NOAA Atlas NESDIS 42

WORLD OCEAN DATABASE 2001
VOLUME 1: INTRODUCTION

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March 2002

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This publication should be cited as:

M. E. Conkright, J. I. Antonov, O. Baranova, T. P. Boyer, H. E. Garcia, R. Gelfeld, D. Johnson, R. A. Locarnini, P. P. Murphy, T. D. O'Brien, I. Smolyar, C. Stephens, 2002: *World Ocean Database 2001, Volume 1: Introduction.* S. Levitus, Ed., NOAA Atlas NESDIS 42, U.S. Government Printing Office, Wash., D.C., 167 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.

Sydney Levitus
National Oceanographic Data Center/World Data Center for Oceanography- Silver Spring
Silver Spring, MD
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 1: Introduction

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ABSTRACT

This atlas describes a collection of scientifically quality controlled ocean profile and plankton data that includes measurements of temperature, salinity, oxygen, phosphate, nitrate, nitrite plus nitrate, silicate, chlorophyll, alkalinity, pH, pCO_2, and TCO_2. A discussion of data sources is provided. Yearly data distribution plots for individual years of all profiles in the database are presented to provide information on the state of ocean profile observations.

1. INTRODUCTION

The *World Ocean Atlas 1994* (WOA94) represented the first database analysis product of the National Oceanographic Data Center (NODC) Ocean Climate Laboratory (OCL). WOA94 included vertical profiles of six variables including temperature, salinity, oxygen, phosphate, nitrate, and silicate as well as objective analyses of these variables at standard depth levels. *World Ocean Database 1998* (WOD98) updated WOA94 to include additional data for these six variables as well as data for additional variables such as chlorophyll, nitrite, pH, alkalinity and plankton as well as high resolution CTD (conductivity-temperature-depth) and high resolution XBT (expendable bathythermograph) profiles. Products derived from this database, such as objective analyses of the variables that comprise WOD98 were made available as a separate atlas and CD-ROM series entitled *World Ocean Atlas 1998* (WOA98). *World Ocean Database 2001* (WOD01) now includes data from new instrument types such as profiling floats (P-ALACE, SOLO, APEX), Undulating Ocean Recorders (*e.g.,* towed CTDs), and Autonomous Pinniped Bathythermographs (instrumented Elephant Seals).

As with our previous work, users can obtain the latest information on WOD01 (*e.g.* Errata sheet, Frequently Asked Questions and Updates) via the NODC Home Page, **http://www.nodc.noaa.gov/** (click on *Ocean Climate Laboratory*, then click on *World Ocean Database 2001*). The purpose of the WOD01 atlas series is to describe the database and show the historical distributions of profiles made using the various instrument types included in WOD01 as well as some specific variables that comprise WOD01. This is accomplished through the display of global data distribution plots for individual years. These same plots as well as year-season data distribution plots are available in color via the NODC Home Page. This provides users with basic information about the data in the historical ocean profile archives of NODC/WDC. In this atlas, "WDC" stands for the World Data Center for Oceanography, Silver Spring which is collocated with NODC. WDC, Silver Spring was formerly known as "WDC-A for Oceanography". More information about the World Data Center System can be found at www.ngdc.noaa.gov/wdcnain.html.

This first WOD01 atlas volume gives general information about WOD01 data and presents yearly data distribution maps for 1941-present for all data profiles merged together (Station Data, CTD, XBT, MBT, TAO buoys). In succeeding volumes of this atlas series yearly, and in some cases seasonal profile distributions for each year are presented for each instrument type. Such data distribution plots are also invaluable as a first step of quality control. We have previously published similar maps and various individuals have informed us of location errors of some profiles.

1.1a Goals for *World Ocean Database 2001* (WOD01)

Our goal in developing and distributing WOD01 is to make available without restriction, the most complete set of historical ocean profile data and plankton measurements possible in electronic form along with appropriate metadata and quality control flags set for:

i) each individual observed level measurement,
i) "data" values at standard depth levels derived from vertical interpolation,
i) data representing an entire cruise.

As with earlier versions of NODC/WDC databases, we expect the data contained in WOD01 will find use in many different areas of oceanography, meteorology, and climatology. Whether studying the role of the ocean as part of the earth's climate system, conducting fisheries research, or managing marine resources, scientists and managers depend on observations of the marine environment in order to fulfill their mission. Oceanography is an observational science. Because of the importance of understanding climate variability as well as in attempting to forecast both natural, as well as possible anthropogenic climate variations, it is necessary to study the role of the ocean as part of the earth's climate system (IPCC (1996); WCRP (1995)).

It is important to note that WOD01 is a product based on data submitted to NODC/WDC by individual scientists and scientific teams as well as institutional, national, and regional data centers. A major contribution of NODC/WDC to the field of oceanography has been to provide centralized databases where all data and metadata are in the same format. This has allowed investigators such as Wyrtki (1971) and Levitus (1982) to construct atlases that have proven to be of utility to the scientific research and the operational forecasting communities.

1.1b Data and instrument (probe) types in WOD01

WOD01 consists of profile data from several oceanographic instrument (probe) types. We present a brief description of some of the major instrument types and/or systems that are (or were) used to make measurements which are included in WOD01. NODC instrument codes are presented by Conkright *et al.* (2002) and are also available via the NODC Home Page.

A description of various oceanographic instruments may be found in the recent publication by Emery and Thomson (1997). Detailed descriptions of instruments and measurement techniques can be found in the scientific literature, some of these sources are given in the bibliography of this atlas.

i) Ocean Station data (OSD)

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 Niskin 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, nitrite plus nitrate, phosphate, silicate, pH, alkalinity, chlorophyll, pCO_2, TCO_2 and plankton.

ii) Conductivity-Temperature-Depth data (CTD)

Conductivity-Temperature-Depth (CTD) instruments measure temperature and conductivity as a function of pressure (depth) at relatively high (often referred to as "continuous") vertical resolution. Salinity is computed from the conductivity measurement. CTD data may be submitted to NODC/WDC at sub-meter vertical resolution. These data are now archived at this resolution whereas in the past, electronic storage limitations resulted in only selected levels being stored. An earlier version of the CTD instrument was the STD (salinity-temperature-depth) which computed salinity from a conductivity sensor as the instrument was moving though the water column. Because of instrument problems that led to erroneous data values (spikes), this method was replaced by the CTD method for which conductivity measurements are recorded from the instrument and then salinity computed with appropriate calibration information. Dissolved oxygen content and chlorophyll can now be measured "continuously" with sensors placed on CTD instruments. New sensors are being developed to make "continuous" measurements of other variables. We refer to CTD "stations" or "casts" to recognize that more than one variable is being measured when a CTD instrument is deployed.

iii) Mechanical Bathythermograph data (MBT)

Mechanical Bathythermograph (MBT) instruments were developed in their modern form around 1938 (Spilhaus, 1938). The instrument provides estimates of temperature as a function of depth in the upper ocean. Earlier versions of the instrument were limited to making measurements in the upper 140 m of the water column. The last U.S. version of this instrument reached a maximum depth of 295 m. A temperature profile as a function of depth is traced on a smoked glass slide which is digitized. Pressure is determined from a pressure sensitive tube known as a Bourdon tube. One advantage of the MBT compared to lowering a reversing thermometer is that the MBT could be dropped from a moving ship and then winched aboard ship again. The accuracy of the MBT instrument is generally acknowledged to be about 0.5°F (0.3°C) (Levitus *et al.*, 1998; Boyer *et al.*, 2002). The Digital Bathythermograph (DBT) instrument is a version of the MBT that reports data electronically rather than mechanically and may reach depths deeper than 295 m. DBT profiles are included in the MBT files.

iv) Expendable Bathythermograph data (XBT)

The Expendable Bathythermograph (XBT) was deployed beginning in 1966 and has replaced the MBT in many measurement programs. There are different models of XBT instruments which have different maximum depth penetration and/or other different characteristics. The T-4, T-6, and T-7 probes reach maximum depths of 450, 750, and 750 m respectively. The T-7 probe differs from the

T-6 probe in that it can be dropped from a faster moving ship and still maintain certain accuracy standards. The T-5 probe reaches a maximum depth of about 1800 m.

The depth of a temperature measurement from an XBT instrument is determined using the time elapsed between when the probe enters the water and the time each temperature measurement is made. A vendor supplied drop-rate equation is utilized. However, the vendor supplied drop-rate equation for T-4, T-6, and T-7 probes was found to have a systematic error and a new equation has been developed by the international research community (Hanawa *et al.*, 1995; UNESCO, 1994). The recommended practice regarding exchange and archiving of XBT profiles is that XBT profile data be exchanged or sent to data centers without correction for the systematic depth error, until an "international mechanism is established to implement the general use of the new equation" (UNESCO, 1994). This policy is to avoid double corrections.

v) Moored Buoy data (MRB)

WOD01 includes moored buoy data from the TAO (Tropical Atmosphere-Ocean, central and eastern Pacific), TRITON (Japan-JAMSTEC, western Pacific), PIRATA (tropical Atlantic), and MARNET arrays. We have included only real-time MRB observations reported over the Global Telecommunication System (GTS) and stored in the Global Temperature Salinity Profile Program (GTSPP) database. Temperature and/or salinity are reported by these instruments. For a description of the TAO buoy network we refer to the work by Hayes *et al.* (1991) and McPhaden (1993, 1995).

vi) Profiling Float data (PFL)

WOD01 includes data from profiling floats which drift at subsurface levels and are preprogrammed to rise to the sea surface at pre-set intervals and record temperature and/or salinity during their ascent. Float types include Profiling Autonomous Lagrangian Circulation Explorer (P-ALACE); PROVOR (free-drifting hydrographic profiler, www.ifremer.fr/coriolis), SOLO (Sounding Oceanographic Lagrangian Observer), and APEX (Autonomous Profiling Explorer). We have included only real-time PFL observations reported over the Global Telecommunication System (GTS) and stored in the Global Temperature Salinity Profile Program (GTSPP) database (www.nodc.noaa.gov).

vii) Drifting Buoy (DRB) data

WOD01 includes data from buoys that drift at the sea surface with thermistor chains extending vertically from them that record temperature. We have included only real-time observations DRB reported over the Global Telecommunication System (GTS) and stored in the Global Temperature Salinity Profile Program (GTSPP) database.

viii) Surface only data (SURF)

WOD01 includes "surface only" (SURF) data from ship-of-opportunity programs (SOOP) and/or research cruises. Variables in the Surface Only Data Files include Temperature, Salinity, pH, Chlorophyll, Alkalinity, pCO_2, and TCO_2.

ix) Undulating Ocean Recorder data (UOR)

WOD01 includes Undulating Ocean Recorder (UOR) data from instruments (probes) mounted on a towed undulating vehicle. Data from the TOGA, JGOFS, PRIME and OMEX projects are included. Data for the following variables are included: temperature, salinity, oxygen, chlorophyll.

x) Autonomous Pinniped Bathythermograph (APB)

Marine scientists have recently initiated programs to instrument marine mammals to record environmental data and transmit these data via satellite to on-shore receivers. WOD01 includes temperature from Elephant Seals instrumented with time-temperature-depth recorders (TTDR) and ARGOS satellite platform terminal transmitters. Details of such data included in WOD01 can be found in the work of Boehlert *et al.* (2001).

1.1c Economic justification for maintaining archives of historical oceanographic data: the value of stewardship

Oceanography is an observational science and it is not possible to replace historical data that have been lost. From this point of view, historical measurements of the ocean are priceless. However, in order to provide input to a "cost-benefit" analysis of the activities of oceanographic data centers and specialized data rescue projects, we can estimate the costs incurred if we wanted to resurvey the world ocean today, in the same manner as represented by the WOD01 Ocean Station Data (OSD) profile archive.

The computation we describe was first performed in 1982 by Mr. Rene Cuzon du Rest, of NODC. We use an average operating cost of $20,000. per day for a medium-sized U.S. research ship with a capability to make two "deep" casts per day or 10 "shallow" casts per day. We define a "deep" cast as extending to a depth of more than 1000 m and a "shallow" cast as extending to less than 1000 m. This is an arbitrary definition but we are only trying to provide a coarse estimate of replacement costs for this database. Using this definition, WOD01 contains approximately 1.8 million shallow casts so that the cost of the ship time to perform these measurements is approximately $3.6 billion. In addition WOD01 contains 323,000 profiles deeper than 1000 m depth, so the cost in ship time to make these "deep" measurements is approximately $3.2 billion. Thus, the total replacement cost of the OSD archive is about $6.8 billion, a figure based only on ship-time operating costs, not salaries for scientists or any other costs.

1.1d Data fusion

It is not uncommon in oceanography that measurements of different variables made from the same sea water samples, are often maintained as separate databases by different principal investigators. In fact, data from the same oceanographic cast may be located at different institutions in different countries. From its inception, NODC recognized the importance of building oceanographic databases in which as much data from each station and each cruise as possible are placed into standard formats, accompanied by appropriate metadata that make the data useful to future generations of scientists. It was the existence of such databases that allowed the *International Indian Ocean Expedition Atlas* (Wyrtki, 1971) and *Climatological Atlas of the World Ocean* (Levitus, 1982) to be produced without the time-consuming, laborious task of gathering data from many different sources. Part of the development of WOD01 has been to expand this data fusion activity by increasing the number of

variables that NODC/WDC makes available as part of standardized databases.

1.1e Distribution media

WOD01 is being distributed on-line (www.noaa.nodc.gov) and on CD-ROMs with all data compressed in DOS format. Based on requests by users of our earlier products, the OCL developed a new ASCII format to make the most efficient use of space on storage media used to transfer data to users. To further minimize storage space requirements, the data have been compressed with the GZIP utility (Conkright *et al.*, 2002). Even with compression, there are seven CD-ROMs containing all profile data in WOD01 at observed levels and one CD-ROM containing all profile data in WOD01 at standard levels. Without compression, the number of CD-ROMs required to distribute the WOD01 database would total about sixteen.

1.1f Application software interfaces

We have included software conversion routines so that users of software packages, databases, and programming languages such as MATLAB, IDL, PC-Surfer, C, and FORTRAN can access the data in WOD01. An effort is in progress to develop a JAVA based interface for viewing data from the WOD01 CD-ROMs. In response to user requests, we have defined the WOD01 format to be as "self defining" as possible so as to eliminate, or at least minimize, the need for any structural changes to the format when new data or instrument types are added or increases in data precision occur. We do not envision any substantial changes to our present data format. We will use the Internet to make available additional convertors, Graphical User Interfaces (GUI), and other software tools that become available.

2. COMPARISON OF WOD01 WITH PREVIOUS GLOBAL OCEAN PROFILE DATABASES

Table 1 shows the amount of data available from different instrument (probe) types that were used in earlier global oceanographic analyses. During the past three years, the archives of historical oceanographic data have grown due to special data management and data observation projects that we discuss in section 3.1 of this atlas, as well as due to normal submission by scientists and operational ocean monitoring programs. With the distribution of WOD01 there are now approximately 7.1 million temperature profiles and 1.5 million salinity profiles (as well as other profile data and plankton data) available to the international research community in a common format with associated metadata and quality control flags. There has been a net increase of about 1.7 million temperature profiles since publication of *World Ocean Database 1998.*

Comparison of the yearly data distribution maps shown in Appendix A of this publication with similar maps shown by Levitus *et al.* (1998b) document that there is now much better data coverage in many years and regions since publication of WOD98. For example, Figs. 1a-c show the distribution of all profile data for 1969 based on: a) the WOD98 database b) the WOD01 and c) the profiles added for 1969 in the compilation of WOD01. There is an obvious increase in the data coverage in space. Table 2 shows a comparison of the total number of Ocean Station Data variables at the sea surface with previous databases.

3. DATA SOURCES

The oceanographic data that comprise WOD01 have been acquired through many sources and projects as well as from individual scientists. Some of the international data exchange organizations are described.

The International Council for the Exploration of the Sea (ICES) was established in 1902 and began collecting and distributing oceanographic data. The pioneering and excellent work in international oceanographic data management and exchange of ICES continues under the guidance of Dr. Harry Dooley.

The International Oceanographic Data Exchange (IODE) activities of the Intergovernmental Oceanographic Commission (IOC), have been responsible for the development of a network of National Oceanographic Data Centers in many countries. This network greatly facilitates international ocean data exchange. The IOC was established to support international oceanographic scientific needs including data exchange on an intergovernmental basis (UNESCO, 1979). Additional information about IODE can be found on their Web Page, **www.unesco.org/iode**).

The World Data Center System was set up during the International Geophysical Year under the auspices of the International Council of Scientific Unions (ICSU, 1996; Rishbeth, 1991; Ruttenberg and Rishbeth, 1994). Contributions of data from scientists, oceanographic institutions, and countries have been sent to WDC for Oceanography, Silver Spring since its inception. There are two other World Data centers for Oceanography. WDC for Oceanography, Obninsk (formerly WDC-B for Oceanography) is located in Russia and WDC for Oceanography, Tianjin is located in China. Additional information about the World Data Center System can be found on the following Web Page, **www.ngdc.noaa.gov/wdc/wdcmain.html**) hosted by the National Geophysical Data Center located in Boulder, Colorado .

3.1 Project results

3.1a IOC *Global Oceanographic Data Archaeology and Rescue Project*

NODC and several other oceanographic data centers initiated "data archaeology and rescue" projects around 1991. Based on the success of these projects, the Intergovernmental Oceanographic Commission of UNESCO initiated a project in 1993 known as the "Global Oceanographic Data Archaeology and Rescue" (GODAR) project with the goal of "locating and rescuing" oceanographic data that are stored in manuscript and/or digital form, that are at risk of being lost due to media decay. The international scientific and data management communities have strongly supported this project. Results from the first phase of this project were described by Levitus *et al.* (1994). With the publication and distribution of WOD01, approximately 3.7 million temperature profiles have been added to the historical archives of oceanographic data since inception of various national data archaeology and rescue projects and the IOC/GODAR project in 1991, and the NODC/WDC "Global Ocean Database Project" in 1996. The status of these projects to date is described by Levitus *et al.* (2002). A partial list of some data sets added since publication of WOD98 is given in Table 3.

3.1b *World Ocean Database Project*

During 1995, World Data Center for Oceanography, Silver Spring initiated a project entitled "*Global Ocean Database*" with support from the NOAA/ESDIM program. This project was instituted because it was recognized that there are substantial oceanographic data in digital form at oceanographic institutes around the world, that while not at risk of being lost due to media degradation or neglect, have not been submitted to the WDC system. WDC for Oceanography has begun requesting institutions to transfer their entire ocean profile and plankton archives to WDC for Oceanography. After receipt at NODC/WDC, the data in these databases are compared to existing data holdings and duplicates and "near duplicates" are eliminated before data are added to the NODC/WDC archives. A substantial effort is involved, but the improvements to the archives greatly serves the user community.

The response to WDC requests for data has been excellent as partially summarized in Table 4. We emphasize that some of, and in some cases the majority of, the data submitted by these institutions may have already existed in NODC/WDC databases. However, we have frequently found that there are large numbers of casts that were thought to be in these databases that were in fact not present. In addition, there were large number of Ocean Station Data casts for which the NODC/WDC databases had temperature and salinity data but not data for other variables (*e.g.*, chlorophyll). These additional data were merged in with the profiles from the existing stations. There were also cases for which the NODC/WDC databases had data only at standard or selected levels. We replaced these data profiles with the corresponding observed level profiles.

In 2001 the IOC initiated a "*World Ocean Database Project*". The goals of this project are to encourage more rapid exchange of modern oceanographic data and to encourage the development of regional oceanographic databases, regional quality control procedures for oceanographic data and regional atlases.

3.1c *IOC Global Temperature-Salinity Profile Program*

The Global Temperature-Salinity Profile Program (GTSPP) (Searle, 1992; IOC, 1998) is a project sponsored by the Intergovernmental Oceanographic Commission to develop databases of temperature-salinity profiles reported in "real-time". The GTSPP files include data from moored buoys (identified in WOD98 as "fixed platforms") such as the NOAA Tropical Atmosphere-Ocean (TAO) array of buoys (Hayes *et al.*, 1991; McPhaden, 1993, 1995) in the Pacific Ocean and from other buoy programs such as TRITON and PIRATA. We incorporated XBT and TAO buoy profiles from this database into WOD01 for the period inclusive through August 2001.

Users wanting GTSPP data after this date can acquire the data over the Internet via the NODC website www.nodc.noaa.gov or by contacting the NODC user Services group (**services@nodc.noaa.gov**).

Users wanting the complete TAO buoy database comprised of data that have had the benefit of additional PMEL processing and quality control, can find instructions for acquiring these data via the Home Page of the Pacific Marine Environmental Laboratory (**www.pmel.noaa.gov**).

3.1d National, regional and international project data sets

The MAST (Marine Science and Technology Programme) program of the European community has promoted international oceanographic data exchange by emphasizing that MAST funded projects must contribute data to appropriate data centers. Some of these contributions are listed in Table 4.

It has become more common for all data from a particular project to be released on CD-ROM as a project data set. We have incorporated data from these CD-ROMs into the WOD01. Examples include: the British Ocean Flux Study (BOFS) and Ocean Margins Experiment (OMEX) datasets produced by the British Oceanographic Data Center and the North Sea Project Database sponsored by the MAST program of the European Community.

3.1e *International Research Projects* data

Data from the WOCE CD-ROM version 2 (CTD and OSD profiles) are included in WOD01. Some WOCE XBT profiles are also part of WOD01. Data from the Joint Global Ocean Flux Study (JGOFS) and the Global Ocean Ecosystem Dynamics (GLOBEC) are also included.

3.2 ICES contribution

As part of the World Ocean Database project, WDC requested that the International Council for the Exploration of the Sea (ICES) data center transfer their archives of publically available data to NODC/WDC. Table 5 shows the data transferred to date. While some of these data already existed in the NODC/WDC profile databases, many were not there.

3.3 Declassified naval data sets

As a result of the end of the Cold War, the navies of several countries have declassified substantial amounts of oceanographic data that were formerly classified, in some cases at the request of the Intergovernmental Oceanographic Commission. Table 6 shows the amount of data recently declassified and transferred to NODC/WDC. It should be recognized that some navies have policies of declassifying substantial amounts of data in real time or with relatively short time delays. For example, the U.S. Navy has contributed approximately 435,000 MBT profiles and the U.S. Coast Guard approximately 217,000 MBT profiles to the NODC/WDC databases. Also, the Australian Navy reports profile data in real-time including data from their Exclusive Economic Zone (EEZ).

3.4 Integrated Global Ocean Service - Volunteer Observing Ship programs

Since the pioneering work of Mathew Maury beginning in 1854, there have been programs in existence to gather meteorological and oceanographic data from merchant ships. These ships are sometimes referred to as Voluntary Observing Ships (VOS) and the programs called Ship-of-Opportunity Programs (SOOP). During the 1970's, the U.S. and France (Scripps Institute of Oceanography and ORSTOM, New Caledonia) began a SOOP program that focused on the deployment of XBT instruments from VOS platforms in the Pacific Ocean (White, 1995). This program expanded to include the Atlantic and Pacific Oceans and is now supported by NOAA Ship-of-Opportunity Program. Several countries are conducting SOOPs or have conducted them. These programs are coordinated internationally by the World Meteorological Organization (WMO) and the

Intergovernmental Oceanographic Commission (IOC). A description of the status of many of these programs can be found in the report, IOC (1989). As described in this report, Australia, Canada, Chile, Germany, Japan, United Kingdom, and Russia have conducted such programs in addition to France and the U.S. A more recent summary of the status of the system is given by Joint IOC-WMO Committee for IGOSS (1996).

3.4a NOAA Ship-of-Opportunity Program (SOOP)

The NOAA SOOP program acquires surface meteorological data and XBT profiles from instruments placed on Volunteer Observing Ships participating in the program. The automated system for acquiring and transmitting these data is known as SEAS (Shipboard Environmental Acquisition System). Data are transmitted via satellite and eventually stored at NODC/WDC. Approximately 20,000 XBT probes are deployed each year as a result of this effort.

3.4b SURTROPAC

The SURTROPAC program is a French Ship-of-Opportunity Program that uses Volunteer Observing Ships to make measurements of sea surface temperature, salinity, and chlorophyll (Dandonneau, 1992). These data are in the SURF file in WOD01.

3.4c Underway CO_2

Surface measurements of pCO_2 and TCO_2 have been included from SOOP programs (Murphy *et al.*, 2001; Zeng *et al.*, 2002) and research cruises (Inoue and Sugimura 1998; Keeling *et al.*, 1965; Murphy *et al.*, 1995; Takahashi *et al.*, 1980; Wanninkhof and Thoning 1993; Weiss *et al.*, 1992; Wong and Chan, 1991; Wong *et al.*, 1995).

4. QUALITY CONTROL FLAGS

Each individual data value and each profile in WOD01 has quality control flags associated with it. A description of these flags and general documentation describing software to read and use the WOD01 database are found in the report by Conkright *et al.* (2002). WOD01 now includes Quality Control Flags assigned by principal investigators. Users can choose to accept or ignore these flags. It is clear that there are both Type I and Type II statistical errors (for normal distributions) associated with these flags. There are some data that have been flagged as being questionable or unrepresentative when in fact they are not. There are some data that have been flagged as being "acceptable" based on our tests which in fact may not be the case. In addition, the sparsity of data, non-normal frequency distributions, and presence of different water masses in close proximity results in incorrect assignment of flags.

The obvious advantage of flagging data is that users can choose to accept or ignore all or part of the flags we assign to data values. The most important flags we set are those that are set based on unusual features produced during objective analyses of the data at standard levels. This is because standard statistical tests may be biased for the reasons described above. Data from small-scale ocean features such as eddies and/or lenses are not representative of the large-scale permanent or semipermanent features we attempt to reproduce with our analyses and will cause unrealistic features such as bull's-eyes to appear. Hence, we flag these data, and other data that cause such features, as

being unrealistic or as questionable data values. It is important to note that an investigator studying the distribution of mesoscale features in the ocean will find data from such features to be the signal he/she is looking for. As noted by Levitus (1982), it is not possible to produce one set of data analyses to serve the requirements of all possible users. A corollary is that it is not possible to produce one set of quality control flags for a database that serve the exact requirements of all investigators. As data are added to a database, investigators must realize that flags set for having violated certain criteria in an earlier version of the database may be reset solely due to the addition of new data which may change the statistics of the region being considered. Even data that have produced unrealistic features may turn out to be realistic when additional data are added to a region of sparse data. Conkright *et al.* (1994b) present the objectively analyzed field of silicate at 1000 m depth using all silicate data available as part of WOA94 and using only data flagged as being acceptable. The differences are obvious.

5. XBT DROP RATE ERROR

The XBT instrument does not measure pressure or depth directly. The depth of an XBT instrument as it falls through the water column is computed from the elapsed time from when the probe enters the water through use of a drop-rate equation. There are several models of the Sippican Expendable Bathythermograph instrument. The manufacturer's drop rate equation for the T4, T-6, and T-7 models are known to contain a systematic error. The systematic error in calculated depth can be as large as 25-30 m at depths of 750 m. To correct for this error a new drop rate equation has been computed (Hanawa *et al.*, 1995; UNESCO, 1994). By international agreement (UNESCO, 1994), XBT profile depths are supposed to be reported to and archived at data centers using the "old' drop-rate equation. This policy is to avoid possible confusion as to whether the profiles have been converted or not. NODC/WDC archives the XBT data as submitted. In fact, some data are submitted using the new drop-rate formula although none of these data are in WOD01. This fact can be demonstrated by using a code in the observed level profile metadata (Conkright *et al.*, 2002).

The observed level XBT profiles are the same data as submitted by originators. However, in preparing standard level data for WOD01, the NODC/OCL corrected the depths of the originator's XBT profiles using the new drop-rate equation, before interpolating to standard levels.

6. STATISTICS OF INDIVIDUAL INSTRUMENT TYPES

We present a series of figures and tables which document the status of the archives of historical ocean profile through the presentation of summary statistics. More detailed information is presented in the individual volumes of WOD01, each describing the historical distributions of an individual instrument or measurement type (e.g. CTD, MBT, XBT, OSD temperature and salinity, nutrients, chlorophyll, pH, alkalinity, pCO_2, and TCO_2 and plankton data).

Table 7 shows the number of stations or profiles in WOD01 submitted by individual country for the OSD, CTD, MBT, and XBT files. This table is sorted by NODC country code. Table 8 shows the same information sorted alphabetically by country name. Tables 9-12 give the contribution by each country of OSD, MBT, XBT, and CTD stations or profiles with each table sorted in descending order by percent contribution.

Figs. 2-4 shows the time series of the yearly totals of Ocean Station Data stations for the World Ocean, southern hemisphere oceans, and northern hemisphere oceans respectively. Tables 13-15 give the yearly counts of OSD stations in table form for the World Ocean, southern hemisphere oceans and northern hemisphere oceans respectively. Fig. 5 shows the distribution of all OSD stations in WOD01.

Figs. 6-8 shows the time series of the yearly totals of Conductivity-Temperature-Depth stations for the World Ocean, southern hemisphere oceans, and northern hemisphere oceans respectively, Tables 16-18 give the yearly counts of CTD stations in table form for the World Ocean, southern hemisphere oceans, and northern hemisphere oceans respectively. Fig. 9 shows the distribution of all CTD stations in WOD01.

Figs. 10-12 shows the time series of the yearly totals of Mechanical Bathythermograph profiles for the World Ocean, southern hemisphere oceans, and northern hemisphere oceans respectively, Tables 19-21 give the yearly counts of MBT profiles for the World Ocean, southern hemisphere oceans, and northern hemisphere oceans respectively. Fig. 13 shows the distribution of all MBT profiles in WOD01.

Figs. 14-16 shows the time series of the yearly totals of Expendable Bathythermograph profiles for the World Ocean, southern hemisphere oceans, and northern hemisphere oceans respectively. Tables 22-24 give the yearly counts of XBT profiles in table form for the World Ocean, southern hemisphere oceans, and northern hemisphere oceans respectively. Fig. 17 shows the distribution of all XBT profiles in WOD01.

Tables 25-37 give the yearly counts of the number of profiles/casts for APB, MRB, PFL, DRB, and UOR. Figs. 18-35 shows the distribution of APB, MRB, PFL, DRB, and UOR profiles/casts.

Fig. 36 shows the distribution of all stations and/or profiles in WOD01 merged together. Table 38 provides the yearly counts of all profiles/casts merged together.

Appendix A is comprised of figures that show the combined yearly distributions of all ocean stations and profiles merged together (OSD+MBT+XBT+CTD+MRB+DRB+PFL+APB) for the period 1941-2001.

7. OUTLOOK FOR FUTURE ACQUISITIONS OF HISTORICAL OCEAN PROFILE AND PLANKTON DATA AND INTERNATIONAL COOPERATION IN A "GLOBAL OCEAN DATABASE PROJECT"

Substantial amounts of historical ocean data continue to be transferred to NODC/WDC for inclusion into databases. The outlook for continuing to be able to increase the amount of such data available to the scientific community is excellent. Based on the positive results of the IOC/GODAR project and the Global Ocean Database Project, we have requested the continued cooperation of the international scientific and data management communities in building the historical ocean data archives. There is a particular need for high resolution CTD data so that we can resolve smaller scale features in the vertical and thus provide objective analyses of variables at greater vertical resolution than present. Examination of the distribution of high resolution CTD profiles shown in Fig. 6 and by Boyer *et al.* (2002) documents the lack of such data for global scale analyses. There is a need for additional

historical chlorophyll, nutrient, oxygen, and plankton data so we can improve understanding of ocean biogeochemical cycles.

Improving the quality of historical data and their associated metadata is a important task. Corrections to possible errors in data and metadata is best done with the expertise of the principal investigators who made the original observations, the data center or group that prepared the data, or be based on historical documents such as cruise and data reports (however, one has to also consider that these documents may contain errors). The continuing response of the international oceanographic community to the GODAR project and the Global Ocean Database Project have been excellent. This response has resulted in global ocean databases that can be used internationally without restriction for the study of many environmental problems.

As the amount of historical oceanographic data continues to increase as a result of international cooperation, the scientific community will be able to make more and more realistic estimates of variability and be able to place confidence intervals on the magnitude of temporal variability of the more frequently sampled variables such as temperature.

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Table 1. Comparison of the number of stations in WOD01 with previous world ocean databases.

Data type	Climatological Atlas of the World Ocean (1982)	WOA94	WOD98	WOD01
Station data and low resolution C/STD casts	425,000	1,194,407	1,373,440	2,121,042
High resolution CTD casts	na	89,000	189,555	311,943
MBT profiles	775,000	1,922,170	2,077,200	2,376,206
XBT profiles	290,000	1,281,942	1,537,203	1,743,590
Moored Buoys	na	na	107,715	297,936
Drifting Buoys	na	na	na	50,549
Profiling Floats	na	na	na	22,637
Undulating Oceanographic Recorders	na	na	na	37,645
Autonomous Pinniped Bathythermograph	na	na	na	75,665
Total Stations	**1,490,000**	**4,487,519**	**5,285,113**	**7,037,213**
Surface only data* (cruises)	na	na	na	4,743*

***** Surface data are represented differently in the database - all observations in a single cruise have been combined into one "station" with depth, value of variable measured and latitude, longitude, and Julian year day to identify data and position of individual observations.

Table 1a. Instrument types in the WOD01

DIRECTORY	SOURCE
OSD	Bottle, low resolution *Conductivity-Temperature-Depth* (CTD), and plankton data
CTD	High resolution *Conductivity-Temperature-Depth* (CTD) data
MBT	Mechanical Bathythermograph (MBT) data
XBT	Expendable (XBT) data
SURF	Surface only data
APB	Autonomous Pinniped Bathythermograph - Time-Temperature Depth recorders attached to elephant seals
MRB	Moored buoy data from TAO (Tropical Atmosphere-Ocean), PIRATA (moored array in the tropical Atlantic), MARNET, and TRITON (Japan-JAMSTEC)
PFL	Profiling float data from Profiling Autonomous Lagrangian Circulation Explorer (P-ALACE) subsurface drifting floats; PROVOR (free-drifting hydrographic profiler), SOLO (Sounding Oceanographic Lagrangian Observer), and APEX (Autonomous Profiling Explorer)
DRB	Drifting buoy data from surface drifting buoys with thermister chains
UOR	Undulating Oceanographic Recorder data from a Conductivity/Temperature/Depth probe mounted on a towed undulating vehicle;

Table 2. Comparison of the number of sea surface observations in WOD01 of several Ocean Station Data variables with previous databases.

Variable	CLIMATOLOGICAL ATLAS OF THE WORLD	WOA94	WOD98	WOD01
Temperature	425,000	1,194,000	1,439,209	1,951,170
Salinity	399,429	1,034,091	1,343,580	1,767,283
Oxygen	159,016	324,627	480,718	586,277
Phosphate	na	171,064	279,011	373,141
Silicate	na	80,235	186,226	261,774
Nitrate	na	61,817	144,523	208,573
pH	na	na	103,338	130,863
Alkalinity	na	na	6,759	22,268
Chlorophyll	na	na	131,690	128,558
Plankton	na	na	na	148,243
pCO_2	na	na	na	2,159
TCO_2	na	na	na	6,018
Nitrate+Nitrite	na	na	na	9,382
Pressure	na	na	na	57,748

Table 3. Some GODAR contributions since publication of WOD98.

Country	Institution or Project	Station Data	XBT	MBT	CTD
Multi-Country	MEDAR/MEDATLAS	6902	7984	23469	13306
Russia	Murmansk Marine Biological Institute	9968	0	0	0
Ukraine	Southern Scientific Research Institute of Marine Fisheries and Oceanography (YugNIRO)	16765	0	28369	0
	Marine Hydrophysical Institute	24	0	0	1527
United States	Woods Hole Oceanographic Institution	10659	0	0	0

Table 4. Some recent contributions of electronic data sets to the *Global and World Ocean Database Projects* from individual countries, institutions and projects.

Country or Agency	Institution or Project	Station Data	XBT	MBT	CTD
Australia	CSIRO (Hobart)	3866	13107	99	2339
Canada	Includes: Marine Environmental Data Service, Institute of Ocean Sciences, and Bedford Institute	6466	2526	3957	24411
Chile	Naval Hydrographic Institute	3018	3	88	3970
Ecuador	Hydrographic Oceanographic Services	1127	0	0	217
France	IFREMER	4771	10258	12947	5877
Japan	Includes: Japan Oceanographic Data Center and MIRC	305540	29135	109074	503
Multi-Country	JGOFS	4962	0	301	4264
	WOCE	5556	0	6461	7048
Republic of Korea	Korean Oceanographic Data Center	11525	0	0	1
United Kingdom	Includes: British Oceanographic Data Center projects: BOFS, North Sea, and OMEX; British Hydrographic Office	34120	4557	11505	2945

Table 5. Contributions of digital data through the ICES Data Center.

Country	Station Data	CTD
Belgium	9220	212
Denmark	32218	729
Finland	46379	251
Iceland	18708	1816
Ireland	2981	10
Netherlands	26139	1856
Norway	94020	8469
Poland	16528	1391
Portugal	6472	1289
Spain	2865	4400
Sweden	51852	165

Table 6. Naval contributions of digital oceanographic cast data.

Country	XBT	MBT	CTD	Station Data
Argentina	1009	6883	73	2324
Russia	1078	42547	32	31622
Turkey	0	0	0	227
United Kingdom	36976	58352	883	31

Table 7 National contributions of OSD, MBT, XBT, CTD casts sorted by NODC Country Code

NODC Country Code	Country Name	OSD Count	% of Total	MBT Count	% of Total	XBT Count	% of Total	CTD Count	% of Total
1	NOT USED	0	0.00	0	0.00	0	0.00	0	0.00
2	NOT USED	0	0.00	0	0.00	0	0.00	0	0.00
3	NOT USED	0	0.00	0	0.00	0	0.00	0	0.00
4	NOT USED	0	0.00	0	0.00	0	0.00	0	0.00
5	NOT USED	0	0.00	0	0.00	0	0.00	0	0.00
6	GERMANY, FEDERAL REPUBLIC OF	63412	2.99	25005	1.05	56544	3.24	24355	7.80
7	GERMANY, DEMOCRATIC REPUBLIC	15083	0.71	0	0.00	67	0.00	823	0.26
8	ARGENTINA	3410	0.16	12303	0.52	2184	0.13	319	0.10
9	AUSTRALIA	32332	1.52	18474	0.78	83155	4.77	7336	2.35
10	AUSTRIA	488	0.02	0	0.00	0	0.00	0	0.00
11	BELGIUM	9220	0.43	1218	0.05	0	0.00	212	0.07
12	BURMA	0	0.00	0	0.00	0	0.00	0	0.00
13	BOLIVIA	0	0.00	0	0.00	0	0.00	0	0.00
14	BRAZIL	9464	0.45	82	0.00	218	0.01	0	0.00
15	BULGARIA	0	0.00	0	0.00	0	0.00	0	0.00
16	NOT USED	0	0.00	0	0.00	0	0.00	0	0.00
17	CAMEROON	0	0.00	0	0.00	0	0.00	0	0.00
18	CANADA	113770	5.36	195947	8.24	48664	2.79	75612	24.21
19	SRI LANKA	0	0.00	0	0.00	0	0.00	0	0.00
20	CHILE	4311	0.20	4161	0.18	2438	0.14	4015	1.29
21	TAIWAN	3027	0.14	0	0.00	3	0.00	107	0.03
22	COLOMBIA	1338	0.06	747	0.03	32	0.00	0	0.00
23	NOT USED	0	0.00	0	0.00	0	0.00	0	0.00
24	KOREA, REPUBLIC OF	39707	1.87	847	0.04	53	0.00	28	0.01
25	NOT USED	0	0.00	0	0.00	0	0.00	0	0.00
26	DENMARK	32220	1.52	0	0.00	5724	0.33	729	0.23
27	ARAB REPUBLIC OF EGYPT	258	0.01	0	0.00	0	0.00	0	0.00
28	ECUADOR	3498	0.16	885	0.04	492	0.03	217	0.07
29	SPAIN	2868	0.14	195	0.01	2995	0.17	4400	1.41
30	NOT USED	0	0.00	0	0.00	0	0.00	0	0.00
31	UNITED STATES	297275	14.00	1100903	46.31	548779	31.47	90067	28.84
32	UNITED STATES	12673	0.60	46660	1.96	248328	14.24	30417	9.74
33	UNITED STATES	5647	0.27	23103	0.97	8874	0.51	1493	0.48
34	FINLAND	46381	2.18	0	0.00	0	0.00	251	0.08
35	FRANCE	36154	1.70	13538	0.57	45690	2.62	16548	5.30
36	GREECE	324	0.02	327	0.01	0	0.00	336	0.11
37	GUATEMALA	0	0.00	0	0.00	0	0.00	0	0.00
38	HAITI	0	0.00	0	0.00	0	0.00	0	0.00
39	NOT USED	0	0.00	0	0.00	0	0.00	0	0.00
40	NOT USED	0	0.00	0	0.00	0	0.00	0	0.00
41	INDIA	4477	0.21	540	0.02	362	0.02	143	0.05
42	INDONESIA	4291	0.20	0	0.00	1214	0.07	159	0.05
43	IRAQ	0	0.00	0	0.00	0	0.00	0	0.00

NODC Country Code	Country Name	OSD Count	% of Total	MBT Count	% of Total	XBT Count	% of Total	CTD Count	% of Total
44	IRAN	0	0.00	0	0.00	0	0.00	0	0.00
45	IRELAND	2981	0.14	0	0.00	0	0.00	10	0.00
46	ICELAND	18708	0.88	0	0.00	4348	0.25	1816	0.58
47	ISRAEL	3051	0.14	0	0.00	0	0.00	195	0.06
48	ITALY	10150	0.48	6268	0.26	772	0.04	8109	2.60
49	JAPAN	525565	24.75	335247	14.10	236424	13.56	1158	0.37
50	JORDAN	0	0.00	0	0.00	0	0.00	0	0.00
51	JAPAN	0	0.00	0	0.00	0	0.00	0	0.00
52	LEBANON	0	0.00	0	0.00	0	0.00	0	0.00
53	LIBYA	0	0.00	0	0.00	0	0.00	0	0.00
54	LIBERIA	0	0.00	0	0.00	33290	1.91	0	0.00
55	MALAGASY REPUBLIC	2524	0.12	405	0.02	62	0.00	0	0.00
56	MOROCCO	0	0.00	0	0.00	0	0.00	0	0.00
57	MEXICO	1283	0.06	0	0.00	2234	0.13	59	0.02
58	NORWAY	94020	4.43	913	0.04	6908	0.40	8469	2.71
59	NEW CALEDONIA	1344	0.06	0	0.00	0	0.00	0	0.00
60	JAPAN	40	0.00	0	0.00	0	0.00	0	0.00
61	NEW ZEALAND	1917	0.09	2435	0.10	5587	0.32	102	0.03
62	PAKISTAN	179	0.01	0	0.00	0	0.00	0	0.00
63	NOT USED	0	0.00	0	0.00	0	0.00	0	0.00
64	NETHERLANDS	26139	1.23	8088	0.34	15294	0.88	1856	0.59
65	PERU	4203	0.20	5212	0.22	714	0.04	0	0.00
66	PHILIPPINES	235	0.01	0	0.00	2298	0.13	0	0.00
67	POLAND	16528	0.78	0	0.00	1320	0.08	1391	0.45
68	PORTUGAL	6473	0.30	2628	0.11	732	0.04	1289	0.41
69	NOT USED	0	0.00	0	0.00	0	0.00	0	0.00
70	DOMINICAN REPUBLIC	0	0.00	0	0.00	0	0.00	0	0.00
71	NOT USED	0	0.00	0	0.00	0	0.00	0	0.00
72	ALBANIA	0	0.00	0	0.00	0	0.00	0	0.00
73	ROMANIA	0	0.00	0	0.00	0	0.00	0	0.00
74	UNITED KINGDOM	132058	6.22	118644	4.99	164948	9.46	10476	3.35
75	EL SALVADOR	0	0.00	0	0.00	0	0.00	0	0.00
76	CHINA, THE PEOPLES REPUBLIC OF	5590	0.26	0	0.00	4568	0.26	2701	0.86
77	SWEDEN	51852	2.44	0	0.00	4552	0.26	165	0.05
78	SWITZERLAND	0	0.00	0	0.00	0	0.00	0	0.00
79	SURINAM	0	0.00	0	0.00	0	0.00	0	0.00
80	SYRIA	0	0.00	0	0.00	0	0.00	0	0.00
81	NOT USED	0	0.00	0	0.00	0	0.00	0	0.00
82	NOT USED	0	0.00	0	0.00	0	0.00	0	0.00
83	NOT USED	0	0	0	0.00	0	0.00	0	0.00
84	NOT USED	0	0	0	0	0	0	0	0
85	NOT USED	0	0.00	0	0.00	0	0.00	0	0.00
86	THAILAND	2801	0.13	77	0.00	29	0.00	0	0.00
87	TOGO	0	0.00	0	0.00	0	0.00	0	0.00
88	TUNISIA	280	0.01	0	0.00	0	0.00	0	0.00
89	TURKEY	301	0.01	0	0.00	0	0.00	199	0.06

NODC Country Code	Country Name	OSD Count	% of Total	MBT Count	% of Total	XBT Count	% of Total	CTD Count	% of Total
90	RUSSIA	335954	15.82	432966	18.21	14578	0.84	13689	4.38
91	SOUTH AFRICA	27593	1.30	20	0.00	5890	0.34	2028	0.65
92	URUGUAY	0	0.00	0	0.00	146	0.01	0	0.00
93	VENEZUELA	3574	0.17	673	0.03	0	0.00	0	0.00
94	VIET-NAM	0	0.00	0	0.00	0	0.00	0	0.00
95	YUGOSLAVIA	5404	0.25	0	0.00	173	0.01	0	0.00
96	NOT USED	0	0.00	0	0.00	0	0.00	0	0.00
97	NOT USED	0	0.00	0	0.00	0	0.00	0	0.00
98	NOT USED	0	0.00	0	0.00	0	0.00	0	0.00
99	UNKNOWN	67807	3.19	16636	0.70	96321	5.52	475	0.15
0	NOT USED	0	0.00	0	0.00	0	0.00	0	0.00
AG	ANTIGUA	0	0.00	0	0.00	6975	0.40	0	0.00
AL	ALGERIA	0	0.00	0	0.00	0	0.00	0	0.00
AN	ANGOLA	621	0.03	0	0.00	0	0.00	0	0.00
BA	BARBADOS	0	0.00	0	0.00	2601	0.15	0	0.00
BH	BAHAMAS	0	0.00	0	0.00	9713	0.56	0	0.00
BN	BONAIRE	0	0.00	0	0.00	0	0.00	0	0.00
CA	CURACAO	0	0.00	0	0.00	0	0.00	0	0.00
CI	CAYMAN ISLANDS	0	0.00	0	0.00	0	0.00	0	0.00
CR	COSTA RICA	0	0.00	0	0.00	29	0.00	0	0.00
CU	CUBA	969	0.05	0	0.00	0	0.00	0	0.00
CV	CAPE VERDE	0	0.00	0	0.00	0	0.00	0	0.00
CY	CYPRUS	0	0.00	0	0.00	2258	0.13	0	0.00
ES	ESTONIA	0	0.00	0	0.00	0	0.00	0	0.00
ET	ETHIOPIA	0	0.00	0	0.00	0	0.00	0	0.00
FJ	FIJI ISLANDS	0	0.00	0	0.00	866	0.05	0	0.00
GA	GABON	0	0.00	0	0.00	0	0.00	0	0.00
GH	GHANA	2670	0.13	12	0.00	0	0.00	0	0.00
GM	GAMBIA	0	0.00	0	0.00	0	0.00	0	0.00
GN	GUINEA-BISSAU	0	0.00	0	0.00	0	0.00	0	0.00
GR	GRENADA	0	0.00	0	0.00	0	0.00	0	0.00
GU	GUINEA	0	0.00	0	0.00	0	0.00	0	0.00
GY	GUYANA	0	0.00	0	0.00	0	0.00	0	0.00
HO	HONDURAS	0	0.00	0	0.00	12	0.00	0	0.00
HK	HONG KONG	0	0.00	0	0.00	3210	0.18	0	0.00
IC	IVORY COAST	3068	0.14	100	0.00	43	0.00	0	0.00
IN	INTERNATIONAL	0	0.00	0	0.00	0	0.00	0	0.00
JA	JAMAICA	0	0.00	0	0.00	0	0.00	0	0.00
KE	KENYA	0	0.00	0	0.00	0	0.00	0	0.00
KU	KUWAIT	0	0.00	0	0.00	1812	0.10	0	0.00
LA	LATVIA	0	0.00	0	0.00	0	0.00	0	0.00
LT	LITHUANIA	0	0.00	0	0.00	0	0.00	0	0.00
MA	MAURITIUS	0	0.00	0	0.00	77	0.00	0	0.00
ML	MALTA	0	0.00	0	0.00	431	0.02	0	0.00
MO	MONACO	2087	0.10	97	0.00	0	0.00	0	0.00
MS	MALAYSIA	154	0.01	0	0.00	0	0.00	0	0.00

NODC Country Code	Country Name	OSD Count	% of Total	MBT Count	% of Total	XBT Count	% of Total	CTD Count	% of Total
MU	MAURITANIA	1217	0.06	0	0.00	0	0.00	0	0.00
MZ	MOZAMBIQUE	0	0.00	0	0.00	0	0.00	0	0.00
NC	NICARAGUA	0	0.00	0	0.00	0	0.00	0	0.00
NI	NIGERIA	759	0.04	89	0.00	0	0.00	0	0.00
OM	OMAN	0	0.00	0	0.00	0	0.00	0	0.00
PA	PANAMA	139	0.01	0	0.00	32697	1.88	0	0.00
QA	QATAR	0	0.00	0	0.00	0	0.00	0	0.00
RC	CONGO	1834	0.09	1234	0.05	0	0.00	0	0.00
RU	RUSSIA	17663	0.83	0	0.00	1	0.00	27	0.01
SA	SAUDI ARABIA	0	0.00	0	0.00	197	0.01	0	0.00
SC	SEYCHELLES	0	0.00	0	0.00	11	0.00	0	0.00
SE	SENEGAL	1975	0.09	245	0.01	0	0.00	0	0.00
SI	SINGAPORE	412	0.02	0	0.00	14565	0.84	0	0.00
SL	SIERRA LEONE	0	0.00	187	0.01	0	0.00	0	0.00
SM	SOMALIA	0	0.00	0	0.00	0	0.00	0	0.00
SO	SOLOMON ISLANDS	0	0.00	0	0.00	0	0.00	0	0.00
SU	SUDAN	0	0.00	0	0.00	0	0.00	0	0.00
SV	SAINT VINCENT	0	0.00	0	0.00	5598	0.32	0	0.00
TN	TONGA	0	0.00	0	0.00	2328	0.13	0	0.00
TT	TRINIDAD/TOBAGO	0	0.00	0	0.00	6	0.00	0	0.00
UA	U. ARAB EMIRATES	0	0.00	0	0.00	0	0.00	0	0.00
UR	UKRAINE	0	0.00	0	0.00	33	0.00	0	0.00
WS	WESTERN SAMOA	0	0.00	0	0.00	0	0.00	0	0.00
YM	YEMEN	85	0.00	0	0.00	0	0.00	0	0.00
ZA	TANZANIA	0	0.00	0	0.00	0	0.00	0	0.00
ZZ	MISCELLANEOUS ORGANIZATIONAL UNITS	0	0.00	0	0.00	195	0.01	564	0.18

The United States, Russia, and Japan have multiple country codes. This is because the NODC Institution Code is limited to two digits and these countries each have more than 99 institutions that can potentially transfer data to NODC/WDC.

Table 8 National contributions of OSD, MBT, XBT, CTD casts sorted alphabetically by country name

NODC Country Code	Country Name	OSD Count	% of Total	MBT Count	% of Total	XBT Count	% of Total	CTD Count	% of Total
72	ALBANIA	0	0.00	0	0.00	0	0.00	0	0.00
AL	ALGERIA	0	0.00	0	0.00	0	0.00	0	0.00
AN	ANGOLA	621	0.03	0	0.00	0	0.00	0	0.00
AG	ANTIGUA	0	0.00	0	0.00	6975	0.40	0	0.00
27	ARAB REPUBLIC OF EGYPT	258	0.01	0	0.00	0	0.00	0	0.00
8	ARGENTINA	3410	0.16	12303	0.52	2184	0.13	319	0.10
9	AUSTRALIA	32332	1.52	18474	0.78	83155	4.77	7336	2.35
10	AUSTRIA	488	0.02	0	0.00	0	0.00	0	0.00
BH	BAHAMAS	0	0.00	0	0.00	9713	0.56	0	0.00
BA	BARBADOS	0	0.00	0	0.00	2601	0.15	0	0.00
11	BELGIUM	9220	0.43	1218	0.05	0	0.00	212	0.07
13	BOLIVIA	0	0.00	0	0.00	0	0.00	0	0.00
BN	BONAIRE	0	0.00	0	0.00	0	0.00	0	0.00
14	BRAZIL	9464	0.45	82	0.00	218	0.01	0	0.00
15	BULGARIA	0	0.00	0	0.00	0	0.00	0	0.00
12	BURMA	0	0.00	0	0.00	0	0.00	0	0.00
17	CAMEROON	0	0.00	0	0.00	0	0.00	0	0.00
18	CANADA	113770	5.36	195947	8.24	48664	2.79	75612	24.21
CV	CAPE VERDE	0	0.00	0	0.00	0	0.00	0	0.00
CI	CAYMAN ISLANDS	0	0.00	0	0.00	0	0.00	0	0.00
20	CHILE	4311	0.20	4161	0.18	2438	0.14	4015	1.29
76	CHINA, THE PEOPLES REPUBLIC OF	5590	0.26	0	0.00	4568	0.26	2701	0.86
22	COLOMBIA	1338	0.06	747	0.03	32	0.00	0	0.00
RC	CONGO	1834	0.09	1234	0.05	0	0.00	0	0.00
CR	COSTA RICA	0	0.00	0	0.00	29	0.00	0	0.00
CU	CUBA	969	0.05	0	0.00	0	0.00	0	0.00
CA	CURACAO	0	0.00	0	0.00	0	0.00	0	0.00
CY	CYPRUS	0	0.00	0	0.00	2258	0.13	0	0.00
26	DENMARK	32220	1.52	0	0.00	5724	0.33	729	0.23
70	DOMINICAN REPUBLIC	0	0.00	0	0.00	0	0.00	0	0.00
28	ECUADOR	3498	0.16	885	0.04	492	0.03	217	0.07
75	EL SALVADOR	0	0.00	0	0.00	0	0.00	0	0.00
ES	ESTONIA	0	0.00	0	0.00	0	0.00	0	0.00
ET	ETHIOPIA	0	0.00	0	0.00	0	0.00	0	0.00
FJ	FIJI ISLANDS	0	0.00	0	0.00	866	0.05	0	0.00
34	FINLAND	46381	2.18	0	0.00	0	0.00	251	0.08
35	FRANCE	36154	1.70	13538	0.57	45690	2.62	16548	5.30
GA	GABON	0	0.00	0	0.00	0	0.00	0	0.00
GM	GAMBIA	0	0.00	0	0.00	0	0.00	0	0.00
7	GERMANY, DEMOCRATIC REPUBLIC OF	15083	0.71	0	0.00	67	0.00	823	0.26
6	GERMANY, FEDERAL REPUBLIC	63412	2.99	25005	1.05	56544	3.24	24355	7.80
GH	GHANA	2670	0.13	12	0.00	0	0.00	0	0.00
36	GREECE	324	0.02	327	0.01	0	0.00	336	0.11

NODC Country Code	Country Name	OSD Count	% of Total	MBT Count	% of Total	XBT Count	% of Total	CTD Count	% of Total
GR	GRENADA	0	0.00	0	0.00	0	0.00	0	0.00
37	GUATEMALA	0	0.00	0	0.00	0	0.00	0	0.00
GU	GUINEA	0	0.00	0	0.00	0	0.00	0	0.00
GN	GUINEA-BISSAU	0	0.00	0	0.00	0	0.00	0	0.00
GY	GUYANA	0	0.00	0	0.00	0	0.00	0	0.00
38	HAITI	0	0.00	0	0.00	0	0.00	0	0.00
HO	HONDURAS	0	0.00	0	0.00	12	0.00	0	0.00
HK	HONG KONG	0	0.00	0	0.00	3210	0.18	0	0.00
46	ICELAND	18708	0.88	0	0.00	4348	0.25	1816	0.58
41	INDIA	4477	0.21	540	0.02	362	0.02	143	0.05
42	INDONESIA	4291	0.20	0	0.00	1214	0.07	159	0.05
IN	INTERNATIONAL	0	0.00	0	0.00	0	0.00	0	0.00
44	IRAN	0	0.00	0	0.00	0	0.00	0	0.00
43	IRAQ	0	0.00	0	0.00	0	0.00	0	0.00
45	IRELAND	2981	0.14	0	0.00	0	0.00	10	0.00
47	ISRAEL	3051	0.14	0	0.00	0	0.00	195	0.06
48	ITALY	10150	0.48	6268	0.26	772	0.04	8109	2.60
IC	IVORY COAST	3068	0.14	100	0.00	43	0.00	0	0.00
JA	JAMAICA	0	0.00	0	0.00	0	0.00	0	0.00
49	JAPAN	525565	24.75	335247	14.10	236424	13.56	1158	0.37
51	JAPAN	0	0.00	0	0.00	0	0.00	0	0.00
60	JAPAN	40	0.00	0	0.00	0	0.00	0	0.00
50	JORDAN	0	0.00	0	0.00	0	0.00	0	0.00
KE	KENYA	0	0.00	0	0.00	0	0.00	0	0.00
24	KOREA,REPUBLIC OF	39707	1.87	847	0.04	53	0.00	28	0.01
KU	KUWAIT	0	0.00	0	0.00	1812	0.10	0	0.00
LA	LATVIA	0	0.00	0	0.00	0	0.00	0	0.00
52	LEBANON	0	0.00	0	0.00	0	0.00	0	0.00
54	LIBERIA	0	0.00	0	0.00	33290	1.91	0	0.00
53	LIBYA	0	0.00	0	0.00	0	0.00	0	0.00
LT	LITHUANIA	0	0.00	0	0.00	0	0.00	0	0.00
55	MALAGASY REPUBLIC	2524	0.12	405	0.02	62	0.00	0	0.00
MS	MALAYSIA	154	0.01	0	0.00	0	0.00	0	0.00
ML	MALTA	0	0.00	0	0.00	431	0.02	0	0.00
MU	MAURITANIA	1217	0.06	0	0.00	0	0.00	0	0.00
MA	MAURITIUS	0	0.00	0	0.00	77	0.00	0	0.00
57	MEXICO	1283	0.06	0	0.00	2234	0.13	59	0.02
ZZ	MISCELLANEOUS ORGANIZATIONAL UNITS	0	0.00	0	0.00	195	0.01	564	0.18
MO	MONACO	2087	0.10	97	0.00	0	0.00	0	0.00
56	MOROCCO	0	0.00	0	0.00	0	0.00	0	0.00
MZ	MOZAMBIQUE	0	0.00	0	0.00	0	0.00	0	0.00
64	NETHERLANDS	26139	1.23	8088	0.34	15294	0.88	1856	0.59
59	NEW CALEDONIA	1344	0.06	0	0.00	0	0.00	0	0.00
61	NEW ZEALAND	1917	0.09	2435	0.10	5587	0.32	102	0.03
NC	NICARAGUA	0	0.00	0	0.00	0	0.00	0	0.00

NODC Country Code	Country Name	OSD Count	% of Total	MBT Count	% of Total	XBT Count	% of Total	CTD Count	% of Total
NI	NIGERIA	759	0.04	89	0.00	0	0.00	0	0.00
58	NORWAY	94020	4.43	913	0.04	6908	0.40	8469	2.71
OM	OMAN	0	0.00	0	0.00	0	0.00	0	0.00
62	PAKISTAN	179	0.01	0	0.00	0	0.00	0	0.00
PA	PANAMA	139	0.01	0	0.00	32697	1.88	0	0.00
65	PERU	4203	0.20	5212	0.22	714	0.04	0	0.00
66	PHILIPPINES	235	0.01	0	0.00	2298	0.13	0	0.00
67	POLAND	16528	0.78	0	0.00	1320	0.08	1391	0.45
68	PORTUGAL	6473	0.30	2628	0.11	732	0.04	1289	0.41
QA	QATAR	0	0.00	0	0.00	0	0.00	0	0.00
73	ROMANIA	0	0.00	0	0.00	0	0.00	0	0.00
90	RUSSIA	335954	15.82	432966	18.21	14578	0.84	13689	4.38
RU	RUSSIA	17663	0.83	0	0.00	1	0.00	27	0.01
SV	SAINT VINCENT	0	0.00	0	0.00	5598	0.32	0	0.00
SA	SAUDI ARABIA	0	0.00	0	0.00	197	0.01	0	0.00
SE	SENEGAL	1975	0.09	245	0.01	0	0.00	0	0.00
SC	SEYCHELLES	0	0.00	0	0.00	11	0.00	0	0.00
SL	SIERRA LEONE	0	0.00	187	0.01	0	0.00	0	0.00
SI	SINGAPORE	412	0.02	0	0.00	14565	0.84	0	0.00
SO	SOLOMON ISLANDS	0	0.00	0	0.00	0	0.00	0	0.00
SM	SOMALIA	0	0.00	0	0.00	0	0.00	0	0.00
91	SOUTH AFRICA	27593	1.30	20	0.00	5890	0.34	2028	0.65
29	SPAIN	2868	0.14	195	0.01	2995	0.17	4400	1.41
19	SRI LANKA	0	0.00	0	0.00	0	0.00	0	0.00
SU	SUDAN	0	0.00	0	0.00	0	0.00	0	0.00
79	SURINAM	0	0.00	0	0.00	0	0.00	0	0.00
77	SWEDEN	51852	2.44	0	0.00	4552	0.26	165	0.05
78	SWITZERLAND	0	0.00	0	0.00	0	0.00	0	0.00
80	SYRIA	0	0.00	0	0.00	0	0.00	0	0.00
21	TAIWAN	3027	0.14	0	0.00	3	0.00	107	0.03
ZA	TANZANIA	0	0.00	0	0.00	0	0.00	0	0.00
86	THAILAND	2801	0.13	77	0.00	29	0.00	0	0.00
87	TOGO	0	0.00	0	0.00	0	0.00	0	0.00
TN	TONGA	0	0.00	0	0.00	2328	0.13	0	0.00
TT	TRINIDAD/TOBAGO	0	0.00	0	0.00	6	0.00	0	0.00
88	TUNISIA	280	0.01	0	0.00	0	0.00	0	0.00
89	TURKEY	301	0.01	0	0.00	0	0.00	199	0.06
UA	U. ARAB EMIRATES	0	0.00	0	0.00	0	0.00	0	0.00
UR	UKRAINE	0	0.00	0	0.00	33	0.00	0	0.00
74	UNITED KINGDOM	132058	6.22	118644	4.99	164948	9.46	10476	3.35
31	UNITED STATES	297275	14.00	1100903	46.31	548779	31.47	90067	28.84
32	UNITED STATES	12673	0.60	46660	1.96	248328	14.24	30417	9.74
33	UNITED STATES	5647	0.27	23103	0.97	8874	0.51	1493	0.48
99	UNKNOWN	67807	3.19	16636	0.70	96321	5.52	475	0.15
92	URUGUAY	0	0.00	0	0.00	146	0.01	0	0.00
93	VENEZUELA	3574	0.17	673	0.03	0	0.00	0	0.00

NODC Country Code	Country Name	OSD Count	% of Total	MBT Count	% of Total	XBT Count	% of Total	CTD Count	% of Total
94	VIET-NAM	0	0.00	0	0.00	0	0.00	0	0.00
WS	WESTERN SAMOA	0	0.00	0	0.00	0	0.00	0	0.00
YM	YEMEN	85	0.00	0	0.00	0	0.00	0	0.00
95	YUGOSLAVIA	5404	0.25	0	0.00	173	0.01	0	0.00

The United States, Russia, and Japan have multiple country codes. This is because the NODC Institution Code is limited to two digits and these countries each have more than 99 institutions that can potentially transfer data to NODC/WDC.

Table 9 National contributions of Oceanographic Station Data (OSD) casts sorted by percent contribution of each country

NODC Country Code	Country Name	OSD Count	% of Total
49	JAPAN	525565	24.75
90	RUSSIA	335954	15.82
31	UNITED STATES	297275	14.00
74	UNITED KINGDOM	132058	6.22
18	CANADA	113770	5.36
58	NORWAY	94020	4.43
99	UNKNOWN	67807	3.19
6	GERMANY, FEDERAL REPUBLIC OF	63412	2.99
77	SWEDEN	51852	2.44
34	FINLAND	46381	2.18
24	KOREA, REPUBLIC OF	39707	1.87
35	FRANCE	36154	1.70
9	AUSTRALIA	32332	1.52
26	DENMARK	32220	1.52
91	SOUTH AFRICA	27593	1.30
64	NETHERLANDS	26139	1.23
46	ICELAND	18708	0.88
RU	RUSSIA	17663	0.83
67	POLAND	16528	0.78
7	GERMANY, DEMOCRATIC REPUBLIC OF	15083	0.71
32	UNITED STATES	12673	0.60
48	ITALY	10150	0.48
14	BRAZIL	9464	0.45
11	BELGIUM	9220	0.43
68	PORTUGAL	6473	0.30
33	UNITED STATES	5647	0.27
76	CHINA, THE PEOPLES REPUBLIC OF	5590	0.26
95	YUGOSLAVIA	5404	0.25
41	INDIA	4477	0.21
20	CHILE	4311	0.20
42	INDONESIA	4291	0.20
65	PERU	4203	0.20
93	VENEZUELA	3574	0.17
28	ECUADOR	3498	0.16
8	ARGENTINA	3410	0.16
IC	IVORY COAST	3068	0.14
47	ISRAEL	3051	0.14
21	TAIWAN	3027	0.14
45	IRELAND	2981	0.14
29	SPAIN	2868	0.14
86	THAILAND	2801	0.13
GH	GHANA	2670	0.13
55	MALAGASY REPUBLIC	2524	0.12

NODC Country Code	Country Name	OSD Count	% of Total
MO	MONACO	2087	0.10
SE	SENEGAL	1975	0.09
61	NEW ZEALAND	1917	0.09
RC	CONGO	1834	0.09
59	NEW CALEDONIA	1344	0.06
22	COLOMBIA	1338	0.06
57	MEXICO	1283	0.06
MU	MAURITANIA	1217	0.06
CU	CUBA	969	0.05
NI	NIGERIA	759	0.04
AN	ANGOLA	621	0.03
10	AUSTRIA	488	0.02
SI	SINGAPORE	412	0.02
36	GREECE	324	0.02
89	TURKEY	301	0.01
88	TUNISIA	280	0.01
27	ARAB REPUBLIC OF EGYPT	258	0.01
66	PHILIPPINES	235	0.01
62	PAKISTAN	179	0.01
MS	MALAYSIA	154	0.01
PA	PANAMA	139	0.01
YM	YEMEN	85	0.00
60	JAPAN	40	0.00

The United States, Russia, and Japan have multiple country codes. This is because the NODC Institution Code is limited to two digits and these countries each have more than 99 institutions that can potentially transfer data to NODC/WDC.

Table 10 National contributions of Mechanical Bathythermograph (MBT) profiles sorted by percent contribution of each country

NODC Country Code	Country Name	MBT Count	% of Total
31	UNITED STATES	1100903	46.31
90	RUSSIA	432966	18.21
49	JAPAN	335247	14.10
18	CANADA	195947	8.24
74	UNITED KINGDOM	118644	4.99
32	UNITED STATES	46660	1.96
6	GERMANY, FEDERAL REPUBLIC OF	25005	1.05
33	UNITED STATES	23103	0.97
9	AUSTRALIA	18474	0.78
99	UNKNOWN	16636	0.70
35	FRANCE	13538	0.57
8	ARGENTINA	12303	0.52
64	NETHERLANDS	8088	0.34
48	ITALY	6268	0.26
65	PERU	5212	0.22
20	CHILE	4161	0.18
68	PORTUGAL	2628	0.11
61	NEW ZEALAND	2435	0.10
RC	CONGO	1234	0.05
11	BELGIUM	1218	0.05
58	NORWAY	913	0.04
28	ECUADOR	885	0.04
24	KOREA, REPUBLIC OF	847	0.04
22	COLOMBIA	747	0.03
93	VENEZUELA	673	0.03
41	INDIA	540	0.02
55	MALAGASY REPUBLIC	405	0.02
36	GREECE	327	0.01
SE	SENEGAL	245	0.01
29	SPAIN	195	0.01
SL	SIERRA LEONE	187	0.01
IC	IVORY COAST	100	0.00
MO	MONACO	97	0.00
NI	NIGERIA	89	0.00
14	BRAZIL	82	0.00
86	THAILAND	77	0.00
91	SOUTH AFRICA	20	0.00
GH	GHANA	12	0.00

The United States, Russia, and Japan have multiple country codes. This is because the NODC Institution Code is limited to two digits and these countries each have more than 99 institutions that can potentially transfer data to NODC/WDC.

Table 11 National contributions of Expendable Bathythermograph (XBT) profiles sorted by percent contribution of each country

NODC Country Code	Country Name	XBT Count	% of Total
31	UNITED STATES	548779	31.47
32	UNITED STATES	248328	14.24
49	JAPAN	236424	13.56
74	UNITED KINGDOM	164948	9.46
99	UNKNOWN	96321	5.52
9	AUSTRALIA	83155	4.77
6	GERMANY, FEDERAL REPUBLIC OF	56544	3.24
18	CANADA	48664	2.79
35	FRANCE	45690	2.62
54	LIBERIA	33290	1.91
PA	PANAMA	32697	1.88
64	NETHERLANDS	15294	0.88
90	RUSSIA	14578	0.84
SI	SINGAPORE	14565	0.84
BH	BAHAMAS	9713	0.56
33	UNITED STATES	8874	0.51
AG	ANTIGUA	6975	0.40
58	NORWAY	6908	0.40
91	SOUTH AFRICA	5890	0.34
26	DENMARK	5724	0.33
SV	SAINT VINCENT	5598	0.32
61	NEW ZEALAND	5587	0.32
76	CHINA, THE PEOPLES REPUBLIC OF	4568	0.26
77	SWEDEN	4552	0.26
46	ICELAND	4348	0.25
HK	HONG KONG	3210	0.18
29	SPAIN	2995	0.17
BA	BARBADOS	2601	0.15
20	CHILE	2438	0.14
TN	TONGA	2328	0.13
66	PHILIPPINES	2298	0.13
CY	CYPRUS	2258	0.13
57	MEXICO	2234	0.13
8	ARGENTINA	2184	0.13
KU	KUWAIT	1812	0.10
67	POLAND	1320	0.08
42	INDONESIA	1214	0.07
FJ	FIJI ISLANDS	866	0.05
48	ITALY	772	0.04
68	PORTUGAL	732	0.04
65	PERU	714	0.04
28	ECUADOR	492	0.03
ML	MALTA	431	0.02

NODC Country Code	Country Name	XBT Count	% of Total
41	INDIA	362	0.02
14	BRAZIL	218	0.01
SA	SAUDI ARABIA	197	0.01
ZZ	MISCELLANEOUS ORGANIZATIONAL UNITS	195	0.01
95	YUGOSLAVIA	173	0.01
92	URUGUAY	146	0.01
MA	MAURITIUS	77	0.00
7	GERMANY, DEMOCRATIC REPUBLIC OF	67	0.00
55	MALAGASY REPUBLIC	62	0.00
24	KOREA, REPUBLIC OF	53	0.00
IC	IVORY COAST	43	0.00
UR	UKRAINE	33	0.00
22	COLOMBIA	32	0.00
86	THAILAND	29	0.00
CR	COSTA RICA	29	0.00
HO	HONDURAS	12	0.00
SC	SEYCHELLES	11	0.00
TT	TRINIDAD/TOBAGO	6	0.00
21	TAIWAN	3	0.00
RU	RUSSIA	1	0.00

The United States, Russia, and Japan have multiple country codes. This is because the NODC Institution Code is limited to two digits and these countries each have more than 99 institutions that can potentially transfer data to NODC/WDC.

Table 13 The number of OSD casts in WOD01 as a function of year for the World Ocean.
Total Number of Profiles = 2,121,042

YEAR	PROFILE	YEAR	PROFILE	YEAR	PROFILE	YEAR	PROFILE	YEAR	PROFILE
1772	2	1818	3	1864	1798	1910	2303	1956	19560
1773	1	1819	0	1865	352	1911	3672	1957	23106
1774	0	1820	2	1866	1494	1912	2535	1958	25227
1775	0	1821	0	1867	78	1913	2689	1959	23770
1776	0	1822	0	1868	791	1914	2350	1960	25583
1777	0	1823	0	1869	557	1915	888	1961	26458
1778	0	1824	2	1870	727	1916	466	1962	26975
1779	0	1825	10	1871	0	1917	636	1963	38236
1780	0	1826	18	1872	0	1918	715	1964	46150
1781	0	1827	30	1873	29	1919	943	1965	46298
1782	0	1828	13	1874	131	1920	1774	1966	45837
1783	0	1829	0	1875	86	1921	2282	1967	48898
1784	0	1830	0	1876	500	1922	2332	1968	46795
1785	0	1831	0	1877	383	1923	3348	1969	53604
1786	0	1832	0	1878	25	1924	4306	1970	47430
1787	0	1833	0	1879	17	1925	4112	1971	53388
1788	0	1834	0	1880	49	1926	4782	1972	59666
1789	0	1835	0	1881	2	1927	4512	1973	55344
1790	0	1836	8	1882	1	1928	5183	1974	48279
1791	0	1837	17	1883	6	1929	5444	1975	46118
1792	0	1838	11	1884	1	1930	5251	1976	47275
1793	0	1839	15	1885	0	1931	5596	1977	47007
1794	0	1840	9	1886	17	1932	8214	1978	53193
1795	0	1841	21	1887	27	1933	8810	1979	58782
1796	0	1842	8	1888	128	1934	10104	1980	50813
1797	0	1843	0	1889	224	1935	11406	1981	53844
1798	0	1844	0	1890	61	1936	11358	1982	51381
1799	0	1845	0	1891	92	1937	11630	1983	47386
1800	0	1846	3	1892	90	1938	13613	1984	51784
1801	0	1847	28	1893	178	1939	15113	1985	57679
1802	0	1848	0	1894	184	1940	9563	1986	54457
1803	0	1849	1	1895	41	1941	8360	1987	49826
1804	10	1850	3	1896	46	1942	5092	1988	45858
1805	1	1851	1	1897	18	1943	5173	1989	49720
1806	0	1852	0	1898	441	1944	4170	1990	50165
1807	0	1853	0	1899	842	1945	3085	1991	33677
1808	0	1854	0	1900	1014	1946	5900	1992	30122
1809	0	1855	4	1901	1057	1947	7935	1993	29261
1810	0	1856	0	1902	1165	1948	11512	1994	15670
1811	0	1857	6	1903	1839	1949	13229	1995	18269
1812	0	1858	23	1904	1962	1950	16441	1996	13023
1813	0	1859	5	1905	2344	1951	20504	1997	12090
1814	0	1860	0	1906	1609	1952	19961	1998	8654
1815	0	1861	0	1907	2094	1953	19374	1999	6690
1816	5	1862	299	1908	1310	1954	19618	2000	3928
1817	27	1863	0	1909	2285	1955	19518	2001	1283

Table 14 The number of OSD casts in WOD01 as a function of year for the southern hemisphere.
Total Number of Profiles = 224,578

YEAR	PROFILE	YEAR	PROFILE	YEAR	PROFILE	YEAR	PROFILE	YEAR	PROFILE
1772	2	1818	3	1864	323	1910	0	1956	1343
1773	1	1819	0	1865	0	1911	107	1957	2752
1774	0	1820	1	1866	0	1912	27	1958	2396
1775	0	1821	0	1867	0	1913	43	1959	2473
1776	0	1822	0	1868	0	1914	258	1960	3553
1777	0	1823	0	1869	0	1915	417	1961	4101
1778	0	1824	1	1870	0	1916	296	1962	5126
1779	0	1825	7	1871	0	1917	528	1963	6505
1780	0	1826	10	1872	0	1918	446	1964	6224
1781	0	1827	18	1873	4	1919	289	1965	6698
1782	0	1828	10	1874	23	1920	269	1966	5930
1783	0	1829	0	1875	77	1921	221	1967	7711
1784	0	1830	0	1876	26	1922	0	1968	8081
1785	0	1831	0	1877	0	1923	34	1969	6076
1786	0	1832	0	1878	0	1924	4	1970	4999
1787	0	1833	0	1879	0	1925	232	1971	6264
1788	0	1834	0	1880	0	1926	331	1972	5785
1789	0	1835	0	1881	0	1927	197	1973	5319
1790	0	1836	3	1882	0	1928	281	1974	5013
1791	0	1837	8	1883	2	1929	467	1975	5175
1792	0	1838	10	1884	0	1930	572	1976	6362
1793	0	1839	15	1885	0	1931	471	1977	5598
1794	0	1840	9	1886	14	1932	390	1978	6079
1795	0	1841	21	1887	5	1933	197	1979	6768
1796	0	1842	8	1888	0	1934	209	1980	5326
1797	0	1843	0	1889	15	1935	138	1981	5745
1798	0	1844	0	1890	0	1936	421	1982	5728
1799	0	1845	0	1891	0	1937	323	1983	5986
1800	0	1846	0	1892	0	1938	490	1984	5103
1801	0	1847	28	1893	0	1939	243	1985	6956
1802	0	1848	0	1894	1	1940	121	1986	6025
1803	0	1849	0	1895	0	1941	322	1987	6646
1804	2	1850	1	1896	0	1942	166	1988	6711
1805	0	1851	0	1897	1	1943	68	1989	4725
1806	0	1852	0	1898	15	1944	398	1990	3164
1807	0	1853	0	1899	10	1945	60	1991	2054
1808	0	1854	0	1900	73	1946	113	1992	4462
1809	0	1855	0	1901	42	1947	367	1993	3347
1810	0	1856	0	1902	15	1948	935	1994	3026
1811	0	1857	6	1903	81	1949	396	1995	3620
1812	0	1858	8	1904	0	1950	745	1996	1292
1813	0	1859	2	1905	0	1951	710	1997	1026
1814	0	1860	0	1906	21	1952	705	1998	472
1815	0	1861	0	1907	0	1953	660	1999	83
1816	2	1862	112	1908	0	1954	705	2000	41
1817	0	1863	0	1909	0	1955	1294	2001	7

Table 15 The number of OSD casts in WOD01 as a function of year for the northern hemisphere.
Total Number of Profiles = 1,896,464

YEAR	PROFILE	YEAR	PROFILE	YEAR	PROFILE	YEAR	PROFILE	YEAR	PROFILE
1772	0	1818	0	1864	1475	1910	2303	1956	18217
1773	0	1819	0	1865	352	1911	3565	1957	20354
1774	0	1820	1	1866	1494	1912	2508	1958	22831
1775	0	1821	0	1867	78	1913	2646	1959	21297
1776	0	1822	0	1868	791	1914	2092	1960	22030
1777	0	1823	0	1869	557	1915	471	1961	22357
1778	0	1824	1	1870	727	1916	170	1962	21849
1779	0	1825	3	1871	0	1917	108	1963	31731
1780	0	1826	8	1872	0	1918	269	1964	39926
1781	0	1827	12	1873	25	1919	654	1965	39600
1782	0	1828	3	1874	108	1920	1505	1966	39907
1783	0	1829	0	1875	9	1921	2061	1967	41187
1784	0	1830	0	1876	474	1922	2332	1968	38714
1785	0	1831	0	1877	383	1923	3314	1969	47528
1786	0	1832	0	1878	25	1924	4302	1970	42431
1787	0	1833	0	1879	17	1925	3880	1971	47124
1788	0	1834	0	1880	49	1926	4451	1972	53881
1789	0	1835	0	1881	2	1927	4315	1973	50025
1790	0	1836	5	1882	1	1928	4902	1974	43266
1791	0	1837	9	1883	4	1929	4977	1975	40943
1792	0	1838	1	1884	1	1930	4679	1976	40913
1793	0	1839	0	1885	0	1931	5125	1977	41409
1794	0	1840	0	1886	3	1932	7824	1978	47114
1795	0	1841	0	1887	22	1933	8613	1979	52014
1796	0	1842	0	1888	128	1934	9895	1980	45487
1797	0	1843	0	1889	209	1935	11268	1981	48099
1798	0	1844	0	1890	61	1936	10937	1982	45653
1799	0	1845	0	1891	92	1937	11307	1983	41400
1800	0	1846	3	1892	90	1938	13123	1984	46681
1801	0	1847	0	1893	178	1939	14870	1985	50723
1802	0	1848	0	1894	183	1940	9442	1986	48432
1803	0	1849	1	1895	41	1941	8038	1987	43180
1804	8	1850	2	1896	46	1942	4926	1988	39147
1805	1	1851	1	1897	17	1943	5105	1989	44995
1806	0	1852	0	1898	426	1944	3772	1990	47001
1807	0	1853	0	1899	832	1945	3025	1991	31626
1808	0	1854	0	1900	941	1946	5787	1992	25660
1809	0	1855	4	1901	1015	1947	7568	1993	25914
1810	0	1856	0	1902	1150	1948	10577	1994	12644
1811	0	1857	0	1903	1758	1949	12833	1995	14649
1812	0	1858	15	1904	1962	1950	15696	1996	11731
1813	0	1859	3	1905	2344	1951	19794	1997	11064
1814	0	1860	0	1906	1588	1952	19256	1998	8182
1815	0	1861	0	1907	2094	1953	18714	1999	6607
1816	3	1862	187	1908	1310	1954	18913	2000	3887
1817	27	1863	0	1909	2285	1955	18224	2001	1276

Table 16 The number of all CTD casts in WOD01 as a function of year for the World Ocean.

Total Number of Profiles = 312,344

YEAR	PROFILE	YEAR	PROFILE	YEAR	PROFILE	YEAR	PROFILE
1967	1526	1976	8010	1985	11269	1994	14761
1968	727	1977	8102	1986	12838	1995	13748
1969	2445	1978	10009	1987	16760	1996	9055
1970	561	1979	9295	1988	13272	1997	10928
1971	980	1980	8576	1989	13972	1998	8931
1972	3185	1981	11700	1990	15722	1999	6457
1973	4989	1982	8683	1991	14063	2000	340
1974	7205	1983	10756	1992	17148	2001	26
1975	6684	1984	11539	1993	18082		

Table 17 The number of all CTD casts in WOD01 as a function of year for the southern hemisphere.

Total Number of Profiles = 40,587

YEAR	PROFILE	YEAR	PROFILE	YEAR	PROFILE	YEAR	PROFILE
1967	607	1976	482	1985	1475	1994	3337
1968	191	1977	799	1986	1347	1995	2805
1969	57	1978	1009	1987	1649	1996	1729
1970	0	1979	745	1988	965	1997	1545
1971	62	1980	797	1989	2093	1998	213
1972	108	1981	401	1990	1465	1999	122
1973	174	1982	473	1991	1679		
1974	326	1983	2297	1992	4565		
1975	952	1984	2060	1993	4058		

Table 18 The number of all CTD casts in WOD01 as a function of year for the northern hemisphere.

Total Number of Profiles = 271,757

YEAR	PROFILE	YEAR	PROFILE	YEAR	PROFILE	YEAR	PROFILE
1967	919	1976	7528	1985	9794	1994	11424
1968	536	1977	7303	1986	11491	1995	10943
1969	2388	1978	9000	1987	15111	1996	7326
1970	561	1979	8550	1988	12307	1997	9383
1971	918	1980	7779	1989	11879	1998	8718
1972	3077	1981	11299	1990	14257	1999	6335
1973	4815	1982	8210	1991	12384	2000	340
1974	6879	1983	8459	1992	12583	2001	26
1975	5732	1984	9479	1993	14024		

Table 19 The number of all MBT profiles in WOD01 as a function of year for the World Ocean.

Total Number of Profiles = 2,376,206

YEAR	PROFILE	YEAR	PROFILE	YEAR	PROFILE	YEAR	PROFILE
1941	10154	1956	50666	1971	40974	1986	44478
1942	7014	1957	60580	1972	43558	1987	40704
1943	17767	1958	70159	1973	34112	1988	34877
1944	36902	1959	65526	1974	35133	1989	21223
1945	41127	1960	72367	1975	27446	1990	18703
1946	23823	1961	77009	1976	33564	1991	8348
1947	28826	1962	85559	1977	34214	1992	3832
1948	30364	1963	91652	1978	35750	1993	3676
1949	36058	1964	89173	1979	39695	1994	81
1950	50364	1965	97277	1980	31128	1995	10
1951	50296	1966	106984	1981	26671	1996	0
1952	61351	1967	94321	1982	23704	1997	0
1953	59352	1968	75460	1983	25224	1998	0
1954	52966	1969	60796	1984	39829	1999	5
1955	45560	1970	44918	1984	35616		

Table 20 The number of all MBT profiles in WOD01 as a function of year for the southern hemisphere.

Total Number of Profiles = 264,648

YEAR	PROFILE	YEAR	PROFILE	YEAR	PROFILE	YEAR	PROFILE
1941	10	1956	4306	1971	6362	1986	6007
1942	1384	1957	8468	1972	6522	1987	6409
1943	2568	1958	10700	1973	6169	1988	3654
1944	3389	1959	9195	1974	4839	1989	2661
1945	1007	1960	9994	1975	2487	1990	1353
1946	914	1961	6945	1976	5104	1991	434
1947	2169	1962	9447	1977	6985	1992	116
1948	143	1963	11417	1978	5986	1993	172
1949	550	1964	9935	1979	6857		
1950	287	1965	10383	1980	5916		
1951	469	1966	10695	1981	4665		
1952	2764	1967	13940	1982	4172		
1953	886	1968	10810	1983	4911		
1954	1057	1969	5901	1984	8200		
1955	2978	1970	5956	1984	6000		

Table 21 The number of all MBT profiles in WOD01 as a function of year for the northern hemisphere.

Total Number of Profiles = 2,111,558

YEAR	PROFILE	YEAR	PROFILE	YEAR	PROFILE	YEAR	PROFILE
1941	10144	1956	45760	1971	34612	1986	38471
1942	5630	1957	52112	1972	37036	1987	34295
1943	15199	1958	59459	1973	27943	1988	31223
1944	33513	1959	56331	1974	30294	1989	18562
1945	40120	1960	62373	1975	24959	1990	17350
1946	22909	1961	70064	1976	28460	1991	7914
1947	26657	1962	76112	1977	27229	1992	3716
1948	30191	1963	80145	1978	29764	1993	3504
1949	35508	1964	79238	1979	32838	1994	81
1950	50077	1965	86894	1980	25212	1995	10
1951	49827	1966	96289	1981	22006	1996	0
1952	58587	1967	80381	1982	19532	1997	0
1953	58466	1968	64650	1983	20313	1998	0
1954	51909	1969	54895	1984	31629	1999	5
1955	42582	1970	38962	1984	29616		

Table 22 The number of all XBT profiles in WOD01 as a function of year for the World Ocean.

Total Number of Profiles = 1,743,592

YEAR	PROFILE	YEAR	PROFILE	YEAR	PROFILE	YEAR	PROFILE
1966	1747	1975	54097	1984	54051	1993	61257
1967	9390	1976	48268	1985	67258	1994	52811
1968	26671	1977	54178	1986	72955	1995	62882
1969	34319	1978	52748	1987	69950	1996	48438
1970	44411	1979	52666	1988	59651	1997	41810
1971	57605	1980	52063	1989	42175	1998	34432
1972	53139	1981	50879	1990	76186	1998	36449
1973	54918	1982	53253	1991	63763	2000	23988
1974	54850	1983	53464	1992	57551	2001	9319

Table 23 The number of all XBT profiles in WOD01 as a function of year for the southern hemisphere.

Total Number of Profiles = 312,290

YEAR	PROFILE	YEAR	PROFILE	YEAR	PROFILE	YEAR	PROFILE
1966	168	1975	4304	1984	8718	1993	17135
1967	644	1976	5912	1985	10193	1994	17102
1968	2136	1977	4778	1986	11400	1995	17730
1969	2032	1978	5800	1987	13050	1996	14532
1970	2561	1979	7161	1988	9875	1997	15779
1971	5163	1980	6680	1989	8698	1998	12132
1972	6548	1981	5717	1990	14803	1998	9864
1973	6424	1982	9395	1991	14204	2000	7816
1974	5898	1983	10203	1992	14242	2001	3493

Table 24 The number of all XBT profiles in WOD01 as a function of year for the northern hemisphere.

Total Number of Profiles = 1,431,300

YEAR	PROFILE	YEAR	PROFILE	YEAR	PROFILE	YEAR	PROFILE
1966	1579	1975	49793	1984	45333	1993	44122
1967	8746	1976	42355	1985	57065	1994	35709
1968	24535	1977	49400	1986	61555	1995	45152
1969	32287	1978	46948	1987	56900	1996	33906
1970	41850	1979	45505	1988	49776	1997	26031
1971	52442	1980	45383	1989	33477	1998	22299
1972	46591	1981	45162	1990	61383	1998	26585
1973	48494	1982	43858	1991	49559	2000	16172
1974	48952	1983	43261	1992	43309	2001	5826

Table 25 The number of all APB profiles in WOD01 as a function of year for the World Ocean.

Total Number of Profiles = 75,665

YEAR	PROFILE	YEAR	PROFILE	YEAR	PROFILE
1997	19875	1998	44626	1999	11164

Table 26 The number of all MRB profiles in WOD01 as a function of year for the World Ocean.

Total Number of Profiles = 297,936

YEAR	PROFILE	YEAR	PROFILE	YEAR	PROFILE	YEAR	PROFILE
1990	1845	1993	22454	1996	22218	1999	45809
1991	3530	1994	25522	1997	29238	2000	49965
1992	12597	1995	26627	1998	33117	2001	25014

Table 27 The number of all MRB profiles in WOD01 as a function of year for the southern hemisphere.

Total Number of Profiles = 92,458

YEAR	PROFILE	YEAR	PROFILE	YEAR	PROFILE	YEAR	PROFILE
1990	648	1993	7049	1996	6160	1999	14774
1991	1145	1994	8323	1997	9450	2000	16809
1992	2201	1995	9384	1998	9524	2001	6982

Table 28 The number of all MRB profiles in WOD01 as a function of year for the northern hemisphere.

Total Number of Profiles = 205,478

YEAR	PROFILE	YEAR	PROFILE	YEAR	PROFILE	YEAR	PROFILE
1990	1197	1993	15405	1996	16049	1999	31035
1991	2385	1994	17199	1997	19788	2000	33156
1992	10396	1995	17243	1998	23593	2001	18032

Table 29 The number of all PFL profiles in WOD01 as a function of year for the World Ocean.

Total Number of Profiles = 22,637

YEAR	PROFILE	YEAR	PROFILE	YEAR	PROFILE	YEAR	PROFILE
1994	14	1996	97	1998	2131	2000	8116
1995	22	1997	42	1999	7620	2001	4595

Table 30 The number of all PFL profiles in WOD01 as a function of year for the southern hemisphere.

Total Number of Profiles = 2,347

YEAR	PROFILE	YEAR	PROFILE	YEAR	PROFILE	YEAR	PROFILE
1998	266	1999	631	2000	834	2001	616

Table 31 The number of all PFL profiles in WOD01 as a function of year for the northern hemisphere.

Total Number of Profiles = 20,290

YEAR	PROFILE	YEAR	PROFILE	YEAR	PROFILE	YEA	PROFILE
1994	14	1996	97	1998	1865	200	7282
1995	22	1997	42	1999	6989	200	3979

Table 32 The number of DRB profiles in WOD01 as a function of year for the World Ocean.

Total Number of Profiles = 50,549

YEAR	PROFILE	YEAR	PROFILE	YEAR	PROFILE	YEAR	PROFILE
1998	401	1999	4810	2000	6572	2001	38766

Table 33 The number of DRB profiles in WOD01 as a function of year for the southern hemisphere.

Total Number of Profiles = 5

YEAR	PROFILE	YEAR	PROFILE
2000	3	2001	2

Table 34 The number of DRB profiles in WOD01 as a function of year for the northern hemisphere.

Total Number of Profiles = 50,544

YEAR	PROFILE	YEAR	PROFILE	YEAR	PROFILE	YEAR	PROFILE
1998	401	1999	4810	2000	6569	2001	38764

Table 35 The number of all UOR profiles in WOD01 as a function of year for the World Ocean.

Total Number of Profiles = 37,631

YEAR	PROFILE	YEAR	PROFILE	YEAR	PROFILE
1992	11913	1994	3974	1996	363
1993	14494	1995	59	1997	6828

Table 36 The number of all UOR profiles in WOD01 as a function of year for the southern hemisphere.

Total Number of Profiles = 31,526

YEAR	PROFILE	YEAR	PROFILE	YEAR	PROFILE
1992	11251	1994	0	1996	0
1993	13447	1995	0	1997	6828

Table 37 The number of all UOR profiles in WOD01 as a function of year for the northern hemisphere.

Total Number of Profiles = 6,125

YEAR	PROFILE	YEAR	PROFILE	YEAR	PROFILE
1992	662	1994	3988	1996	363
1993	1053	1995	59	1997	

Table 38 The number of all casts (OSD+CTD+XBT+MBT+MRB+DRB+PFL+UOR+APB) in WOD01 as a function of year for the World Ocean.

Total Number of Profiles = 7,037,614

YEAR	PROFILE	YEAR	PROFILE	YEAR	PROFILE	YEAR	PROFILE	YEAR	PROFILE
1772	2	1818	3	1864	1798	1910	2303	1956	69626
1773	1	1819	0	1865	352	1911	3672	1957	83686
1774	0	1820	2	1866	1494	1912	2535	1958	95386
1775	0	1821	0	1867	78	1913	2689	1959	89296
1776	0	1822	0	1868	791	1914	2350	1960	97950
1777	0	1823	0	1869	557	1915	888	1961	103467
1778	0	1824	2	1870	727	1916	466	1962	112534
1779	0	1825	10	1871	0	1917	636	1963	129798
1780	0	1826	18	1872	0	1918	715	1964	135323
1781	0	1827	30	1873	29	1919	943	1965	143575
1782	0	1828	13	1874	131	1920	1774	1966	154568
1783	0	1829	0	1875	86	1921	2282	1967	154135
1784	0	1830	0	1876	500	1922	2332	1968	149653
1785	0	1831	0	1877	383	1923	3348	1969	151164
1786	0	1832	0	1878	25	1924	4306	1970	137320
1787	0	1833	0	1879	17	1925	4112	1971	152947
1788	0	1834	0	1880	49	1926	4782	1972	159548
1789	0	1835	0	1881	2	1927	4512	1973	149363
1790	0	1836	8	1882	1	1928	5183	1974	145467
1791	0	1837	17	1883	6	1929	5444	1975	134345
1792	0	1838	11	1884	1	1930	5251	1976	137116
1793	0	1839	15	1885	0	1931	5596	1977	143501
1794	0	1840	9	1886	17	1932	8214	1978	151700
1795	0	1841	21	1887	27	1933	8810	1979	160438
1796	0	1842	8	1888	128	1934	10104	1980	142580
1797	0	1843	0	1889	224	1935	11406	1981	143094
1798	0	1844	0	1890	61	1936	11358	1982	137021
1799	0	1845	0	1891	92	1937	11630	1983	136830
1800	0	1846	3	1892	90	1938	13613	1984	157203
1801	0	1847	28	1893	178	1939	15113	1985	171822
1802	0	1848	0	1894	184	1940	9563	1986	184728
1803	0	1849	1	1895	41	1941	18514	1987	177240
1804	10	1850	3	1896	46	1942	12106	1988	153658
1805	1	1851	1	1897	18	1943	22940	1989	127090
1806	0	1852	0	1898	441	1944	41072	1990	162621
1807	0	1853	0	1899	842	1945	44212	1991	123381
1808	0	1854	0	1900	1014	1946	29723	1992	133163
1809	0	1855	4	1901	1057	1947	36761	1993	149224
1810	0	1856	0	1902	1165	1948	41846	1994	112847
1811	0	1857	6	1903	1839	1949	49287	1995	121617
1812	0	1858	23	1904	1962	1950	66805	1996	93194
1813	0	1859	5	1905	2344	1951	70800	1997	120811
1814	0	1860	0	1906	1609	1952	81312	1998	132291
1815	0	1861	0	1907	2094	1953	78726	1999	119004
1816	5	1862	299	1908	1310	1954	72584	2000	92909
1817	27	1863	0	1909	2285	1955	65078	2001	79003

9. APPENDIX A: YEARLY DISTRIBUTION MAPS OF ALL CASTS IN WOD01

This appendix contains yearly data distributions of all profile data contained in WOD01, surface only data are not plotted. We have combined all data from the OSD, CTD, MBT, XBT, MRB, DRB, PFL, UOR, and APB files together for each year. Ocean Station Data occur during the full period covered by WOD01 which is 1772-present, MBT profiles exist during 1941-present, XBT profiles exist during 1966- present, CTD exists during 1967-present, APB profiles exist during 1997-1999, MRB profiles exist during 1990-2001, PFL profiles exist during1994-2001, DRB profiles exist during 1998-2001, and UOR profiles exist during 1992-1997 . 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 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 profiles are plotted including profiles that may be erroneously located over land. However, WOD01 contains some profiles from various lakes so care should be exercised in the use of these profiles 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 profiles and a large dot indicates five or more profiles.

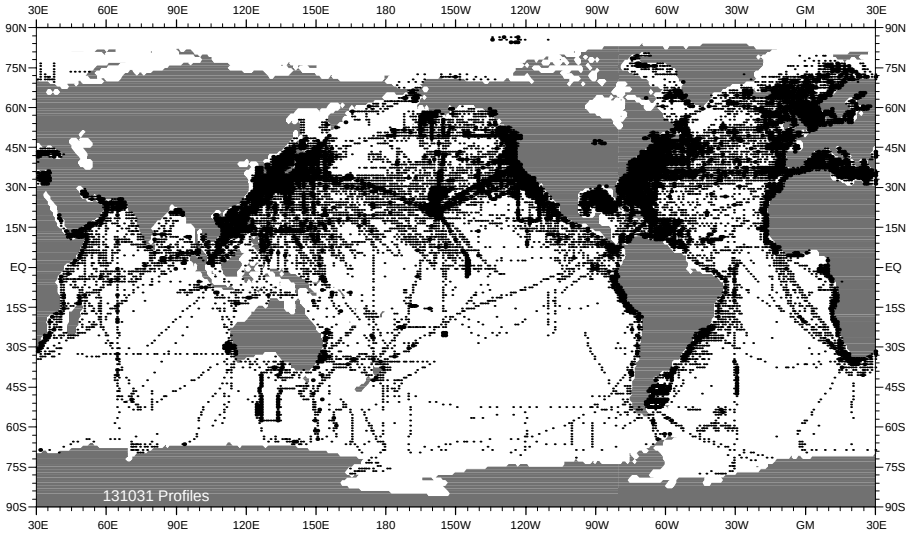
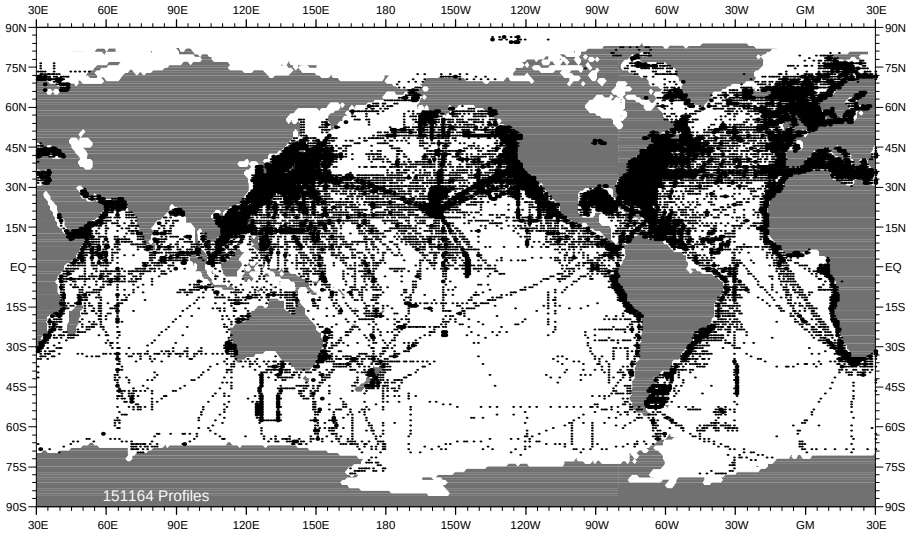
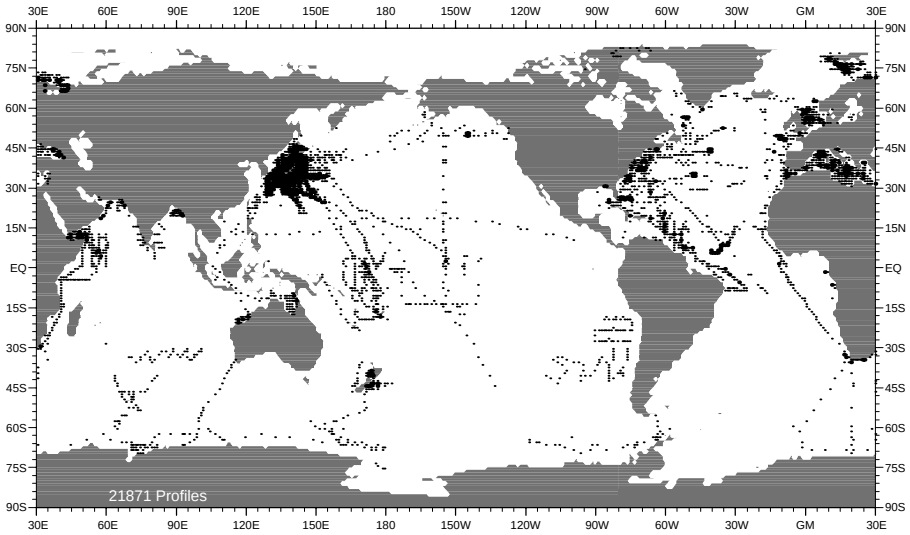


Fig. 1 Distribution of all stations for 1969; a) stations used in WOD98



b) stations used in WOD01



c) additions to WOD01 over WOD98

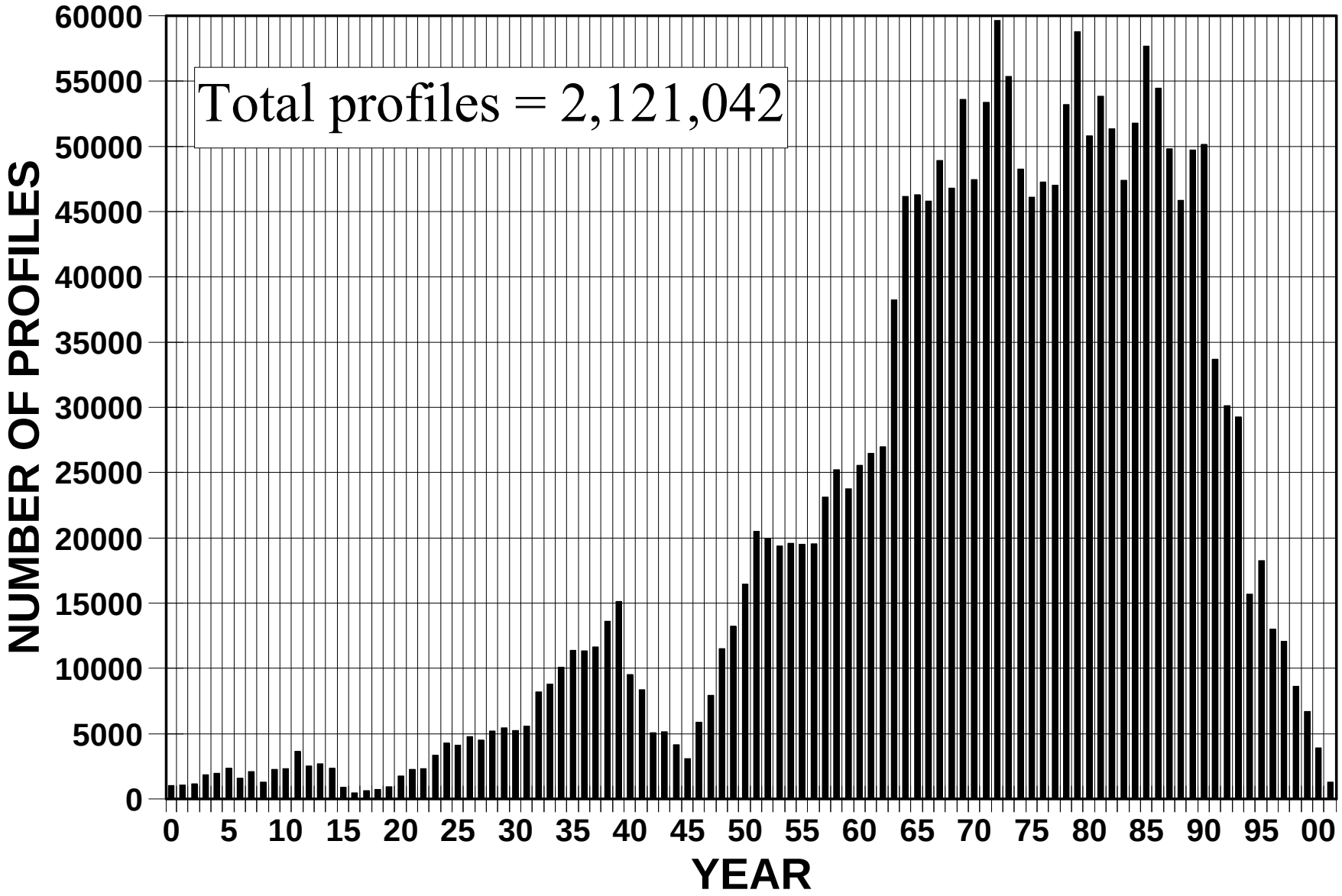


Fig. 2 Time series of OSD casts in WOD01 for the world ocean as a function of year.

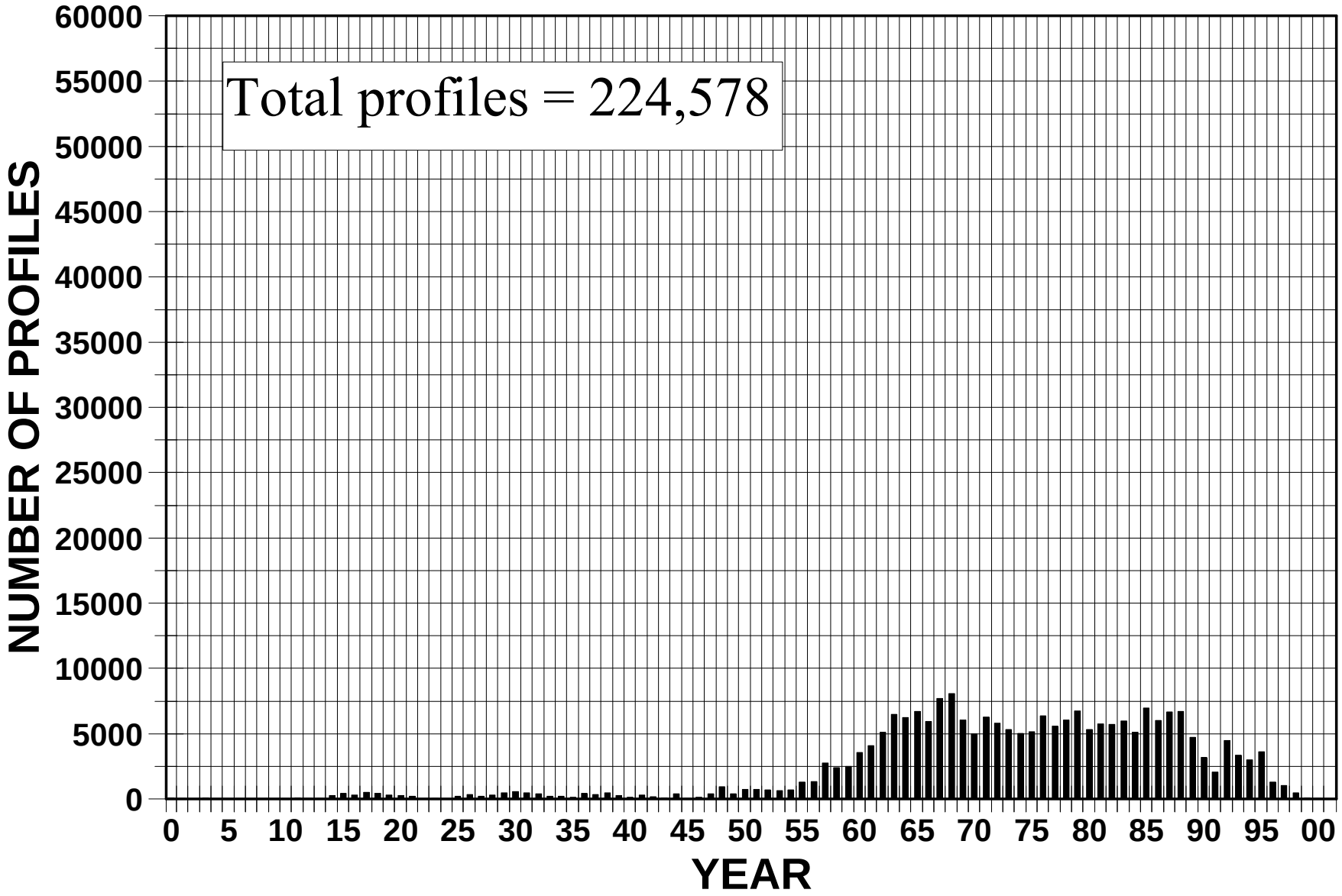


Fig. 3 Time series of OSD casts in WOD01 for the southern hemisphere as a function of year

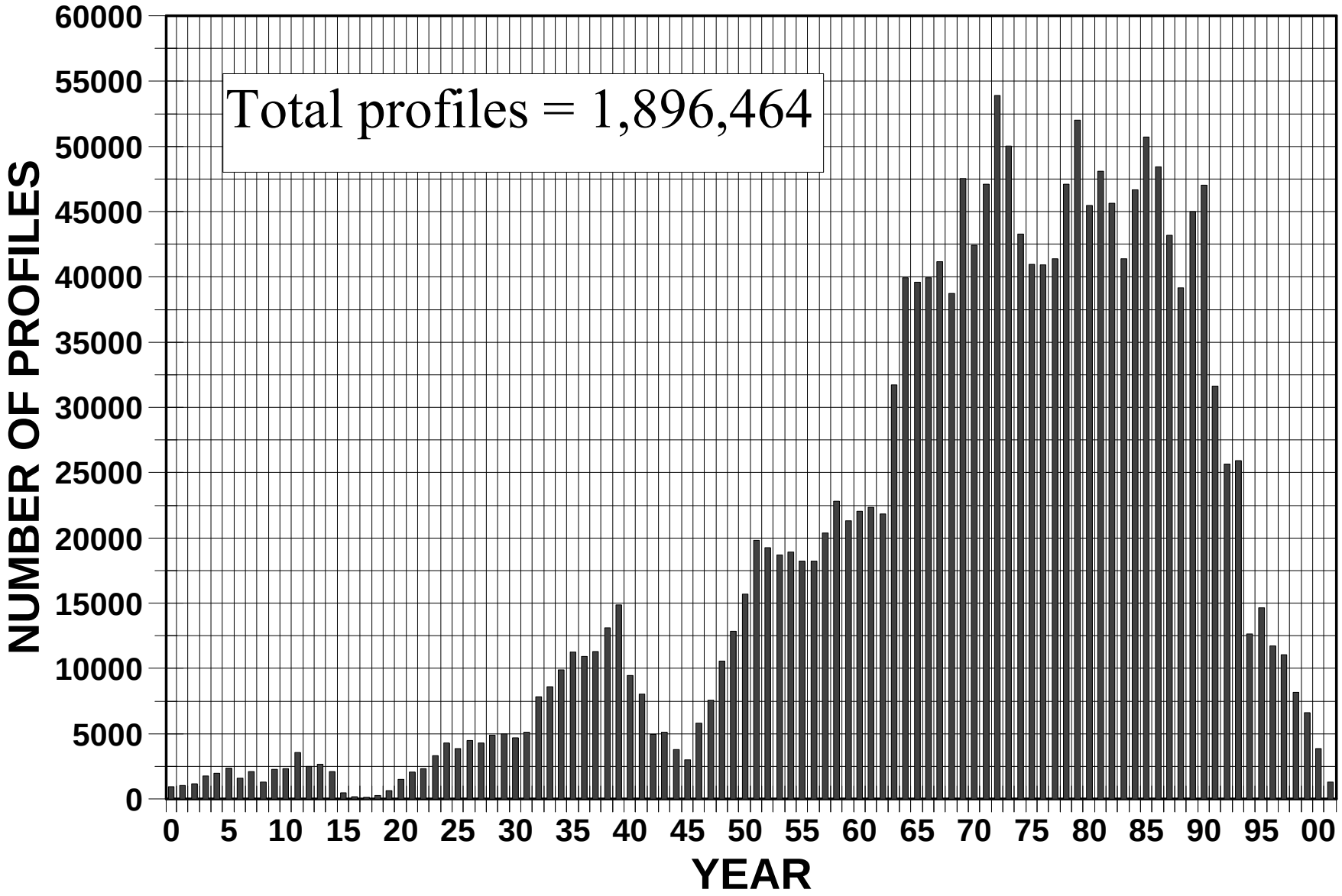


Fig. 4 Time series of OSD casts in WOD01 for the northern hemisphere as a function of year.

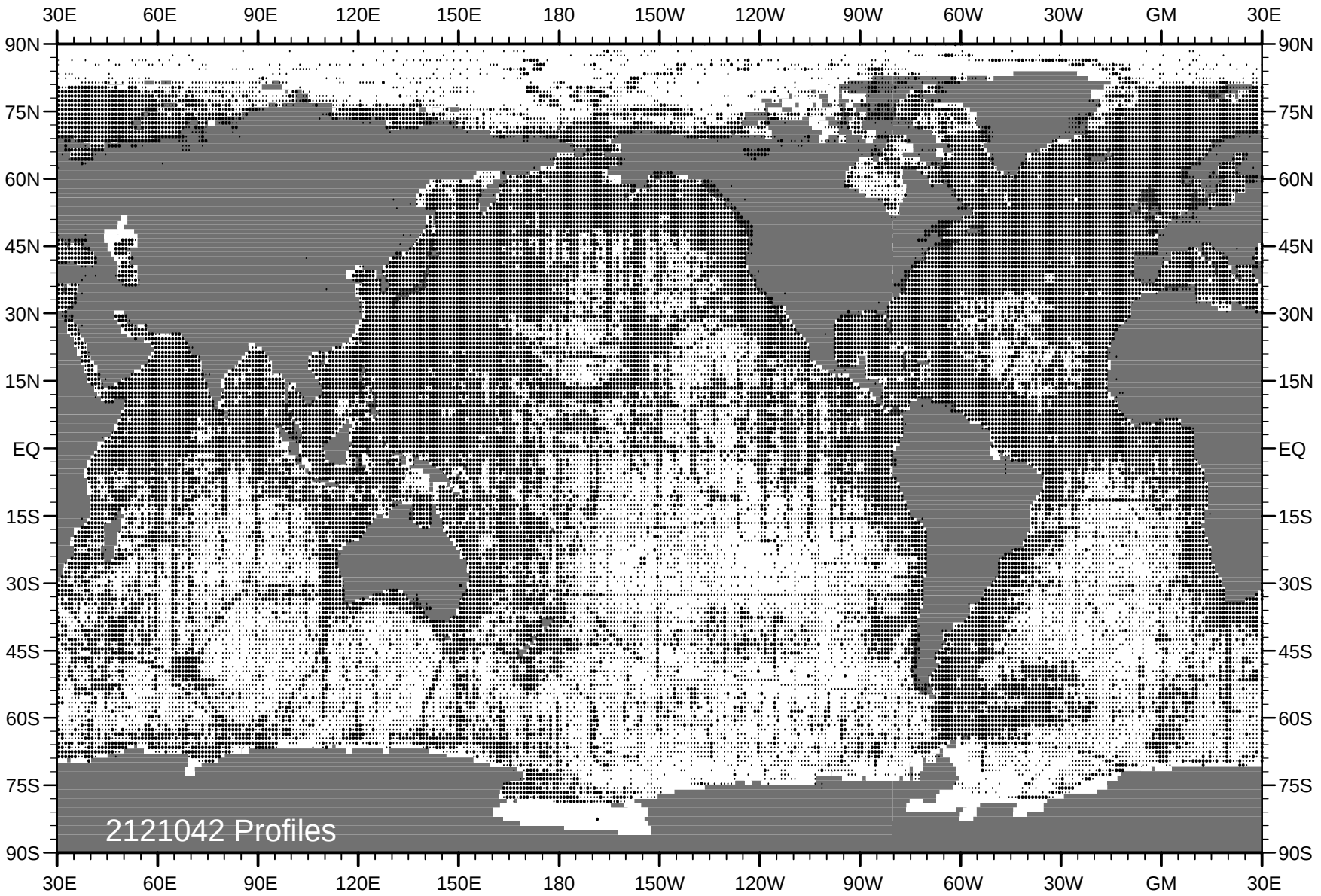


Fig. 5 Distribution of all casts in the Ocean Station Data files of WOD01.
Dots show location of 1-degree squares containing any data.

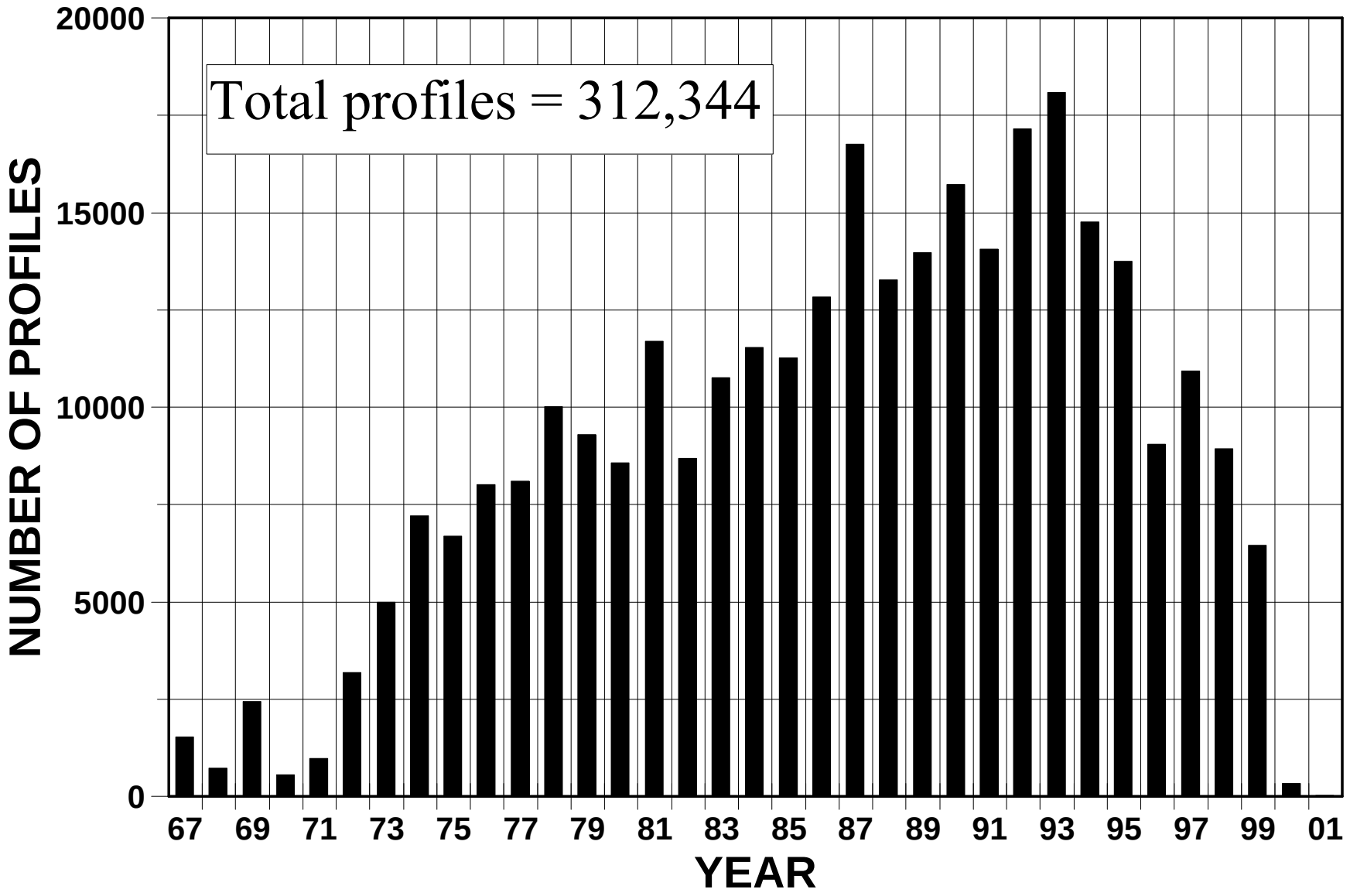


Fig. 6 Time series of CTD casts in WOD01for the world ocean as a function of year.

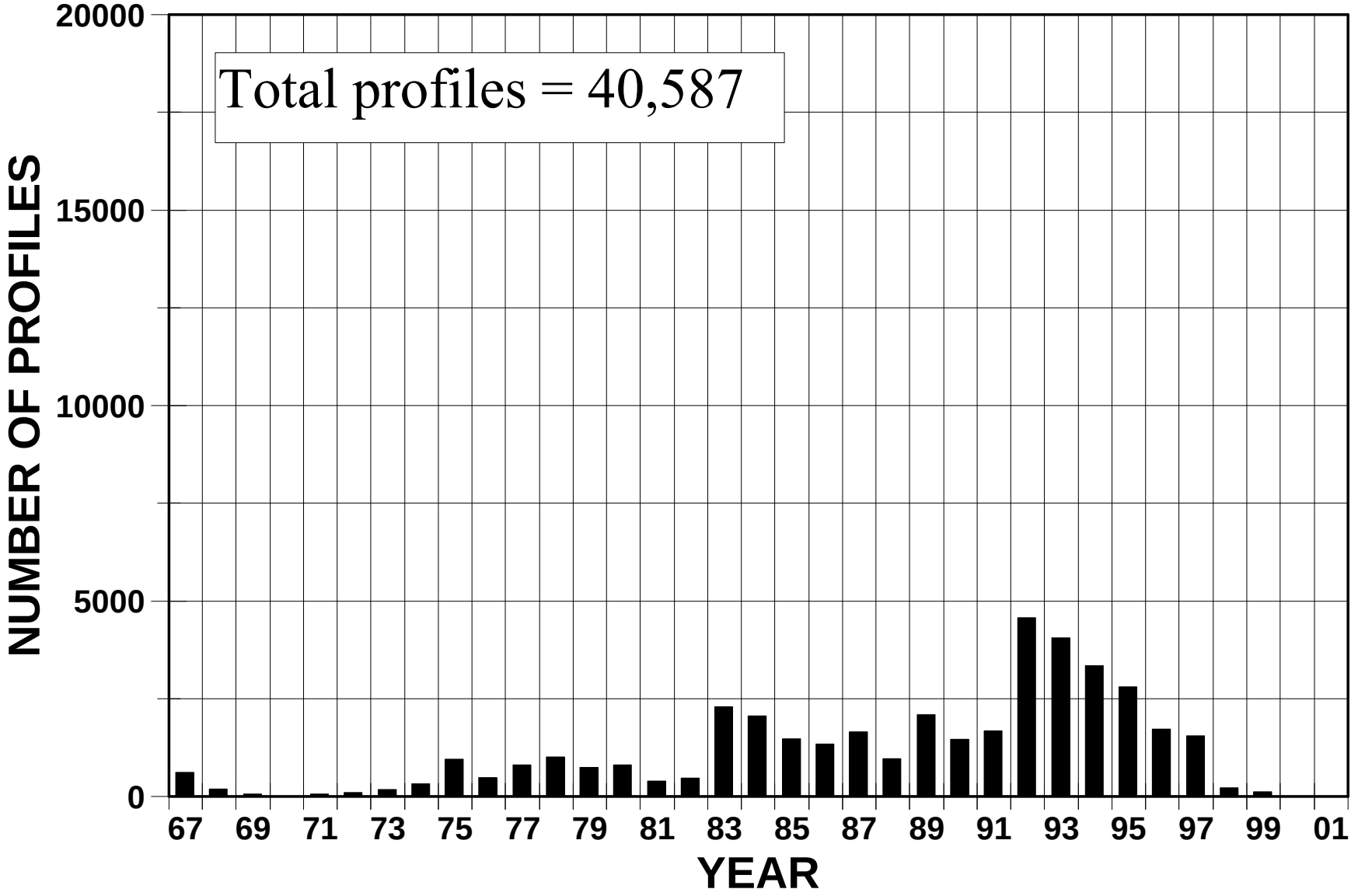


Fig. 7 Time series of CTD casts in WOD01 for the southern hemisphere as a function of year.

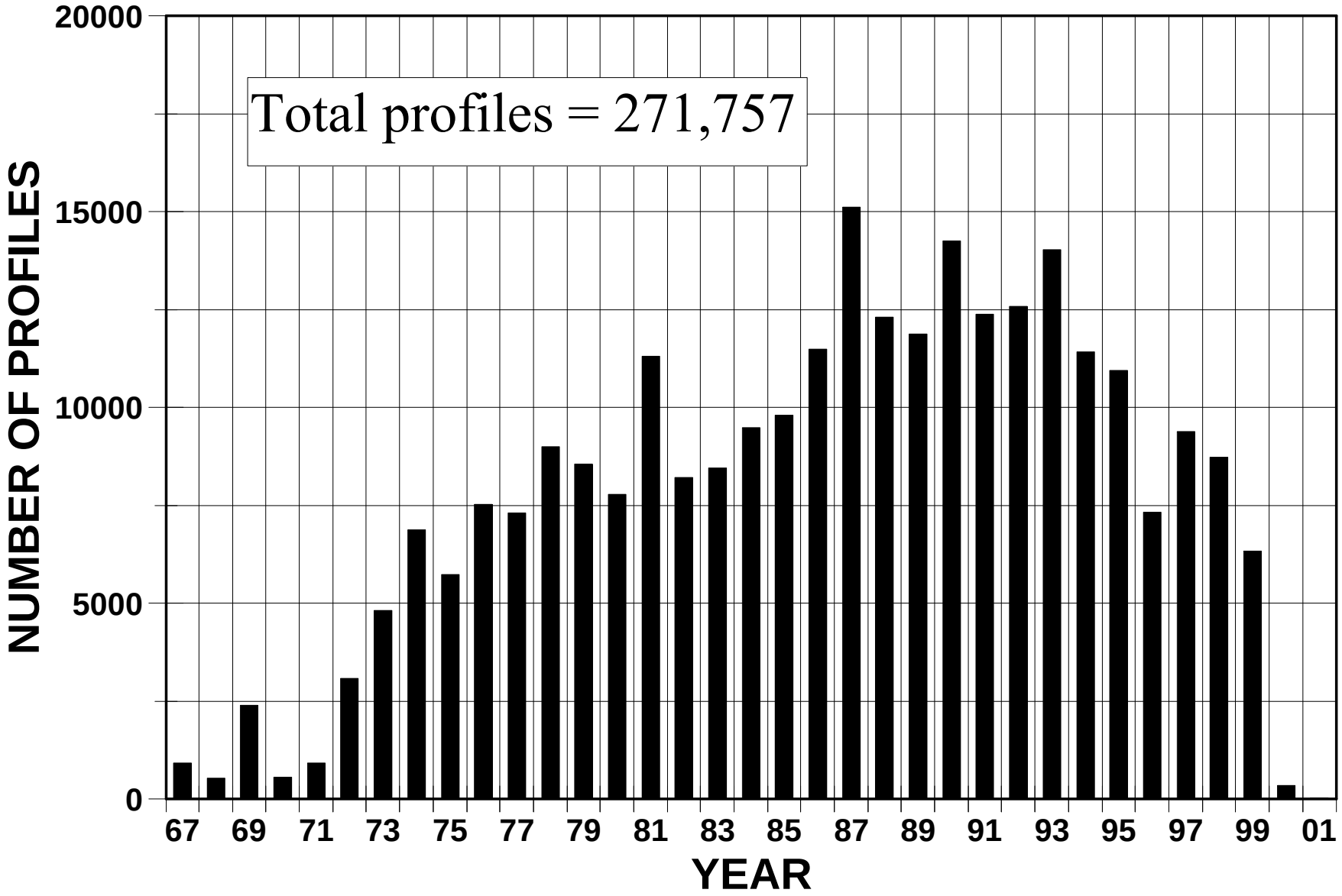


Fig. 8 Time series of CTD casts in WOD01 for the northern hemisphere as a function of year.

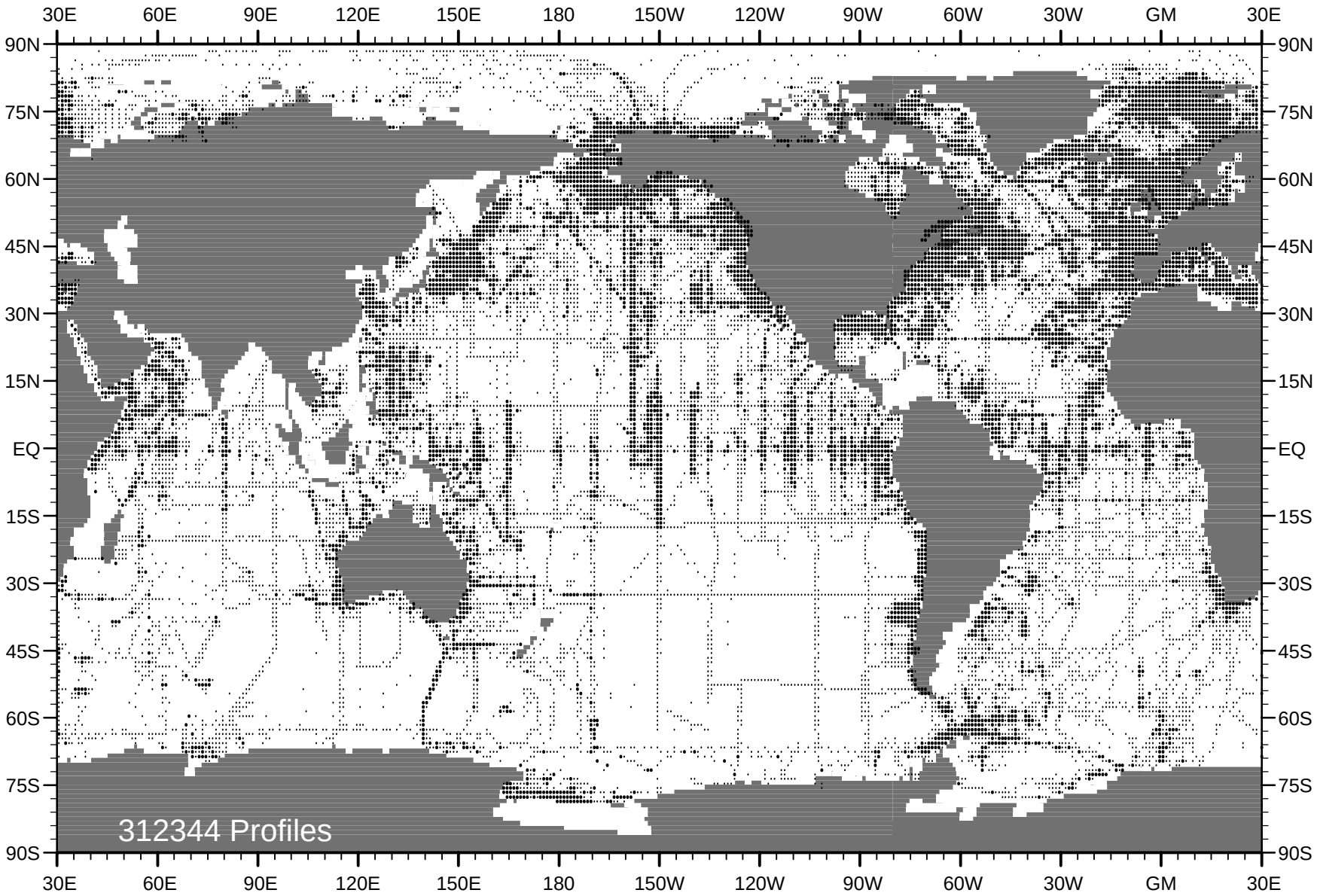


Fig. 9 Distribution of all casts in the CTD files of WOD01.
Dots show location of 1-degree squares containing any data.

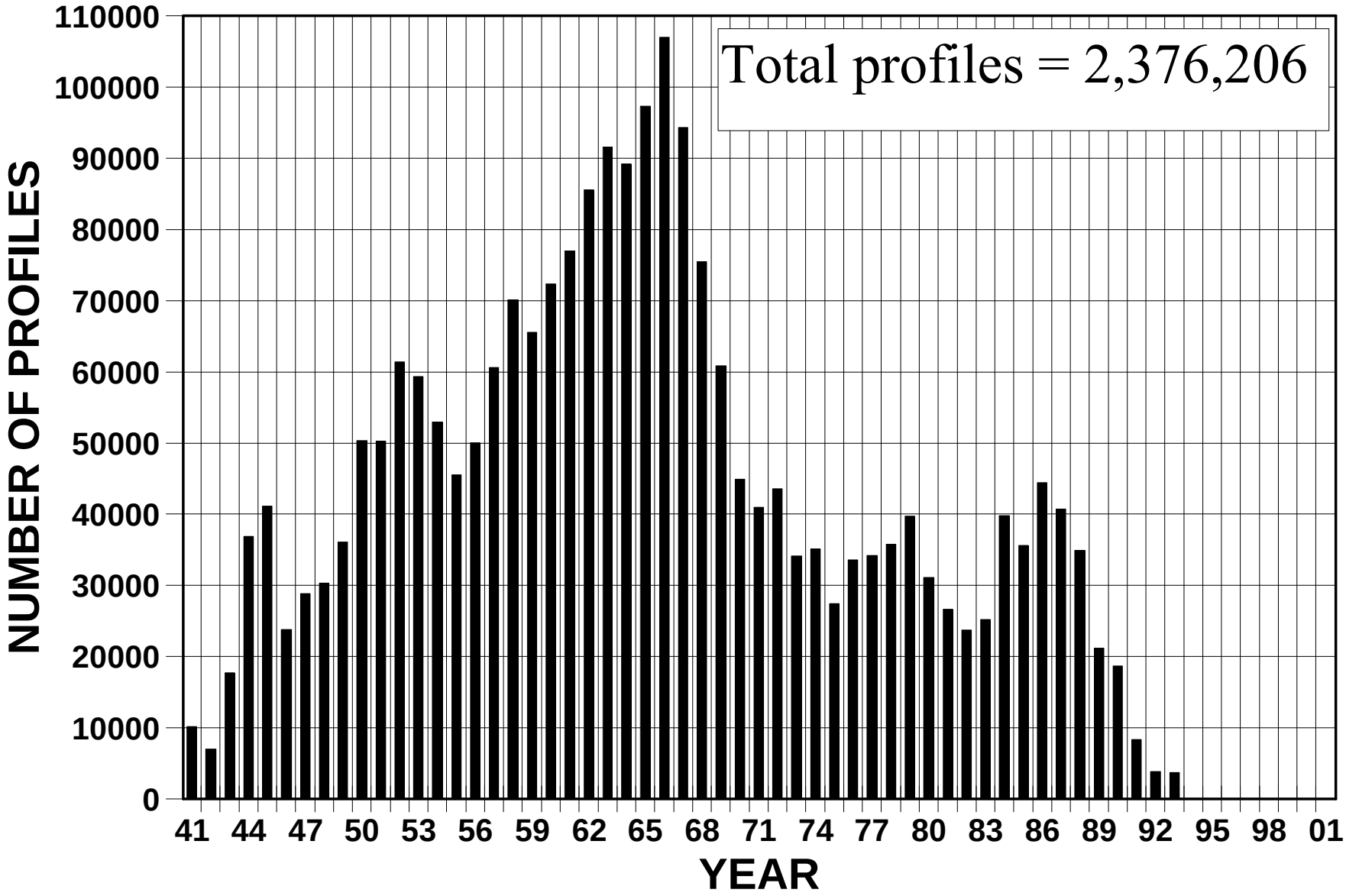


Fig. 10 Time series of MBT profiles in WOD01 for the world ocean as a function of year.

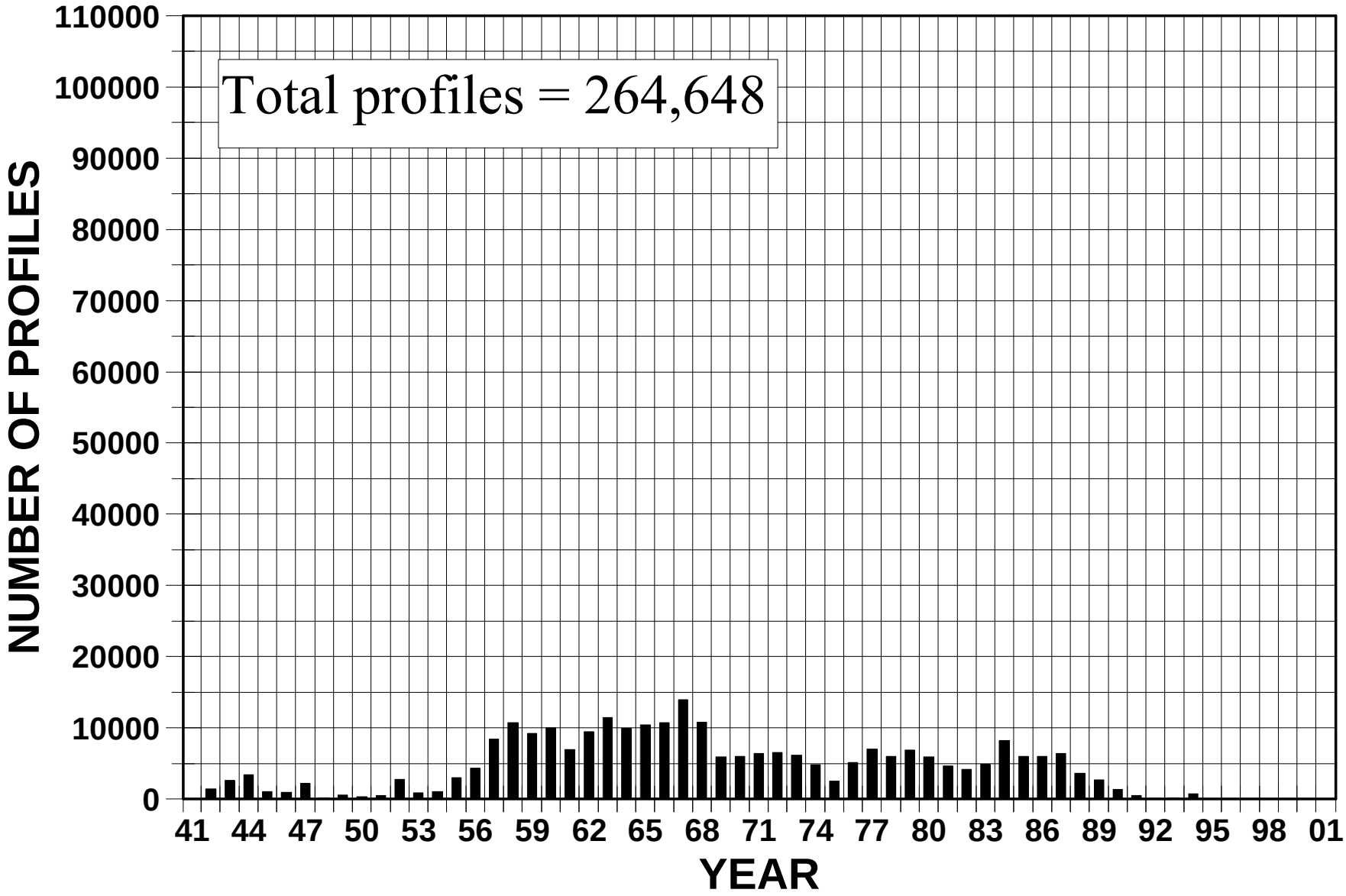


Fig. 11 Time series of MBT profiles in WOD01 for the southern hemisphere as a function of year.

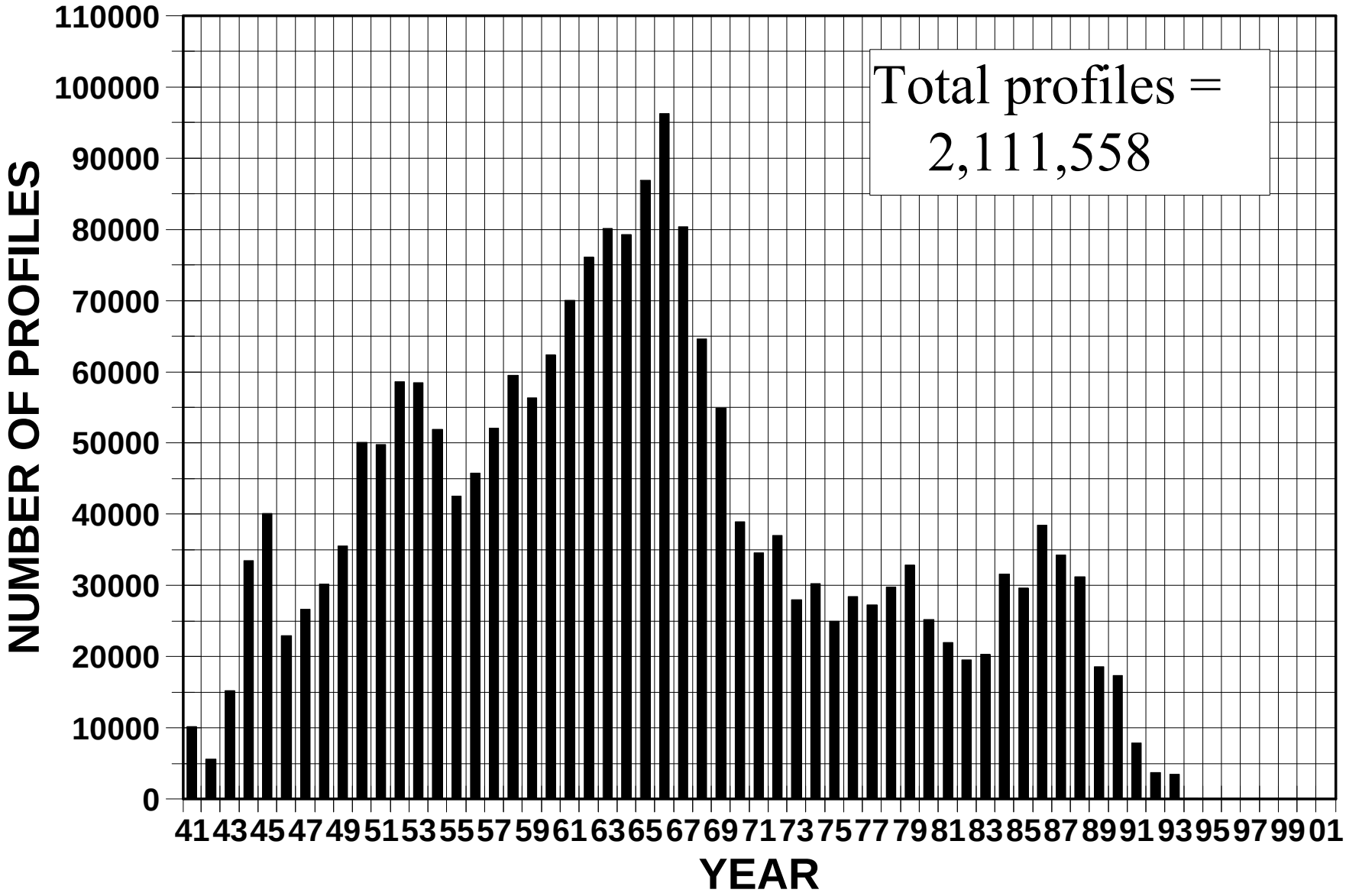


Fig. 12 Time series of MBT profiles in WOD01 for the northern hemisphere as a function of year.

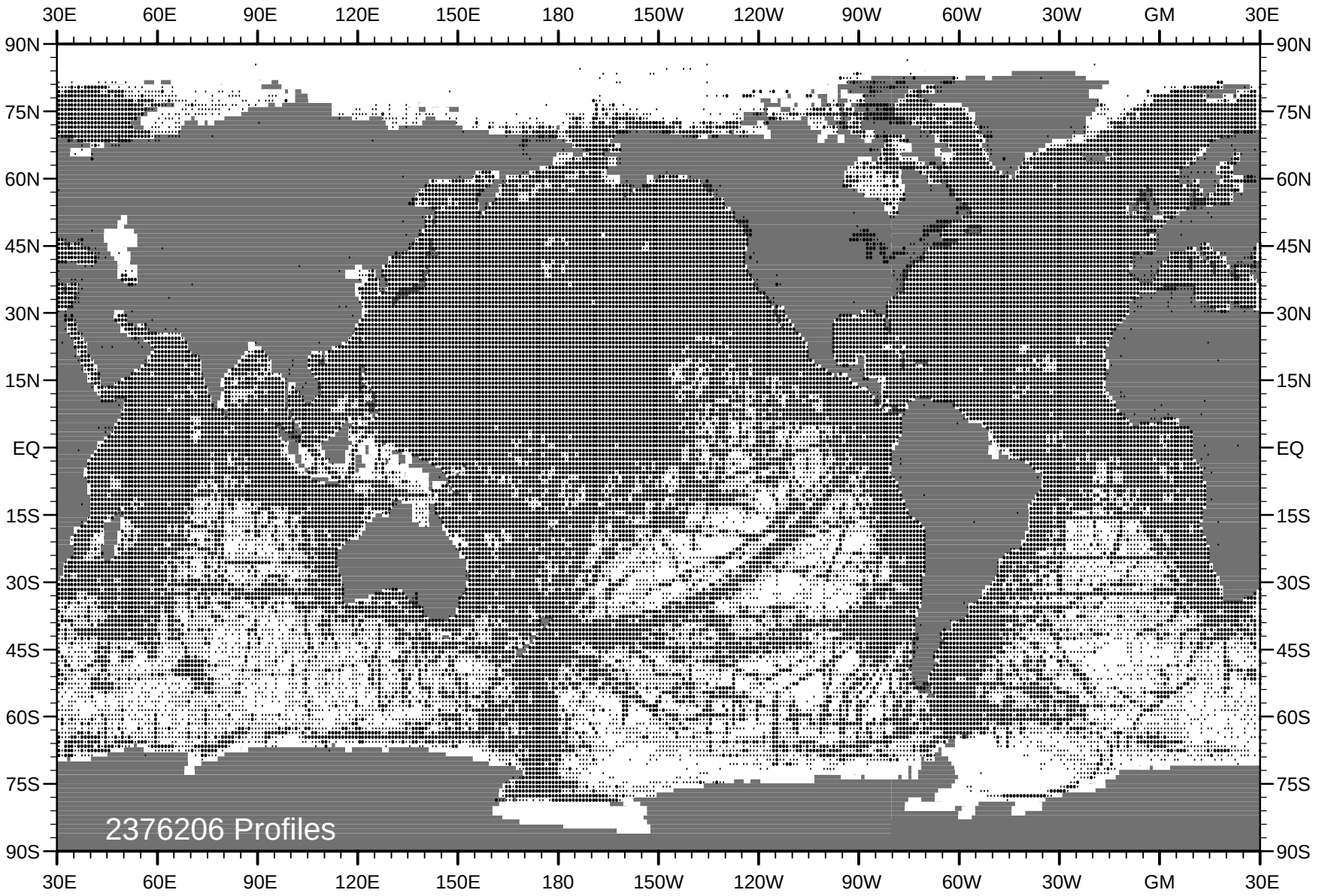


Fig. 13 Distribution of all profiles in the MBT files of WOD01.
Dots show location of 1-degree squares containing any data.

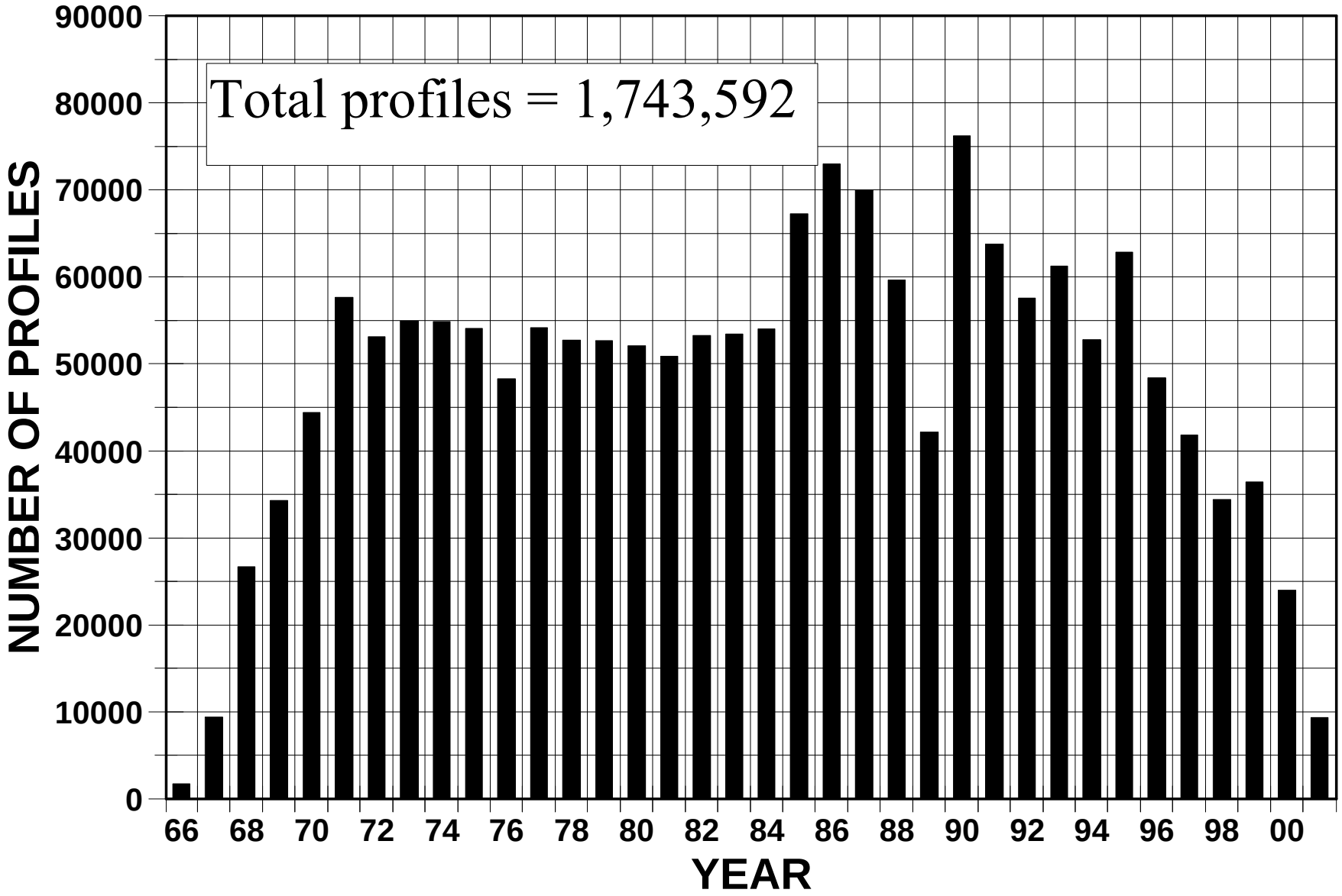


Fig. 14 Time series of XBT profiles in WOD01 for the world ocean as a function of year.

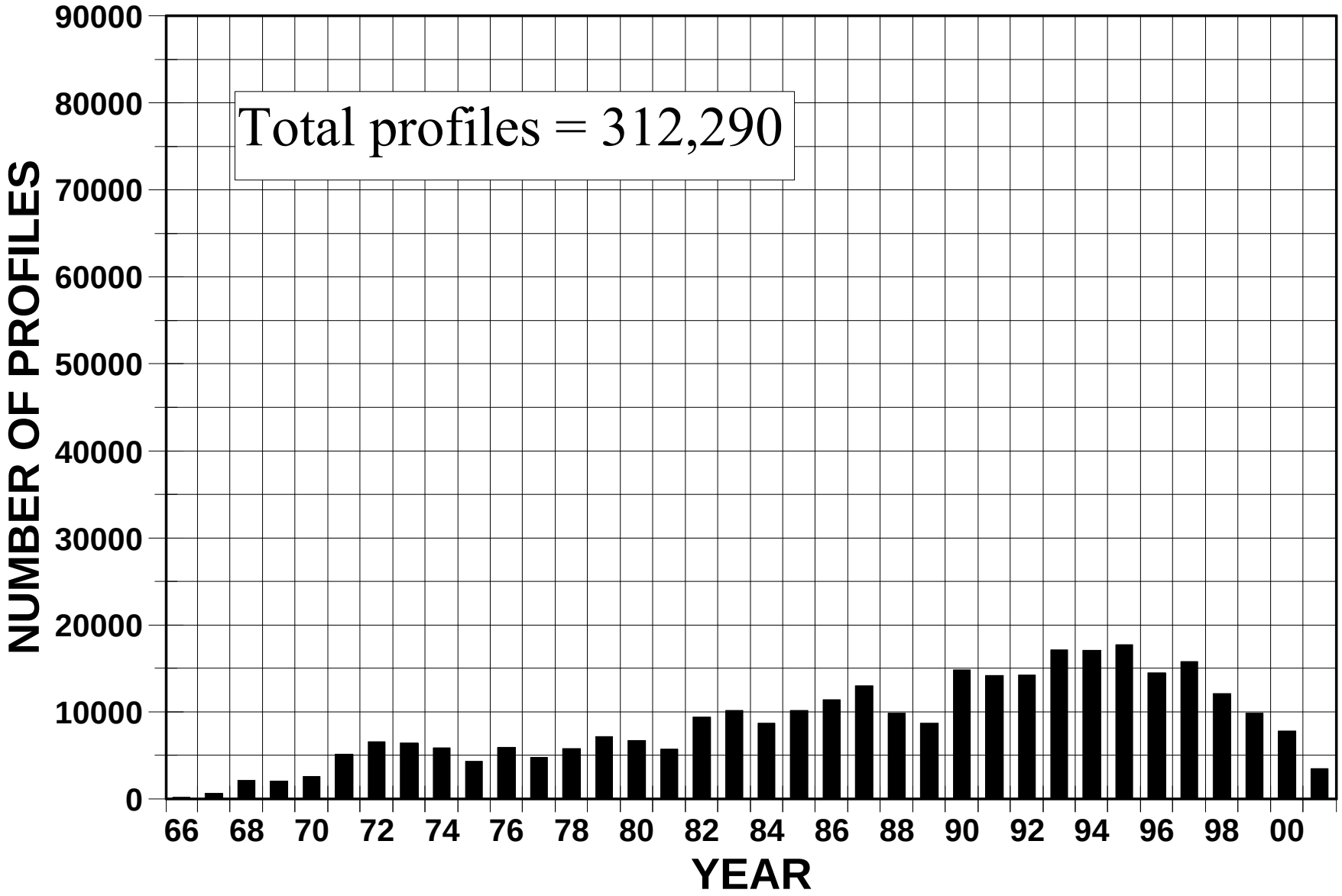


Fig. 15 Time series of XBT profiles in WOD01 for the southern hemisphere as a function of year.

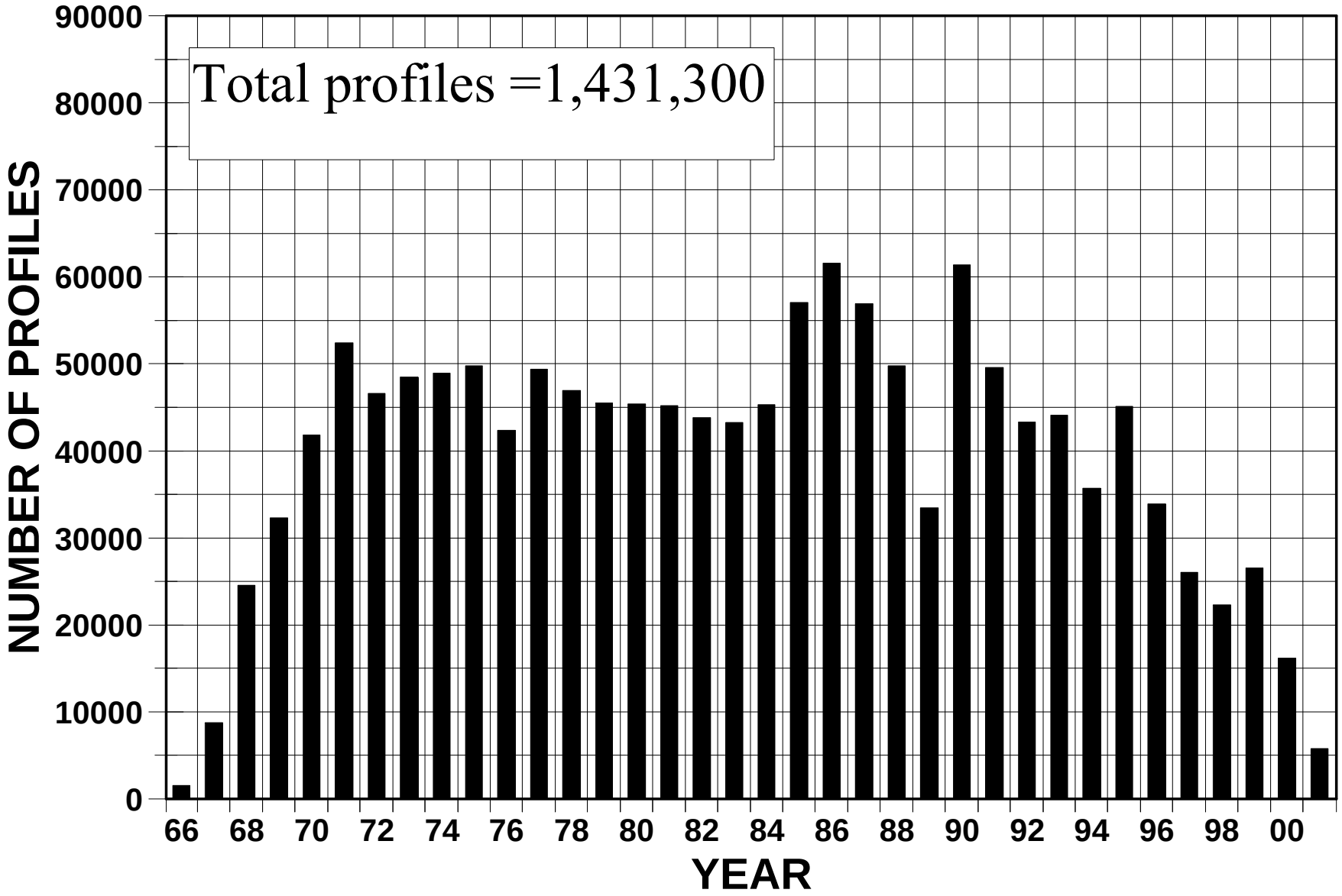


Fig. 16 Time series of XBT profiles in WOD01 for the northern hemisphere as a function of year.

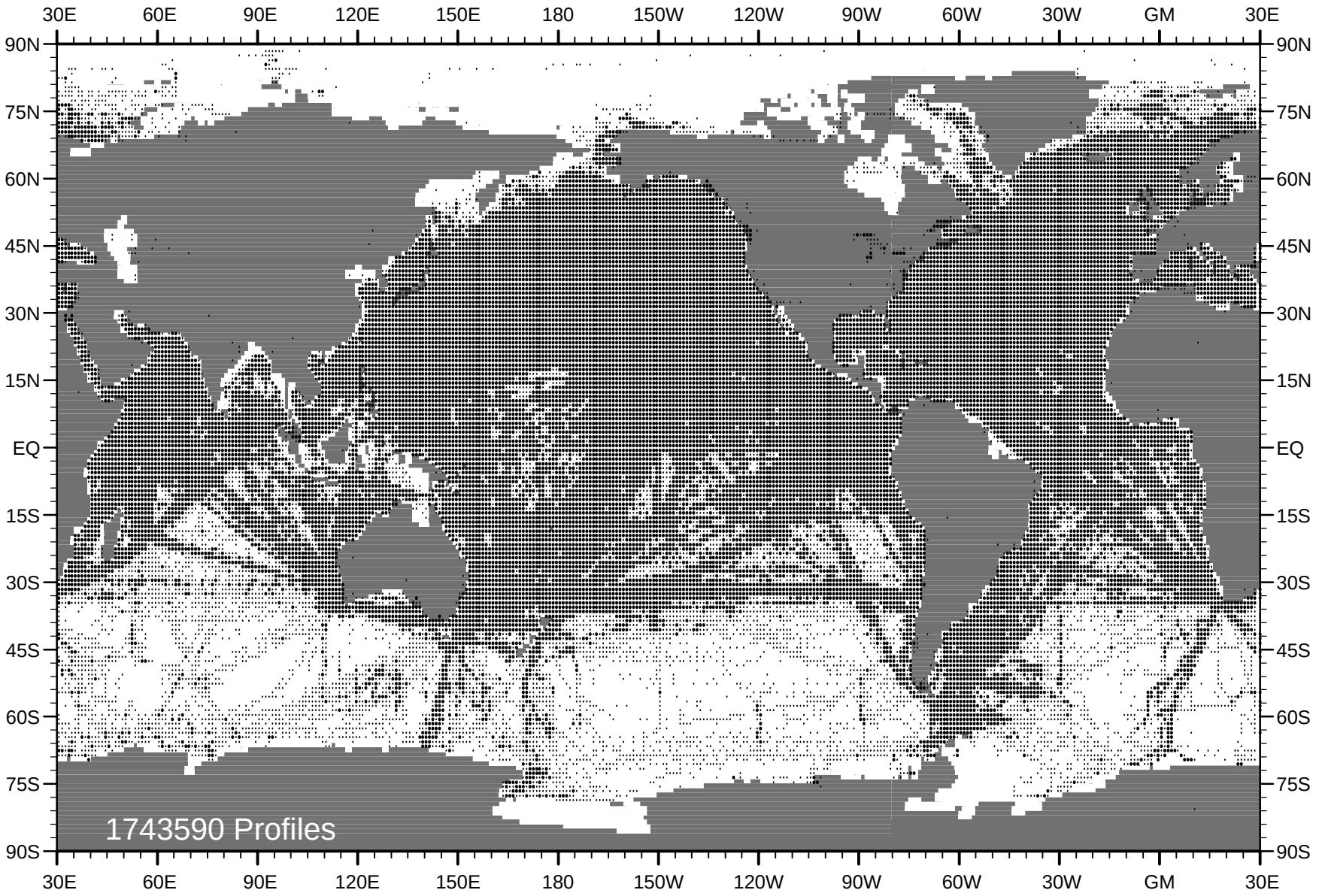


Fig. 17 Distribution of all profiles in the XBT files of WOD01.
Dots show location of 1-degree squares containing any data.

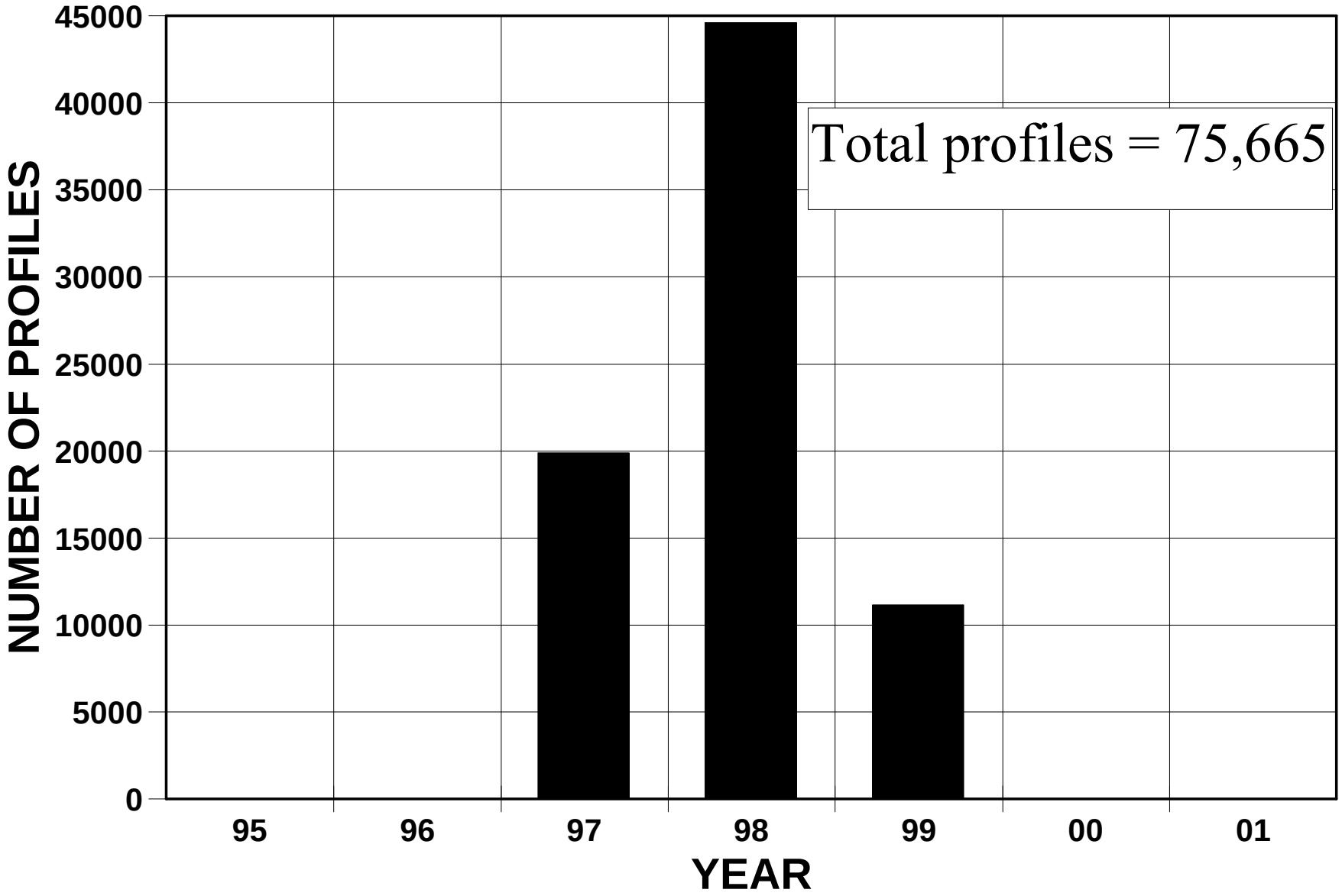


Fig. 18 Time series of APB profiles in WOD01 for the world ocean as a function of year.

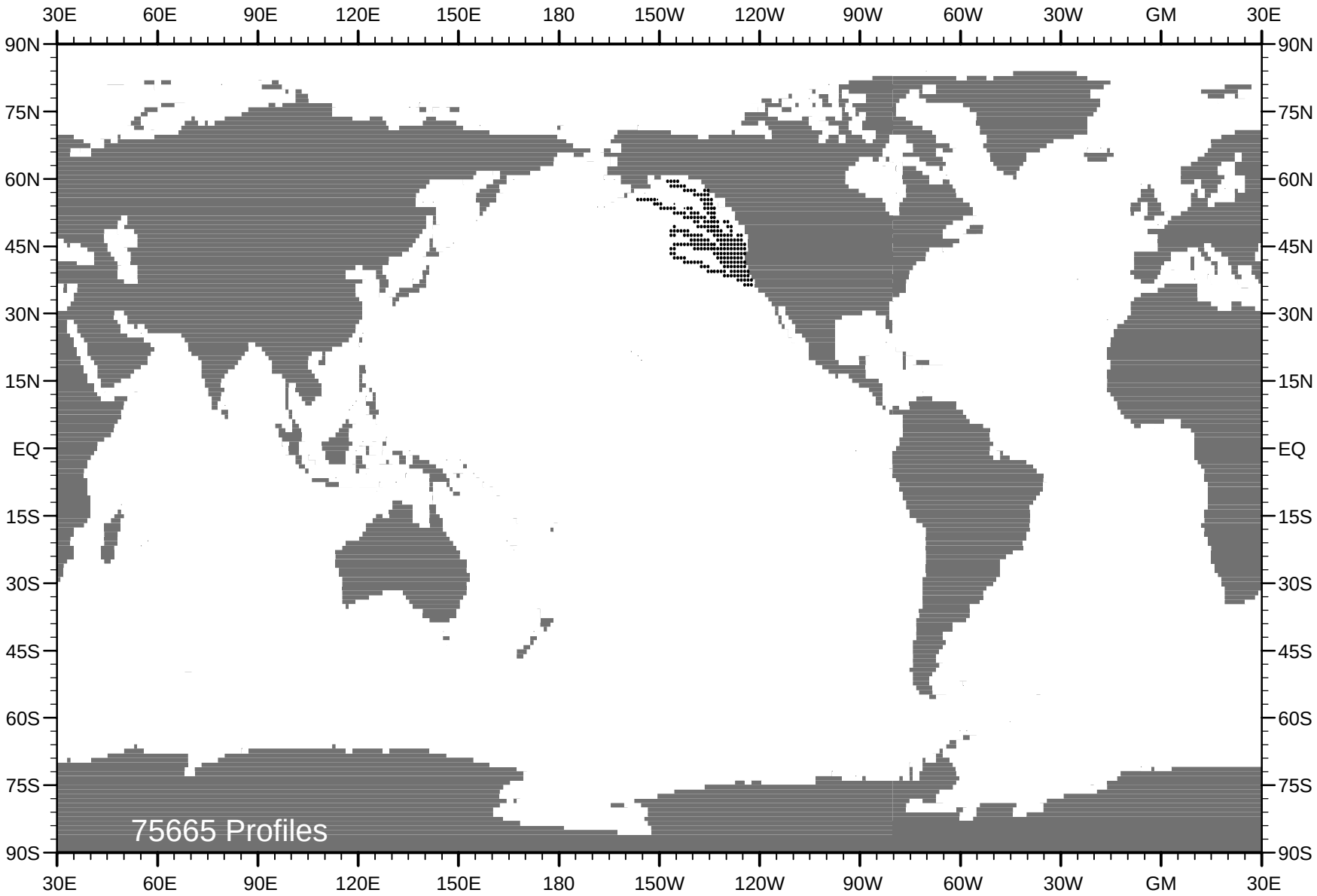


Fig. 19 Distribution of all profiles in the APB files of WOD01.
Dots show location of 1-degree squares containing any data.

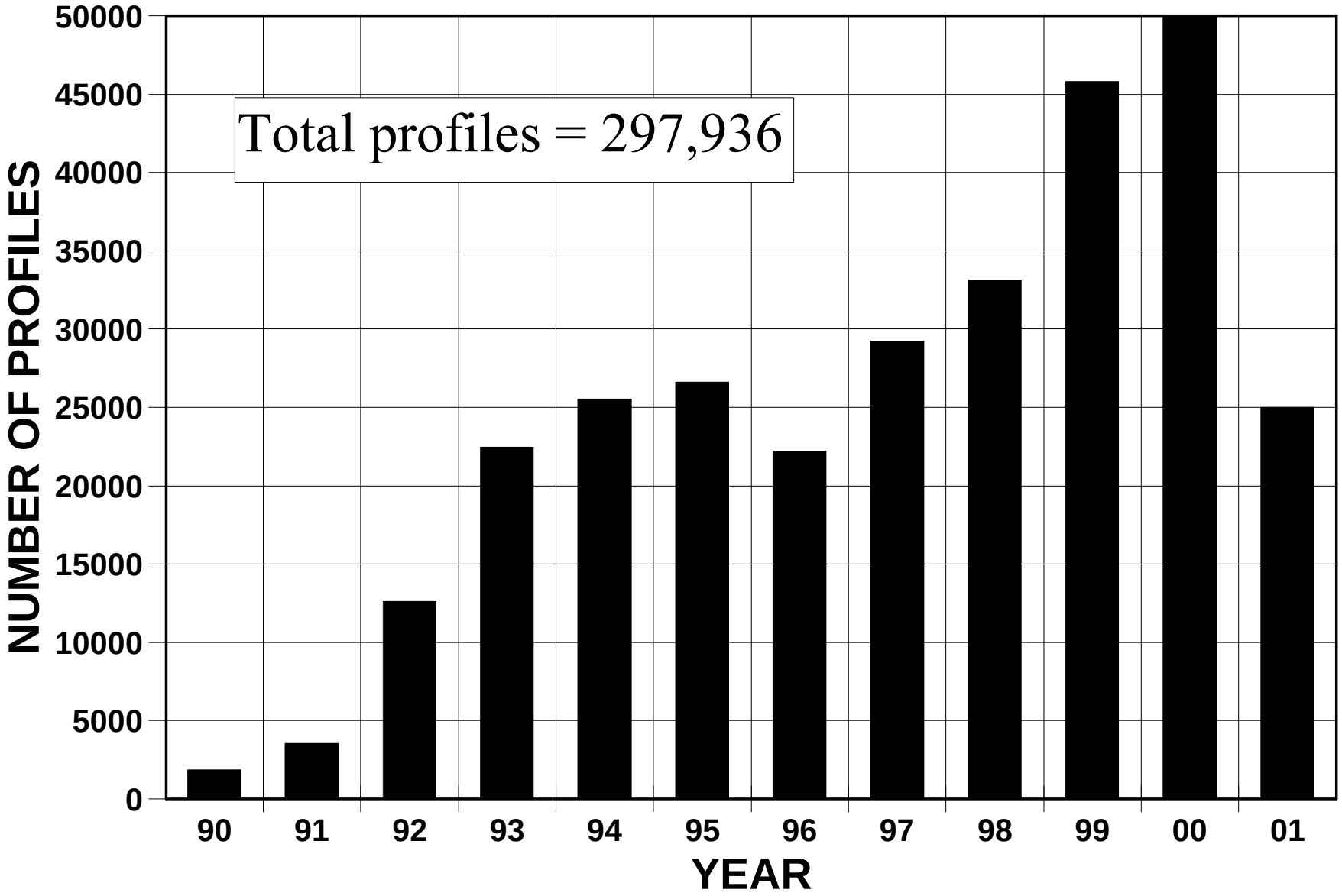


Fig. 20 Time series of MRB profiles in WOD01 for the world ocean as a function of year.

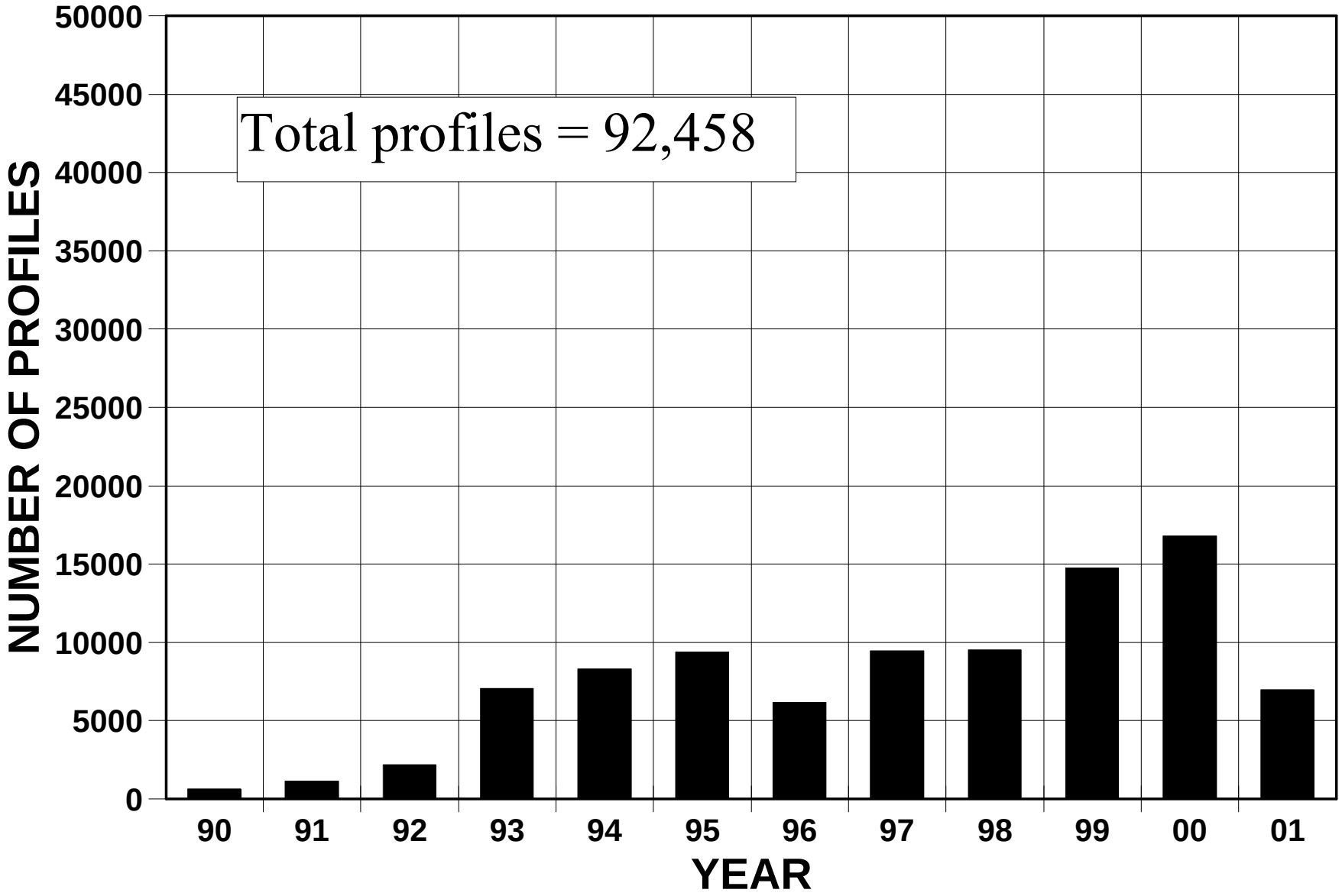


Fig. 21 Time series of MRB profiles in WOD01 for the southern hemisphere as a function of year.

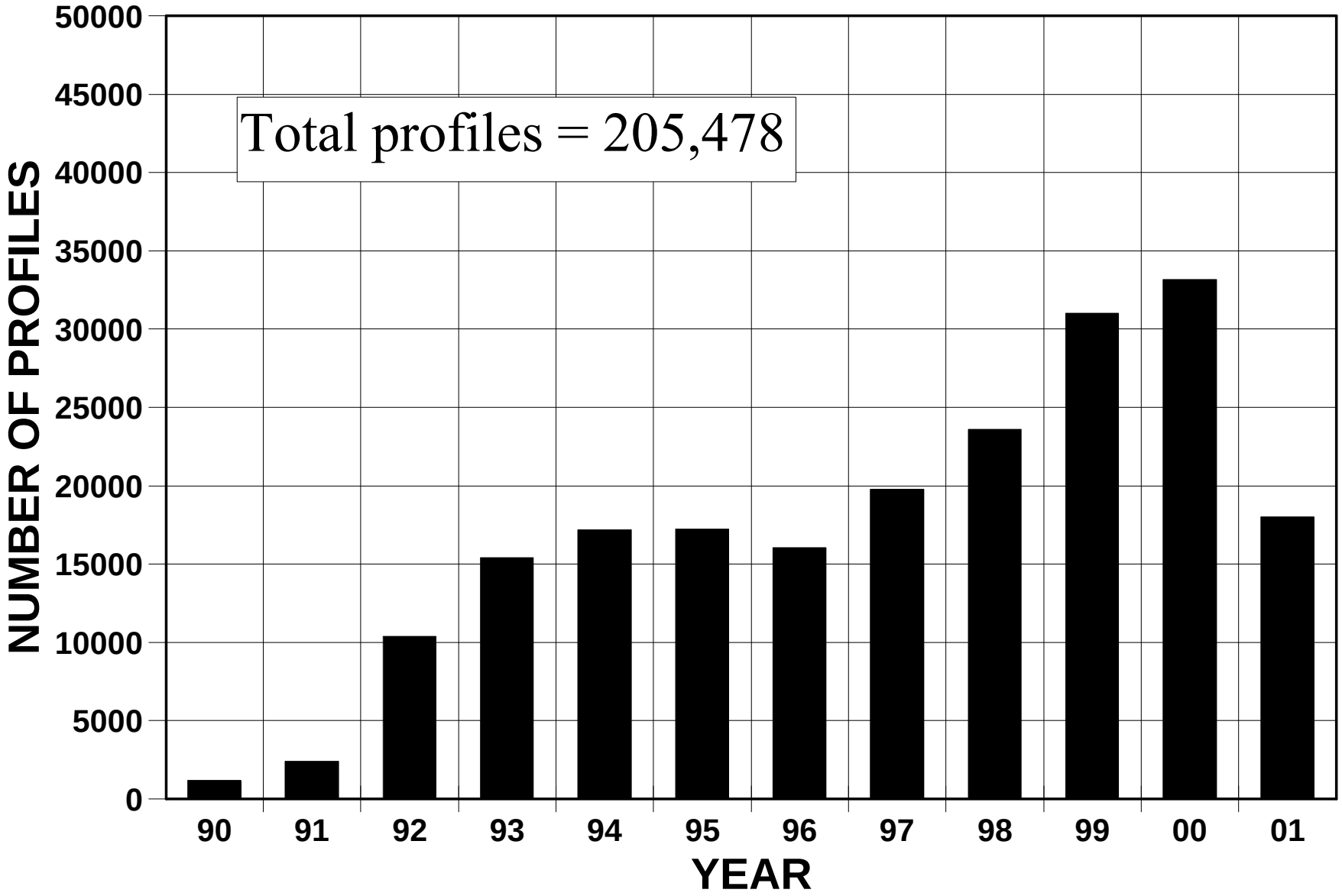


Fig. 22 Time series of MRB profiles in WOD01 for the northern hemisphere as a function of year.

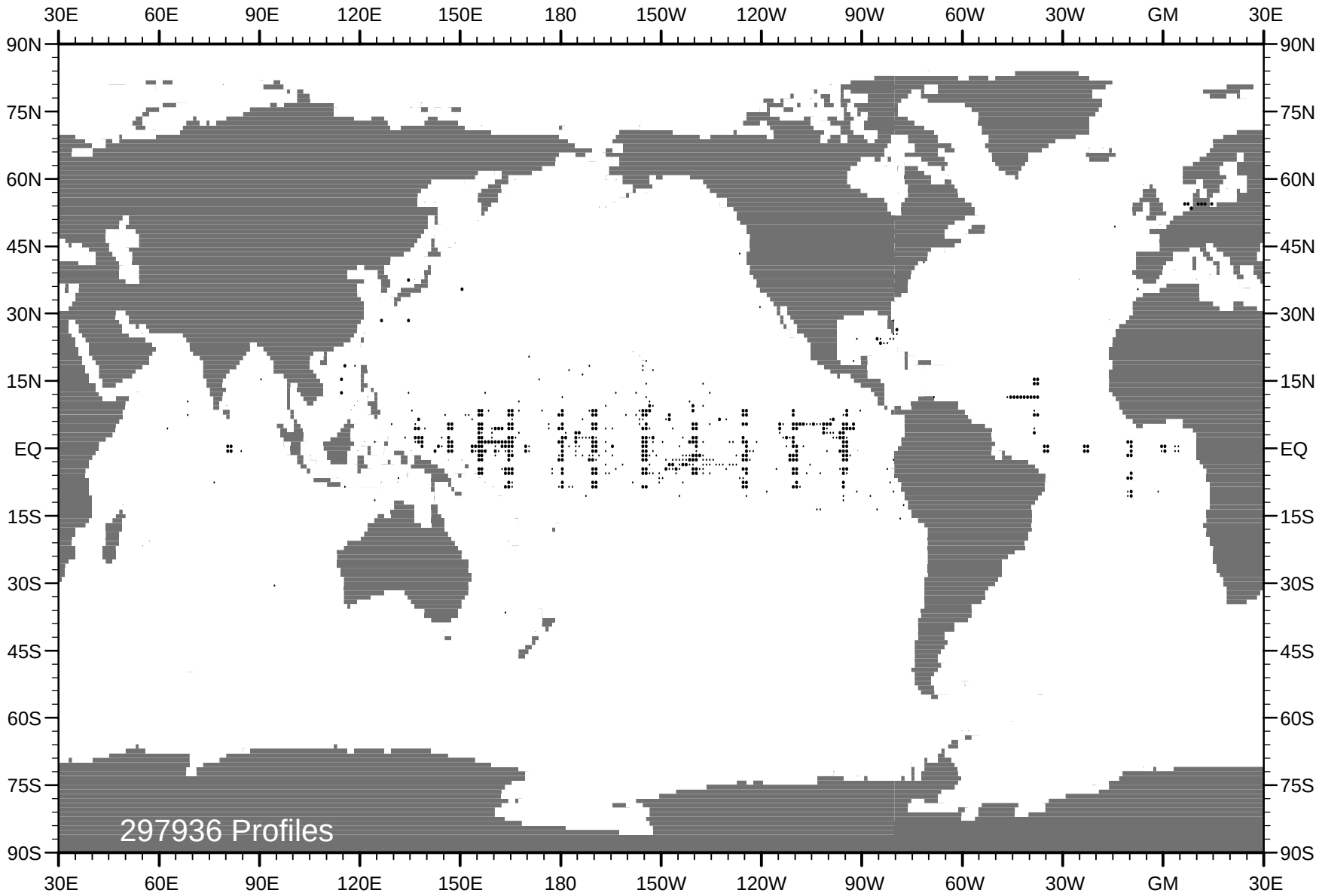


Fig. 23 Distribution of all profiles in the MRB files of WOD01.
Dots show location of 1-degree squares containing any data.

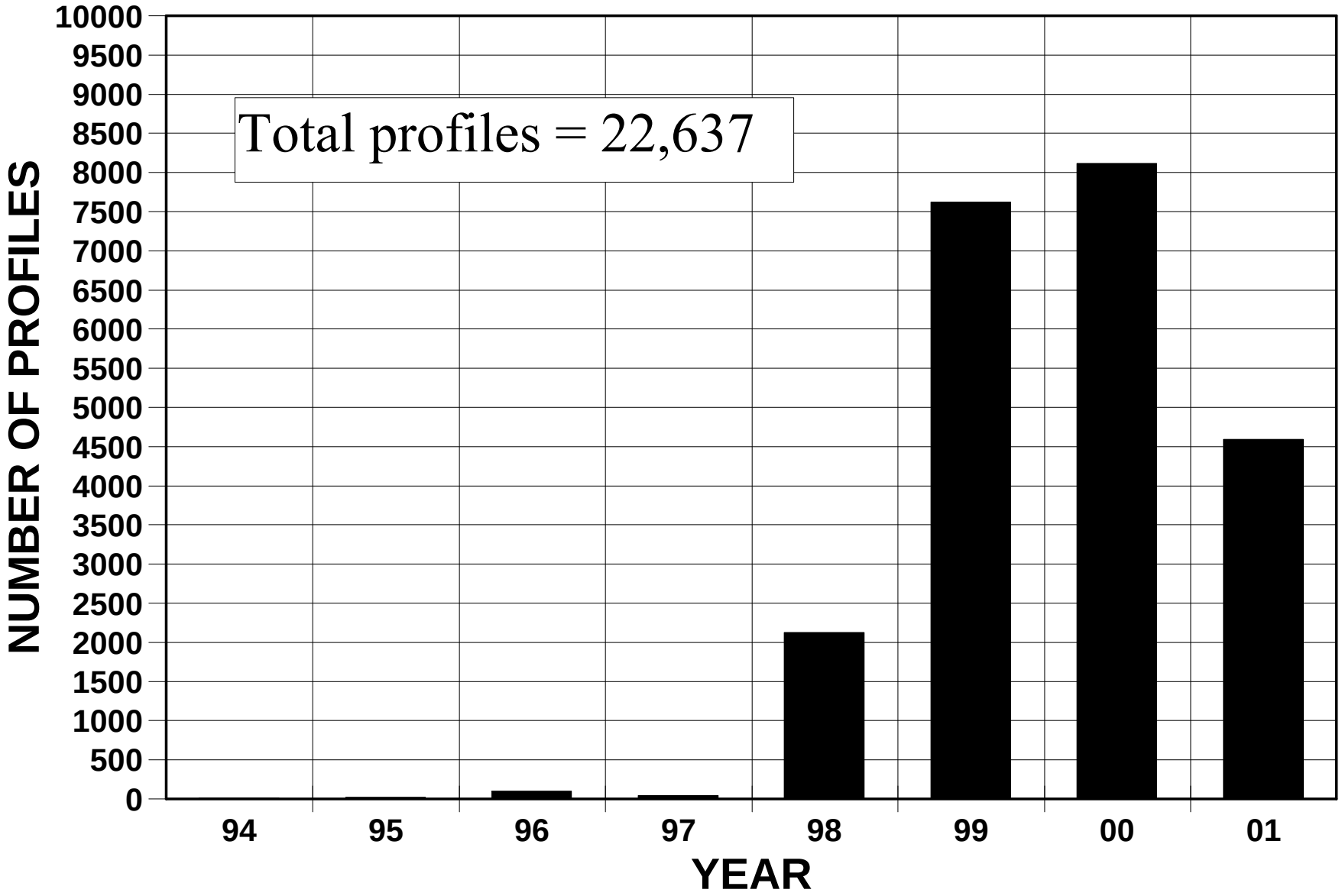


Fig. 24 Time series of PFL profiles in WOD01 for the world ocean as a function of year.

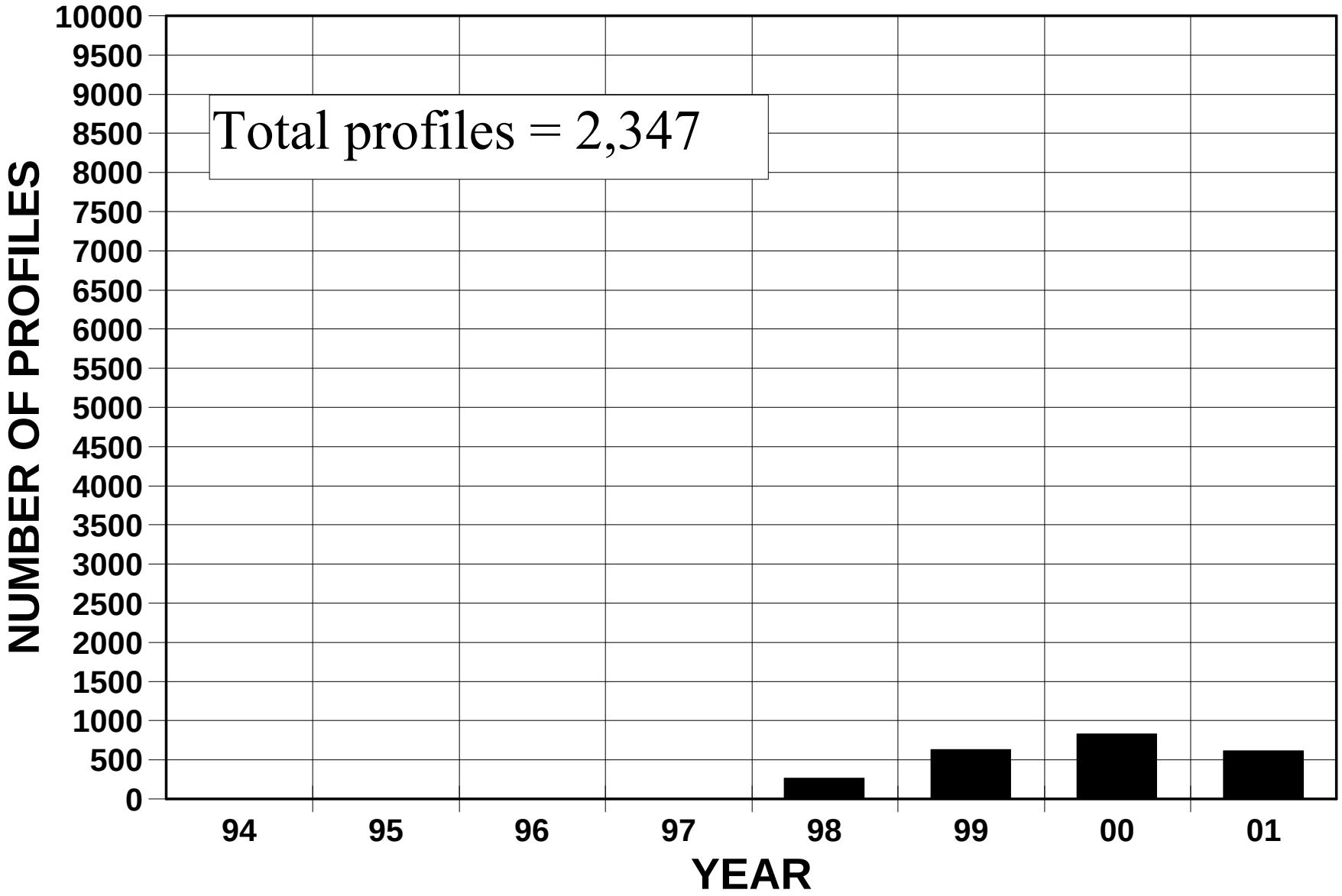


Fig. 25 Time series of PFL profiles in WOD01 for the southern hemisphere as a function of year.

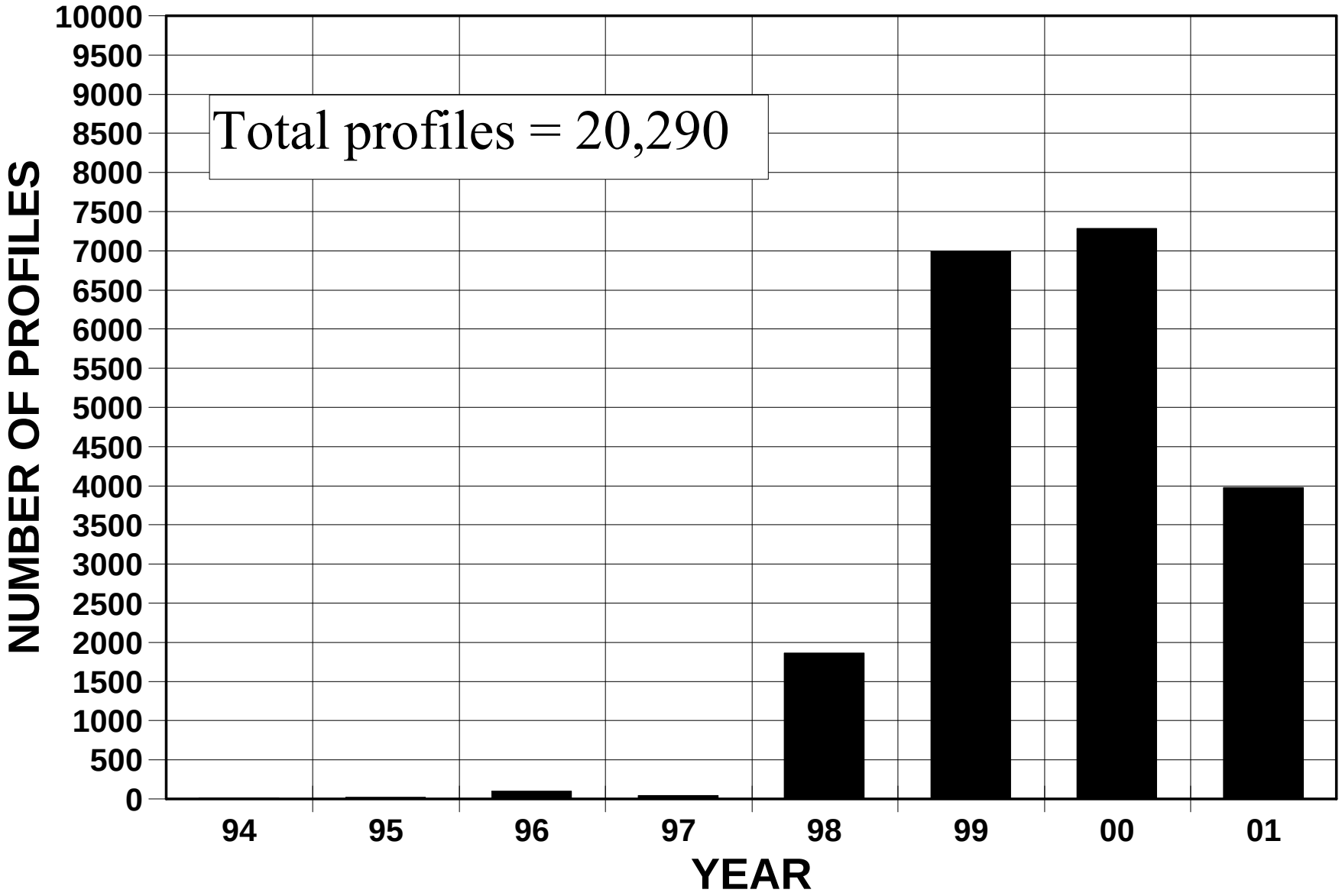


Fig. 26 Time series of PFL profiles in WOD01 for the northern hemisphere as a function of year.

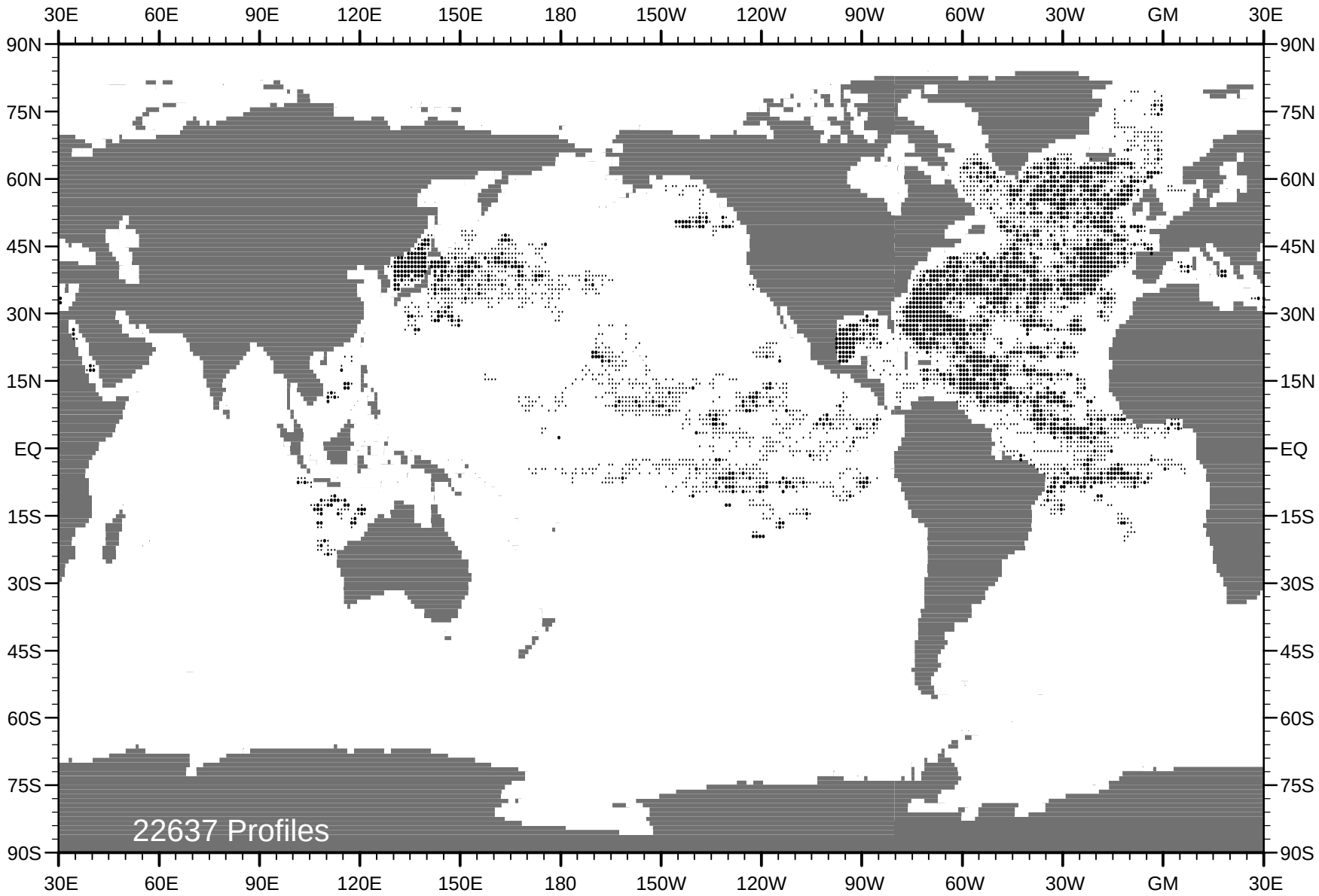


Fig. 27 Distribution of all profiles in the PFL files of WOD01.
Dots show location of 1-degree squares containing any data.

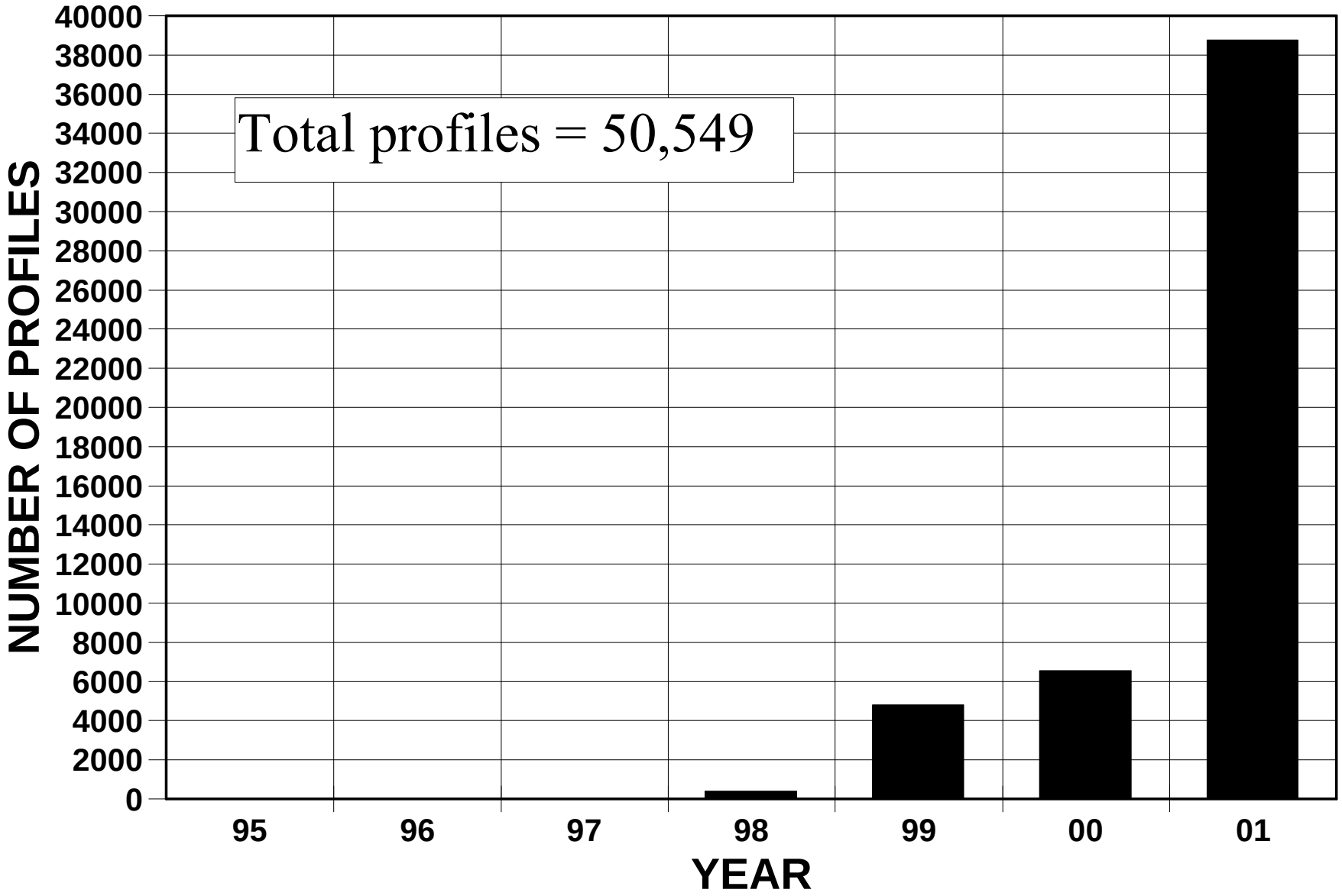


Fig. 28 Time series of DRB profiles in WOD01 for the world ocean as a function of year.

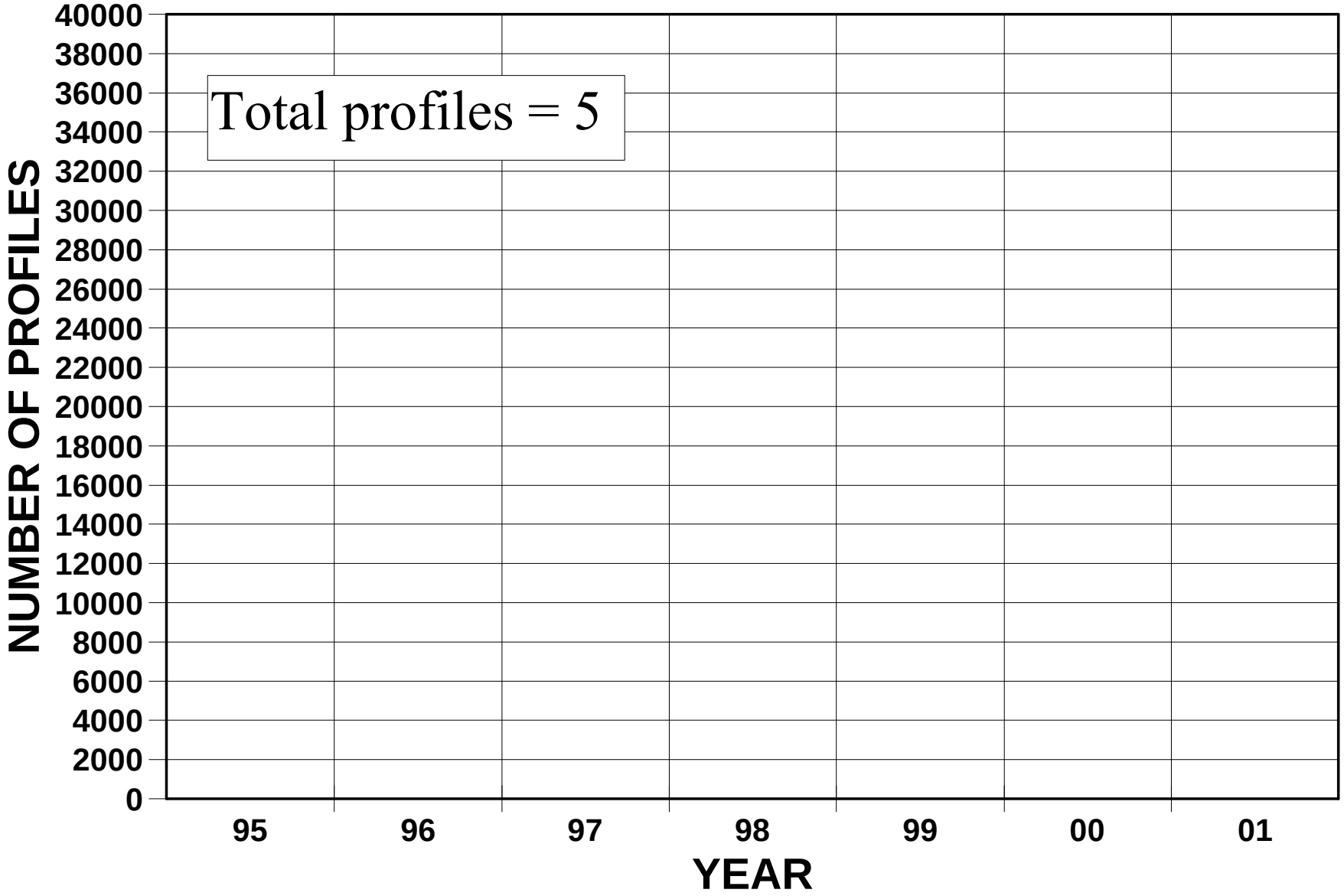


Fig. 29 Time series of DRB profiles in WOD01 for the southern hemisphere as a function of year.

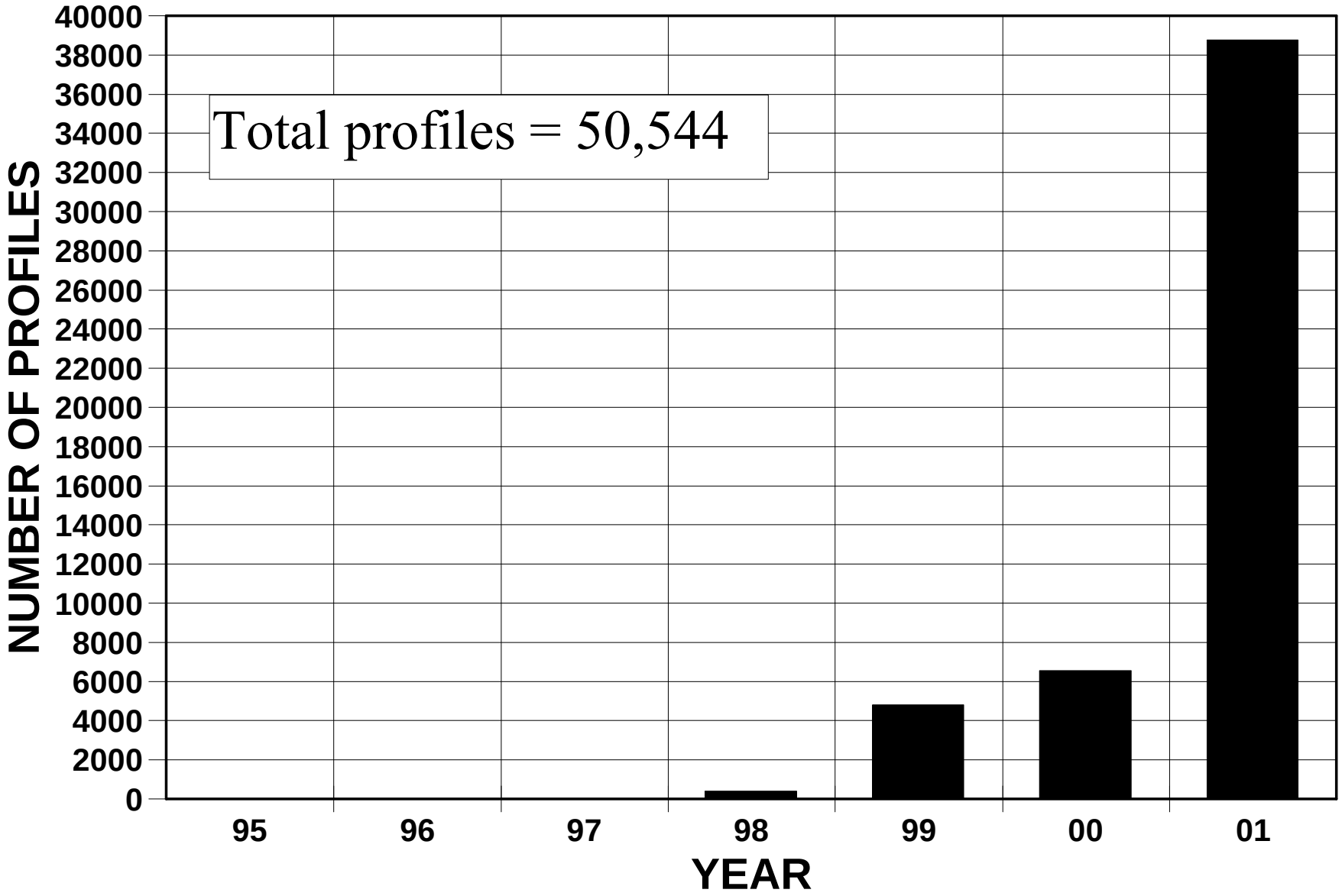


Fig. 30 Time series of DRB profiles in WOD01 for the northern hemisphere as a function of year.

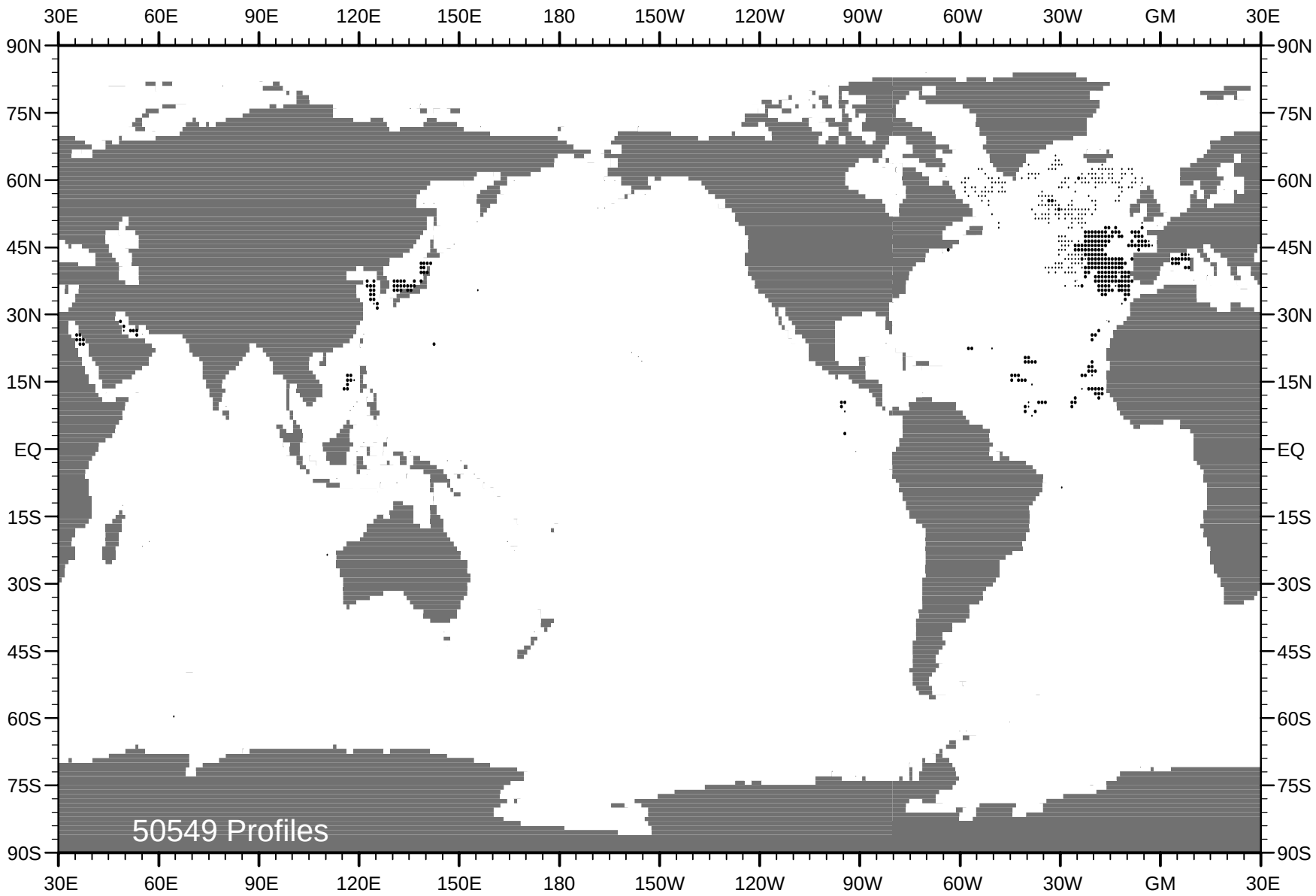


Fig. 31 Distribution of all profiles in the DRB files of WOD01.
Dots show location of 1-degree squares containing any data.

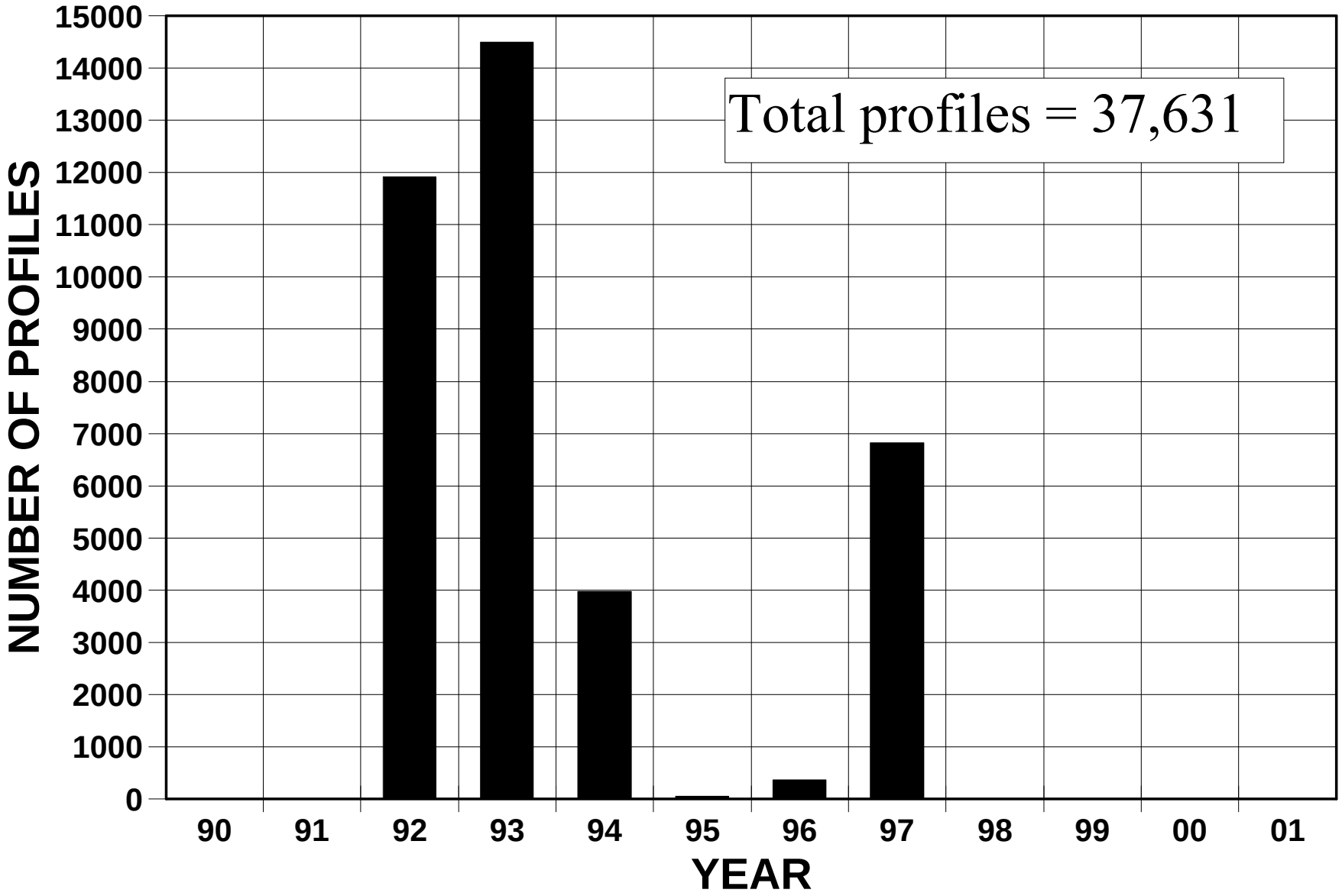


Fig. 32 Time series of UOR profiles in WOD01 for the world ocean as a function of year.

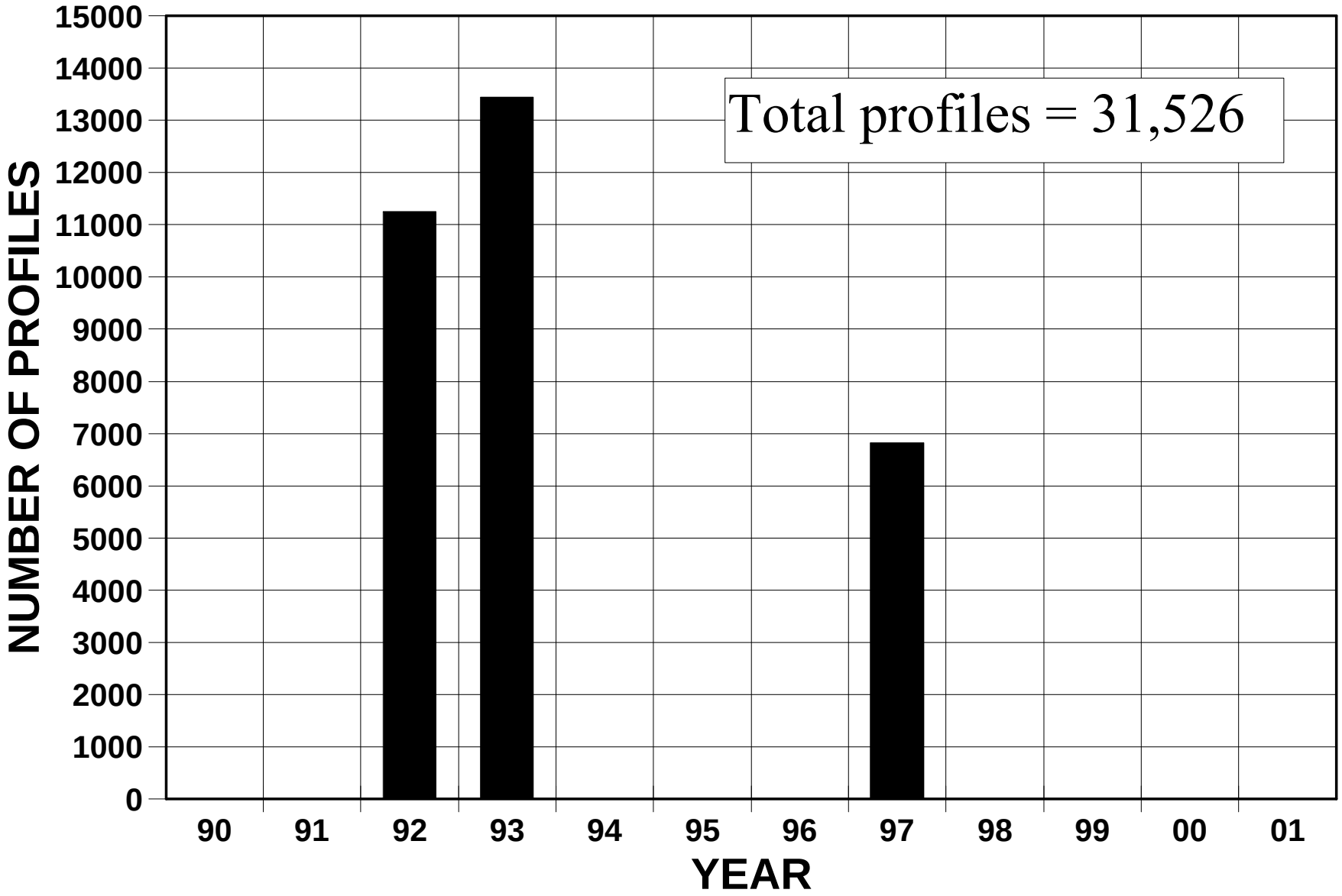


Fig. 33 Time series of UOR profiles in WOD01 for the southern hemisphere as a function of year.

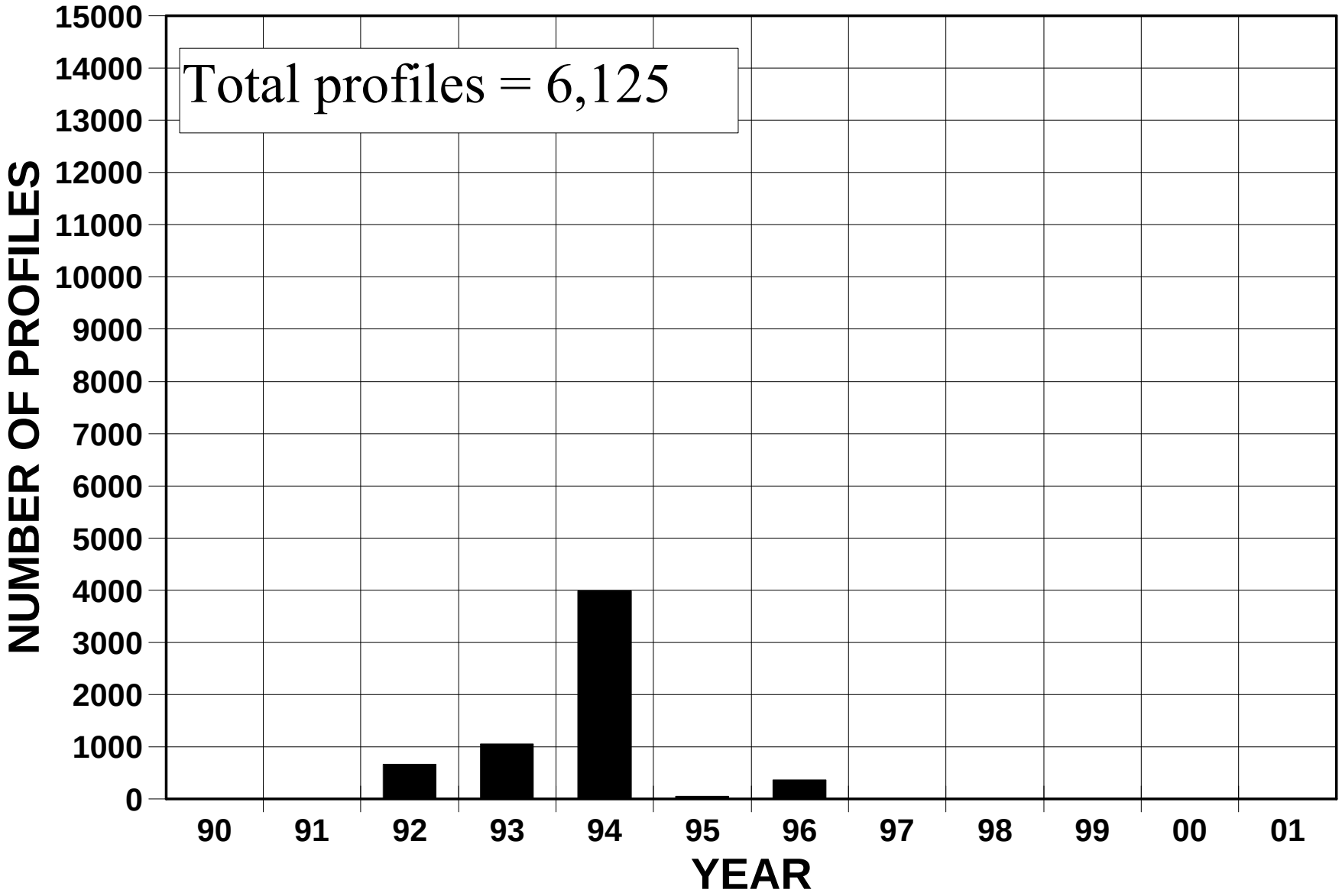


Fig. 34 Time series of UOR profiles in WOD01 for the northern hemisphere as a function of year.

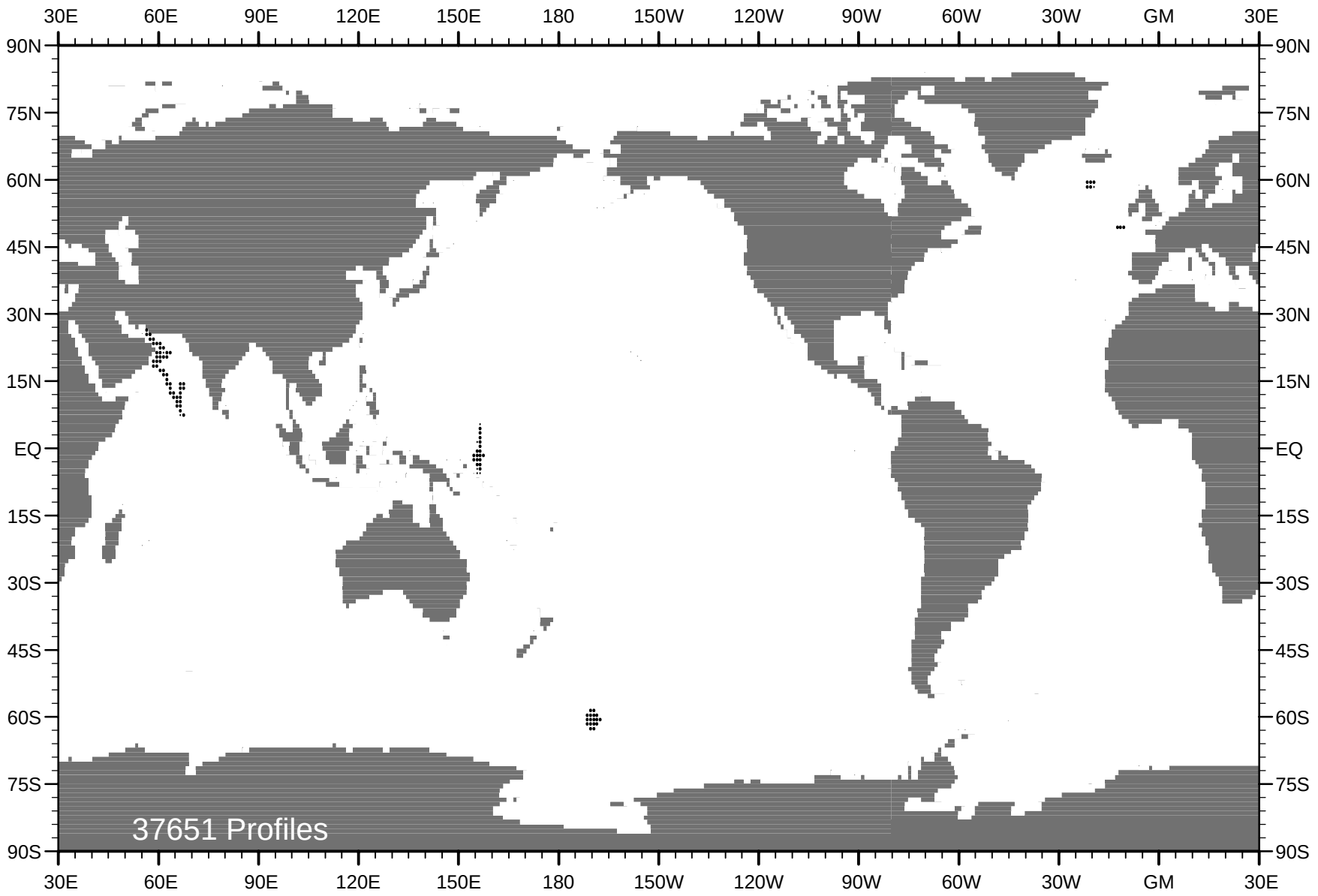


Fig. 35 Distribution of all profiles in the UOR files of WOD01.
Dots show location of 1-degree squares containing any data.

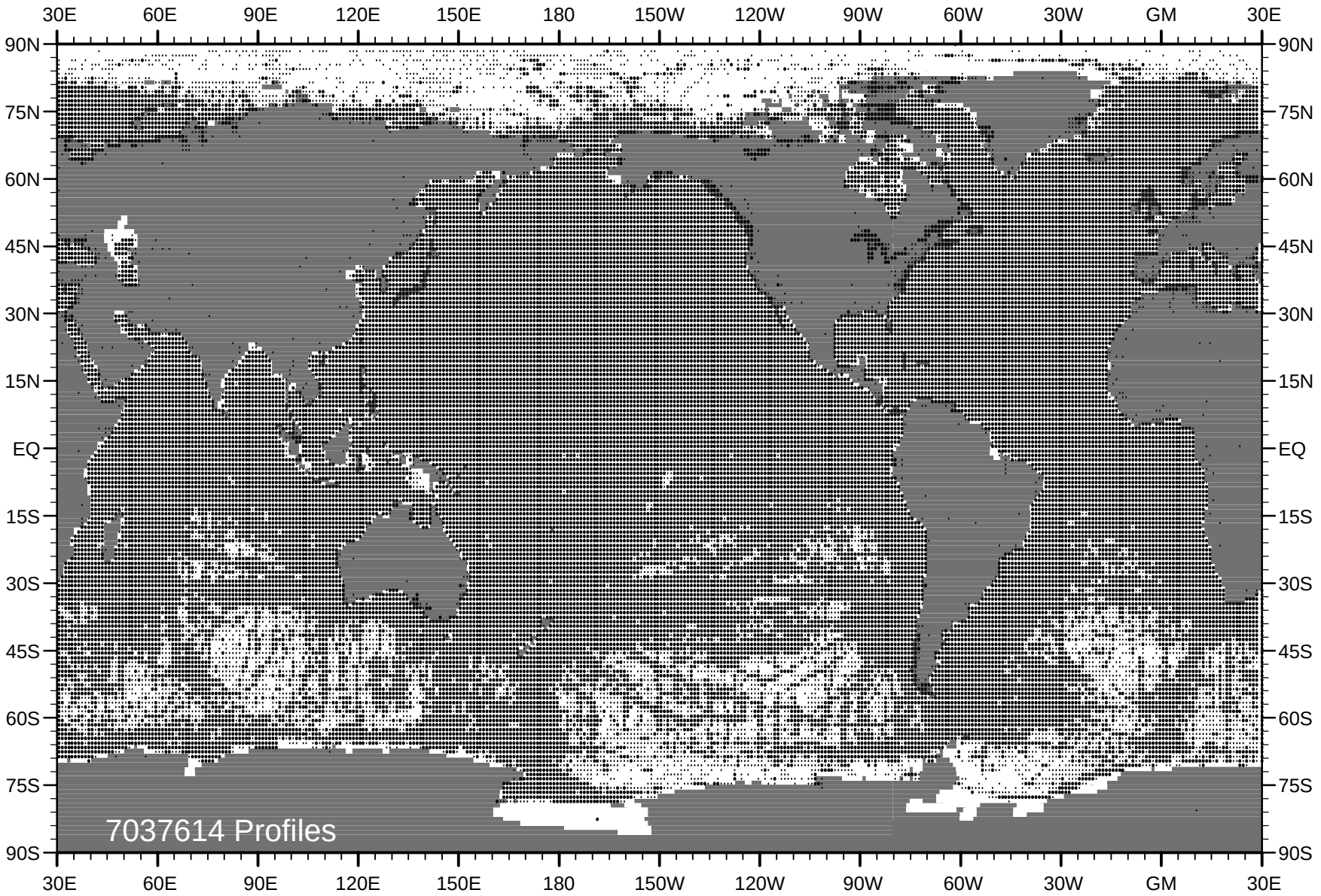


Fig. 36 Distribution of all profiles (OSD+CTD+MBT+XBT+MRB+DRB+PFL+APB+UOR) in WOD01.
Dots show location of 1-degree squares containing any data.

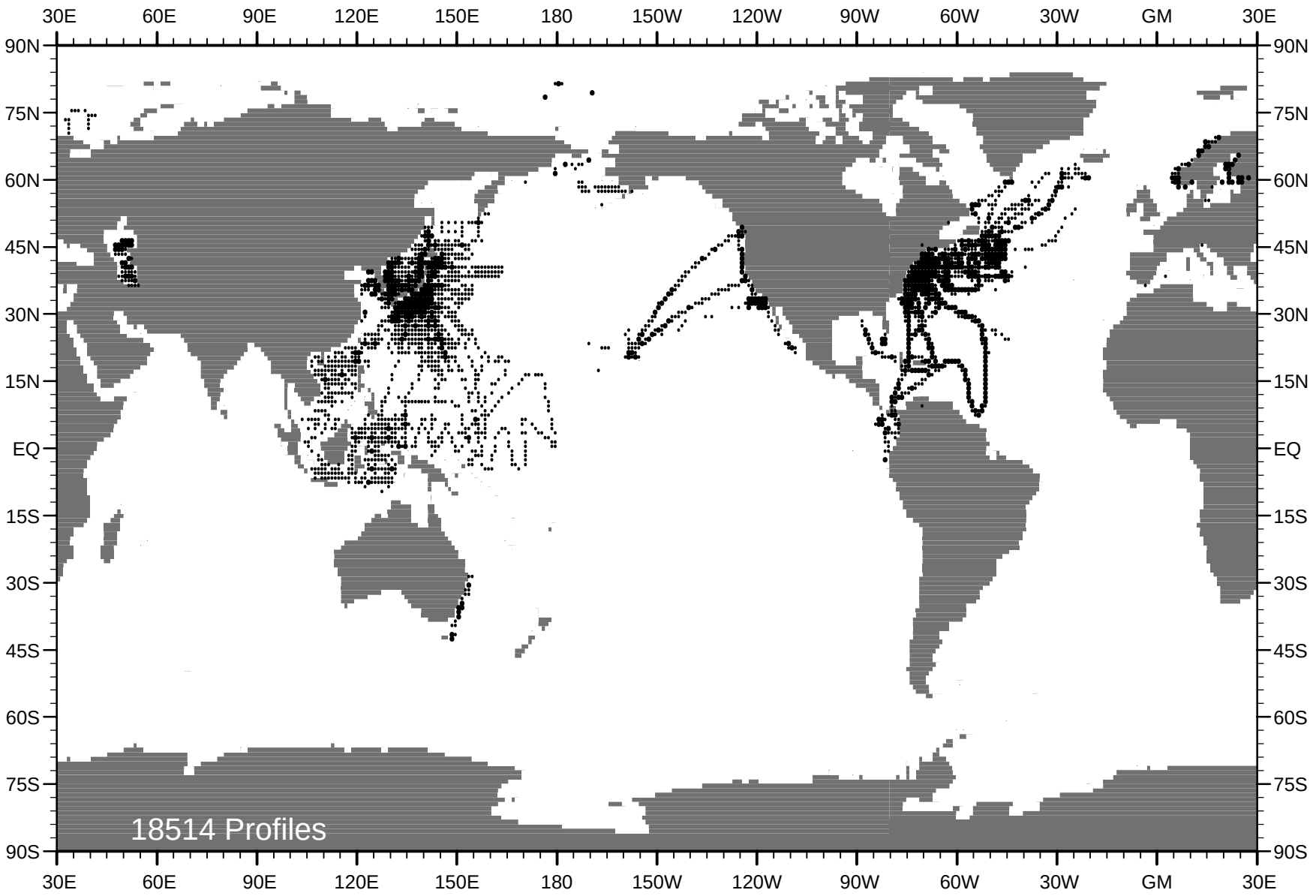


Fig. A1 Distribution of all data profiles (OSD+MBT) in WOD01 for year 1941 .

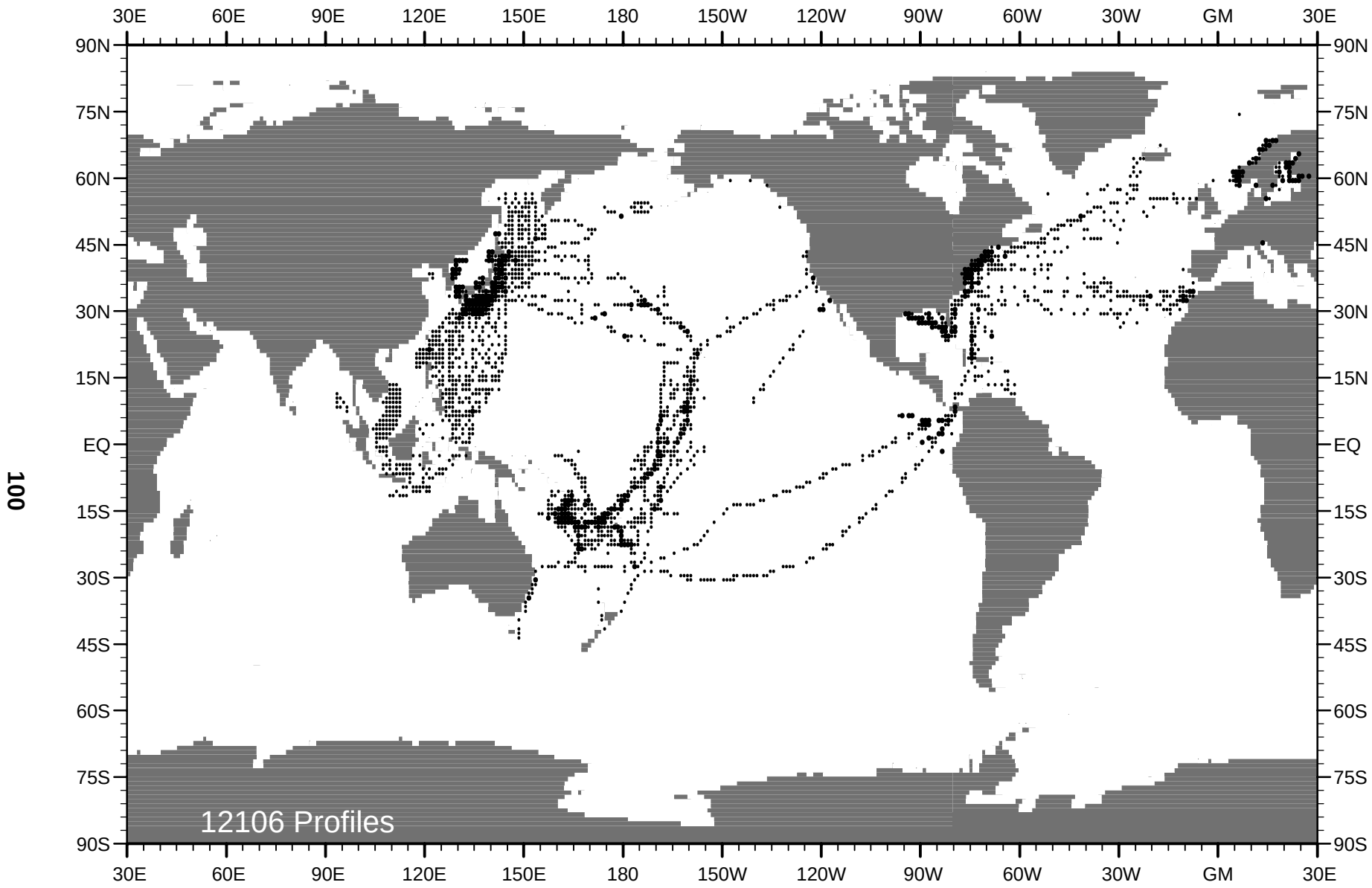


Fig. A2 Distribution of all data profiles (OSD+MBT) in WOD01 for year 1942 .

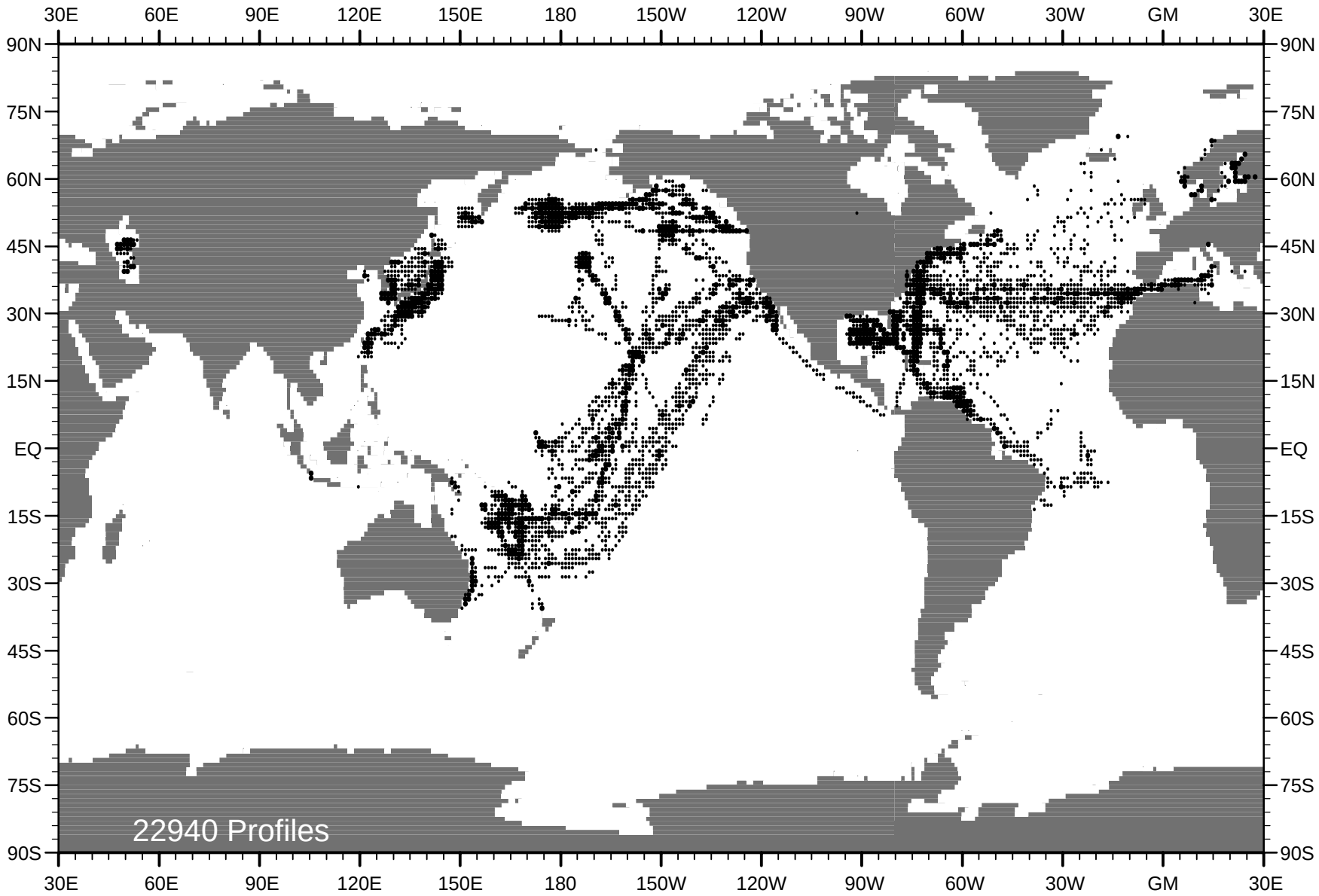


Fig. A3 Distribution of all data profiles (OSD+MBT) in WOD01 for year 1943 .

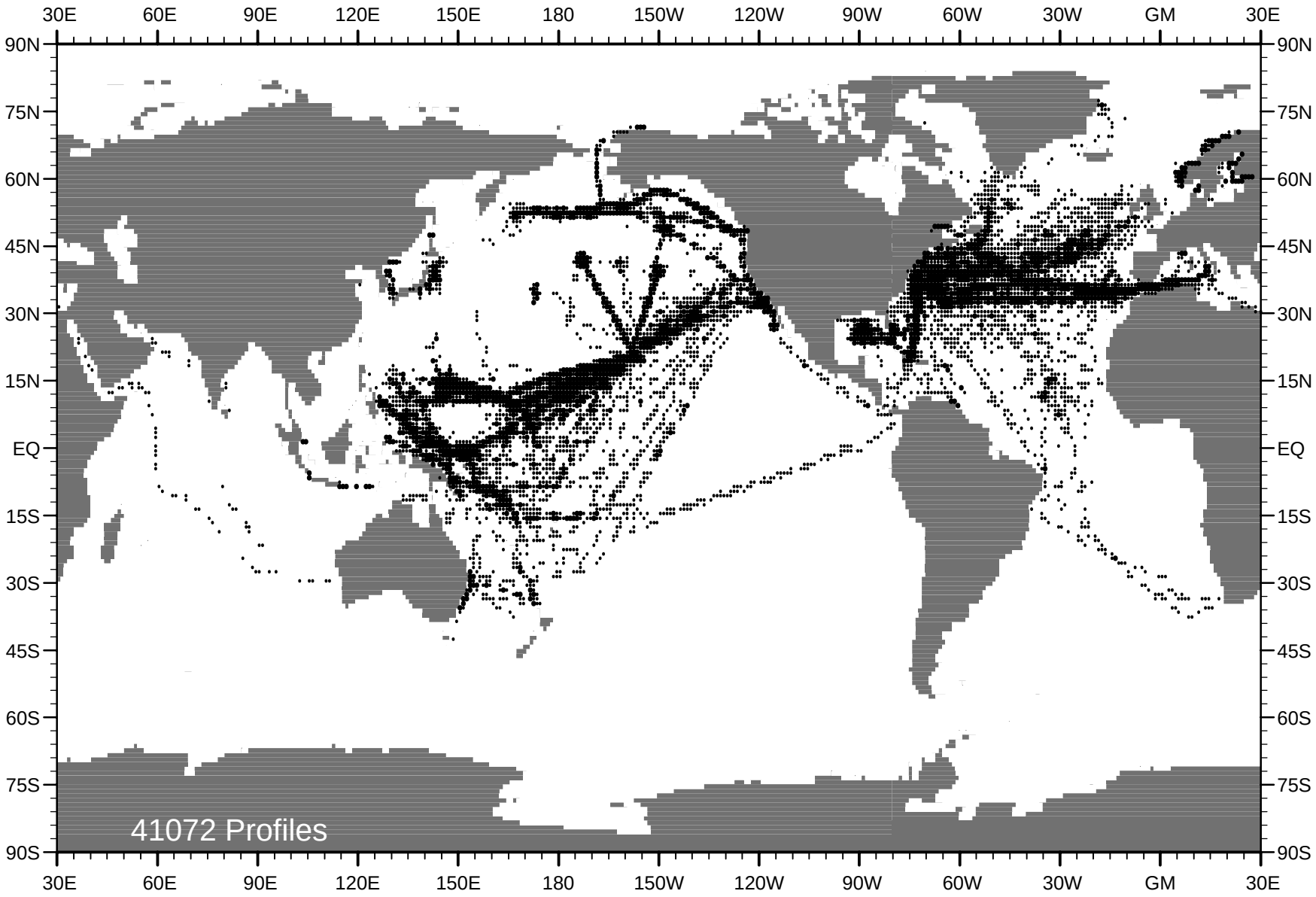


Fig. A4 Distribution of all data profiles (OSD+MBT) in WOD01 for year 1944 .

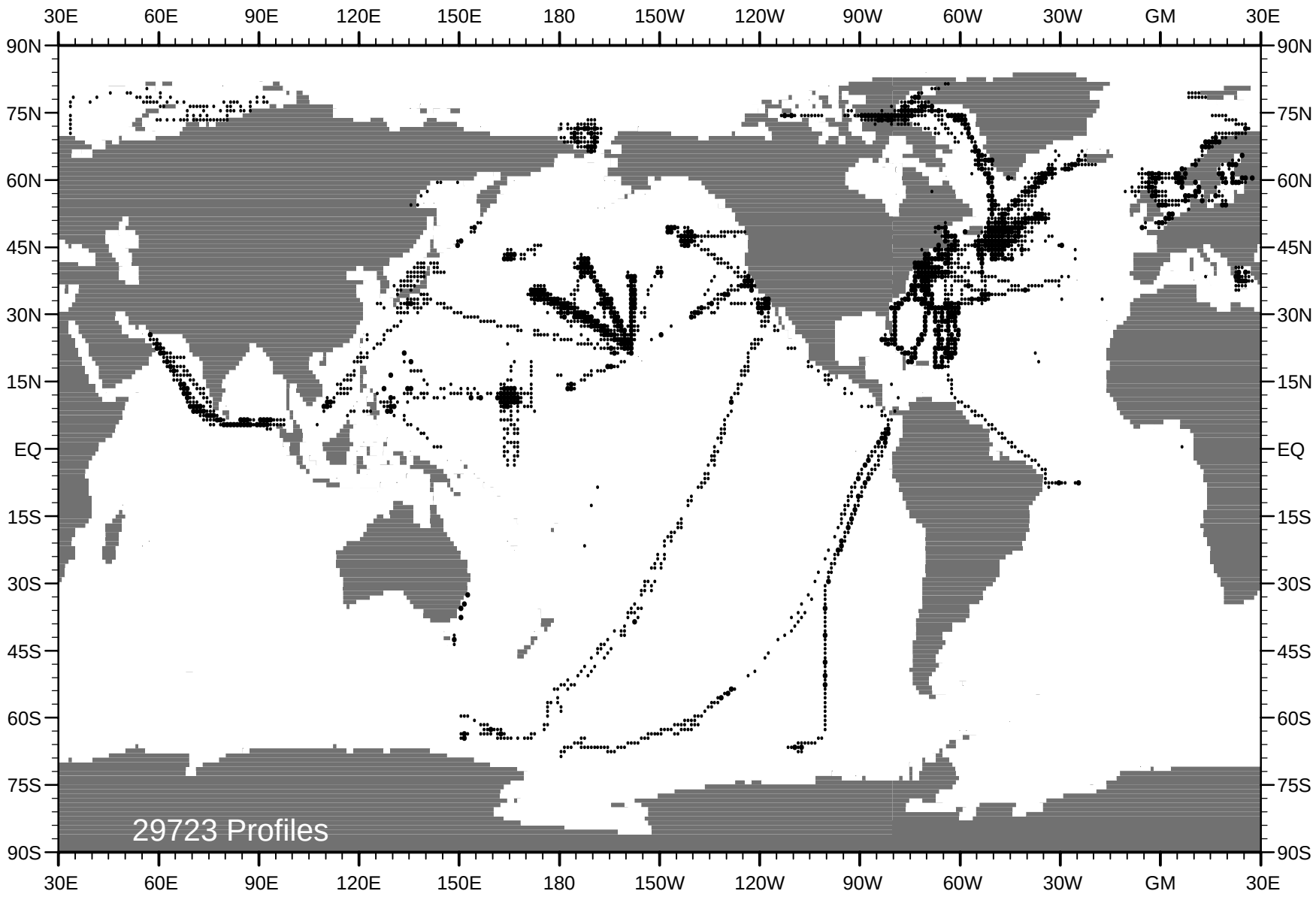


Fig. A6 Distribution of all data profiles (OSD+MBT) in WOD01 for year 1946 .

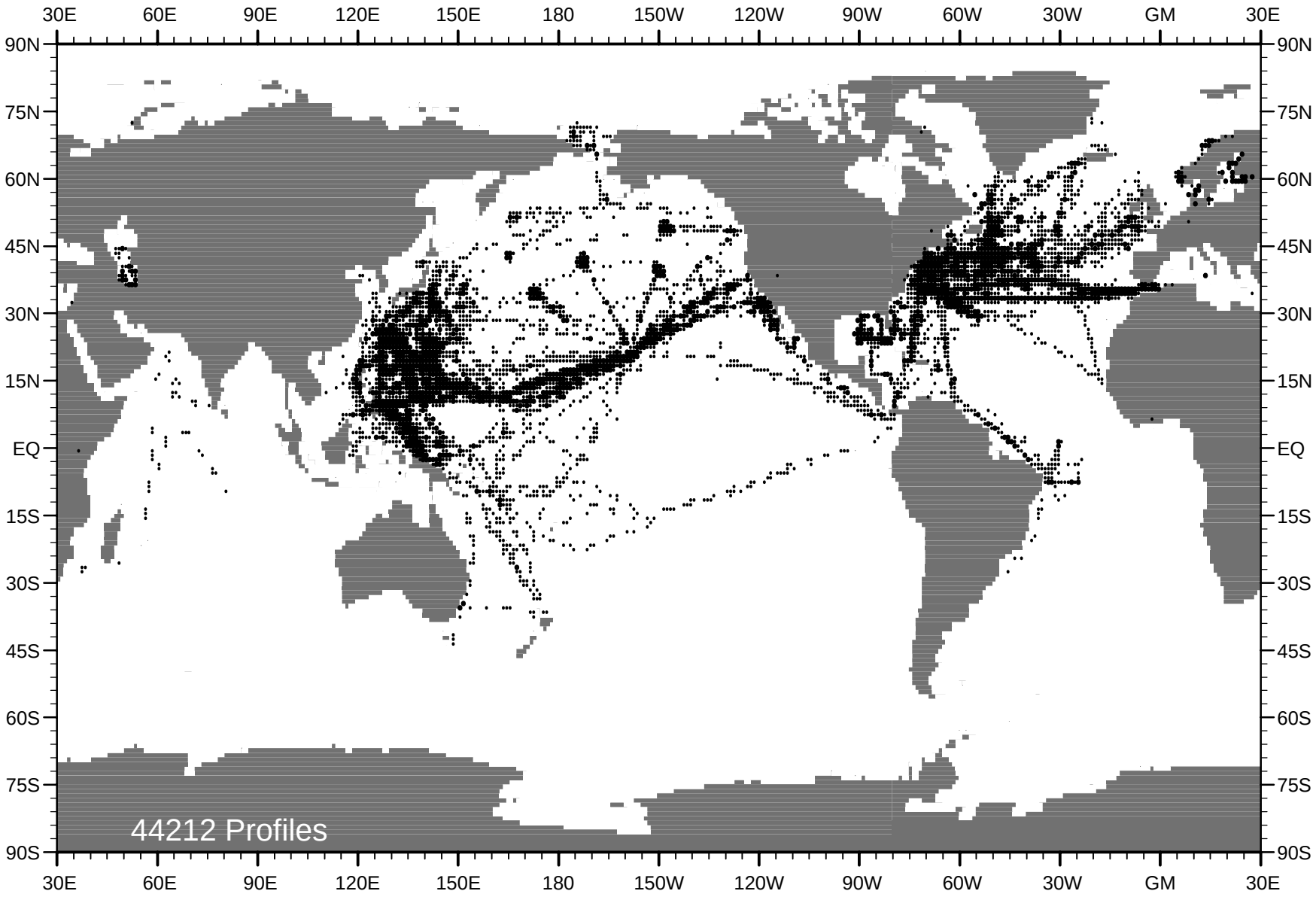


Fig. A5 Distribution of all data profiles (OSD+MBT) in WOD01 for year 1945 .

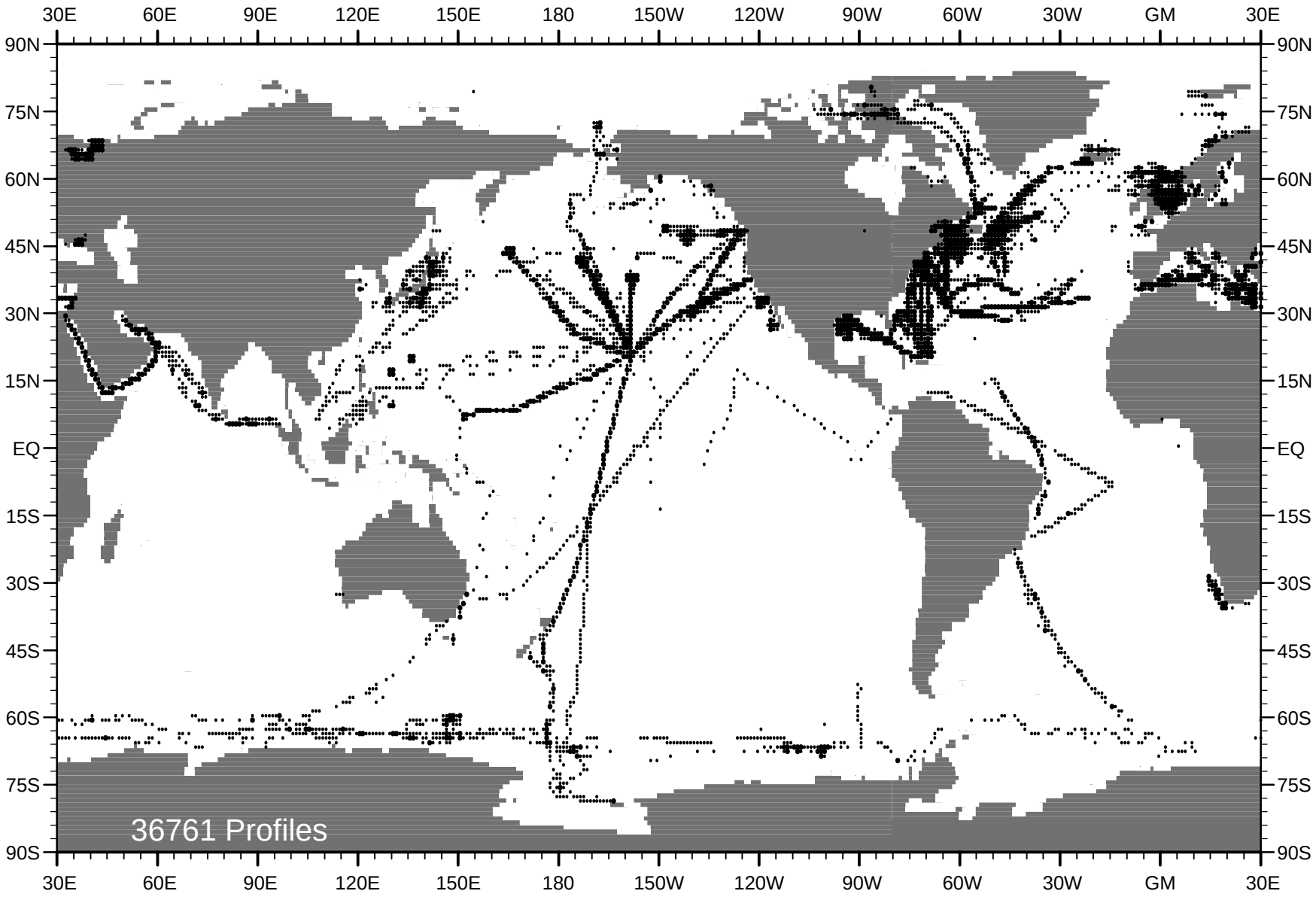


Fig. A7 Distribution of all data profiles (OSD+MBT) in WOD01 for year 1947 .

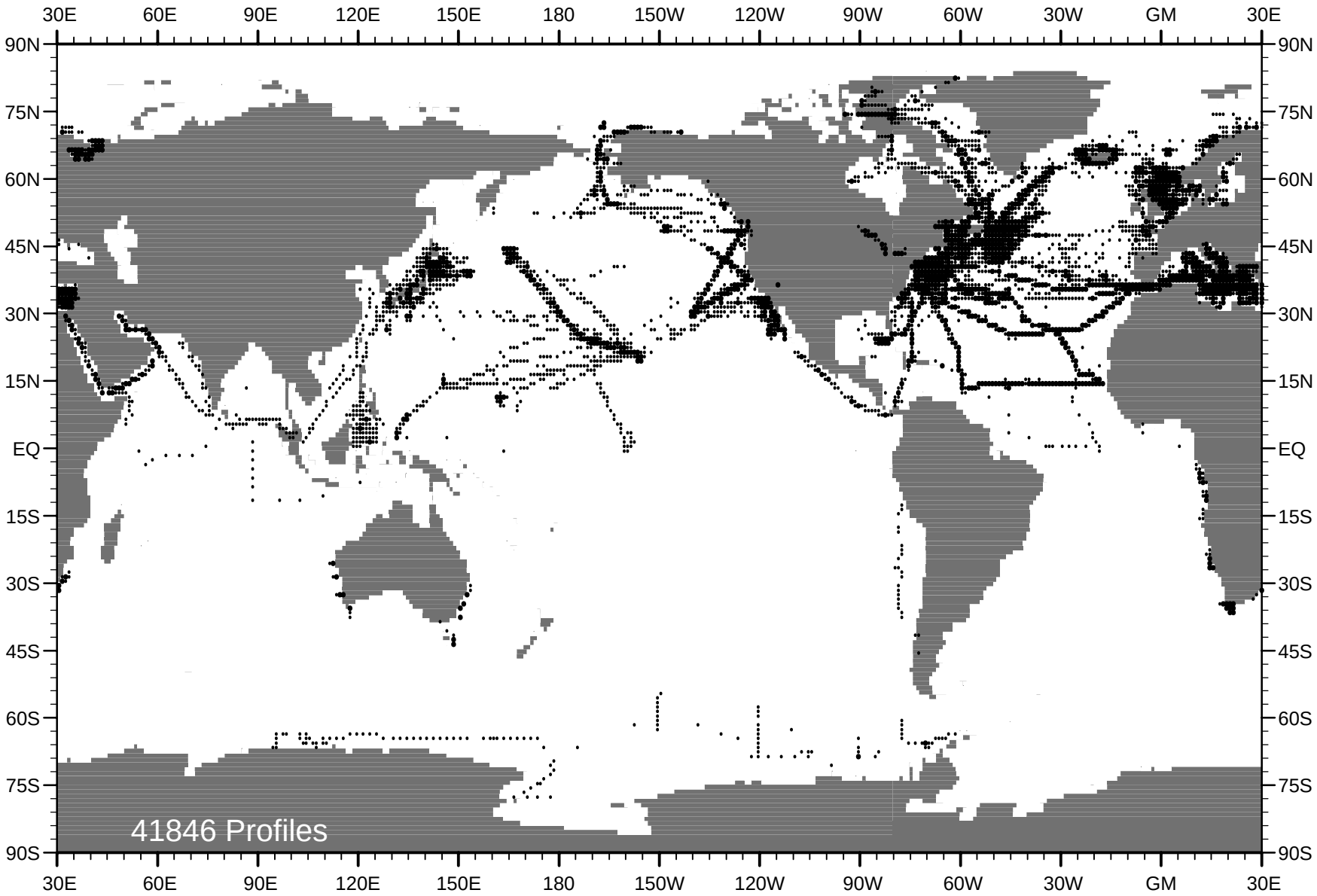


Fig. A8 Distribution of all data profiles (OSD+MBT) in WOD01 for year 1948 .

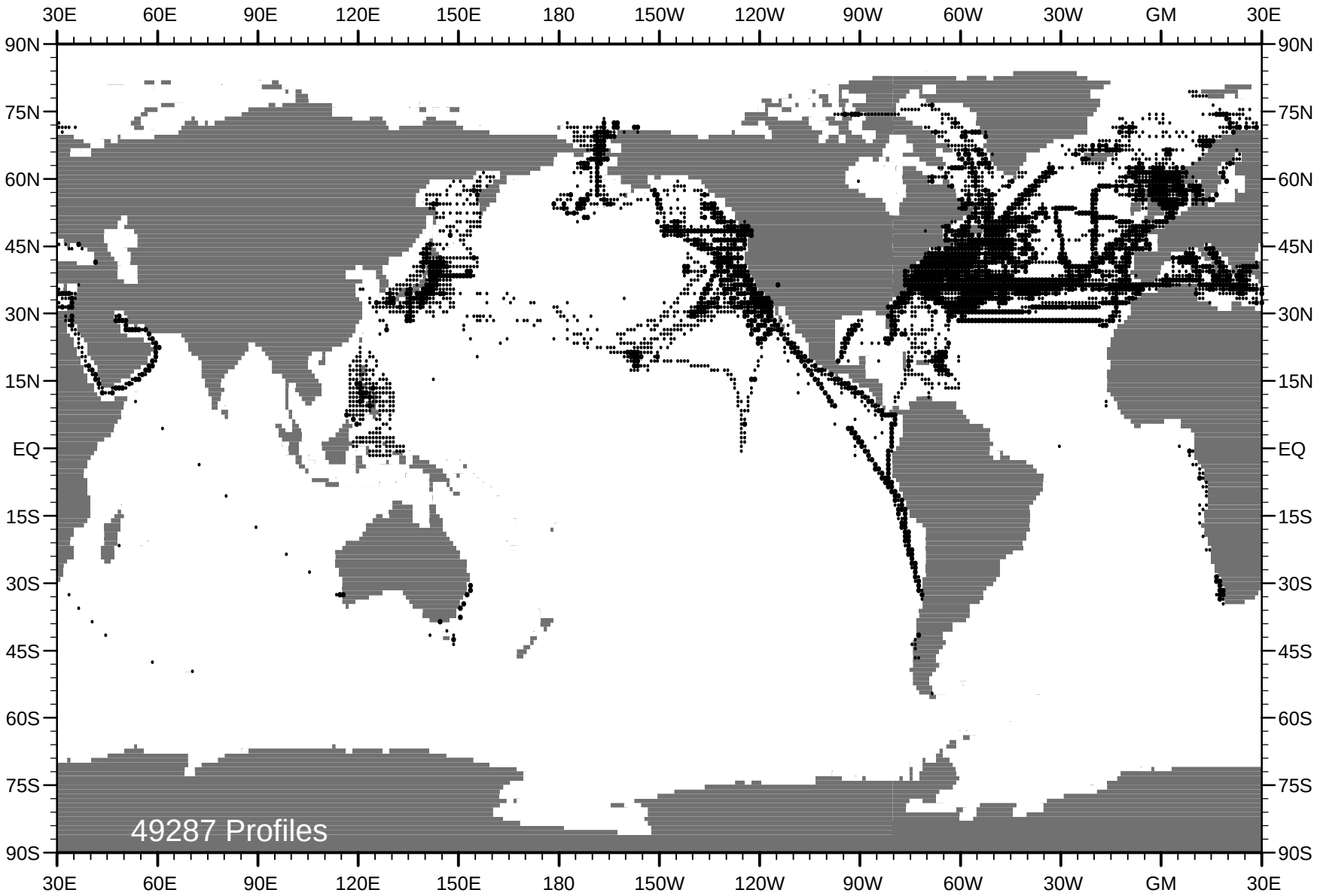


Fig. A9 Distribution of all data profiles (OSD+MBT) in WOD01 for year 1949 .

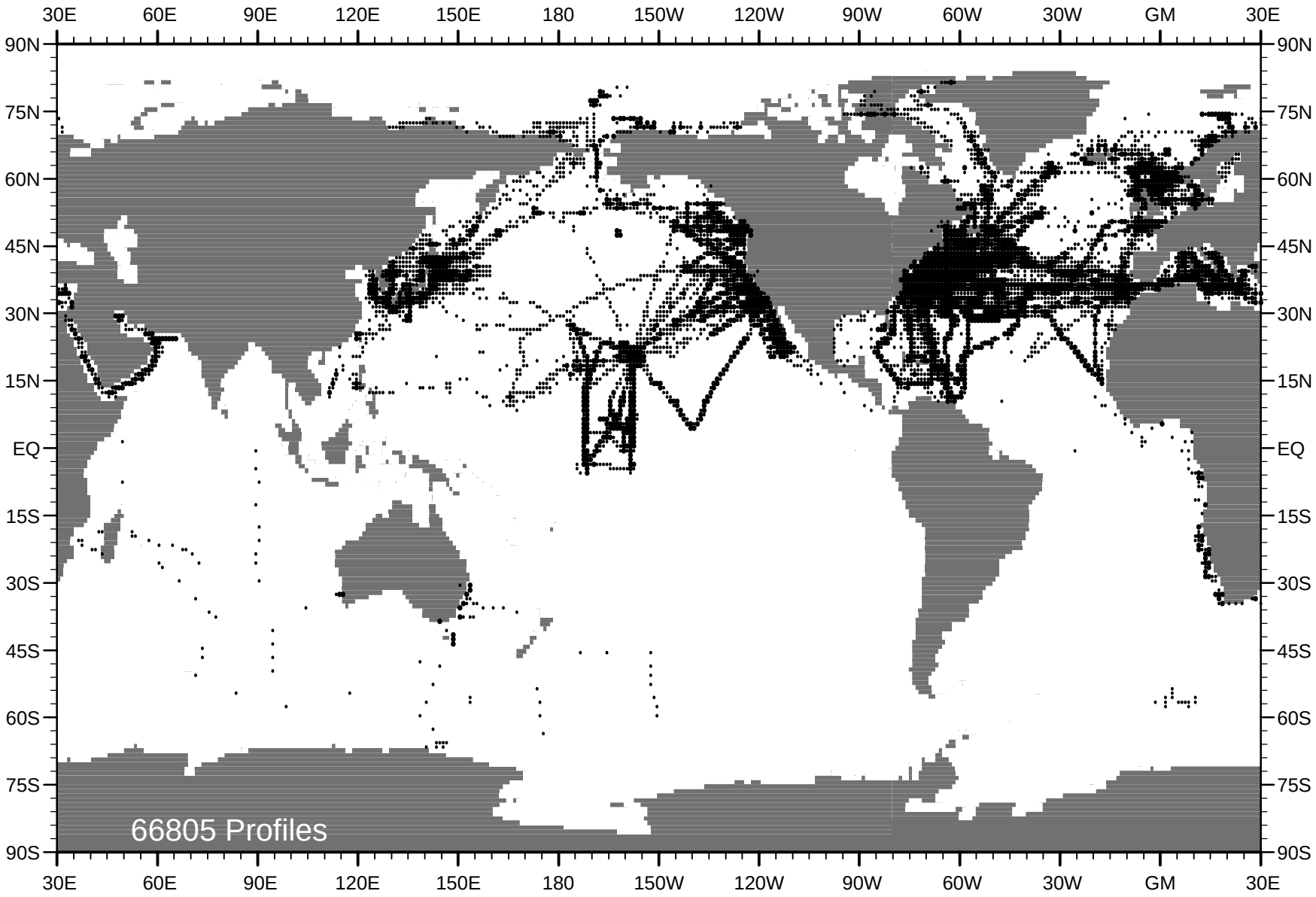


Fig. A10 Distribution of all data profiles (OSD+MBT) in WOD01 for year 1950 .

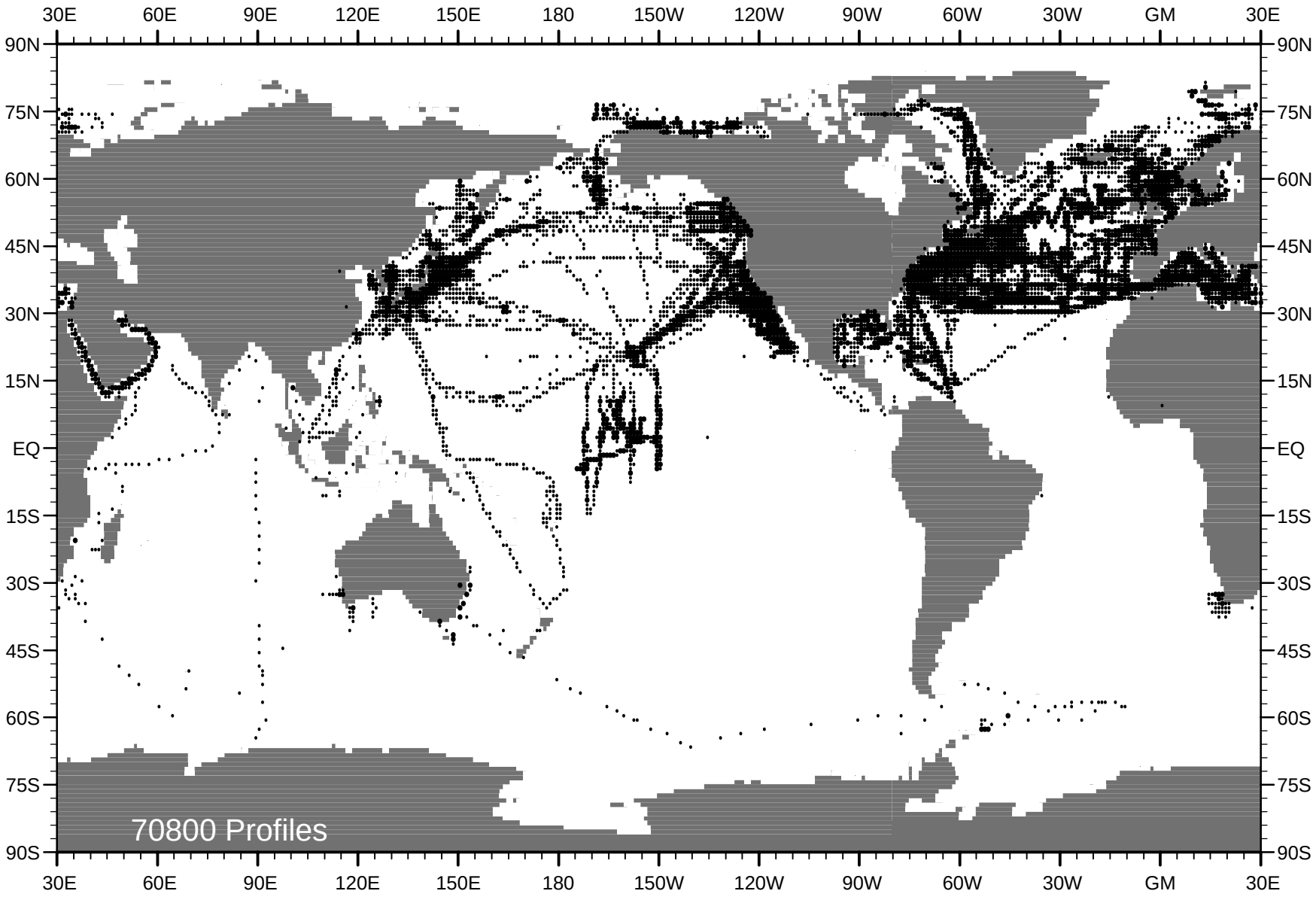


Fig. A11 Distribution of all data profiles (OSD+MBT) in WOD01 for year 1951 .

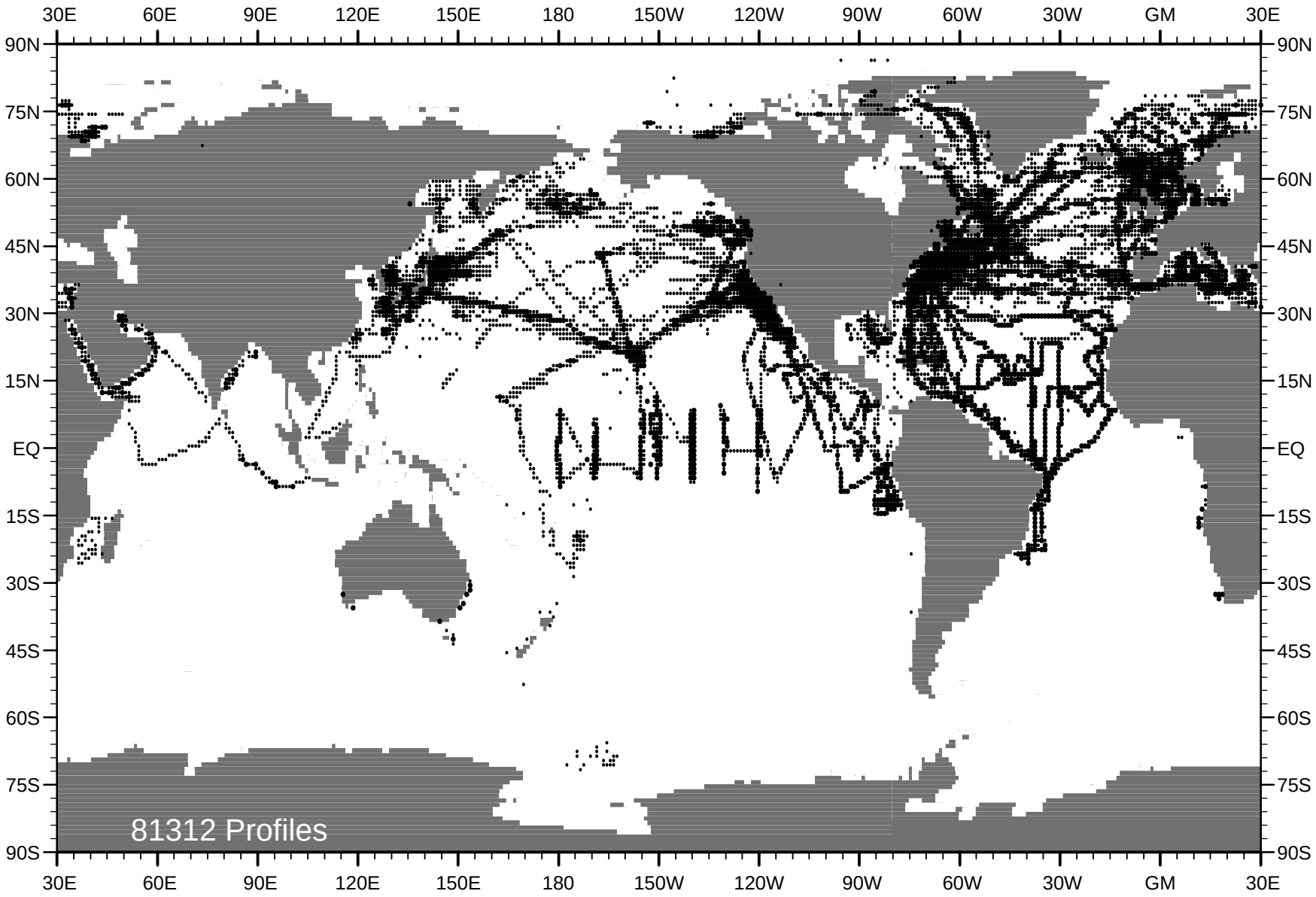


Fig. A12 Distribution of all data profiles (OSD+MBT) in WOD01 for year 1952 .

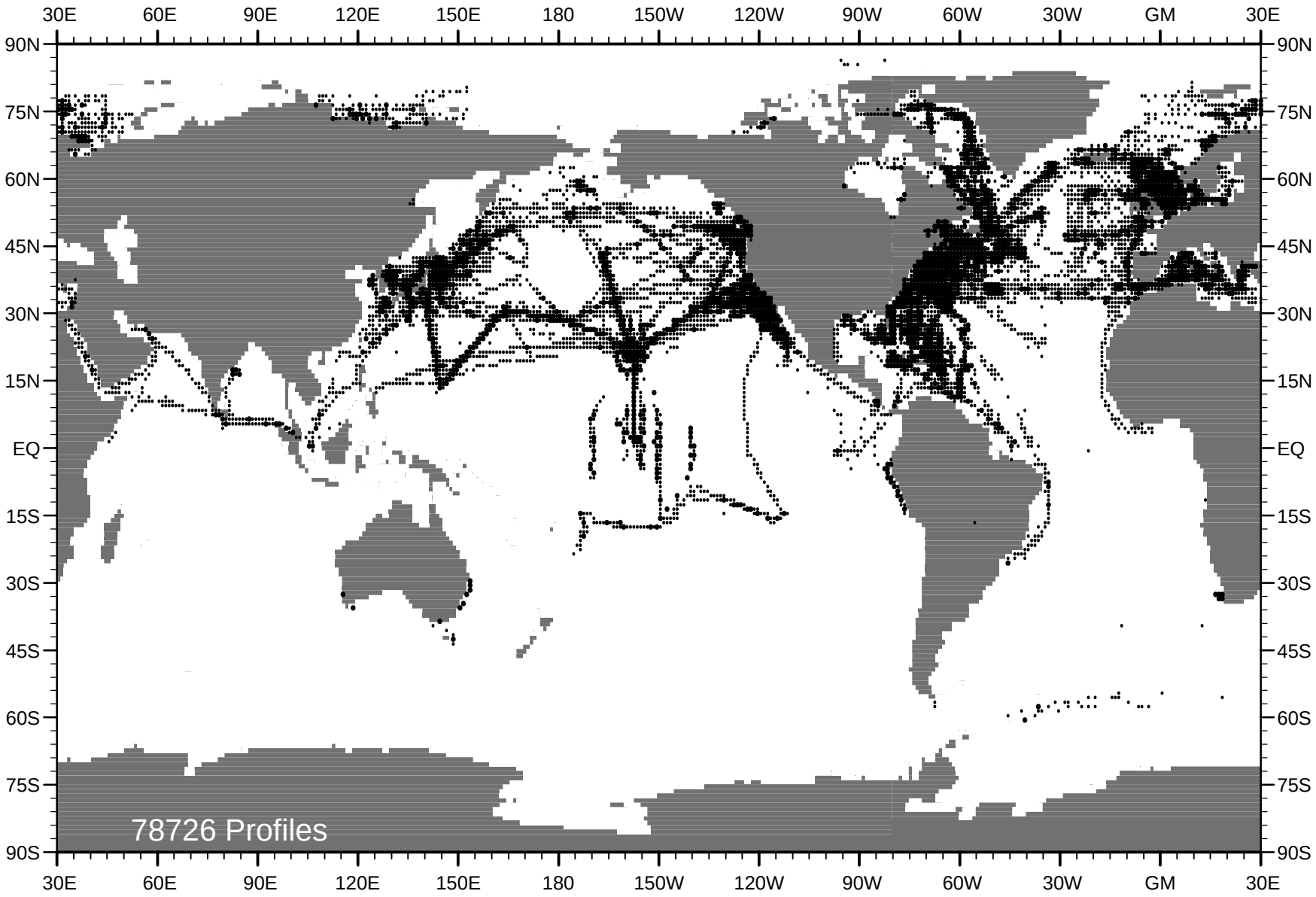


Fig. A13 Distribution of all data profiles (OSD+MBT) in WOD01 for year 1953 .

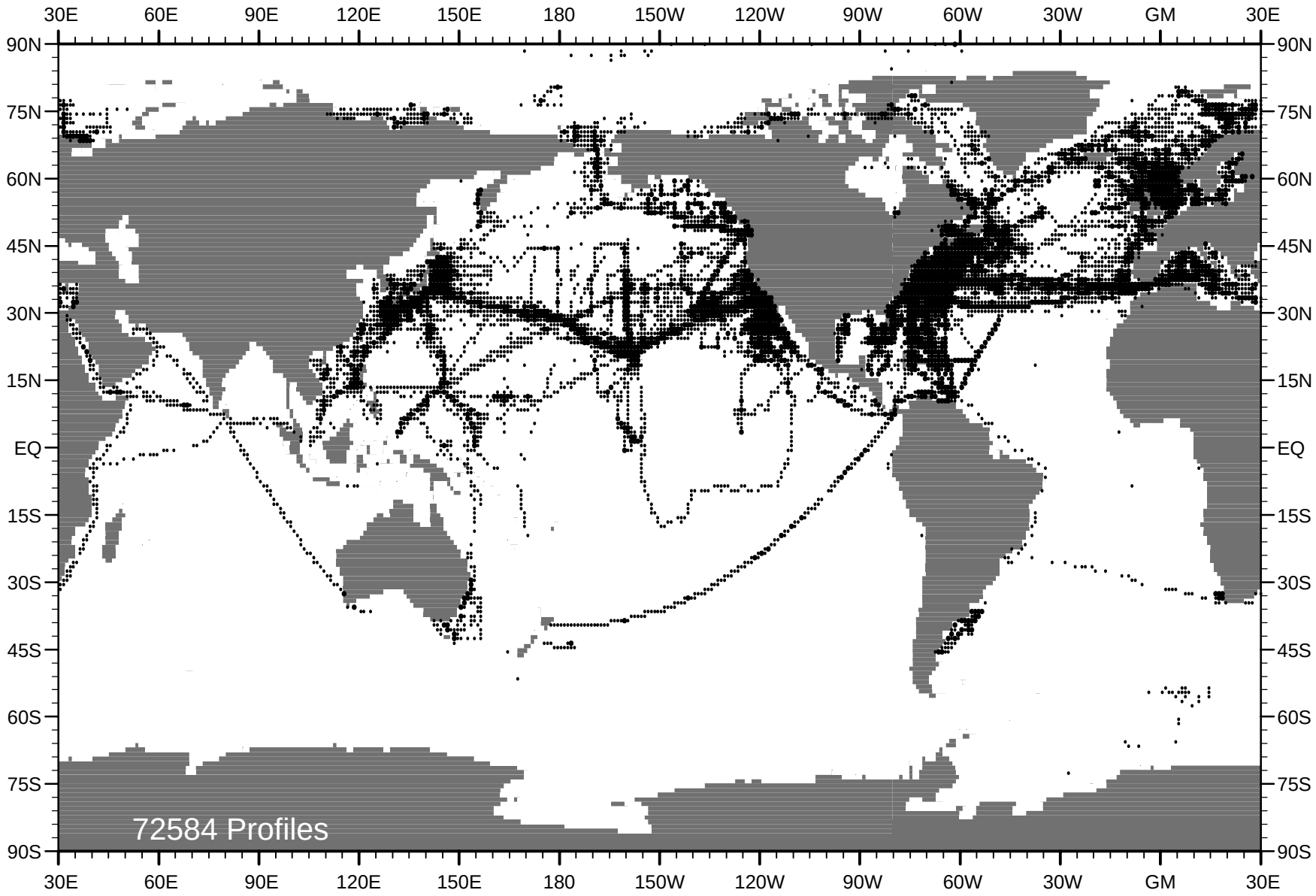


Fig. A14 Distribution of all data profiles (OSD+MBT) in WOD01 for year 1954 .

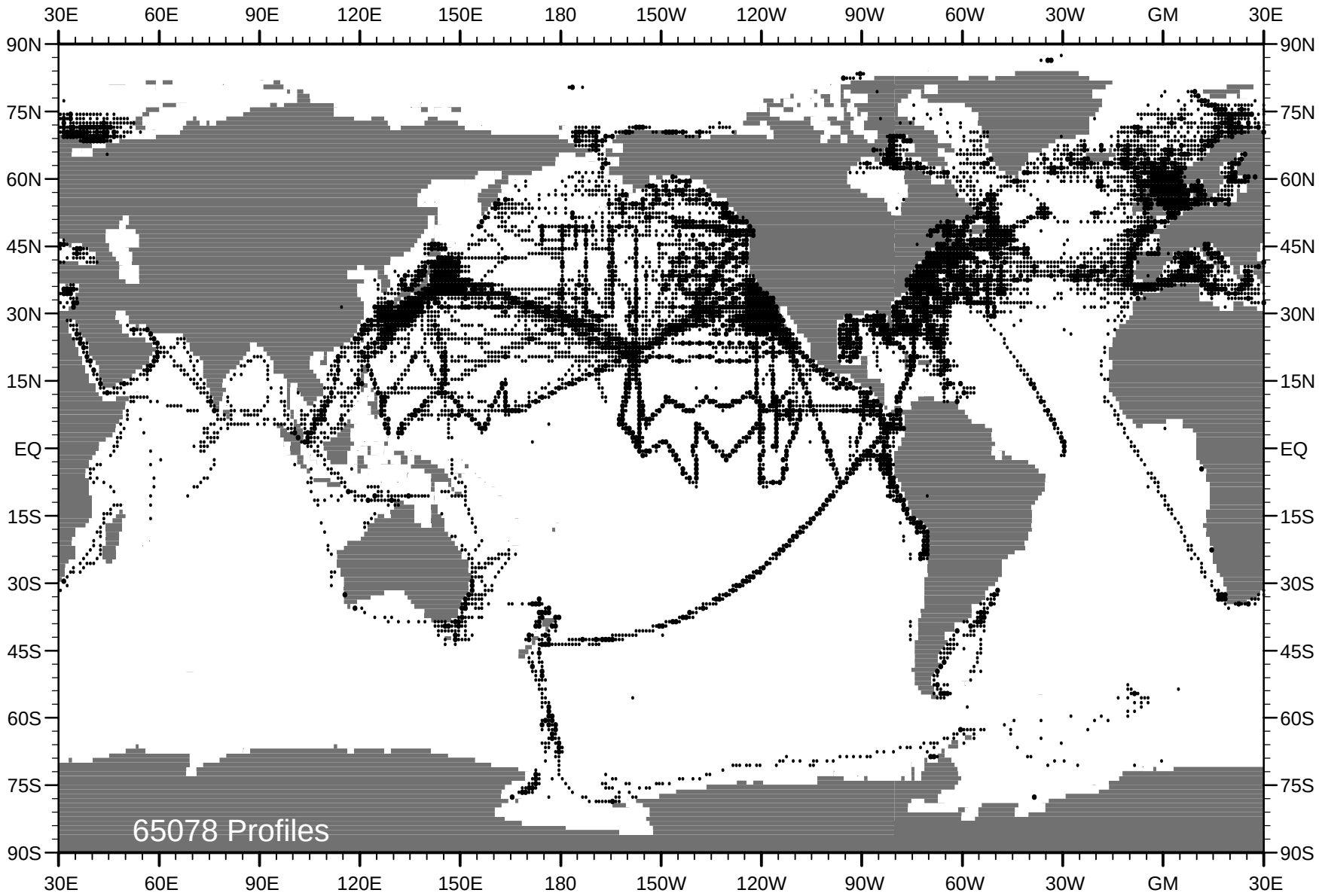


Fig. A15 Distribution of all data profiles (OSD+MBT) in WOD01 for year 1955 .

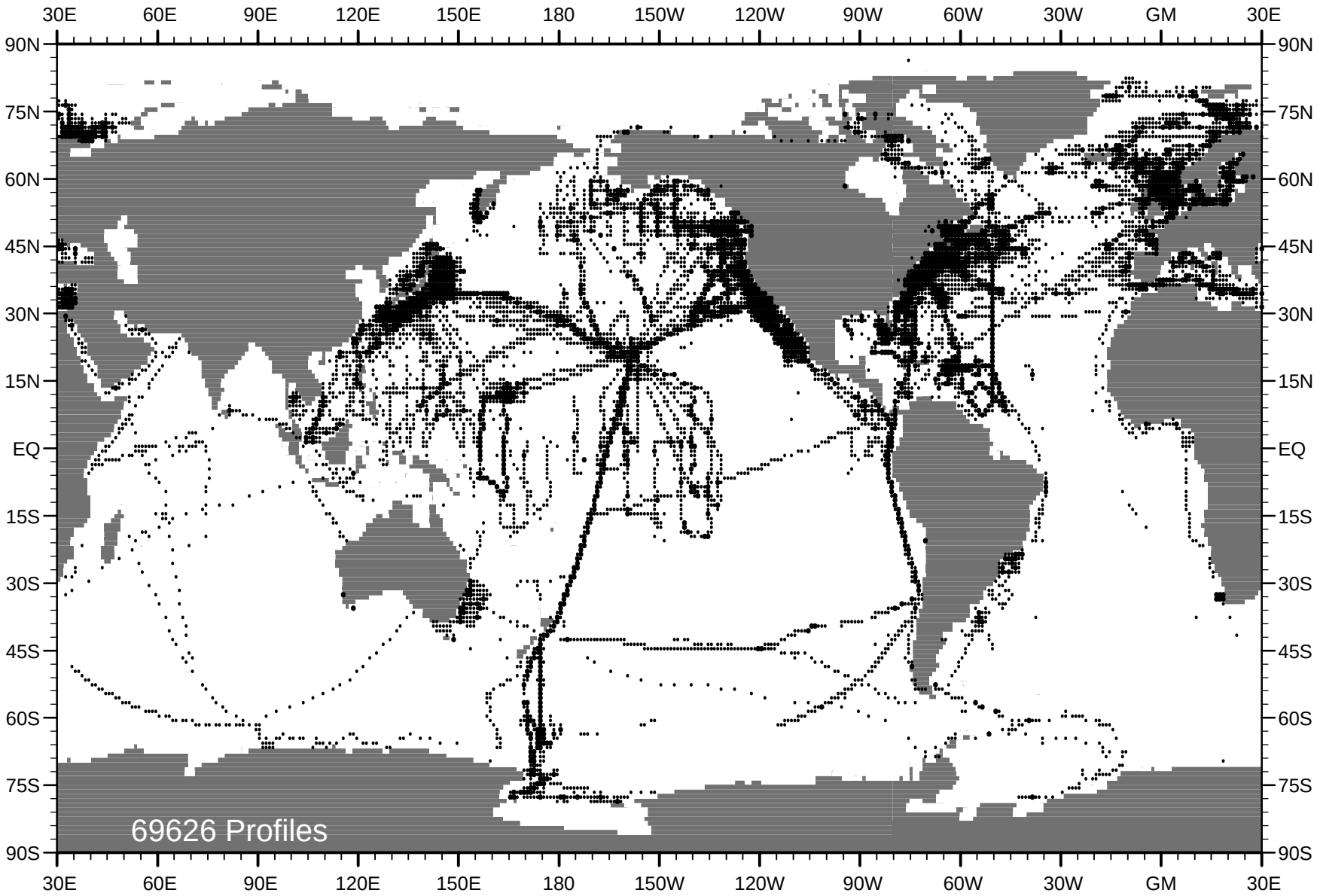


Fig. A16 Distribution of all data profiles (OSD+MBT) in WOD01 for year 1956 .

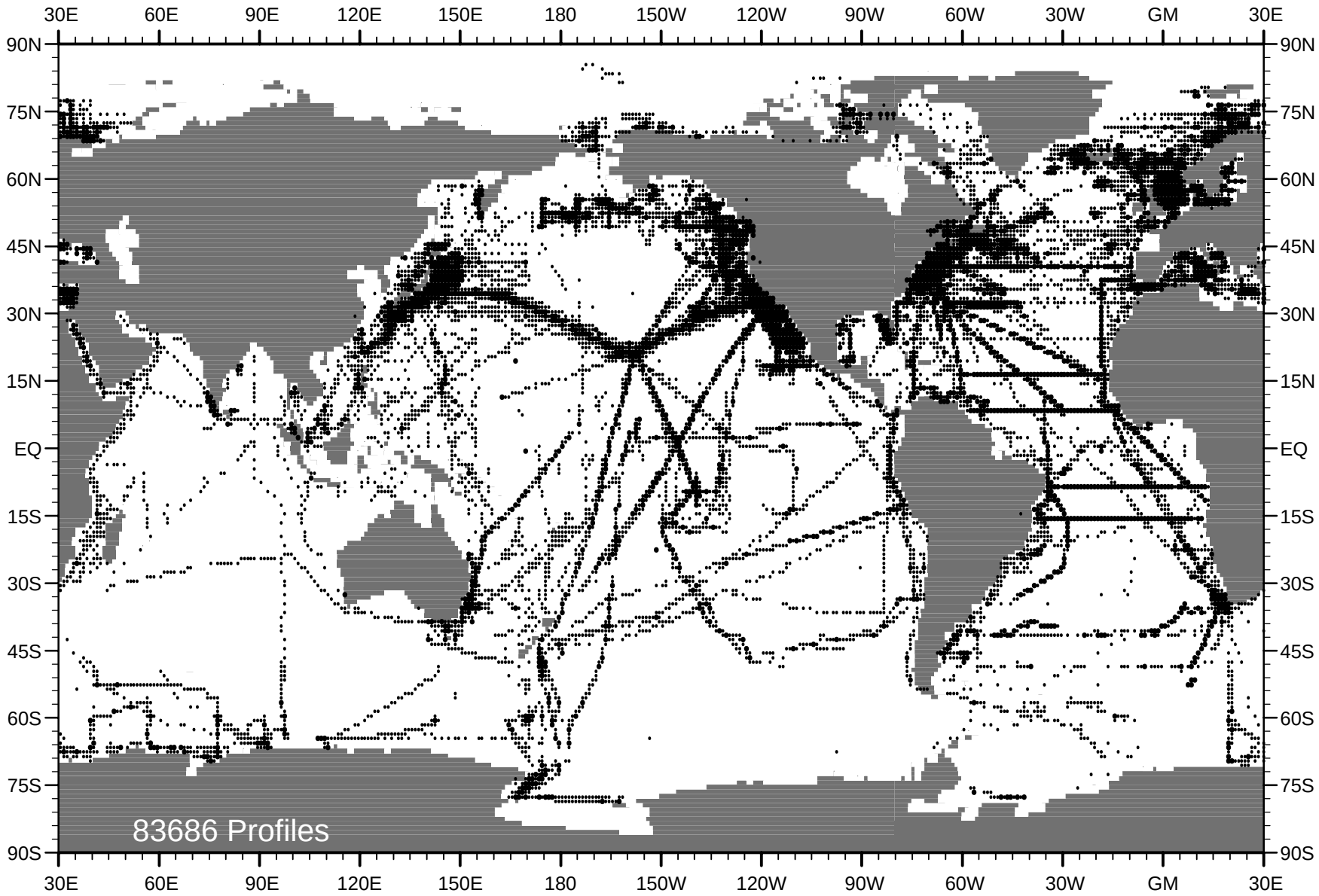


Fig. A17 Distribution of all data profiles (OSD+MBT) in WOD01 for year 1957 .

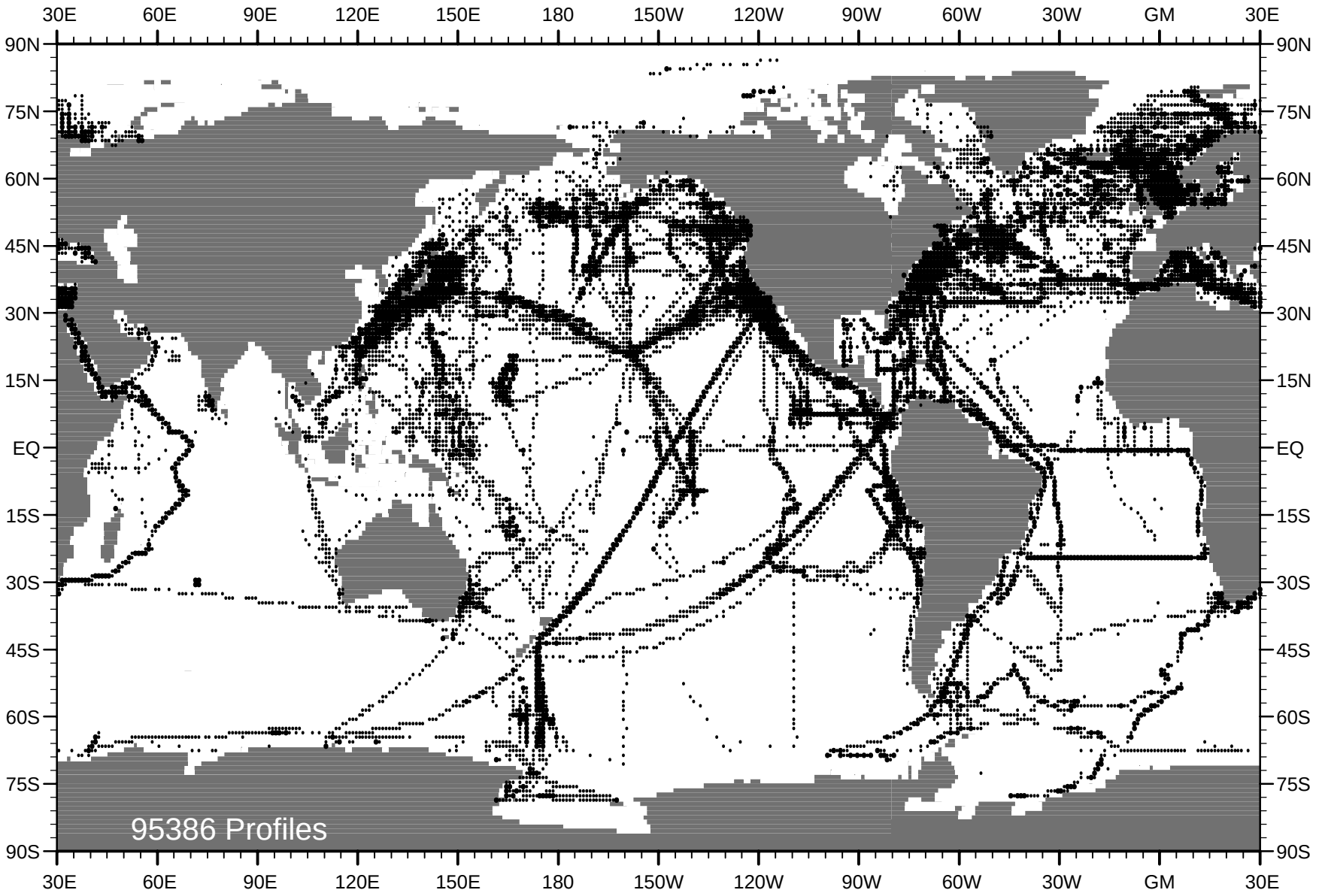


Fig. A18 Distribution of all data profiles (OSD+MBT) in WOD01 for year 1958 .

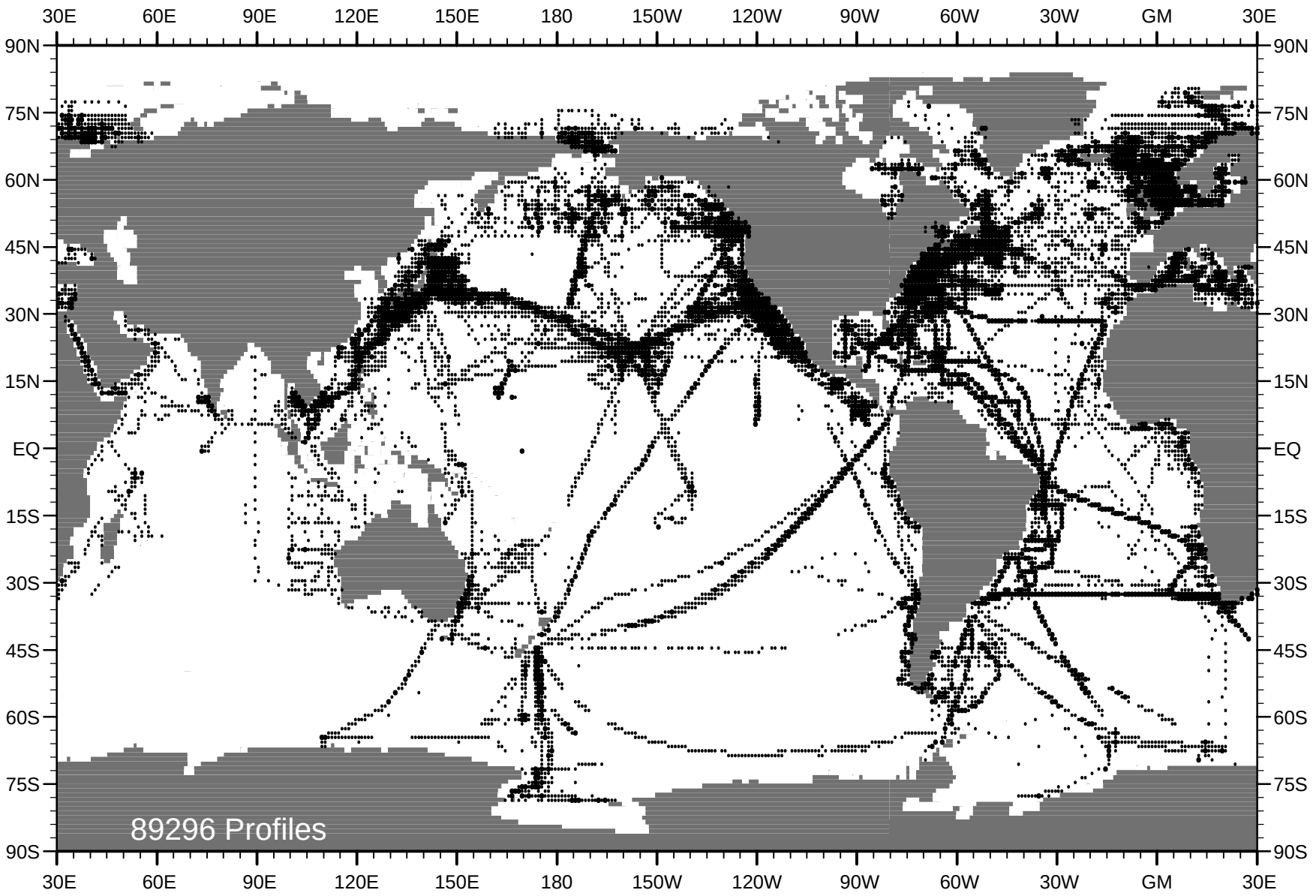


Fig. A19 Distribution of all data profiles (OSD+MBT) in WOD01 for year 1959 .

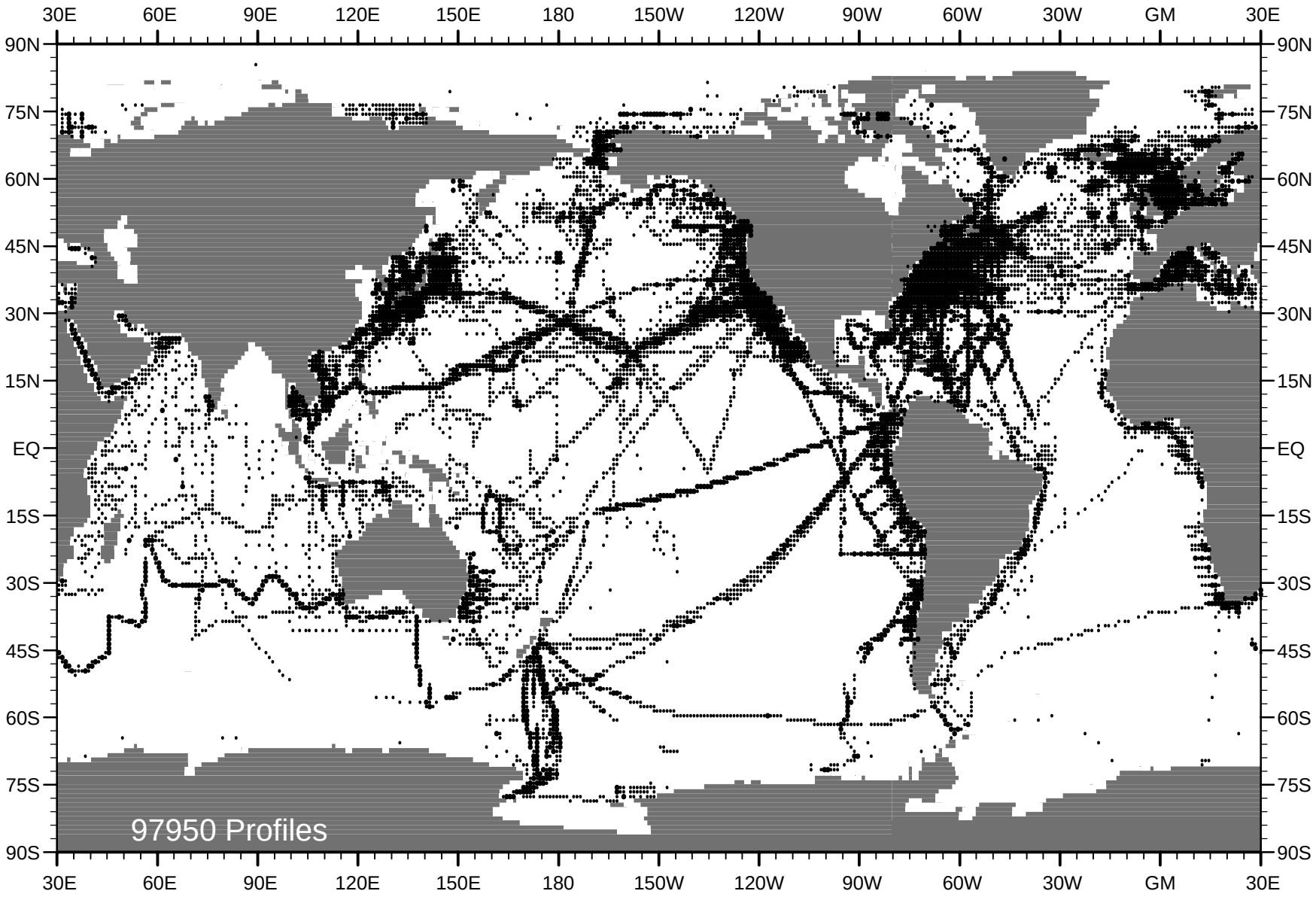


Fig. A20 Distribution of all data profiles (OSD+MBT) in WOD01 for year 1960 .

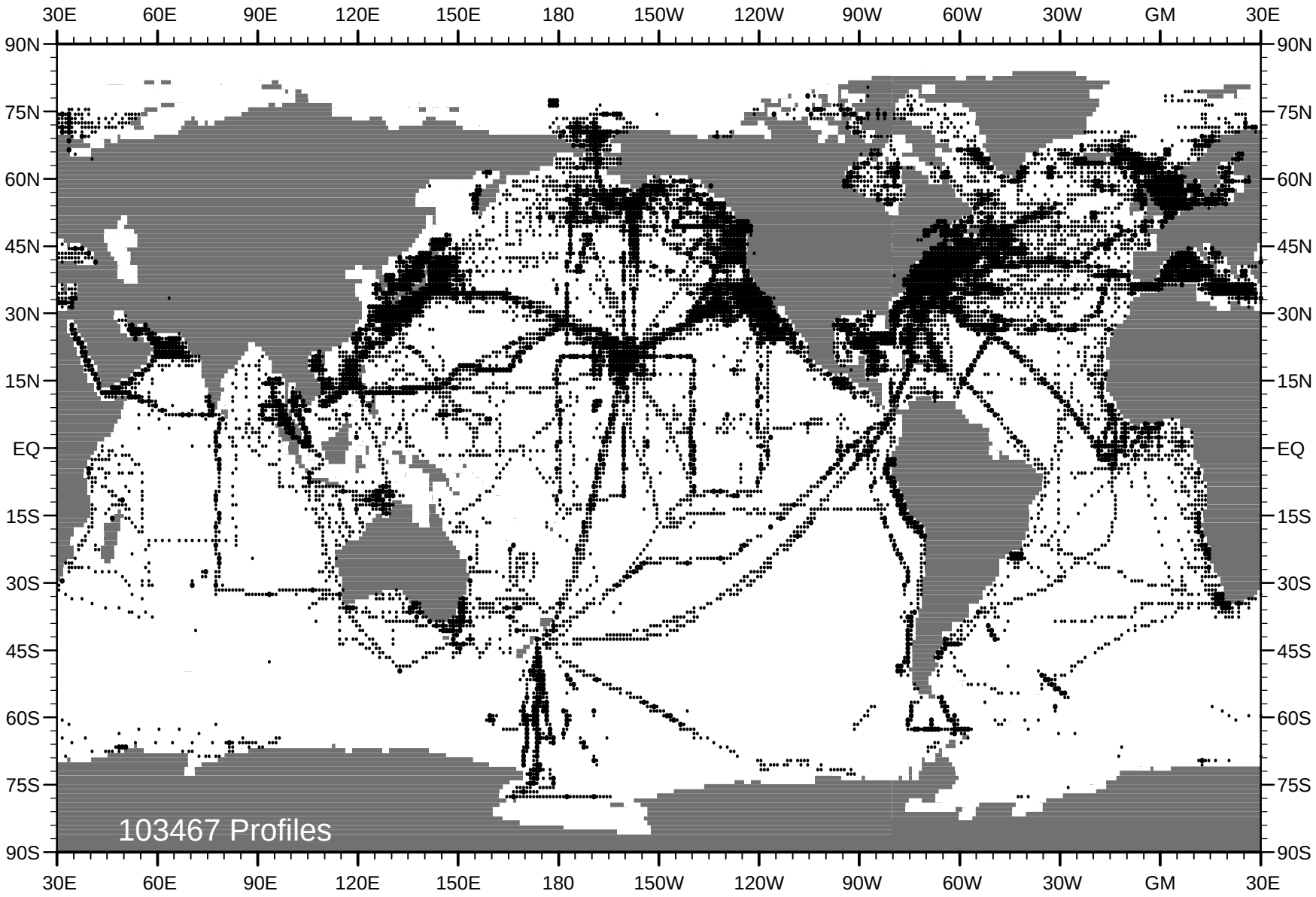


Fig. A21 Distribution of all data profiles (OSD+MBT) in WOD01 for year 1961 .

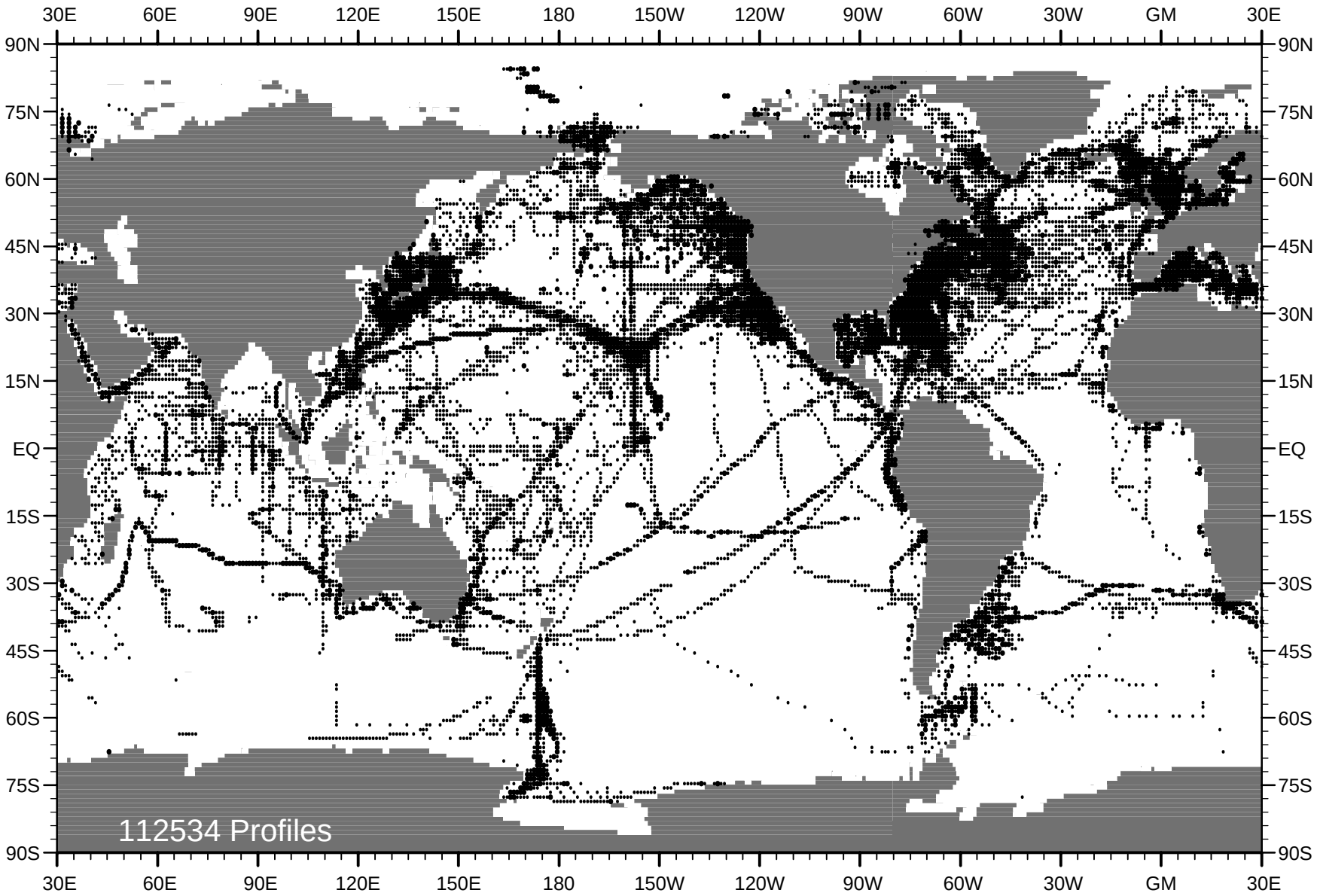


Fig. A22 Distribution of all data profiles (OSD+MBT) in WOD01 for year 1962 .

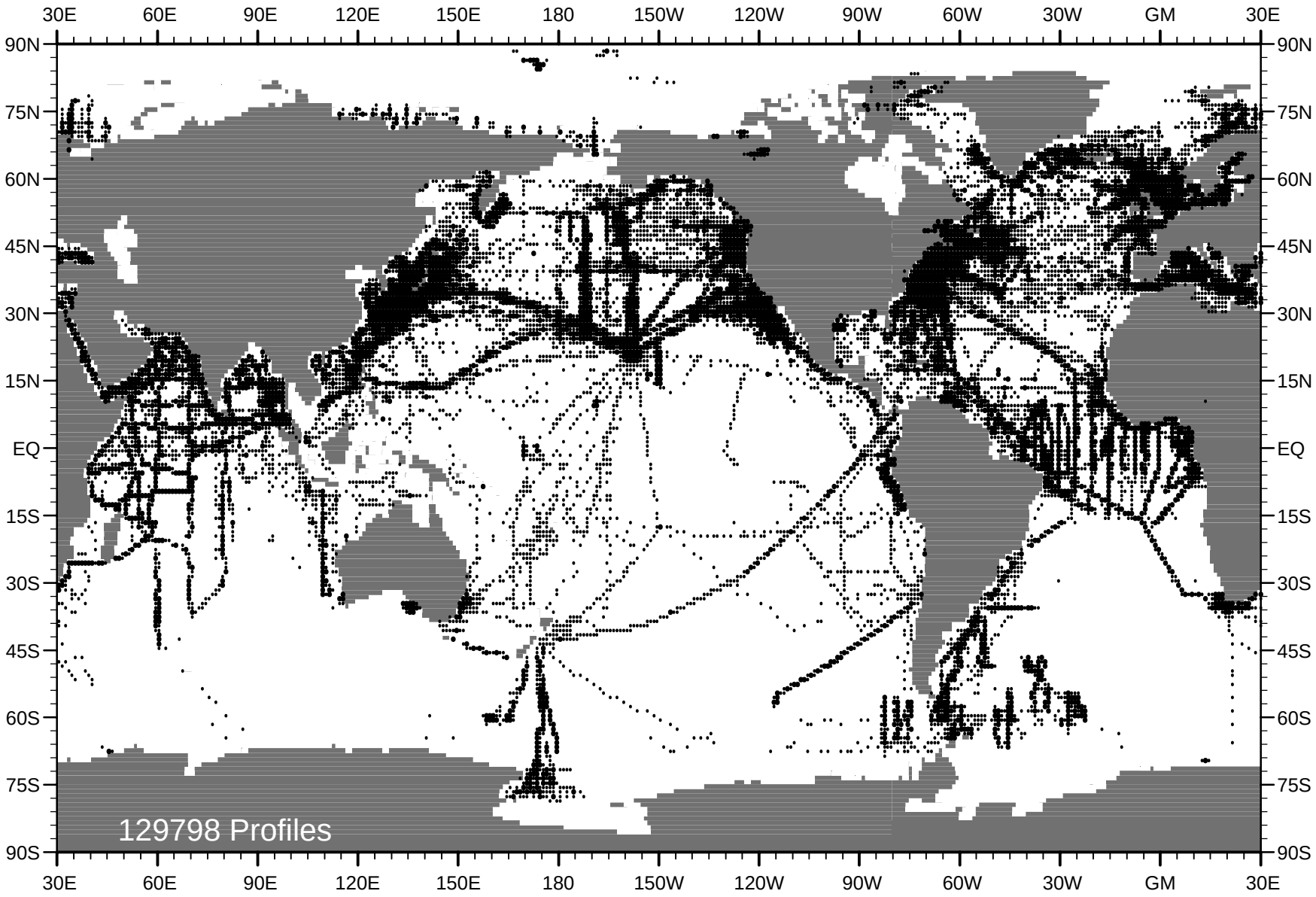


Fig. A23 Distribution of all data profiles (OSD+MBT) in WOD01 for year 1963 .

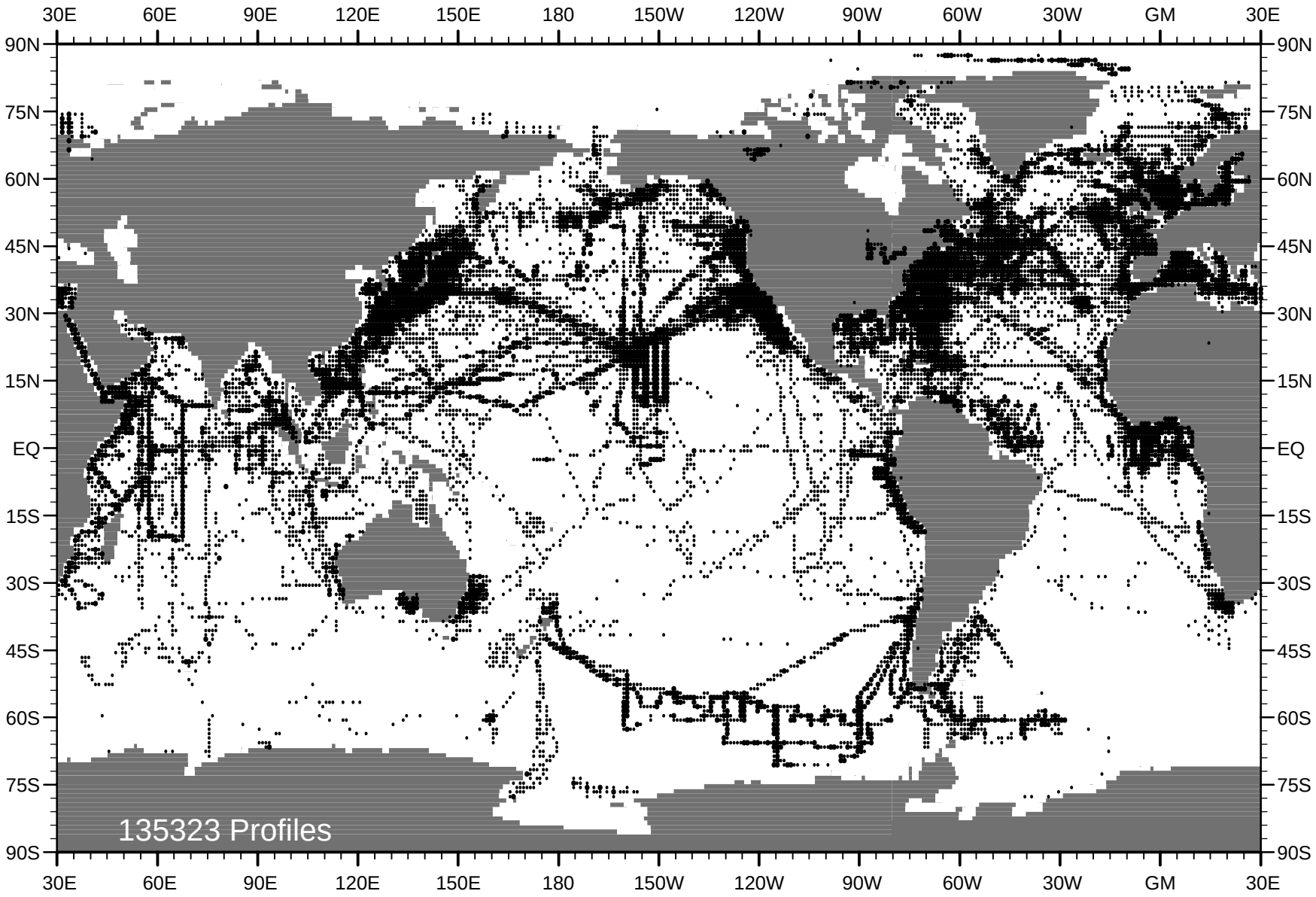


Fig. A24 Distribution of all data profiles (OSD+MBT) in WOD01 for year 1964 .

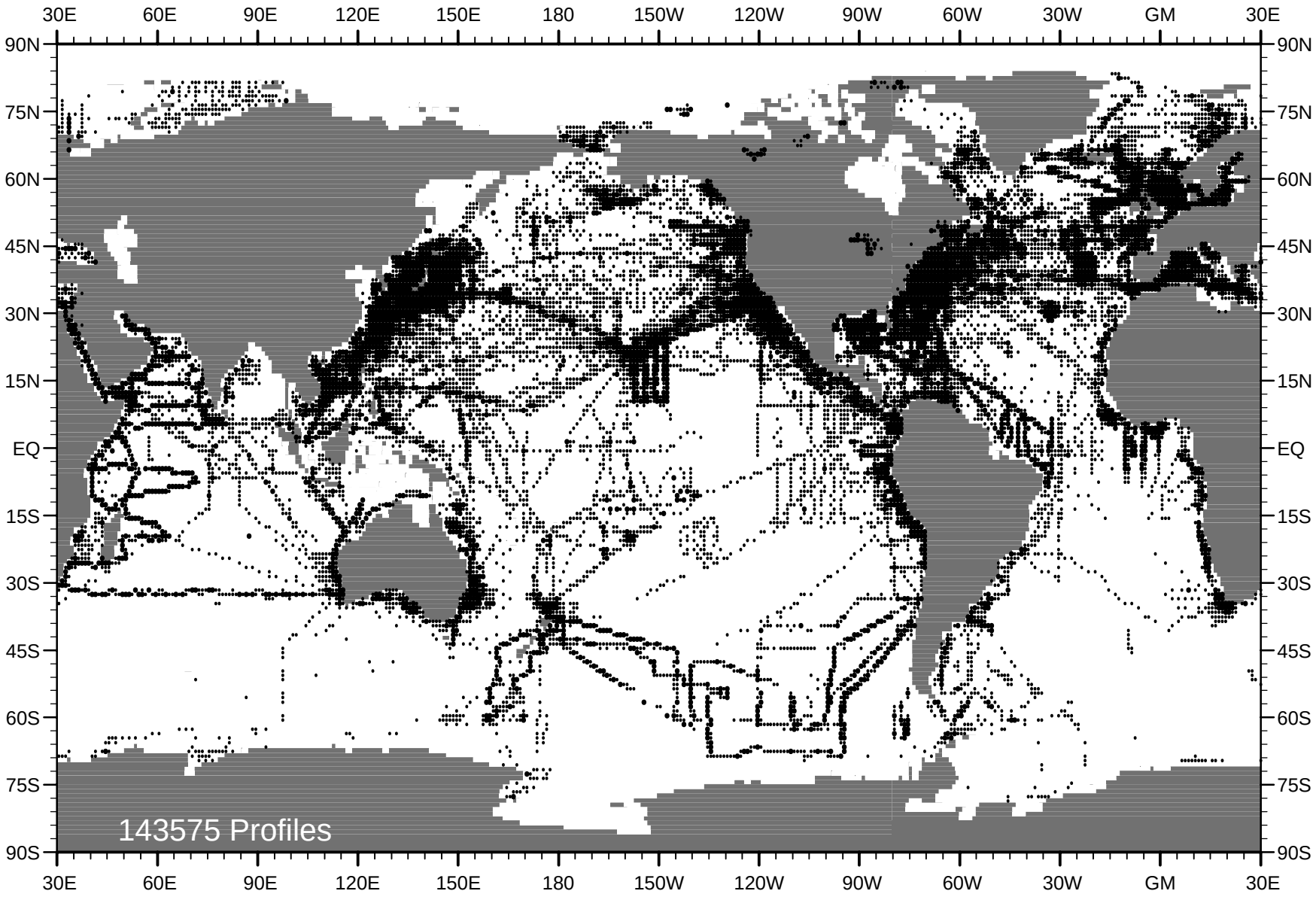


Fig. A25 Distribution of all data profiles (OSD+MBT) in WOD01 for year 1965 .

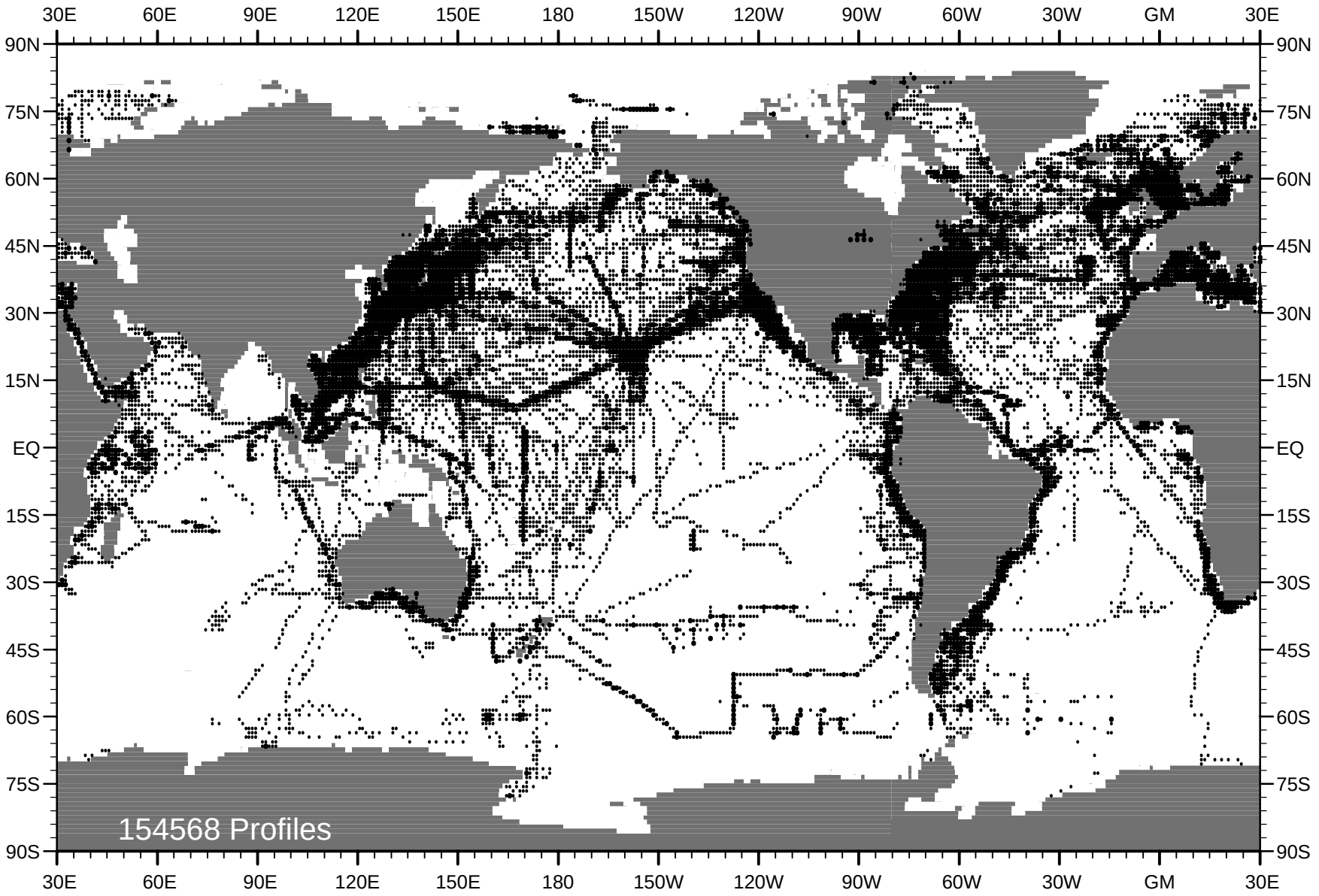


Fig. A26 Distribution of all data profiles (OSD+MBT+XBT) in WOD01 for year 1966 .

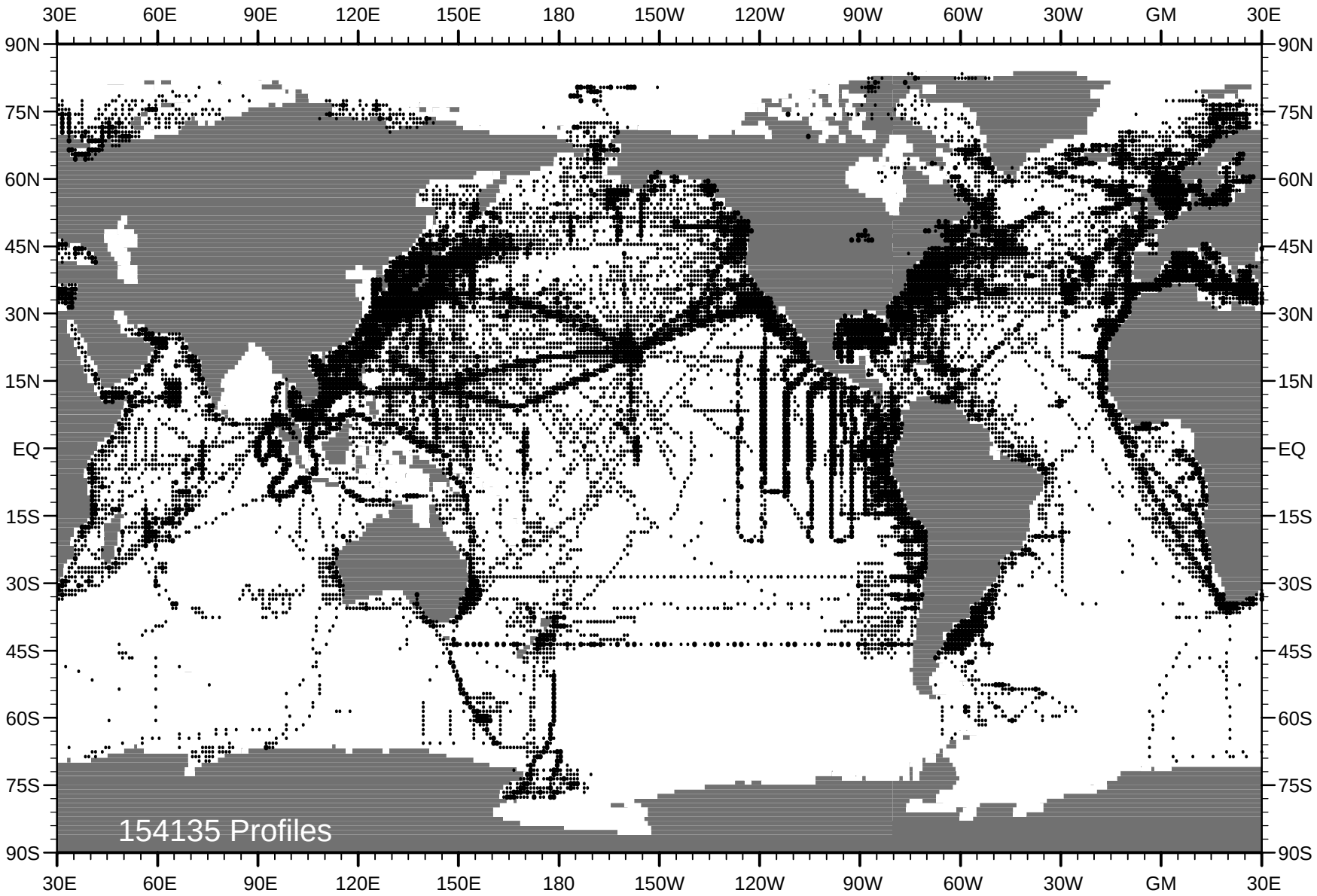


Fig. A27 Distribution of all data profiles (OSD+MBT+XBT+CTD) in WOD01 for year 1967 .

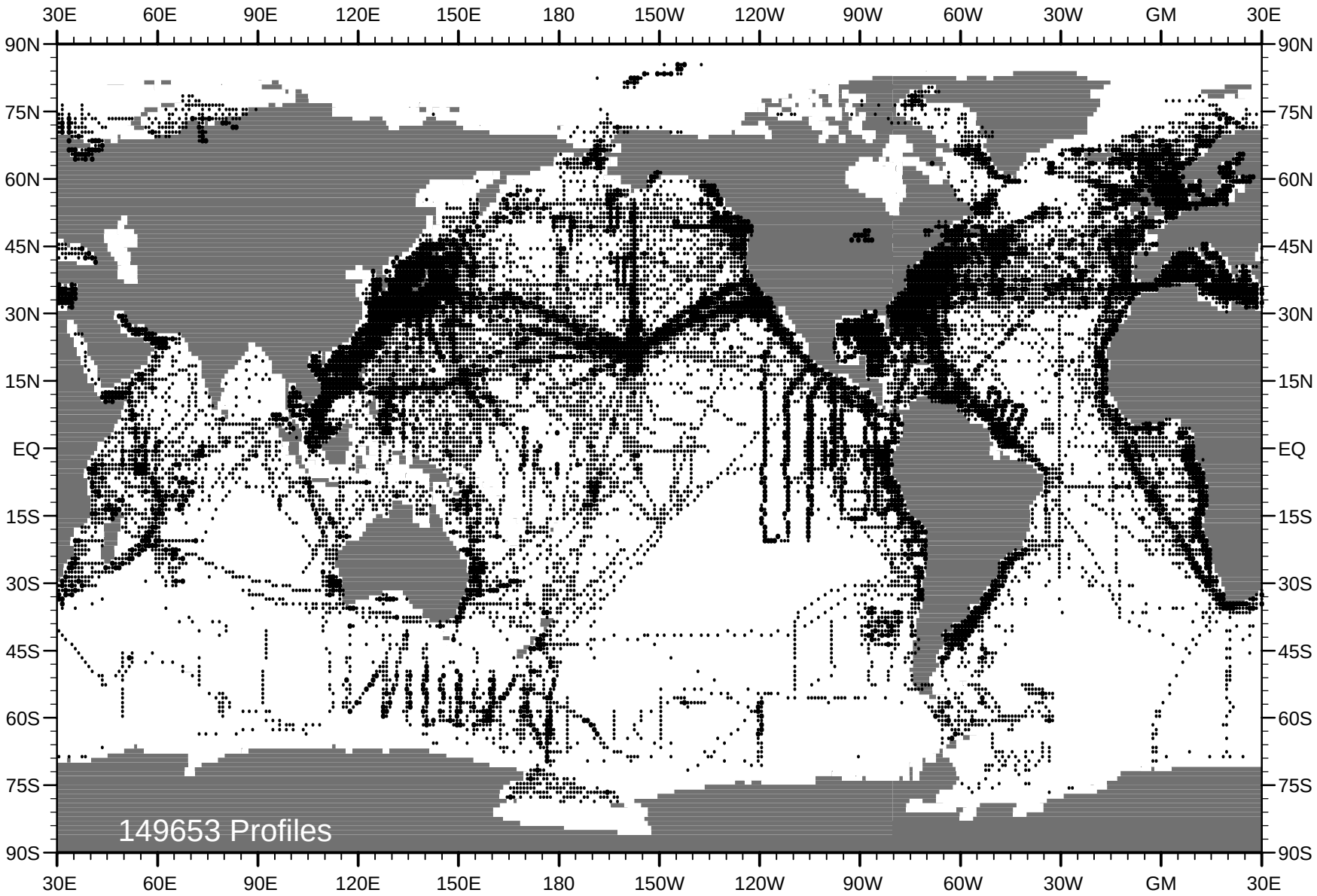


Fig. A28 Distribution of all data profiles (OSD+MBT+XBT+CTD) in WOD01 for year 1968 .

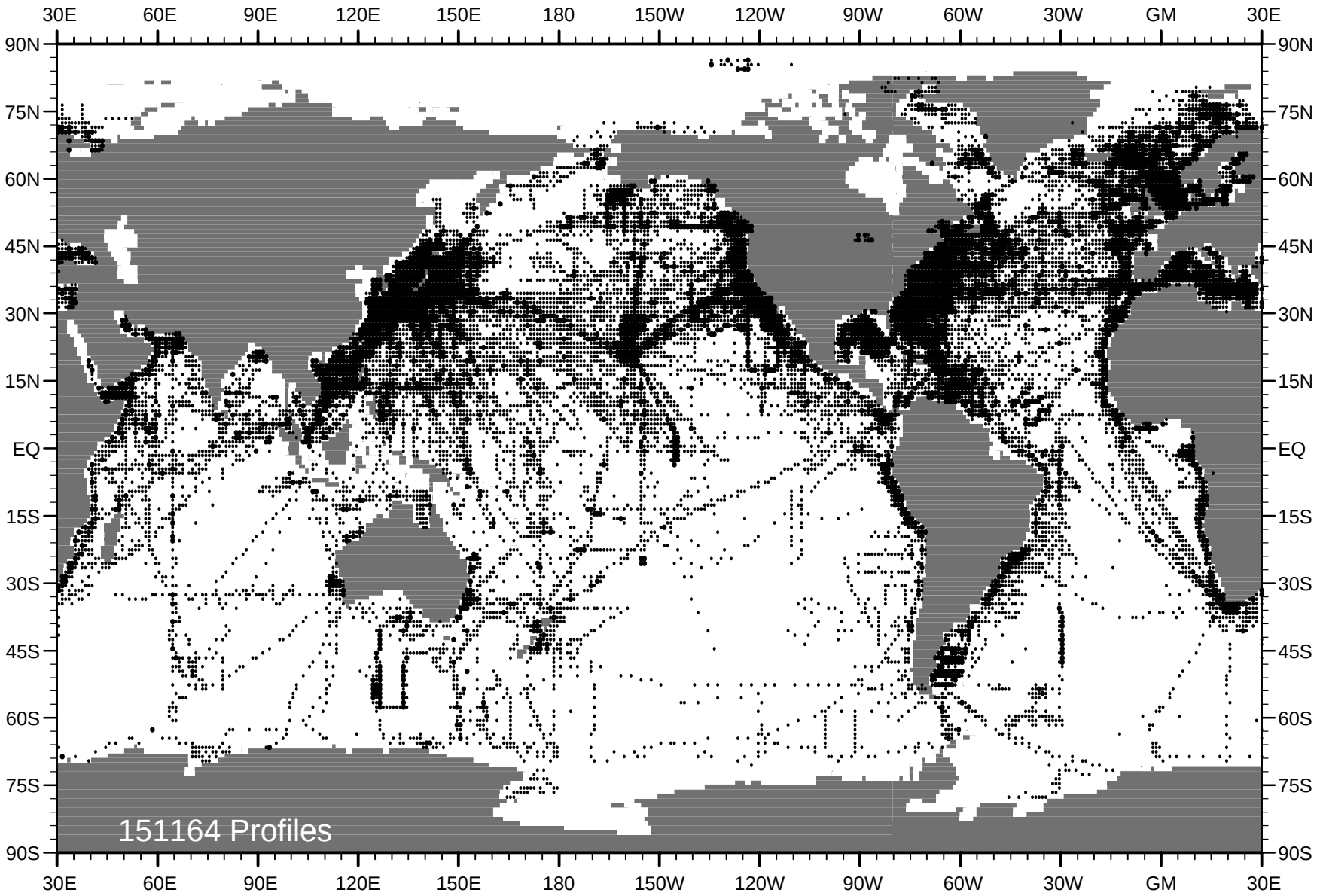


Fig. A29 Distribution of all data profiles (OSD+MBT+XBT+CTD) in WOD01 for year 1969 .

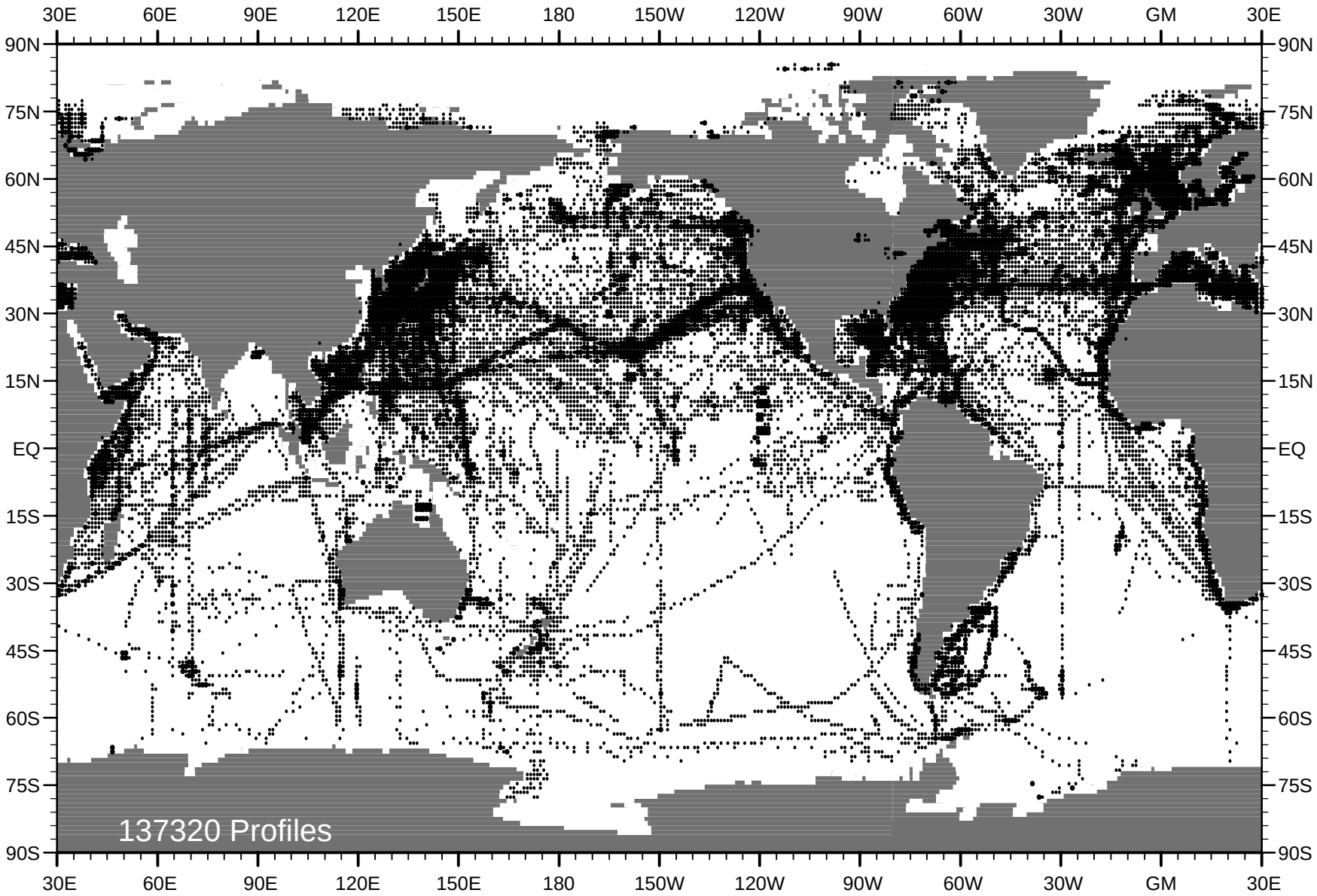


Fig. A30 Distribution of all data profiles (OSD+MBT+XBT+CTD) in WOD01 for year 1970 .

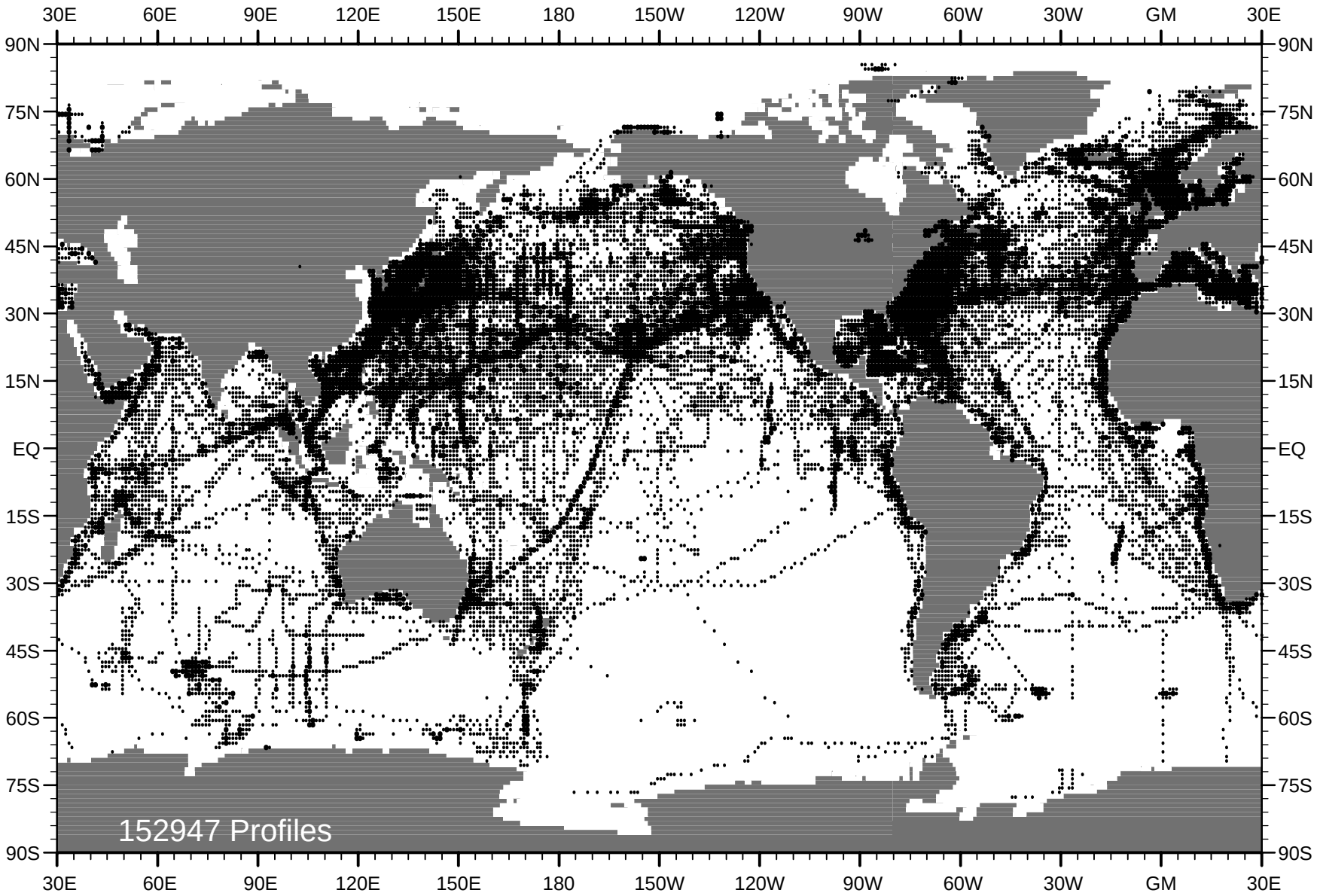


Fig. A31 Distribution of all data profiles (OSD+MBT+XBT+CTD) in WOD01 for year 1971 .

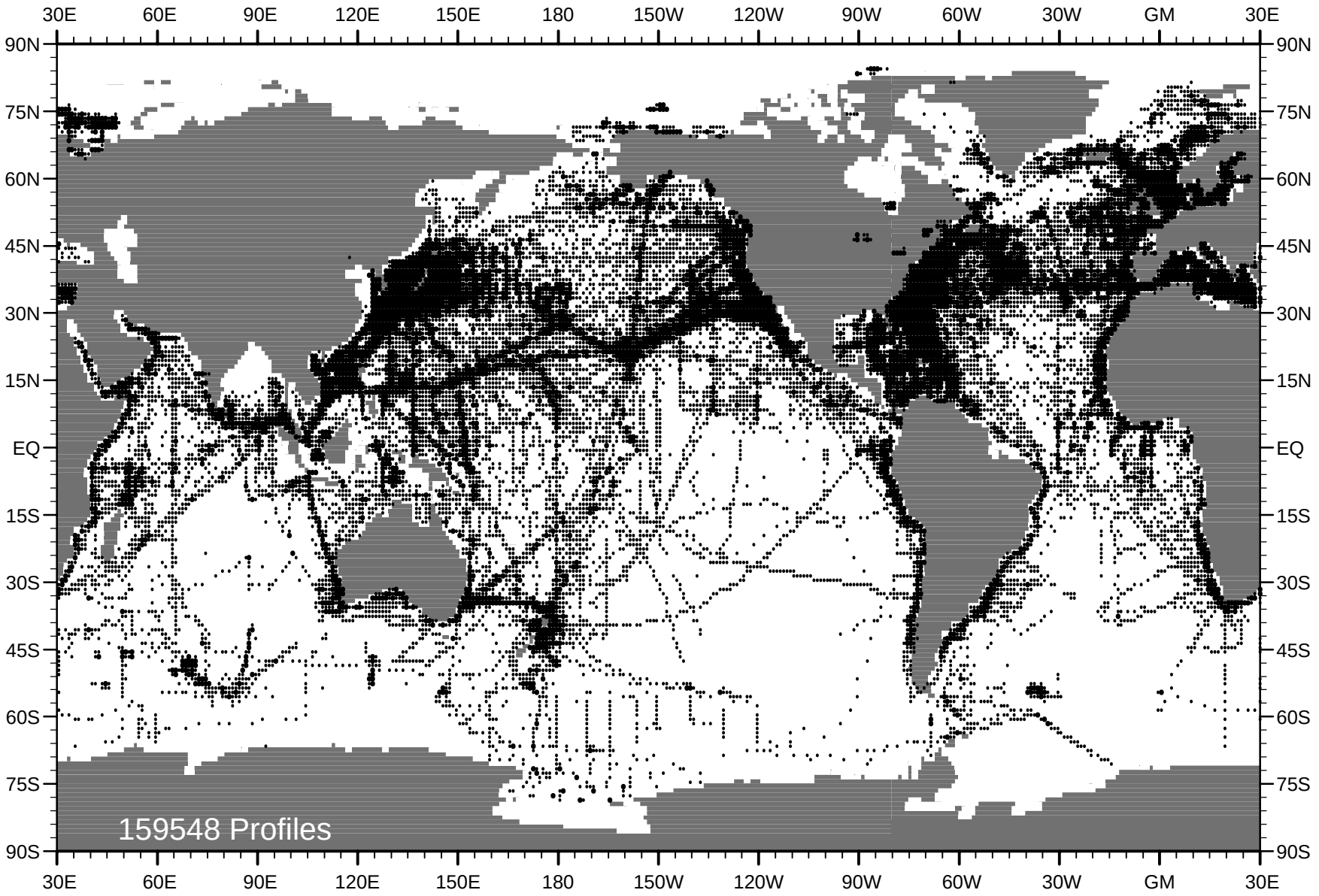


Fig. A32 Distribution of all data profiles (OSD+MBT+XBT+CTD) in WOD01 for year 1972 .

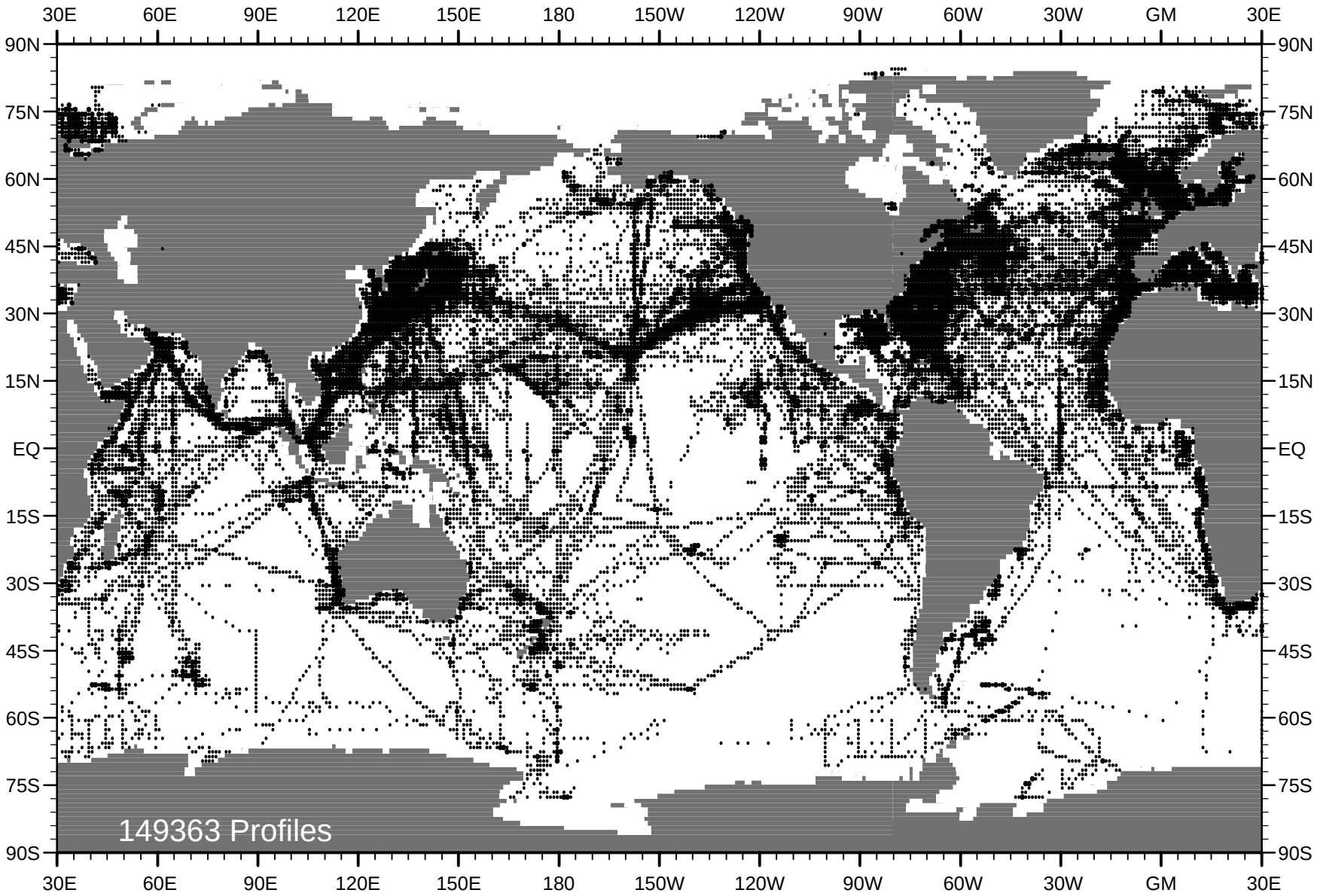


Fig. A33 Distribution of all data profiles (OSD+MBT+XBT+CTD) in WOD01 for year 1973 .

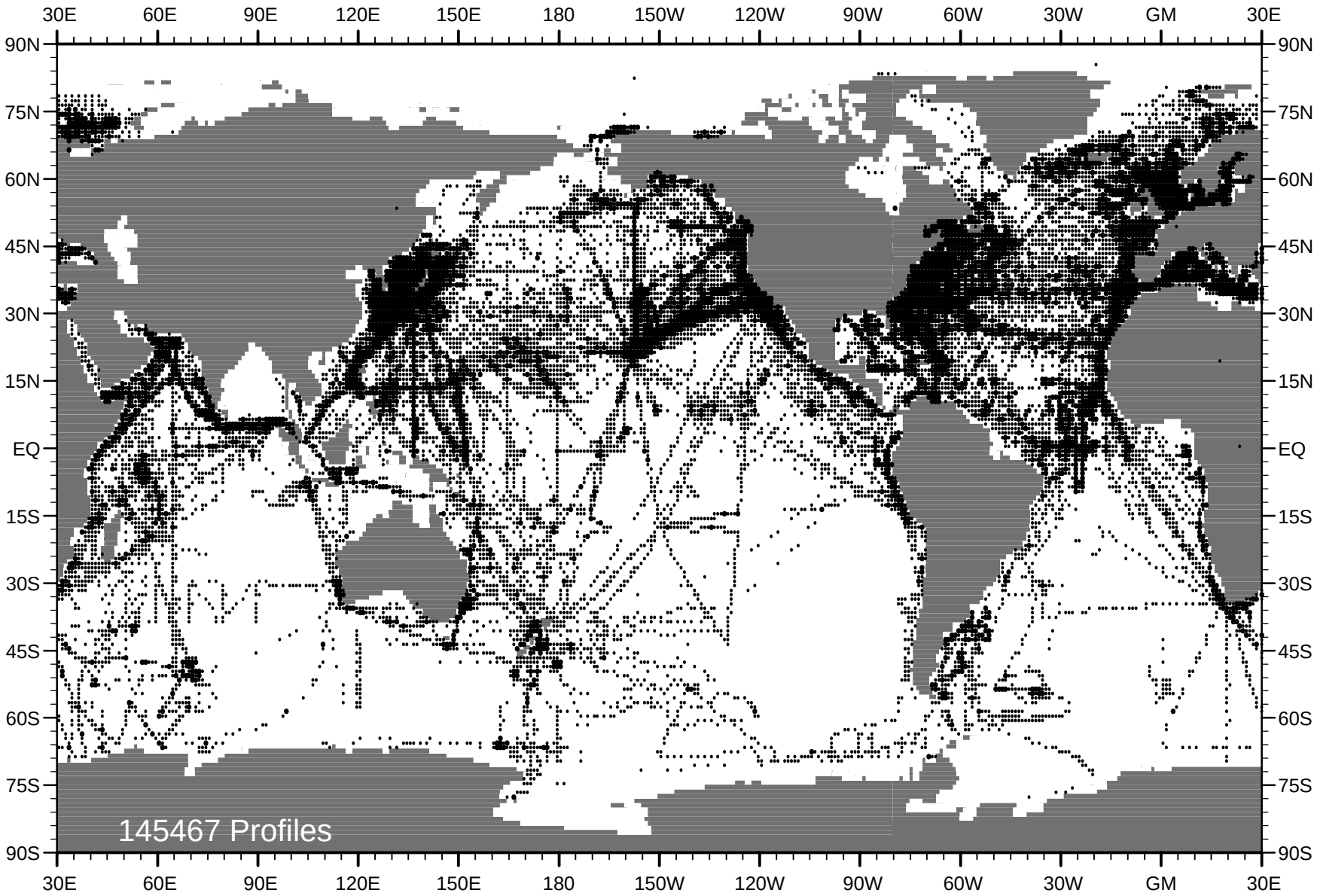


Fig. A34 Distribution of all data profiles (OSD+MBT+XBT+CTD) in WOD01 for year 1974 .

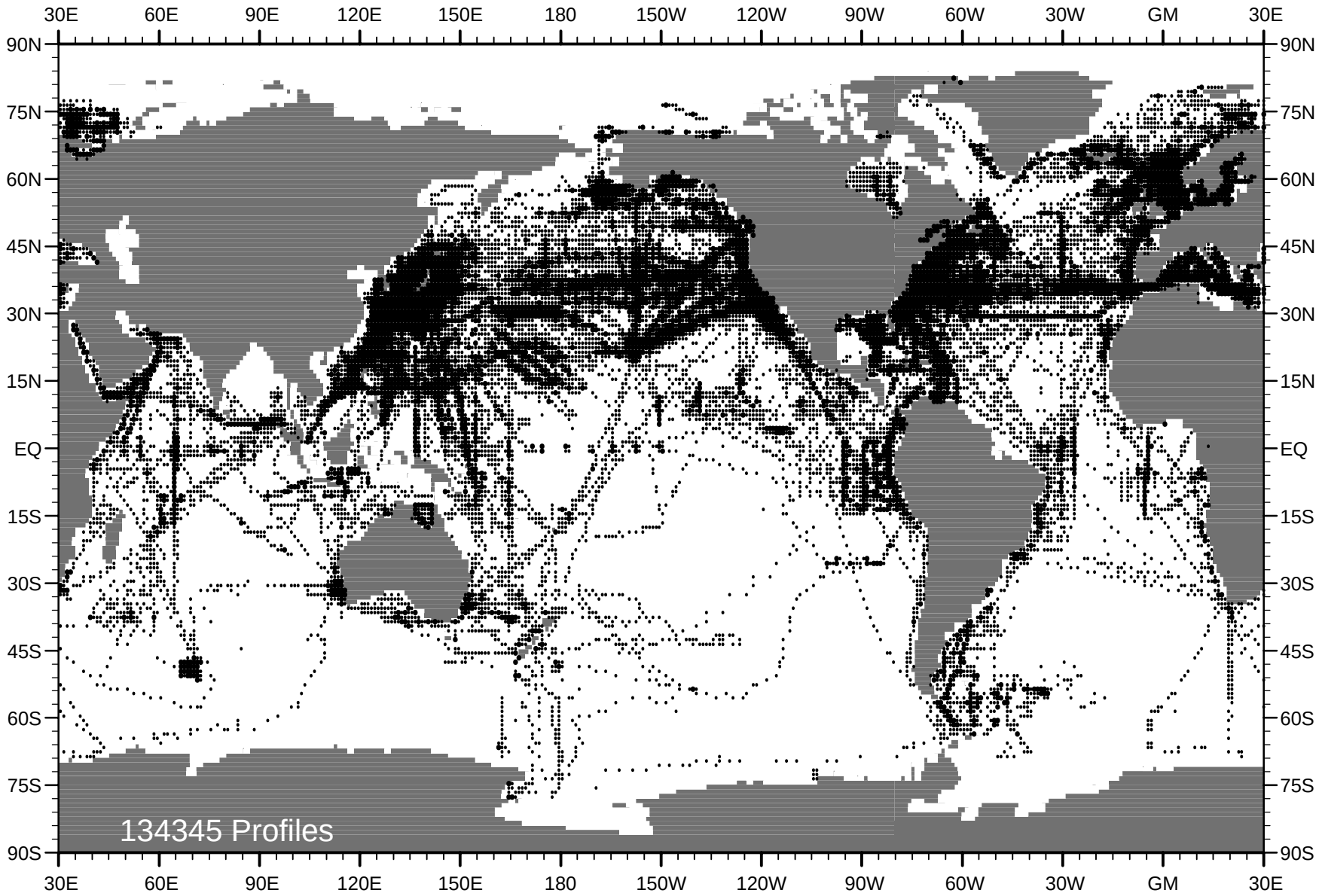


Fig. A35 Distribution of all data profiles (OSD+MBT+XBT+CTD) in WOD01 for year 1975 .

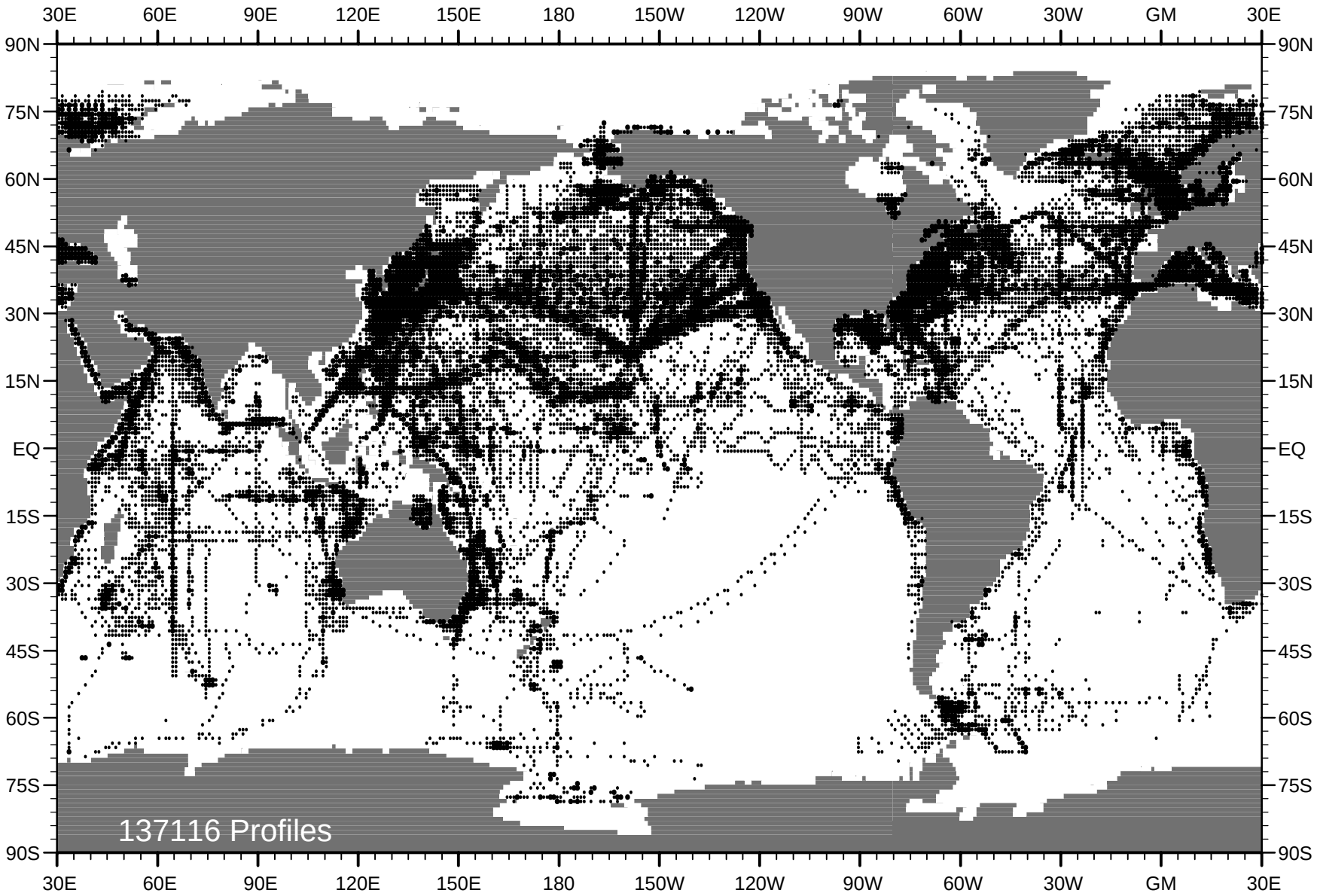


Fig. A36 Distribution of all data profiles (OSD+MBT+XBT+CTD) in WOD01 for year 1976 .

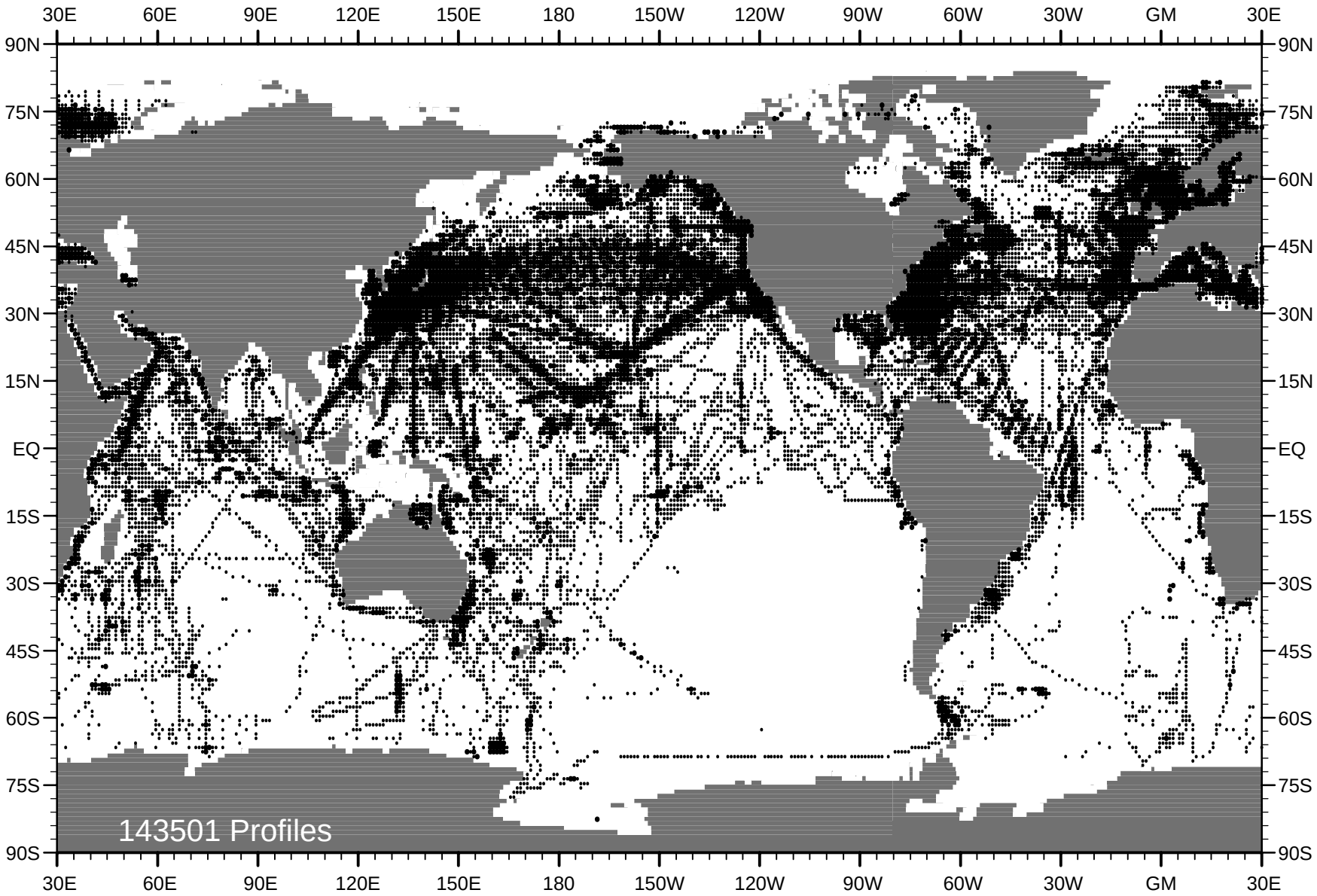


Fig. A37 Distribution of all data profiles (OSD+MBT+XBT+CTD) in WOD01 for year 1977 .

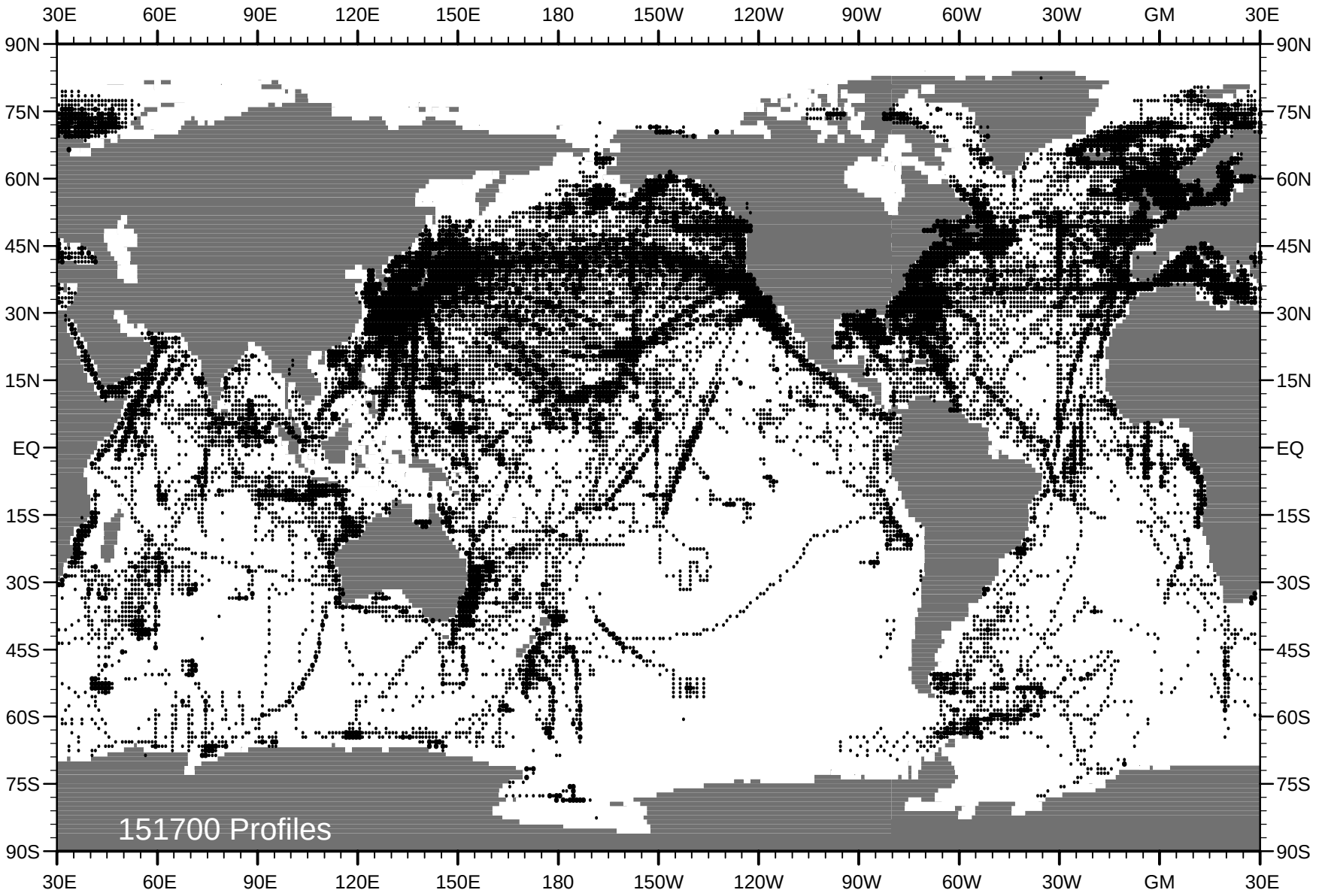


Fig. A38 Distribution of all data profiles (OSD+MBT+XBT+CTD) in WOD01 for year 1978 .

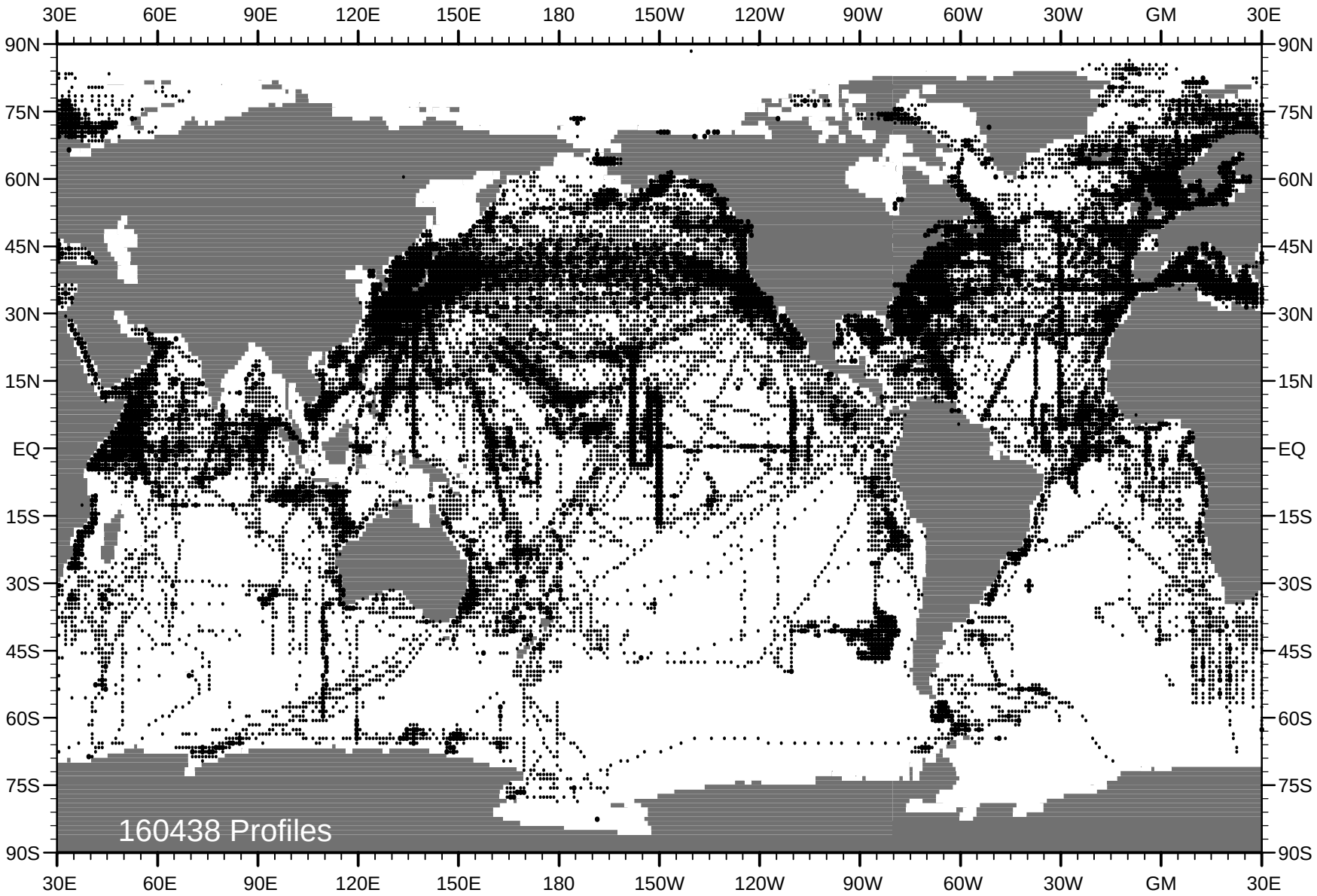


Fig. A39 Distribution of all data profiles (OSD+MBT+XBT+CTD) in WOD01 for year 1979 .

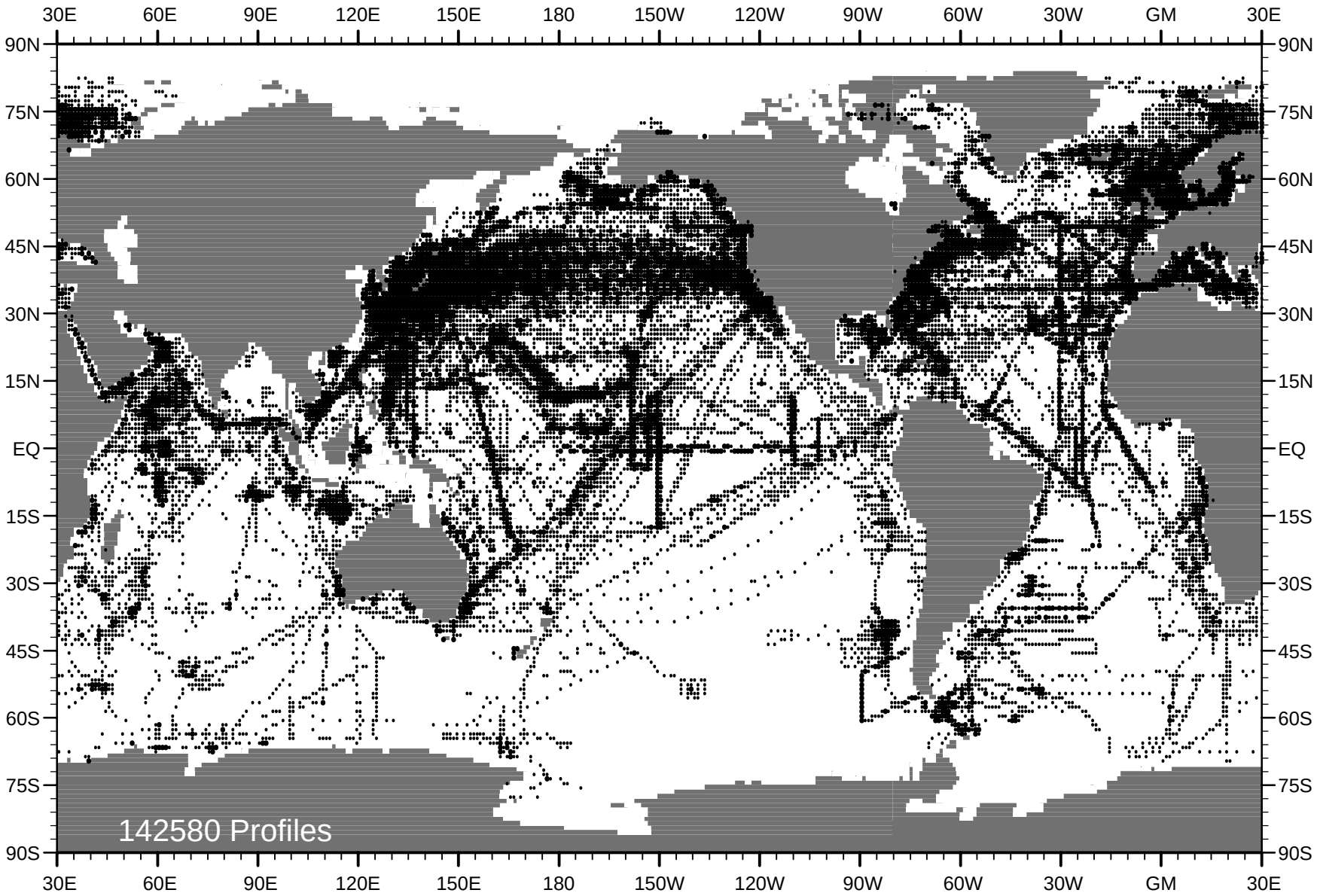


Fig. A40 Distribution of all data profiles (OSD+MBT+XBT+CTD) in WOD01 for year 1980 .

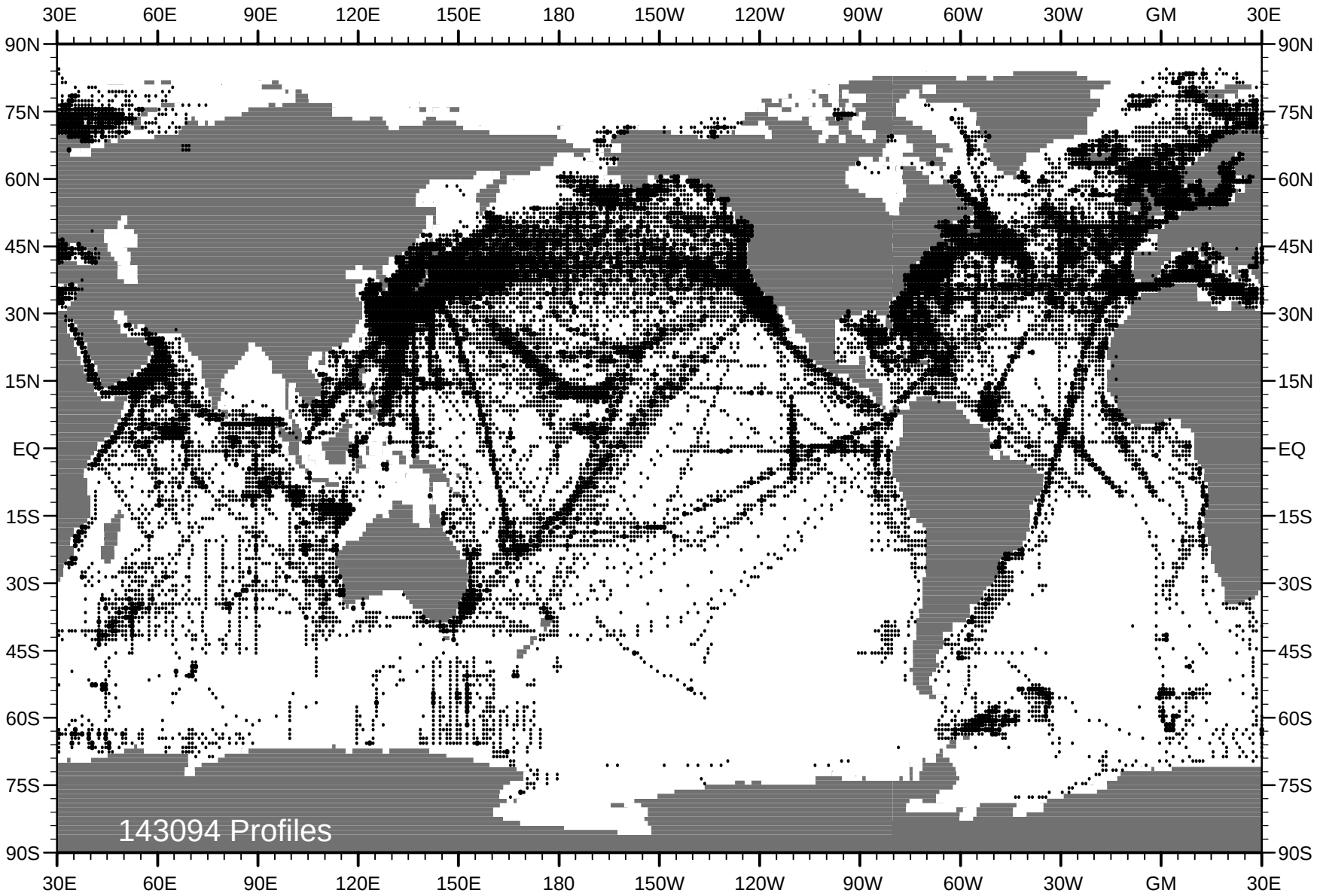


Fig. A41 Distribution of all data profiles (OSD+MBT+XBT+CTD) in WOD01 for year 1981 .

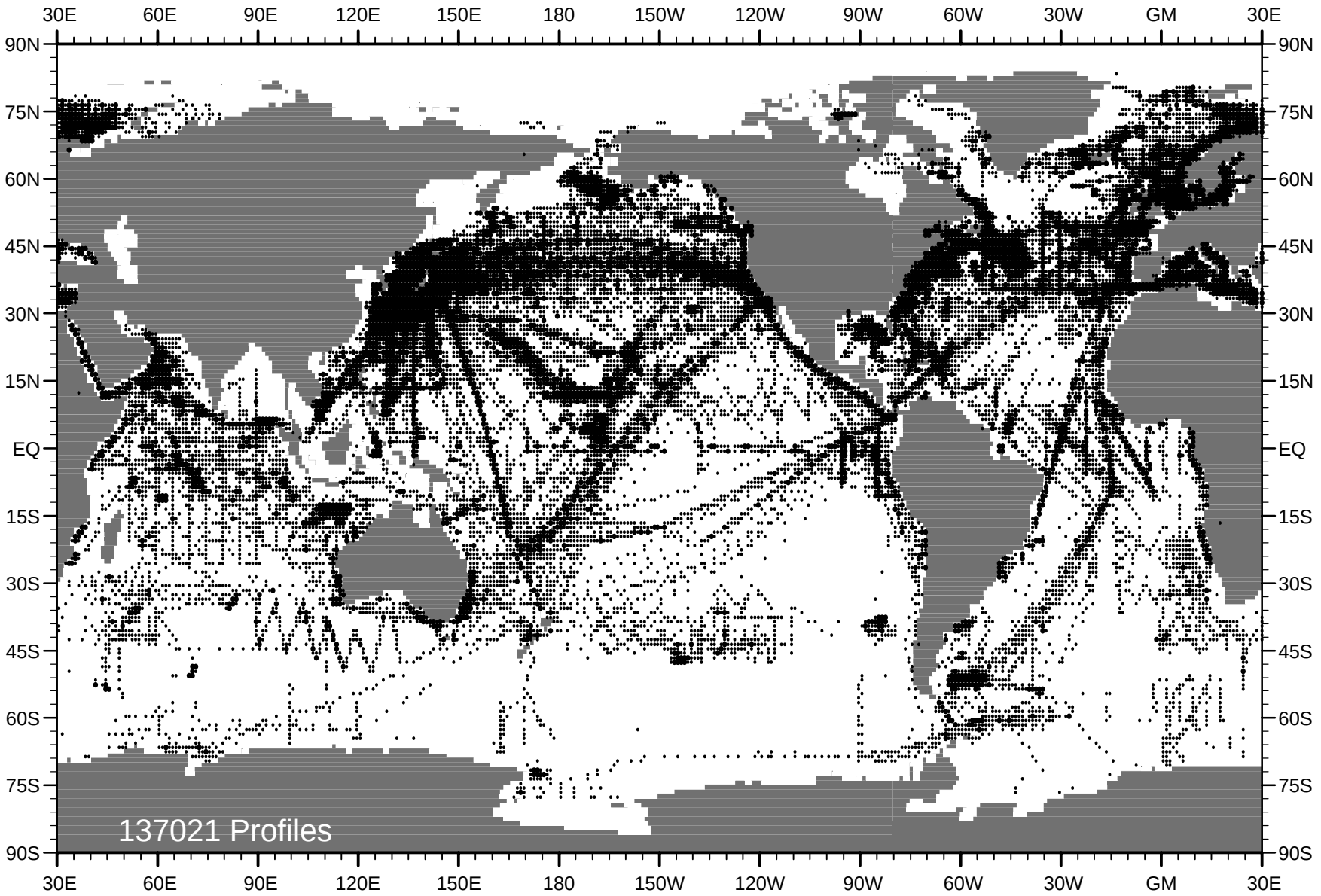


Fig. A42 Distribution of all data profiles (OSD+MBT+XBT+CTD) in WOD01 for year 1982 .

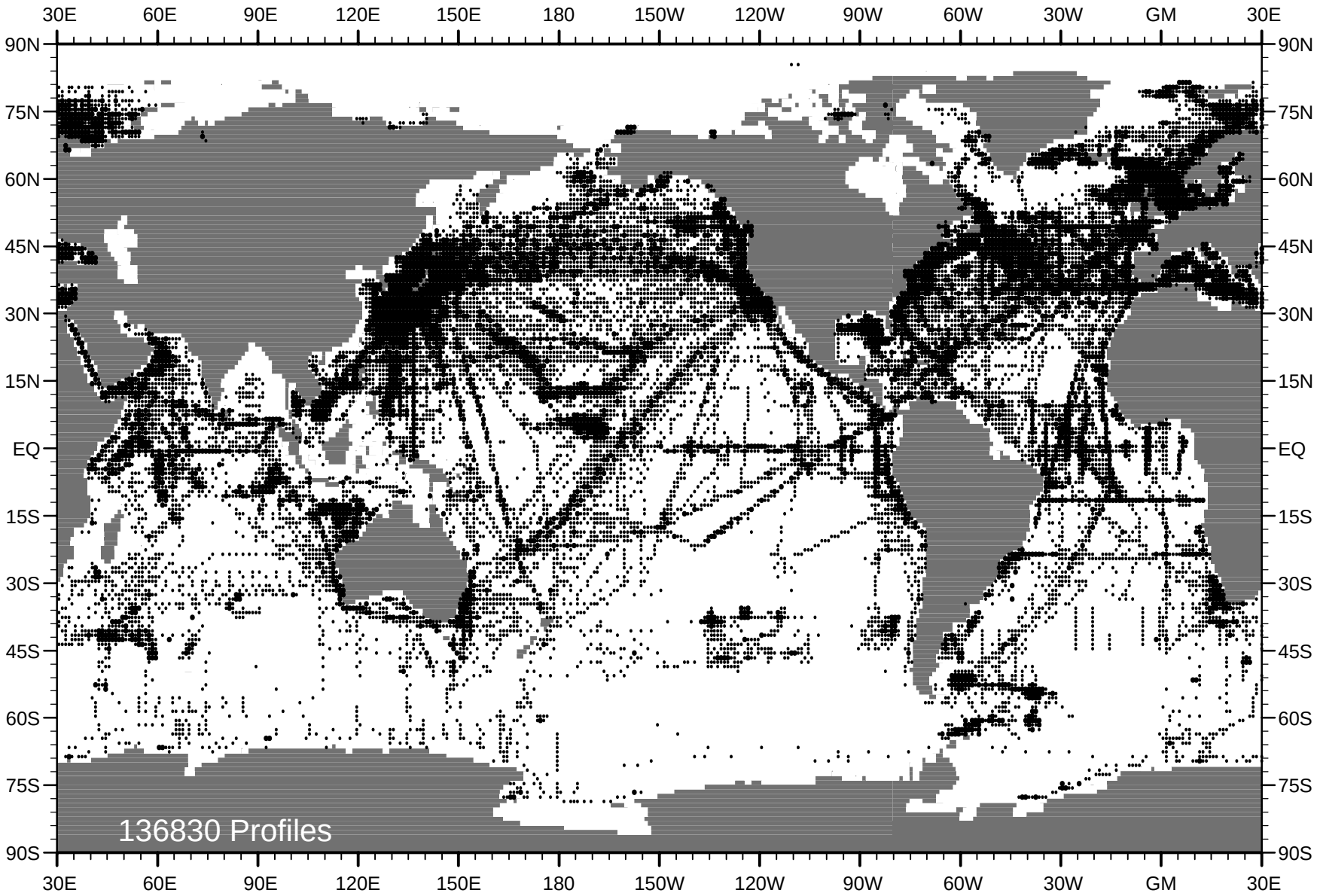


Fig. A43 Distribution of all data profiles (OSD+MBT+XBT+CTD) in WOD01 for year 1983 .

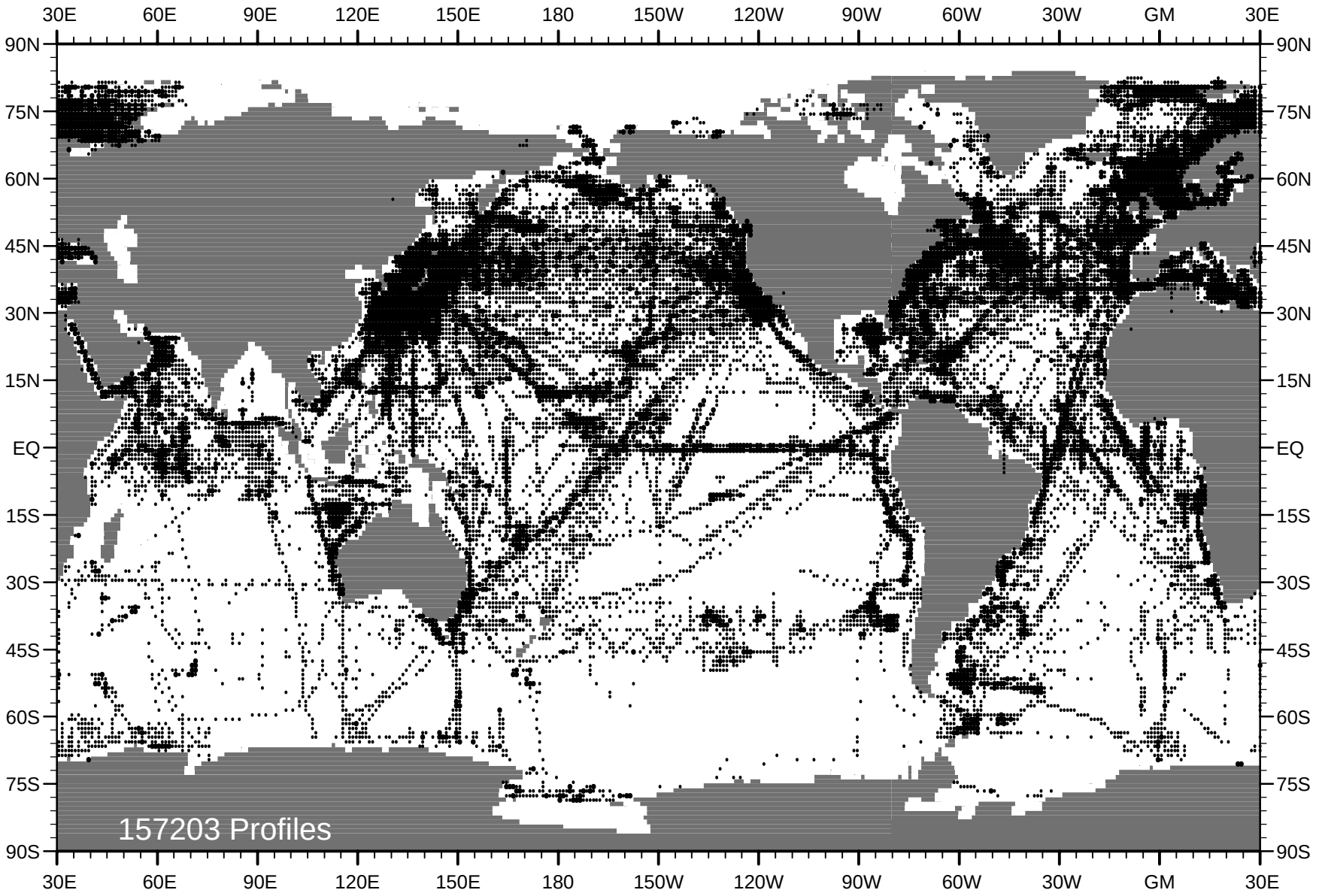


Fig. A44 Distribution of all data profiles (OSD+MBT+XBT+CTD) in WOD01 for year 1984 .

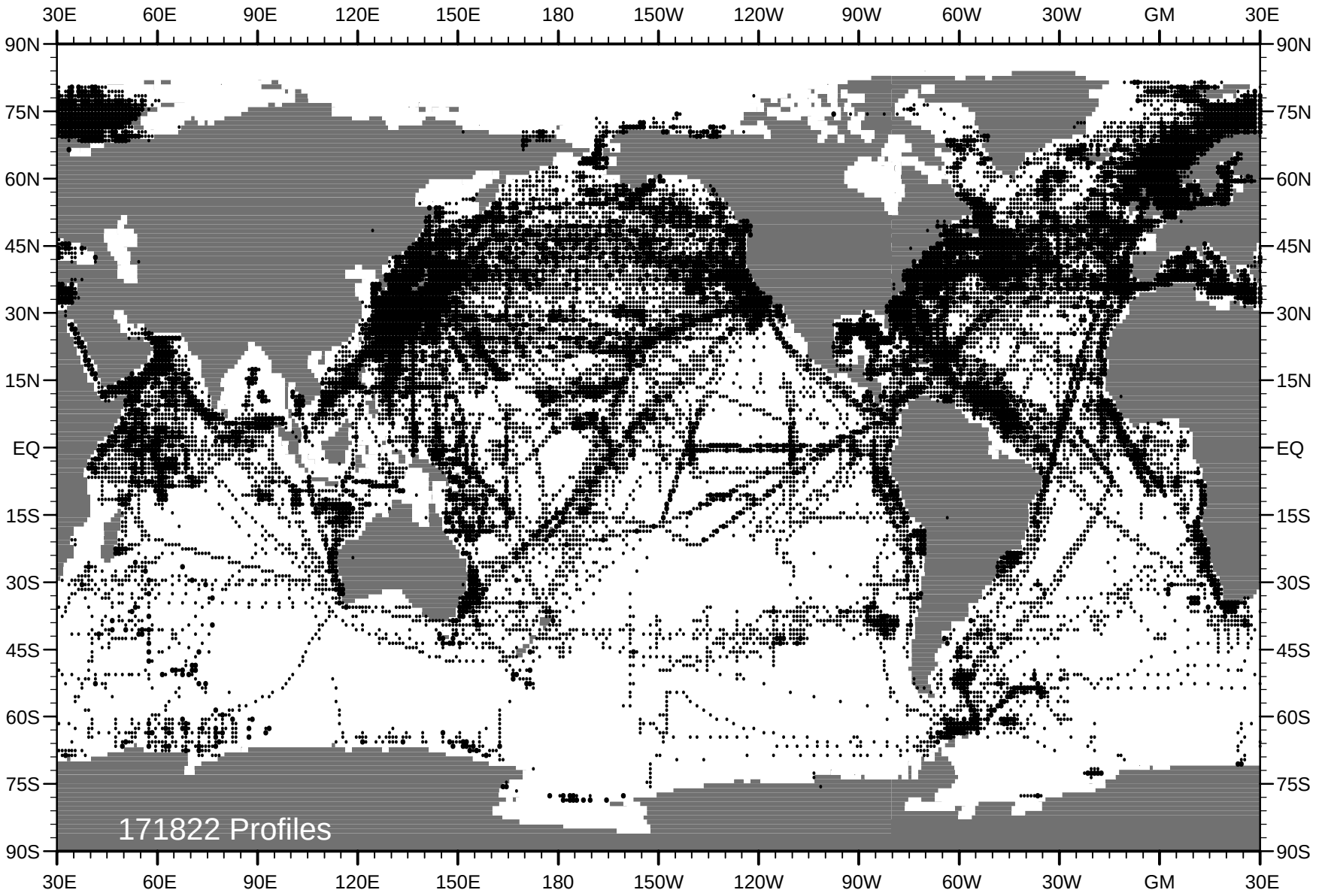


Fig. A45 Distribution of all data profiles (OSD+MBT+XBT+CTD) in WOD01 for year 1985 .

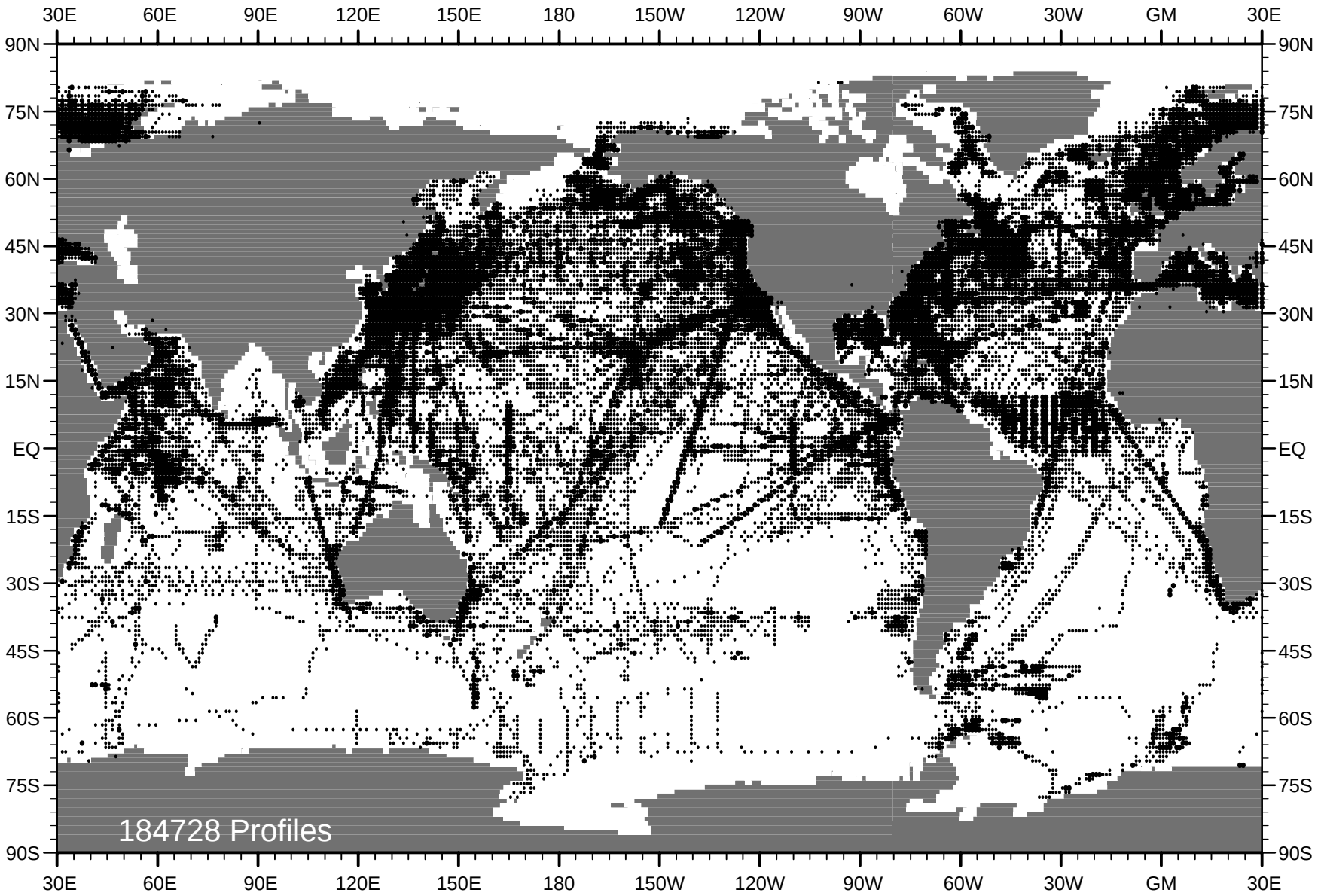


Fig. A46 Distribution of all data profiles (OSD+MBT+XBT+CTD) in WOD01 for year 1986 .

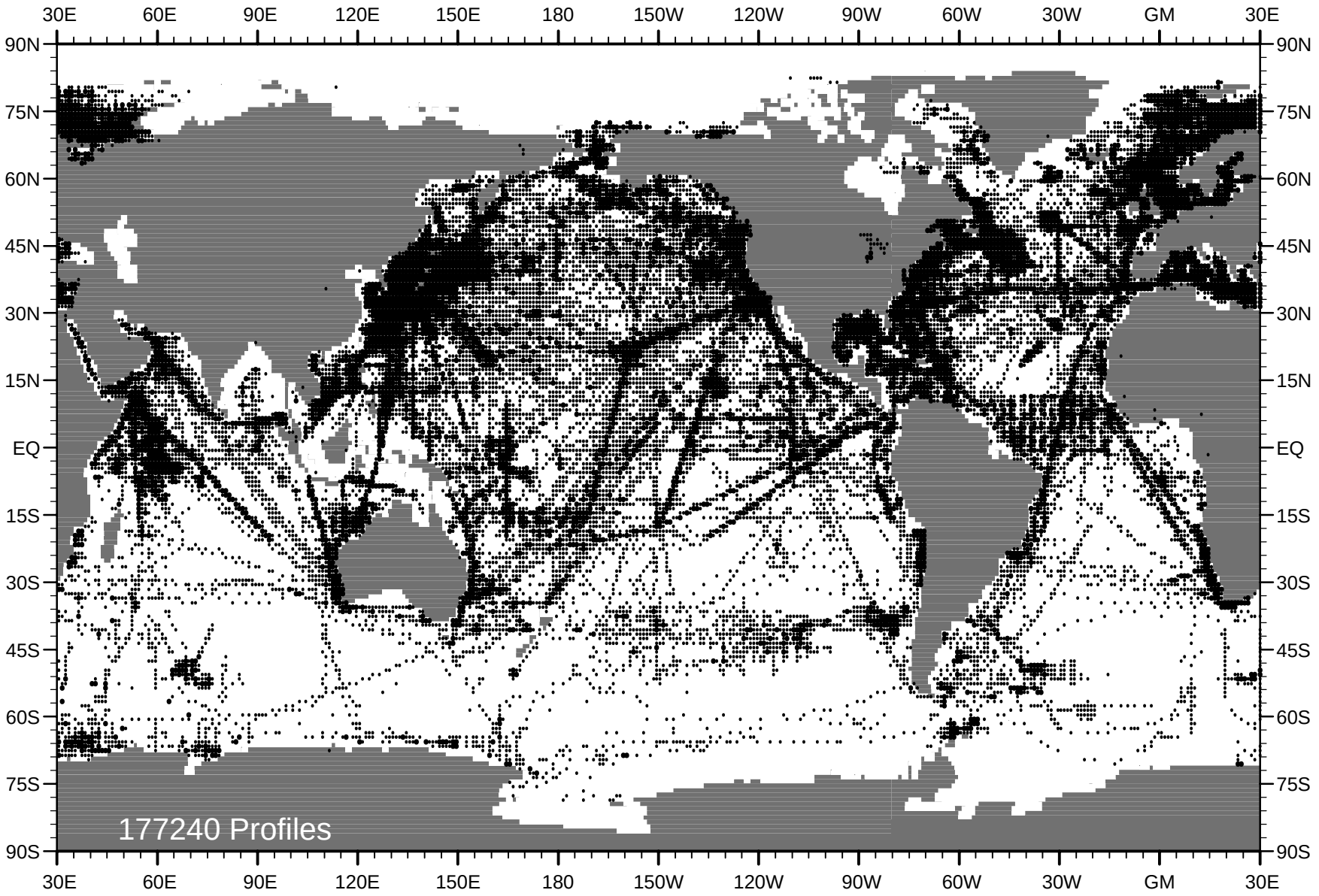


Fig. A47 Distribution of all data profiles (OSD+MBT+XBT+CTD) in WOD01 for year 1987 .

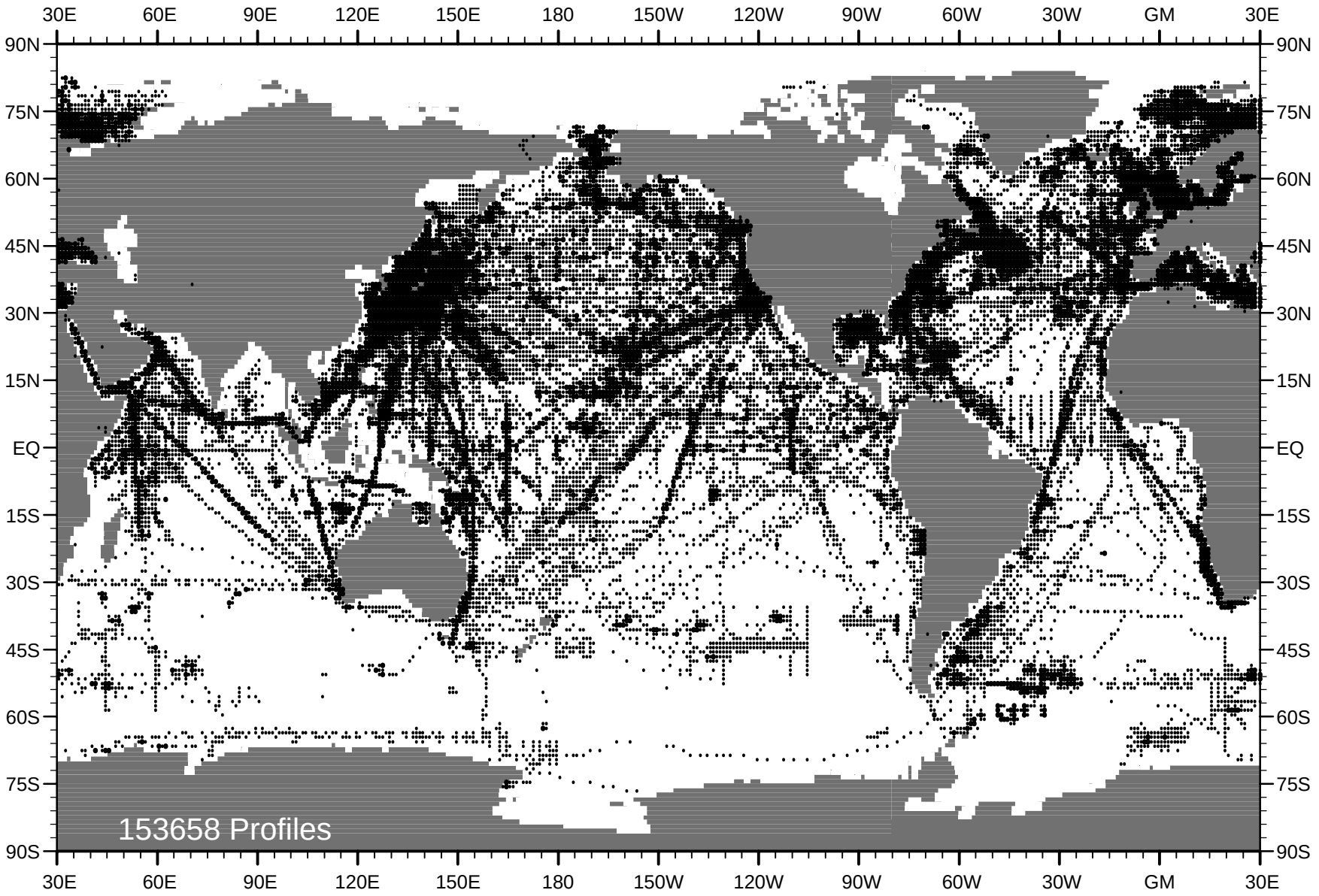


Fig. A48 Distribution of all data profiles (OSD+MBT+XBT+CTD) in WOD01 for year 1988 .

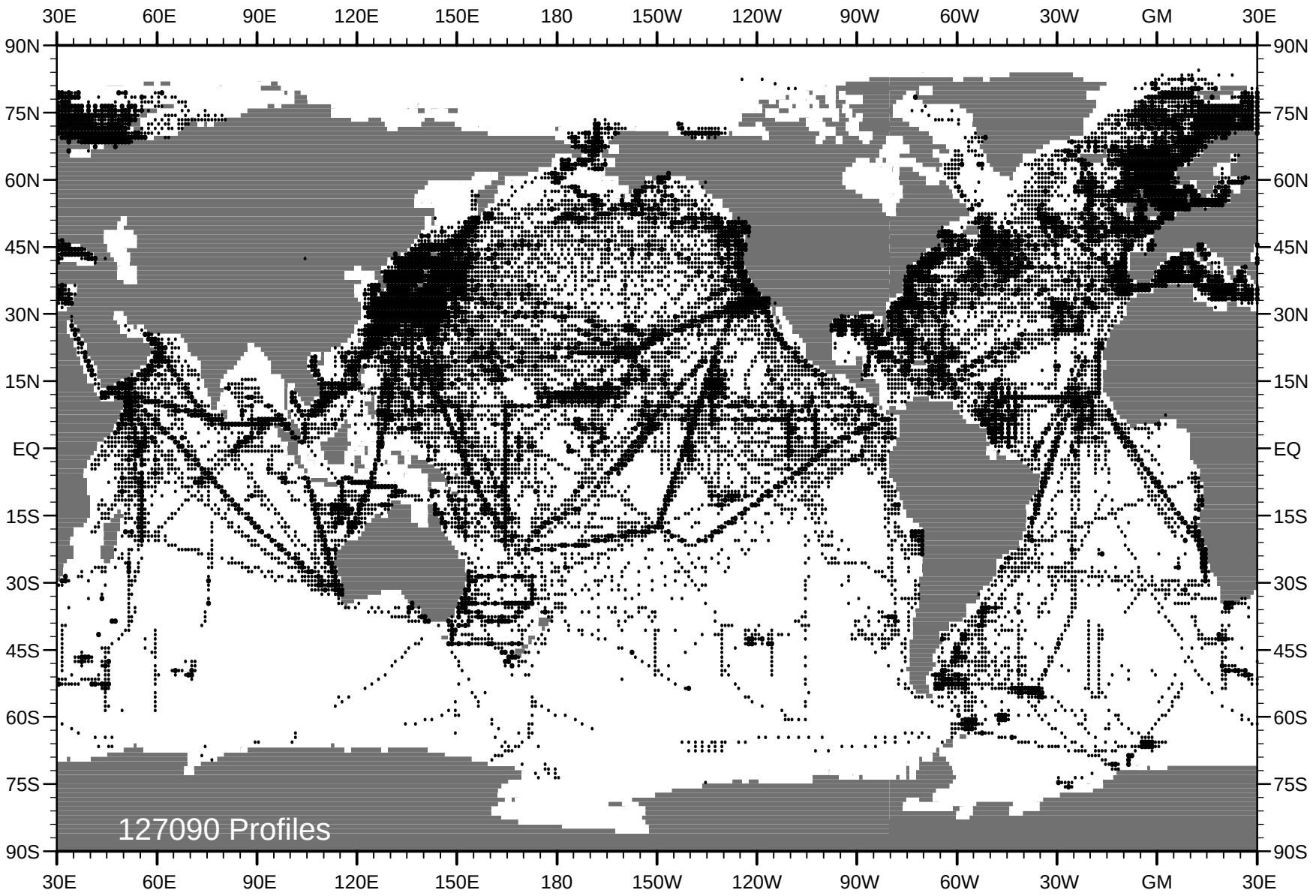


Fig. A49 Distribution of all data profiles (OSD+MBT+XBT+CTD) in WOD01 for year 1989 .

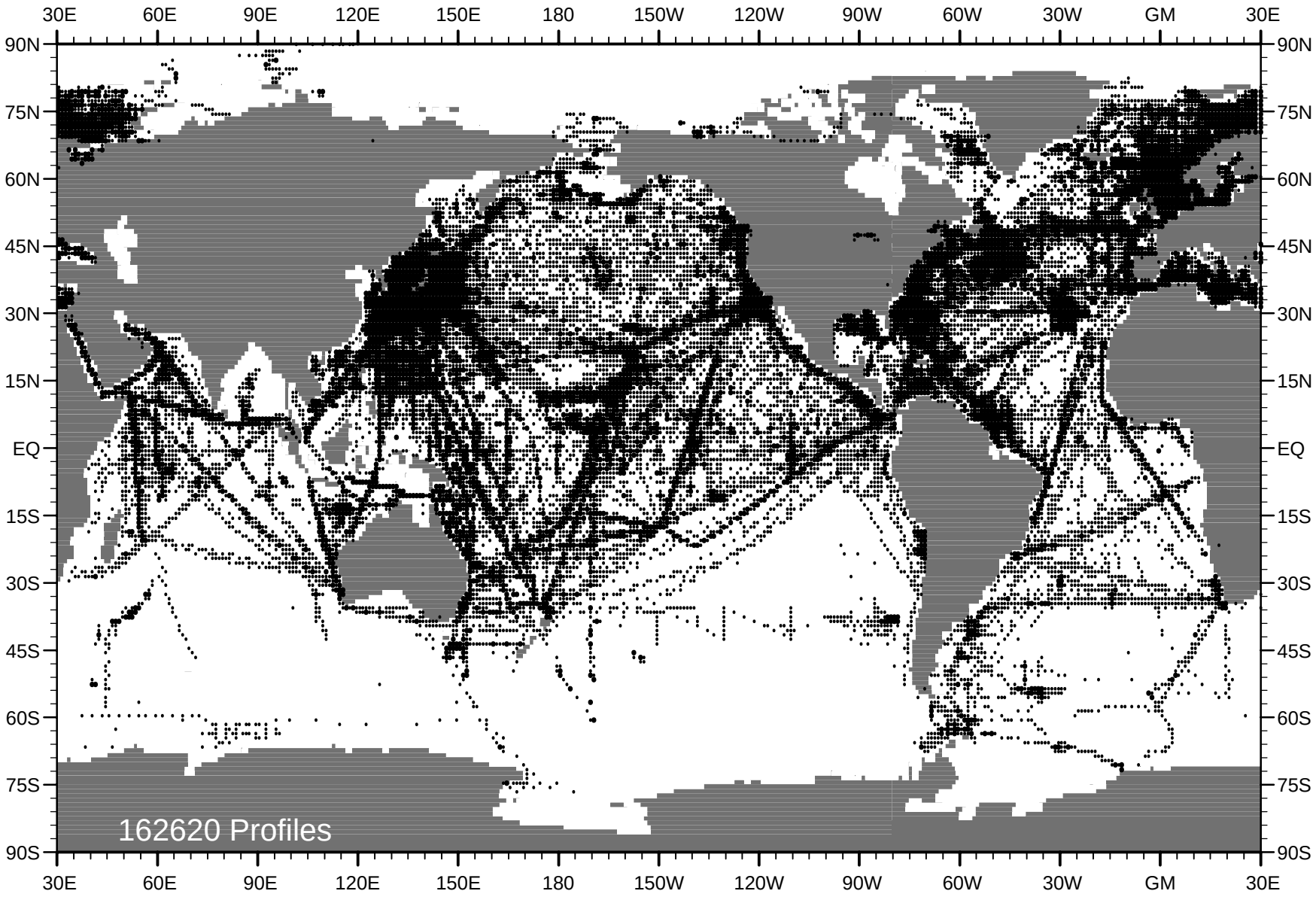


Fig. A50 Distribution of all data profiles (OSD+MBT+XBT+CTD+MRB) in WOD01 for year 1990 .

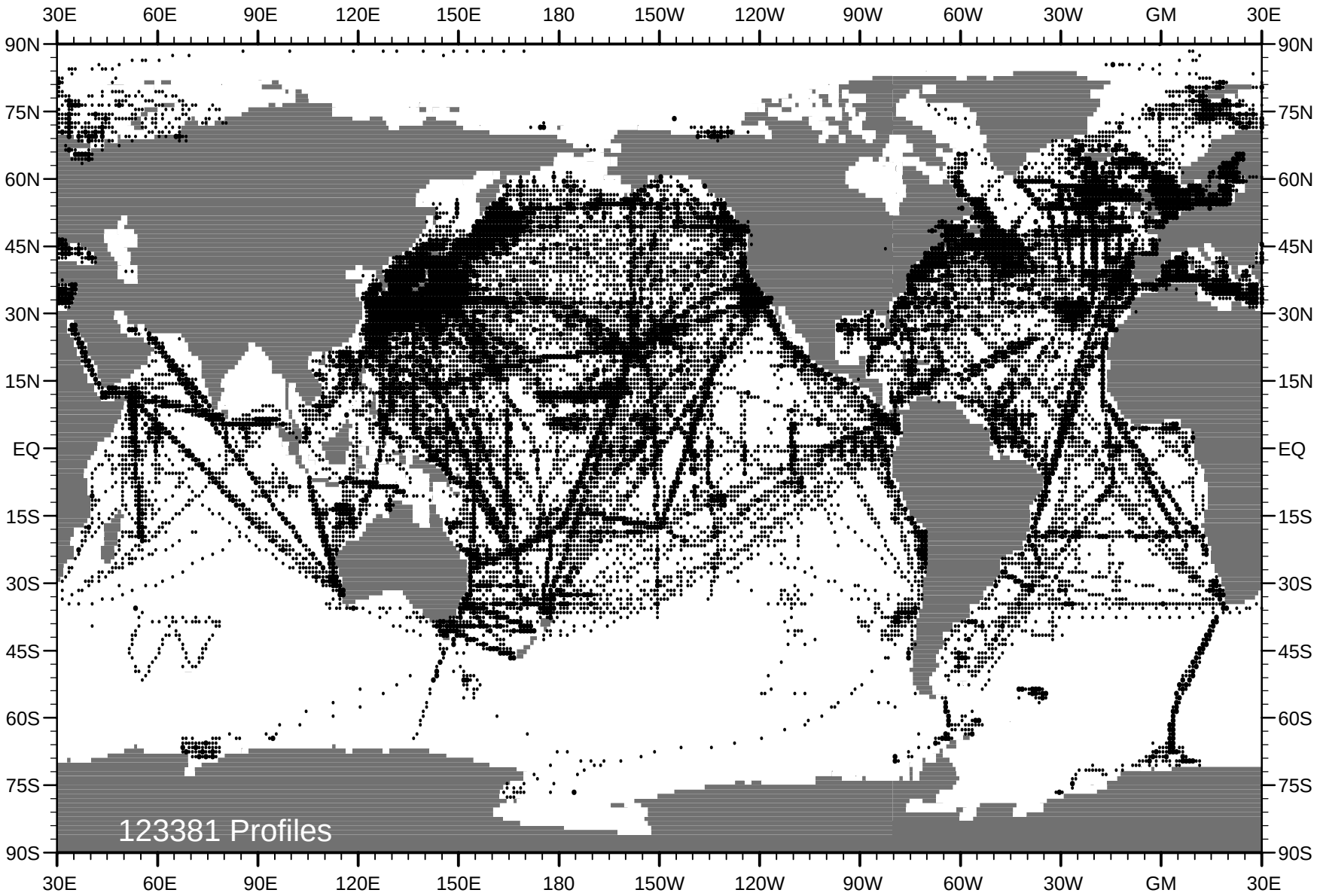


Fig. A51 Distribution of all data profiles (OSD+MBT+XBT+CTD+MRB) in WOD01 for year 1991 .

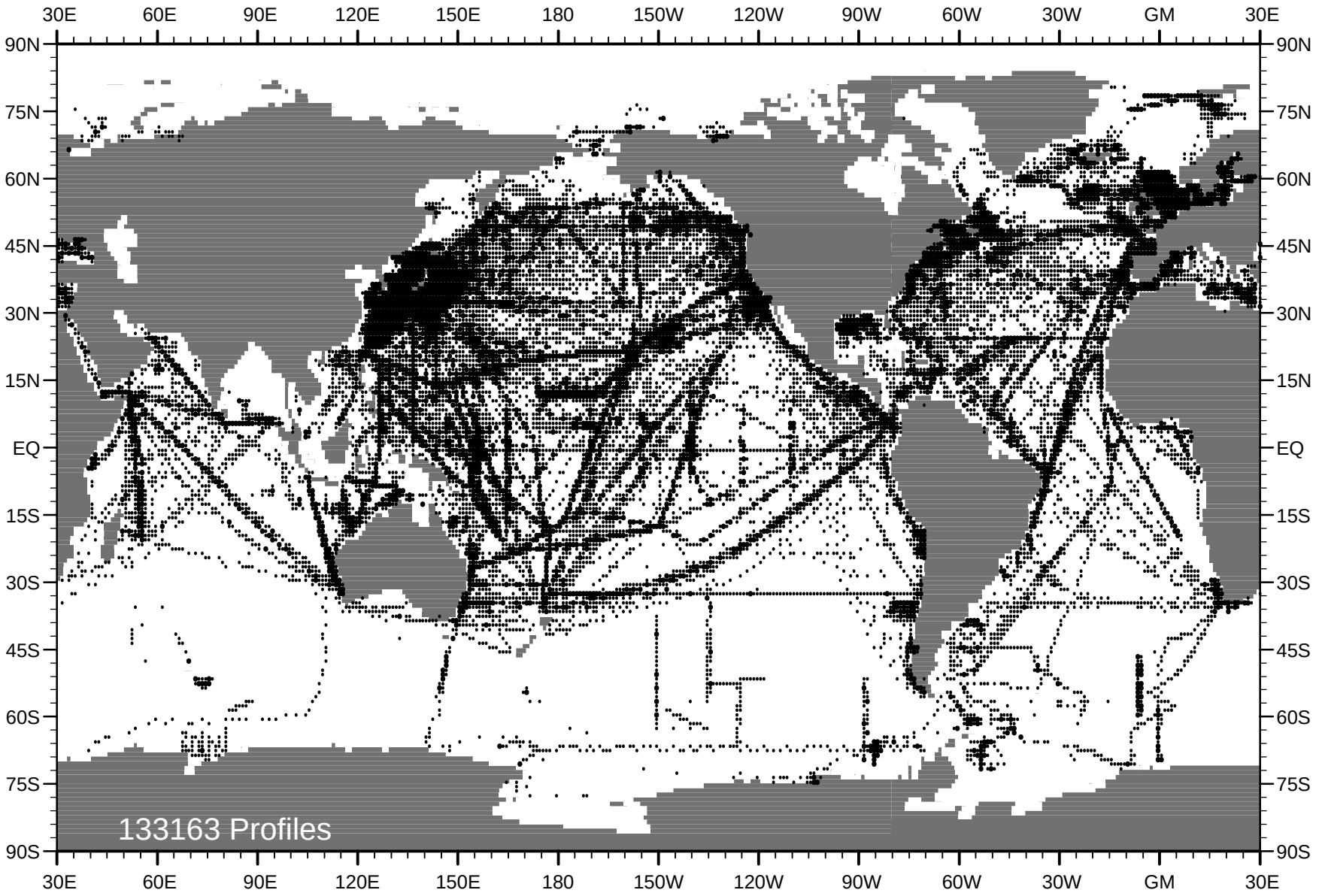


Fig. A52 Distribution of all data profiles (OSD+MBT+XBT+CTD+MRB+UOR) in WOD01 for year 1992 .

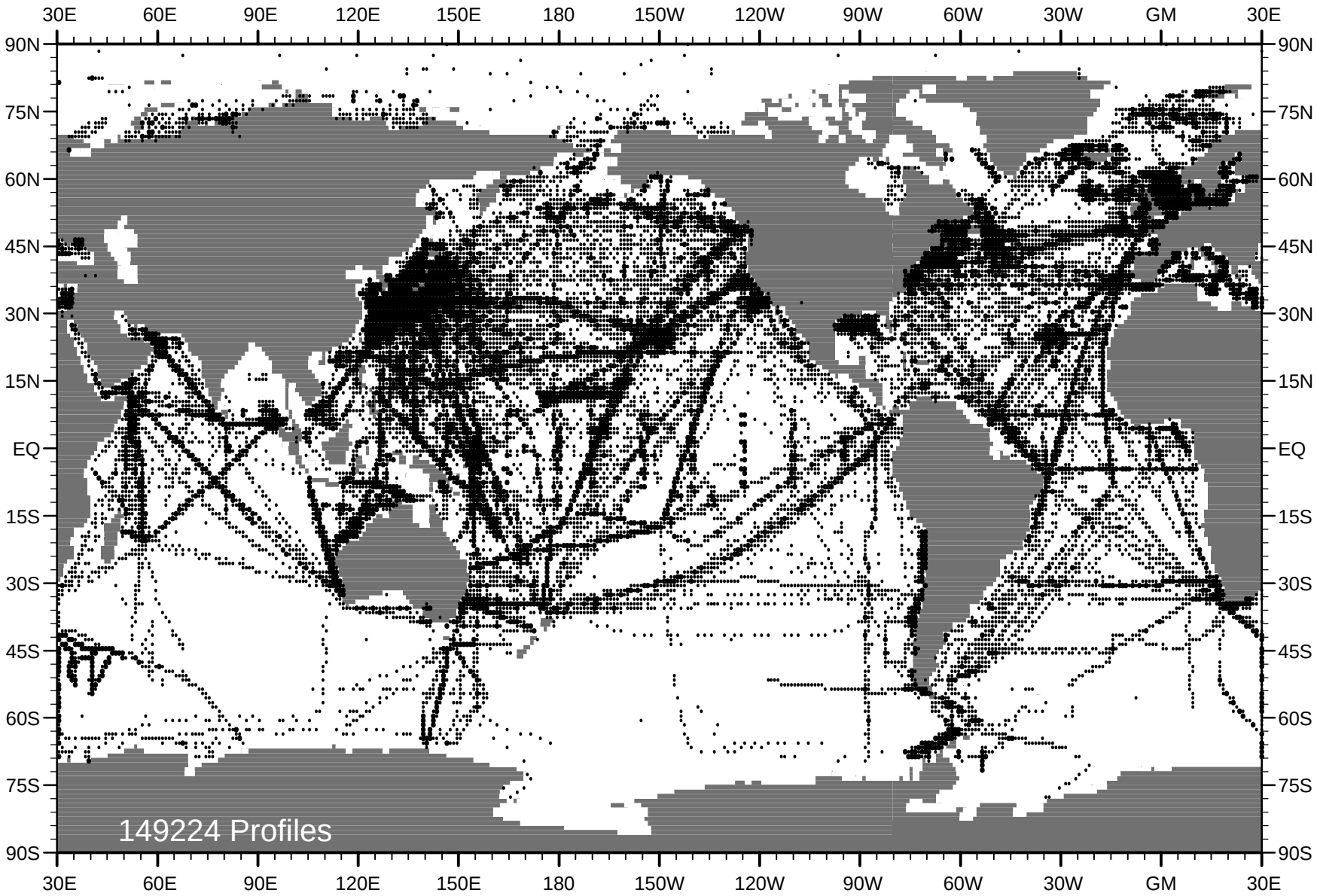


Fig. A53 Distribution of all data profiles (OSD+MBT+XBT+CTD+MRB+UOR) in WOD01 for year 1993 .

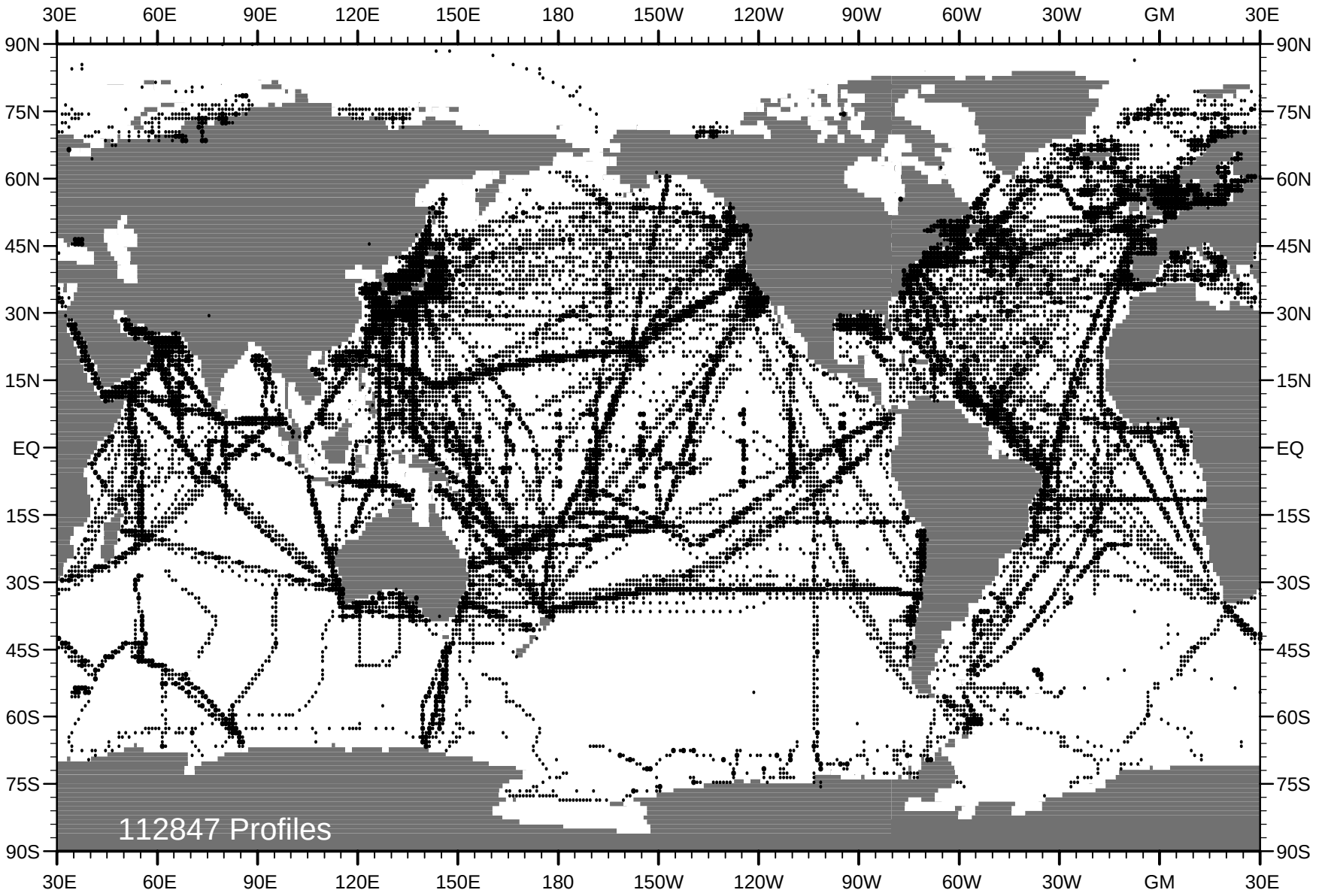


Fig. A54 Distribution of all data profiles (OSD+MBT+XBT+CTD+MRB+UOR+PFL) in WOD01 for year 1994 .

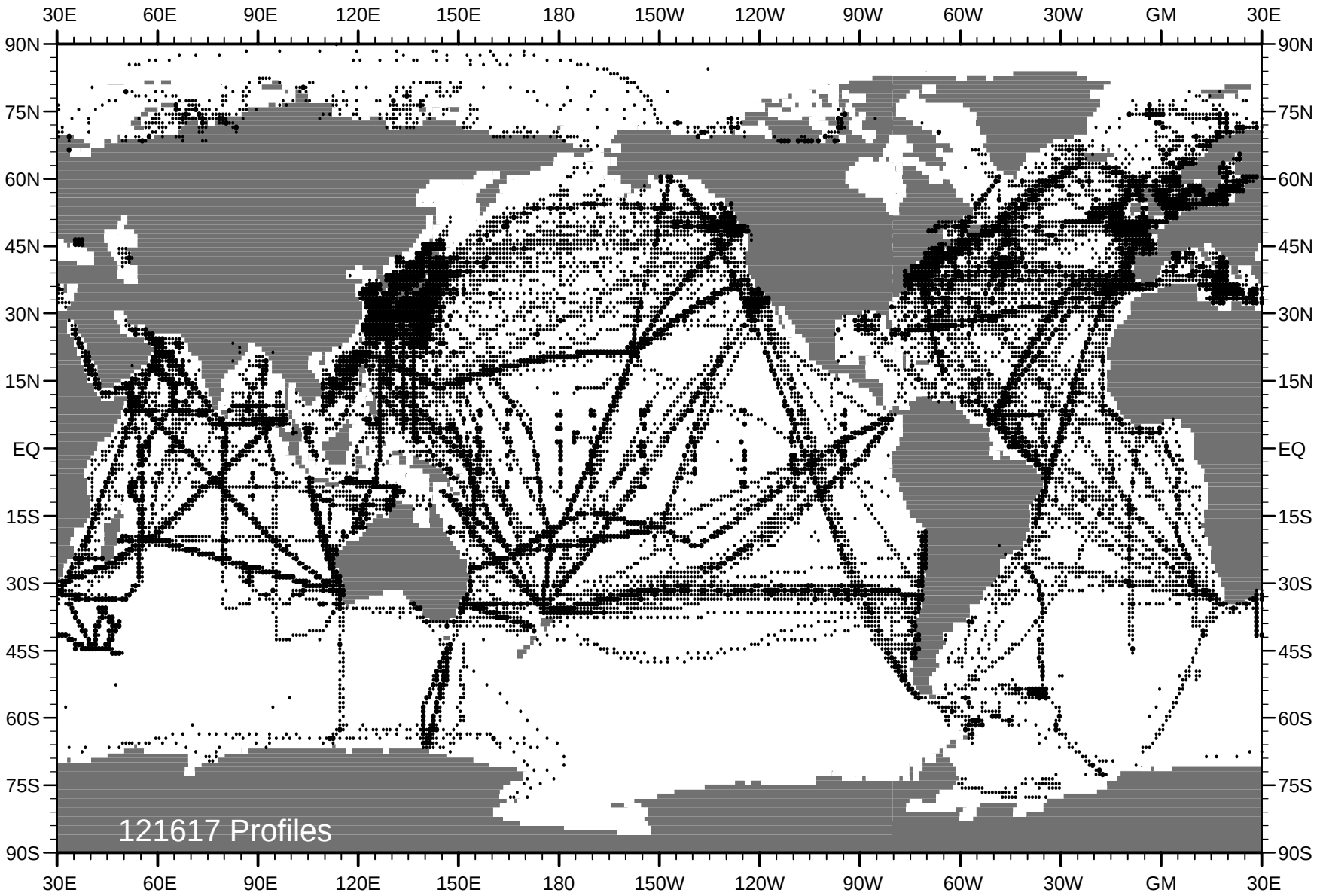


Fig. A55 Distribution of all data profiles (OSD+MBT+XBT+CTD+MRB+UOR+PFL) in WOD01 for year 1995 .

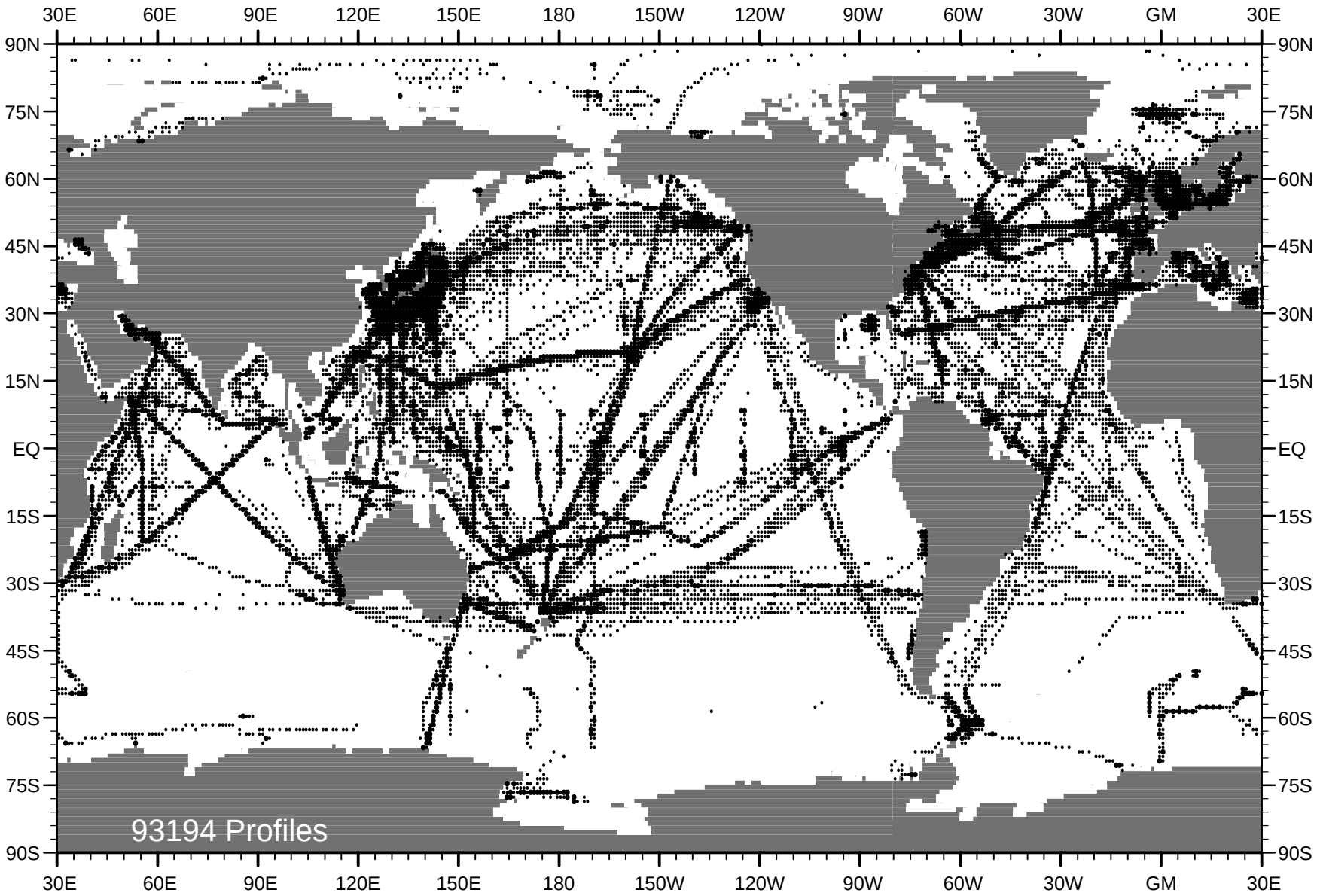


Fig. A56 Distribution of all data profiles (OSD+MBT+XBT+CTD+MRB+UOR+PFL) in WOD01 for year 1996 .

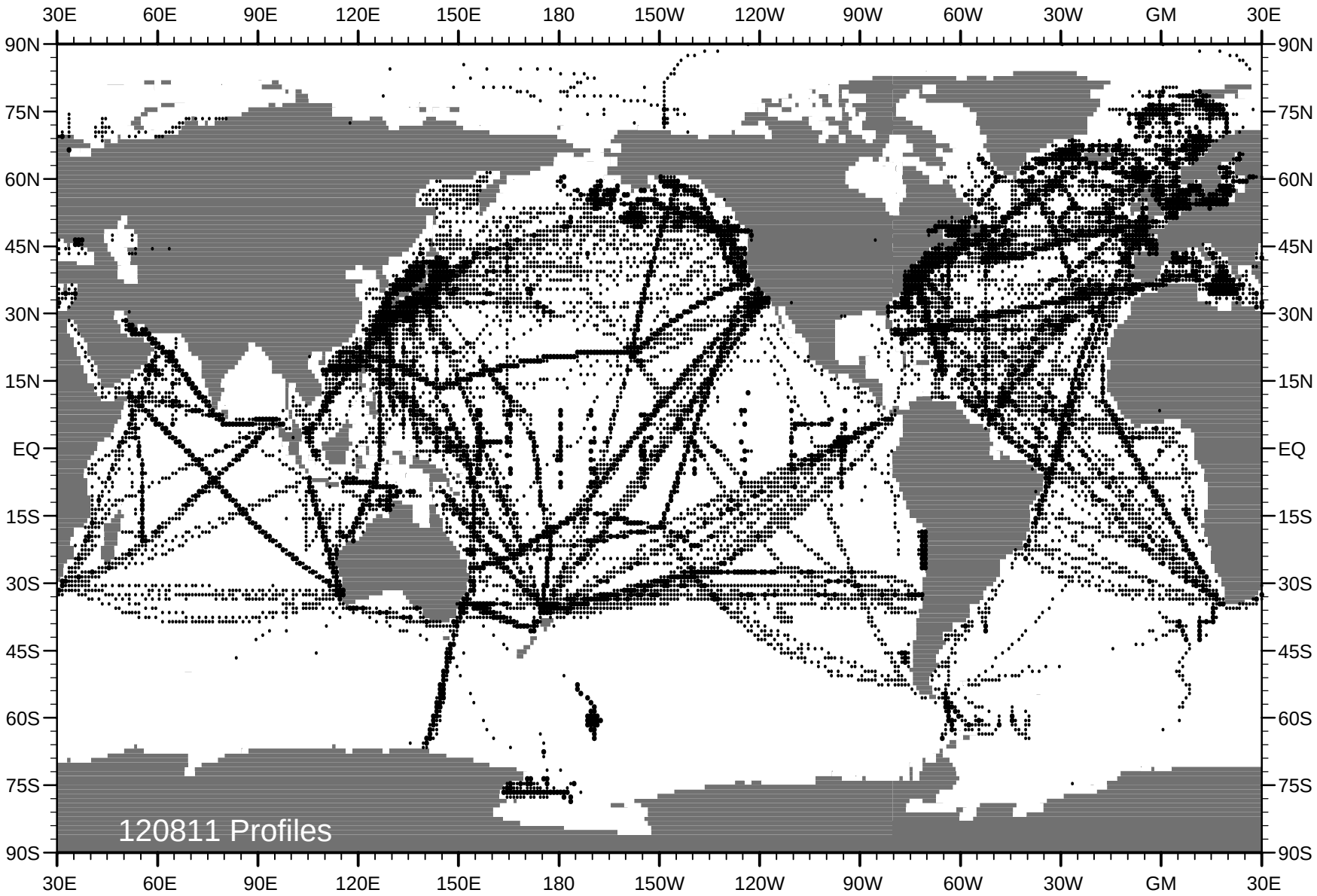


Fig. A57 Distribution of all data profiles (OSD+MBT+XBT+CTD+MRB+UOR+PFL+APB) in WOD01 for year 1997 .

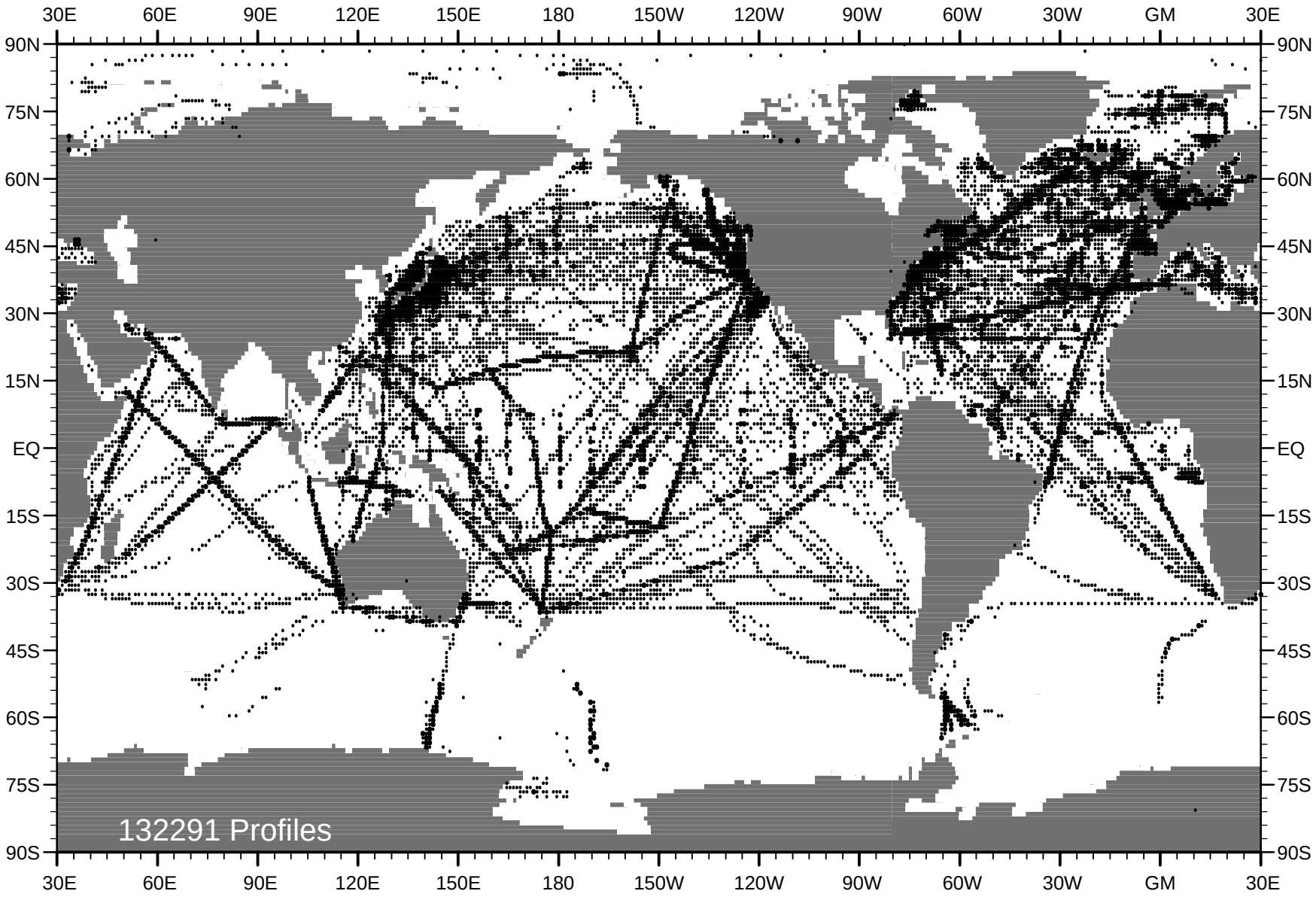


Fig. A58 Distribution of all data profiles (OSD+MBT+XBT+CTD+MRB+UOR+PFL+APB+DRB) in WOD01 for year 1998 .

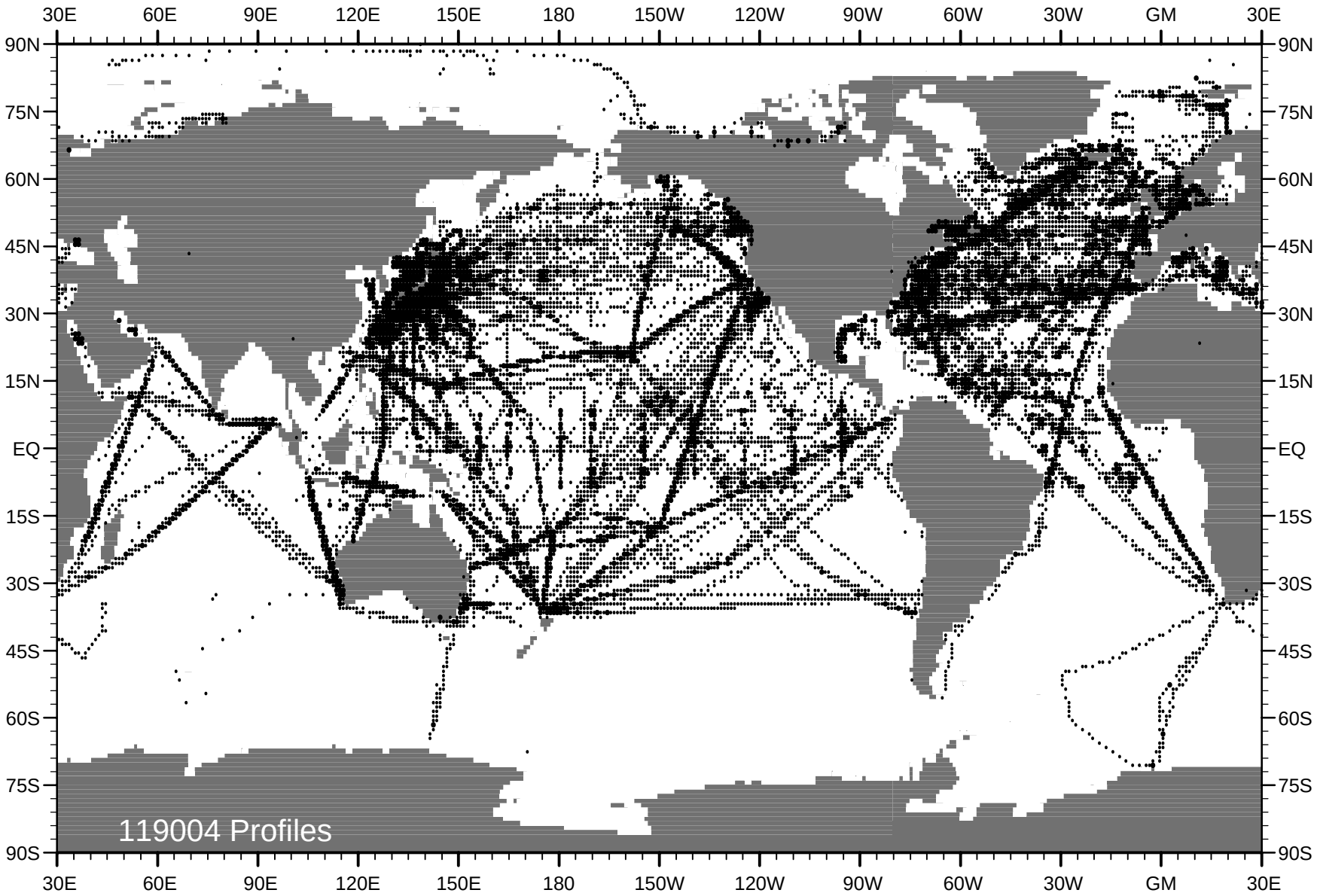


Fig. A59 Distribution of all data profiles (OSD+MBT+XBT+CTD+MRB+UOR+PFL+APB+DRB) in WOD01 for year 1999 .

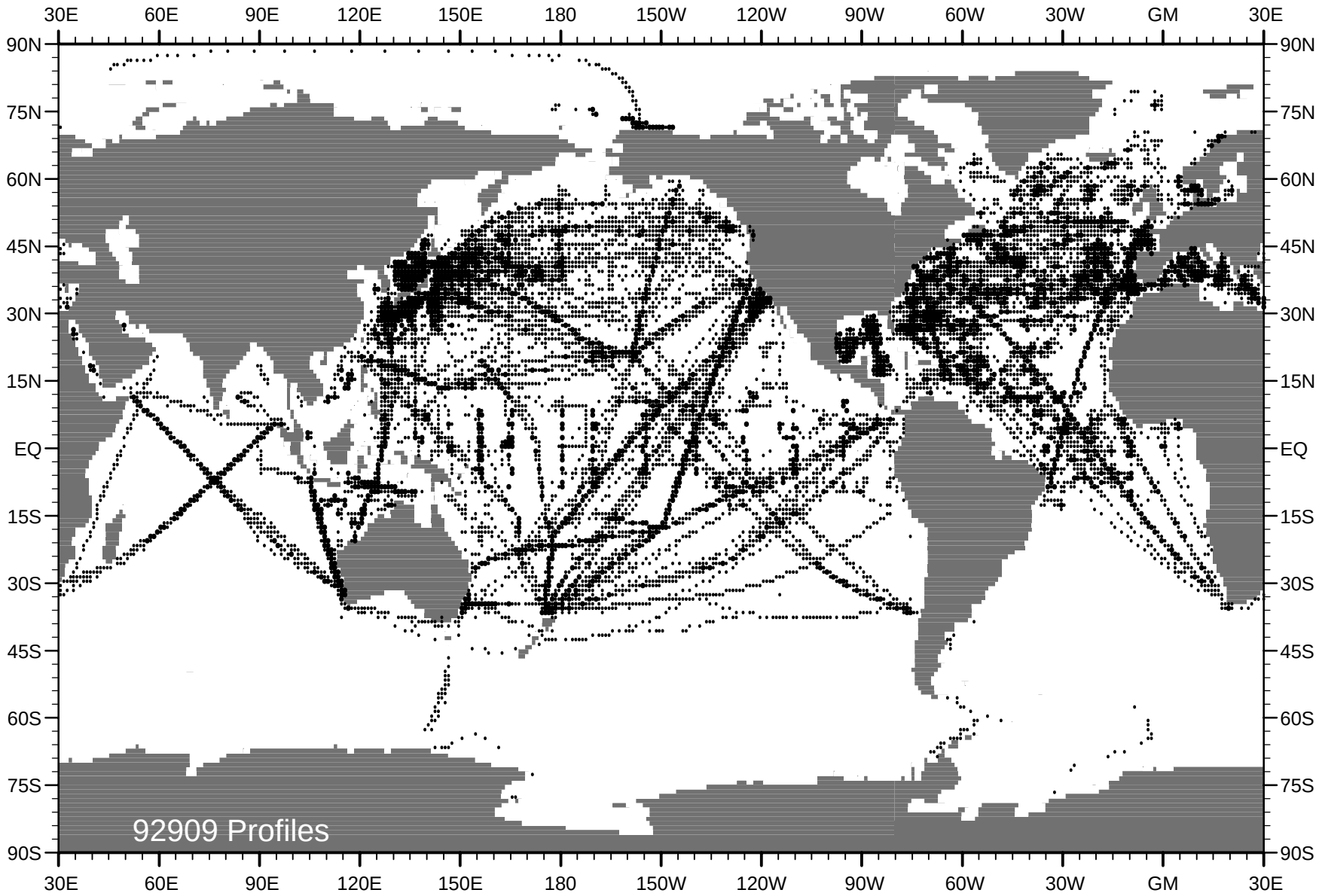


Fig. A60 Distribution of all data profiles (OSD+MBT+XBT+CTD+MRB+UOR+PFL+APB+DRB) in WOD01 for year 2000 .

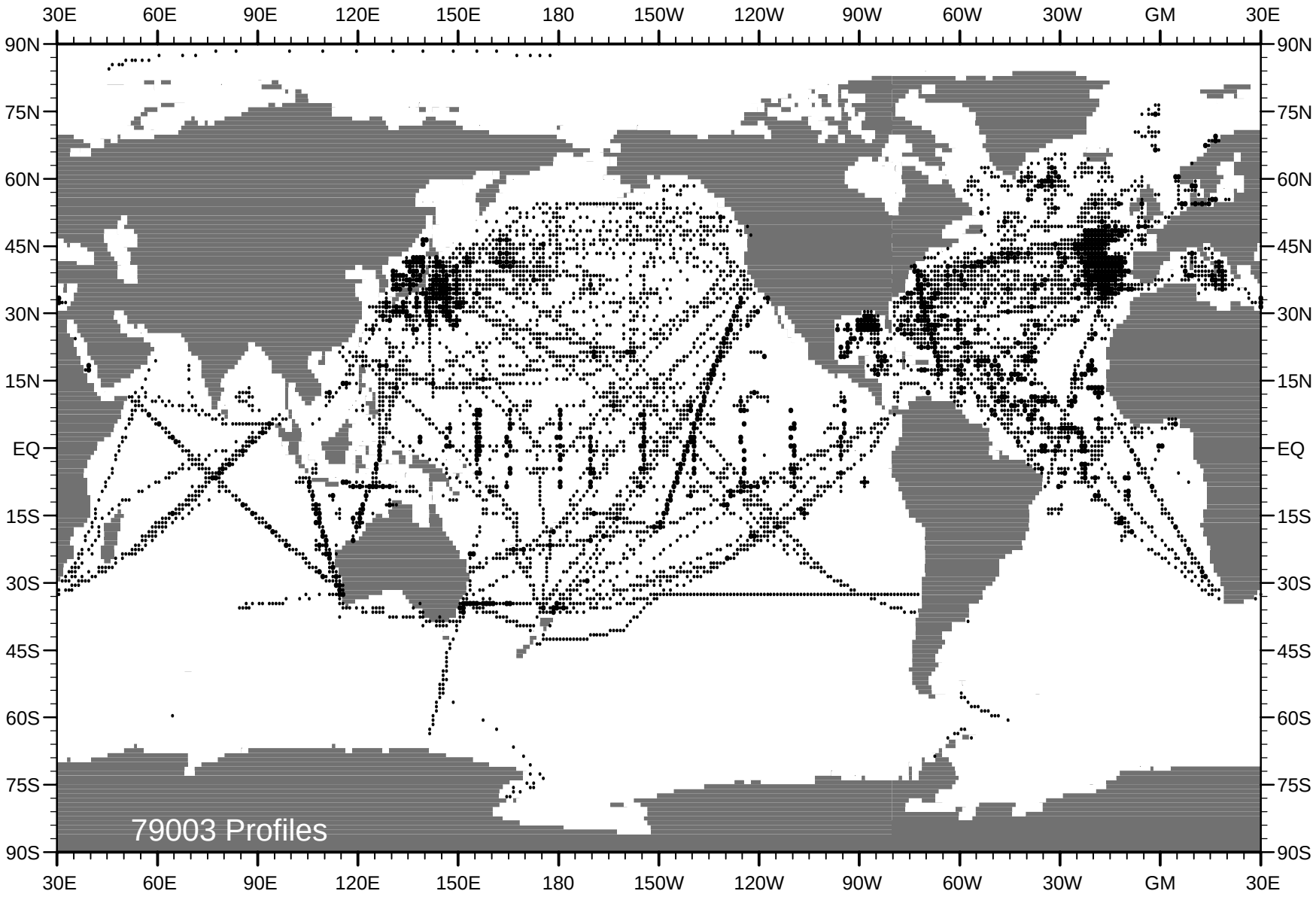


Fig. A61 Distribution of all data profiles (OSD+MBT+XBT+CTD+MRB+UOR+PFL+APB+DRB) in WOD01 for year 2001 .