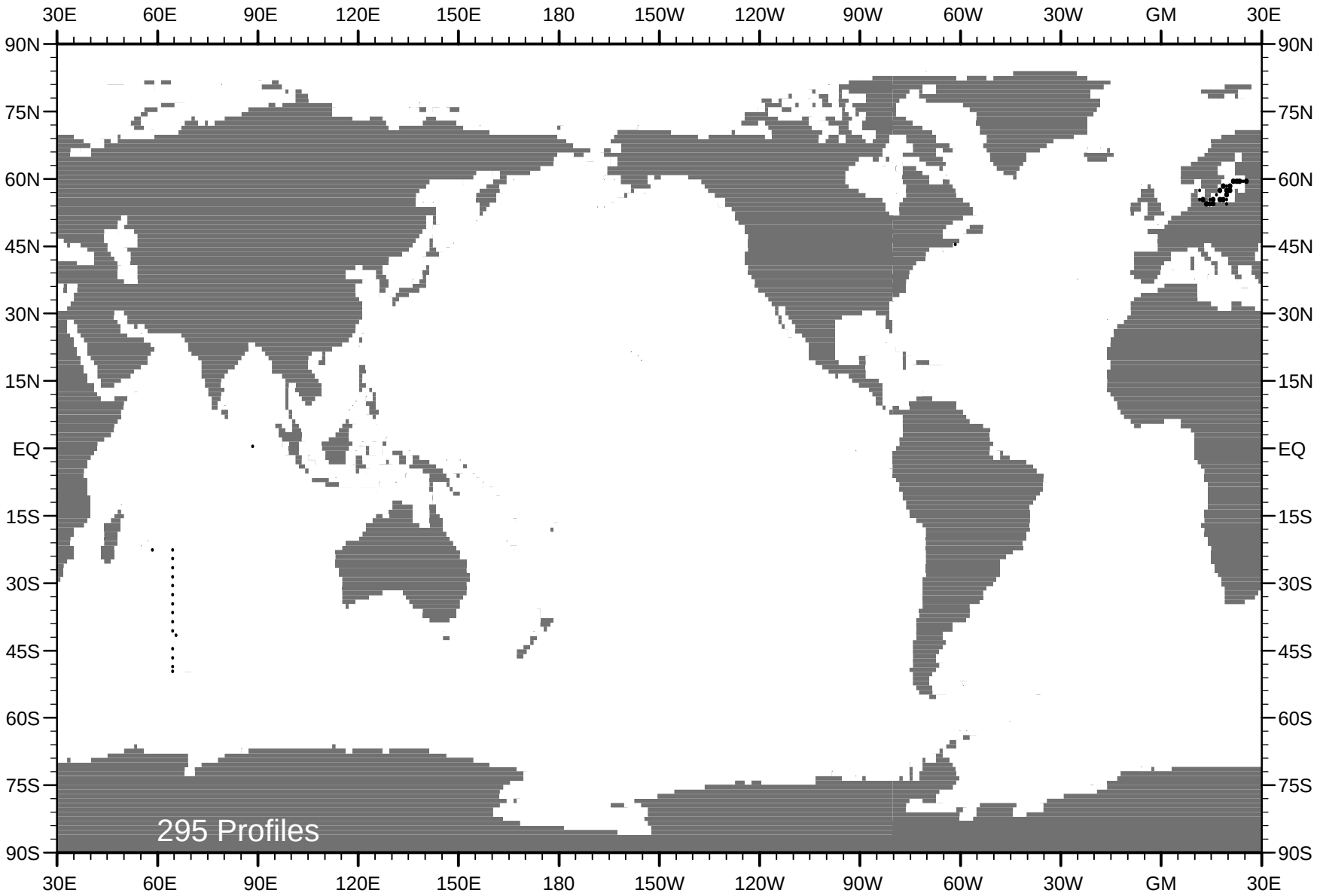


Fig. B35 Distribution of all Ocean Station Data (OSD) alkalinity profiles in WOD01 for year 1969 .

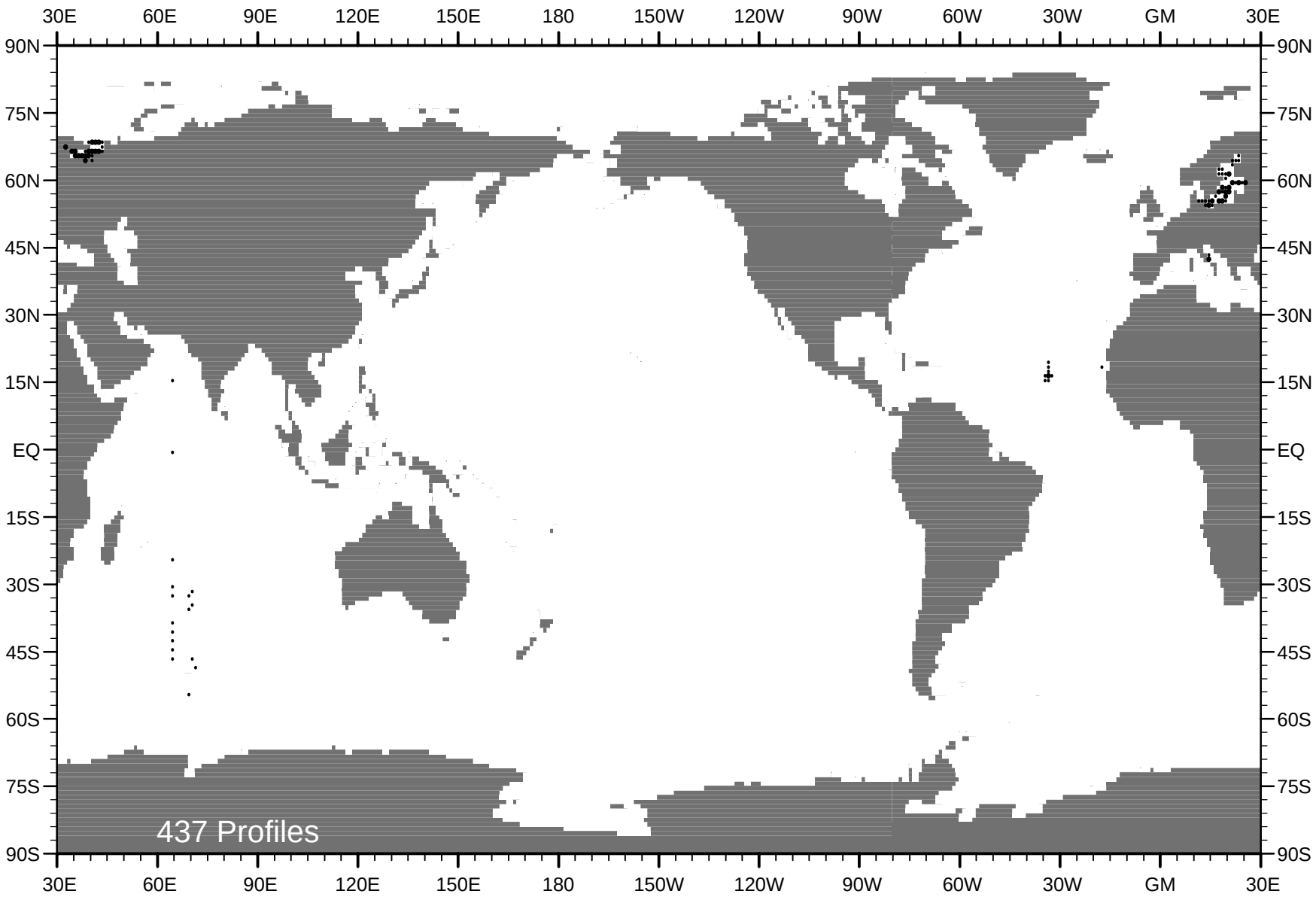


Fig. B36 Distribution of all Ocean Station Data (OSD) alkalinity profiles in WOD01 for year 1970 .

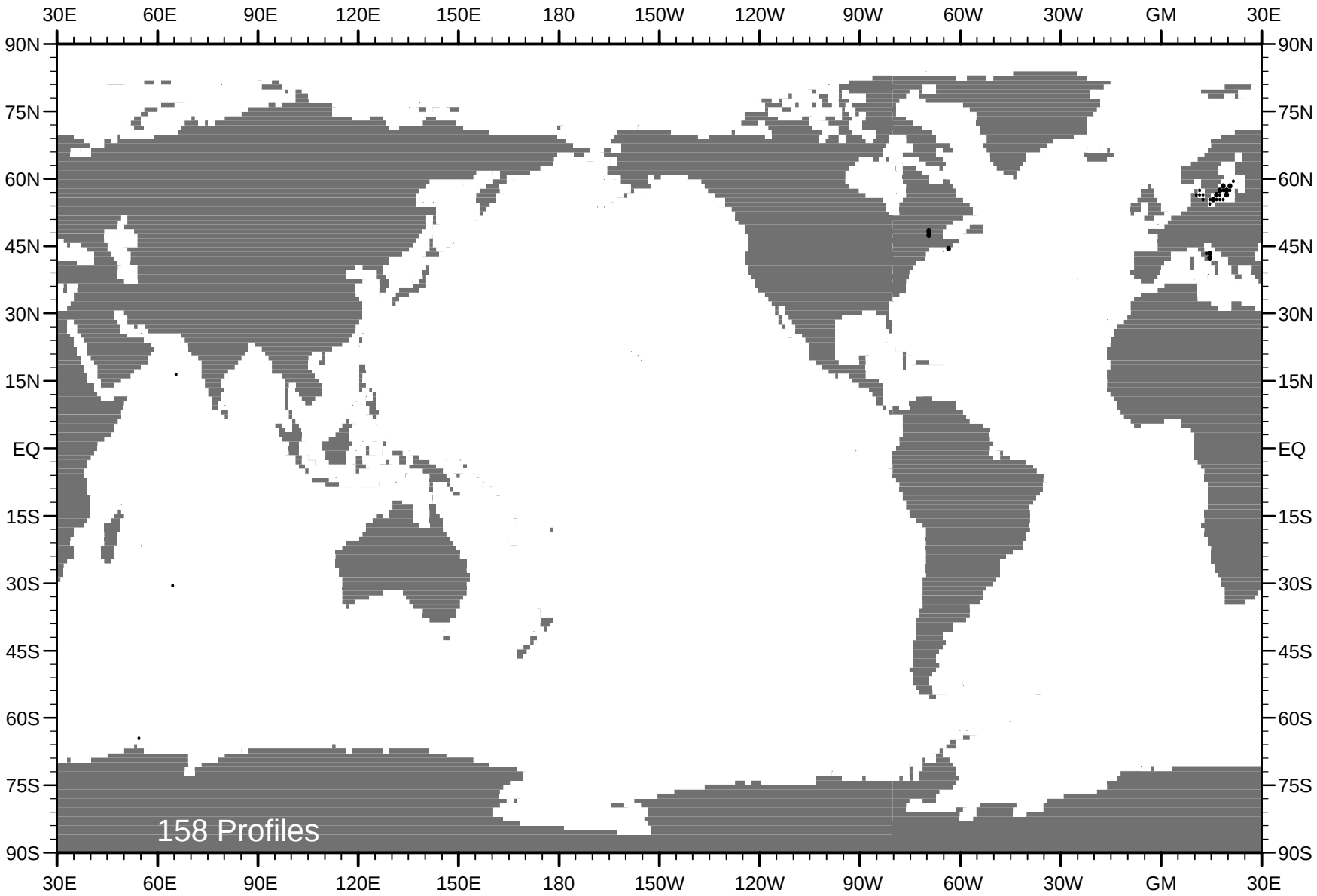


Fig. B37 Distribution of all Ocean Station Data (OSD) alkalinity profiles in WOD01 for year 1971 .

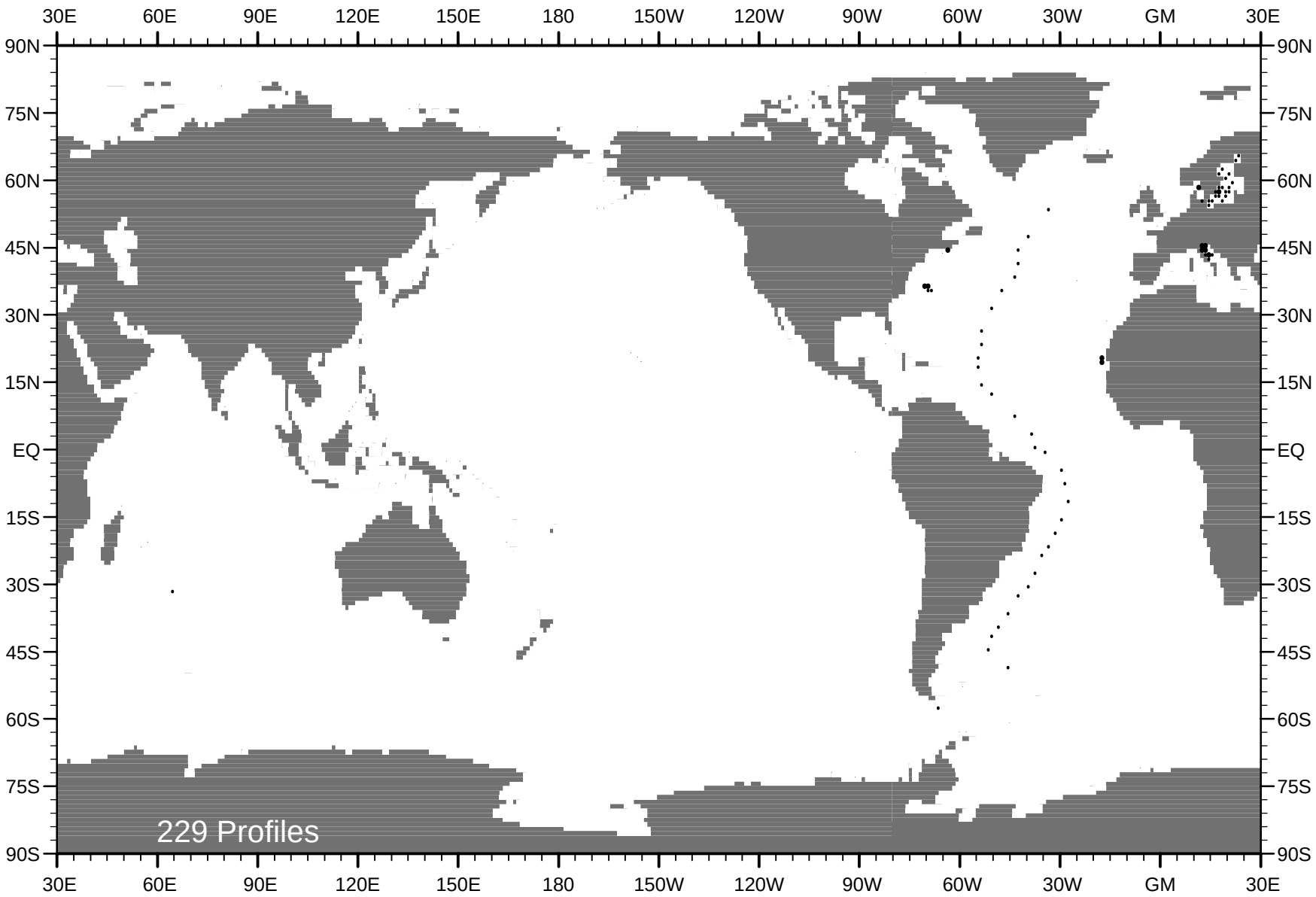


Fig. B38 Distribution of all Ocean Station Data (OSD) alkalinity profiles in WOD01 for year 1972 .

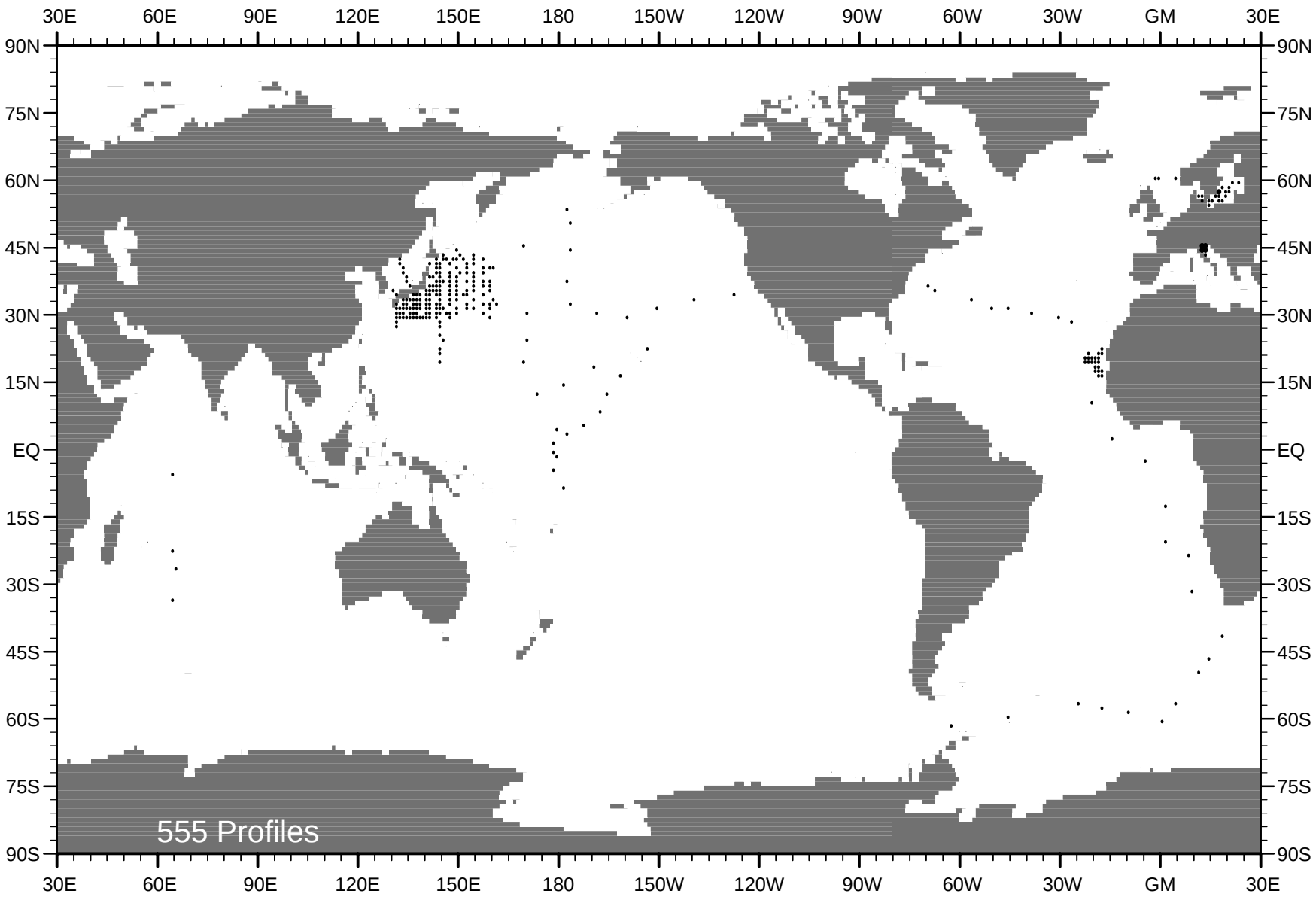


Fig. B39 Distribution of all Ocean Station Data (OSD) alkalinity profiles in WOD01 for year 1973 .

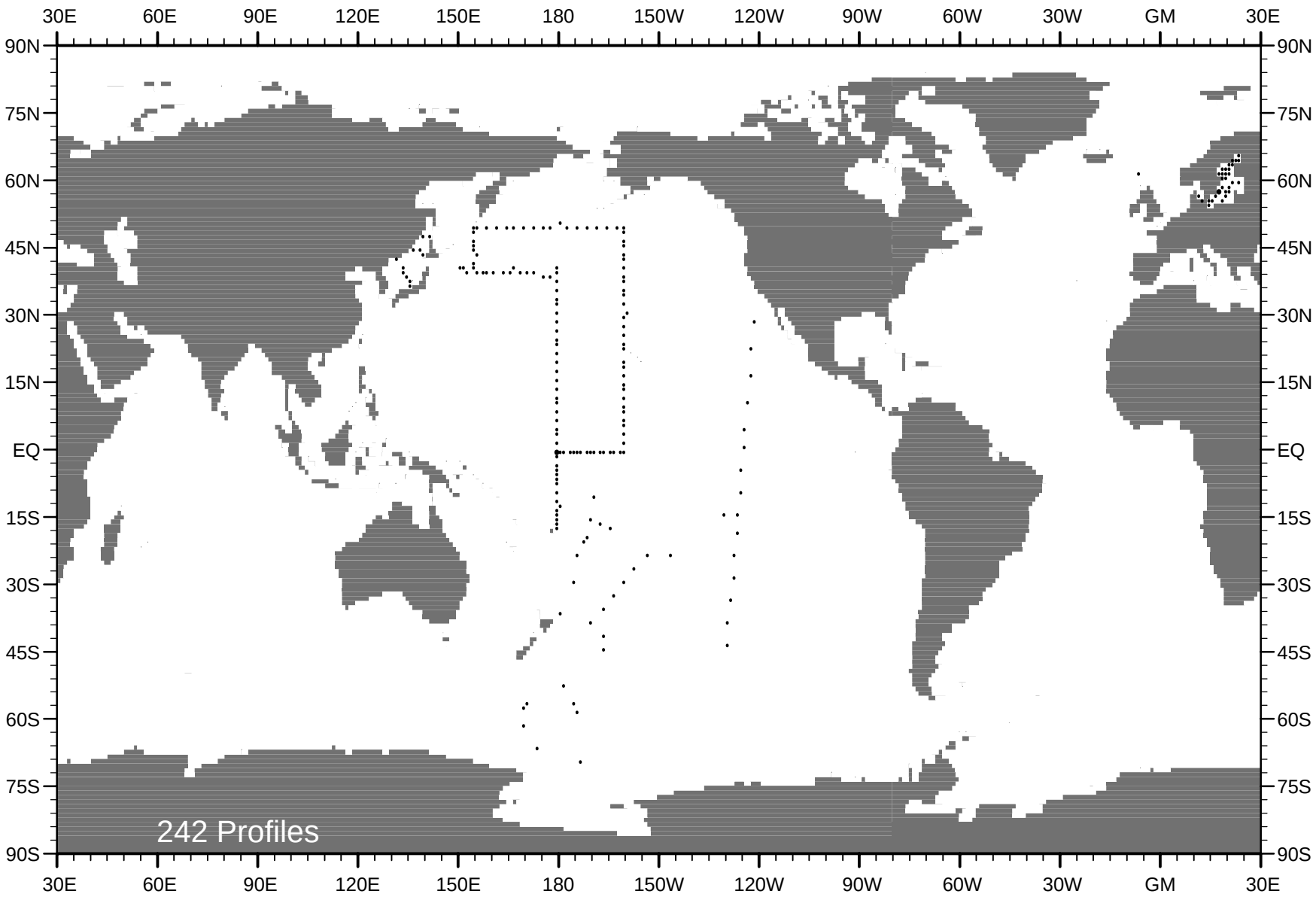


Fig. B40 Distribution of all Ocean Station Data (OSD) alkalinity profiles in WOD01 for year 1974 .

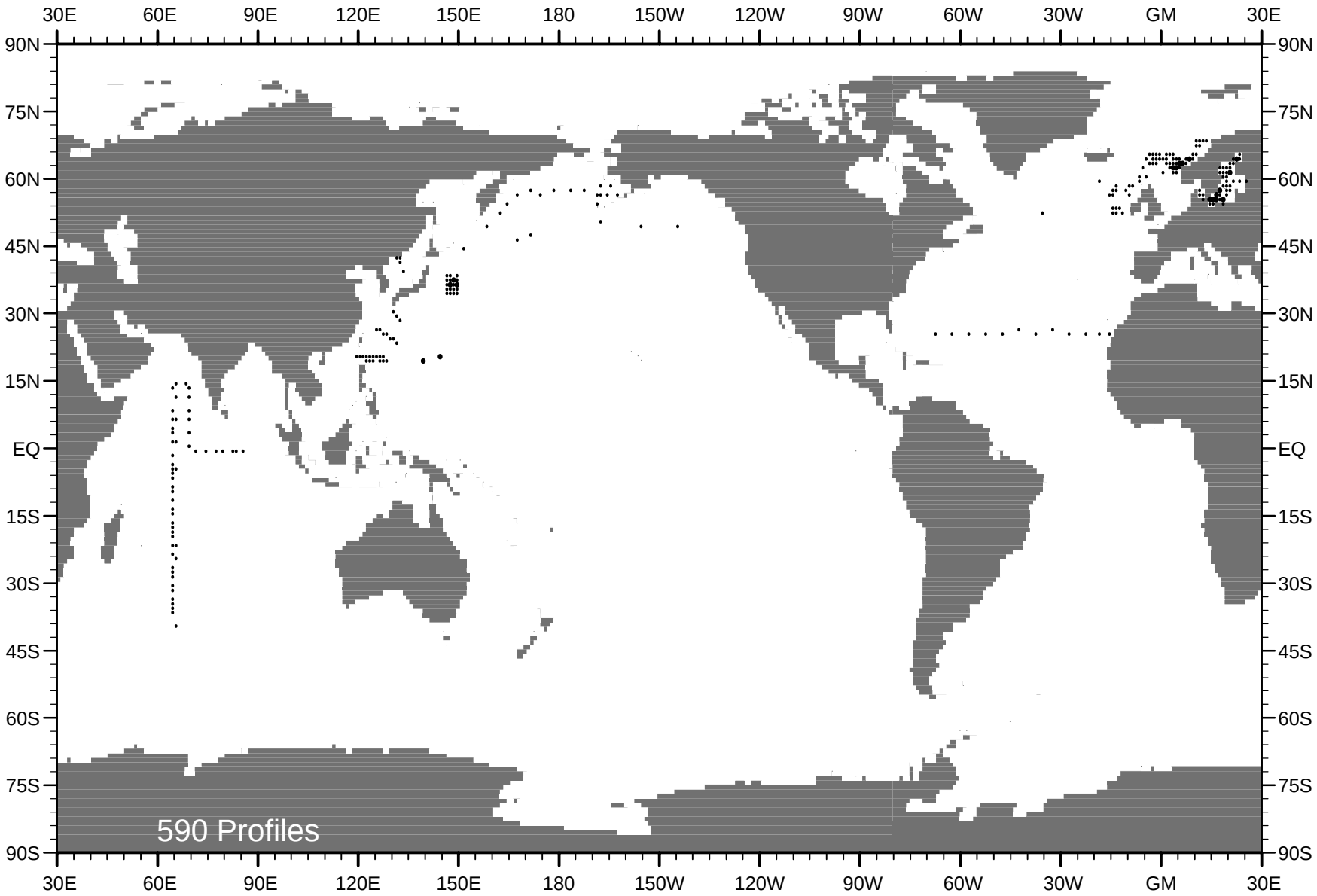


Fig. B41 Distribution of all Ocean Station Data (OSD) alkalinity profiles in WOD01 for year 1975 .

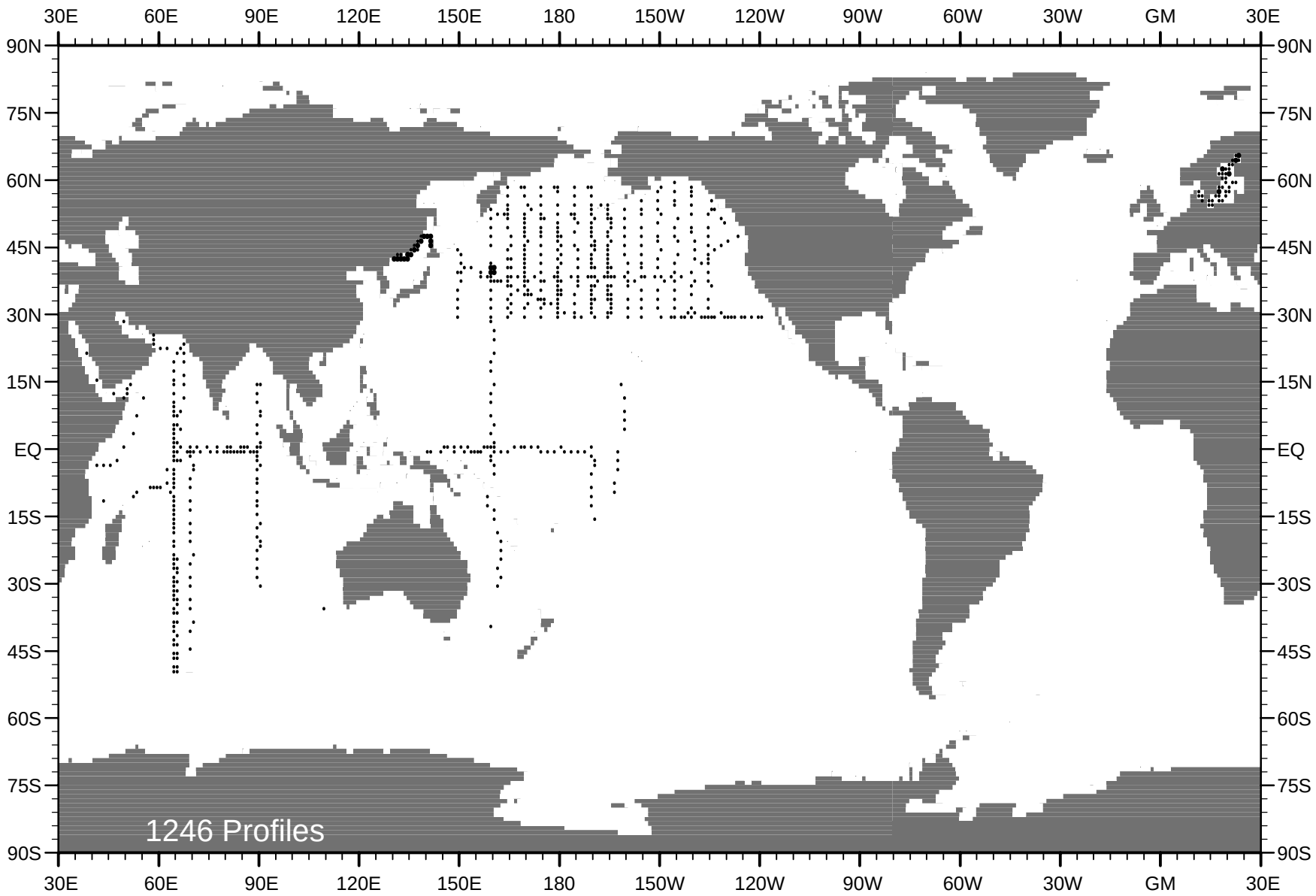


Fig. B42 Distribution of all Ocean Station Data (OSD) alkalinity profiles in WOD01 for year 1976 .

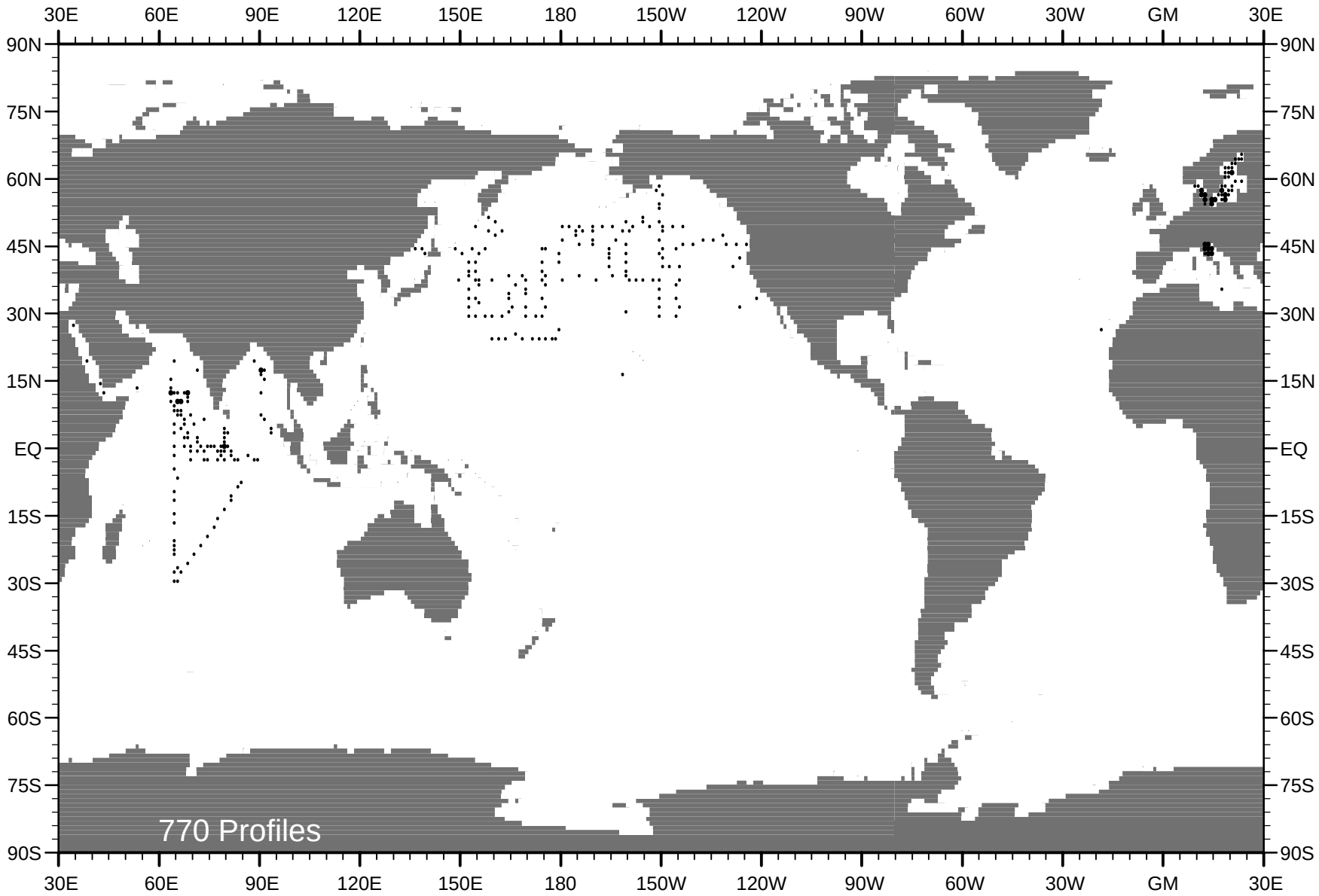


Fig. B43 Distribution of all Ocean Station Data (OSD) alkalinity profiles in WOD01 for year 1977 .

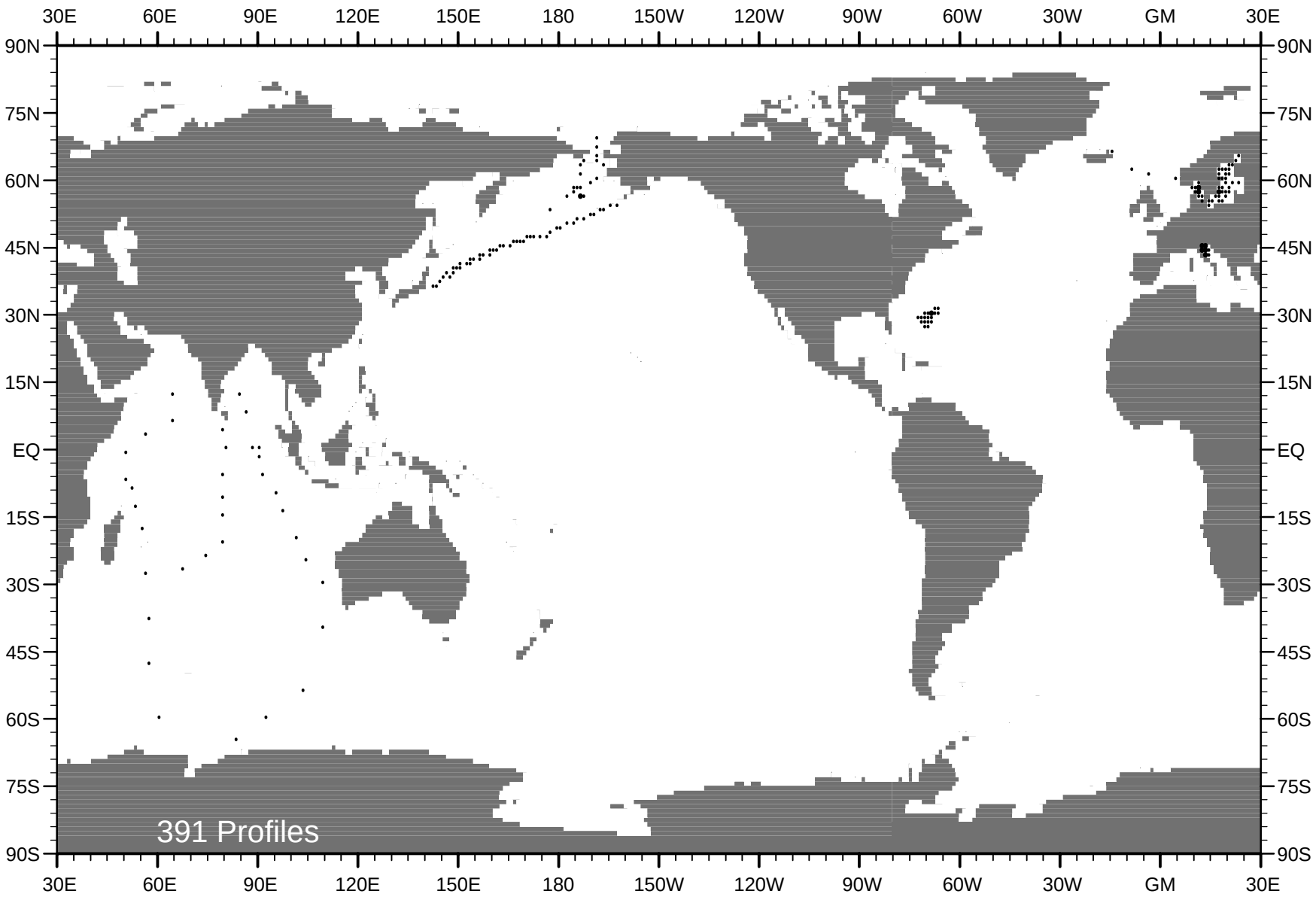


Fig. B44 Distribution of all Ocean Station Data (OSD) alkalinity profiles in WOD01 for year 1978 .

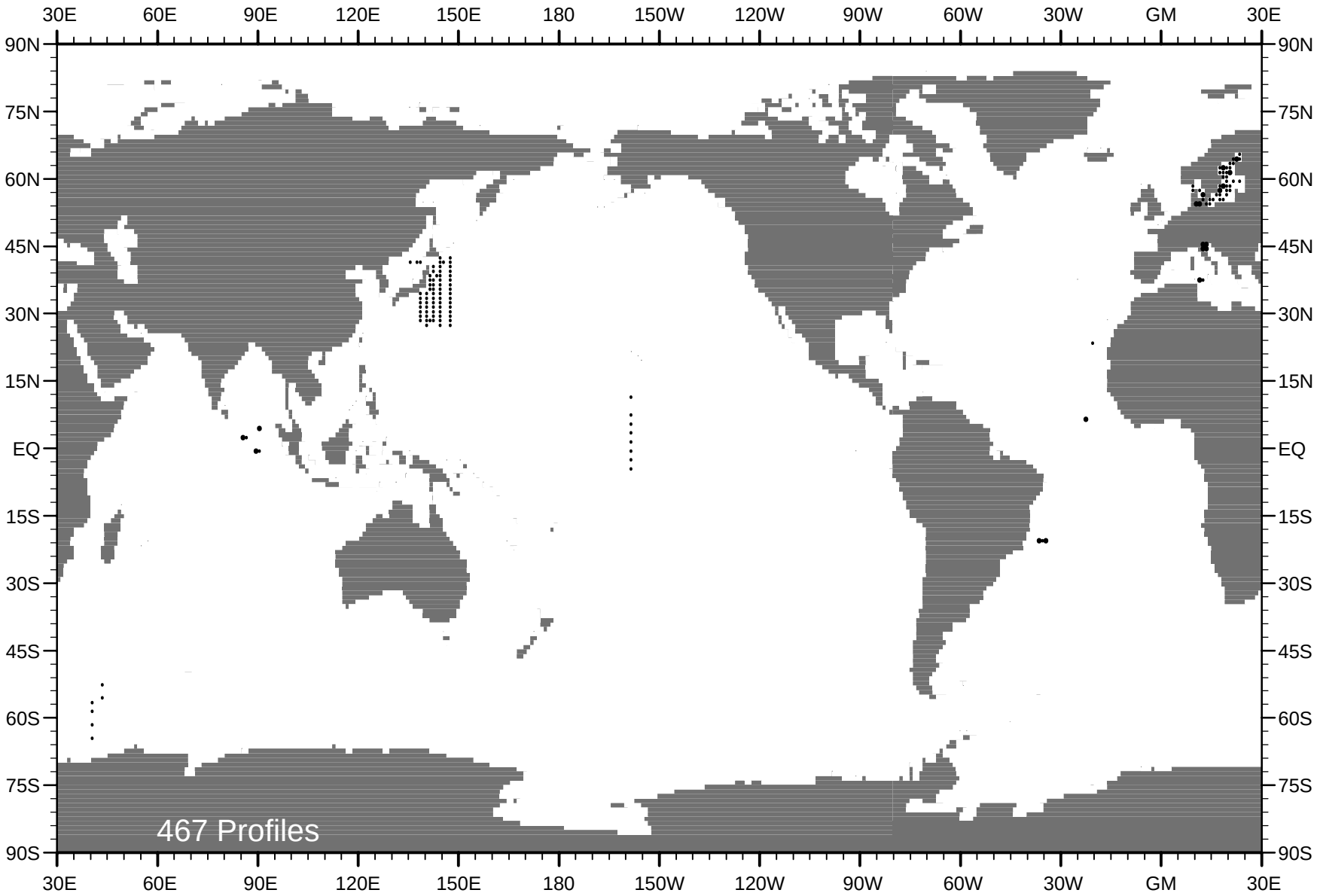


Fig. B45 Distribution of all Ocean Station Data (OSD) alkalinity profiles in WOD01 for year 1979 .

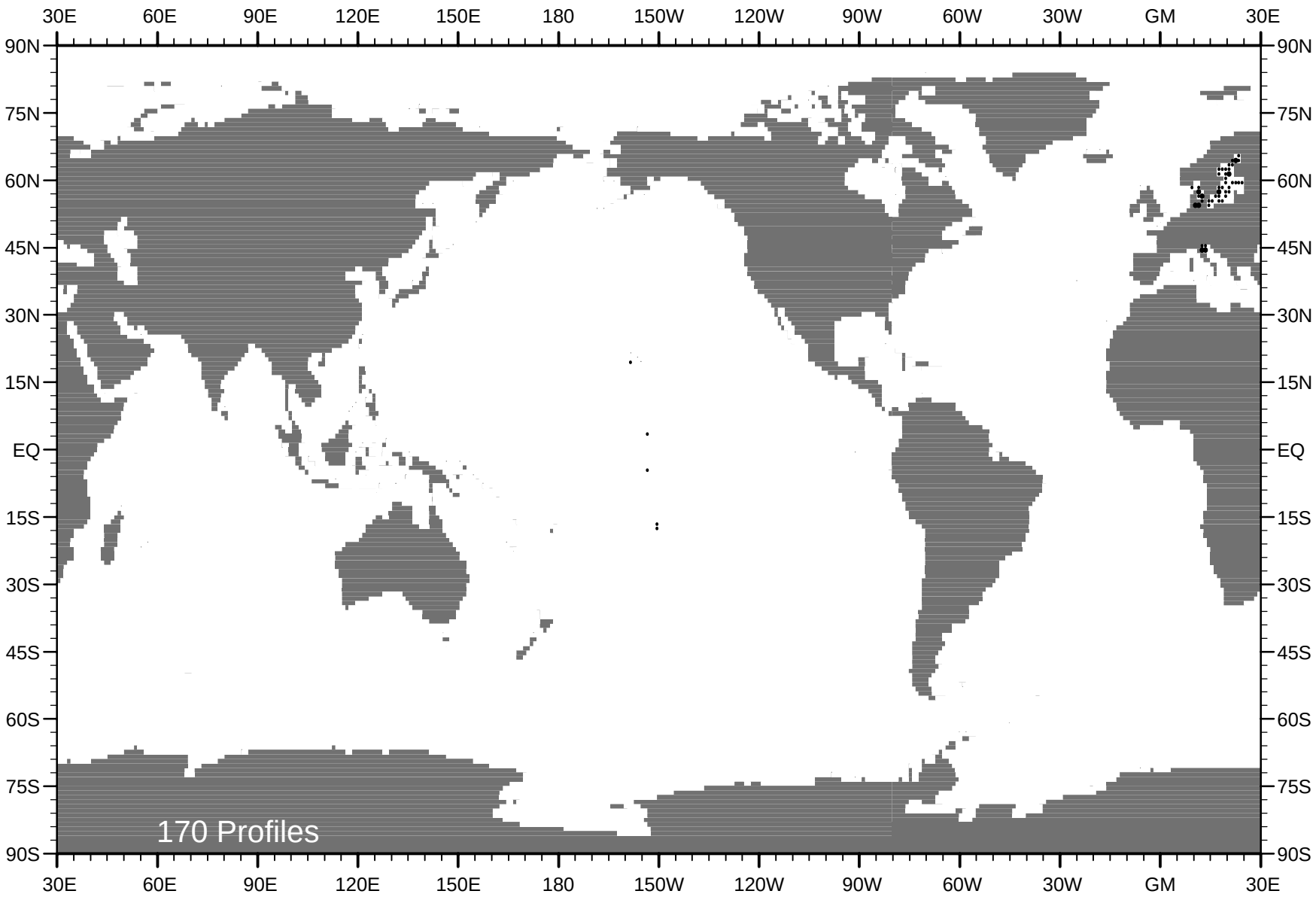


Fig. B46 Distribution of all Ocean Station Data (OSD) alkalinity profiles in WOD01 for year 1980 .

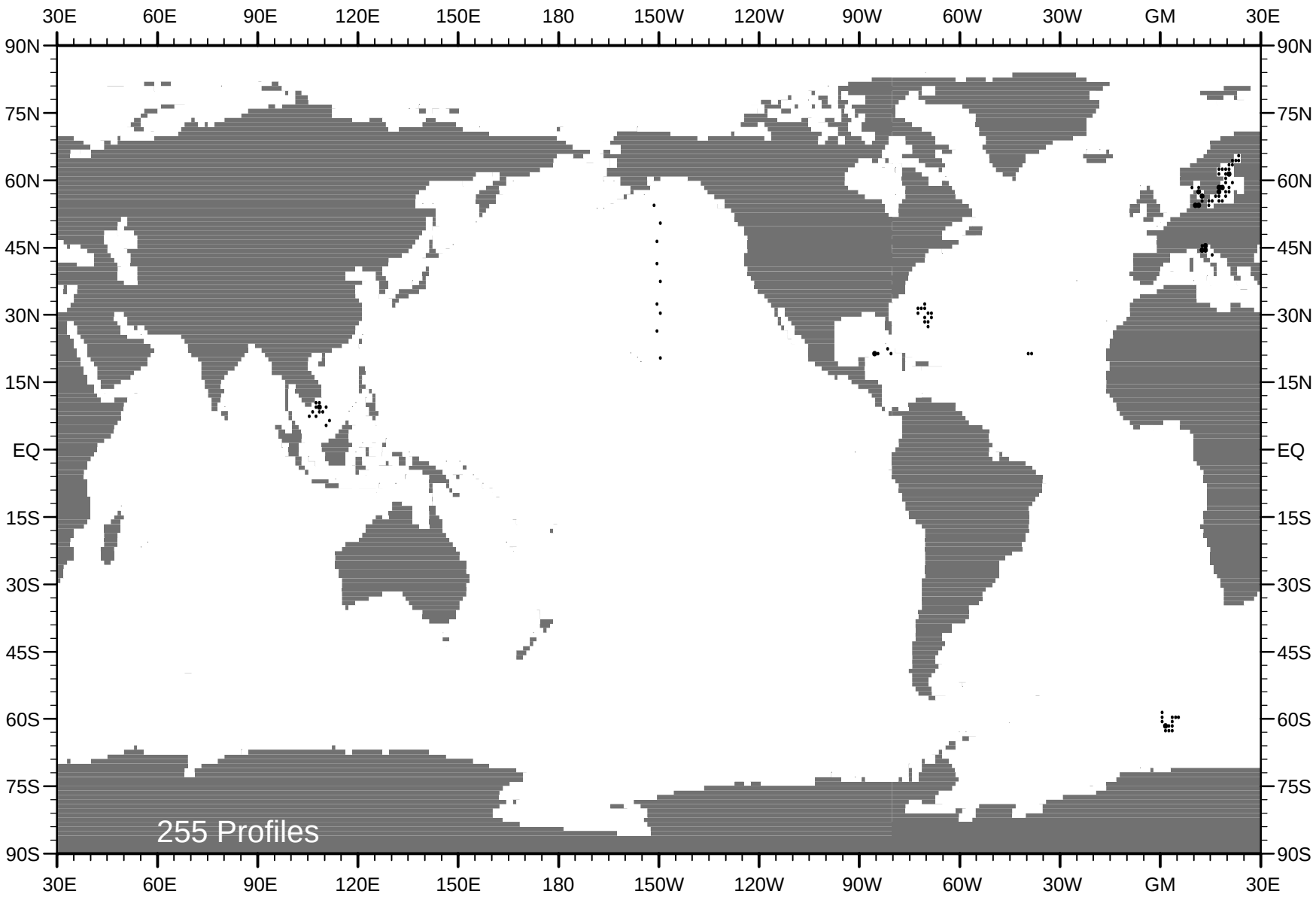


Fig. B47 Distribution of all Ocean Station Data (OSD) alkalinity profiles in WOD01 for year 1981 .

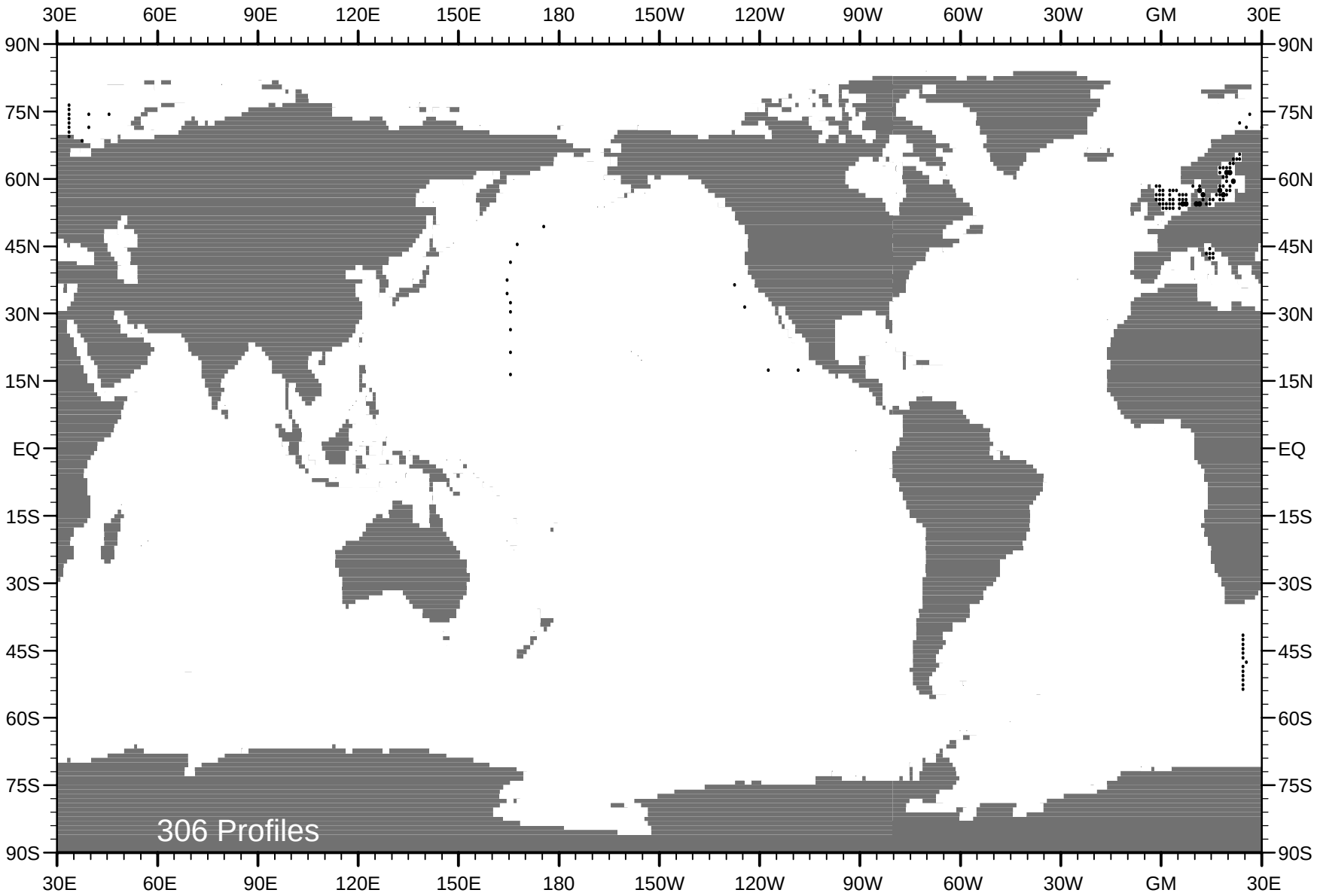


Fig. B48 Distribution of all Ocean Station Data (OSD) alkalinity profiles in WOD01 for year 1982 .

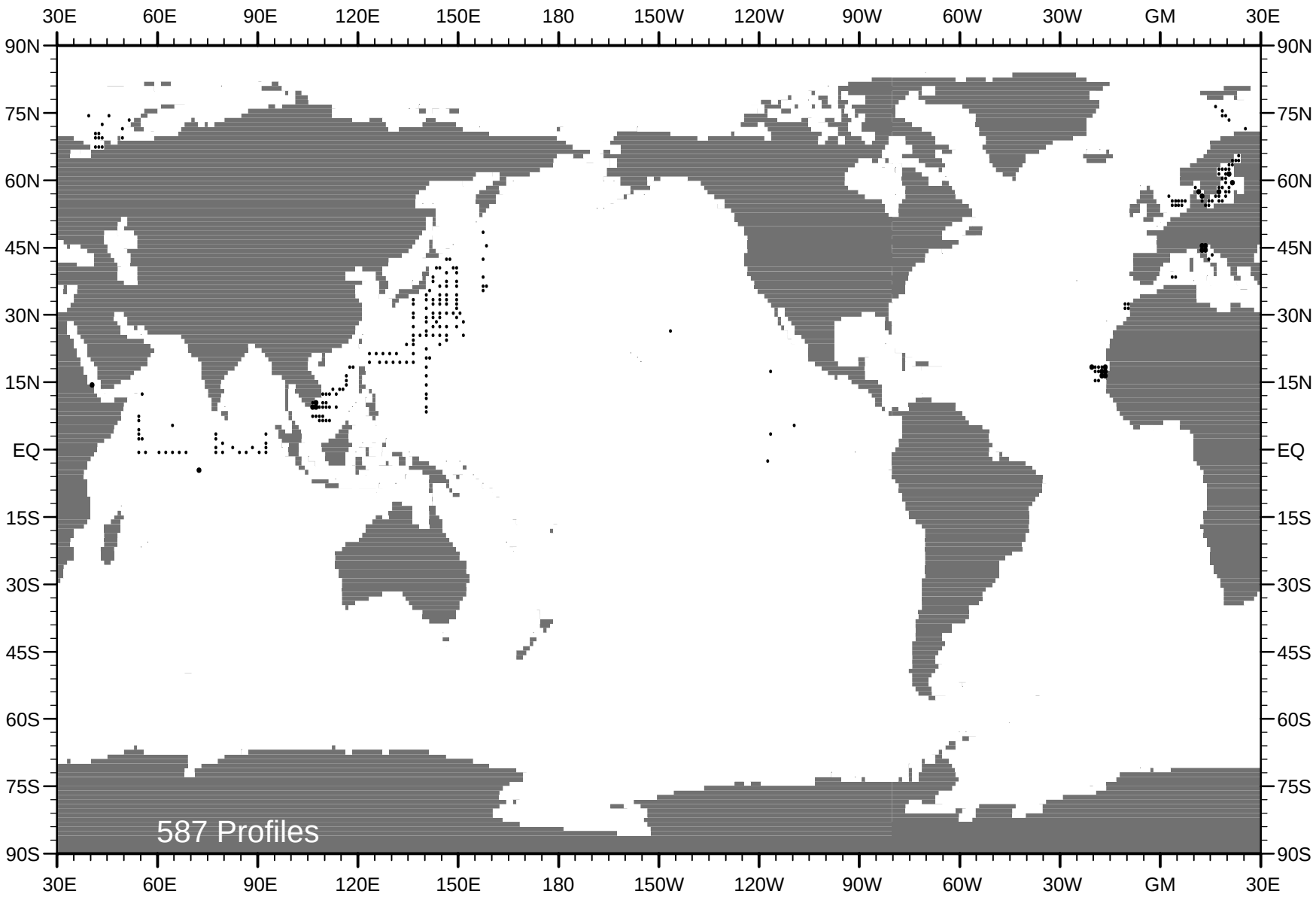


Fig. B49 Distribution of all Ocean Station Data (OSD) alkalinity profiles in WOD01 for year 1983 .

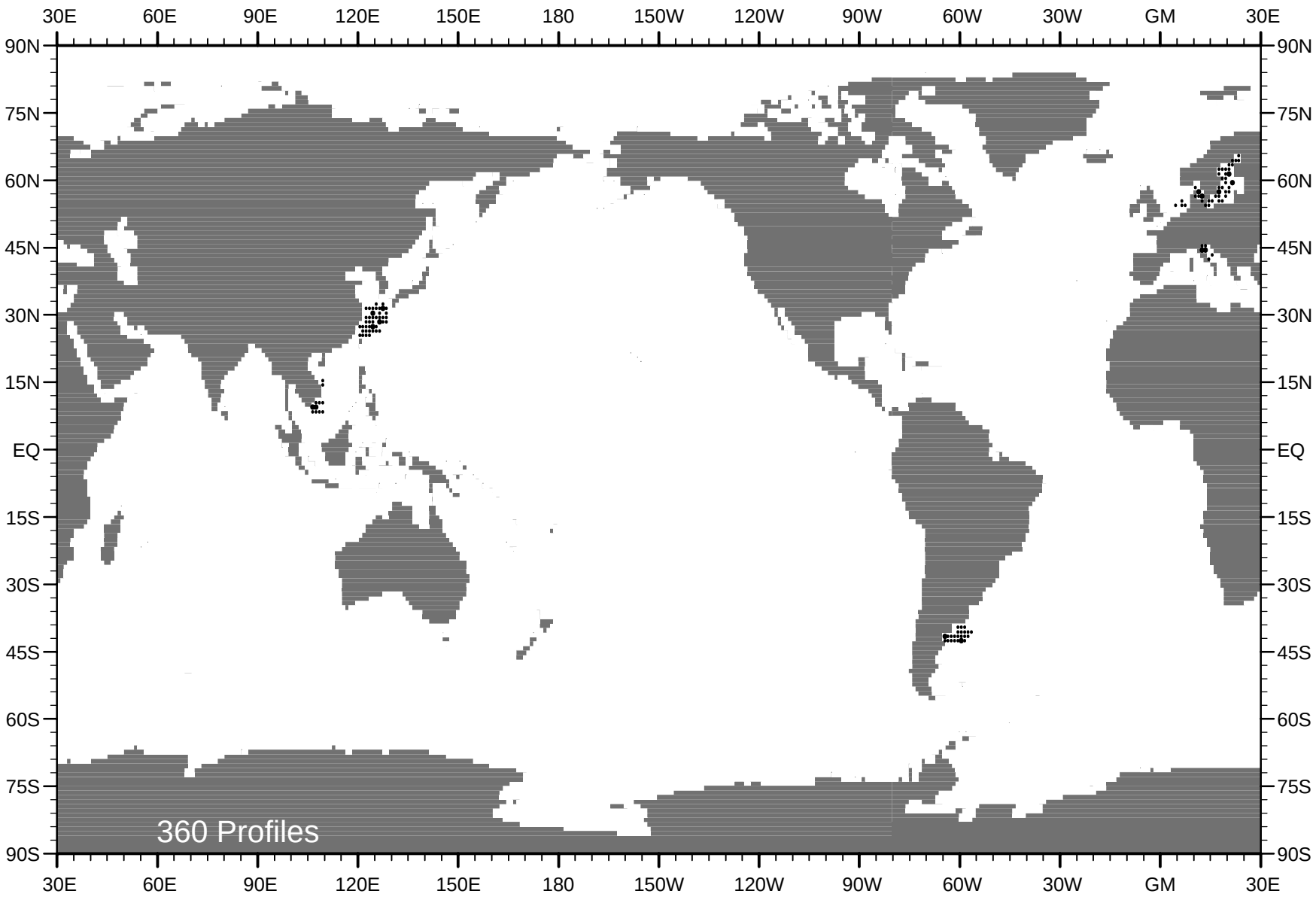


Fig. B50 Distribution of all Ocean Station Data (OSD) alkalinity profiles in WOD01 for year 1984 .

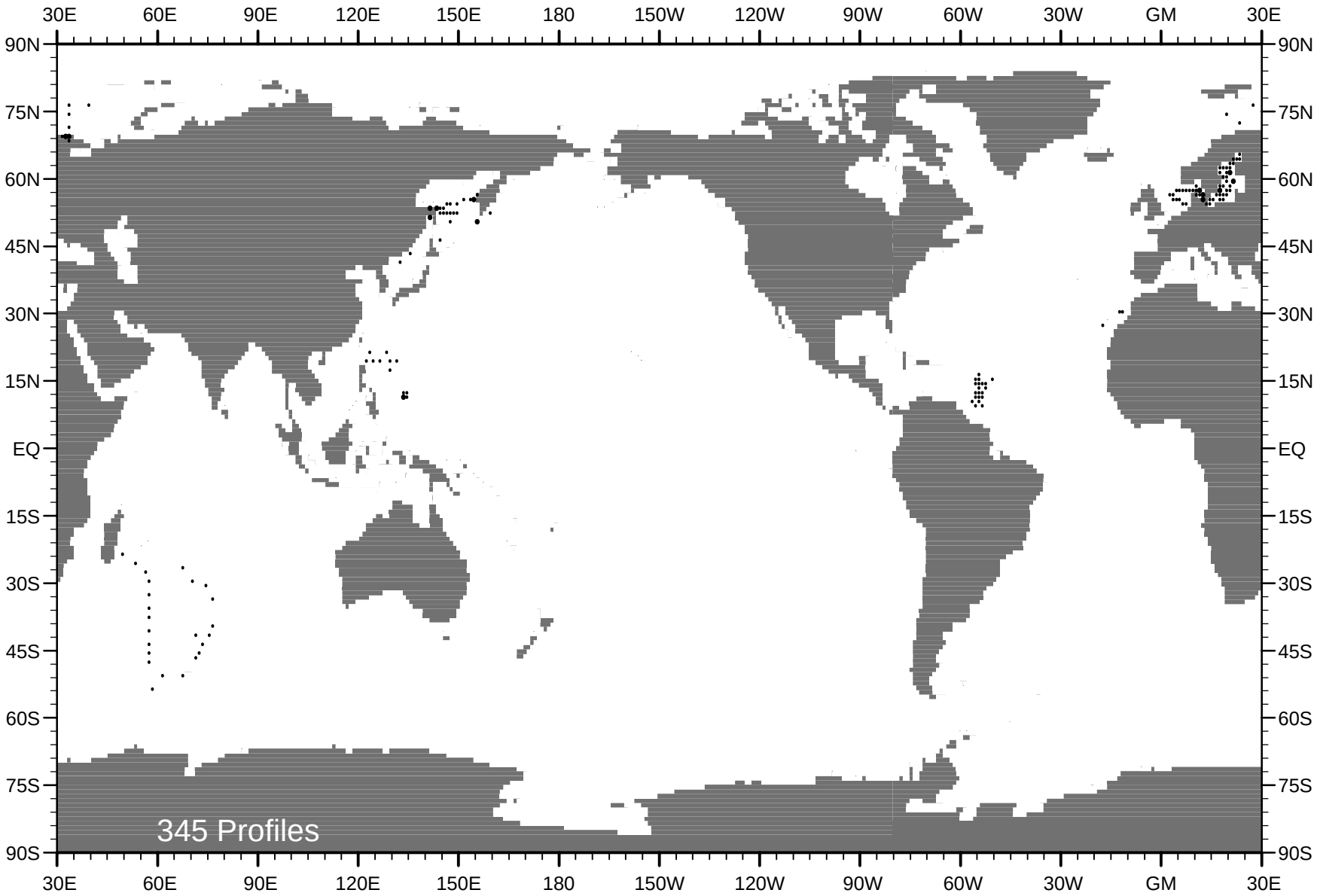


Fig. B51 Distribution of all Ocean Station Data (OSD) alkalinity profiles in WOD01 for year 1985 .

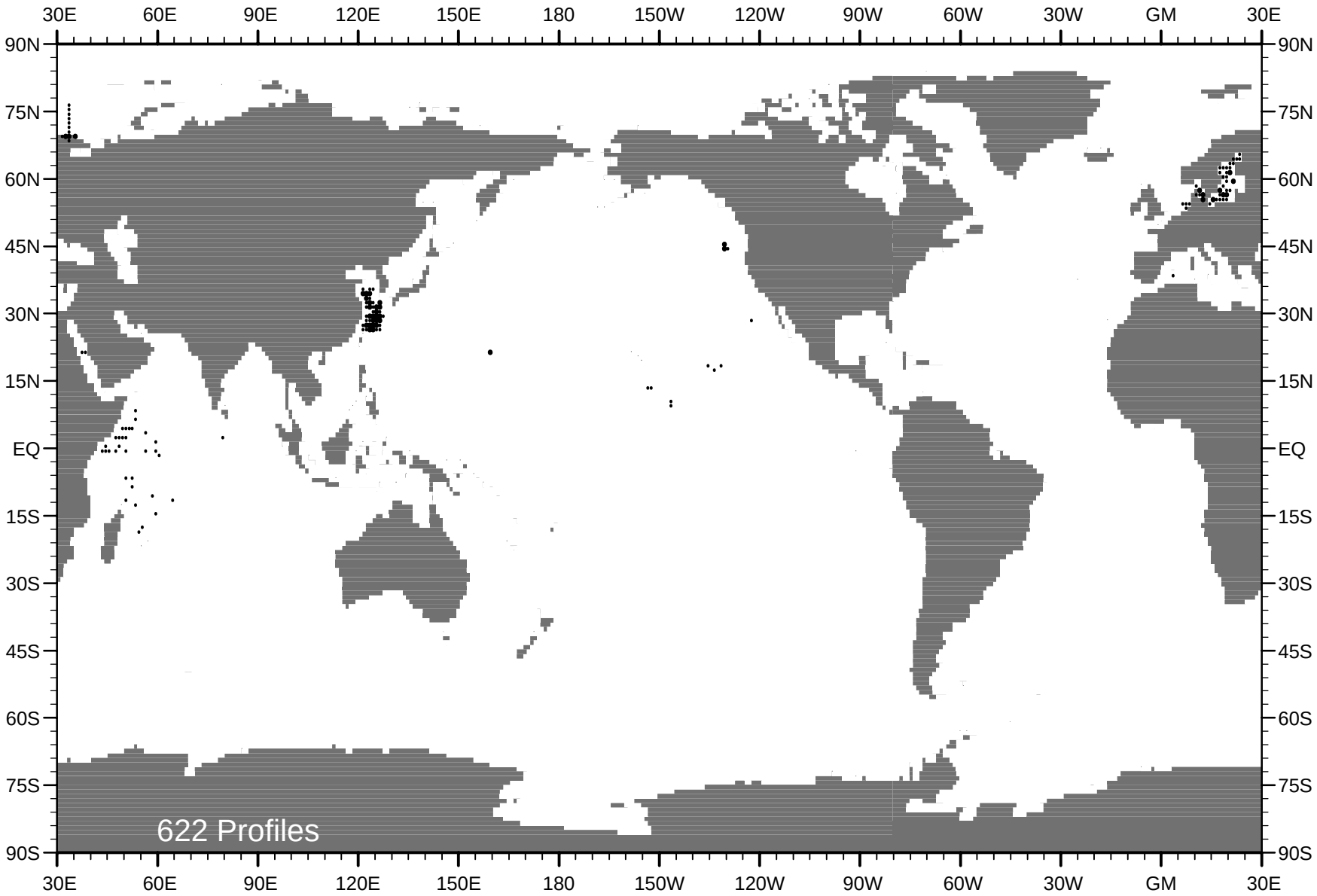


Fig. B52 Distribution of all Ocean Station Data (OSD) alkalinity profiles in WOD01 for year 1986 .

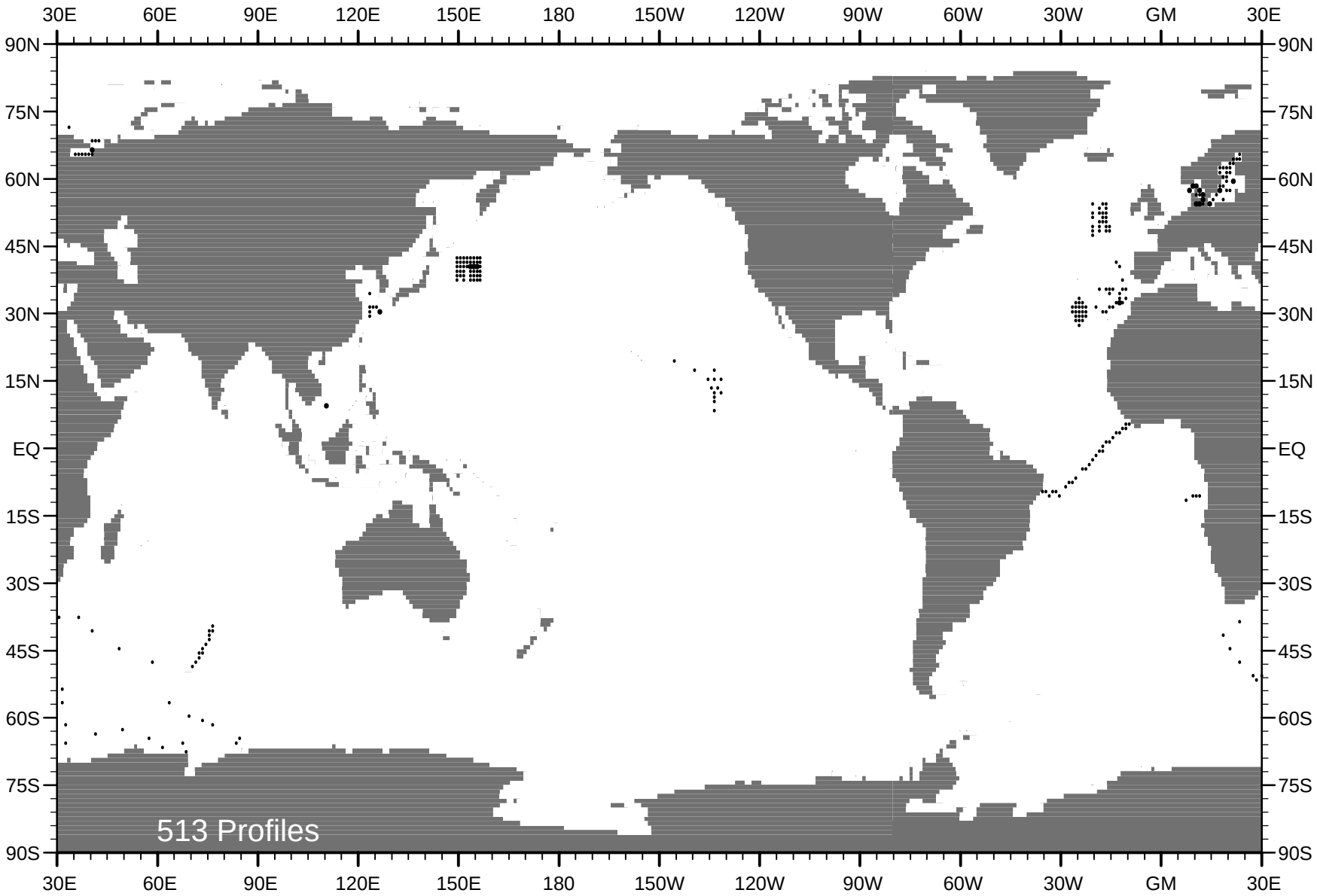


Fig. B53 Distribution of all Ocean Station Data (OSD) alkalinity profiles in WOD01 for year 1987 .

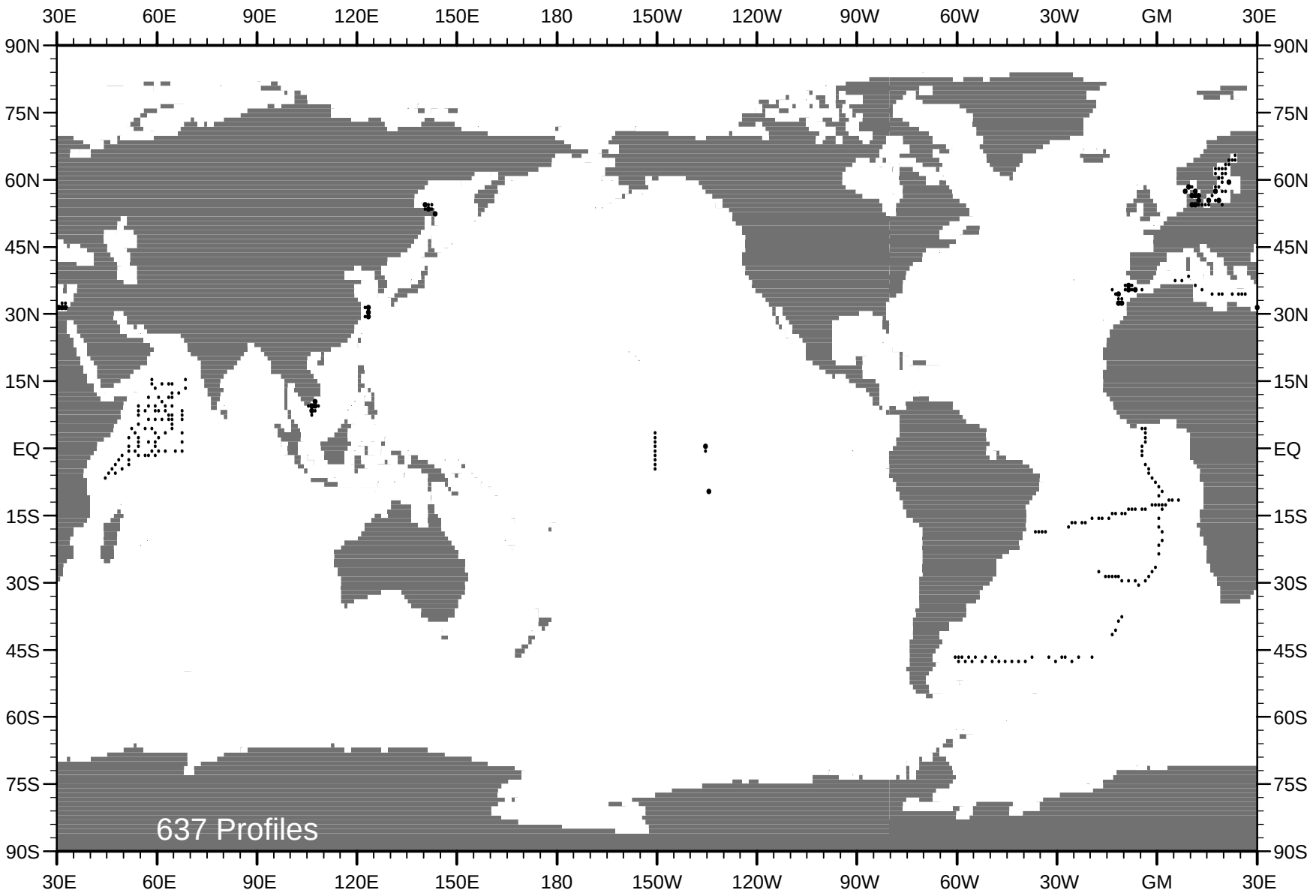


Fig. B54 Distribution of all Ocean Station Data (OSD) alkalinity profiles in WOD01 for year 1988 .

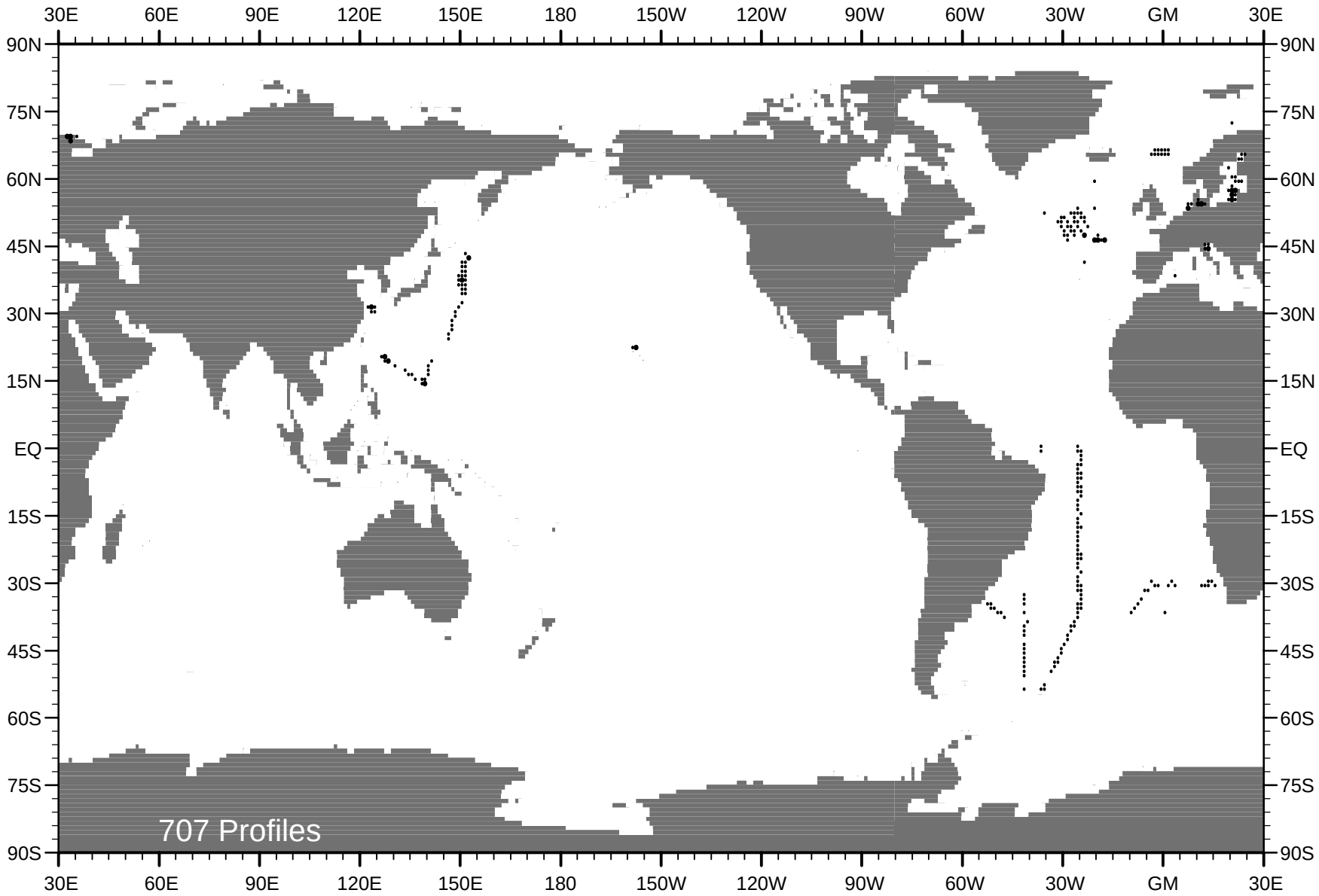


Fig. B55 Distribution of all Ocean Station Data (OSD) alkalinity profiles in WOD01 for year 1989 .

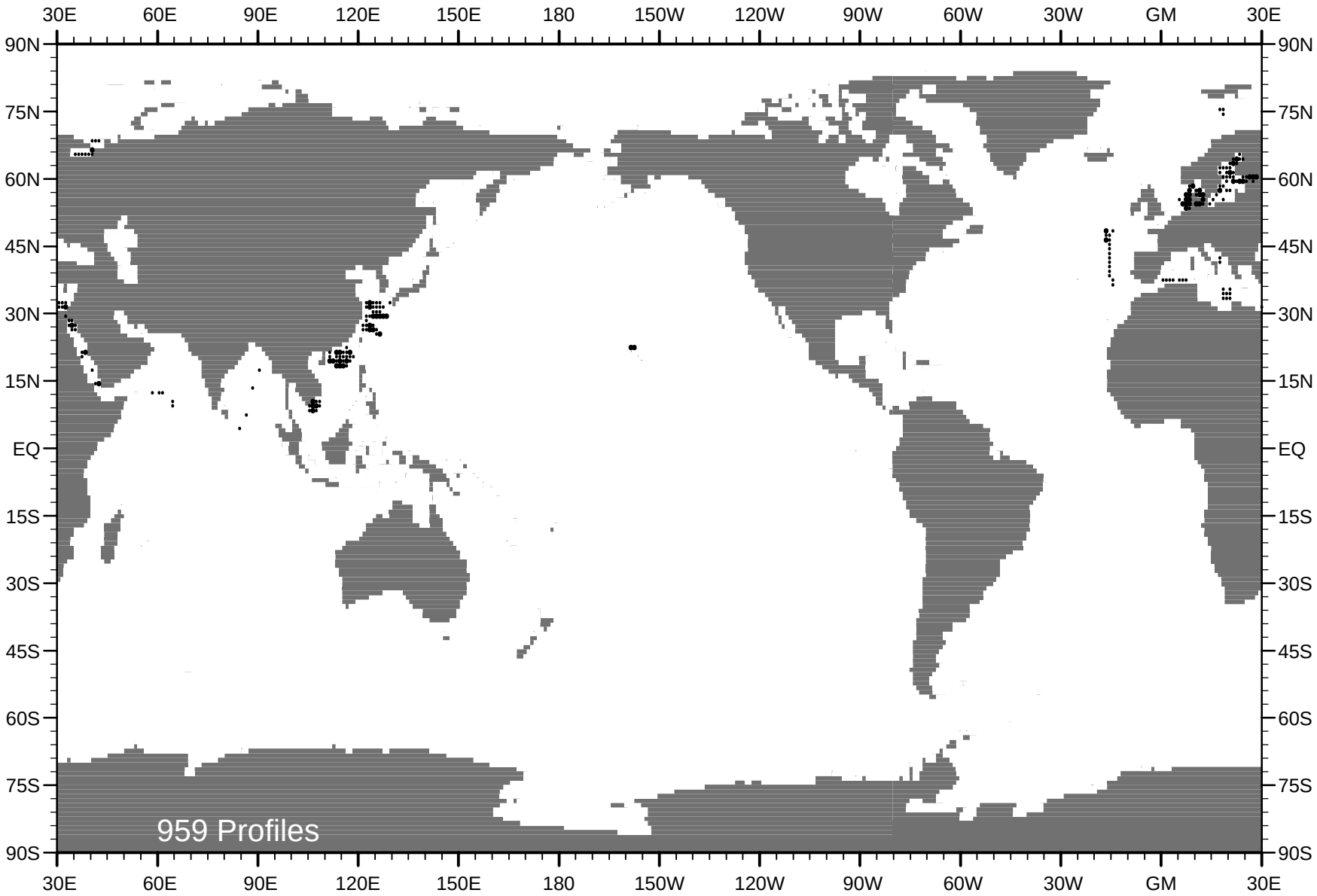
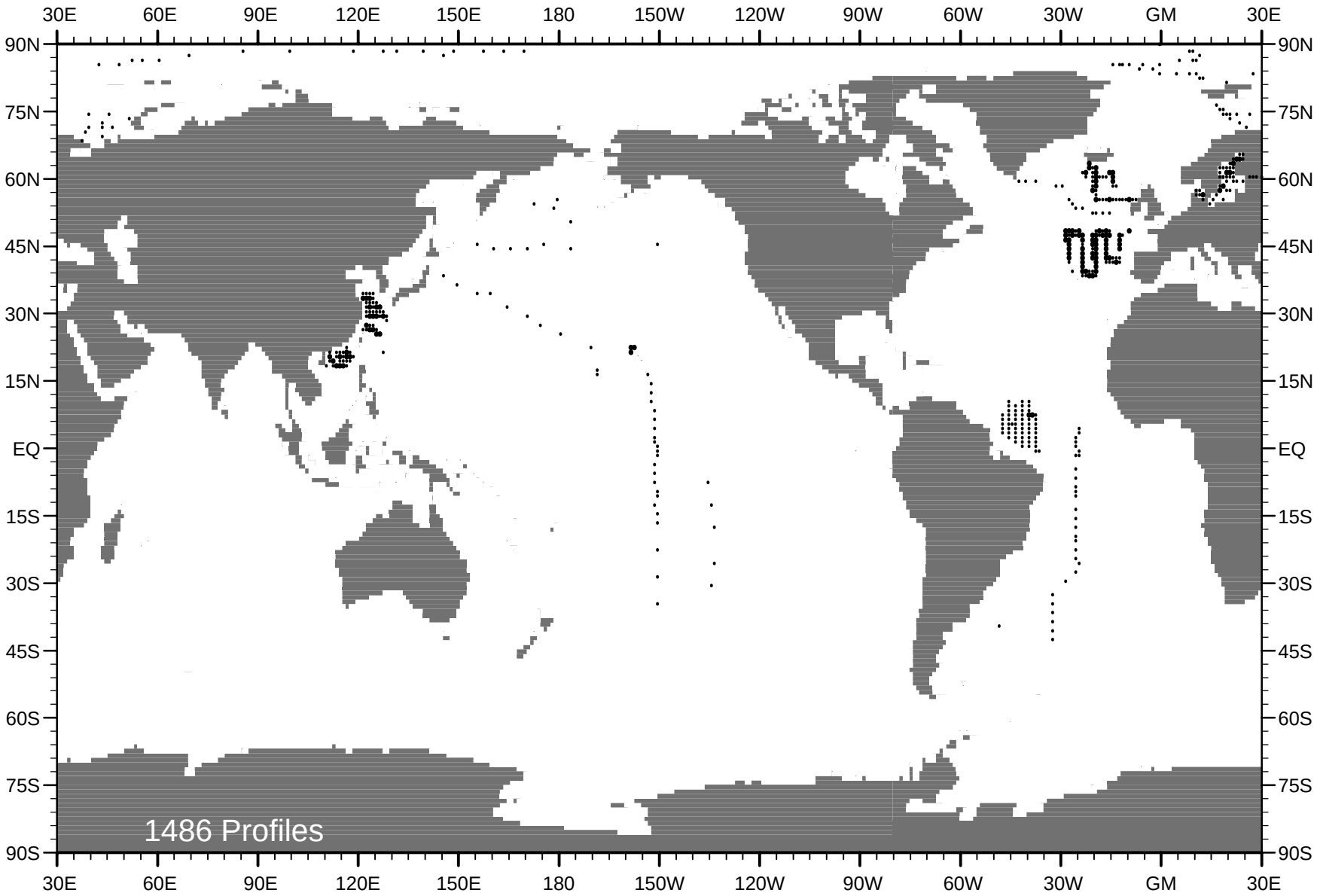


Fig. B56 Distribution of all Ocean Station Data (OSD) alkalinity profiles in WOD01 for year 1990 .



180

Fig. B57 Distribution of all Ocean Station Data (OSD) alkalinity profiles in WOD01 for year 1991 .

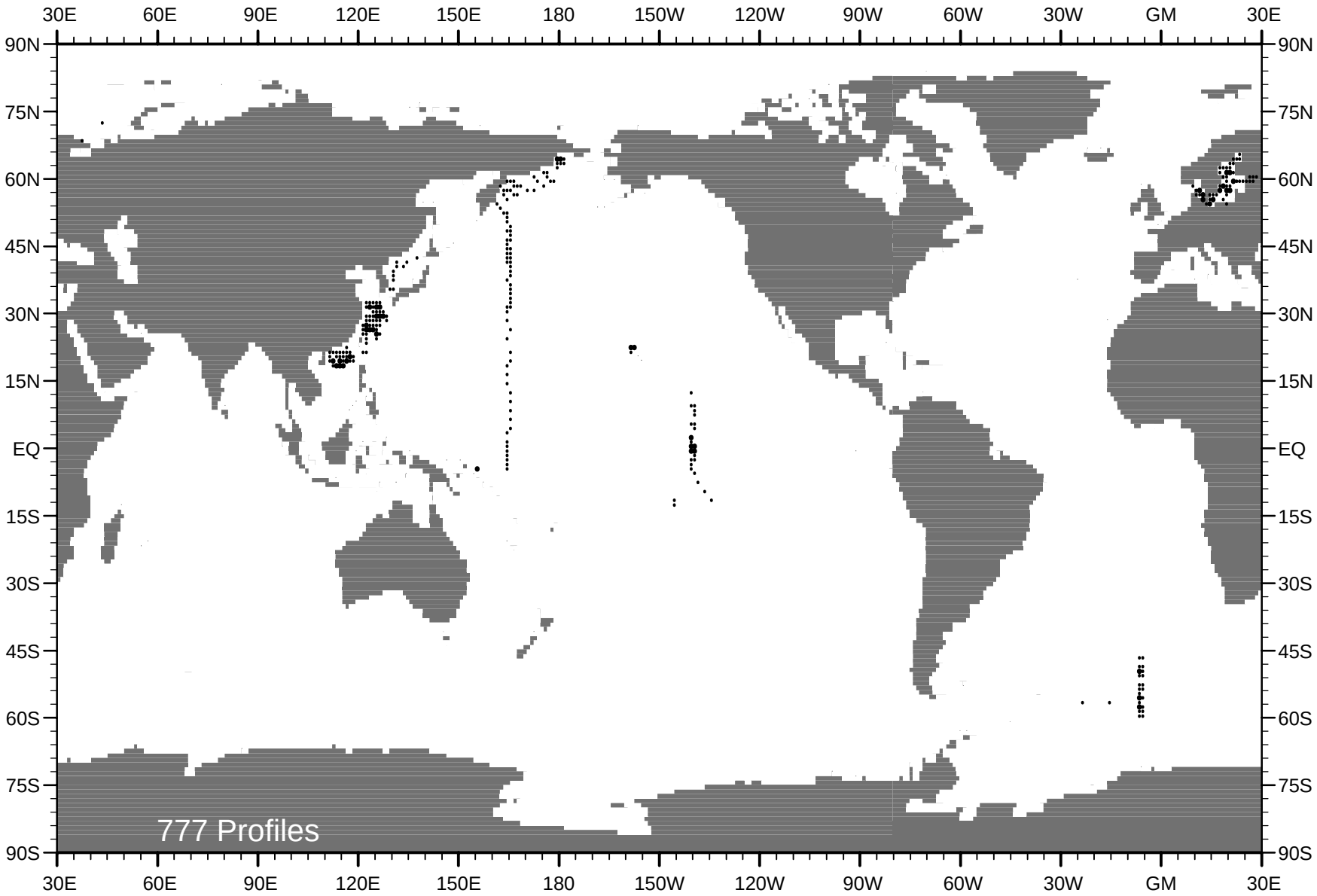


Fig. B58 Distribution of all Ocean Station Data (OSD) alkalinity profiles in WOD01 for year 1992 .

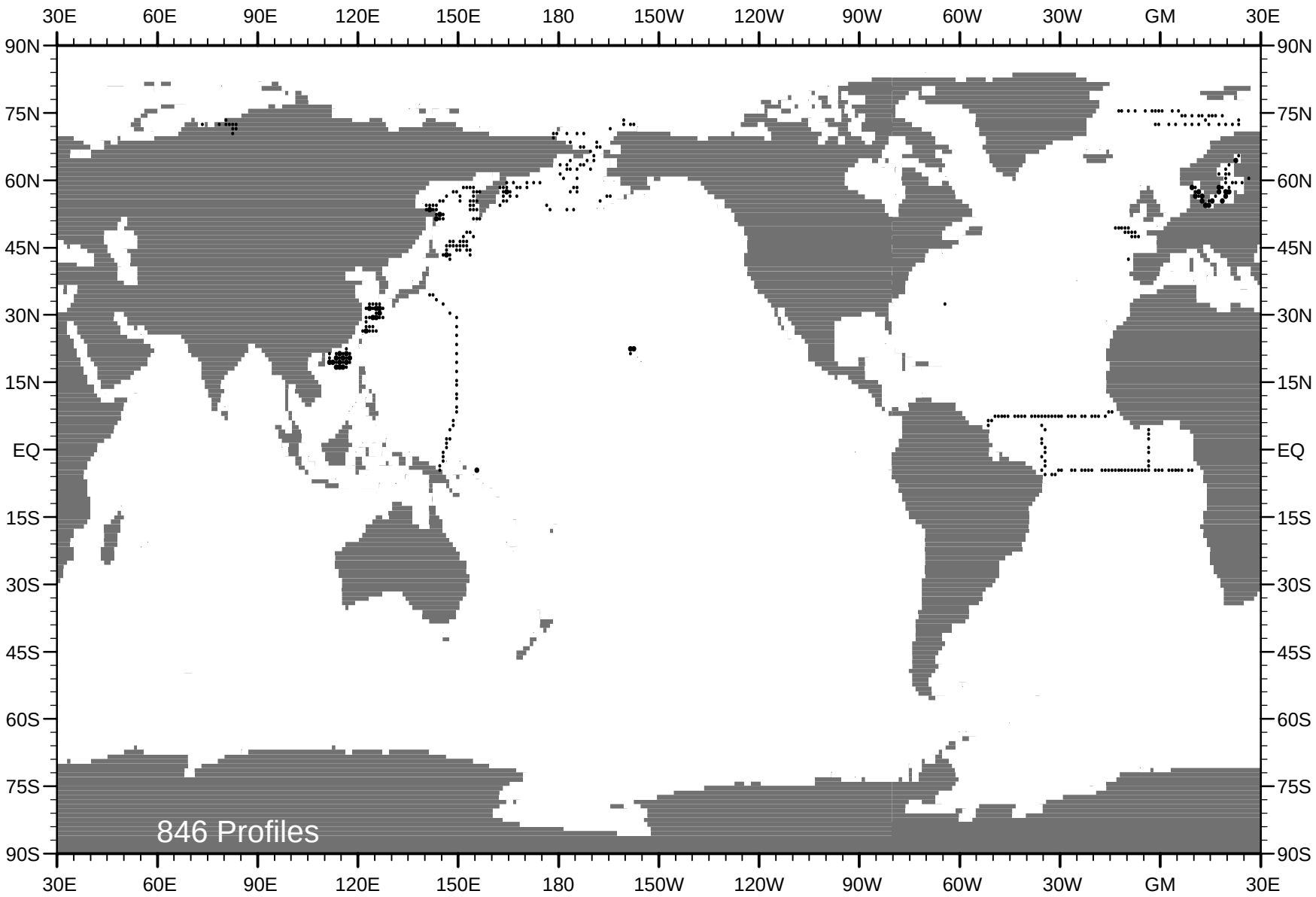


Fig. B59 Distribution of all Ocean Station Data (OSD) alkalinity profiles in WOD01 for year 1993 .

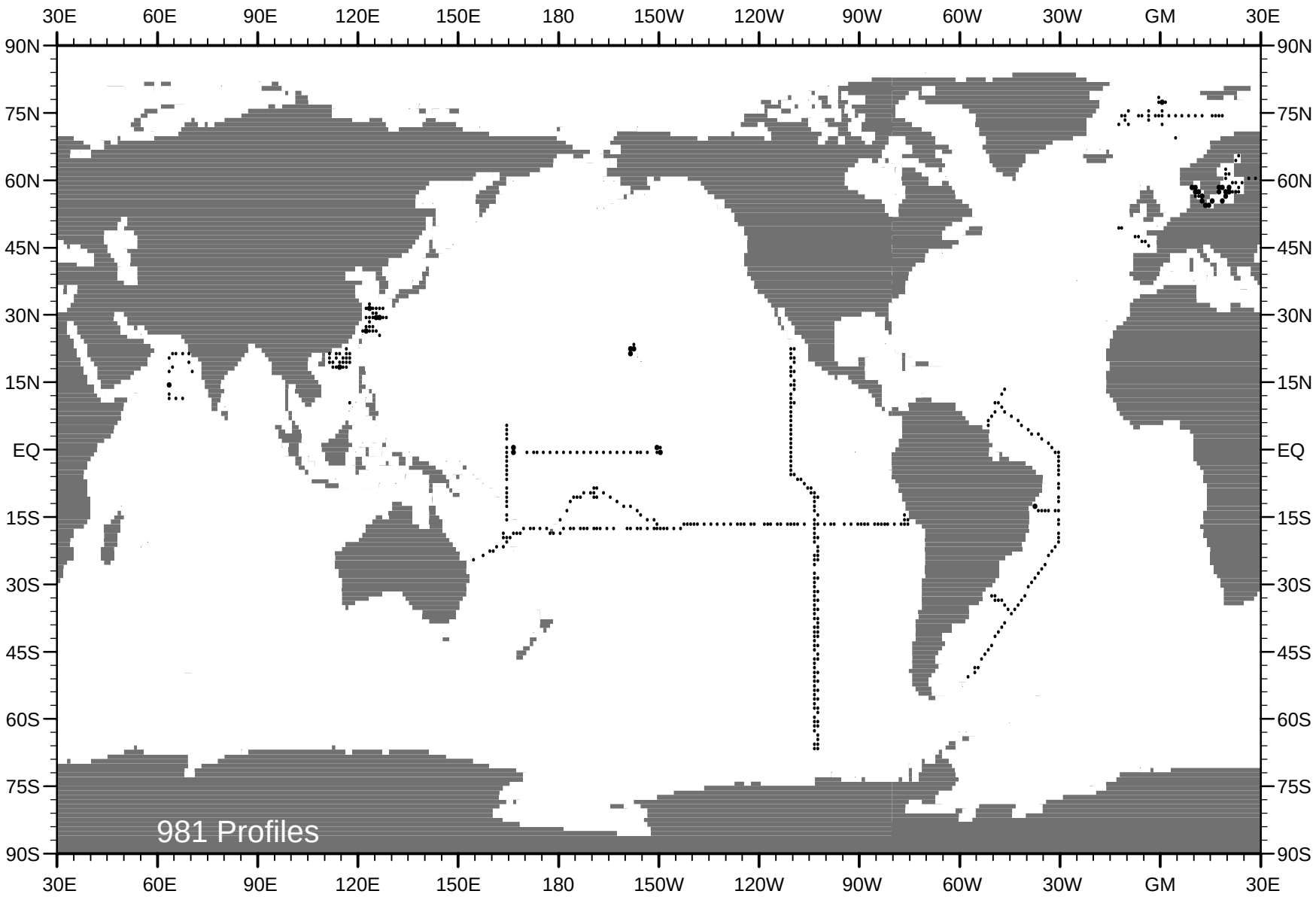


Fig. B60 Distribution of all Ocean Station Data (OSD) alkalinity profiles in WOD01 for year 1994 .

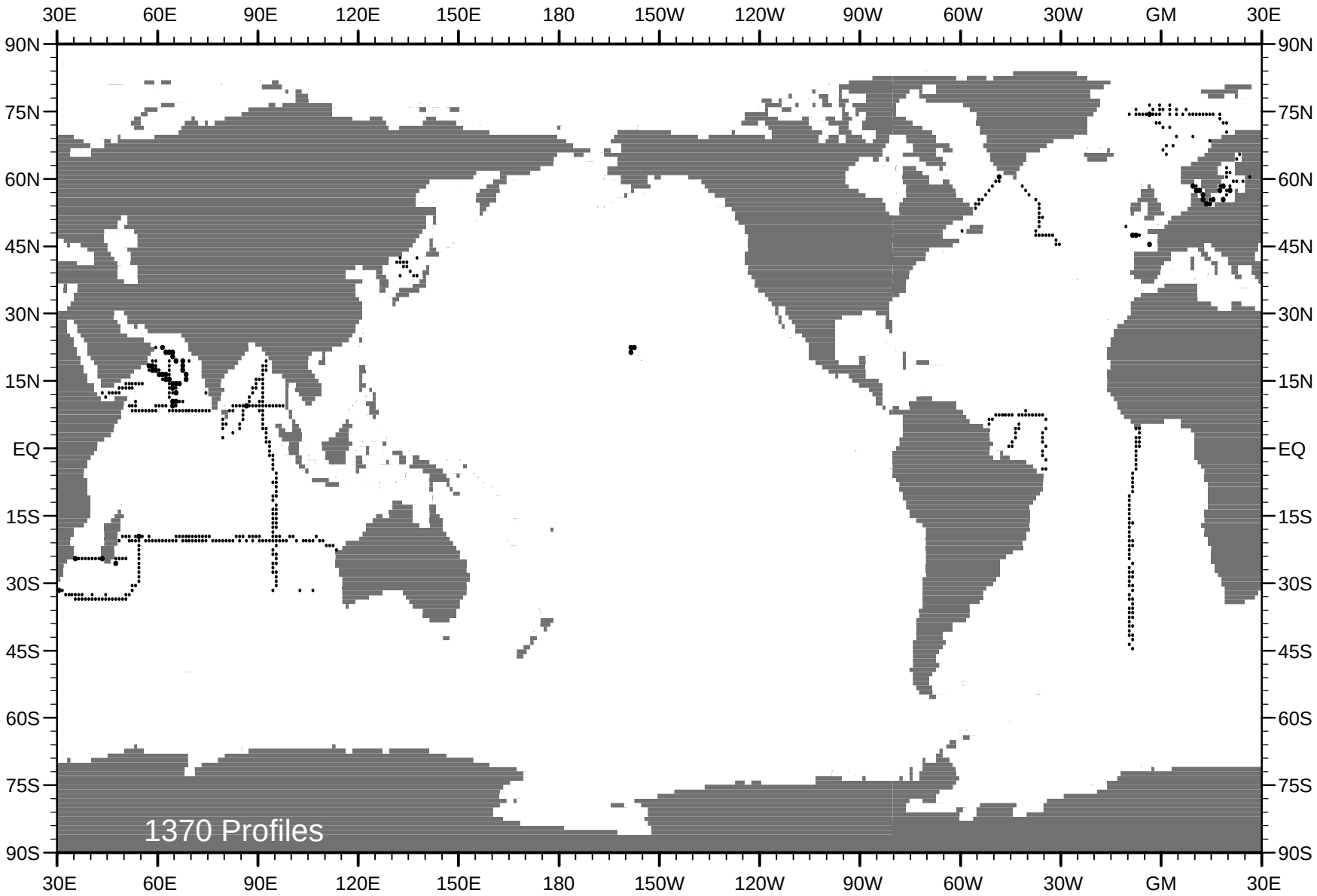


Fig. B61 Distribution of all Ocean Station Data (OSD) alkalinity profiles in WOD01 for year 1995 .

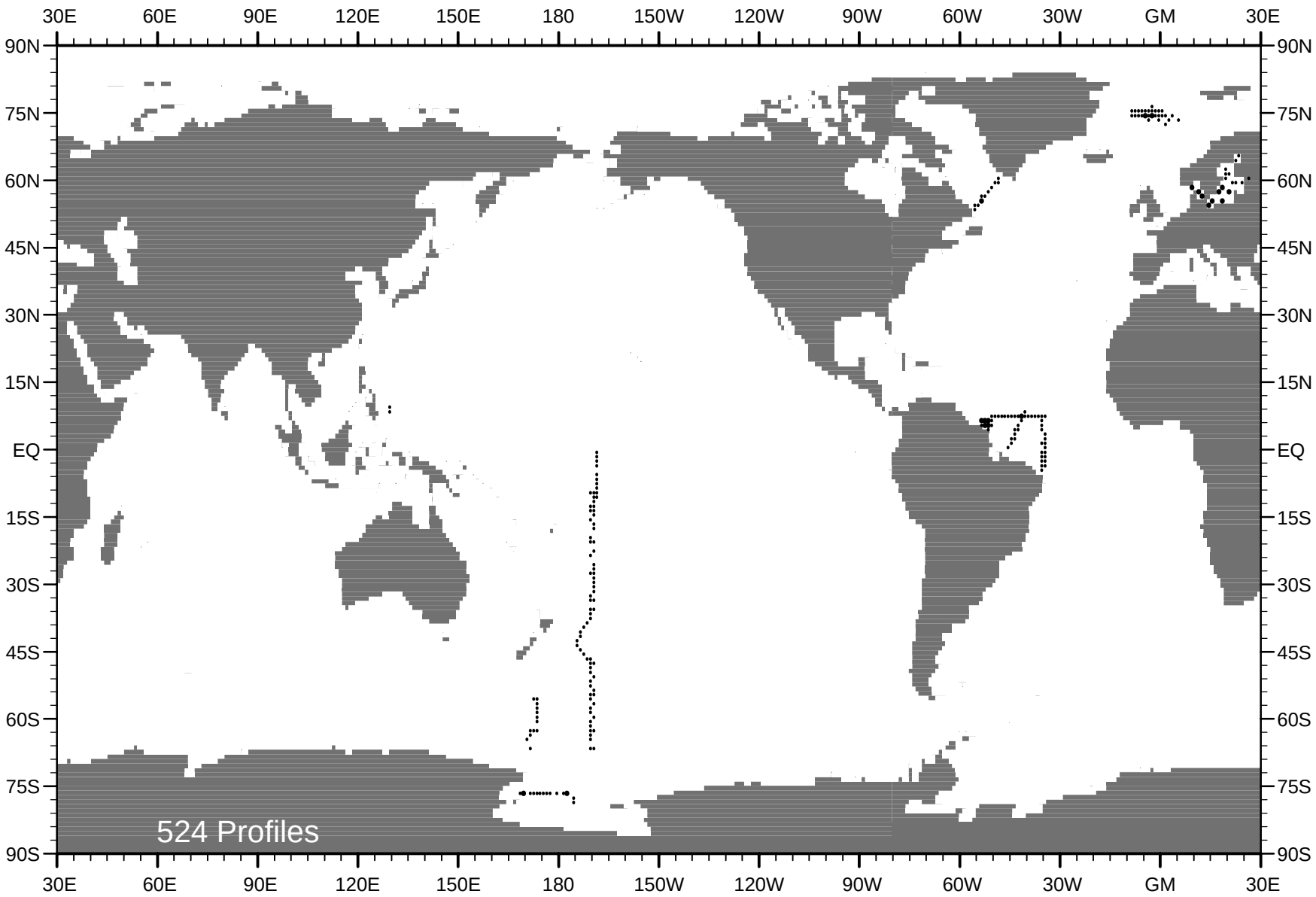


Fig. B62 Distribution of all Ocean Station Data (OSD) alkalinity profiles in WOD01 for year 1996 .

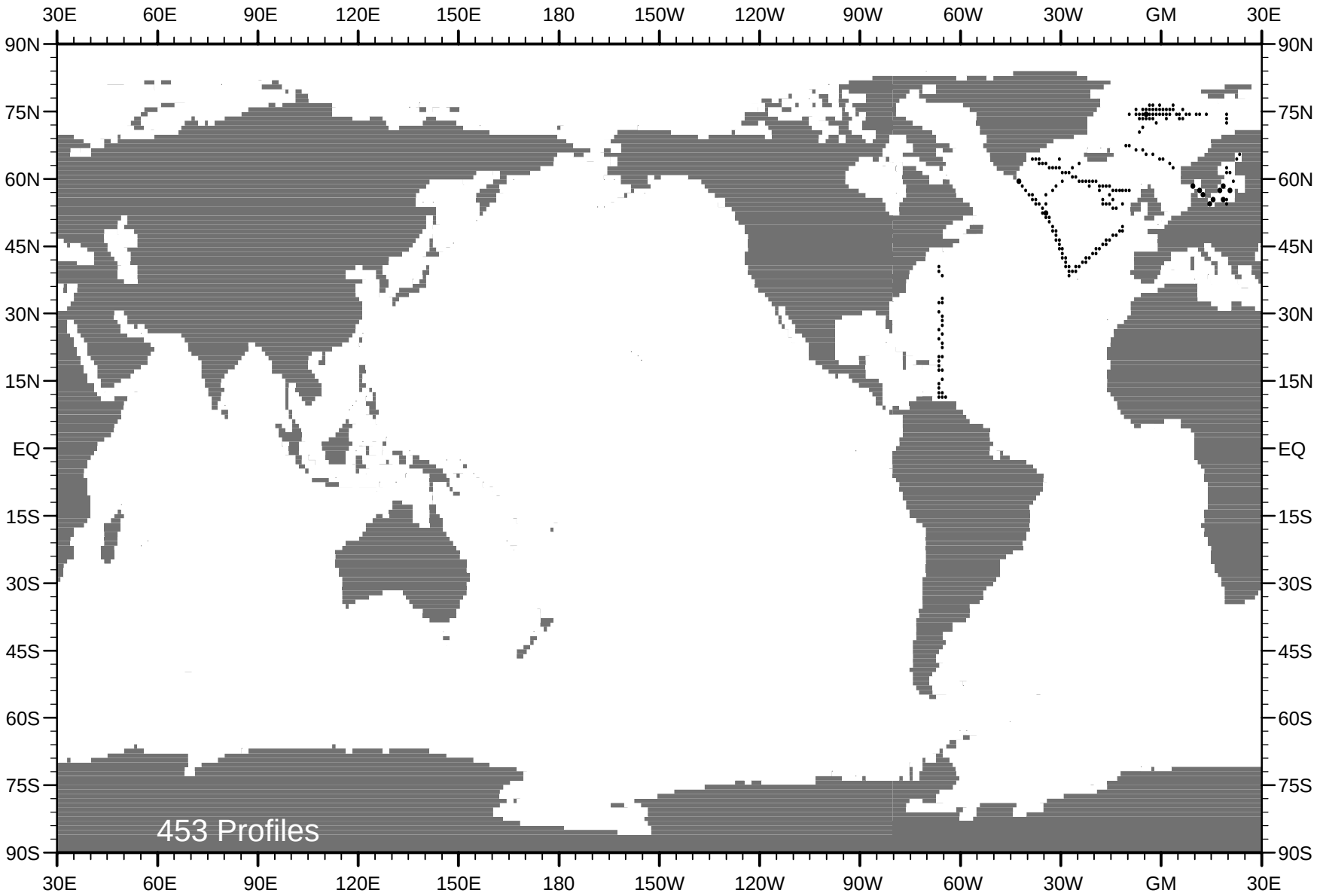


Fig. B63 Distribution of all Ocean Station Data (OSD) alkalinity profiles in WOD01 for year 1997 .

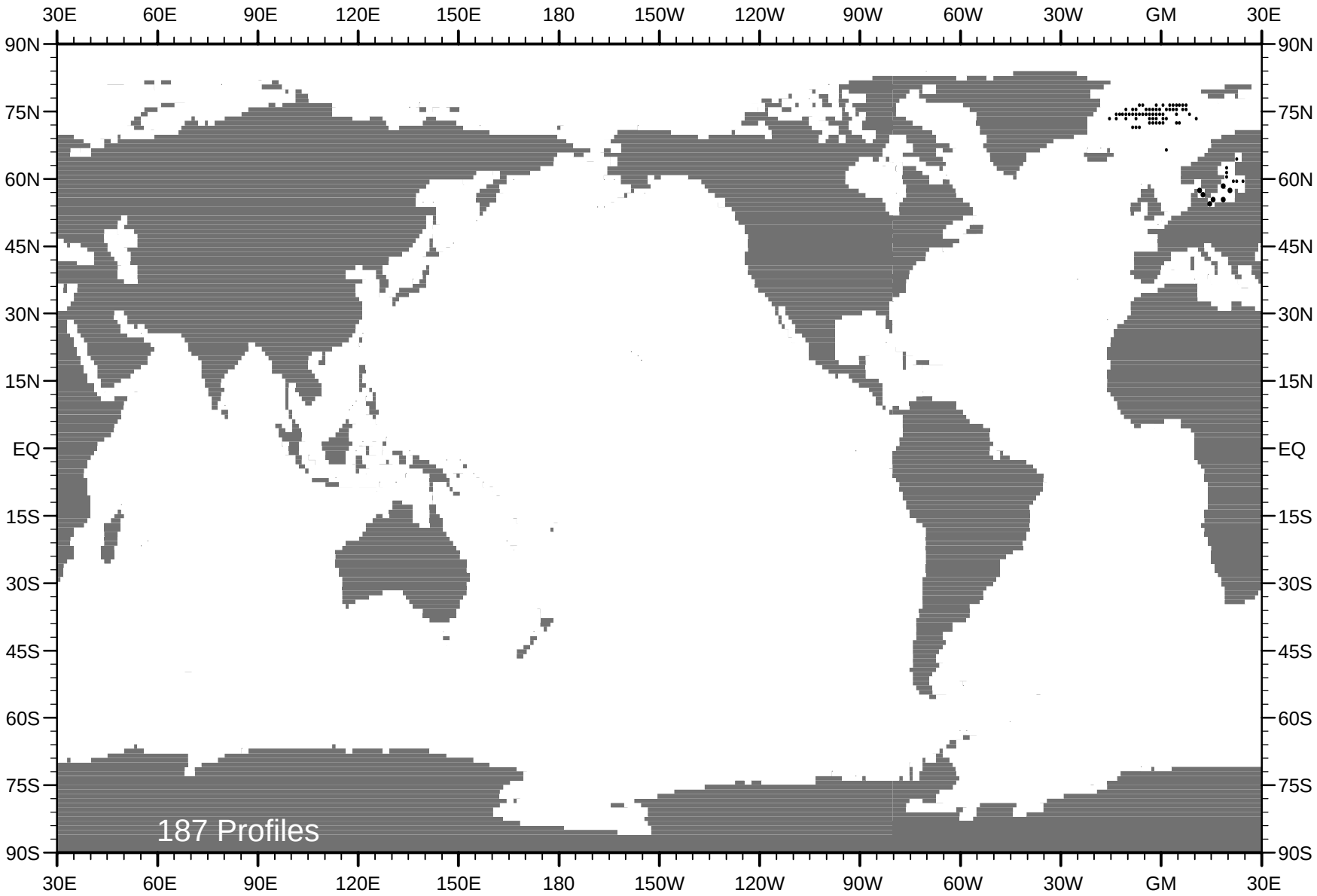


Fig. B64 Distribution of all Ocean Station Data (OSD) alkalinity profiles in WOD01 for year 1998 .

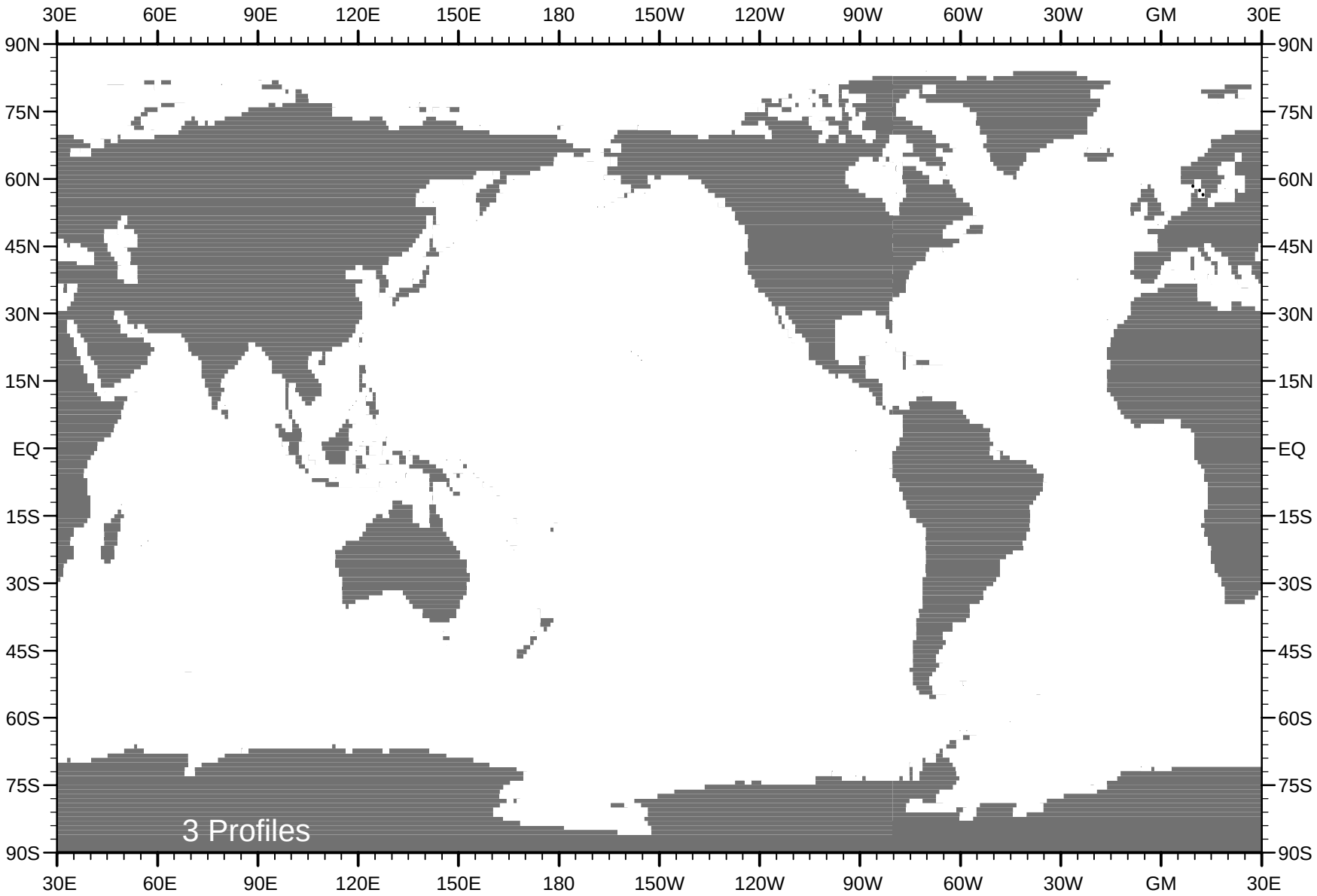


Fig. B65 Distribution of all Ocean Station Data (OSD) alkalinity profiles in WOD01 for year 1999 .

6. APPENDIX C: DISTRIBUTIONS FOR INDIVIDUAL YEARS OF ALL OCEAN STATION DATA (OSD) pCO_2 PROFILES IN WOD01

This appendix contains yearly distributions of all OSD pCO_2 profiles contained in WOD01. These maps provide some history of the observational progress of the field of oceanography. They also serve as indicators of whether or not a particular data set from a scientist or institution is part of the NODC/WDC-A archive. The exchange of information provided by the publication of such maps has provided us with valuable information about deficiencies in the database. The locations of all WOD01 OSD pCO_2 profiles are plotted including stations that may be erroneously located over land. However, WOD01 contains some stations from various lakes so care should be exercised in the use of these stations and the determination as to whether they represent errors in locations.

For all figures in Appendix C, a small dot indicates a one-degree square containing from one to four stations and a large dot indicates five or more stations.

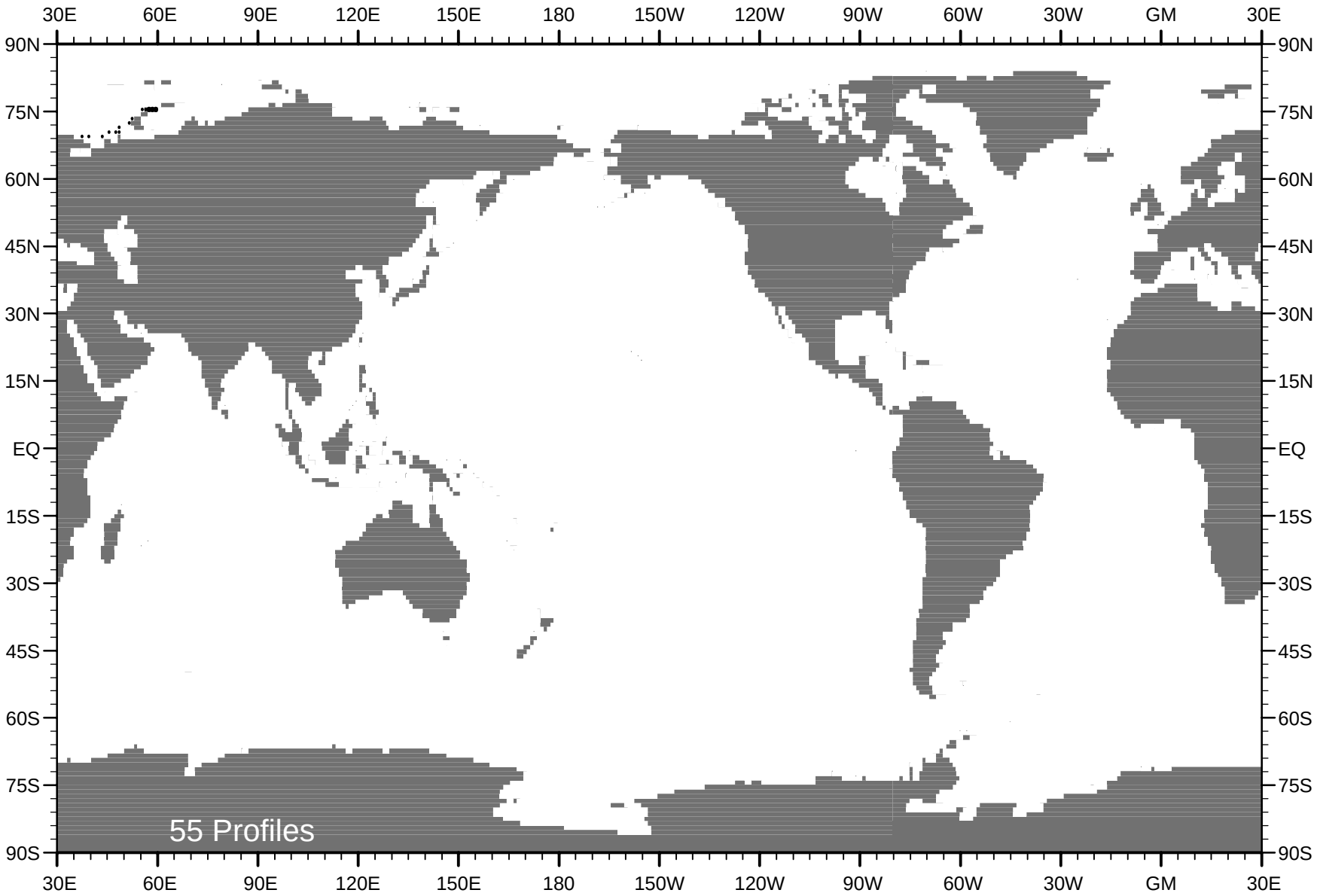


Fig. C1 Distribution of all Ocean Station Data (OSD) pCO_2 profiles in WOD01 for year 1967 .

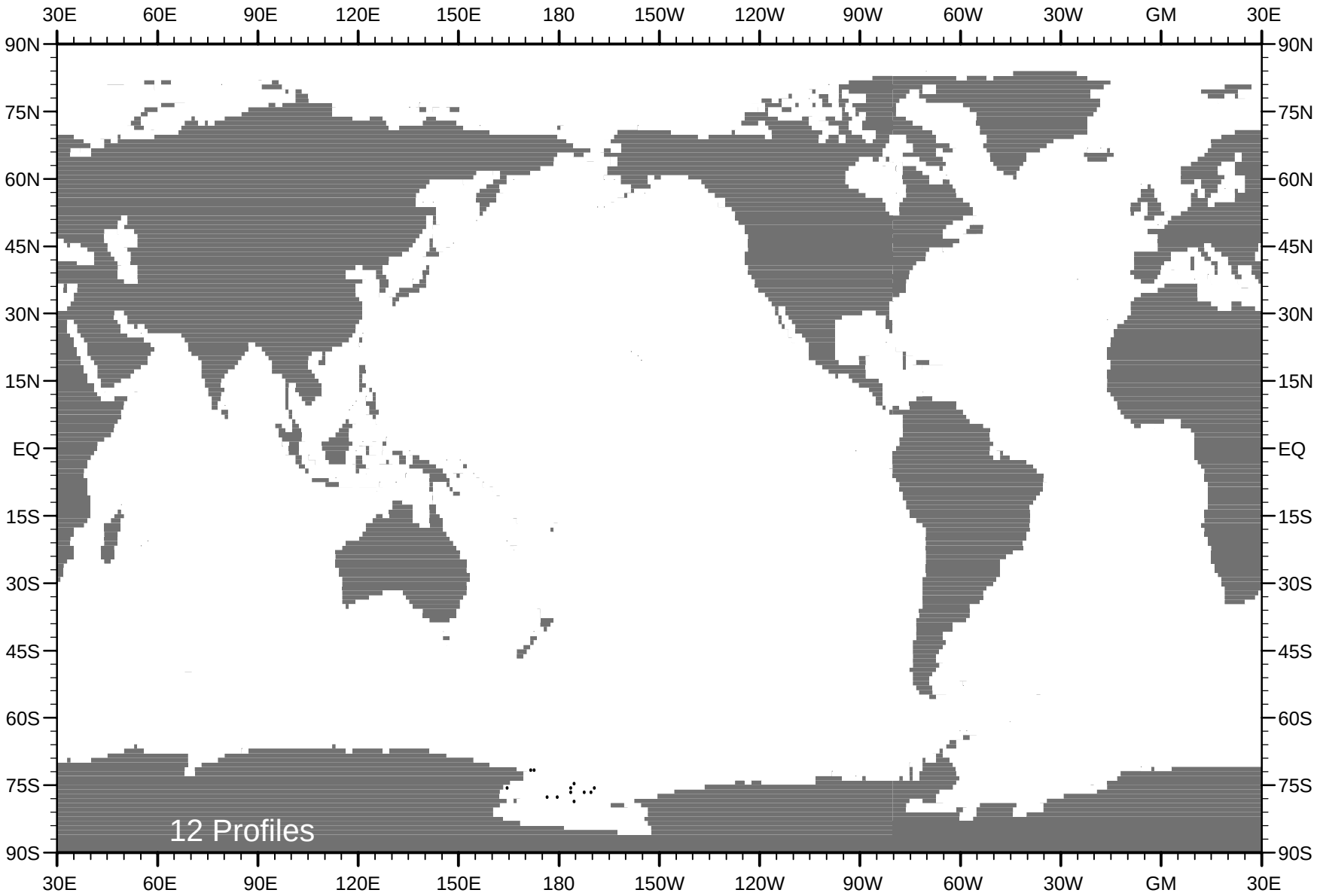


Fig. C2 Distribution of all Ocean Station Data (OSD) pCO_2 profiles in WOD01 for year 1984 .

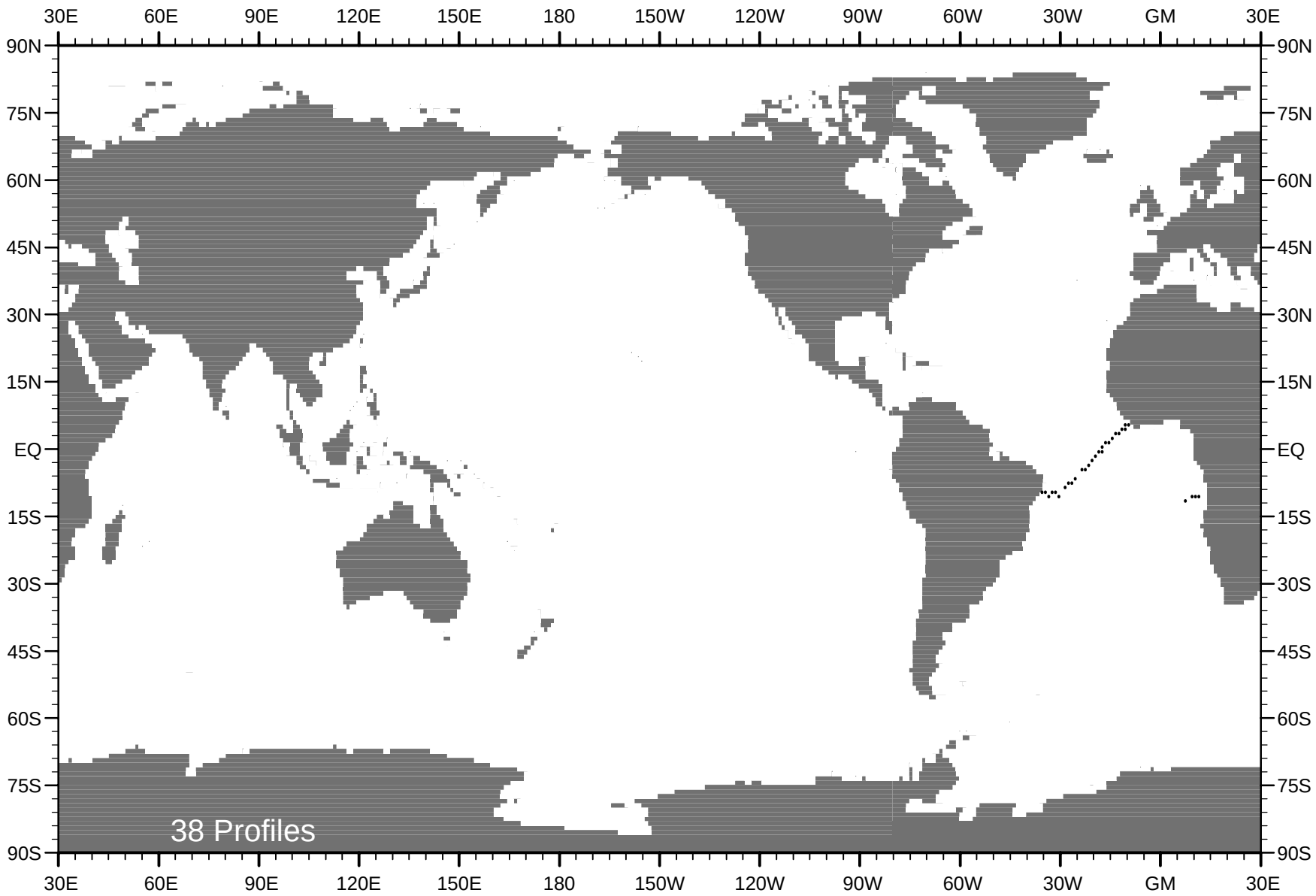


Fig. C3 Distribution of all Ocean Station Data (OSD) pCO_2 profiles in WOD01 for year 1987 .

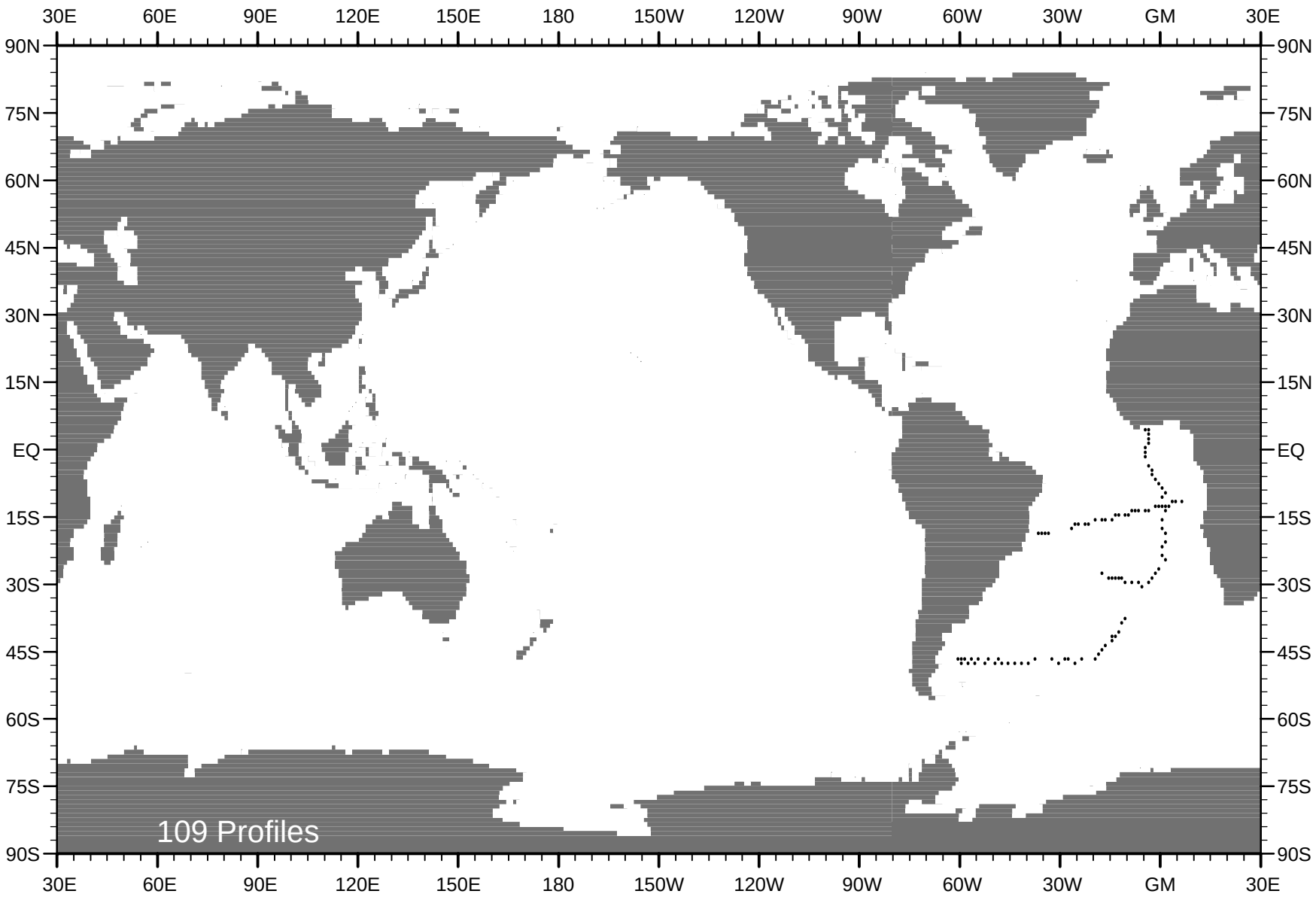


Fig. C4 Distribution of all Ocean Station Data (OSD) pCO_2 profiles in WOD01 for year 1988 .

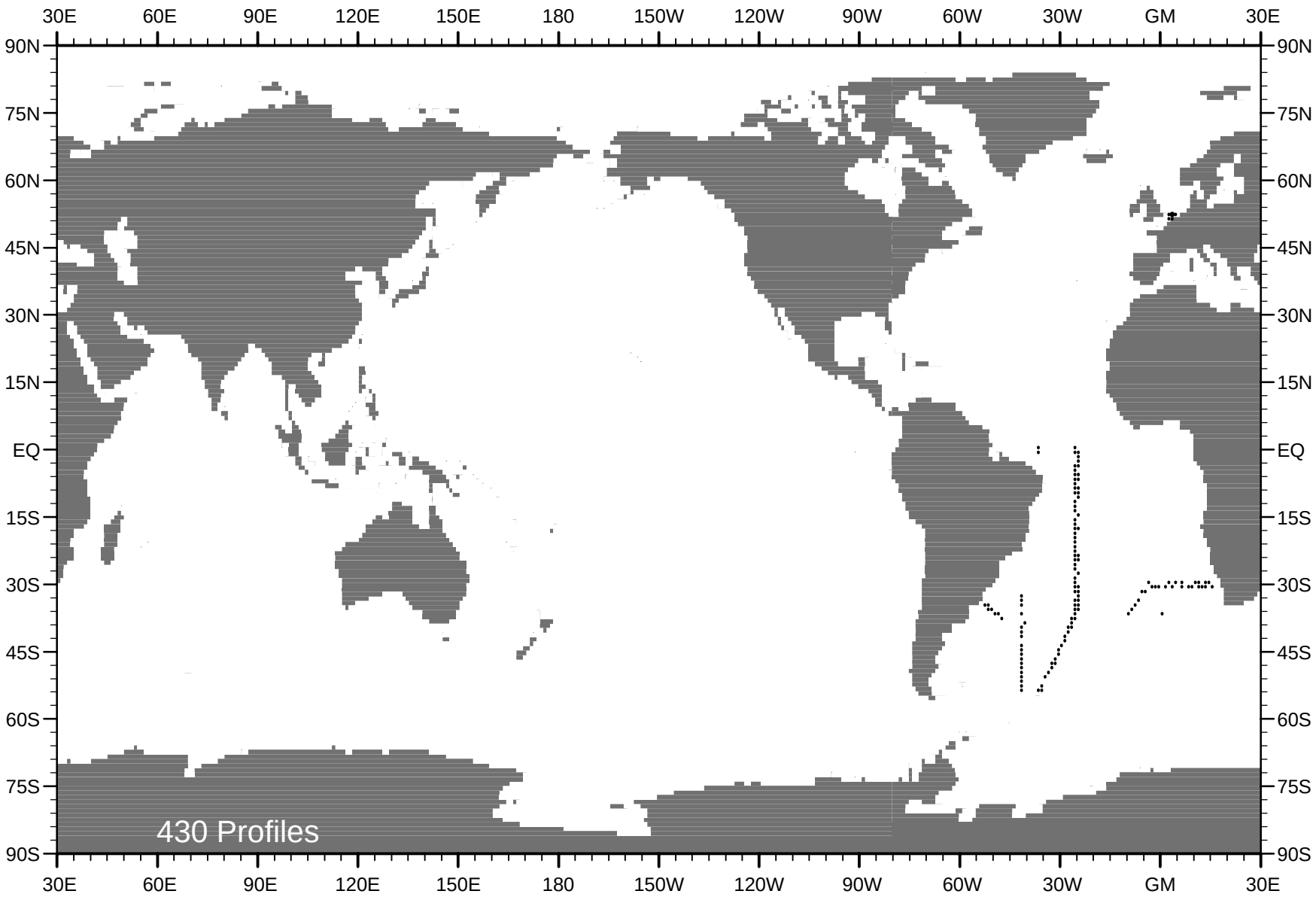


Fig. C5 Distribution of all Ocean Station Data (OSD) pCO_2 profiles in WOD01 for year 1989 .

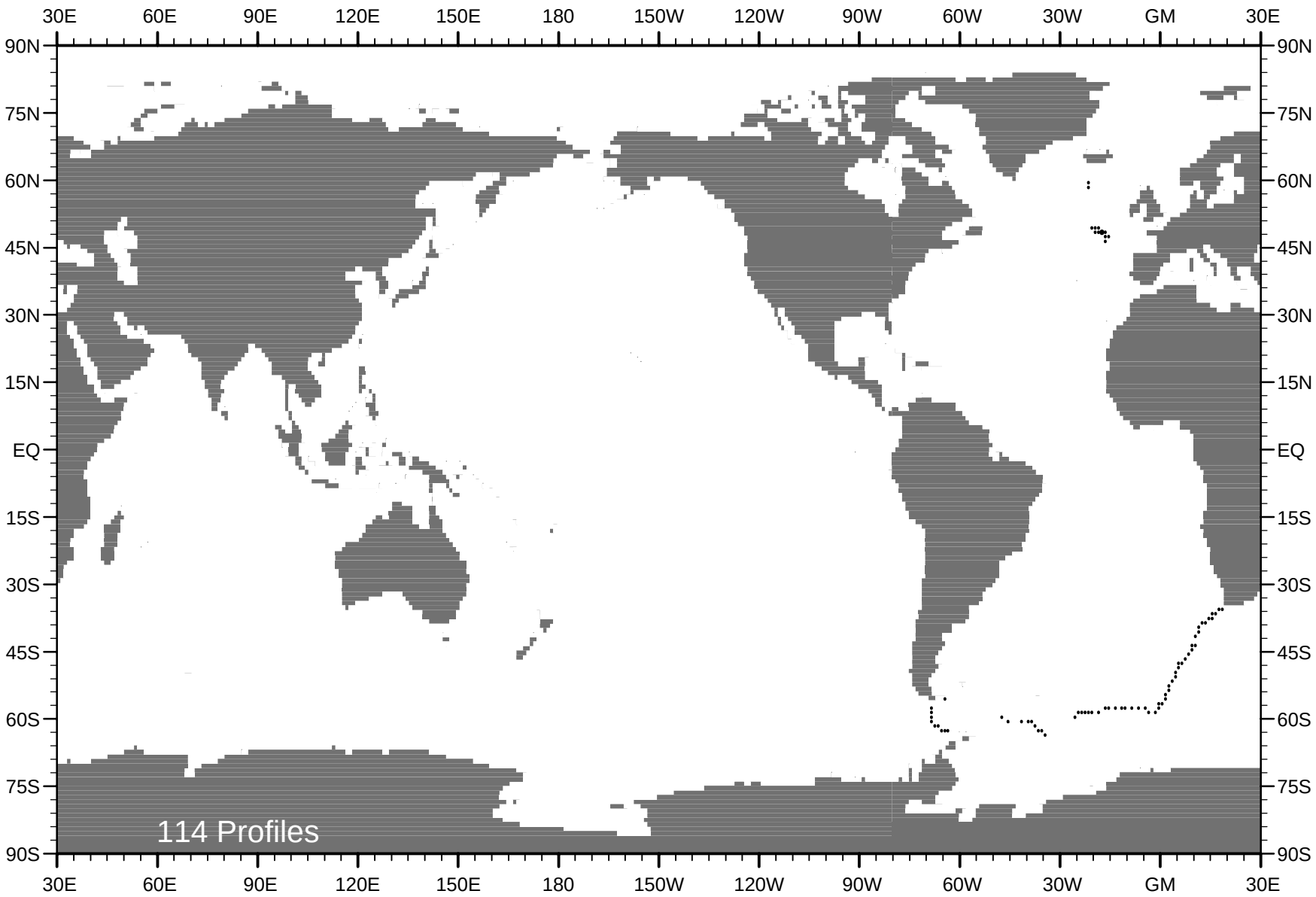


Fig. C6 Distribution of all Ocean Station Data (OSD) pCO_2 profiles in WOD01 for year 1990 .

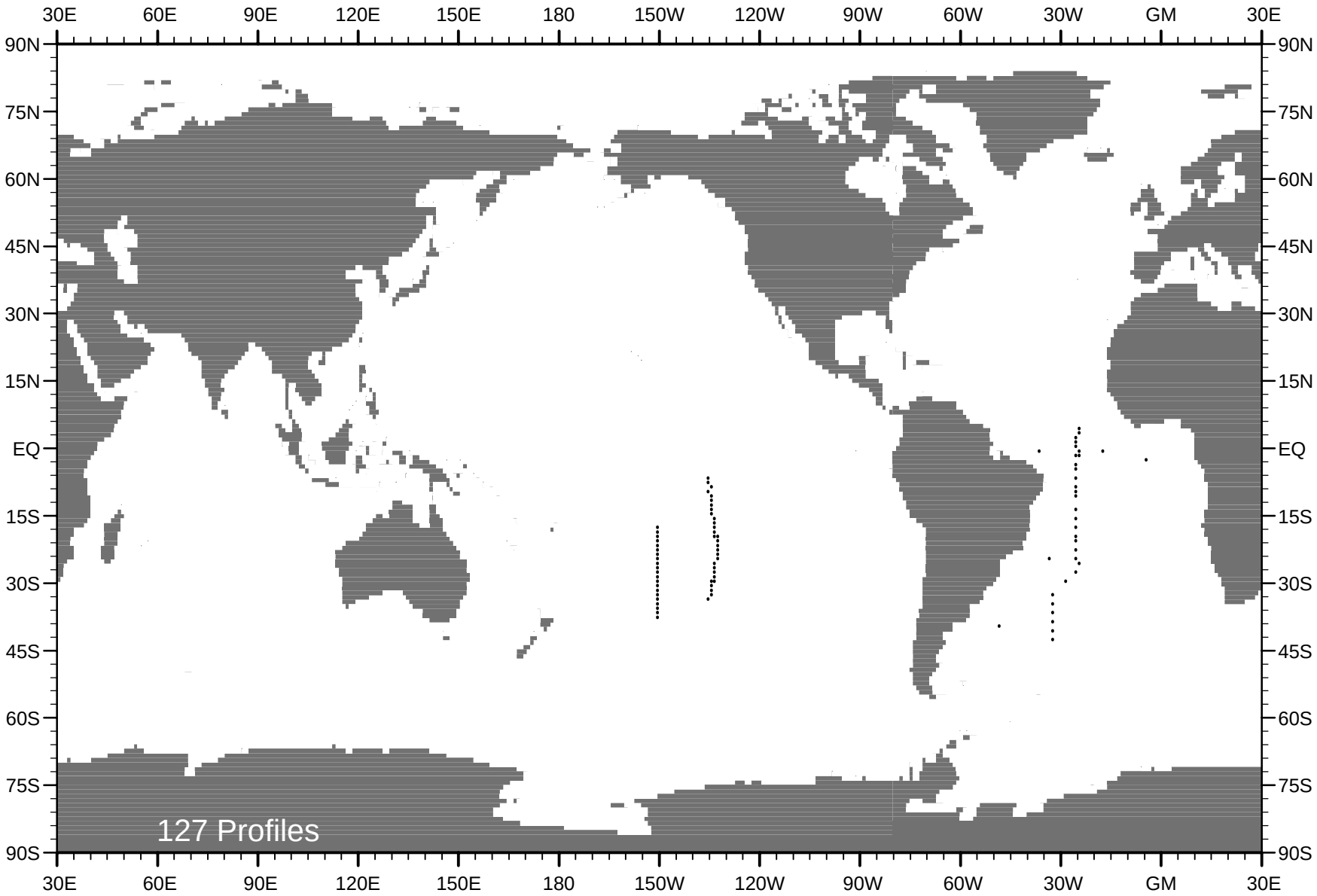


Fig. C7 Distribution of all Ocean Station Data (OSD) pCO_2 profiles in WOD01 for year 1991 .

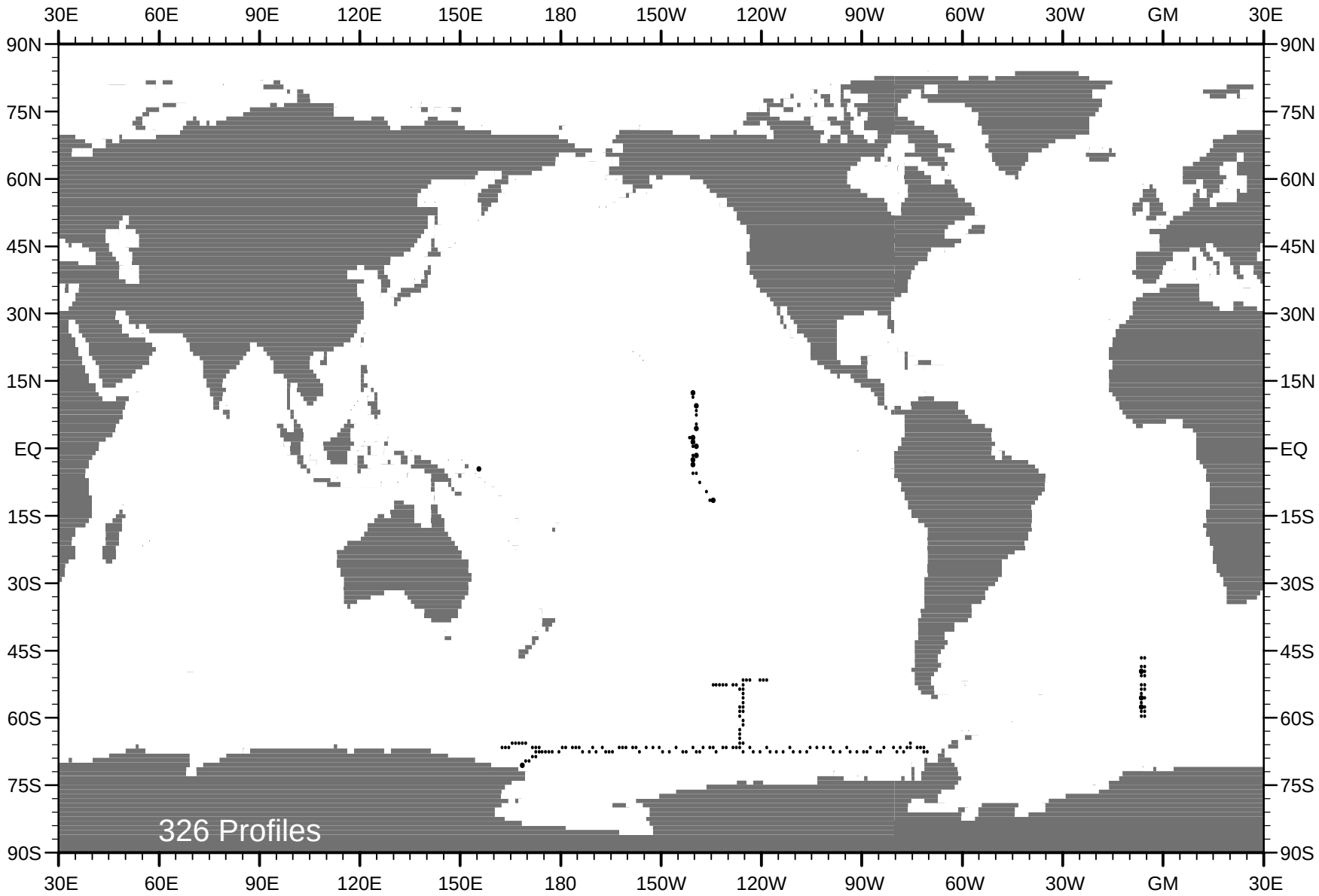


Fig. C8 Distribution of all Ocean Station Data (OSD) pCO_2 profiles in WOD01 for year 1992 .

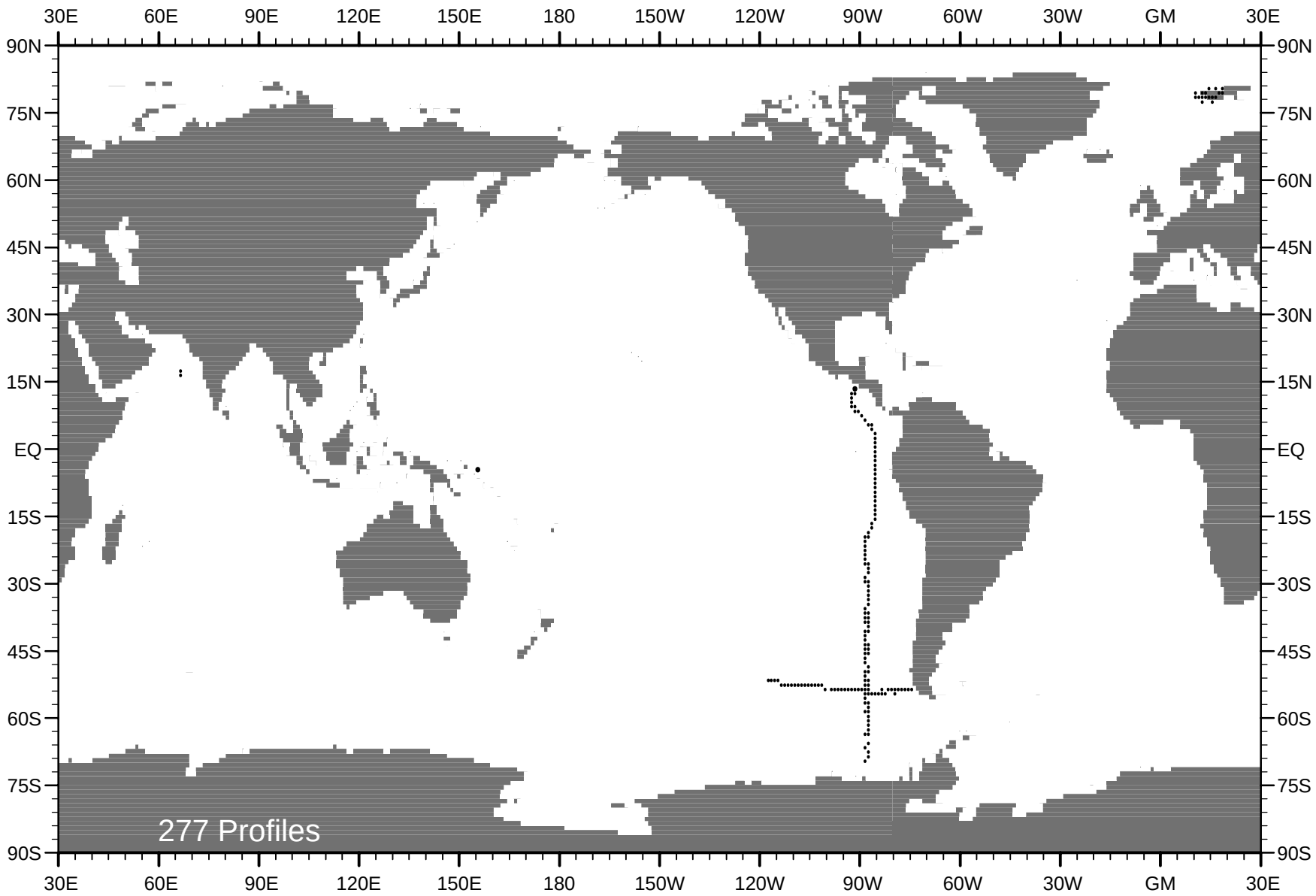


Fig. C9 Distribution of all Ocean Station Data (OSD) pCO_2 profiles in WOD01 for year 1993 .

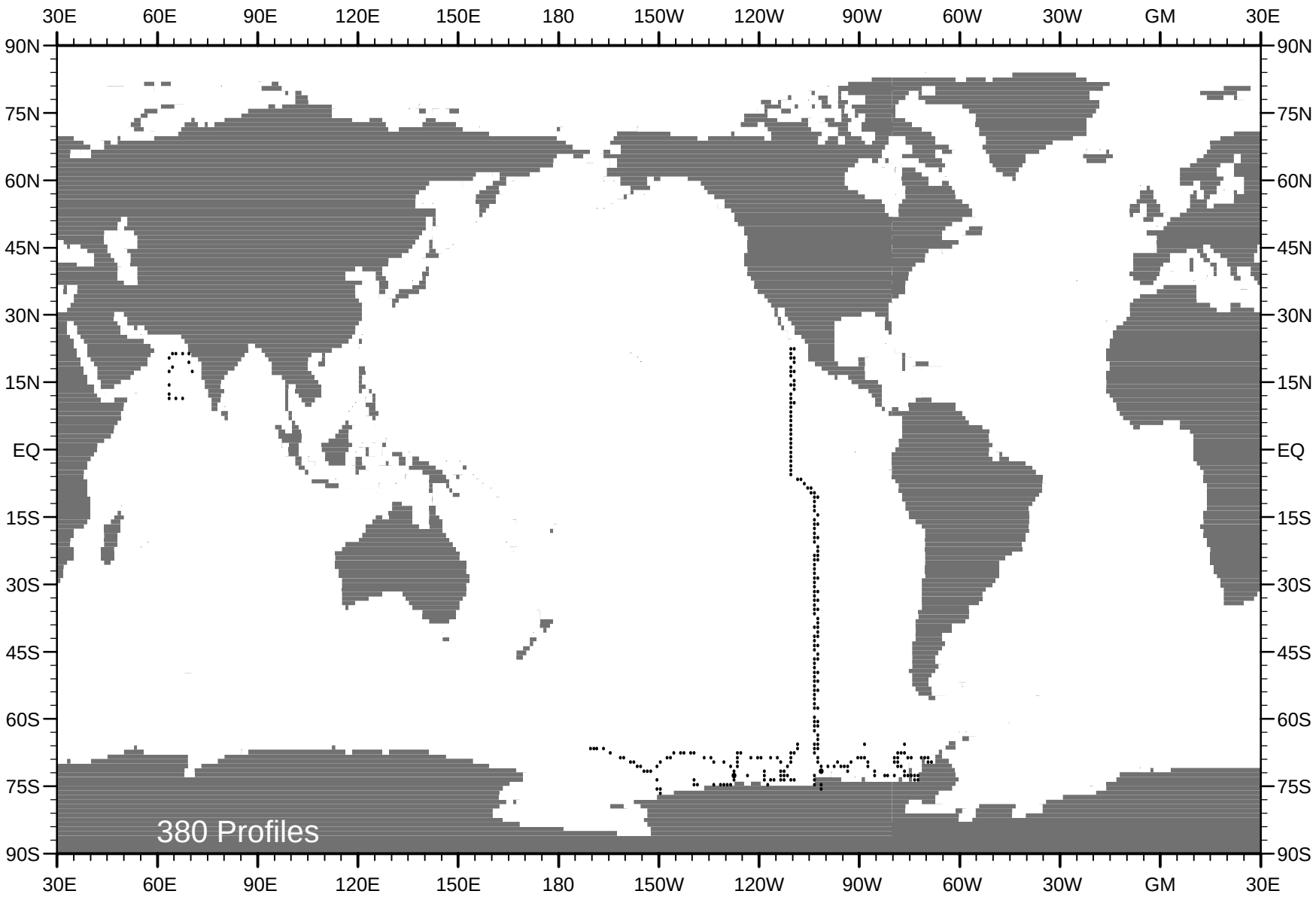


Fig. C10 Distribution of all Ocean Station Data (OSD) pCO_2 profiles in WOD01 for year 1994 .

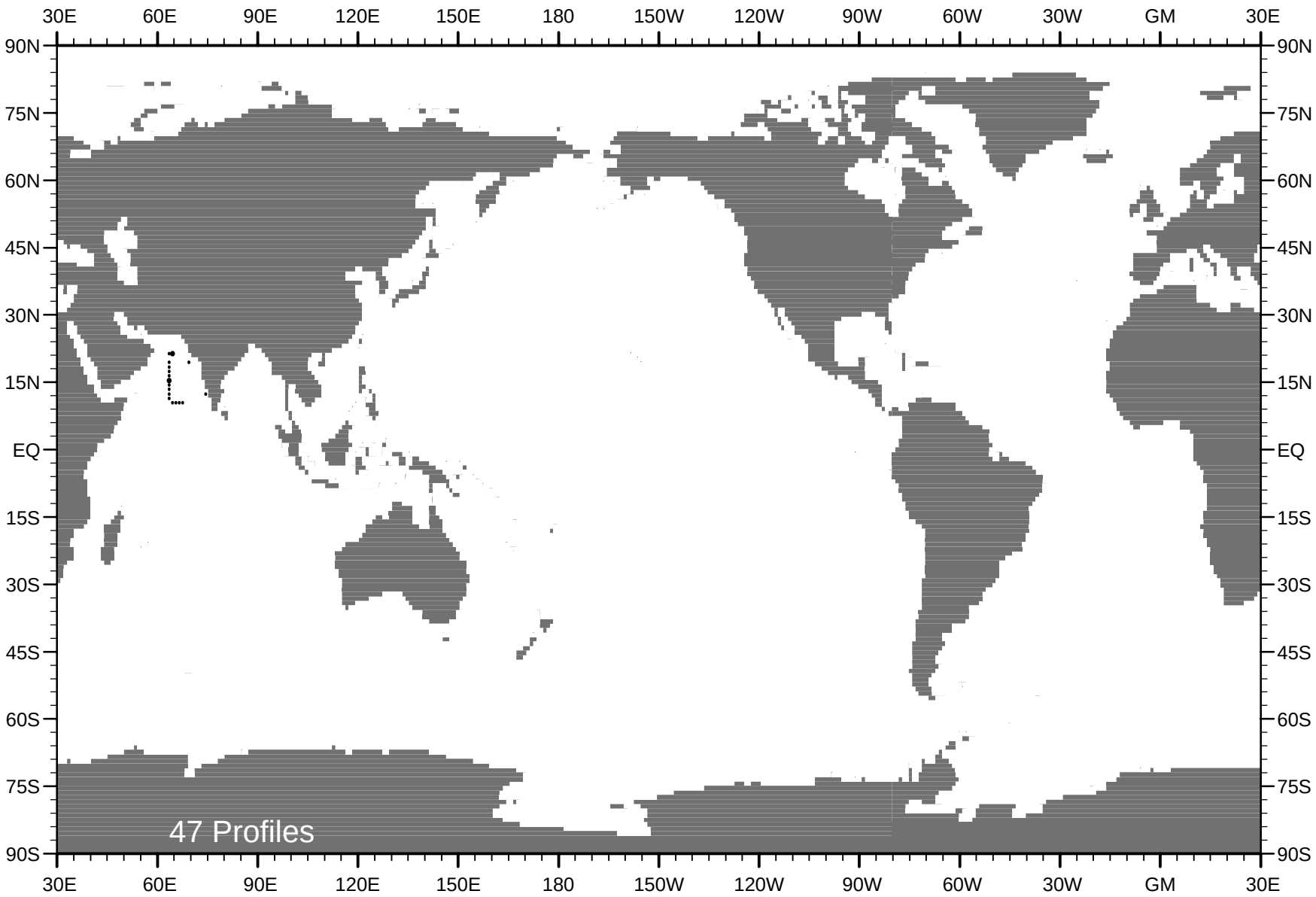


Fig. C11 Distribution of all Ocean Station Data (OSD) pCO_2 profiles in WOD01 for year 1995 .

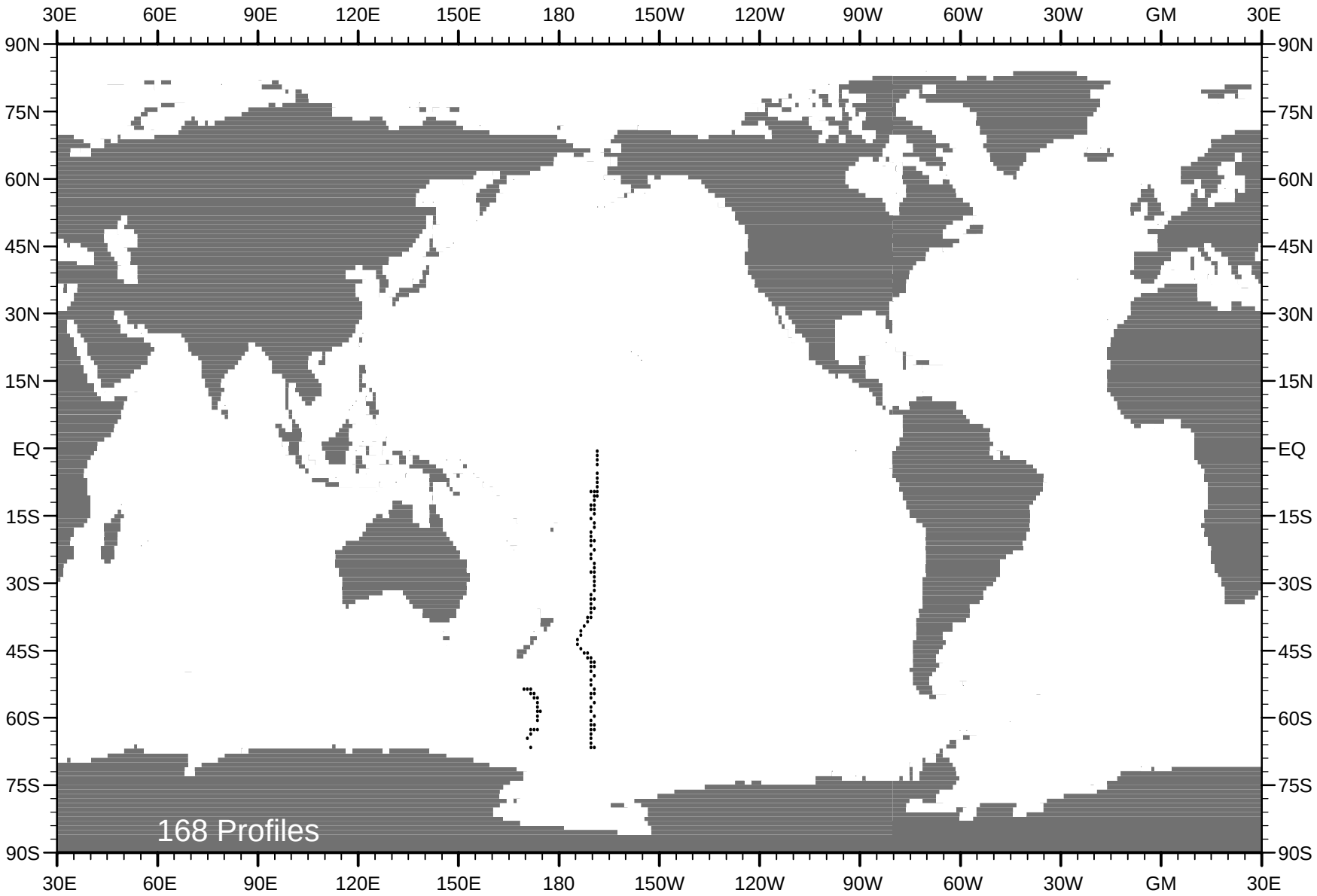


Fig. C12 Distribution of all Ocean Station Data (OSD) pCO_2 profiles in WOD01 for year 1996 .

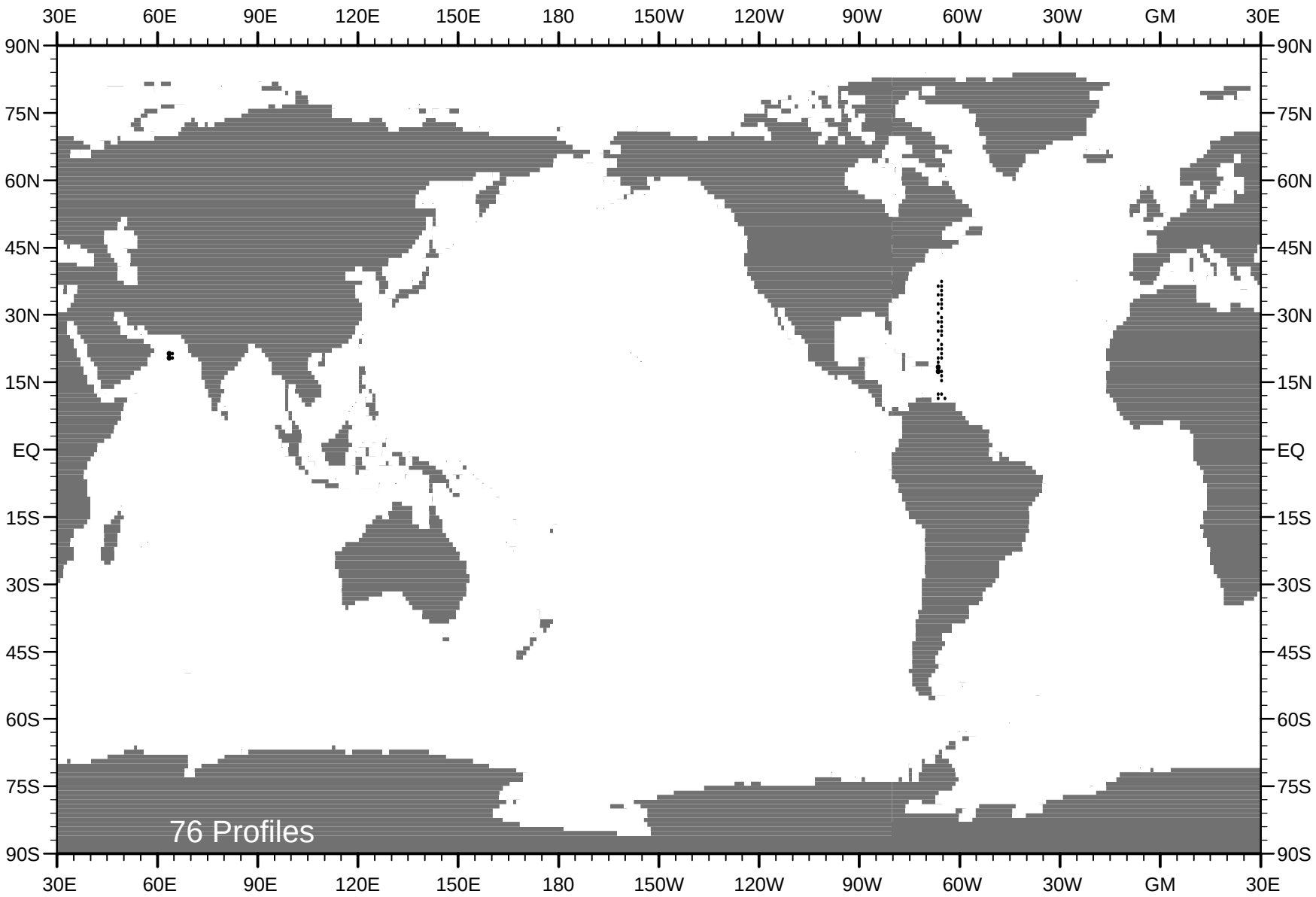


Fig. C13 Distribution of all Ocean Station Data (OSD) pCO_2 profiles in WOD01 for year 1997 .

7. APPENDIX D: DISTRIBUTIONS FOR INDIVIDUAL YEARS OF ALL OCEAN STATION DATA (OSD) tCO_2 PROFILES IN WOD01

This appendix contains yearly distributions of all OSD tCO_2 profiles contained in WOD01. These maps provide some history of the observational progress of the field of oceanography. They also serve as indicators of whether or not a particular data set from a scientist or institution is part of the NODC/WDC-A archive. The exchange of information provided by the publication of such maps has provided us with valuable information about deficiencies in the database. The locations of all WOD01 OSD tCO_2 profiles are plotted including stations that may be erroneously located over land. However, WOD01 contains some stations from various lakes so care should be exercised in the use of these stations and the determination as to whether they represent errors in locations.

For all figures in Appendix D, a small dot indicates a one-degree square containing from one to four stations and a large dot indicates five or more stations.

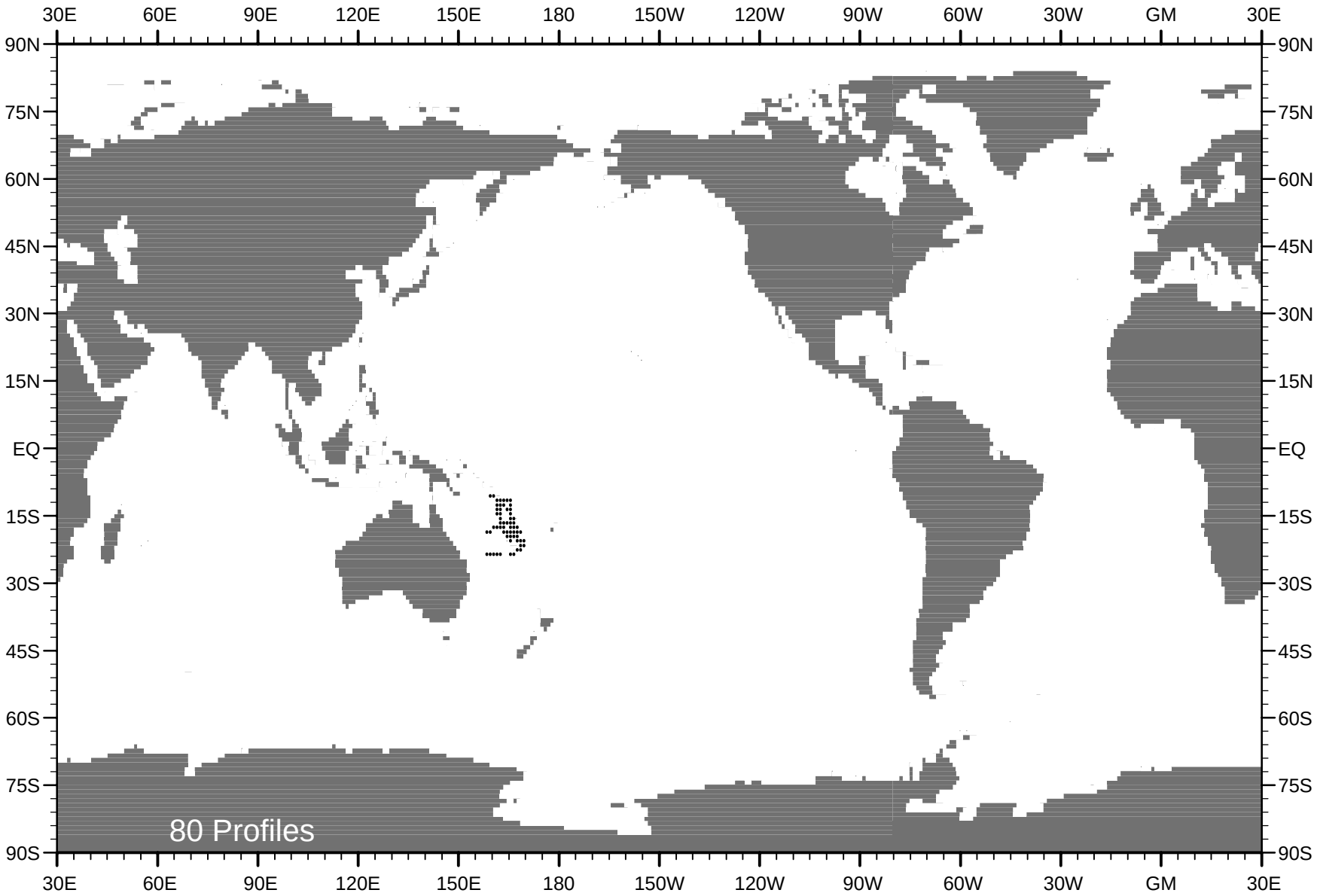


Fig. D1 Distribution of all Ocean Station Data (OSD) tCO_2 profiles in WOD01 for year 1958 .

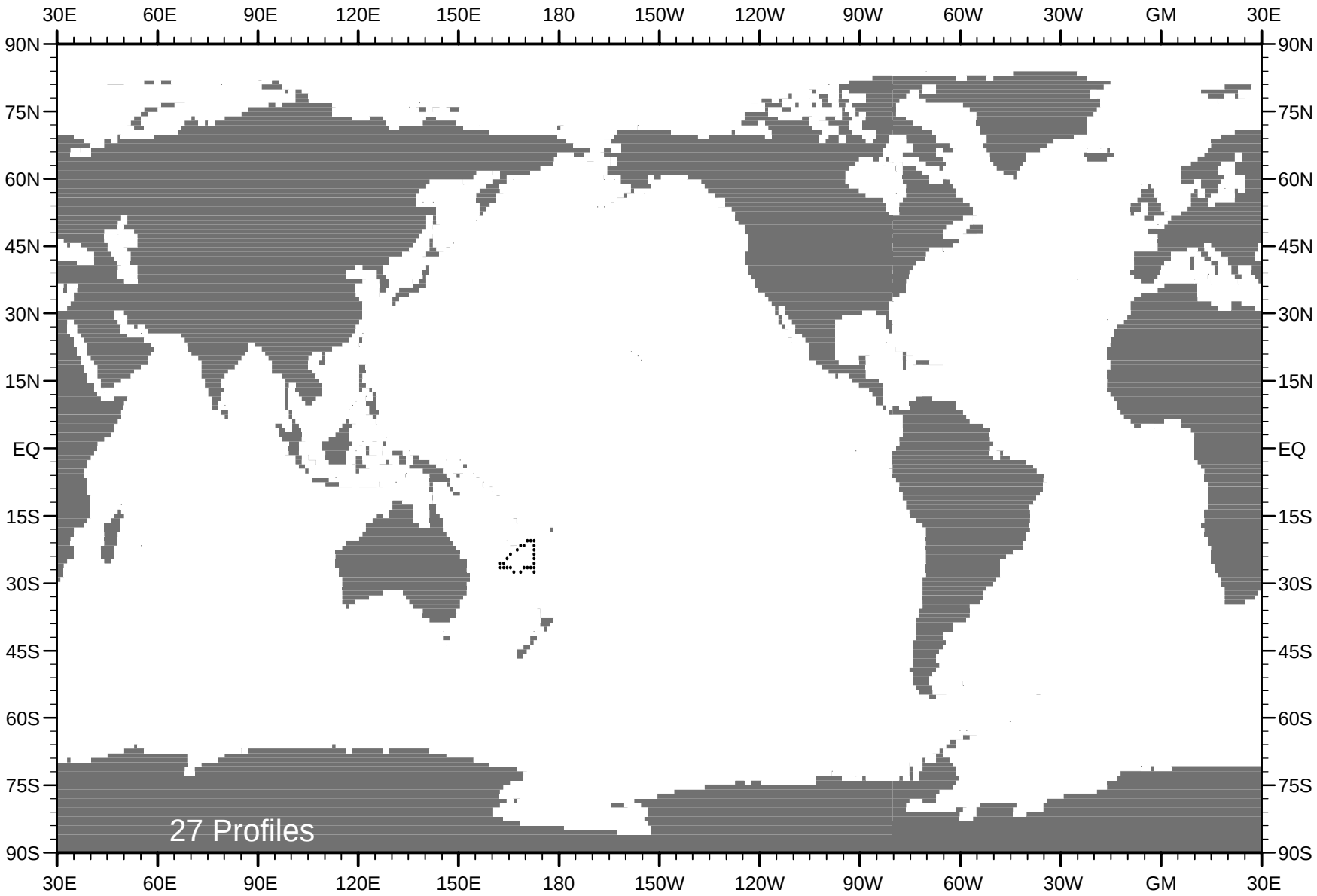


Fig. D2 Distribution of all Ocean Station Data (OSD) tCO_2 profiles in WOD01 for year 1959 .

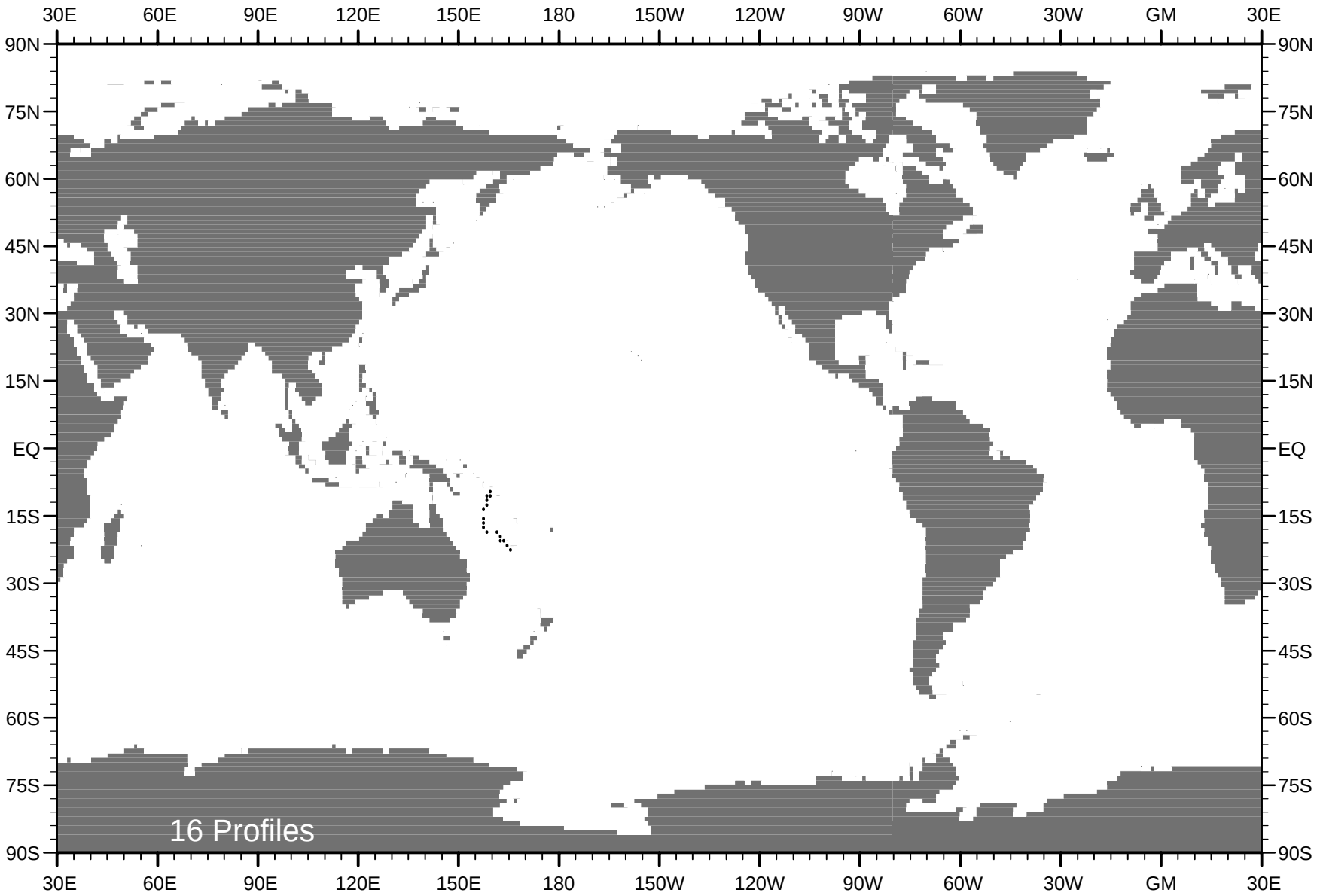


Fig. D3 Distribution of all Ocean Station Data (OSD) tCO_2 profiles in WOD01 for year 1960 .

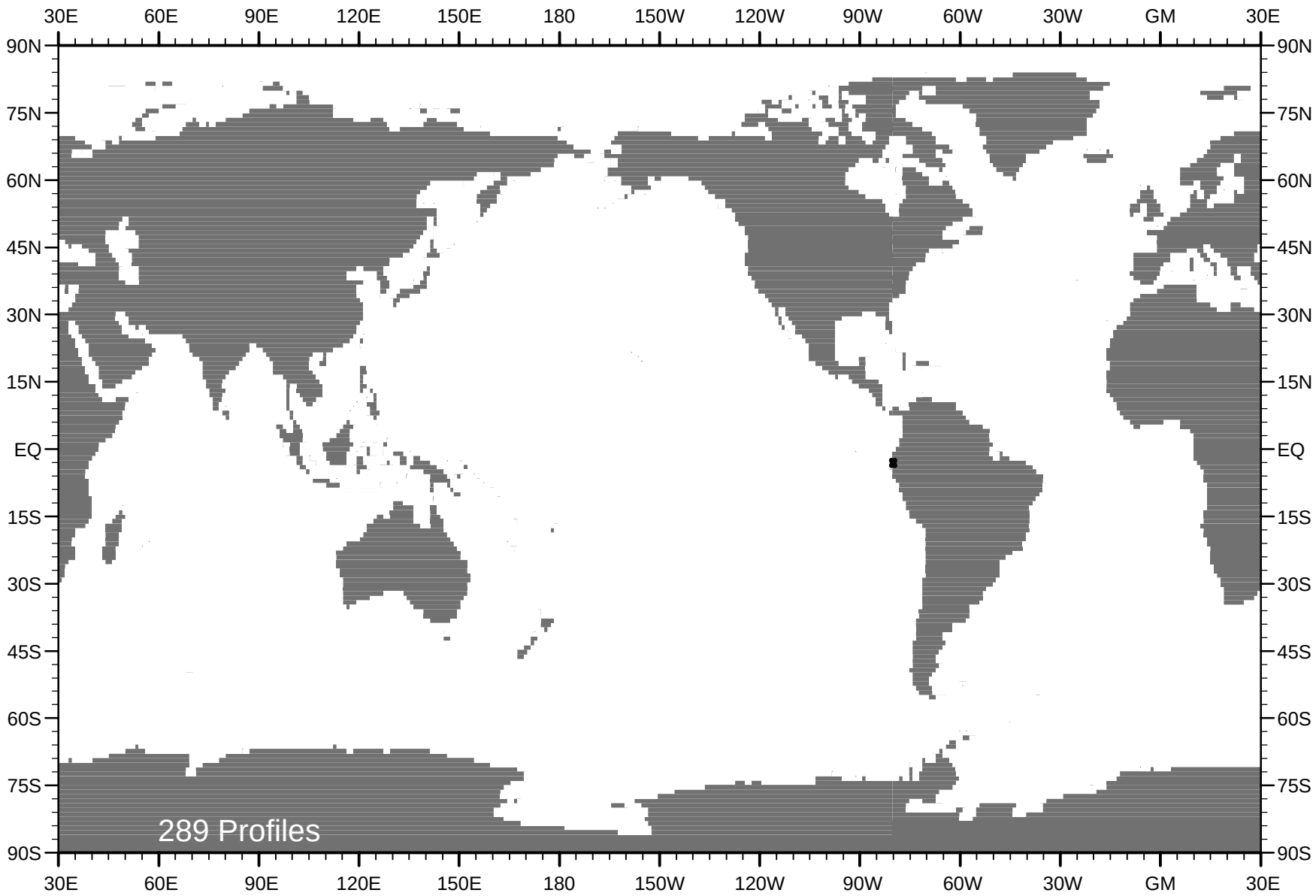


Fig. D4 Distribution of all Ocean Station Data (OSD) tCO_2 profiles in WOD01 for year 1962 .

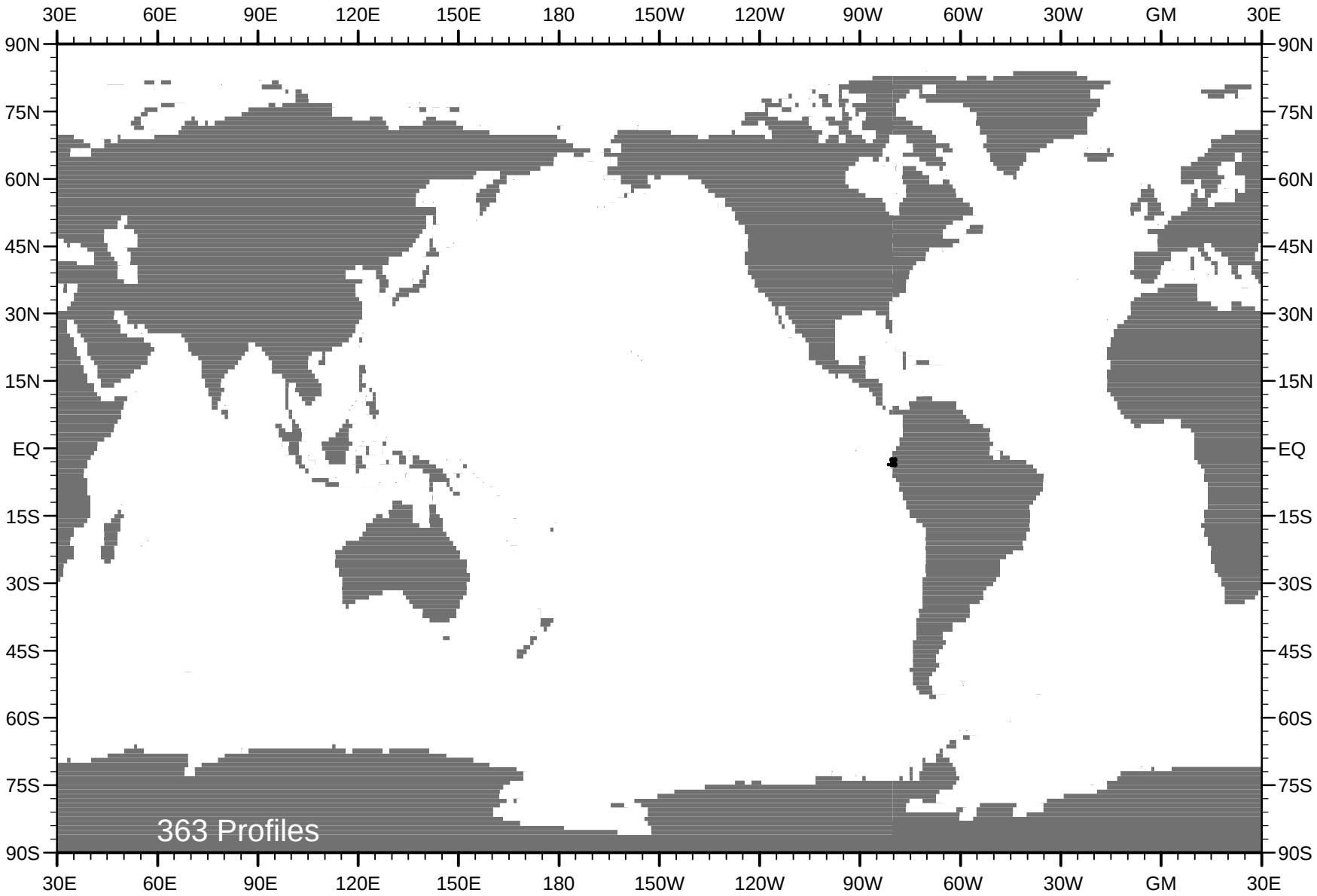


Fig. D5 Distribution of all Ocean Station Data (OSD) tCO_2 profiles in WOD01 for year 1963 .

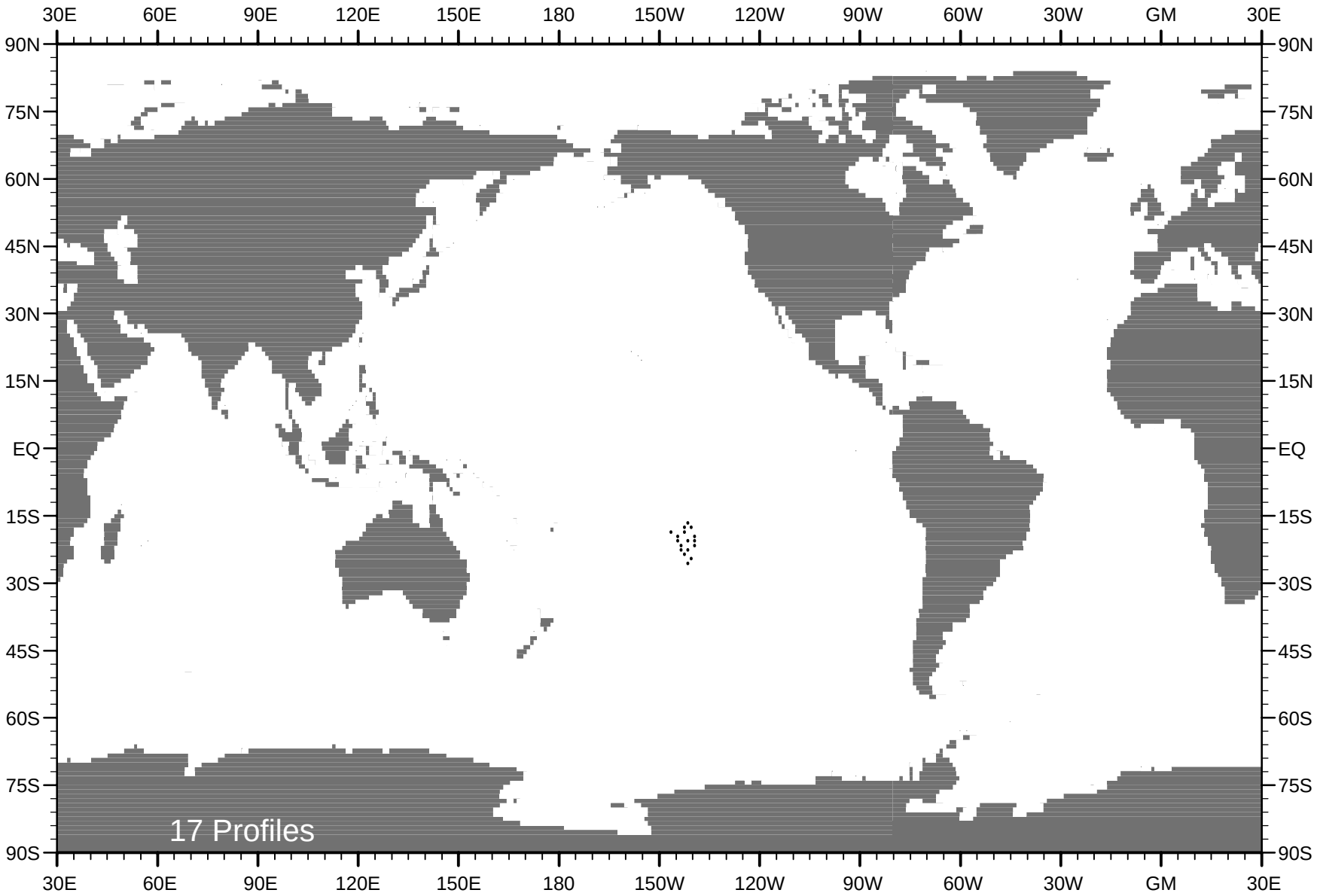


Fig. D6 Distribution of all Ocean Station Data (OSD) tCO_2 profiles in WOD01 for year 1964 .

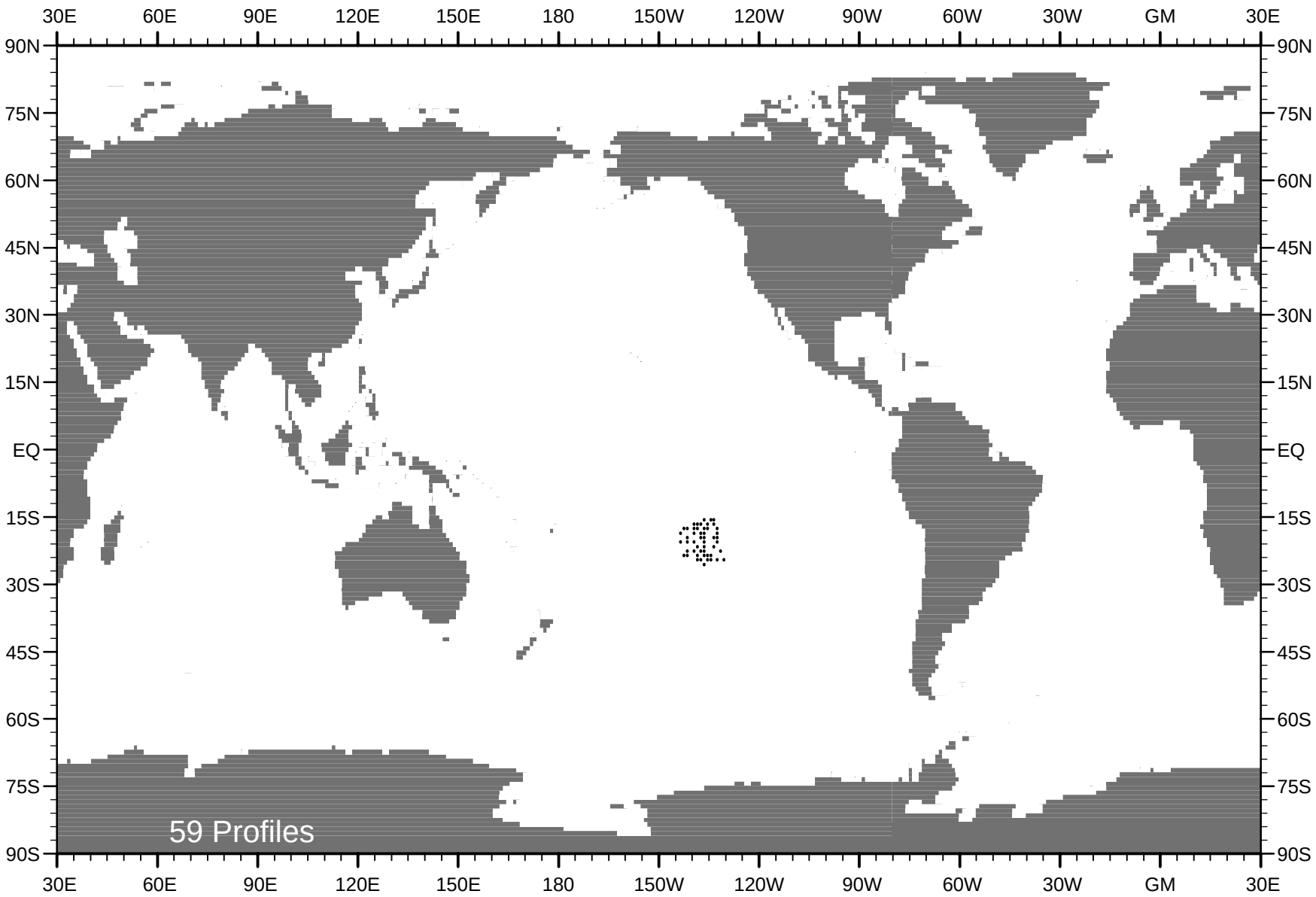


Fig. D7 Distribution of all Ocean Station Data (OSD) tCO_2 profiles in WOD01 for year 1965 .

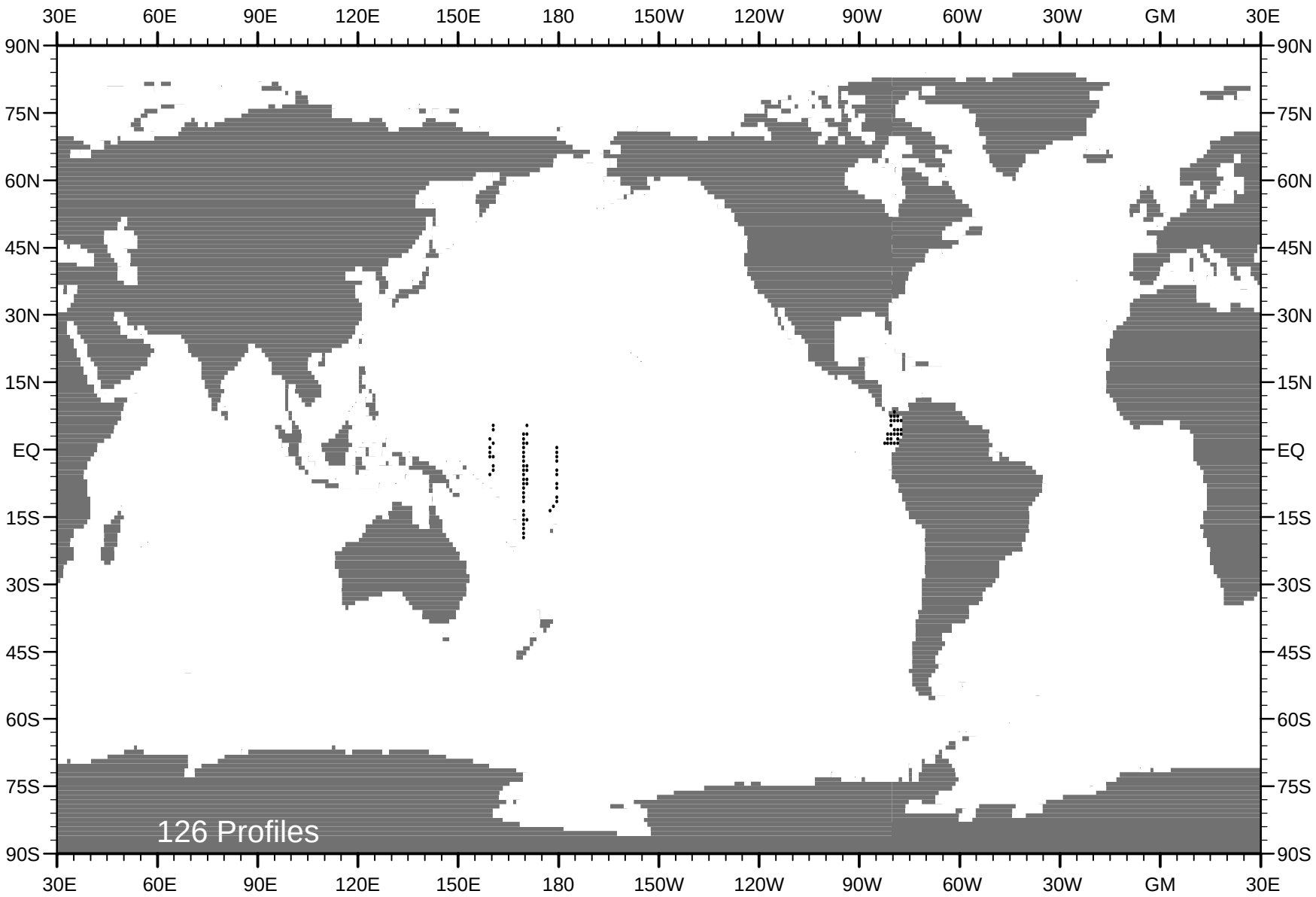


Fig. D8 Distribution of all Ocean Station Data (OSD) tCO_2 profiles in WOD01 for year 1966 .

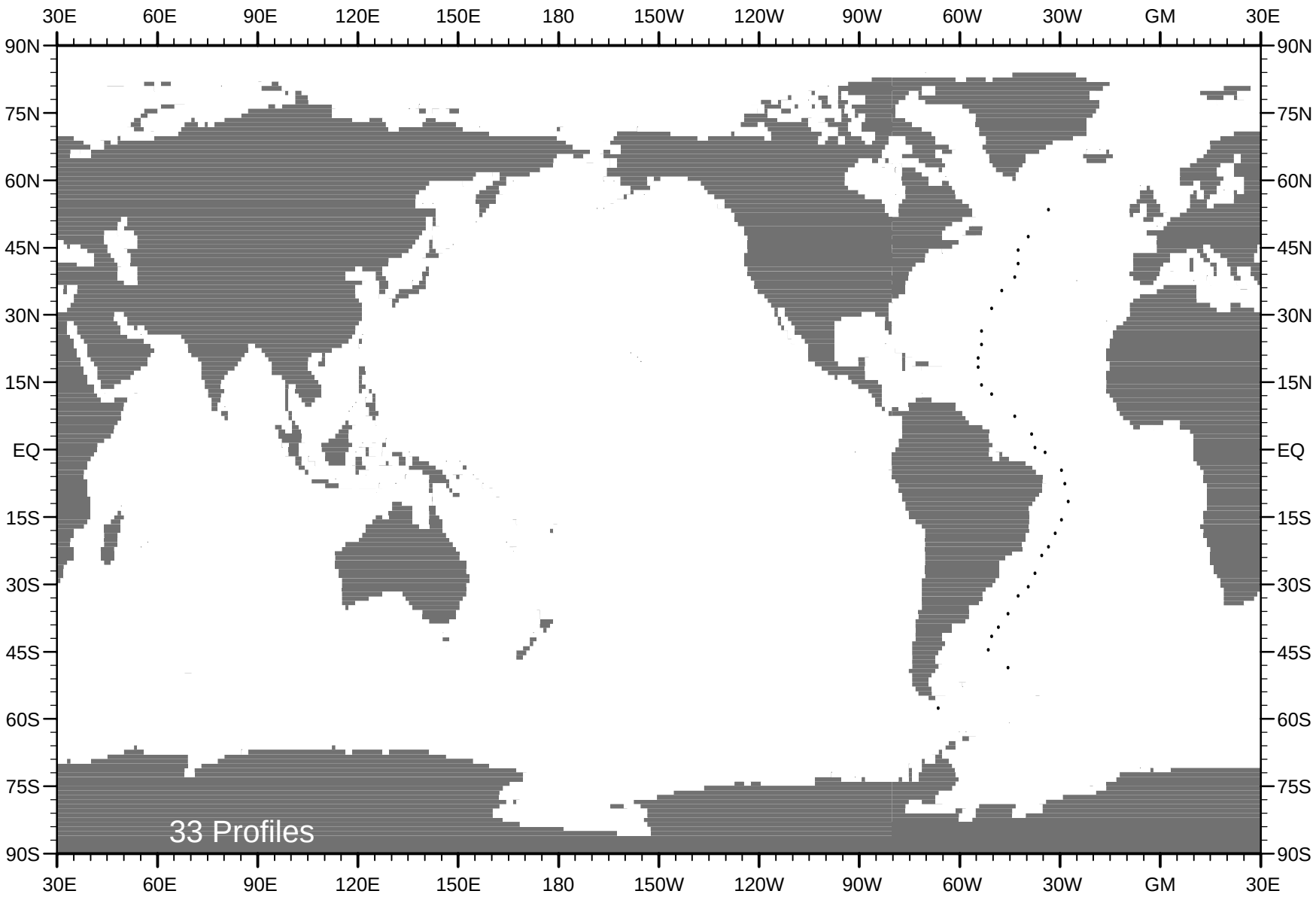


Fig. D9 Distribution of all Ocean Station Data (OSD) tCO_2 profiles in WOD01 for year 1972 .

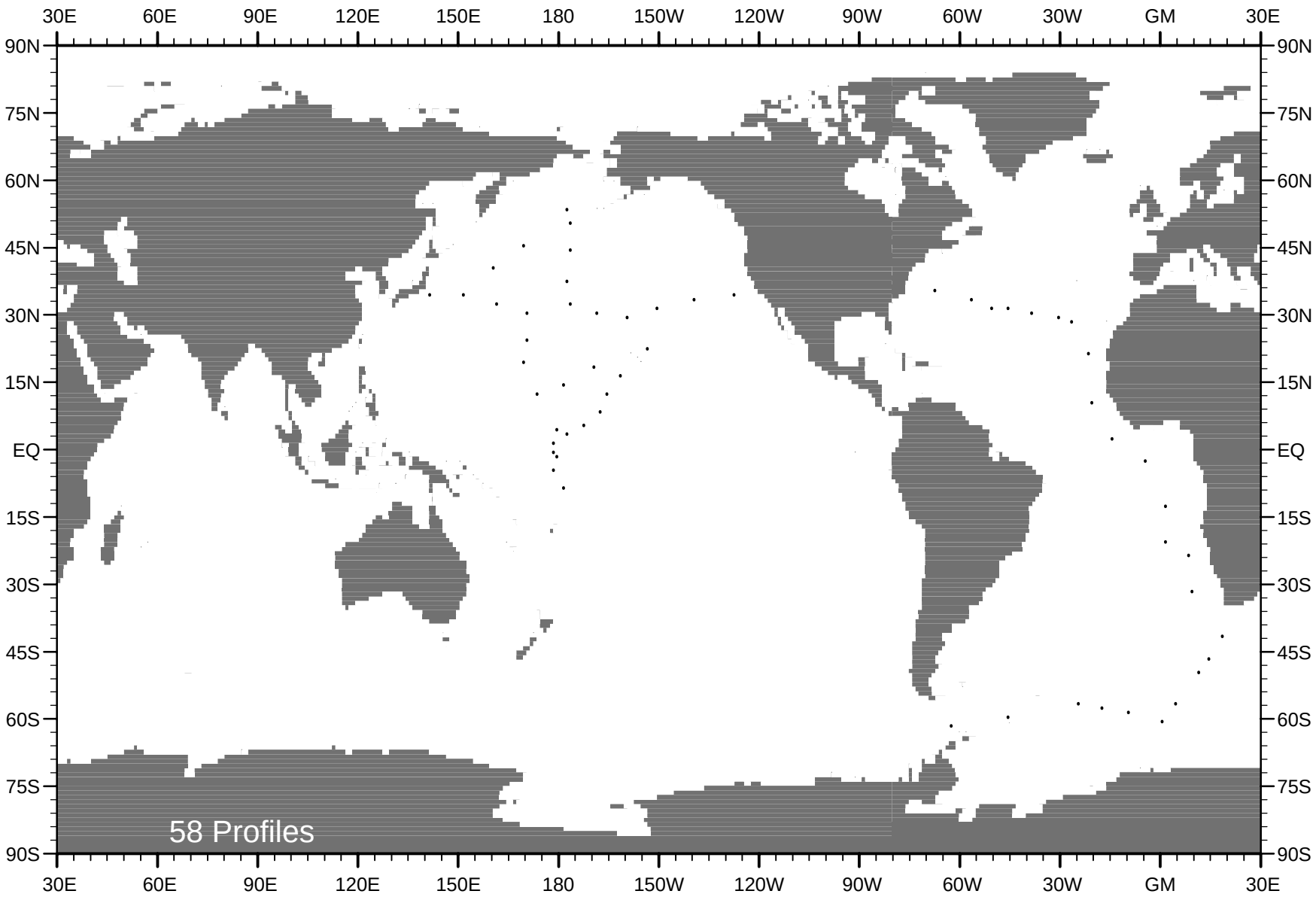


Fig. D10 Distribution of all Ocean Station Data (OSD) tCO_2 profiles in WOD01 for year 1973 .

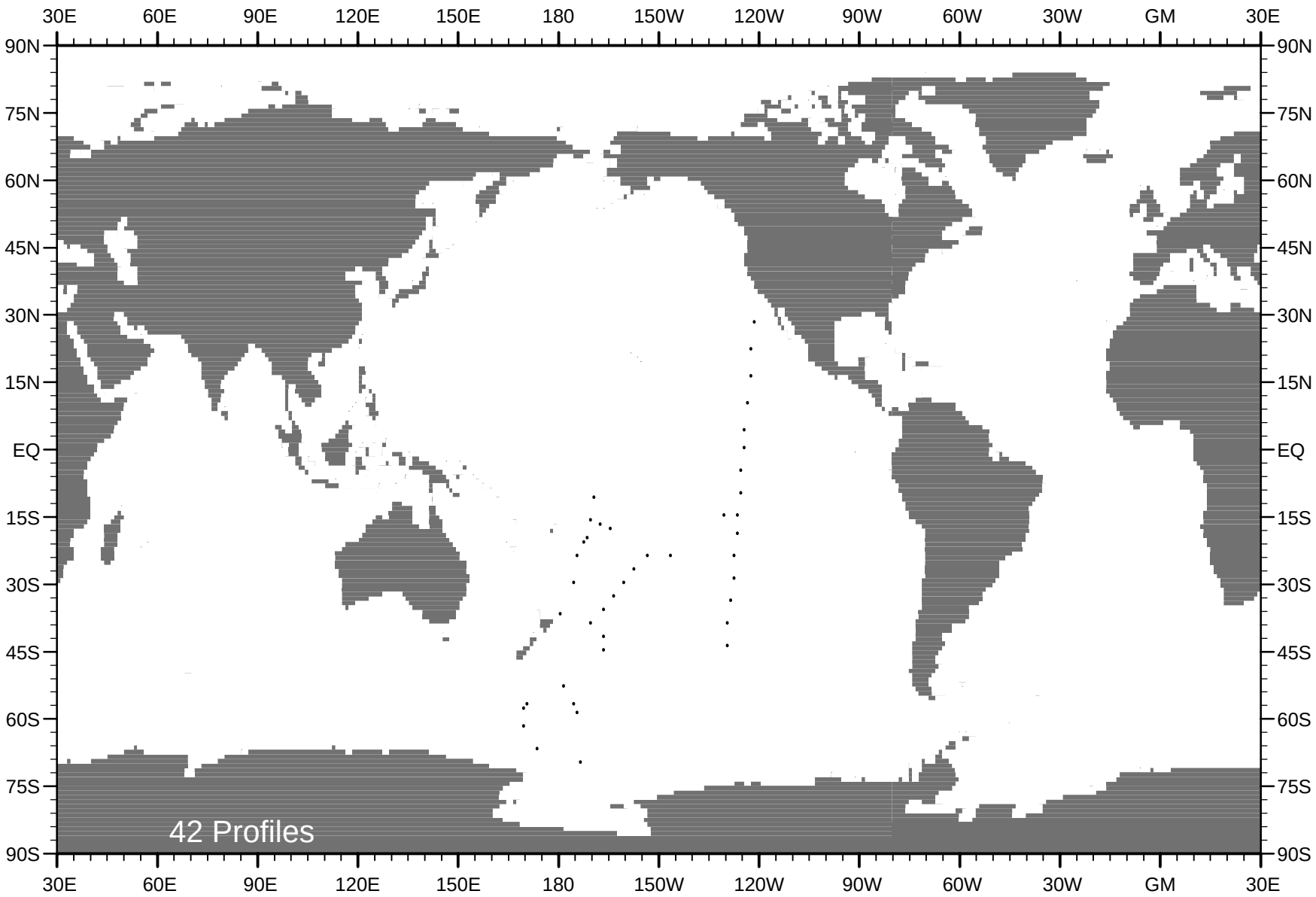


Fig. D11 Distribution of all Ocean Station Data (OSD) tCO_2 profiles in WOD01 for year 1974 .

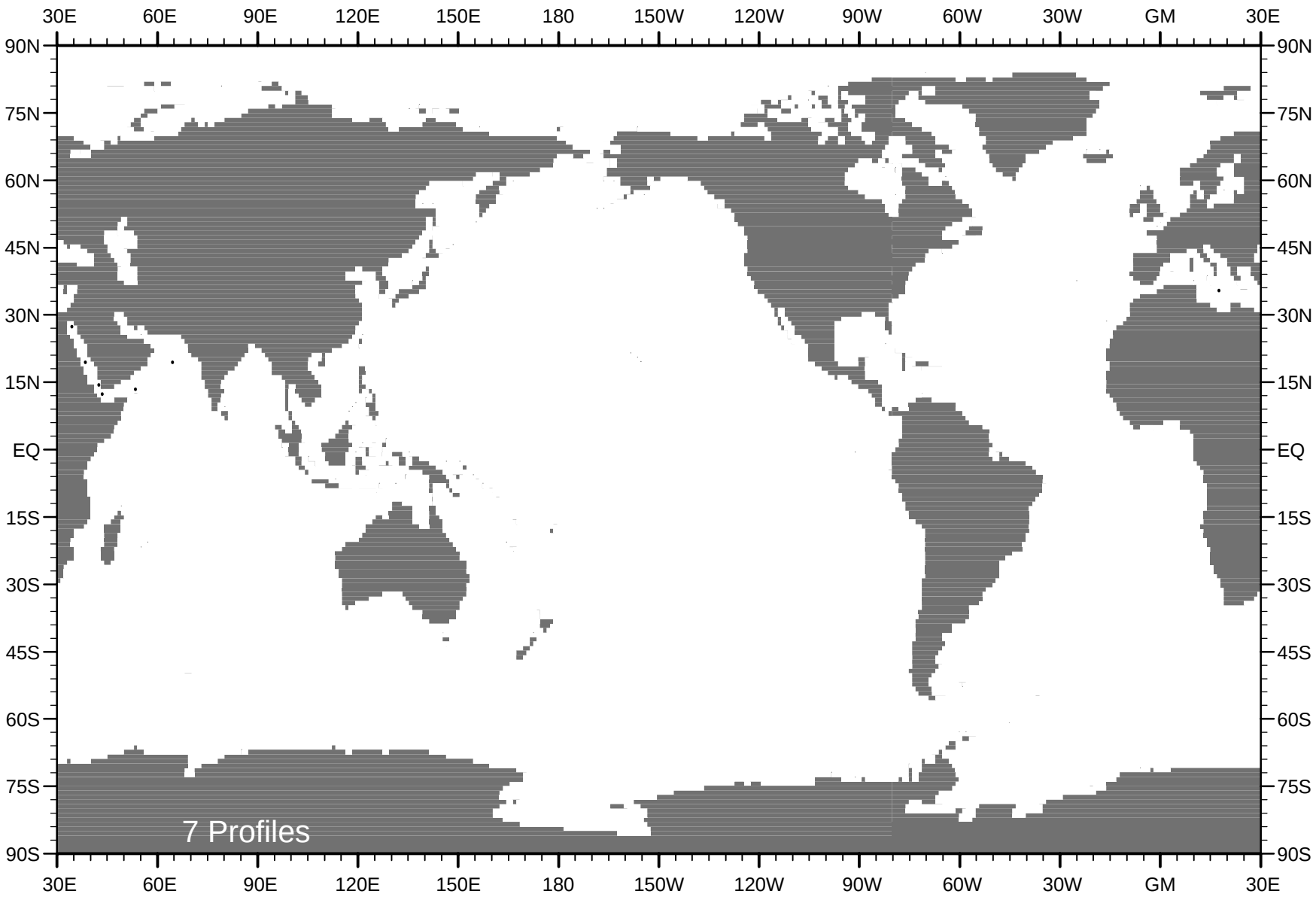
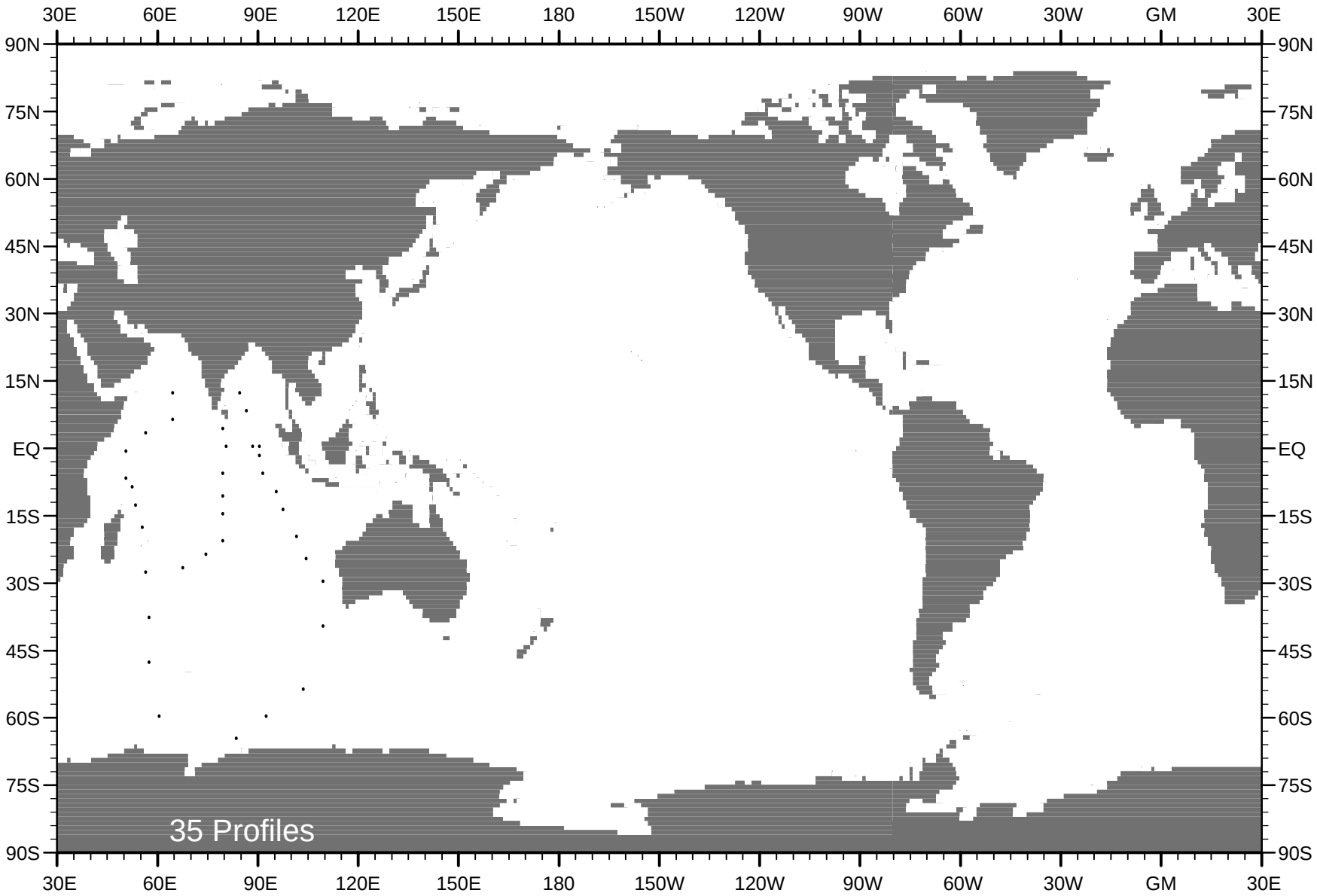


Fig. D12 Distribution of all Ocean Station Data (OSD) tCO_2 profiles in WOD01 for year 1977 .



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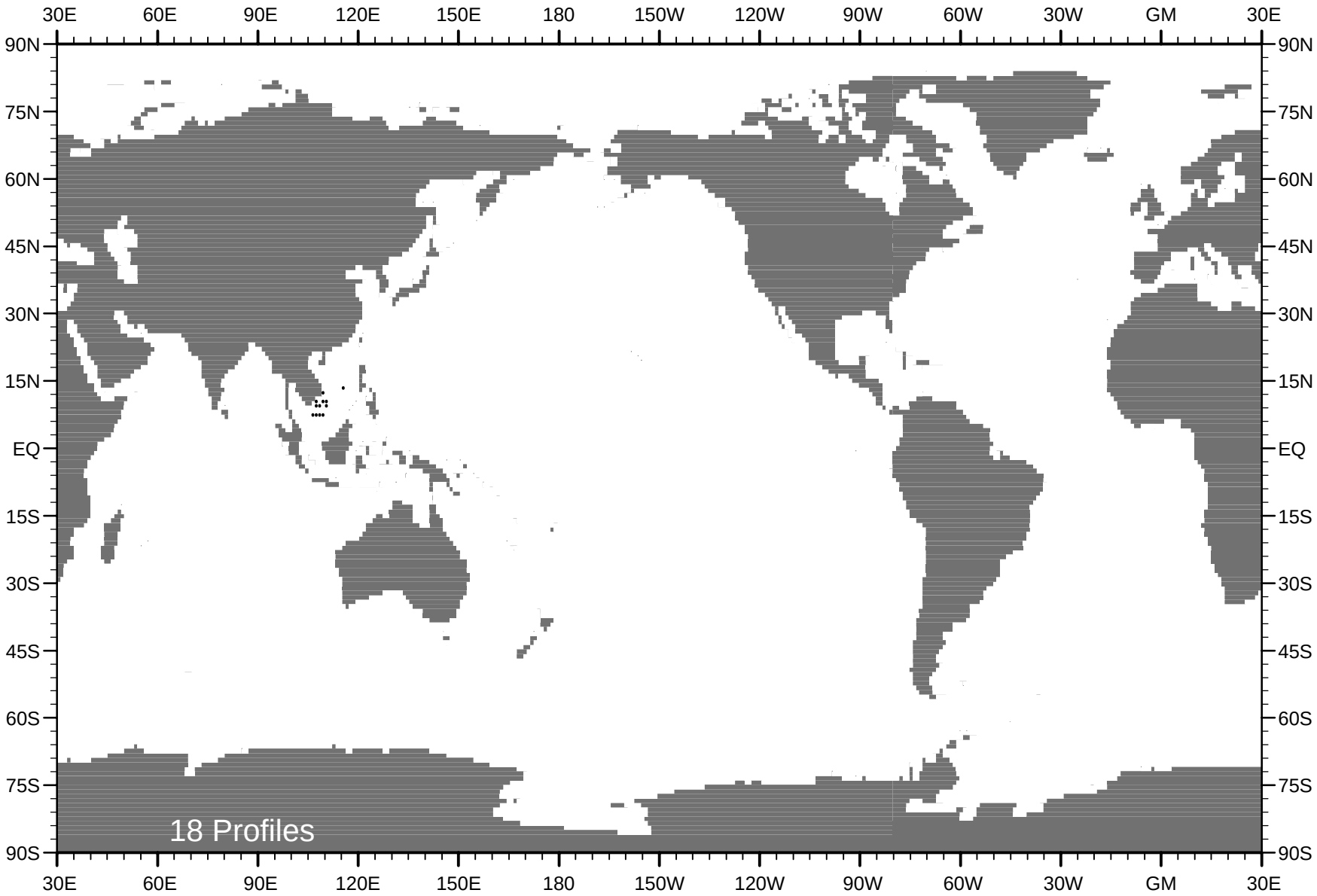

Fig. D14 Distribution of all Ocean Station Data (OSD) tCO_2 profiles in WOD01 for year 1983 .

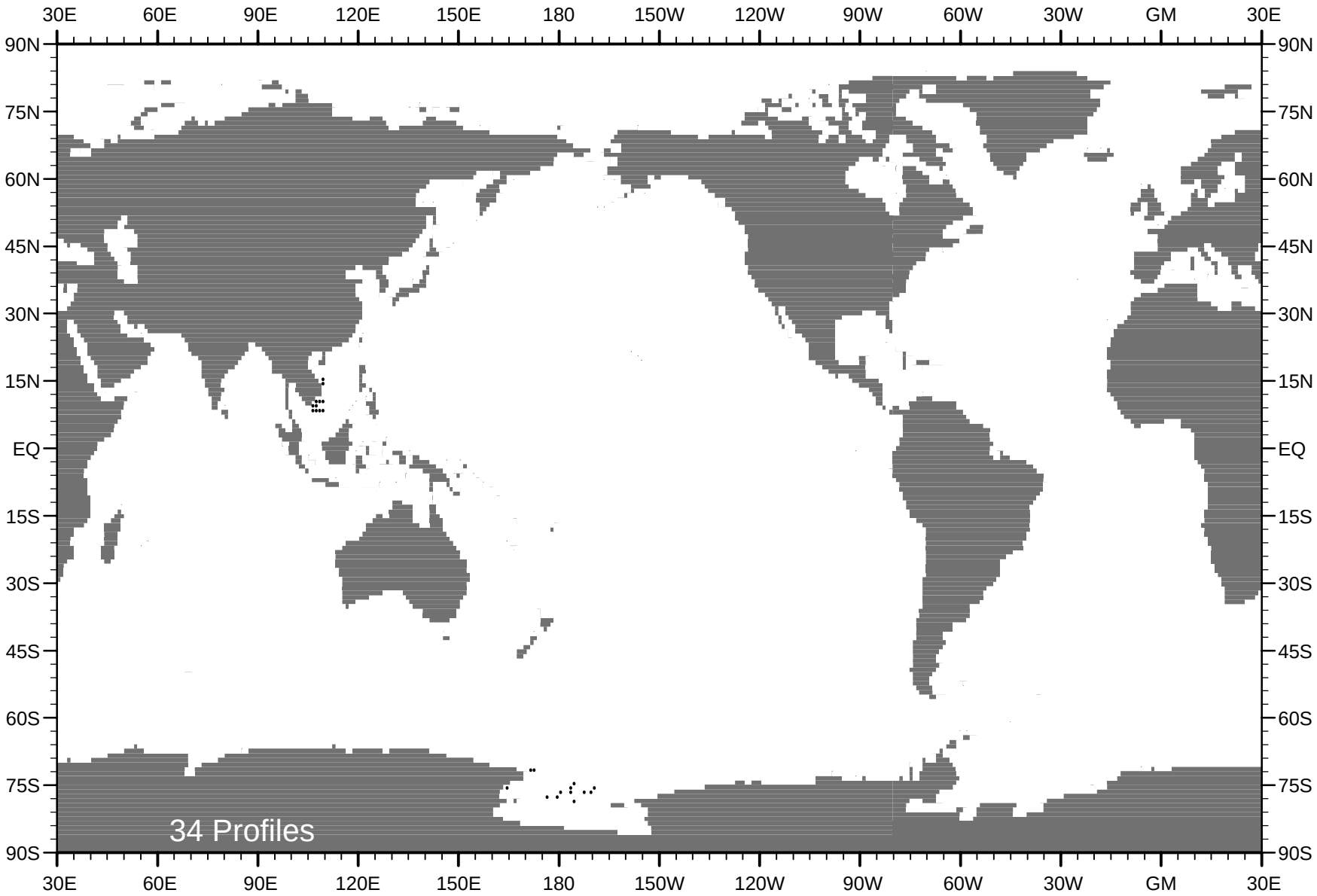

Fig. D15 Distribution of all Ocean Station Data (OSD) tCO_2 profiles in WOD01 for year 1984 .

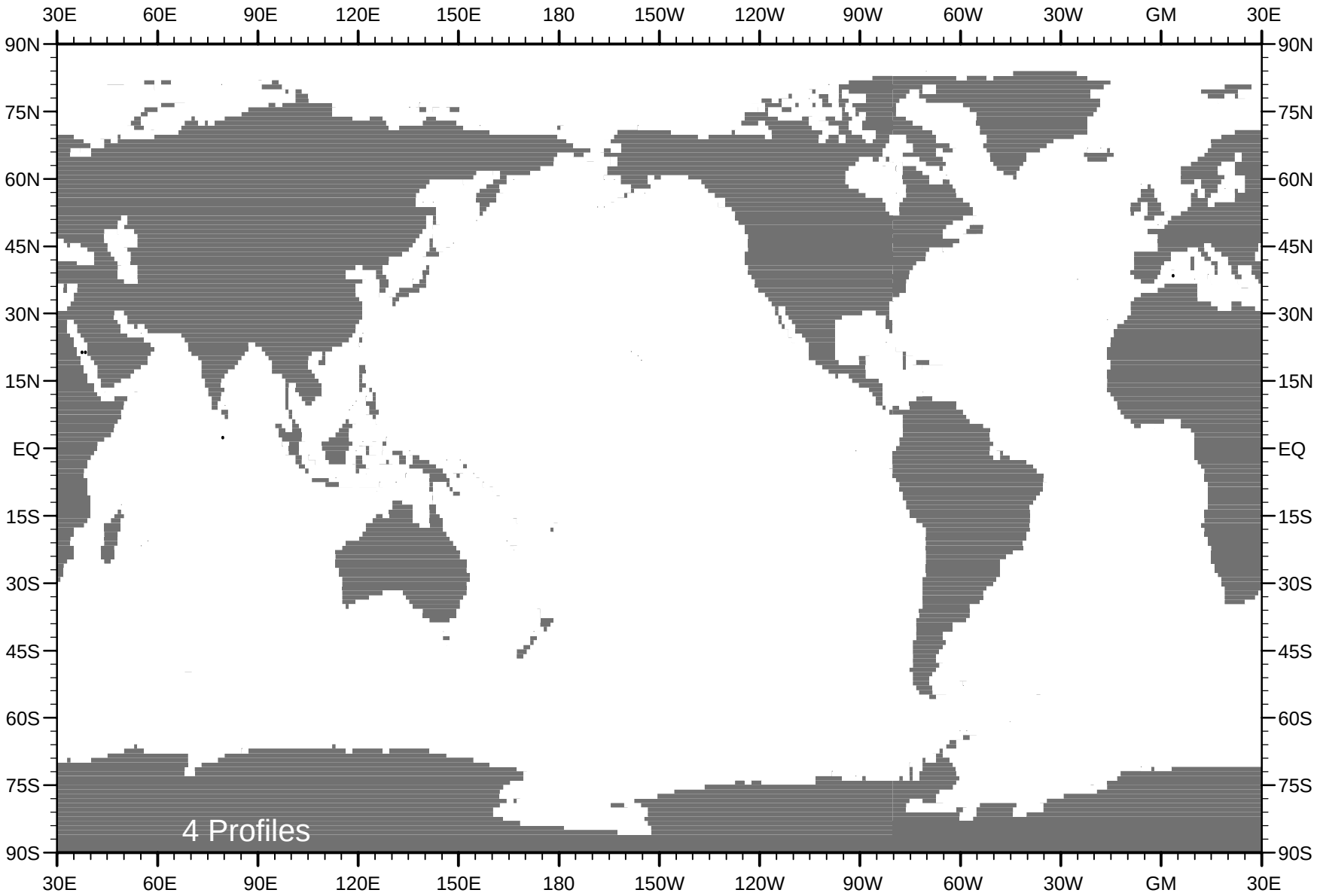

Fig. D16 Distribution of all Ocean Station Data (OSD) tCO_2 profiles in WOD01 for year 1986 .

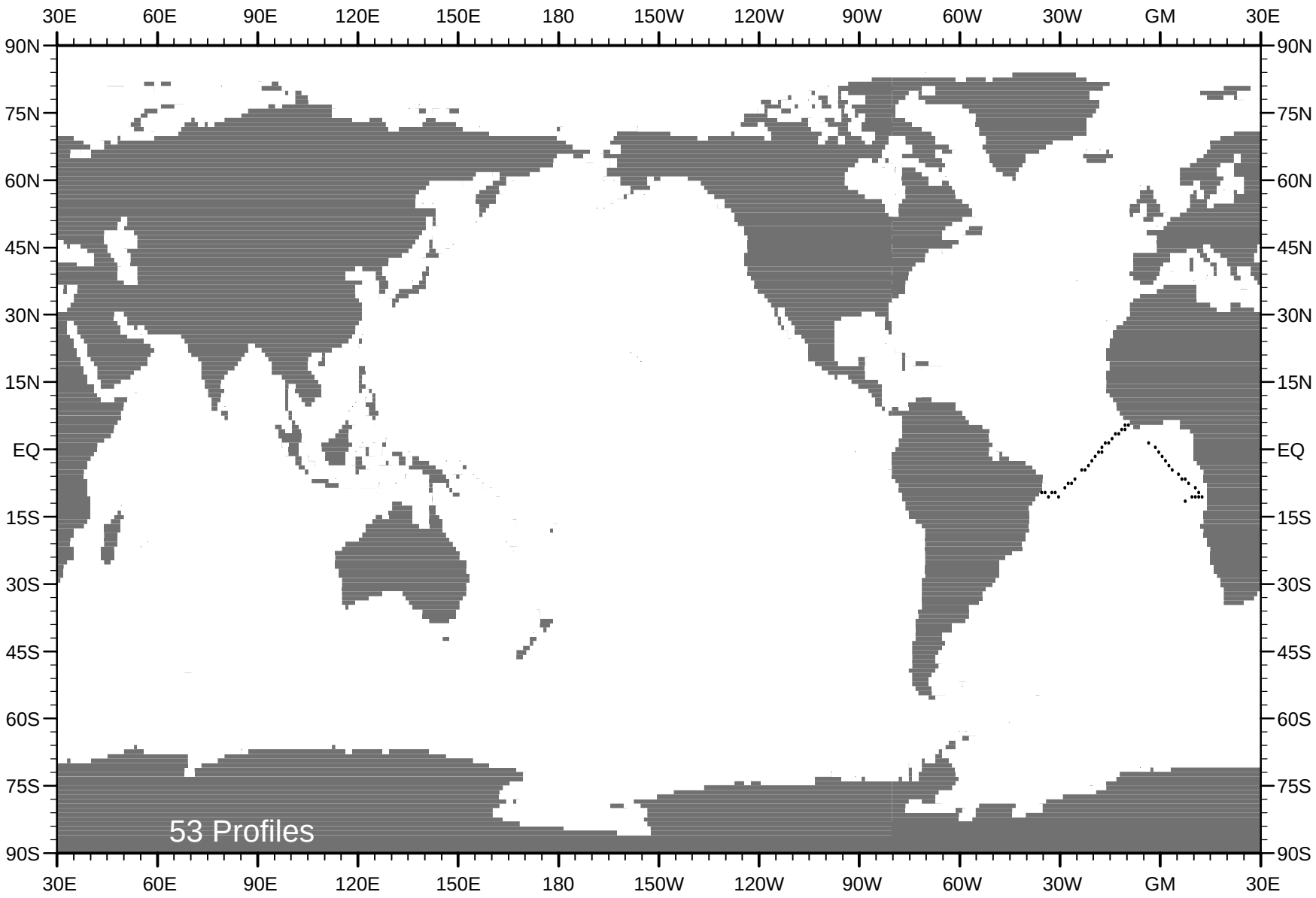

Fig. D17 Distribution of all Ocean Station Data (OSD) tCO_2 profiles in WOD01 for year 1987 .

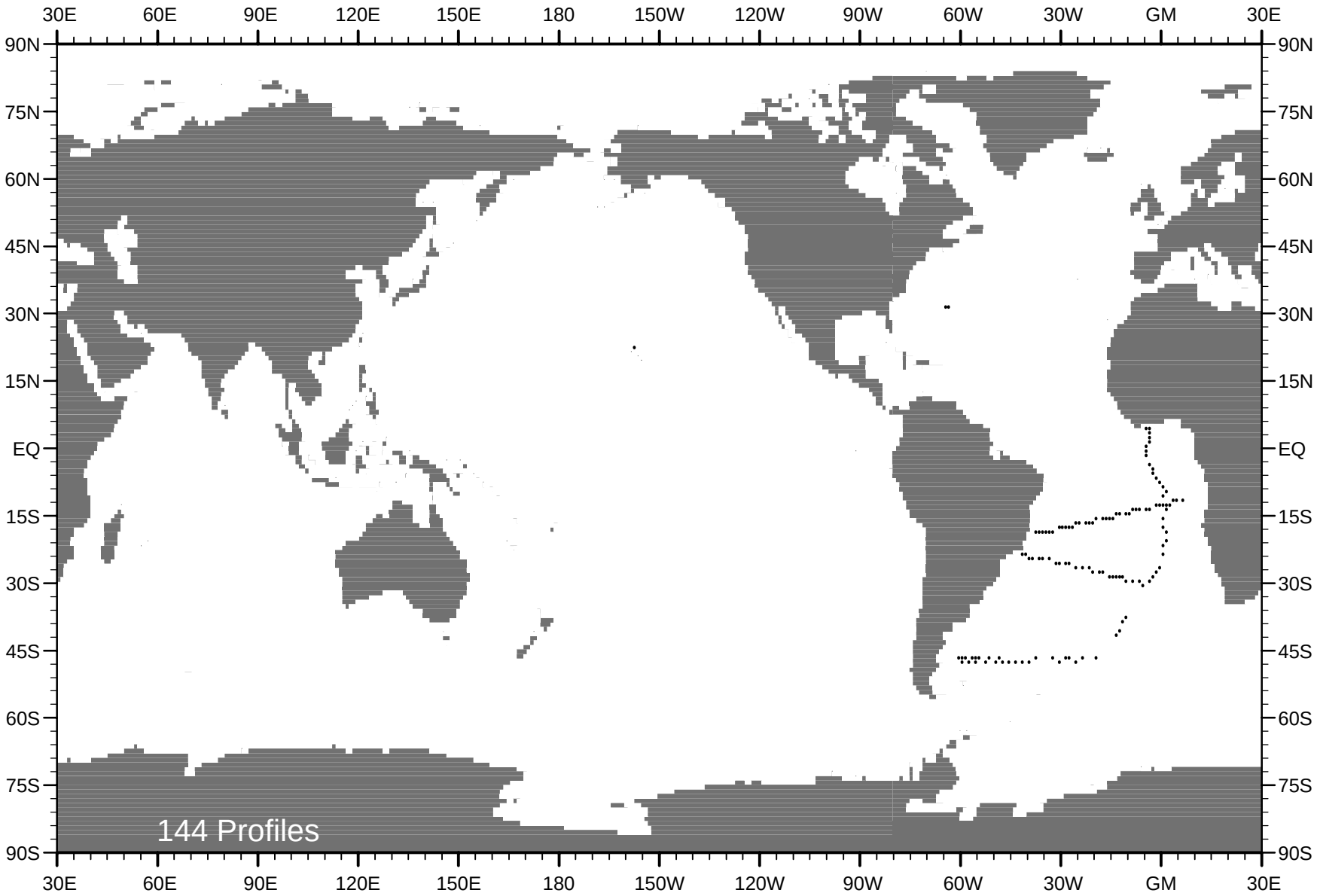

Fig. D18 Distribution of all Ocean Station Data (OSD) tCO_2 profiles in WOD01 for year 1988 .

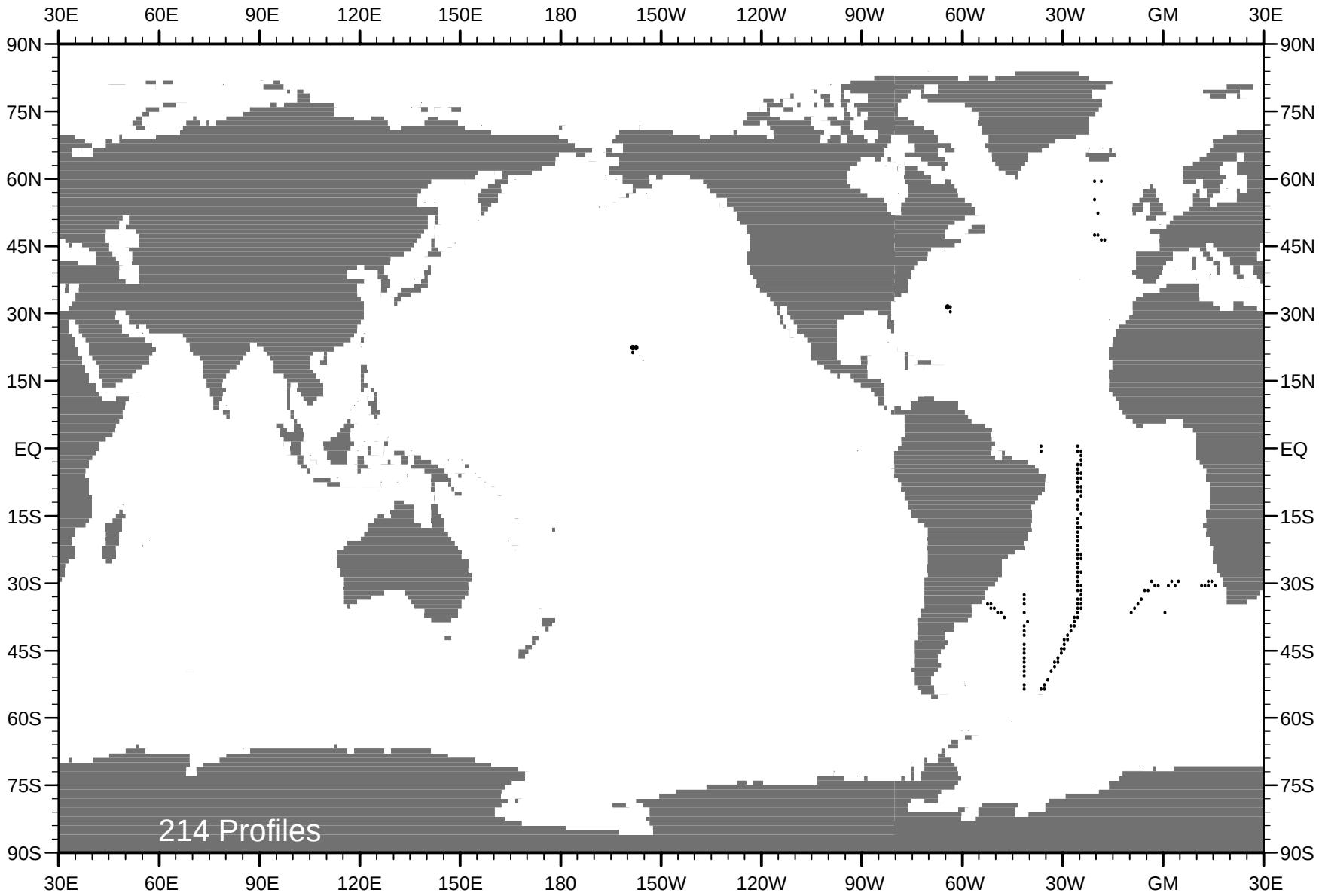

Fig. D19 Distribution of all Ocean Station Data (OSD) tCO_2 profiles in WOD01 for year 1989 .

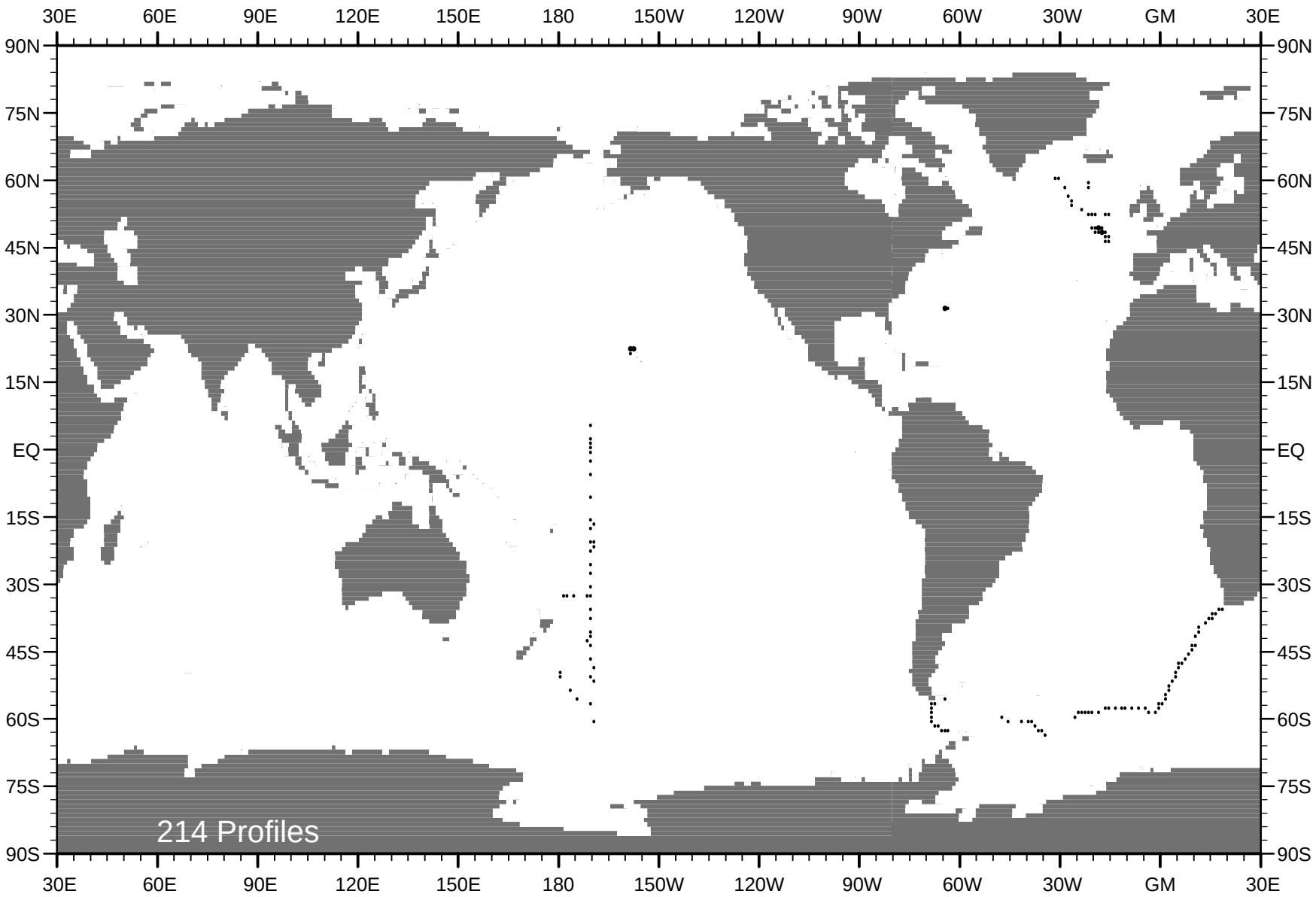

Fig. D20 Distribution of all Ocean Station Data (OSD) tCO_2 profiles in WOD01 for year 1990 .

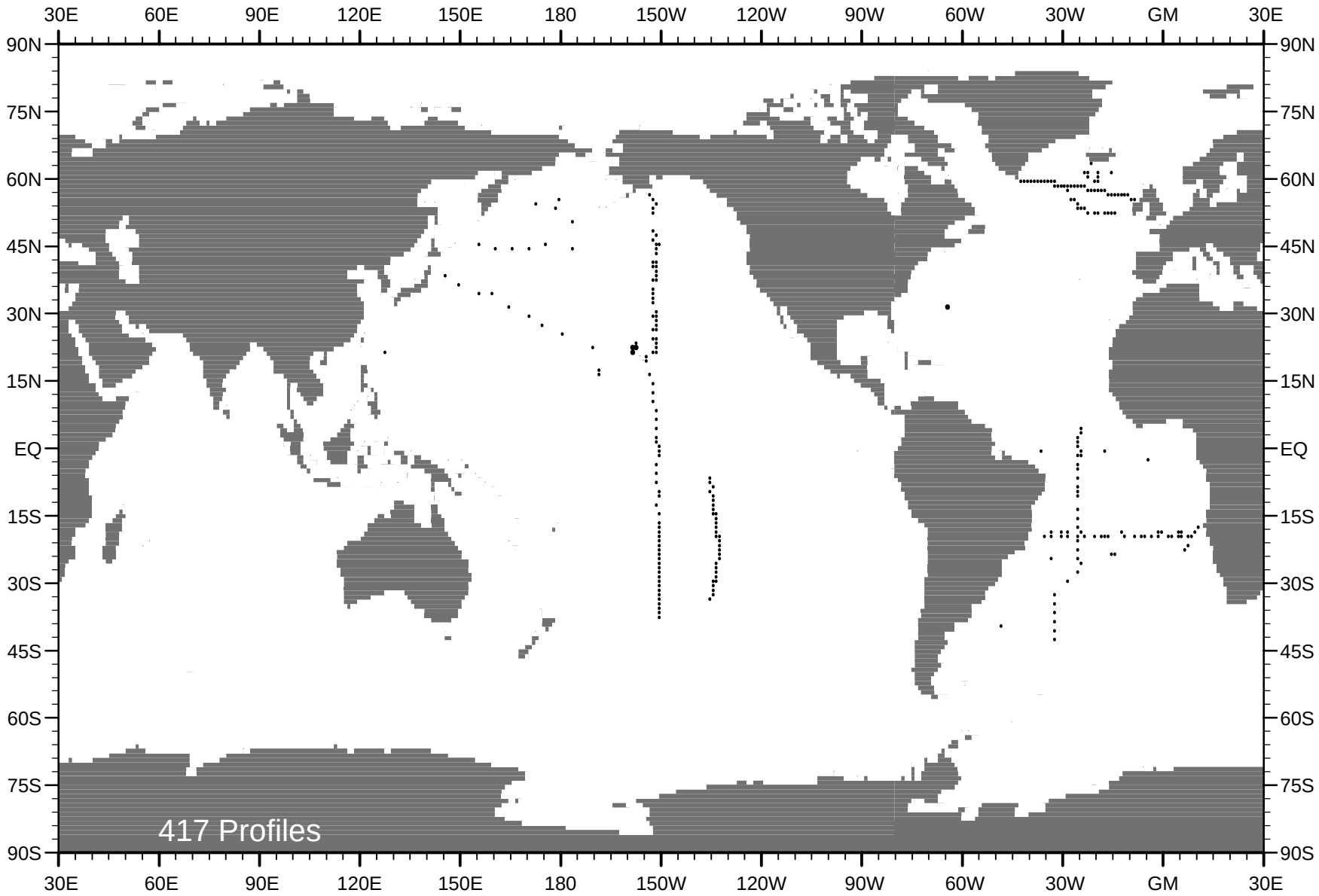

Fig. D21 Distribution of all Ocean Station Data (OSD) tCO_2 profiles in WOD01 for year 1991 .

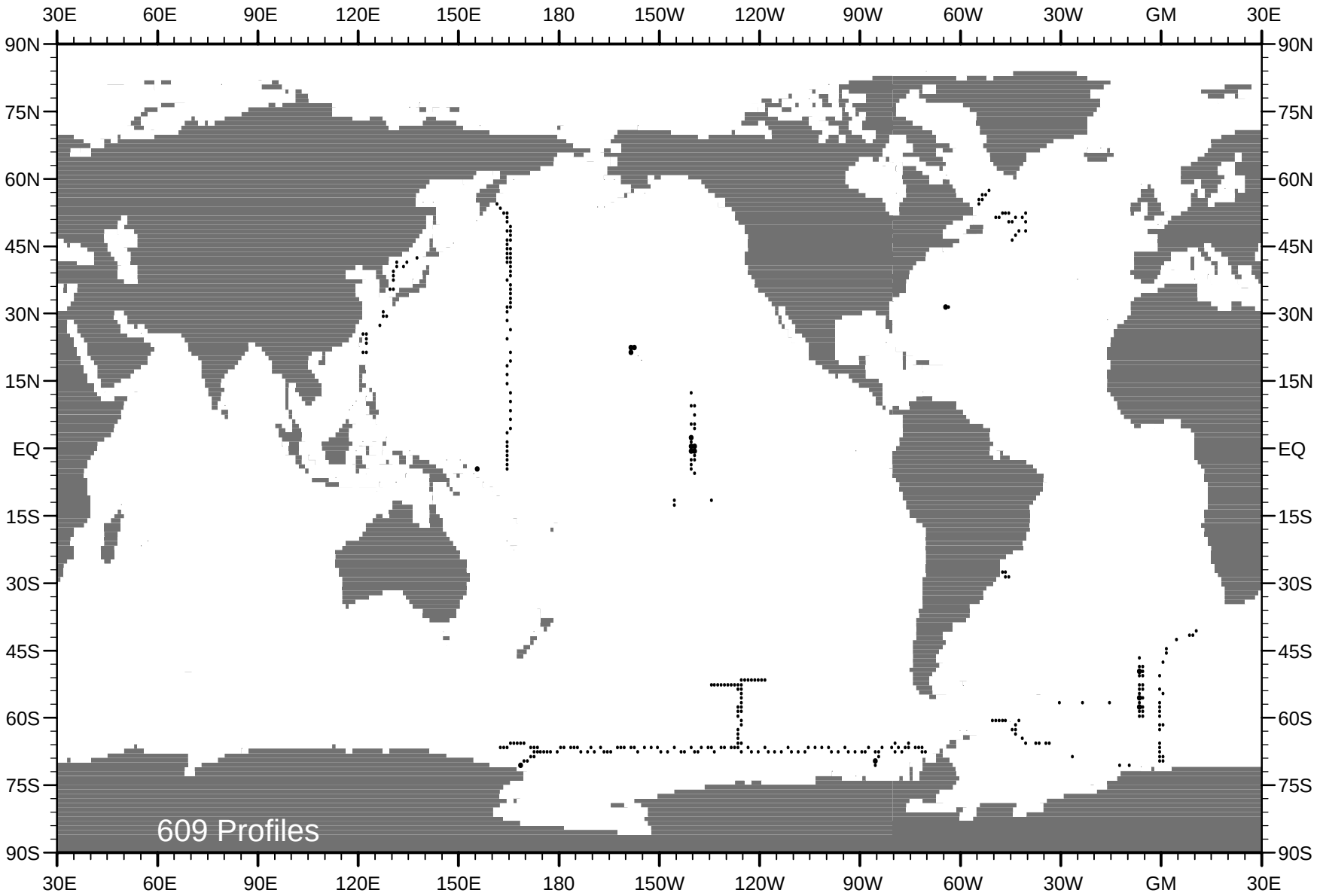

Fig. D22 Distribution of all Ocean Station Data (OSD) tCO_2 profiles in WOD01 for year 1992 .

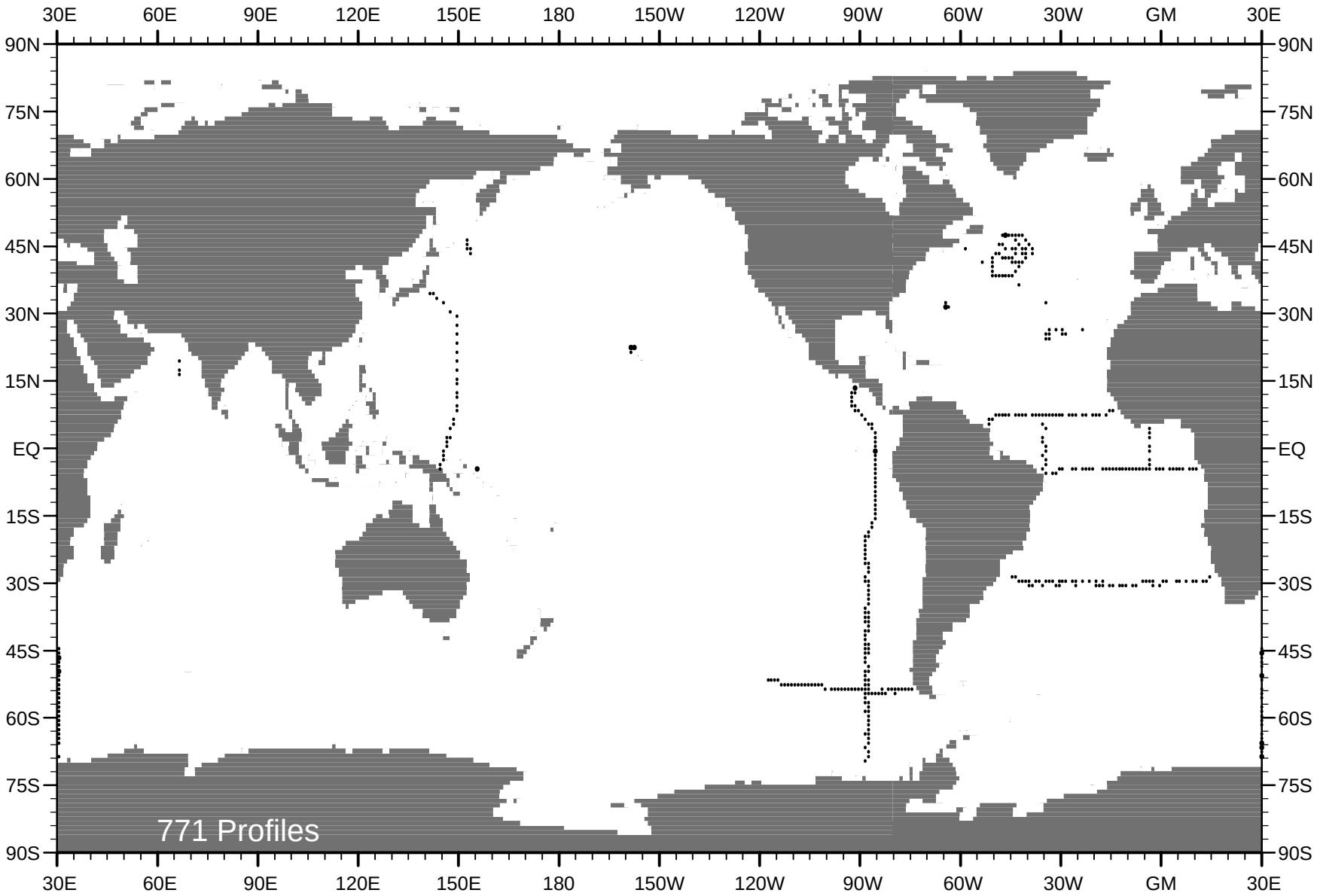

Fig. D23 Distribution of all Ocean Station Data (OSD) tCO_2 profiles in WOD01 for year 1993 .

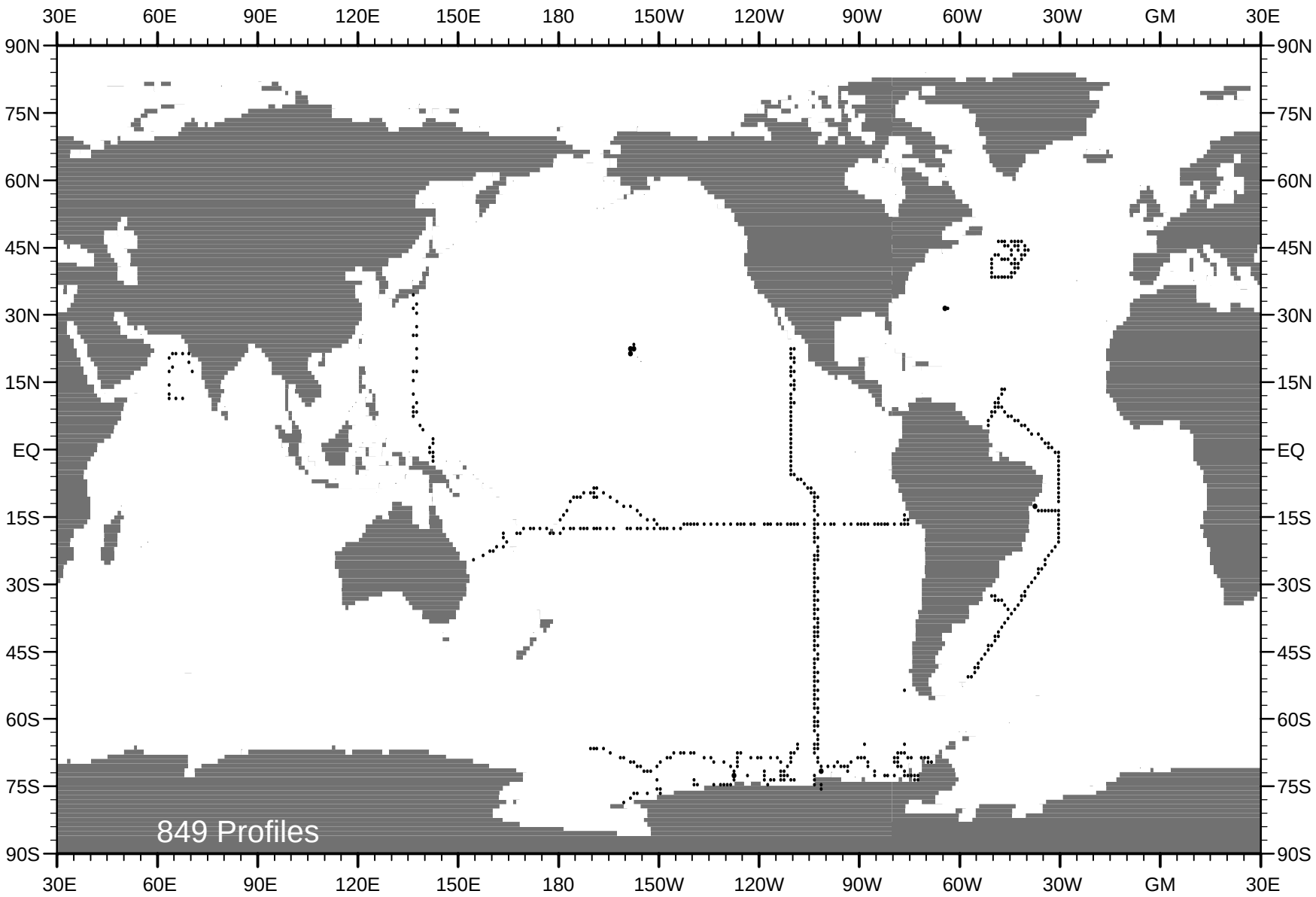

Fig. D24 Distribution of all Ocean Station Data (OSD) tCO_2 profiles in WOD01 for year 1994 .

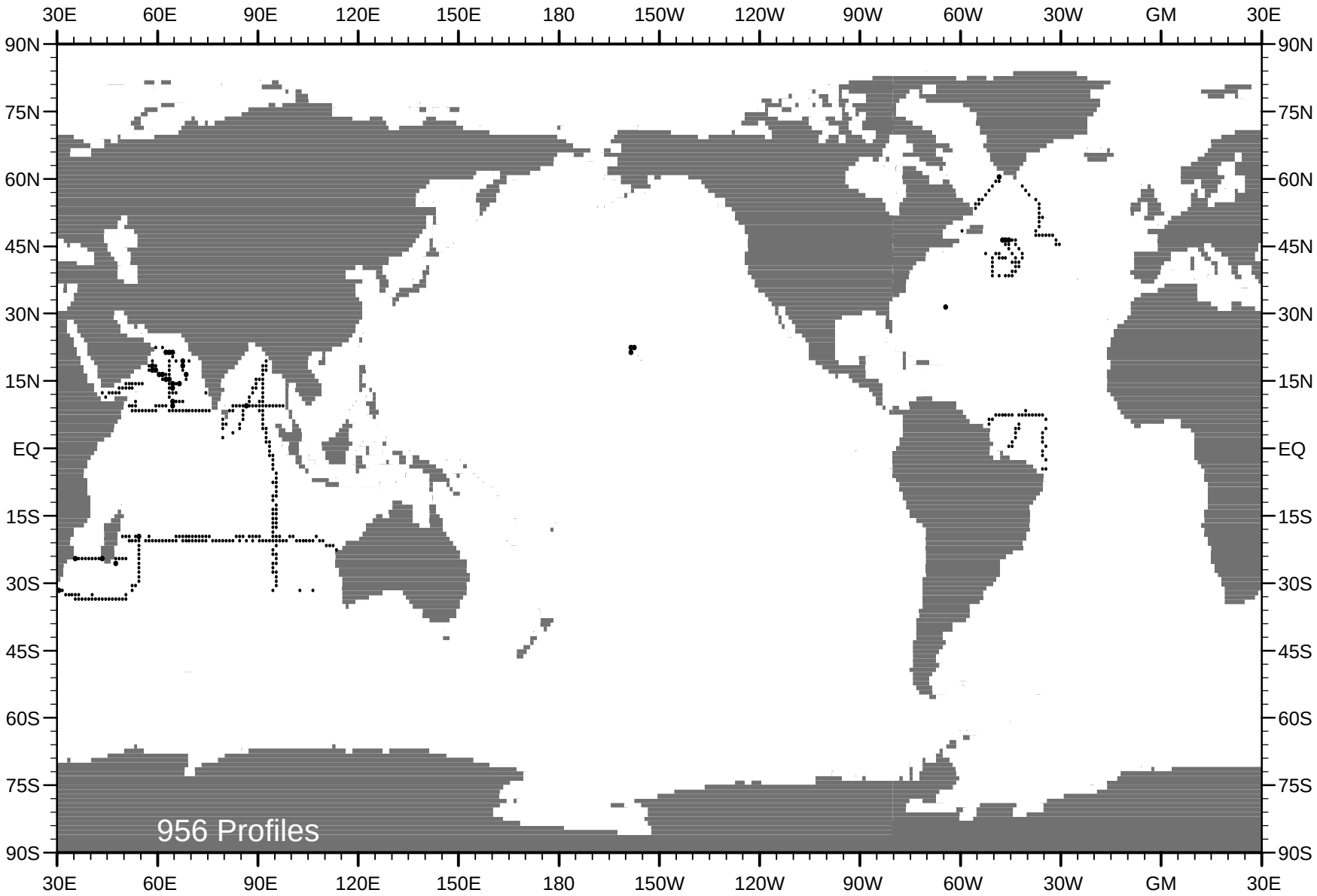

Fig. D25 Distribution of all Ocean Station Data (OSD) tCO_2 profiles in WOD01 for year 1995 .

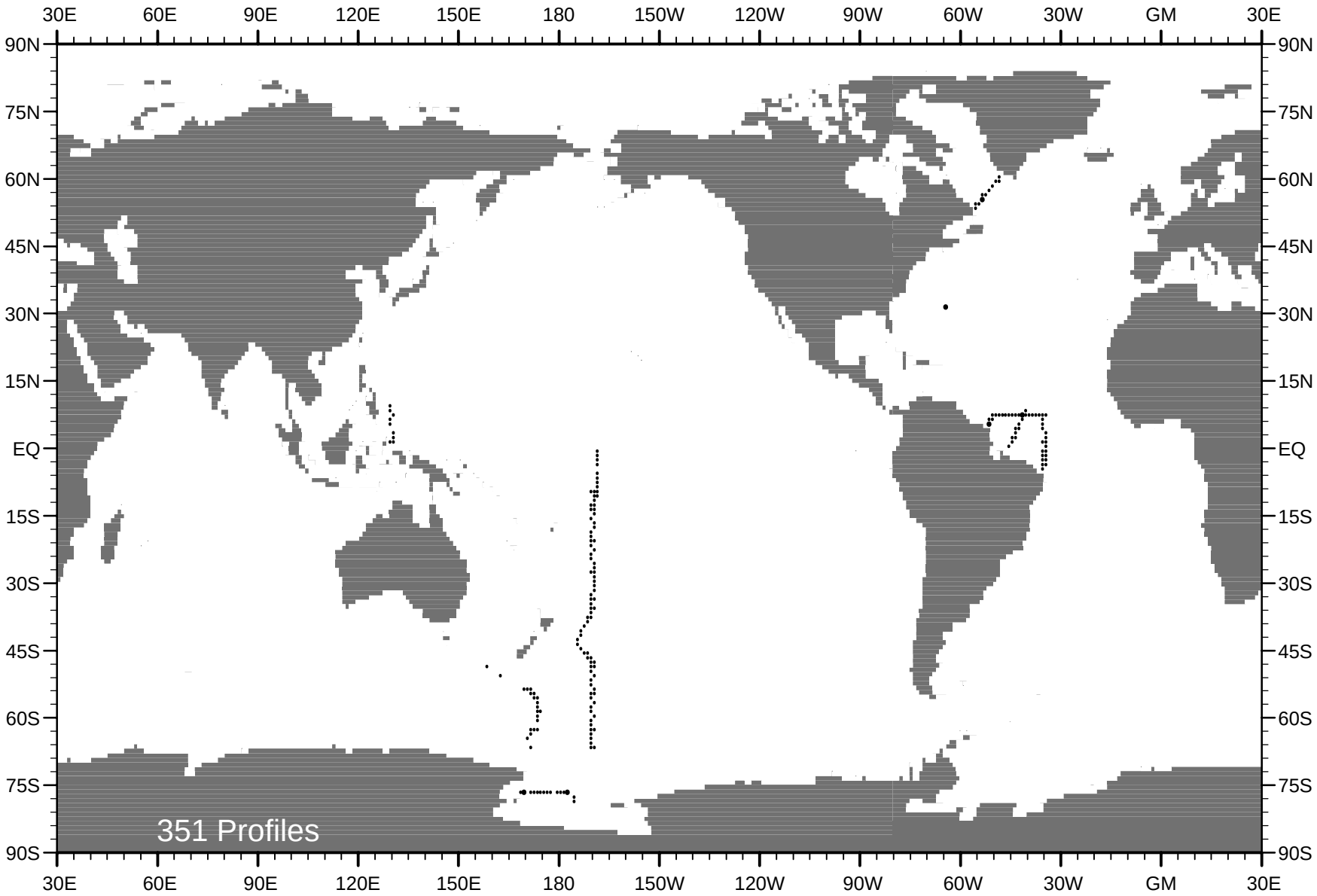

Fig. D26 Distribution of all Ocean Station Data (OSD) tCO_2 profiles in WOD01 for year 1996 .

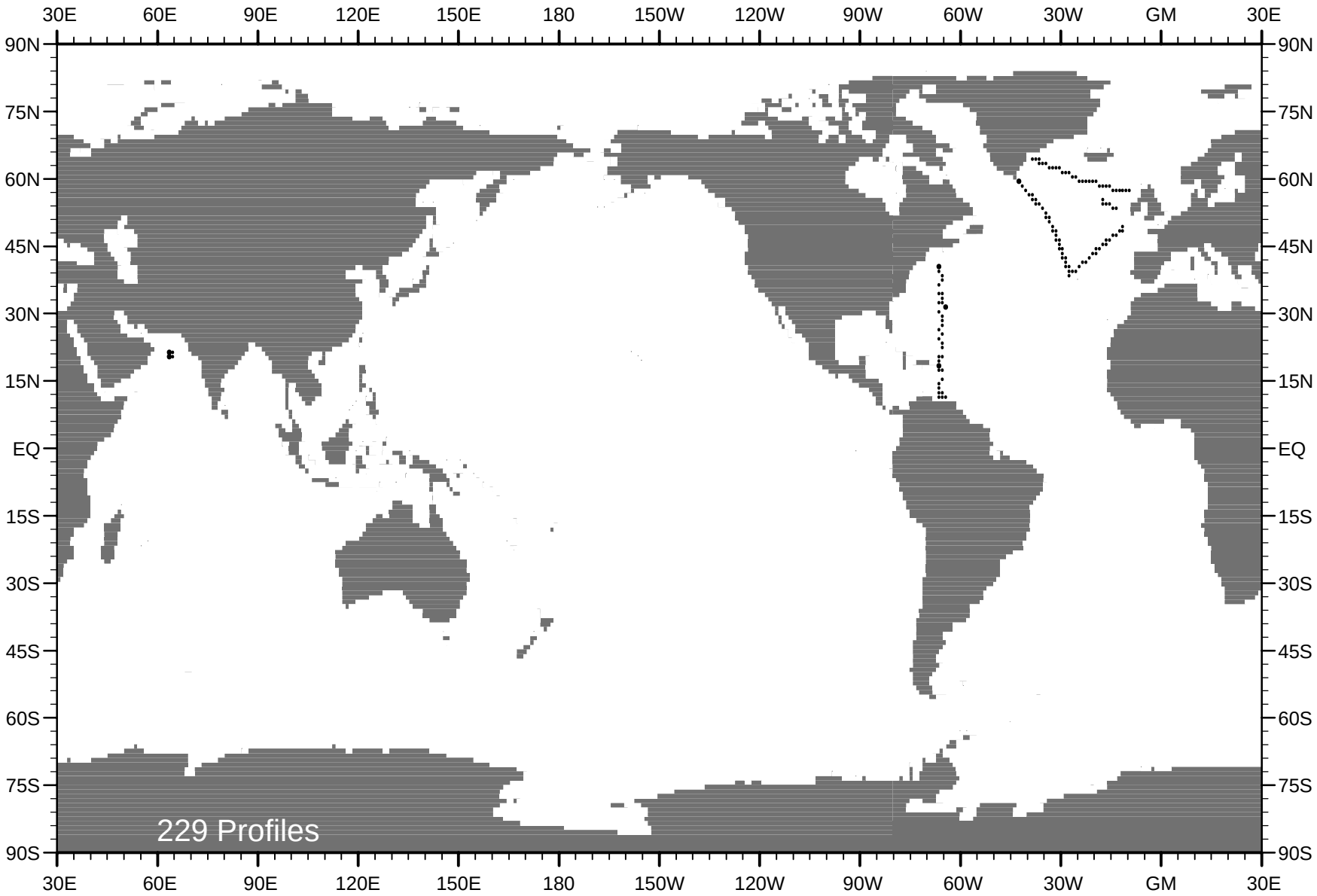

Fig. D27 Distribution of all Ocean Station Data (OSD) tCO_2 profiles in WOD01 for year 1997 .

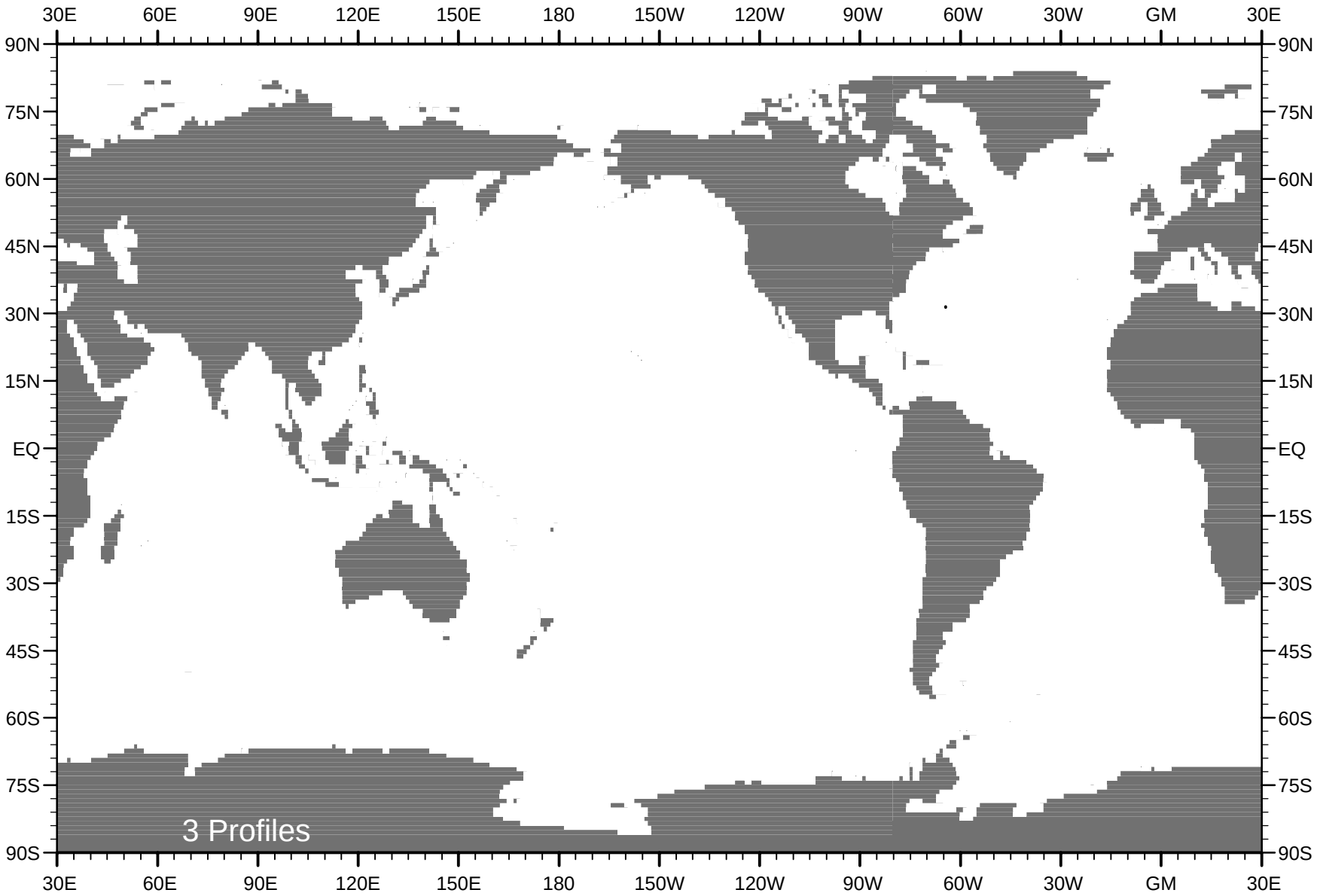

Fig. D28 Distribution of all Ocean Station Data (OSD) tCO_2 profiles in WOD01 for year 1998 .

8. APPENDIX E: DISTRIBUTIONS FOR INDIVIDUAL YEARS OF ALL SURFACE-ONLY pCO_2 DATA IN WOD01

This appendix contains yearly distributions of all Surface-only pCO_2 data contained in WOD01. These maps provide some history of the observational progress of the field of oceanography. They also serve as indicators of whether or not a particular data set from a scientist or institution is part of the NODC/WDC-A archive. The exchange of information provided by the publication of such maps has provided us with valuable information about deficiencies in the database. The locations of all WOD01 Surface-only pCO_2 profiles are plotted including stations that may be erroneously located over land. However, WOD01 contains some stations from various lakes so care should be exercised in the use of these stations and the determination as to whether they represent errors in locations.

For all figures in Appendix E, a small dot indicates a one-degree square containing from one to four stations and a large dot indicates five or more stations.

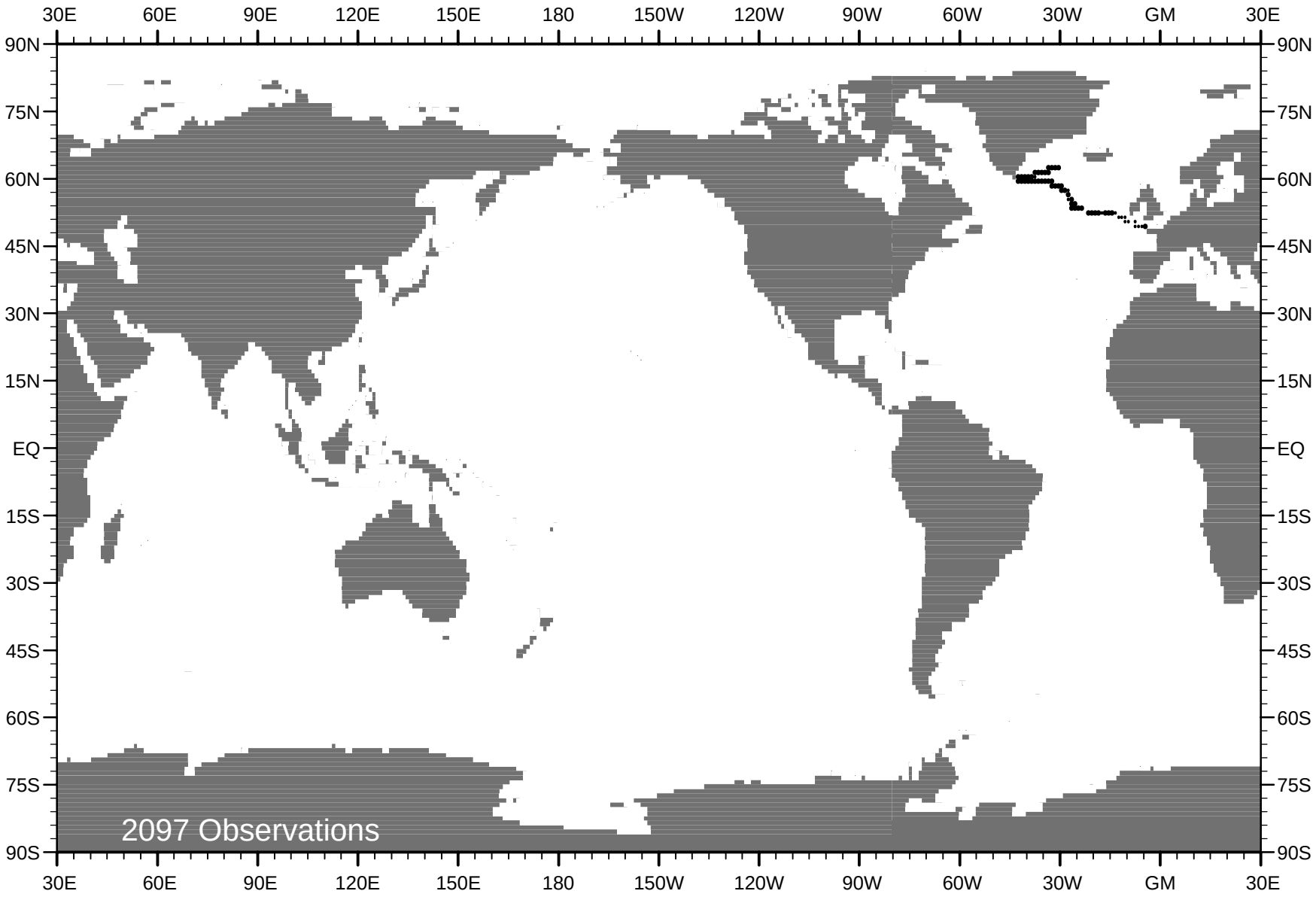

Fig. E1 Distribution of all Surface-only (SURF) pCO_2 data in WOD01 for year 1991 .

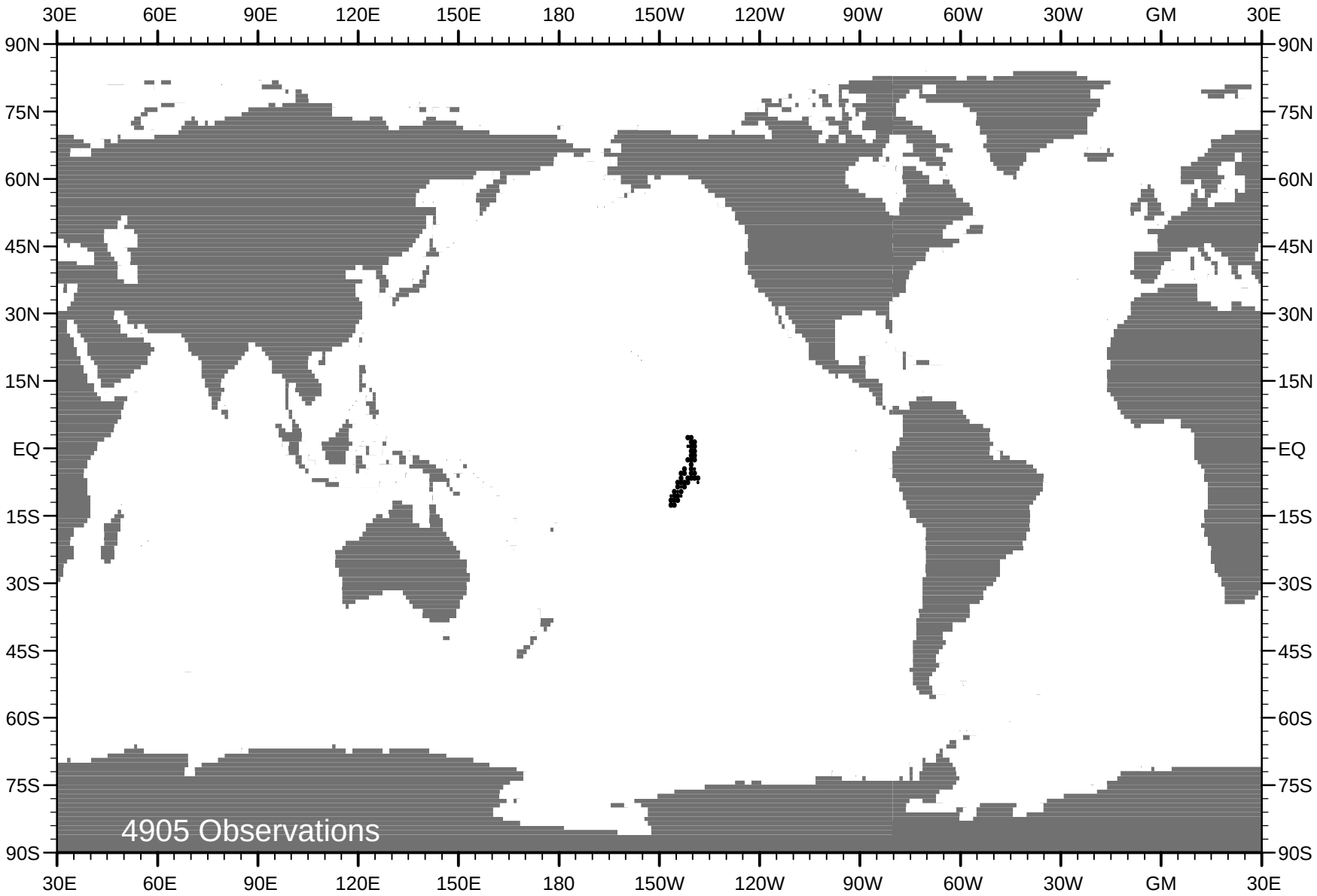

Fig. E2 Distribution of all Surface-only (SURF) pCO_2 data in WOD01 for year 1992 .

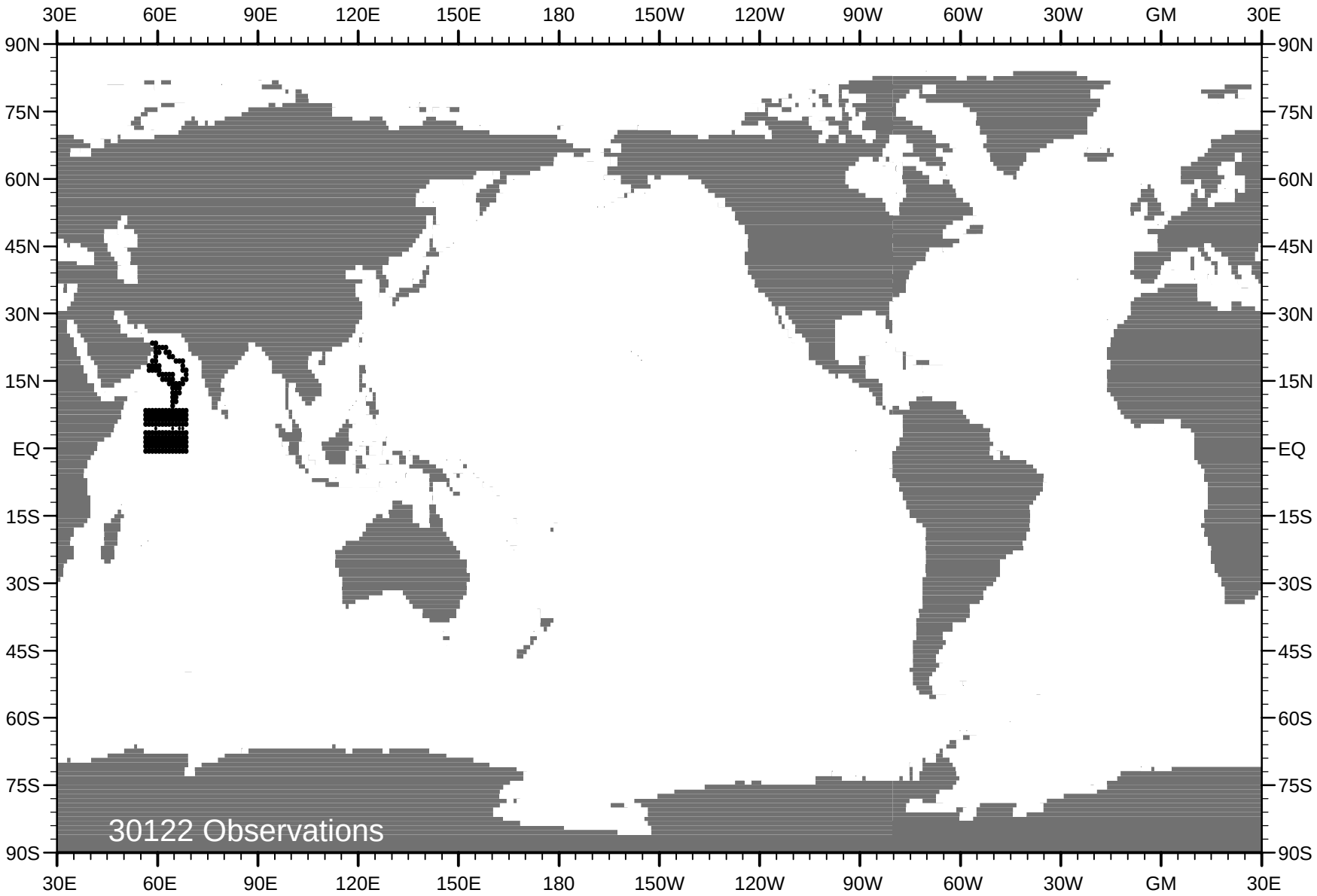

Fig. E3 Distribution of all Surface-only (SURF) pCO_2 data in WOD01 for year 1995 .