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COMPILATION OF ATMOSPHERIC GAS CONCENTRATION PROFILES FROM 0 TO 50 KM

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INTRODUCTION

The compilation of atmospheric gas concentration profiles described in this report was created at NASA Langley Research Center as a convenient on-line reference data set for line-by-line simulations of atmospheric infrared absorption and emission signals. Profiles from this compilation are also useful as "initial guesses" in iterative procedures for retrieval of gas concentrations from measured atmospheric infrared data. Since a number of researchers in the field of atmospheric remote sensing have informally requested copies of this compilation, the author has decided to release these data in the form of a Technical Memorandum.

In this report, a brief description of the data will be followed by a listing of the data set as it appears on the NASA Langley computer system, and a list of references. The final section of this report contains plots of each of the 52 gas concentration profiles included in the compilation. The author acknowledges the assistance of Ms. Pamela L. Rarig, of the Systems and Applied Sciences Corporation, who developed the plotting program used to produce the figures in this report.

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DESCRIPTION OF THE DATA

The first 28 gases on the compilation are those for which spectroscopic data are given on the AFGL (Rothman, 1981; Rothman et al., 1981) and GEISA (Chedin et al., 1980, 1981) atmospheric absorption line parameter compilations. Concentration profiles for these gases are listed in order according to their AFGL integer gas codes. Since this gas profile compilation has been developed primarily as a data base for simulation of atmospheric absorption or emission, profiles are included for all the major infrared-active species (H_2O, CO_2, O_3, N_2O, CO, CH_4, O_2), even though some of these profiles may not be of great interest for photochemical studies. The fundamental collision-induced bands of both N_2 and O_2 appear quite strong in tropospheric and lower-stratospheric spectra (Rinsland et al., 1981, 1982), and the atmospheric N_2 profile has also been included in this compilation. PH_3 is not known to exist in the unpolluted terrestrial atmosphere, but its line parameters are included in the GEISA tape and are used in analysis of atmospheric spectra of the outer planets. In this compilation, the terrestrial PH_3 volume mixing ratio has been set to a negligible value (1.0×10^{-20}).

The last 24 gases in this compilation are species which have either been measured in the stratosphere or are considered to be important sources, sinks or intermediate reservoirs for photochemically active species in the stratosphere (Hudson and Reed, 1979; Hudson et al., 1981). All of these gases have molecular spectra in the infrared, but detailed listings of their absorption line parameters are not yet available. However, the concentration profiles listed here may be used in conjunction with laboratory spectra such as those compiled by Murcray and Goldman

(1981) to estimate the magnitude of atmospheric absorption by these species at various altitudes. These concentration profiles are loosely grouped according to category, ie., hydrocarbons, halocarbons, odd-hydrogen species, odd-nitrogen species, and sulfur-containing molecules.

The data file is written in the form of 80-character card images. For each species there is a header card containing the gas name left-justified in the first 15 columns, and columns 16 through 80 contain a description of the major references for the gas concentration profile. This header card is followed by one to six cards containing the atmospheric volume mixing ratios at 2-km intervals, beginning at 50 km and ending at the ground (0 km).

The gas concentration profiles in this data set have been based on both atmospheric measurements and the results of photochemical models, compiled from an extensive literature search by the author. The majority of references for these profiles are included in the Hudson et al. (1981) report, and a few more recent results are added here. Although for a number of species many measurements and model studies have been reported in the literature, the references on the header cards are limited to the more recent results and to review articles. Unless otherwise stated on the header card, the set of volume mixing ratios for each species represents the "typical" diurnally averaged, seasonally averaged Northern Hemisphere midlatitude gas concentration profile. When both model results and atmospheric measurements were available, the measurements have been weighted more heavily in the determination of the average concentration profile. In some cases where neither measurements nor model results were available over the entire 0-50 km altitude range (e.g. NH_3, HI, HCN, C_2H_4,

$CHCl_2F$, HNO_2, HO_2NO_2 and H_2S), the author has extrapolated the concentration profiles based on available information such as spectroscopic upper limits, expected ground-level concentrations or estimated tropospheric lifetimes.

The average gas concentration profiles presented here, while useful for "ball-park" estimates of atmospheric absorption or emission or for initialization of retrieval algorithms, may be quite different from concentration profiles actually measured at specific times and locations on the Earth, particularly in the case of diurnally varying species. The reader interested in simulation of atmospheric absorption or emission for a specific case, for example, a sunset spectrum taken in mid-winter at high latitude, should consult the individual references given here and in the Hudson et al. (1981) report to obtain more detailed gas concentration profiles.

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H2O                ELLSAESSER ET AL.(1980) AND 1976 U.S. STANDARD ATM.
     5.0E-06,     4.8E-06,     4.6E-06,     4.5E-06,     4.5E-06,
     4.5E-06,     4.4E-06,     4.4E-06,     4.3E-06,     4.2E-06,
     4.1E-06,     3.9E-06,     3.7E-06,     3.5E-06,     3.5E-06,
     3.5E-06,     3.4E-06,     3.2E-06,     2.9E-06,     6.0E-06,
     2.0E-05,     6.5E-04,     1.5E-03,     3.8E-03,     9.7E-03,
     1.0E-02
CO2                1976 U.S. STANDARD ATM.
   26*3.14E-04
O3                 1976 U.S. STANDARD ATM.
     3.1E-06,     3.8E-06,     4.7E-06,     5.8E-06,     6.4E-06,
     7.3E-06,     7.8E-06,     8.1E-06,     7.7E-06,     7.2E-06,
     6.6E-06,     6.2E-06,     5.7E-06,     4.7E-06,     3.6E-06,
     2.6E-06,     1.6E-06,     8.5E-07,     5.0E-07,     3.1E-07,
     1.3E-07,     6.0E-08,     4.1E-08,     3.4E-08,   2*3.3E-08
N2O                GOLDAN ET AL(1980,81), FABIAN ET AL(1981A), COFFEY ET AL(1981A)
     1.0E-09,     2.0E-09,     4.0E-09,     7.0E-09,     1.0E-08,
     1.6E-08,     2.2E-08,     3.2E-08,     5.0E-08,     7.0E-08,
     9.0E-08,     1.1E-07,     1.3E-07,     1.6E-07,     2.0E-07,
     2.4E-07,     2.7E-07,     2.9E-07,     3.0E-07,     3.1E-07,
   6*3.2E-07
CO                 FABIAN ET AL.(1981A), EHHALT AND TONNISSEN(1980)
   5*3.0E-08,
     3.0E-08,     3.0E-08,     2.7E-08,     2.4E-08,     2.2E-08,
     2.0E-08,     1.9E-08,     1.8E-08,     1.7E-08,     1.6E-08,
     1.5E-08,     2.0E-08,     3.0E-08,     5.0E-08,     8.0E-08,
     1.0E-07,     1.2E-07,     1.3E-07,     1.3E-07,     1.4E-07,
     1.5E-07
CH4                FABIAN ET AL.(1981A), EHHALT AND TONNISSEN(1980)
     1.0E-07,     1.5E-07,     2.0E-07,     2.5E-07,     3.2E-07,
     4.0E-07,     4.8E-07,     5.7E-07,     6.6E-07,     7.3E-07,
     8.0E-07,     8.6E-07,     9.3E-07,     1.0E-06,     1.1E-06,
     1.3E-06,     1.4E-06,     1.5E-06,     1.5E-06,     1.6E-06,
     1.6E-06,     1.6E-06,     1.7E-06,     1.7E-06,   2*1.7E-06
O2                 1976 U.S. STANDARD ATM.
   26*2.09E-01
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NO                COFFEY ET AL.(1981A) AND OTHERS
      1.0E-08,     1.0E-08,     1.0E-08,     1.0E-08,     1.1E-08,
      1.2E-08,     1.0E-08,     9.0E-09,     7.0E-09,     4.0E-09,
      2.5E-09,     1.5E-09,     8.0E-10,     4.0E-10,     3.0E-10,
      2.5E-10,     2.3E-10,     2.7E-10,     3.0E-10,     3.0E-10,
   6*3.0E-10
SO2               TURCO ET AL.(1981B), INN ET AL.(1981) AND OTHERS
      3.5E-11,     3.1E-11,     2.3E-11,     1.8E-11,     1.5E-11,
      1.3E-11,     1.2E-11,     1.1E-11,     1.1E-11,     1.2E-11,
      1.3E-11,     1.5E-11,     1.7E-11,     1.9E-11,     2.2E-11,
      3.1E-11,     5.0E-11,     6.0E-11,     5.6E-11,     5.5E-11,
      6.0E-11,     7.0E-11,     9.5E-11,     1.4E-10,     2.5E-10,
      3.0E-10
NO2               ROSCOE ET AL.(1981), COFFEY ET AL.(1981A) AND OTHERS
      1.0E-09,     1.5E-09,     2.0E-09,     2.5E-09,     3.0E-09,
      3.5E-09,     4.5E-09,     5.0E-09,     5.5E-09,     7.0E-09,
      7.5E-09,     4.5E-09,     3.1E-09,     2.2E-09,     1.2E-09,
      9.0E-10,     4.0E-10,     3.5E-10,     3.3E-10,     3.0E-10,
   6*3.0E-10
NH3               HOELL ET AL.(1980) U.S.A. EAST COAST MEAS.
  15*1.0E-13,
      1.0E-12,     1.0E-11,     1.0E-10,     3.0E-10,     4.0E-10,
      5.5E-10,     7.0E-10,     8.5E-10,     1.0E-09,     1.2E-09,
      1.3E-09
HNO3              COFFEY ET AL.(1981A) AND OTHERS
      5.0E-12,     1.0E-11,     2.0E-11,     4.0E-11,     7.0E-11,
      1.0E-10,     2.0E-10,     3.5E-10,     6.0E-10,     1.0E-09,
      2.0E-09,     3.0E-09,     3.5E-09,     4.0E-09,     3.0E-09,
      2.0E-09,     1.1E-09,     3.0E-10,     2.0E-10,     1.0E-10,
      9.0E-11,     8.0E-11,     7.0E-11,     5.0E-11,     4.0E-11,
      3.0E-11
OH                YUNG ET AL.(1980), TURCO ET AL.(1981B), ANDERSON(1971,1976)
      8.0E-10,     7.0E-10,     6.0E-10,     5.0E-10,     4.0E-10,
      3.1E-10,     2.2E-10,     1.3E-10,     5.8E-11,     2.8E-11,
      1.0E-11,     6.1E-12,     2.9E-12,     1.0E-12,     5.2E-13,
      1.9E-13,     1.3E-13,     8.1E-14,     5.3E-14,     4.9E-14,
      4.7E-14,    5*4.4E-14
HF                CRUTZEN ET AL.(1978), SZE(1978) MODELS + ALL MEAS. THRU 1981
      4.5E-10,     4.4E-10,     4.3E-10,     4.2E-10,     4.1E-10,
      4.0E-10,     3.8E-10,     3.6E-10,     3.4E-10,     3.2E-10,
      3.0E-10,     2.5E-10,     2.0E-10,     1.5E-10,     1.0E-10,
      6.0E-11,     2.5E-11,     1.0E-11,     4.5E-12,     2.0E-12,
      6.0E-13,     2.3E-13,     9.0E-14,     3.0E-14,   2*1.0E-14
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HCL            CRUTZEN ET AL.(1978), MILLER ET AL.(1980) + ALL MEAS. THRU 1981
     1.3E-09,     1.3E-09,     1.3E-09,     1.3E-09,     1.4E-09,
     1.5E-09,     1.7E-09,     1.8E-09,     1.6E-09,     1.2E-09,
     1.0E-09,     7.0E-10,     6.5E-10,     6.0E-10,     5.5E-10,
     5.0E-10,     4.0E-10,     2.5E-10,     1.0E-11,     3.0E-11,
     2.4E-11,     2.2E-11,     2.6E-11,     3.3E-11,     6.5E-11,
     1.0E-10
HBR            YUNG ET AL.(1980)
     7.4E-12,     7.4E-12,     7.3E-12,     7.0E-12,     6.4E-12,
     5.1E-12,     3.9E-12,     3.1E-12,     2.4E-12,     2.1E-12,
     1.8E-12,     1.7E-12,     1.7E-12,     1.7E-12,     1.7E-12,
  11*1.7E-12
HI             CICERONE (1981)
  26*3.0E-12
CLO            PARRISH ET AL.(1981), ANDERSON (1980), WATERS ET AL.(1981)
     1.0E-10,     1.3E-10,     1.7E-10,     3.0E-10,     6.0E-10,
     7.2E-10,     7.0E-10,     6.0E-10,     5.0E-10,     4.0E-10,
     2.0E-10,     1.0E-10,     5.0E-11,     2.0E-11,     1.0E-11,
     6.0E-12,     2.5E-12,     1.3E-12,     7.0E-13,     4.0E-13,
     2.0E-13,     1.5E-13,     1.2E-13,   3*1.0E-13
OCS            TURCO ET AL.(1981B), INN ET AL.(1979,1981) AND OTHERS
     1.0E-14,     1.0E-14,     2.5E-14,     8.0E-14,     2.0E-13,
     5.0E-13,     1.0E-12,     2.5E-12,     6.0E-12,     1.7E-11,
     3.0E-11,     7.0E-11,     1.1E-10,     1.4E-10,     1.9E-10,
     2.4E-10,     3.1E-10,     3.9E-10,     4.7E-10,     5.0E-10,
     5.2E-10,     5.3E-10,     5.5E-10,     5.6E-10,     5.8E-10,
     6.0E-10
H2CO           BARBE ET AL.(1979), EHHALT AND TONNISSEN (1980)
     4.0E-11,     5.1E-11,     6.5E-11,     8.0E-11,     9.5E-11,
     1.1E-10,     1.2E-10,     1.2E-10,     1.1E-10,     1.0E-10,
     9.0E-11,     8.0E-11,     6.0E-11,     5.0E-11,     4.0E-11,
     3.3E-11,     3.4E-11,     3.6E-11,     3.7E-11,     3.3E-11,
     3.4E-11,     5.0E-11,     7.0E-11,     1.3E-10,     3.0E-10,
     2.4E-09
HOCL           BOUGHNER AND NEALY (1979) MODEL
     3.2E-11,     4.4E-11,     7.7E-11,     1.4E-10,     1.9E-10,
     2.8E-10,     3.2E-10,     3.5E-10,     3.4E-10,     3.0E-10,
     2.6E-10,     2.1E-10,     1.5E-10,     9.8E-11,     5.8E-11,
     3.0E-11,     1.6E-11,     8.4E-12,     5.1E-12,     5.2E-12,
     4.1E-12,     4.5E-12,     6.2E-12,     1.0E-11,     1.4E-11,
     7.7E-12
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N2              1976 U.S. STANDARD ATM.
  26*7.81E-01
HCN             COFFEY ET AL.(1981B), M.SMITH, PRIVATE, 1982
  20*1.7E-10,
     1.5E-10,     1.0E-10,     3.0E-11,     1.0E-11,     3.0E-12,
     1.0E-12
CH3CL           RASMUSSEN ET AL.(1980), LEIFER ET AL.(1981)
     1.0E-14,     3.0E-14,     1.0E-13,     2.0E-13,     5.0E-13,
     1.0E-12,     2.0E-12,     5.0E-12,     1.0E-11,     2.0E-11,
     5.0E-11,     1.0E-10,     2.0E-10,     2.6E-10,     3.2E-10,
     3.7E-10,     4.2E-10,     4.8E-10,     5.3E-10,     5.7E-10,
     5.9E-10,     6.0E-10,     6.0E-10,     6.0E-10,     6.4E-10,
     7.0E-10
H2O2            YUNG ET AL.(1980), BOUGHNER AND NEALY(1979), WATERS ET AL.(1981)
     2.5E-10,     2.8E-10,     3.2E-10,     3.4E-10,     3.6E-10,
     4.0E-10,     5.3E-10,     7.5E-10,     1.0E-09,     1.2E-09,
     1.1E-09,     8.5E-10,     6.0E-10,     4.1E-10,     2.6E-10,
     1.8E-10,     1.4E-10,     1.7E-10,     1.8E-10,     1.9E-10,
   6*2.0E-10
C2H2            GOLDMAN ET AL(1981A), CRONN+ROBINSON(1979), RUDOLPH+EHHALT(1981)
  10*1.0E-14,
     1.0E-14,     1.0E-14,     2.0E-14,     5.0E-14,     1.0E-13,
     3.0E-13,     8.0E-13,     2.5E-12,     7.0E-12,     2.0E-11,
     2.3E-11,     2.5E-11,     3.0E-11,     5.0E-11,     8.0E-11,
     3.0E-10
C2H6            CRONN AND ROBINSON(1979), RUDOLPH ET AL.(1981)
   5*1.0E-13,
     1.0E-13,     1.0E-13,     2.0E-13,     5.0E-13,     1.0E-12,
     2.0E-12,     5.0E-12,     1.0E-11,     2.0E-11,     3.3E-11,
     6.0E-11,     1.0E-10,     2.0E-10,     5.0E-10,     1.0E-09,
     1.7E-09,     1.8E-09,     1.9E-09,     2.0E-09,     2.0E-09,
     2.0E-09
PH3             NO REFS
  26*1.0E-20
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C3H8          RUDOLPH ET AL.(1981)
 10*1.0E-14,
    1.0E-14,     3.0E-14,     1.0E-13,     3.0E-13,     1.0E-12,
    4.0E-12,     1.1E-11,     2.0E-11,     3.7E-11,     1.0E-10,
    1.8E-10,     2.0E-10,     2.2E-10,     2.5E-10,     3.0E-10,
    4.0E-10
C2H4          RASMUSSEN ET AL.(1981) GROUND-LEVEL MEAS. ONLY
 10*1.0E-14,
    1.0E-14,     1.0E-14,     3.0E-14,     1.0E-13,     3.0E-13,
    1.0E-12,     3.0E-12,     1.0E-11,     2.0E-11,     5.0E-11,
    1.0E-10,     1.1E-10,     1.3E-10,     1.5E-10,     1.7E-10,
    2.0E-10
CFCL3         GOLDAN ET AL.(1980), FABIAN ET AL.(1981A,B)
  5*1.0E-14,
    1.0E-14,     1.0E-14,     1.0E-14,     2.0E-14,     7.0E-14,
    2.0E-13,     7.0E-13,     2.0E-12,     6.0E-12,     1.7E-11,
    4.0E-11,     5.6E-11,     7.8E-11,     1.1E-10,     1.4E-10,
  6*1.5E-10
CF2CL2        GOLDAN ET AL.(1980), FABIAN ET AL.(1981A,B)
    1.0E-13,     1.7E-13,     2.5E-13,     4.0E-13,     7.0E-13,
    1.2E-12,     2.5E-12,     4.7E-12,     8.5E-12,     1.7E-11,
    2.8E-11,     3.8E-11,     5.2E-11,     7.4E-11,     9.6E-11,
    1.3E-10,     1.7E-10,     2.2E-10,     2.4E-10,     2.6E-10,
    2.8E-10,     2.9E-10,     2.9E-10,   3*3.0E-10
CF3CL         FABIAN ET AL.(1981B), PENKETT ET AL.(1981)
    1.3E-12,     1.4E-12,     1.5E-12,     1.6E-12,     1.7E-12,
    1.8E-12,     1.9E-12,     2.0E-12,     2.1E-12,     2.1E-12,
    2.2E-12,     2.5E-12,     2.8E-12,     3.0E-12,     3.1E-12,
    3.3E-12,     3.6E-12,     3.9E-12,     4.2E-12,     5.0E-12,
  6*5.0E-12
CHCLF2        RASMUSSEN ET AL.(1981),GOLDMAN ET AL.(1981A),LEIFER ET AL.(1981)
  5*1.0E-15,
    1.0E-15,     1.0E-15,     3.0E-15,     1.0E-14,     3.0E-14,
    1.0E-13,     3.0E-13,     1.0E-12,     3.0E-12,     1.0E-11,
    3.0E-11,     4.5E-11,     5.0E-11,     5.3E-11,     5.4E-11,
  6*5.5E-11
CHCL2F        PENKETT ET AL.(1980) GROUND-LEVEL MEAS. ONLY
 10*1.0E-16,
    3.0E-16,     1.0E-15,     3.0E-15,     1.0E-14,     2.0E-14,
    5.0E-14,     1.0E-13,     2.0E-13,     4.0E-13,     7.0E-13,
    1.0E-12,     1.1E-12,     1.2E-12,     1.3E-12,     1.4E-12,
    1.6E-12
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CCL4          CRUTZEN ET AL.(1978), WILLIAMS ET AL.(1976), LEIFER ET AL.(1981)
      1.0E-14,     1.0E-14,     1.0E-14,     2.0E-14,     5.0E-14,
      1.0E-13,     2.0E-13,     5.0E-13,     1.0E-12,     2.3E-12,
      4.5E-12,     8.0E-12,     1.2E-11,     2.0E-11,     4.0E-11,
      8.0E-11,     9.0E-11,     1.1E-10,     1.3E-10,     1.4E-10,
    6*1.4E-10
CF4           FABIAN ET AL.(1981B), PENKETT ET AL.(1981), GOLDMAN ET AL.(1979)
      6.0E-11,     6.1E-11,     6.1E-11,     6.1E-11,     6.2E-11,
      6.2E-11,     6.3E-11,     6.3E-11,     6.4E-11,     6.4E-11,
      6.5E-11,     6.6E-11,     6.7E-11,     6.8E-11,     6.9E-11,
   11*7.0E-11
CF3BR         FABIAN ET AL.(1981B), PENKETT ET AL.(1981)
   10*1.0E-16,
      3.0E-15,     1.0E-14,     6.0E-14,     1.3E-13,     2.2E-13,
      4.0E-13,     5.0E-13,     6.0E-13,     7.0E-13,     8.0E-13,
    6*9.0E-13
CH3CCL3       LEIFER ET AL.(1981), CRUTZEN ET AL.(1978)
    5*1.0E-14,
      4.0E-14,     1.0E-13,     2.5E-13,     6.0E-13,     1.0E-12,
      2.3E-12,     4.0E-12,     7.0E-12,     1.2E-11,     2.0E-11,
      3.3E-11,     6.0E-11,     1.0E-10,     1.2E-10,     1.3E-10,
    6*1.4E-10
C2F3CL3       FABIAN ET AL.(1981B), SINGH ET AL.(1979)
      1.0E-15,     1.0E-15,     1.0E-15,     2.0E-15,     5.0E-15,
      1.0E-14,     2.0E-14,     5.0E-14,     1.0E-13,     2.0E-13,
      5.0E-13,     7.5E-13,     1.0E-12,     2.0E-12,     3.2E-12,
      5.0E-12,     7.0E-12,     9.0E-12,     1.1E-11,     1.3E-11,
      1.5E-11,     1.6E-11,     1.7E-11,     1.8E-11,   2*1.9E-11
C2F4CL2       FABIAN ET AL.(1981B), SINGH ET AL.(1979)
      7.0E-14,     1.1E-13,     1.4E-13,     2.2E-13,     4.0E-13,
      7.0E-13,     1.0E-12,     1.5E-12,     2.3E-12,     3.2E-12,
      4.0E-12,     4.2E-12,     4.5E-12,     4.9E-12,     5.4E-12,
      6.1E-12,     7.0E-12,     7.5E-12,     8.0E-12,     8.5E-12,
      9.0E-12,     9.5E-12,     1.0E-11,     1.0E-11,   2*1.1E-11
C2F5CL        FABIAN ET AL.(1981B), PENKETT ET AL.(1981)
      4.2E-13,     4.5E-13,     4.9E-13,     5.4E-13,     6.1E-13,
      7.0E-13,     8.0E-13,     9.0E-13,     1.0E-12,     1.1E-12,
      1.2E-12,     1.3E-12,     1.4E-12,     1.6E-12,     1.9E-12,
      2.3E-12,     2.6E-12,     3.0E-12,     3.5E-12,     4.0E-12,
    6*4.0E-12
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C2F6          FABIAN ET AL.(1981B), PENKETT ET AL.(1981)
     1.5E-12,     1.6E-12,     1.7E-12,     1.8E-12,     1.9E-12,
     2.0E-12,     2.1E-12,     2.2E-12,     2.4E-12,     2.7E-12,
     3.0E-12,     3.1E-12,     3.2E-12,     3.3E-12,     3.4E-12,
  11*4.0E-12
HO2           YUNG ET AL.(1980), LOGAN ET AL.(1979), ANDERSON ET AL.(1981)
     7.8E-10,     7.2E-10,     6.6E-10,     6.0E-10,     5.4E-10,
     4.8E-10,     4.3E-10,     3.8E-10,     3.3E-10,     3.1E-10,
     1.6E-10,     8.0E-11,     5.0E-11,     2.5E-11,     1.2E-11,
     7.6E-12,     5.1E-12,     4.3E-12,     3.0E-12,     1.8E-12,
     1.2E-12,   5*1.0E-12
HNO2          MURCRAY(1979), PLATT AND PERNER(1980) UPPER LIMITS
  10*1.0E-10,
     1.0E-10,     1.0E-10,     1.0E-10,     9.0E-11,     8.0E-11,
     7.0E-11,     6.5E-11,     6.0E-11,     5.5E-11,     5.0E-11,
     4.5E-11,     4.0E-11,     3.5E-11,     3.0E-11,     2.5E-11,
     2.0E-11
HO2NO2        MURCRAY (1979) UPPER LIMIT AT 26 KM
  26*4.0E-10
NO3           NOXON ET AL.(1978,1980), NAUDET ET AL.(1981) NIGHTIME
   5*4.0E-10,
     4.0E-10,     3.5E-10,     2.7E-10,     1.8E-10,     1.0E-10,
     7.0E-11,     1.2E-11,     8.0E-12,     5.0E-12,     3.0E-12,
     2.0E-12,     1.0E-12,     1.0E-12,     1.5E-12,     2.0E-12,
   6*3.0E-12
N2O5          BOUGHNER AND NEALY(1979), HUDSON ET AL.(1981), KING ET AL.(1976)
     2.2E-14,     7.0E-13,     3.6E-12,     9.6E-11,     3.6E-10,
     6.8E-10,     1.0E-09,     9.4E-10,     8.8E-10,     8.0E-10,
     7.6E-10,     3.8E-10,     1.4E-10,     6.0E-11,     3.0E-11,
     1.2E-11,     5.0E-12,     2.5E-12,     1.2E-12,     7.0E-13,
     4.2E-13,     2.8E-13,     1.9E-13,     1.3E-13,     1.0E-13,
     7.0E-14
CLONO2        HUDSON AND REED (1979), MURCRAY ET AL.(1979)
     1.0E-12,     2.0E-12,     4.0E-12,     7.0E-12,     1.1E-11,
     2.1E-11,     6.5E-11,     1.8E-10,     4.0E-10,     6.0E-10,
     8.0E-10,     8.3E-10,     8.5E-10,     7.5E-10,     4.3E-10,
     2.6E-10,     1.5E-10,     8.0E-11,     5.0E-11,     3.2E-11,
     2.0E-11,     1.7E-11,     1.2E-11,     1.0E-11,     8.0E-12,
     7.0E-12
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CS2	SZE AND KO (1980), TURCO ET AL.(1981B) MODELS + ALL MEAS.				
10*1.0E-15,					
	3.0E-15,	1.0E-14,	3.0E-14,	1.0E-13,	3.0E-13,
	1.0E-12,	3.0E-12,	1.0E-11,	3.0E-11,	3.5E-11,
	4.0E-11,	4.5E-11,	5.0E-11,	5.6E-11,	6.2E-11,
	7.0E-11				
H2S	RODHE AND ISAKSEN(1980), JAESCHKE ET AL.(1980), SZE AND KO(1980)				
10*1.0E-15,					
	1.0E-15,	1.0E-15,	1.0E-15,	3.0E-15,	1.0E-14,
	3.0E-14,	1.0E-13,	3.0E-13,	1.0E-12,	3.0E-12,
	7.0E-12,	1.0E-11,	1.3E-11,	2.0E-11,	3.0E-11,
	1.0E-10				
H2SO4	ARNOLD ET AL.(1981), TURCO ET AL.(1981A)				
	7.0E-12,	1.1E-11,	1.4E-11,	1.9E-11,	2.4E-11,
	3.6E-11,	4.0E-11,	6.0E-11,	3.9E-11,	2.5E-11,
	5.2E-12,	7.7E-13,	1.4E-13,	8.2E-14,	5.2E-14,
	3.8E-14,	2.8E-14,	2.0E-14,	1.5E-14,	1.1E-14,
	8.1E-15,	6.4E-15,	5.1E-15,	4.1E-15,	3.3E-15,
	2.7E-15				

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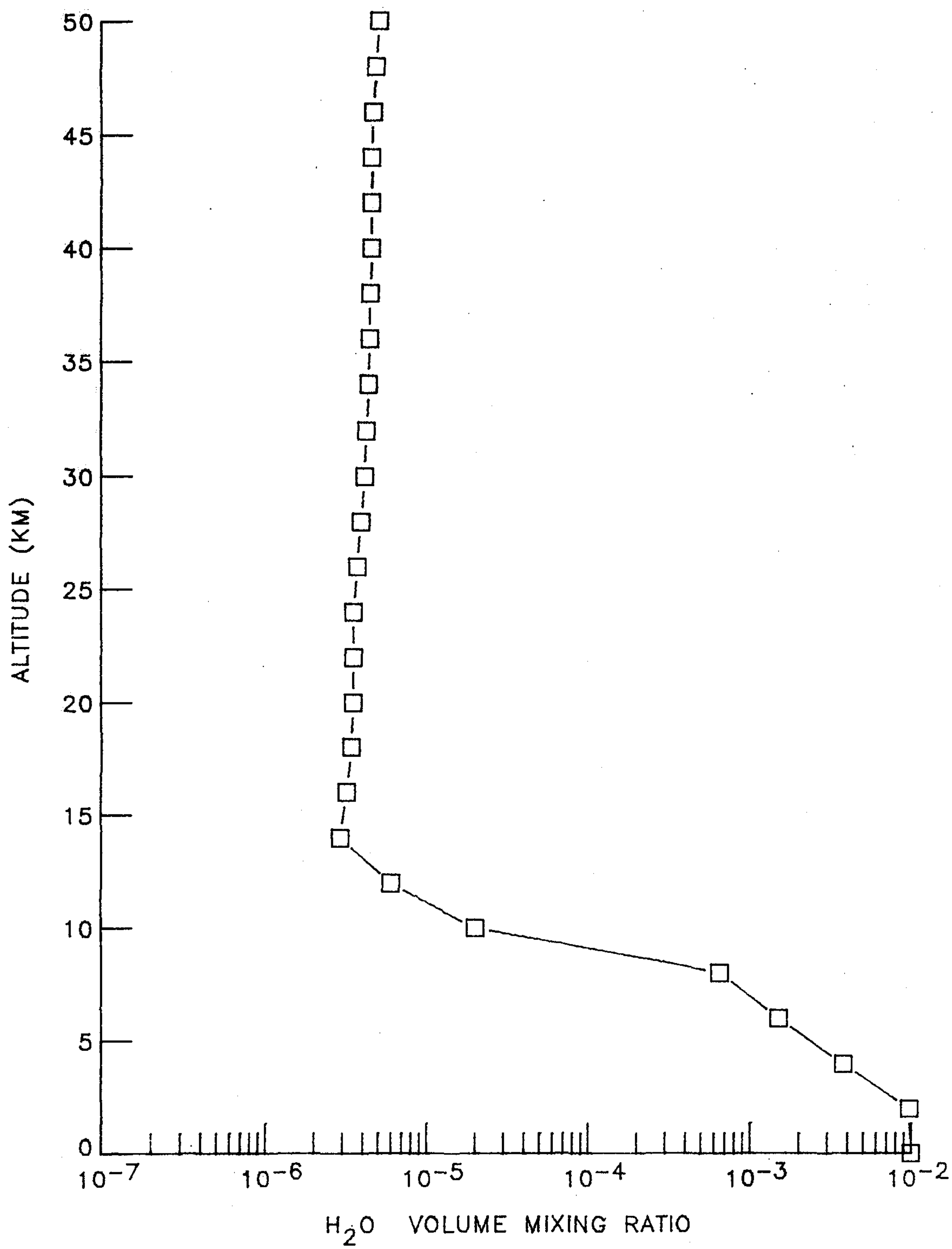

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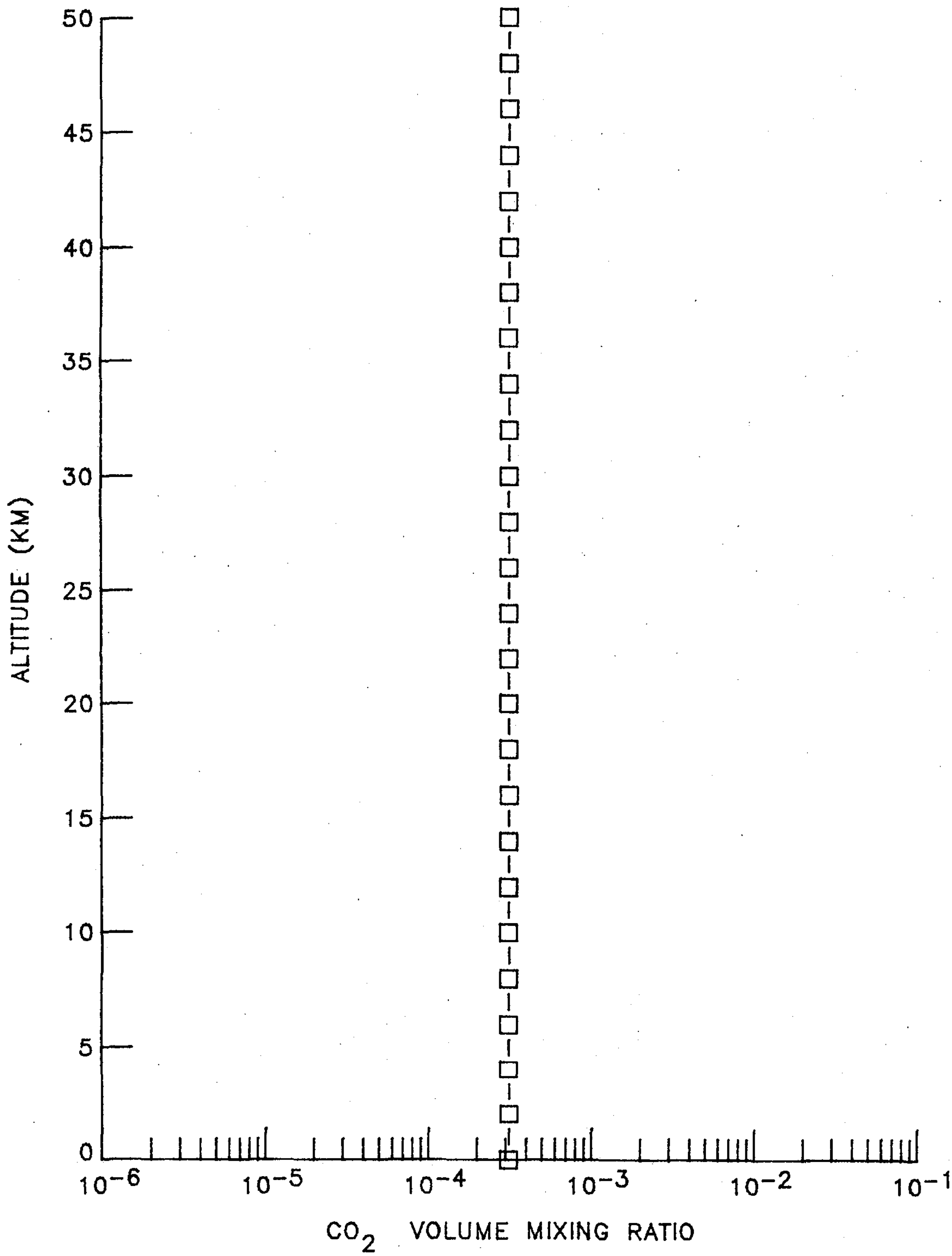
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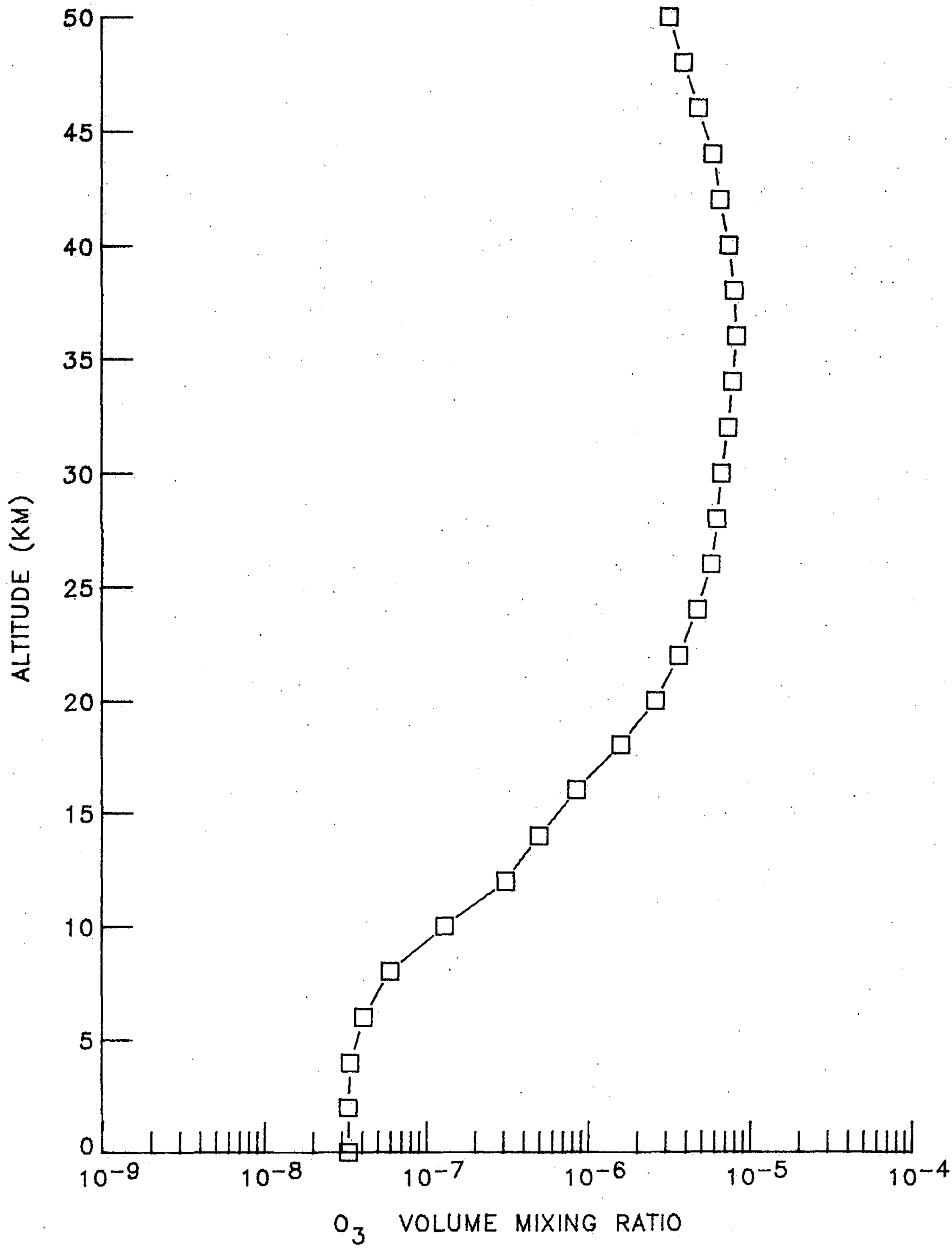
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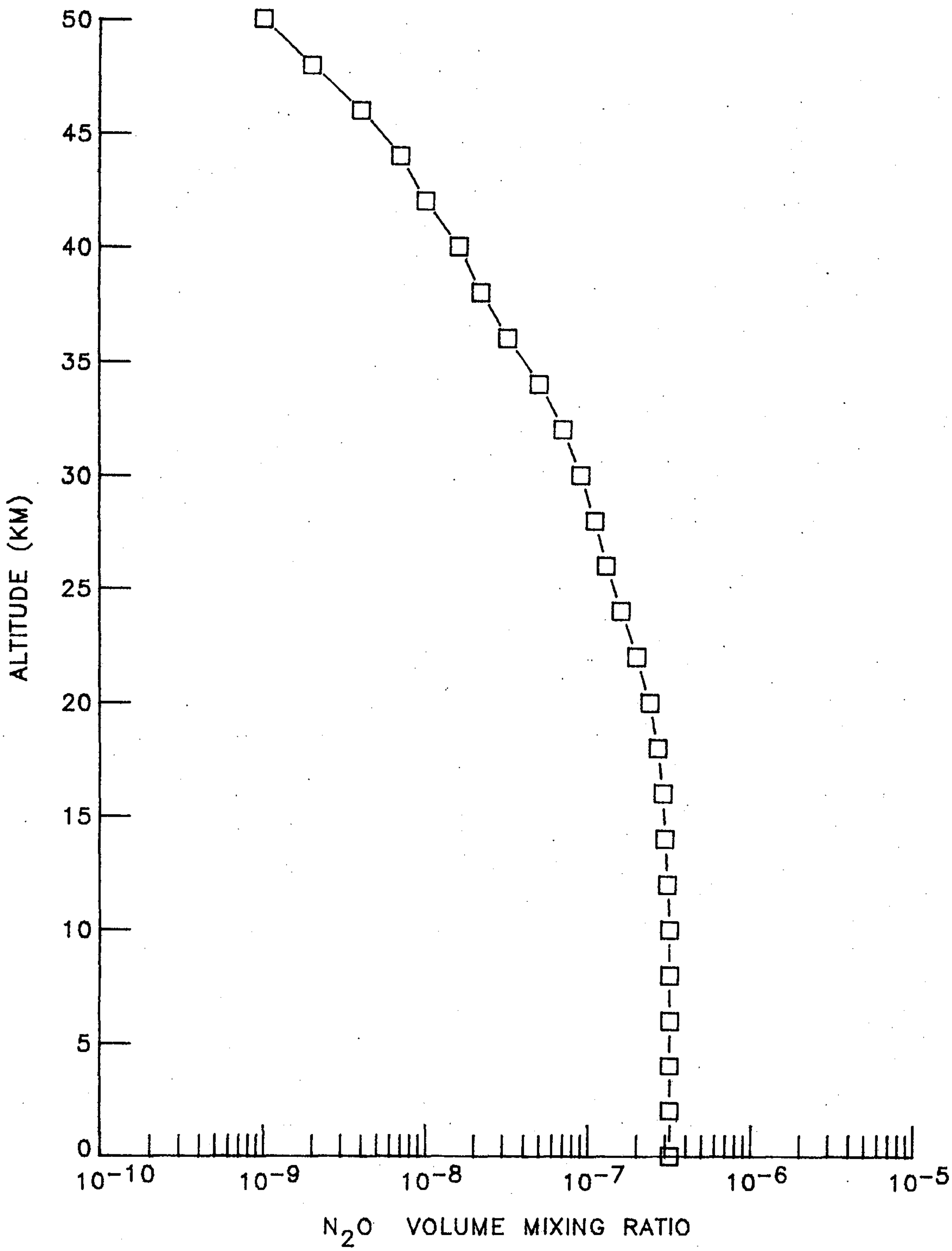

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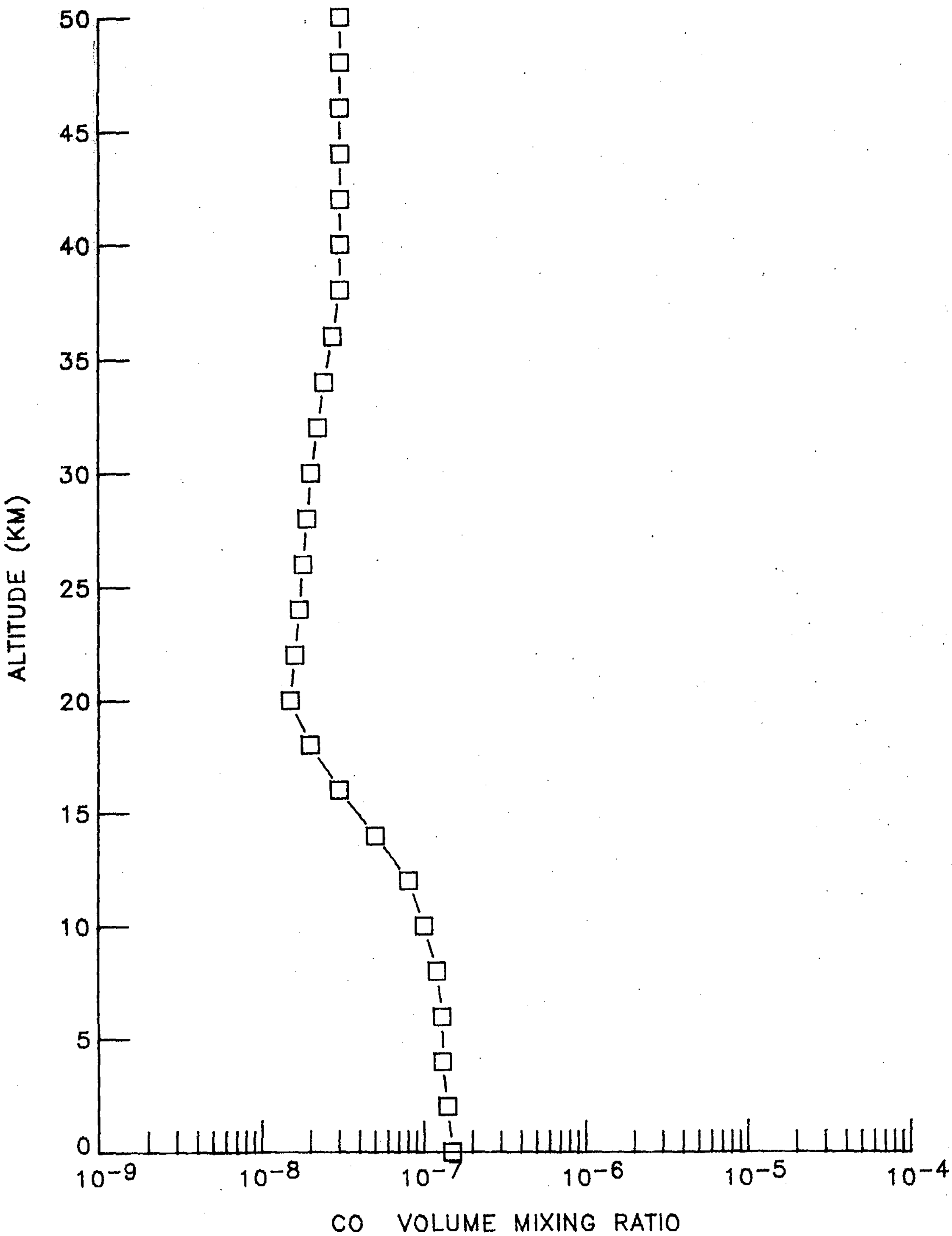
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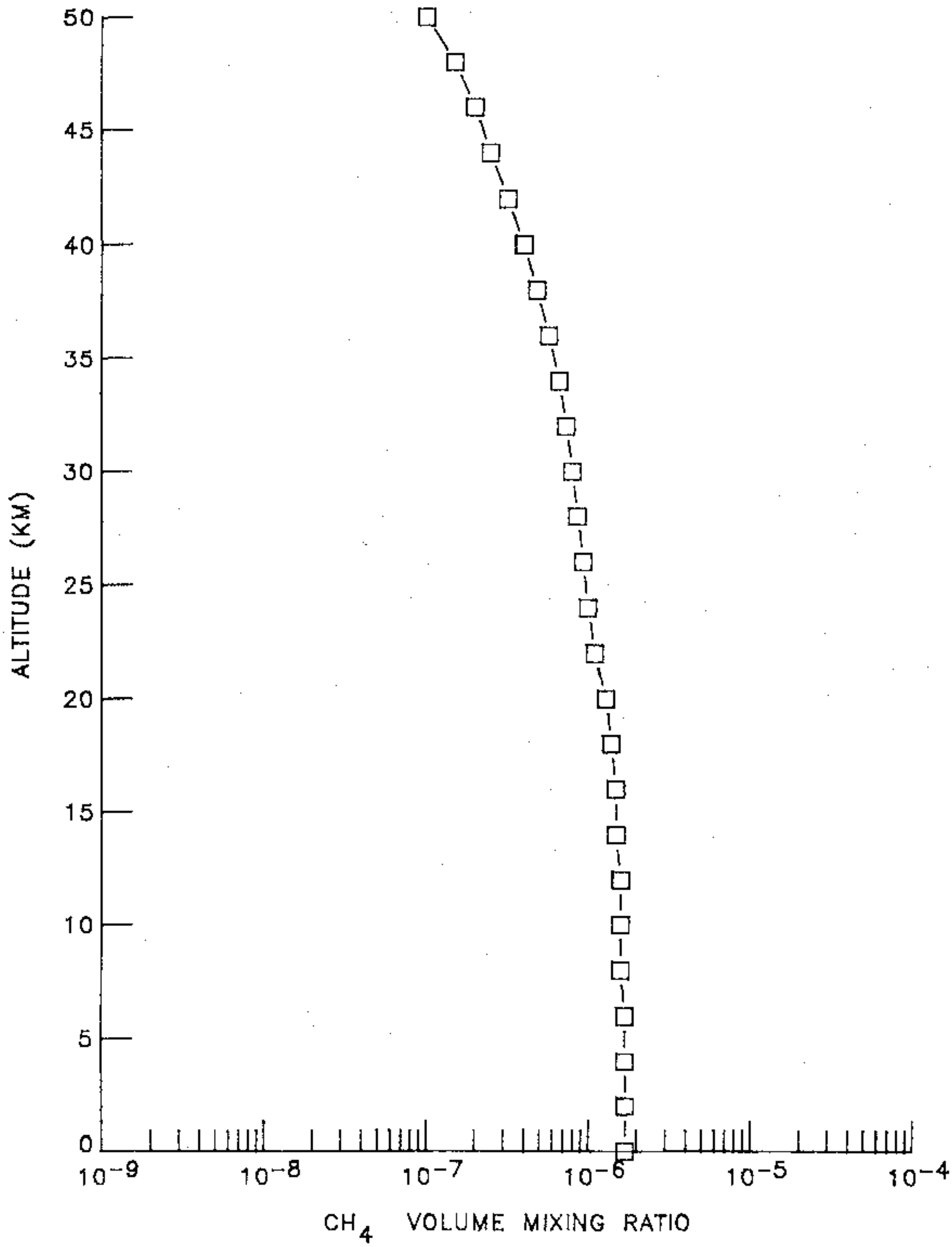

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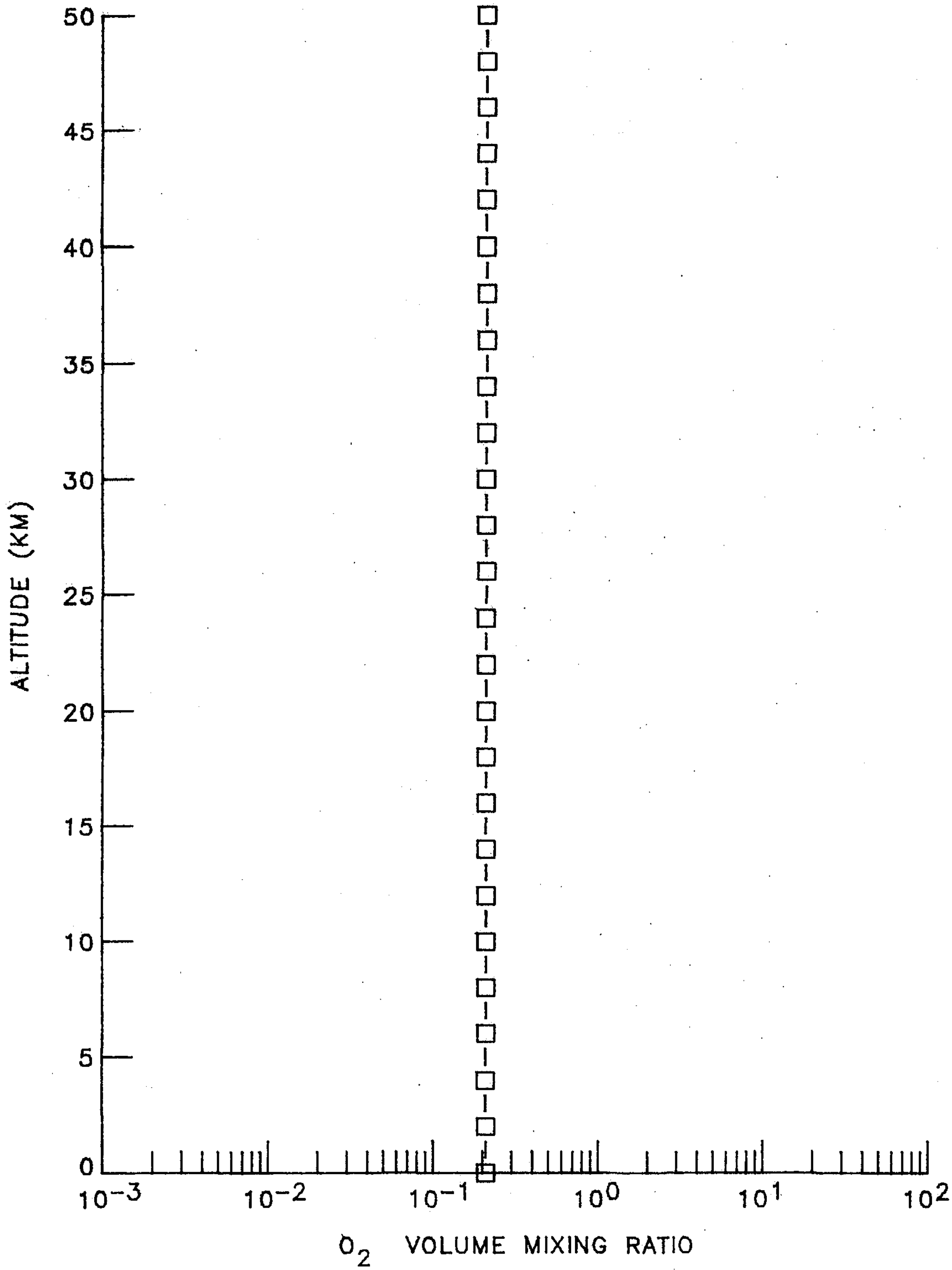
CH_4 VOLUME MIXING RATIO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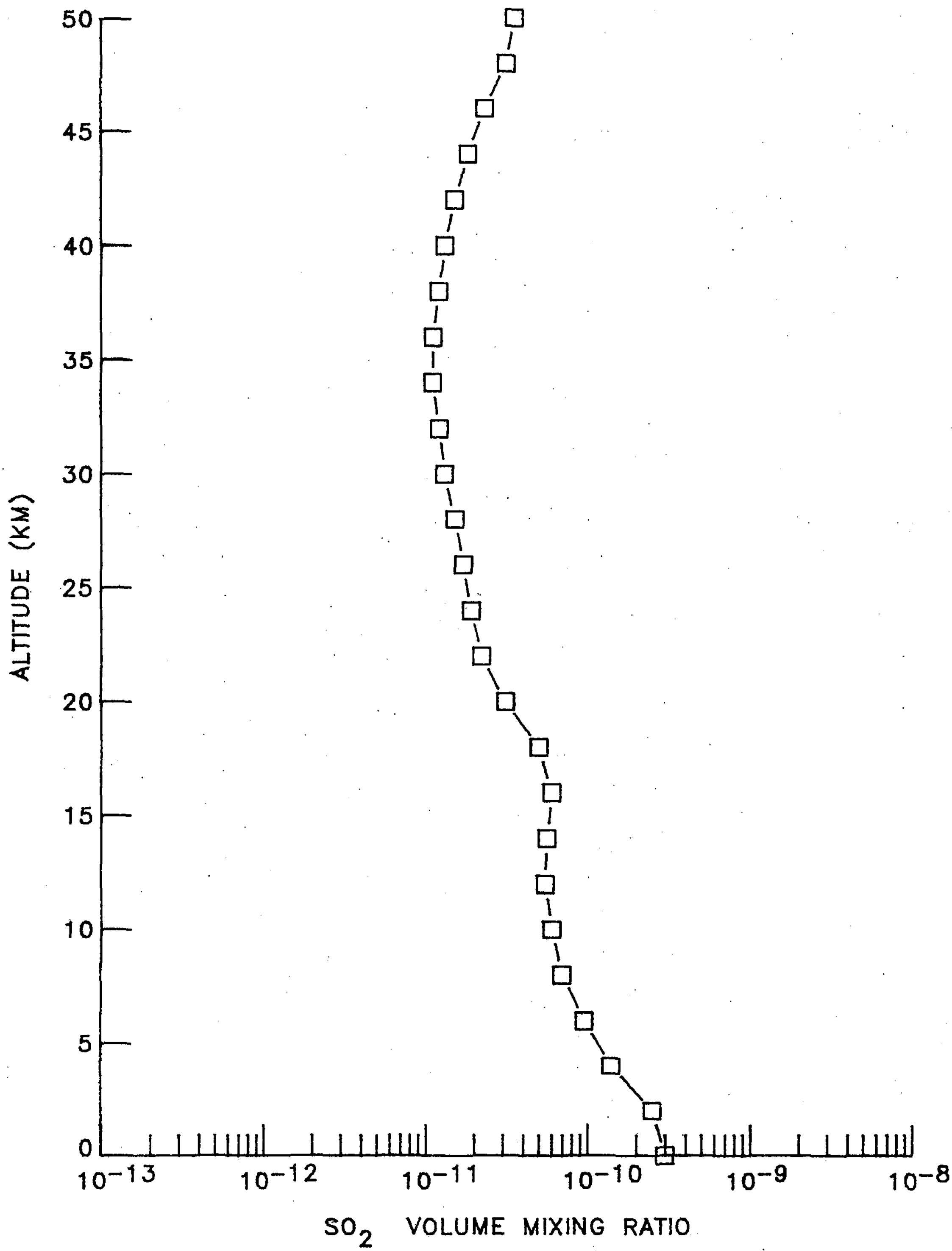
O_2 VOLUME MIXING RATIO



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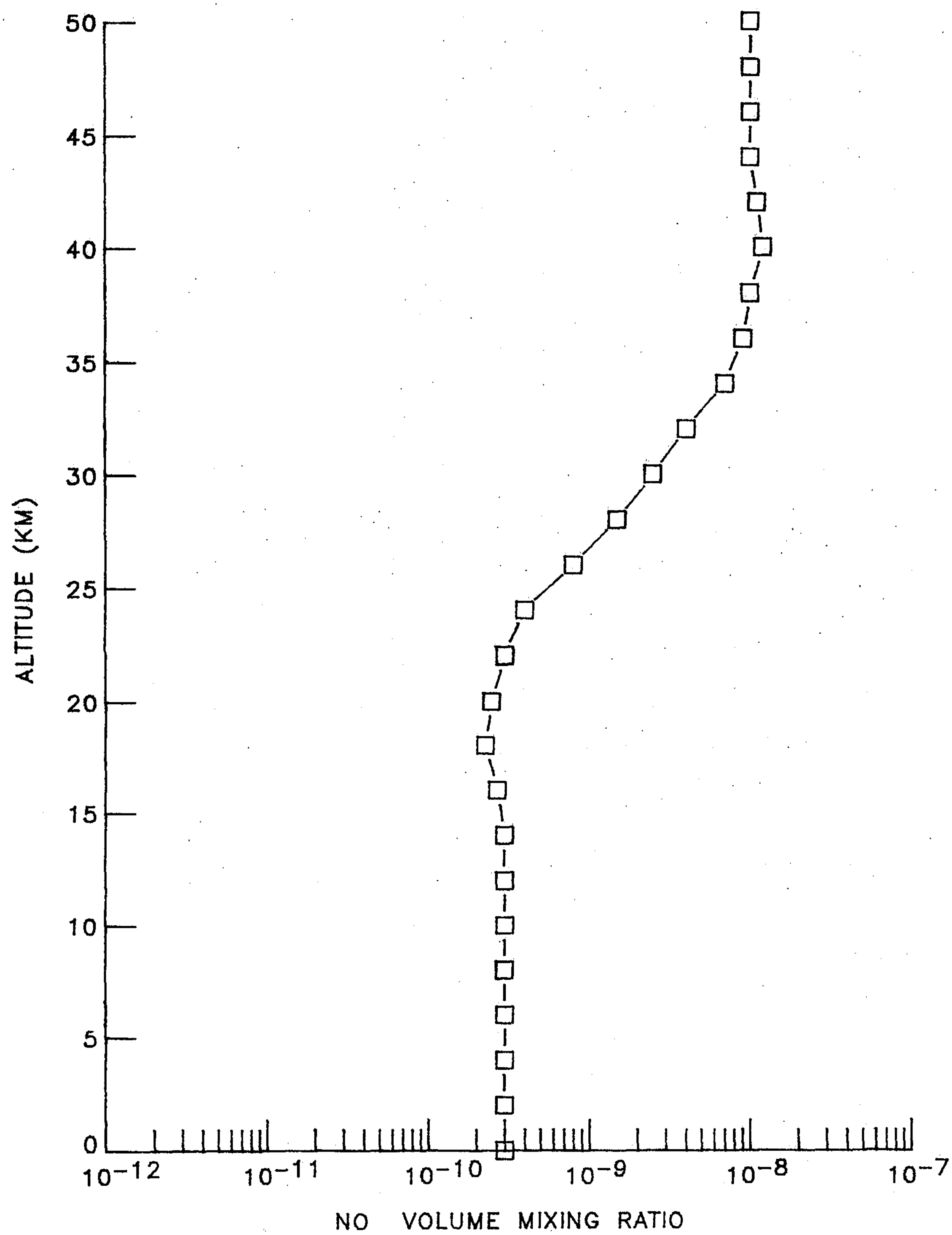
SO_2 VOLUME MIXING RATIO



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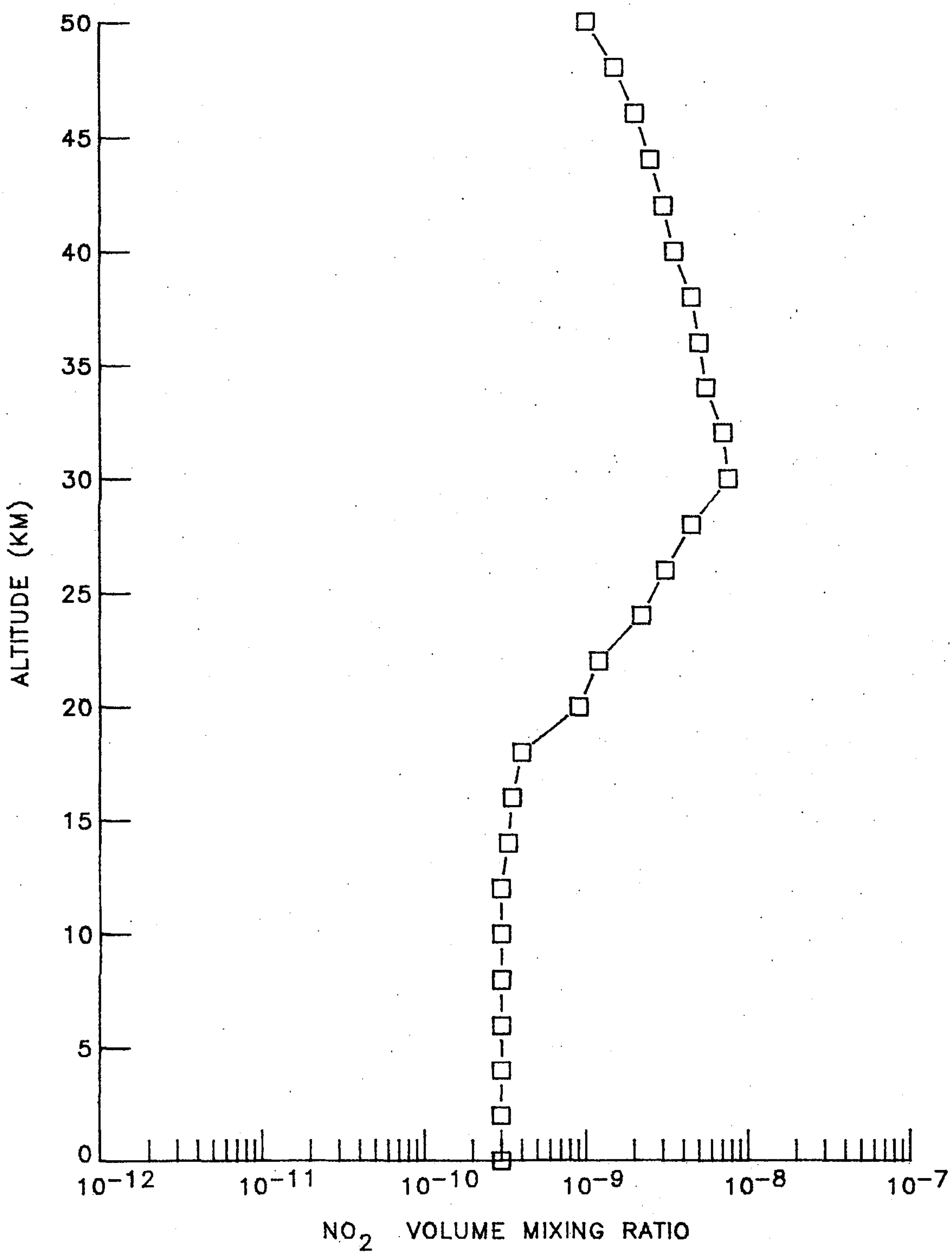
NO VOLUME MIXING RATIO



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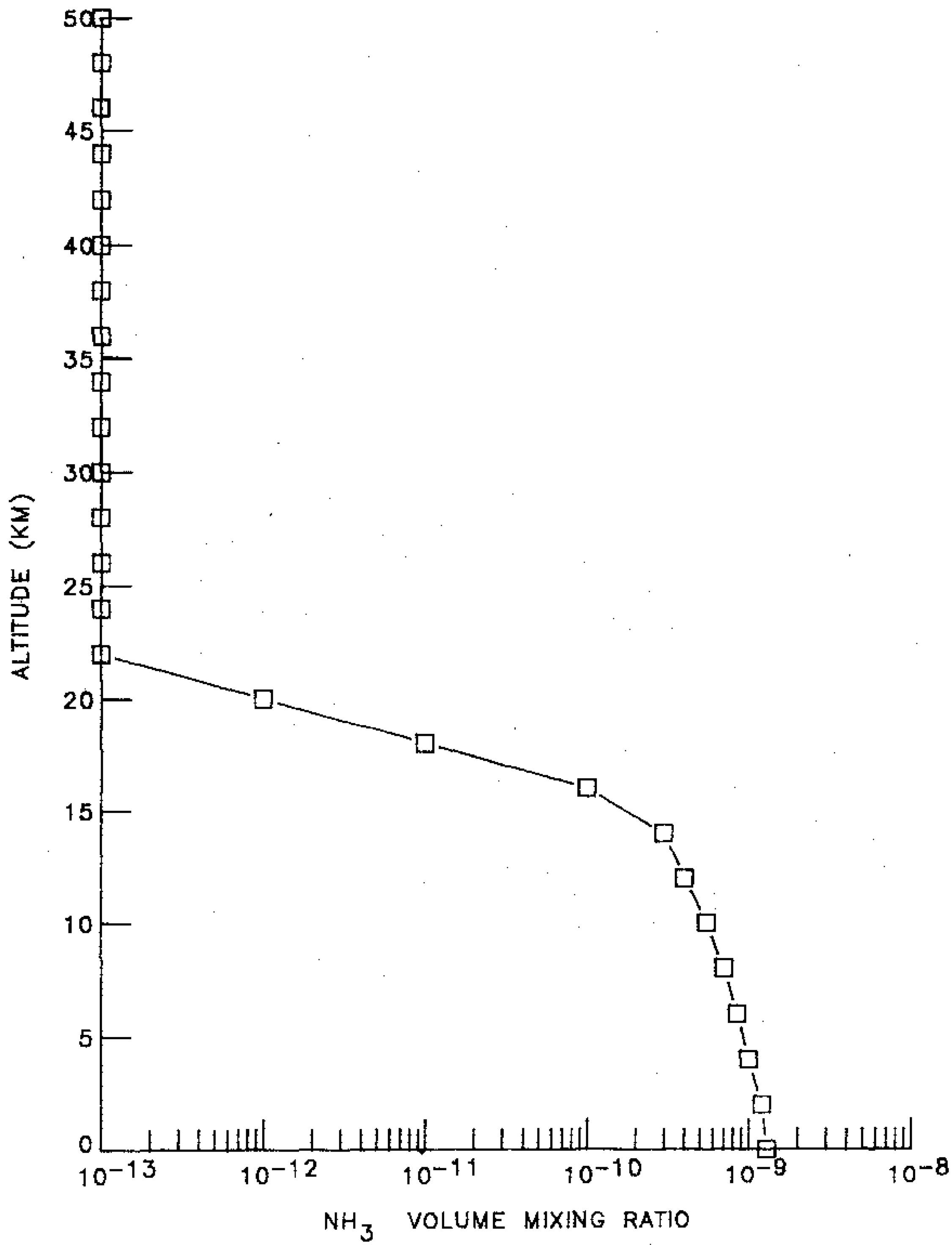
NO_2 VOLUME MIXING RATIO



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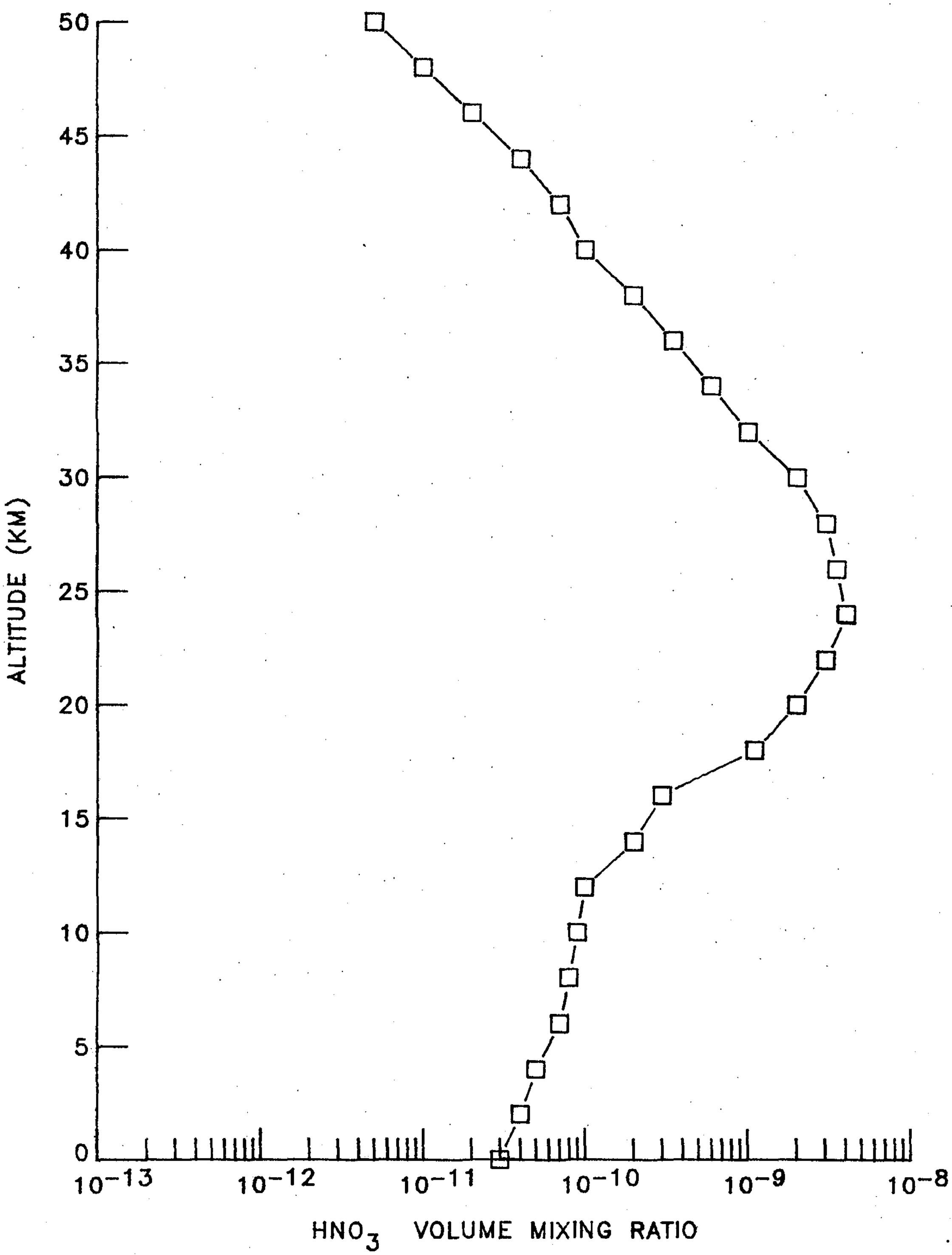
NH_3 VOLUME MIXING RATIO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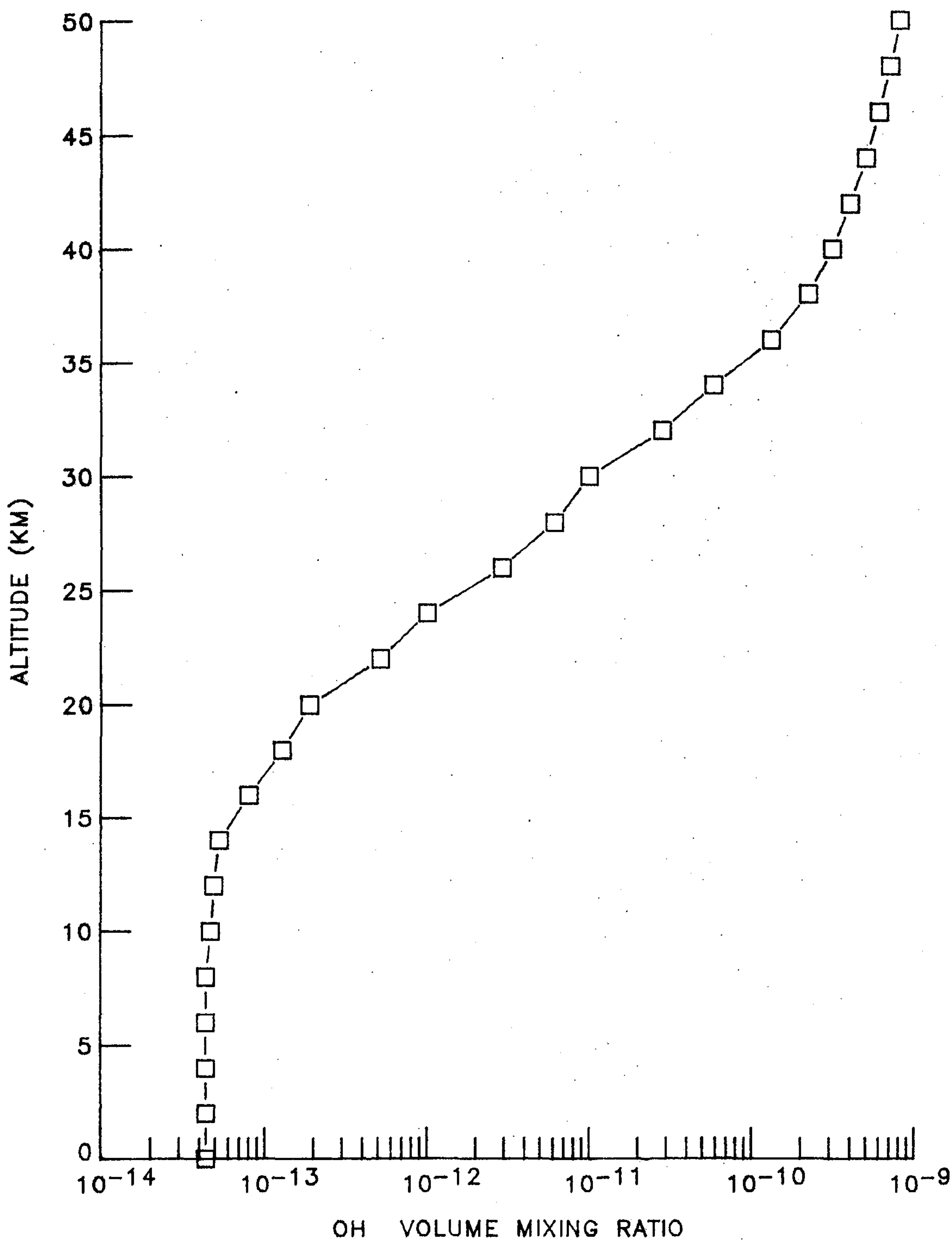
HNO_3 VOLUME MIXING RATIO



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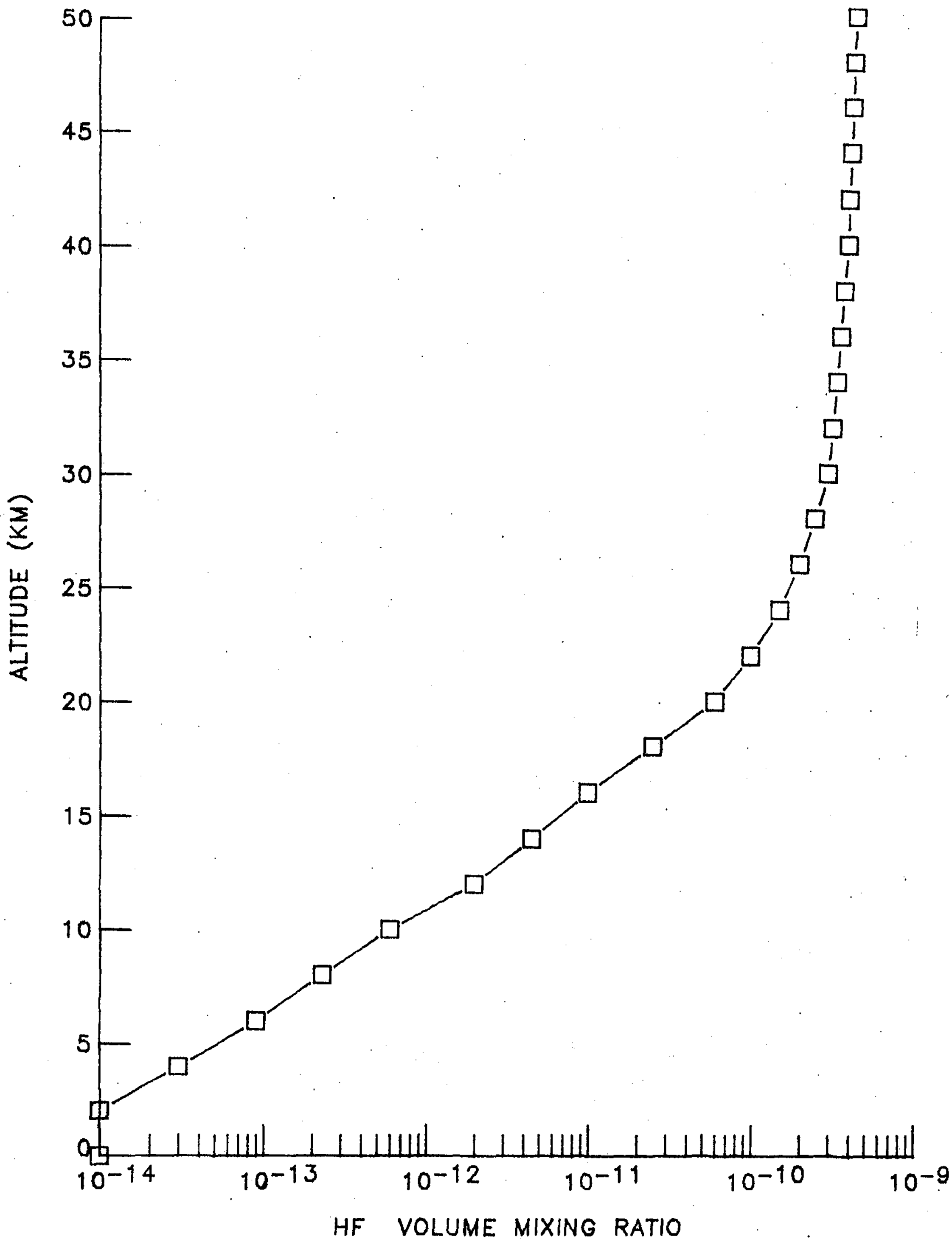
OH VOLUME MIXING RATIO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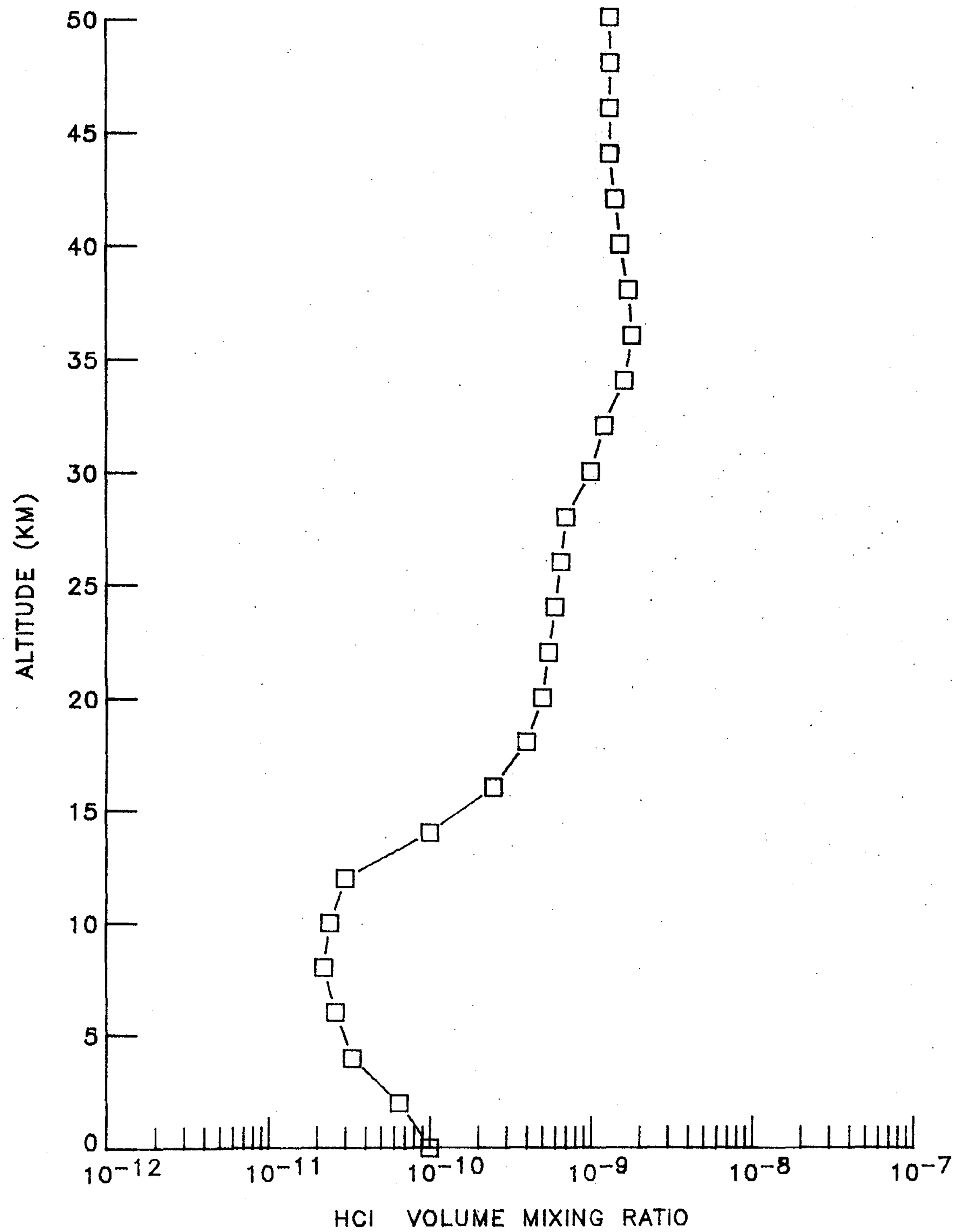
HF VOLUME MIXING RATIO



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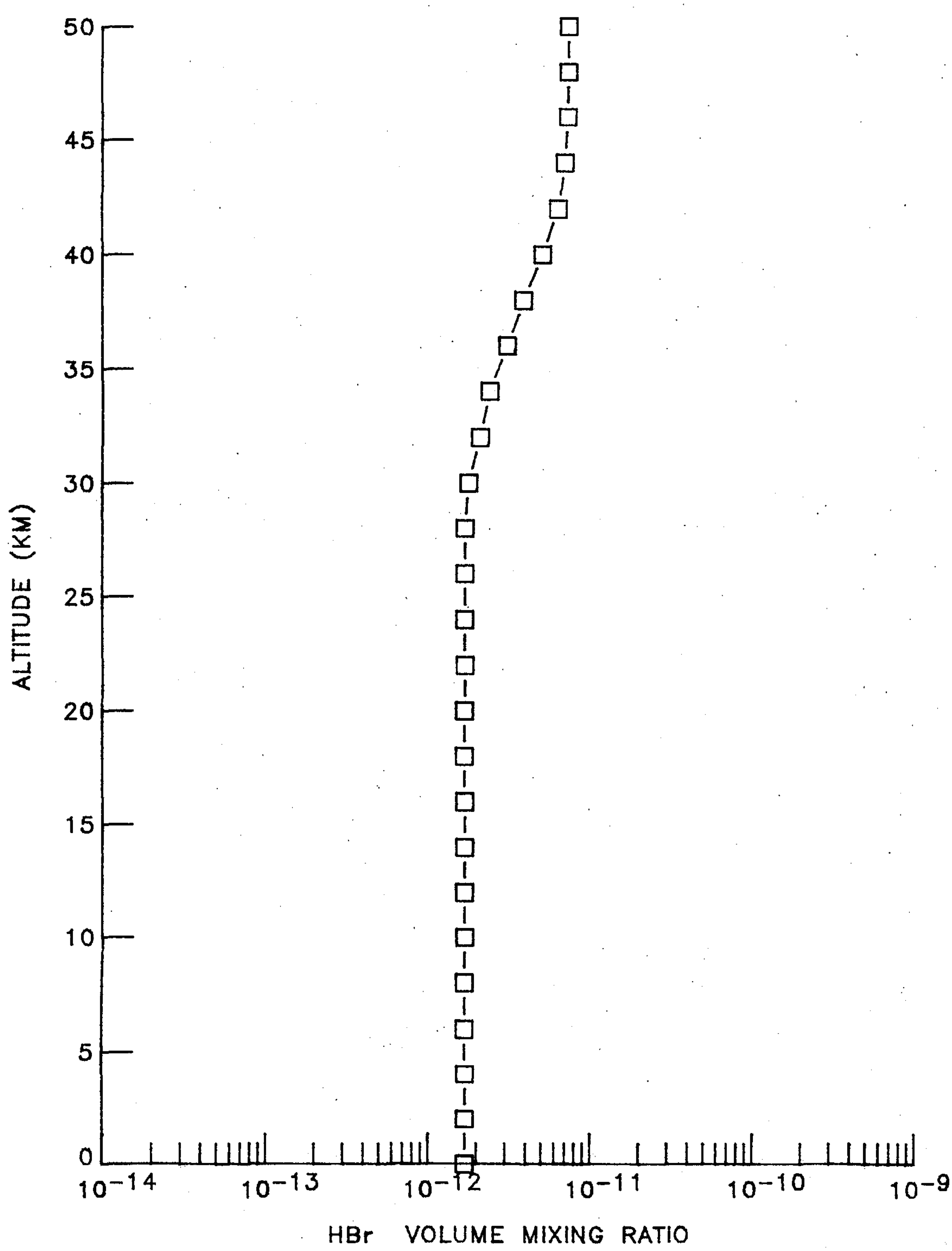
HCl VOLUME MIXING RATIO



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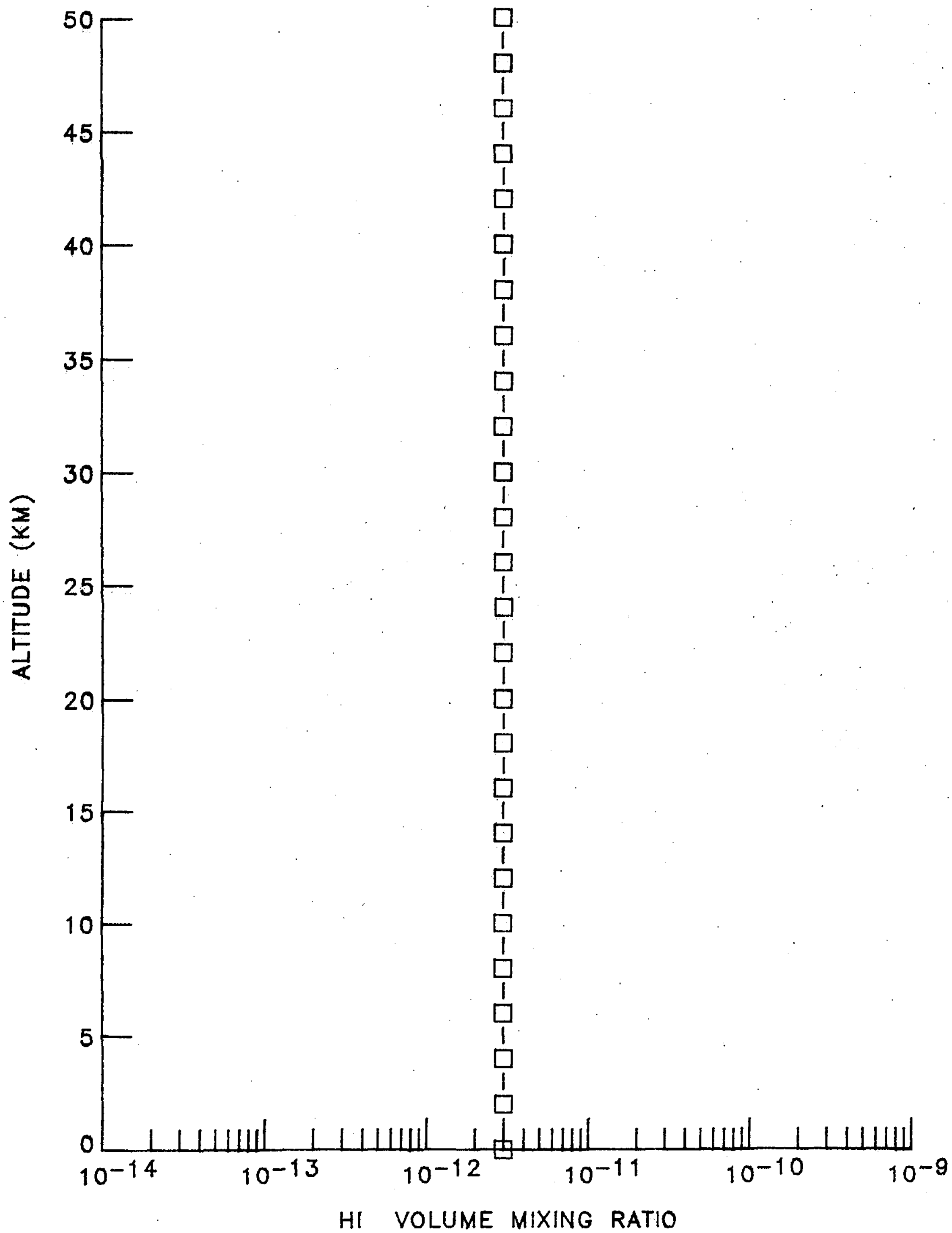
HBr VOLUME MIXING RATIO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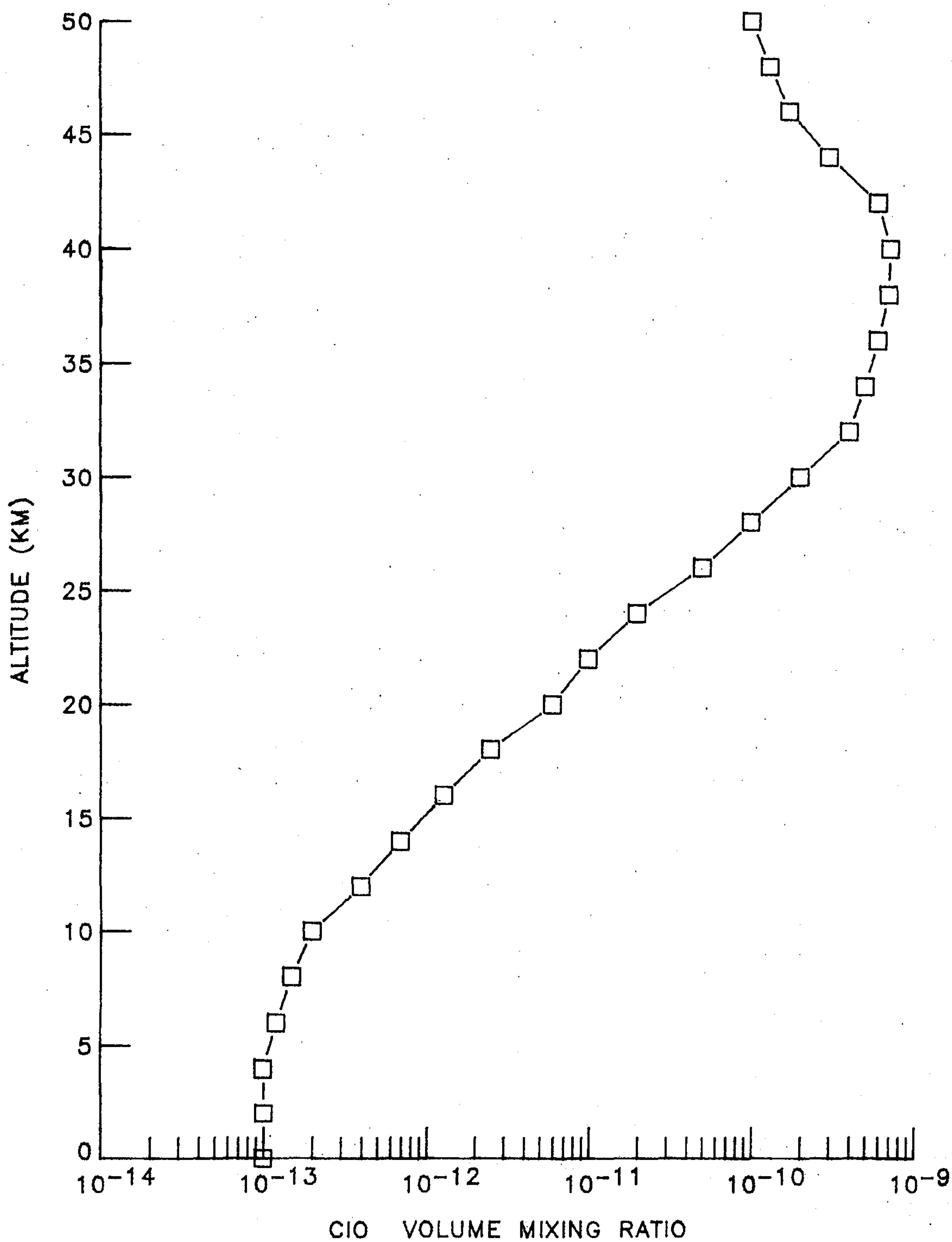
HI VOLUME MIXING RATIO



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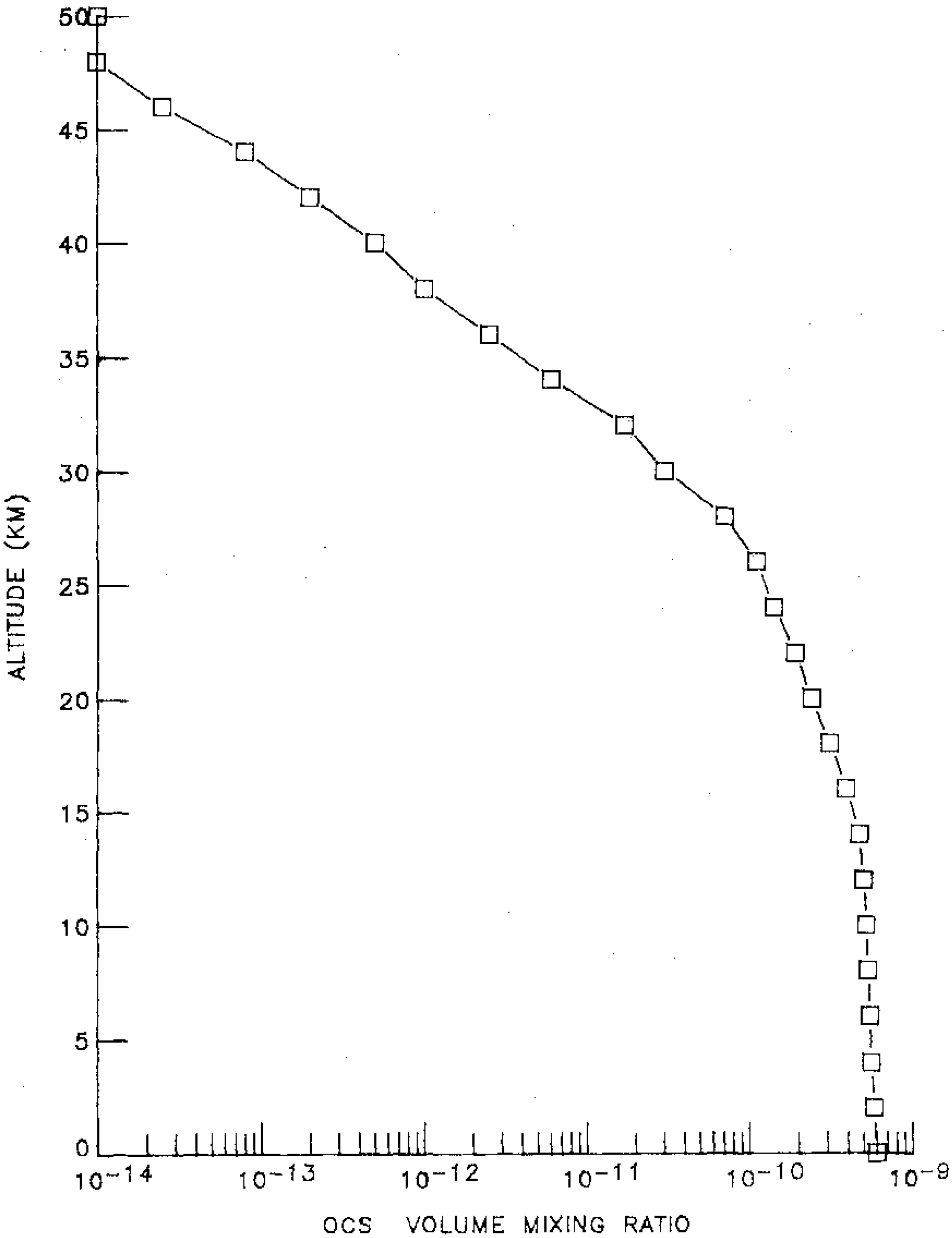
10−9
ClO VOLUME MIXING RATIO



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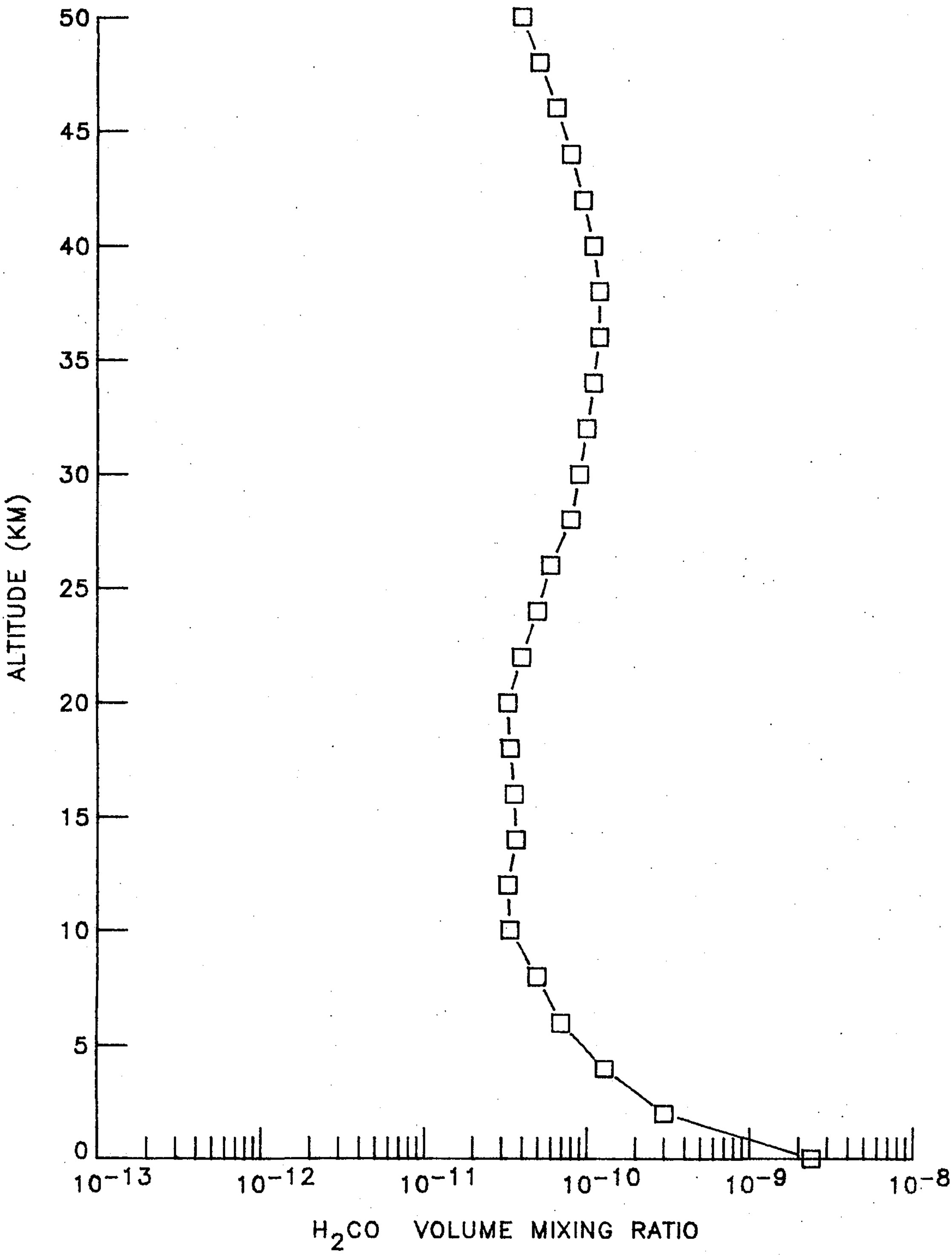
OCS VOLUME MIXING RATIO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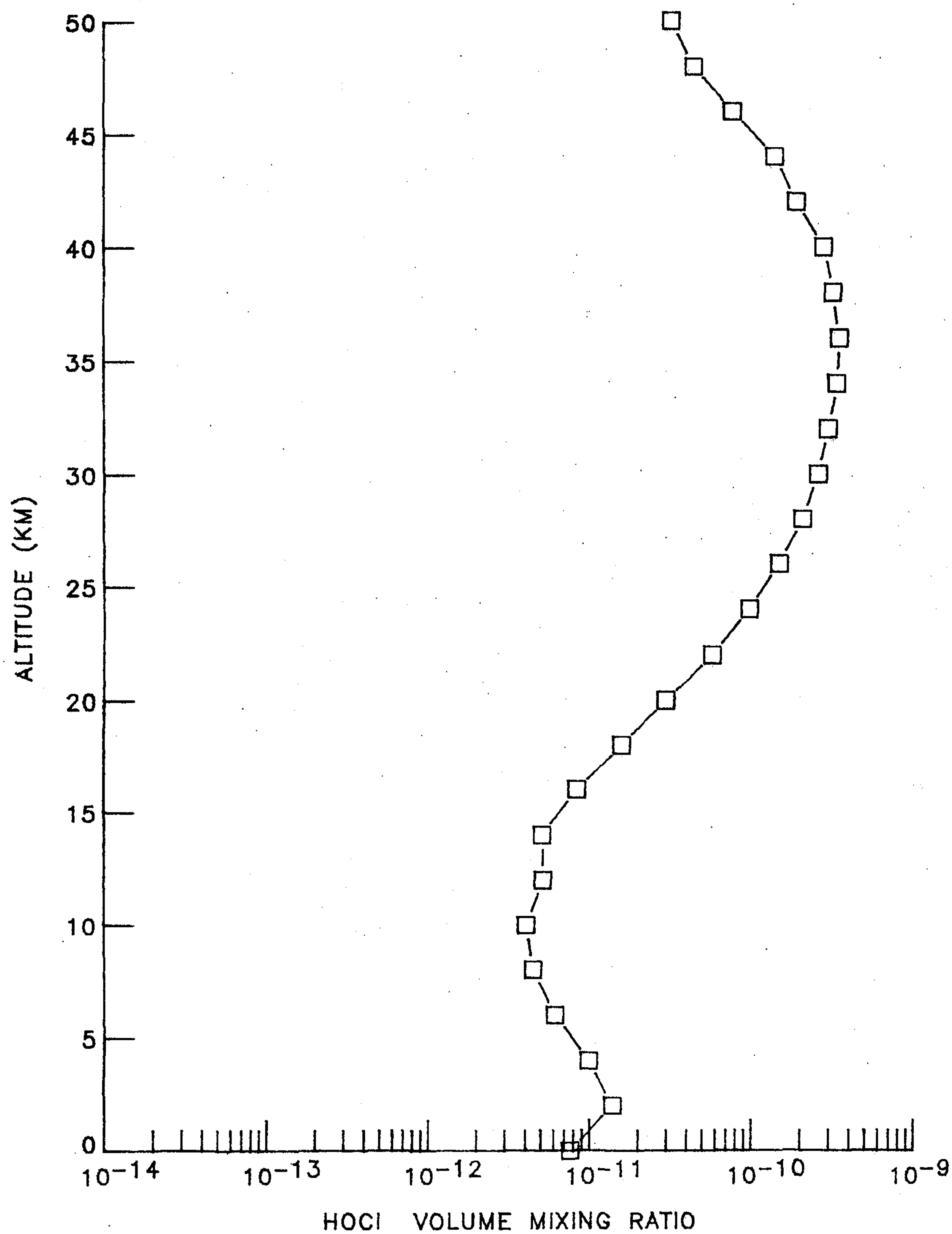
10−8
H2CO VOLUME MIXING RATIO



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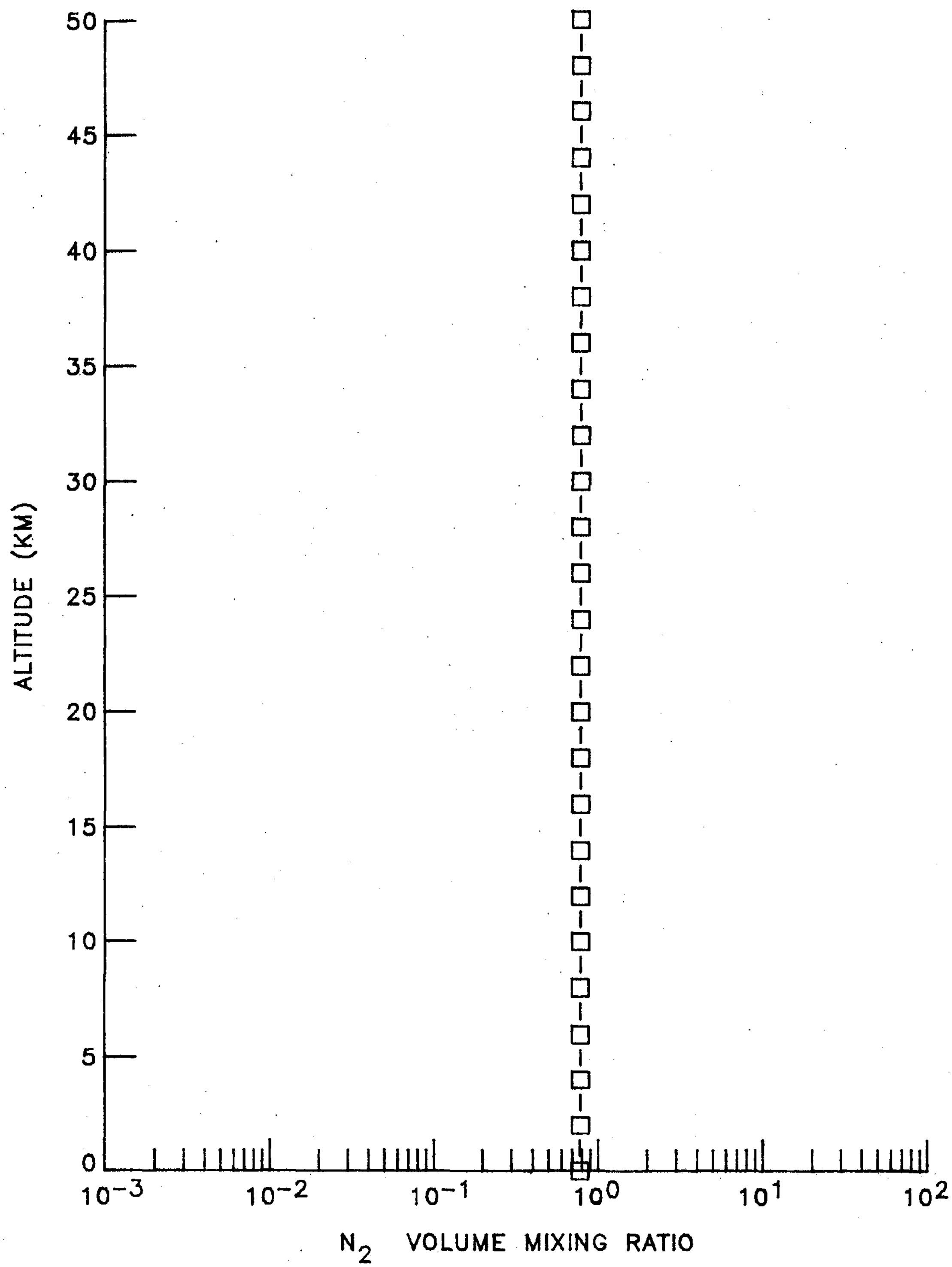
HOCl VOLUME MIXING RATIO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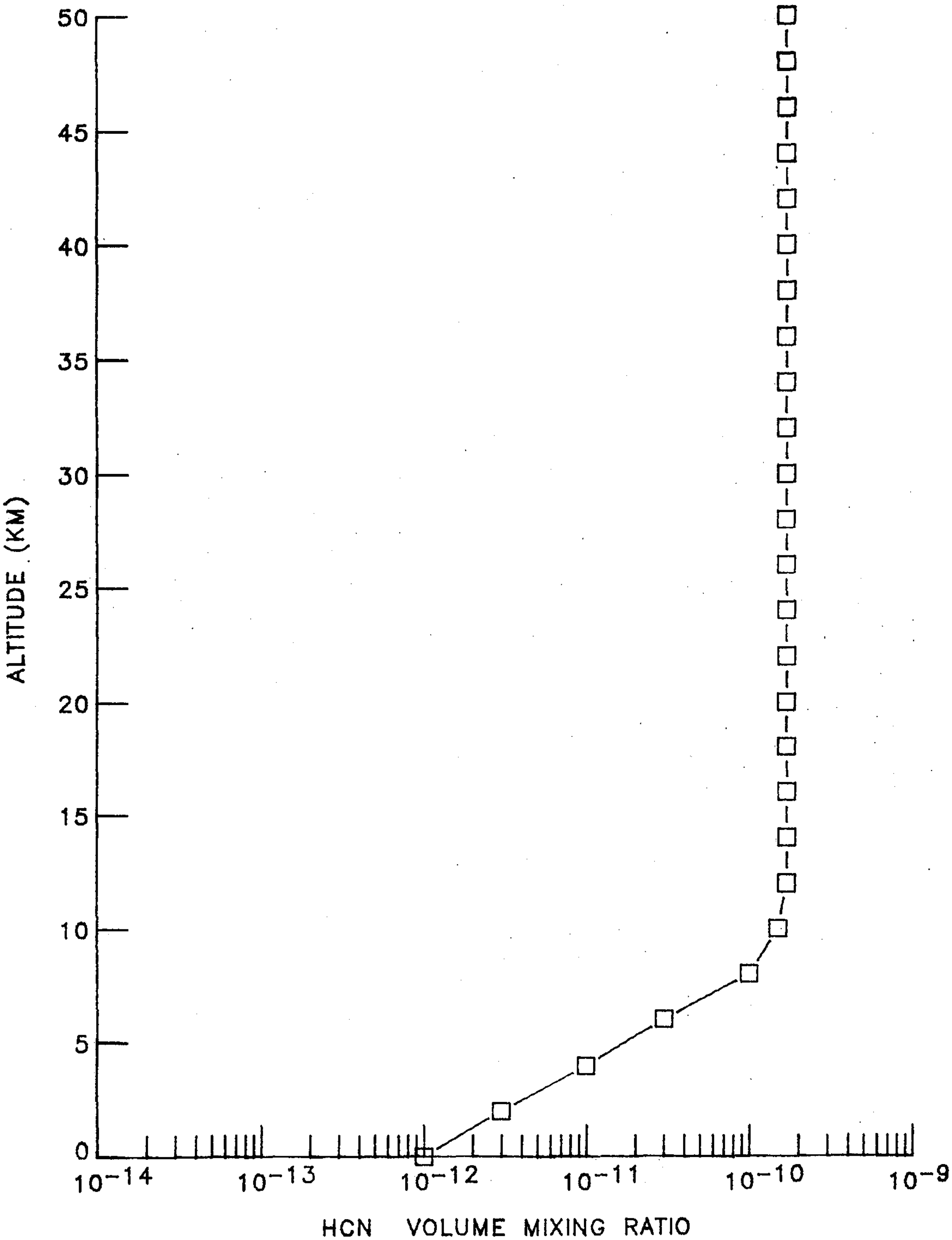
N_2 VOLUME MIXING RATIO



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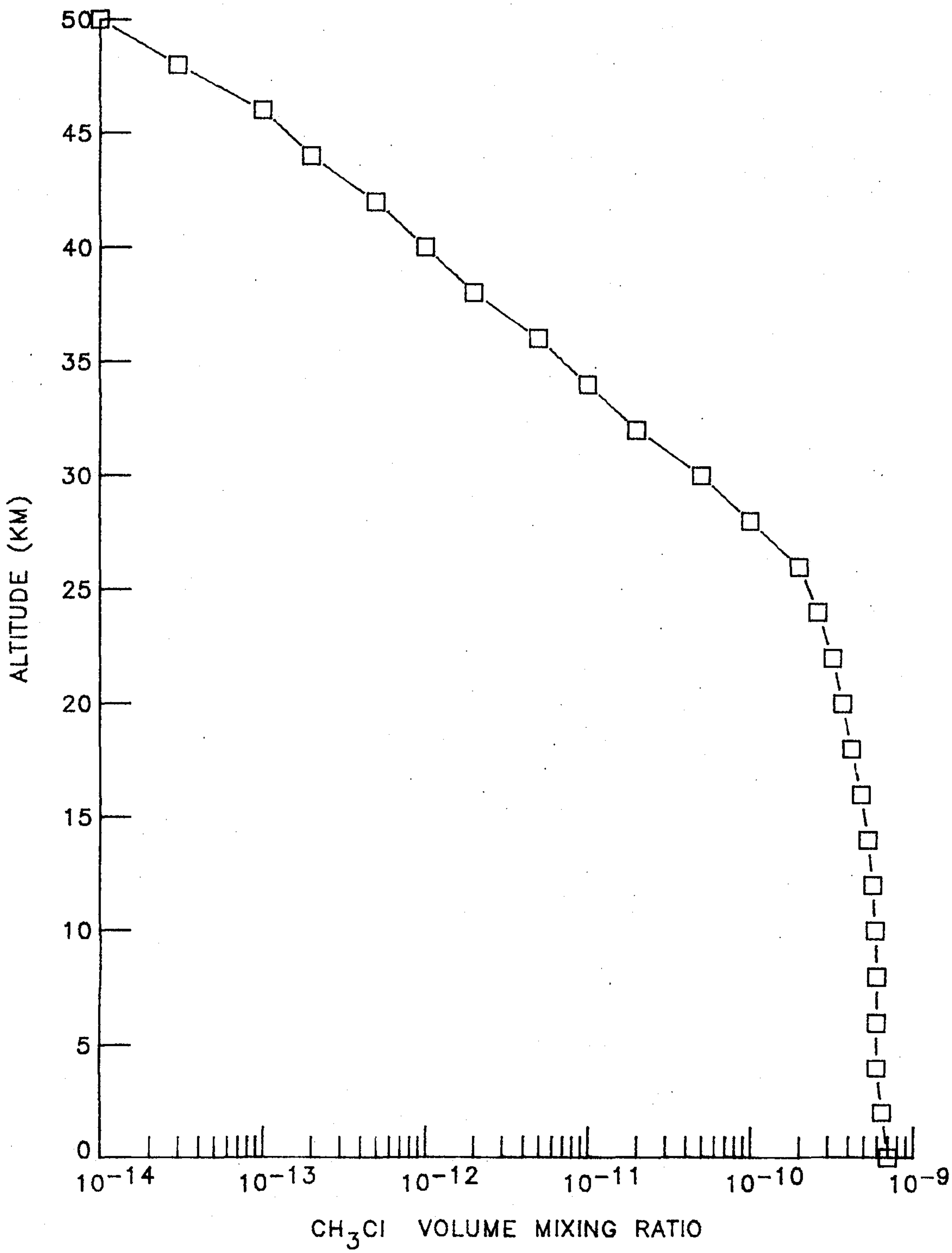
HCN VOLUME MIXING RATIO



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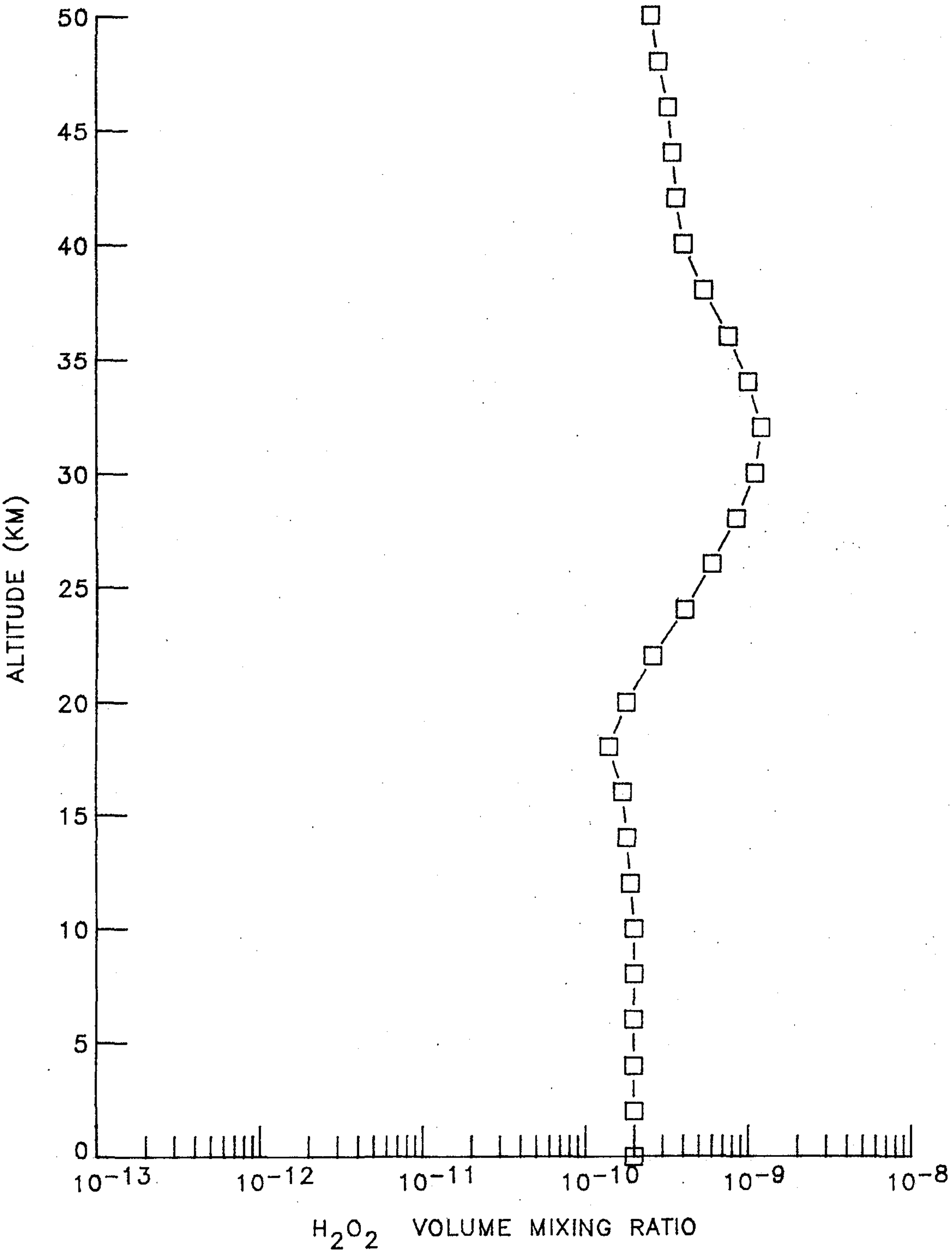
CH_3Cl VOLUME MIXING RATIO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ALTITUDE (KM)
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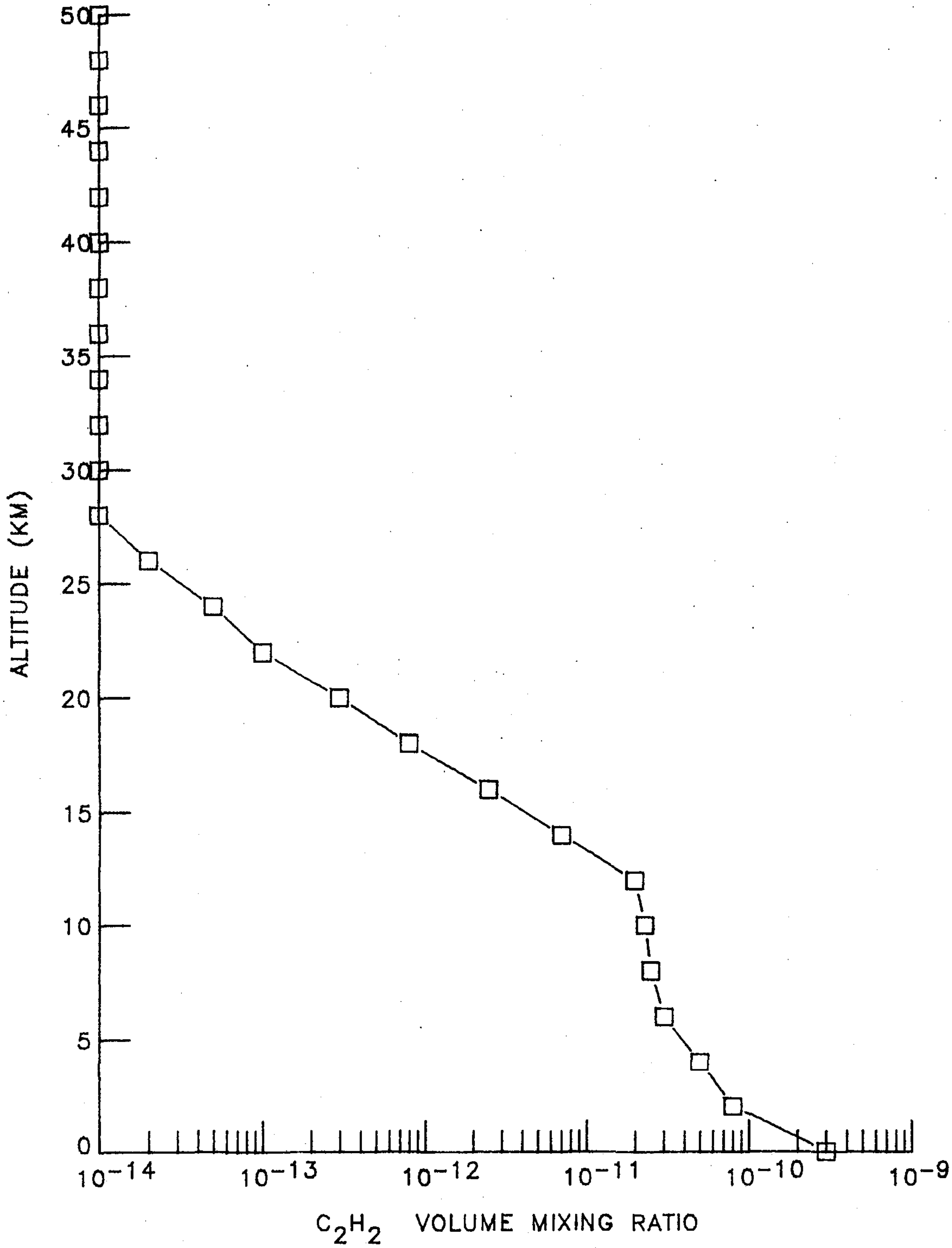
H_2O_2 VOLUME MIXING RATIO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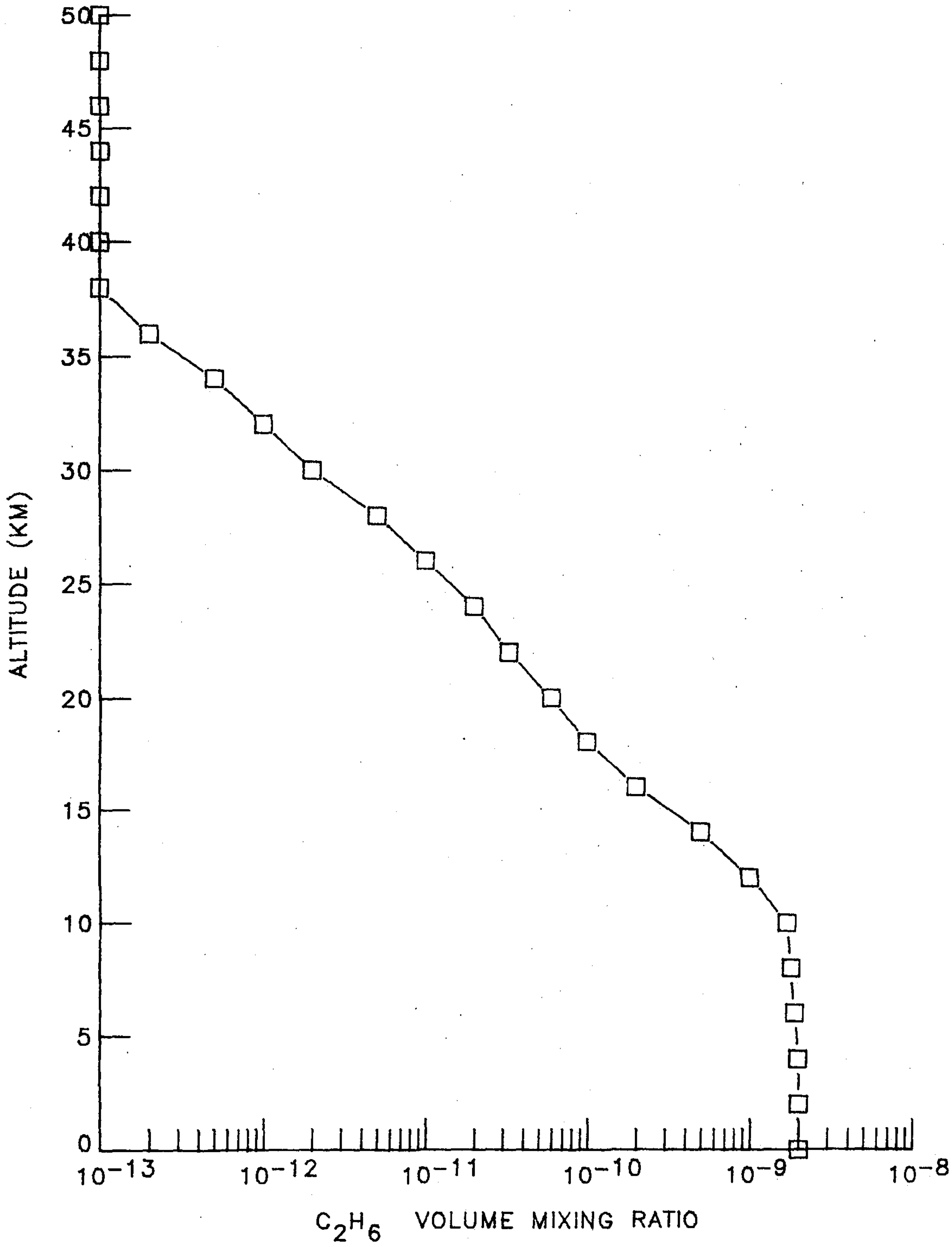
C_2H_2 VOLUME MIXING RATIO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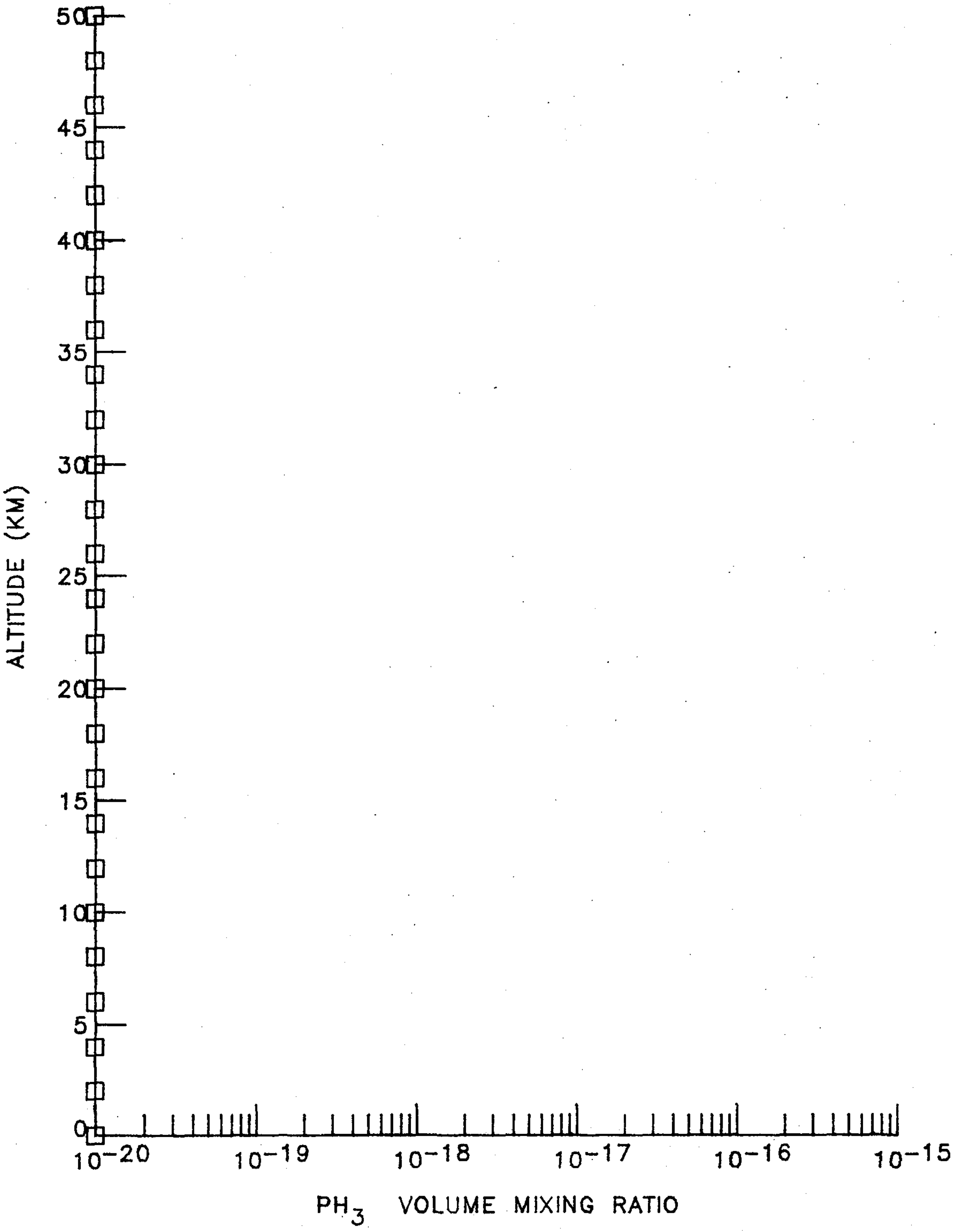
C_2H_6 VOLUME MIXING RATIO



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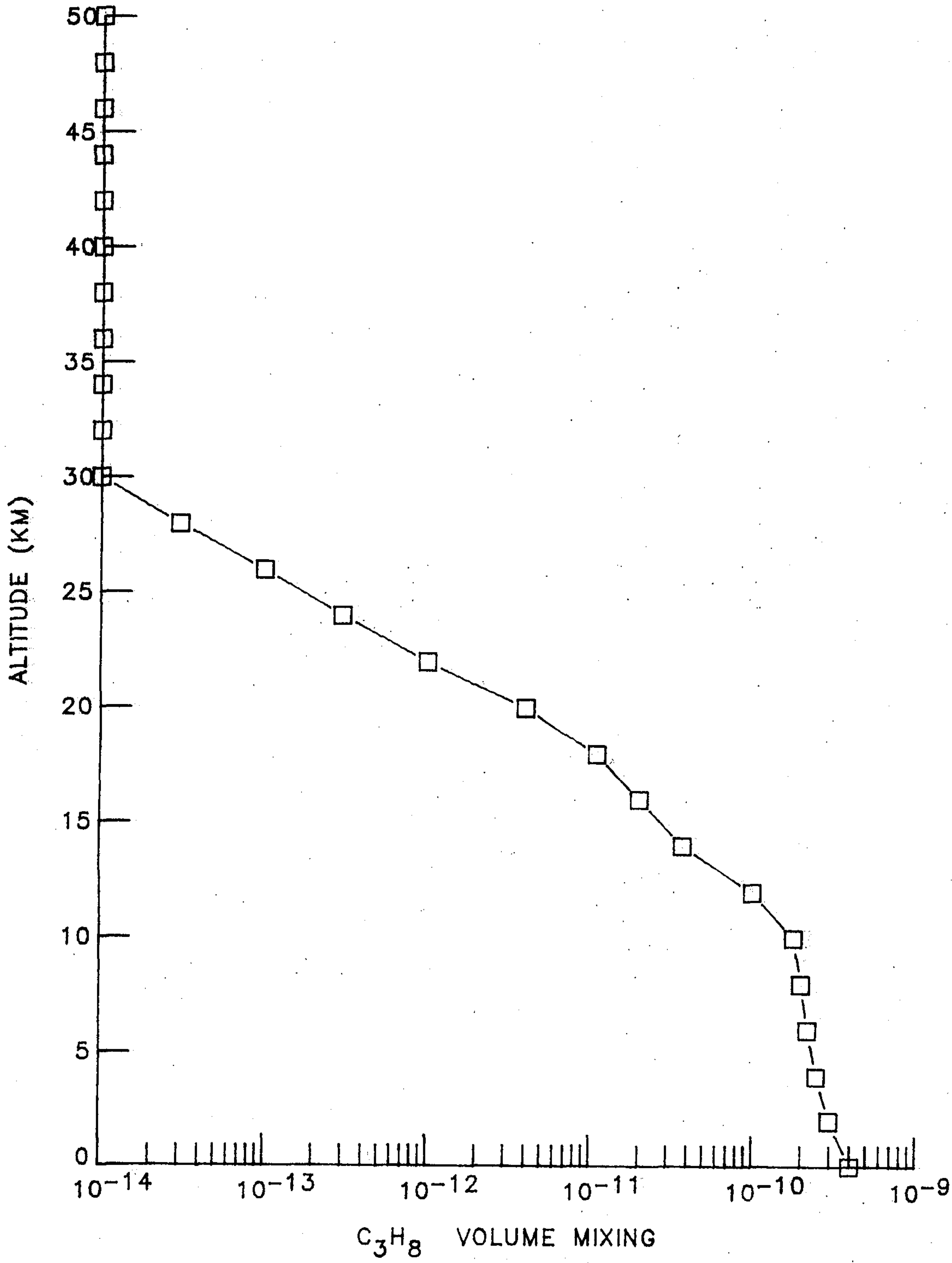
PH_3 VOLUME MIXING RATIO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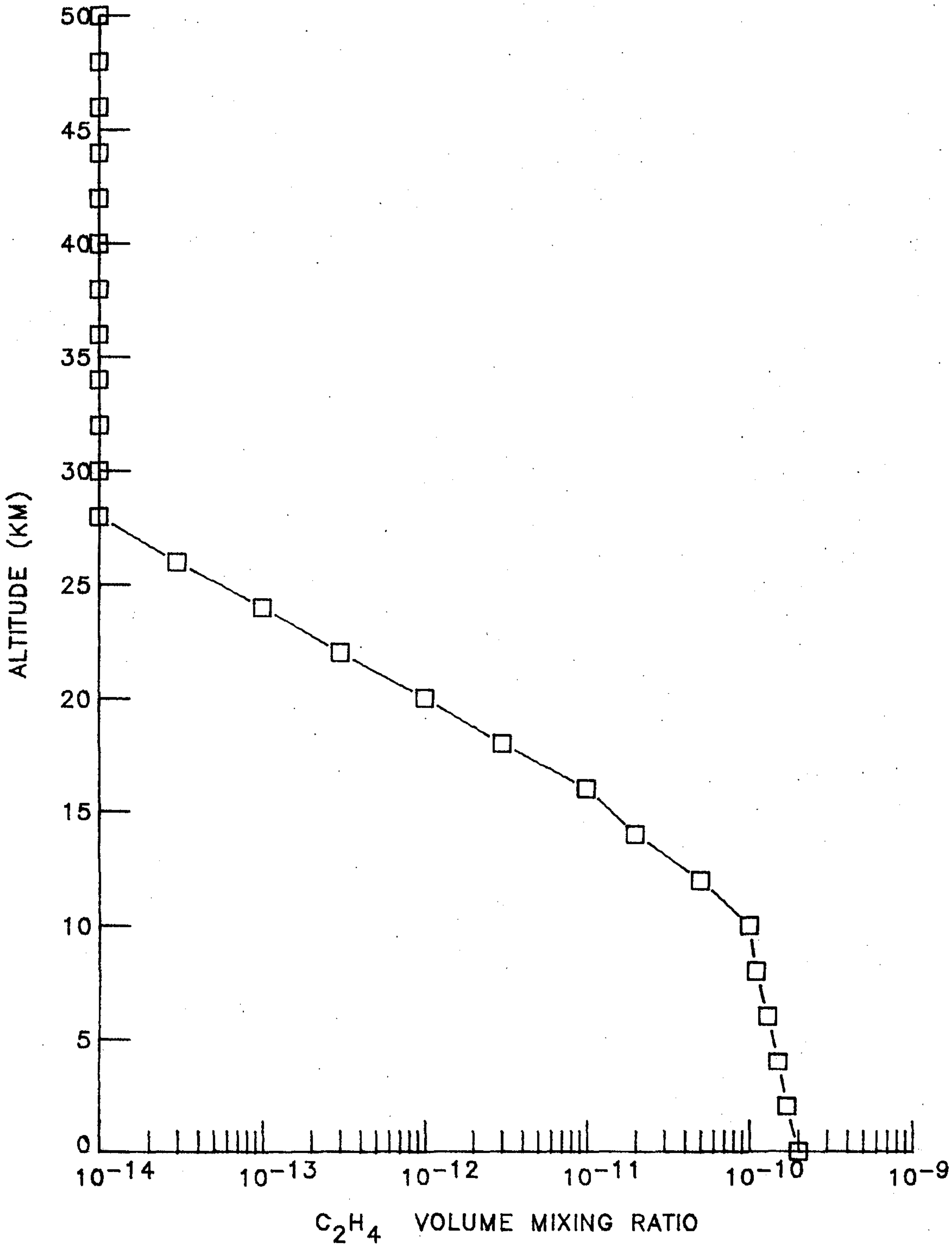
C_3H_8 VOLUME MIXING



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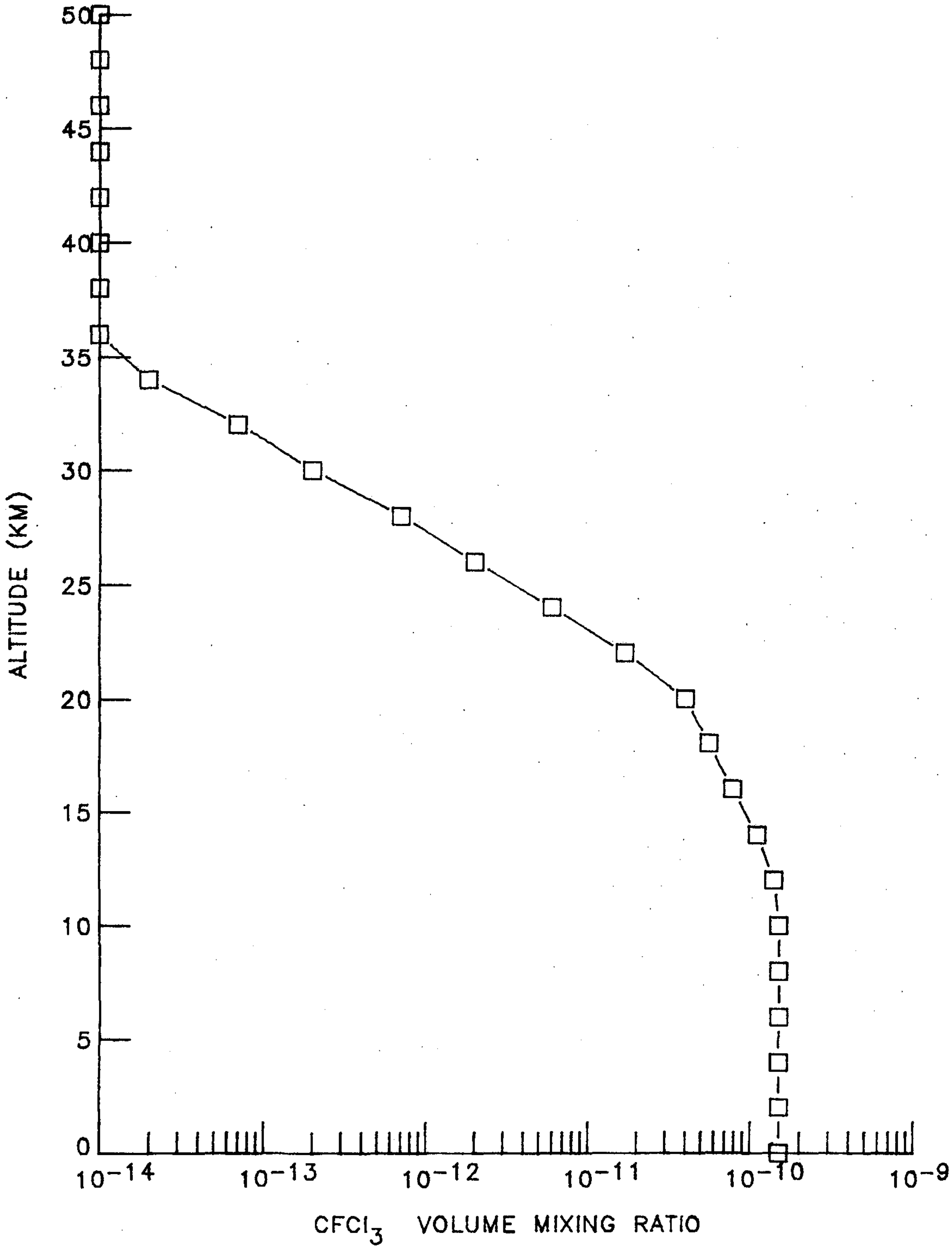
C_2H_4 VOLUME MIXING RATIO



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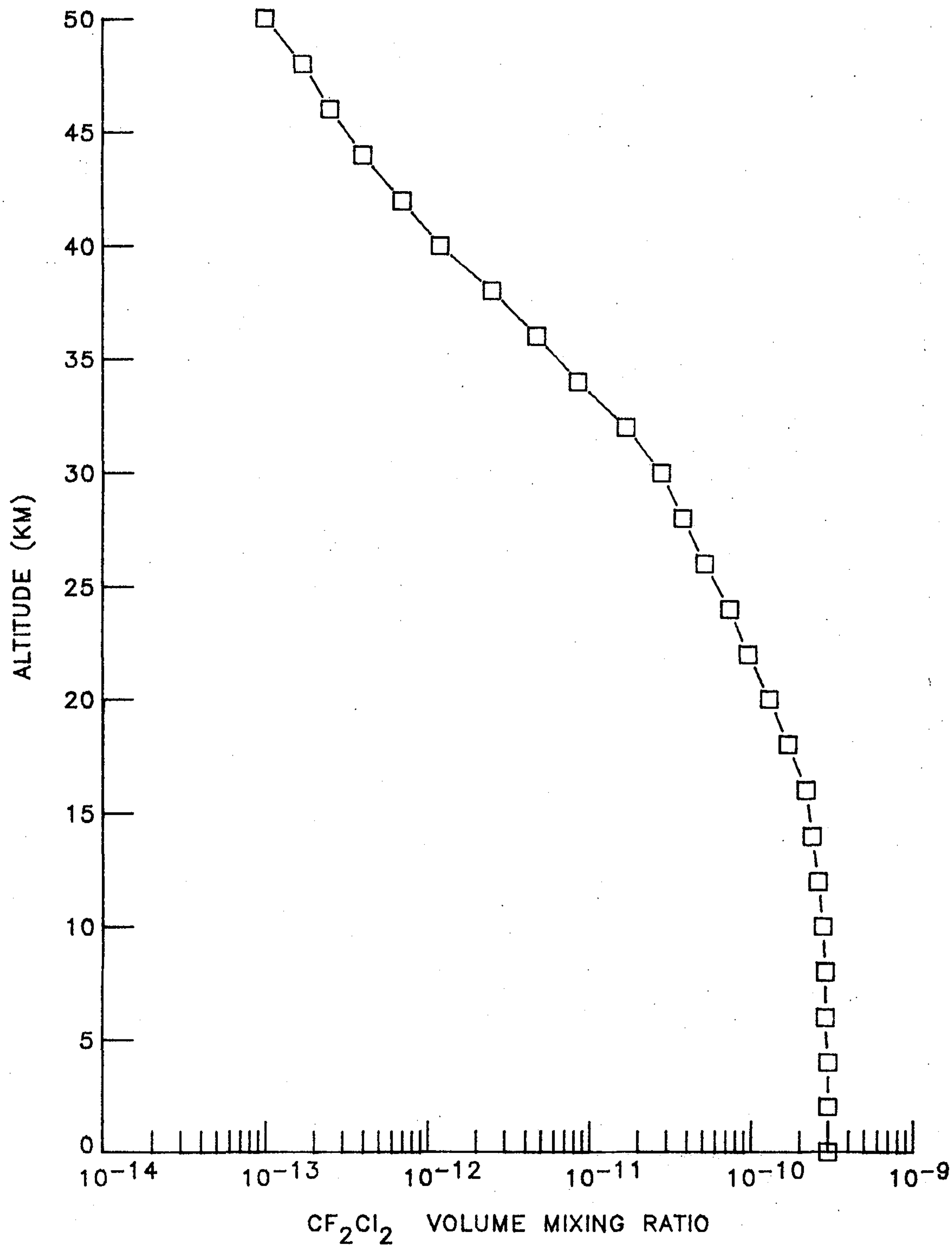
$CFCl_3$ VOLUME MIXING RATIO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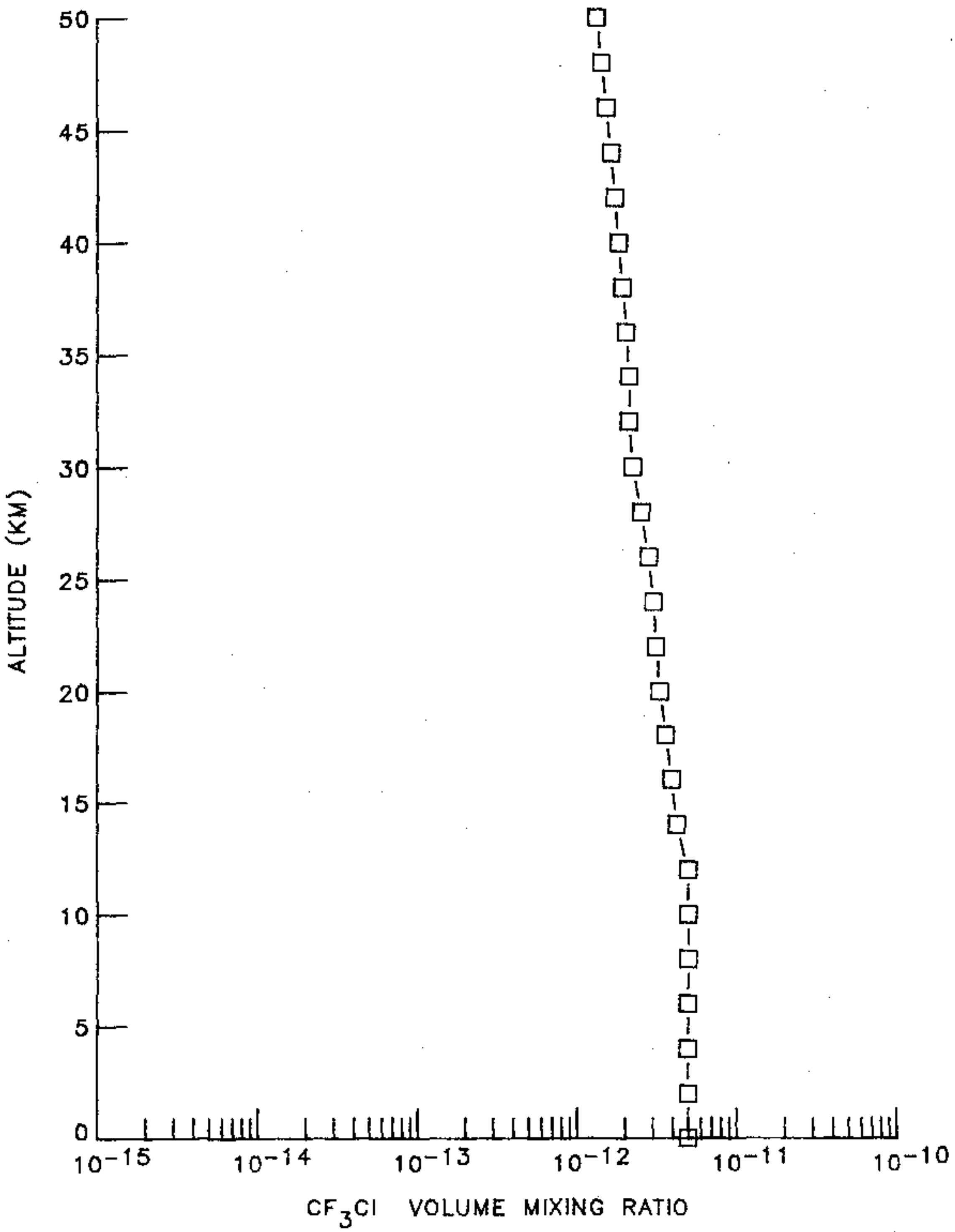
CF_2Cl_2 VOLUME MIXING RATIO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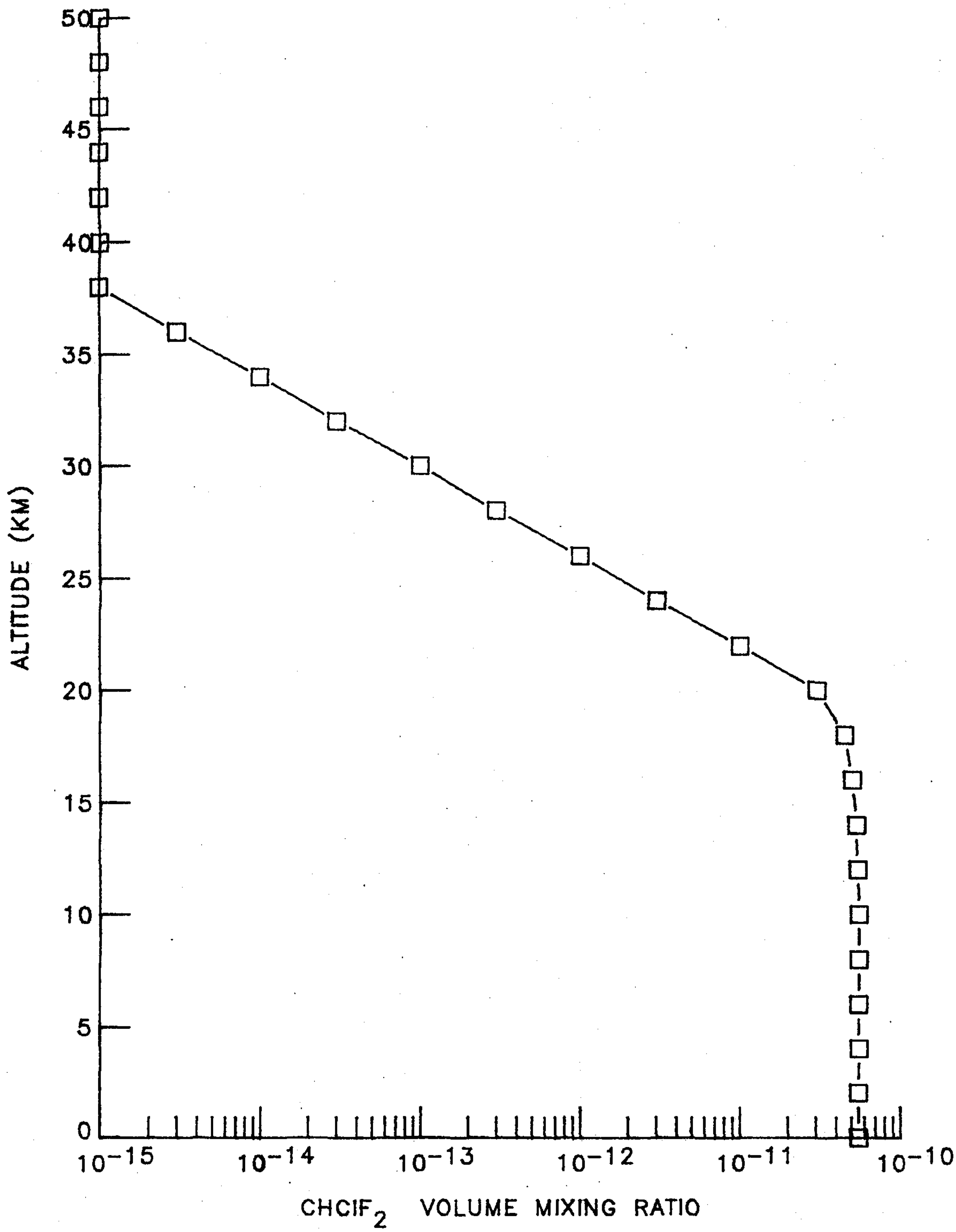
CF_3Cl VOLUME MIXING RATIO



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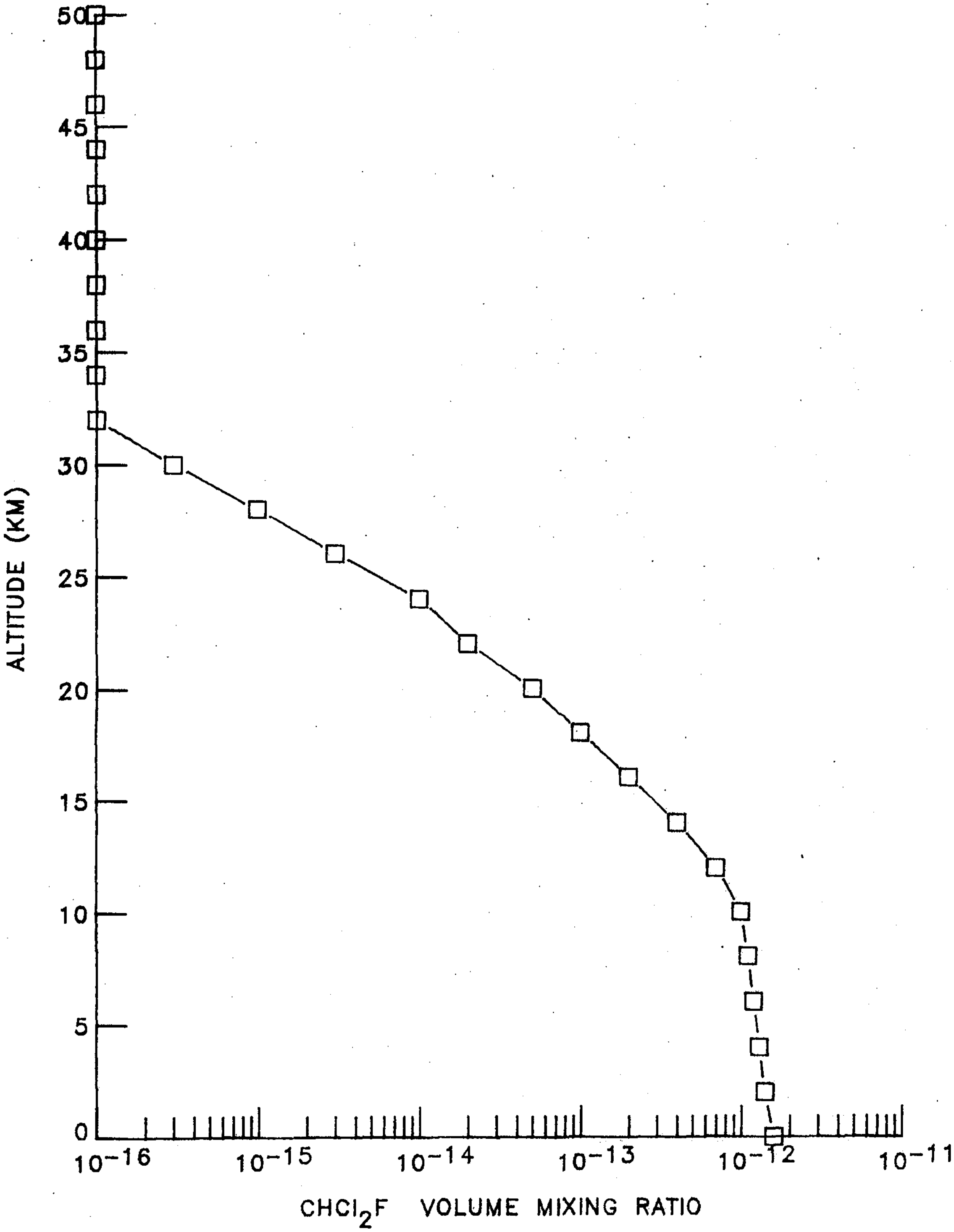
$CHClF_2$ VOLUME MIXING RATIO



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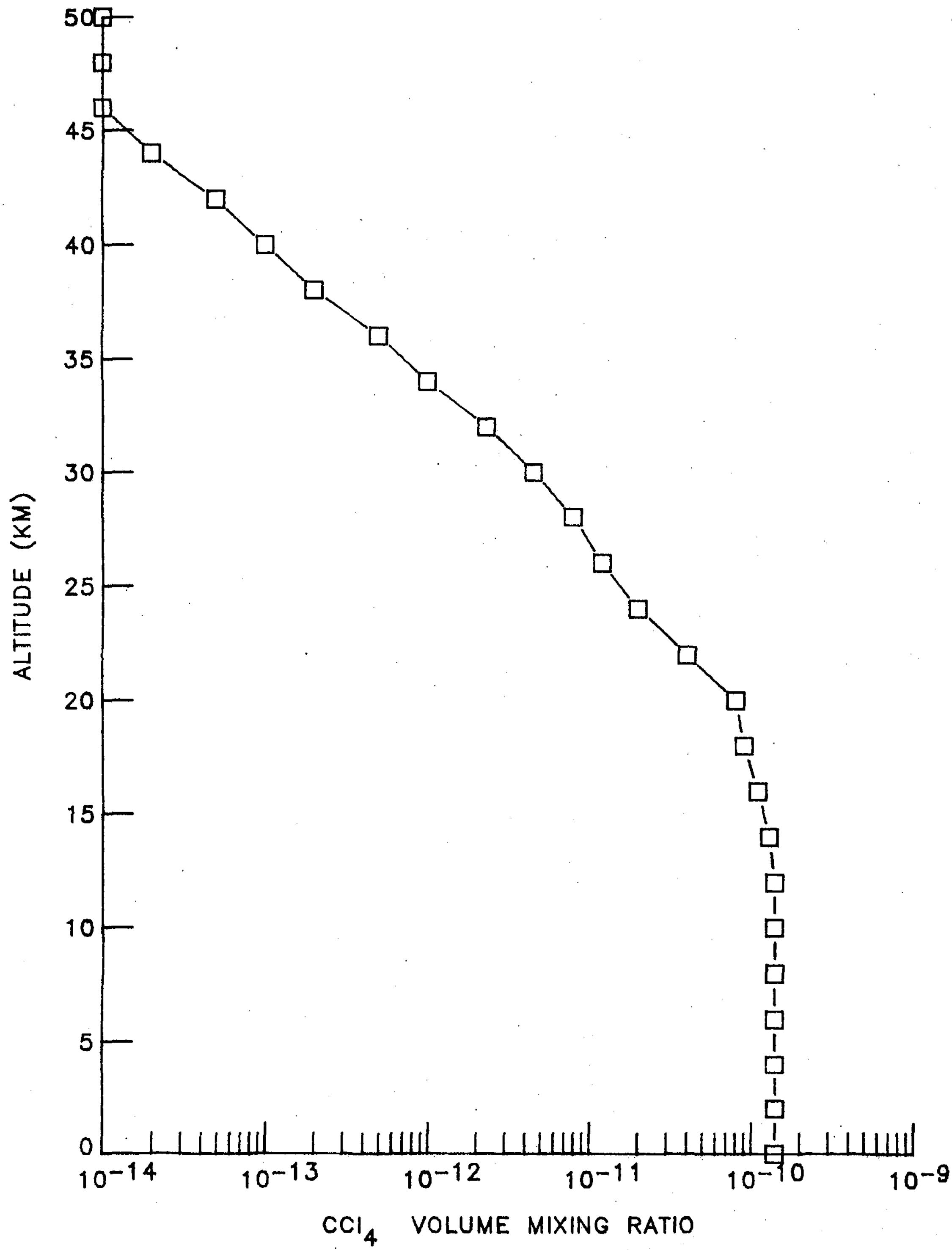
$CHCl_2F$ VOLUME MIXING RATIO



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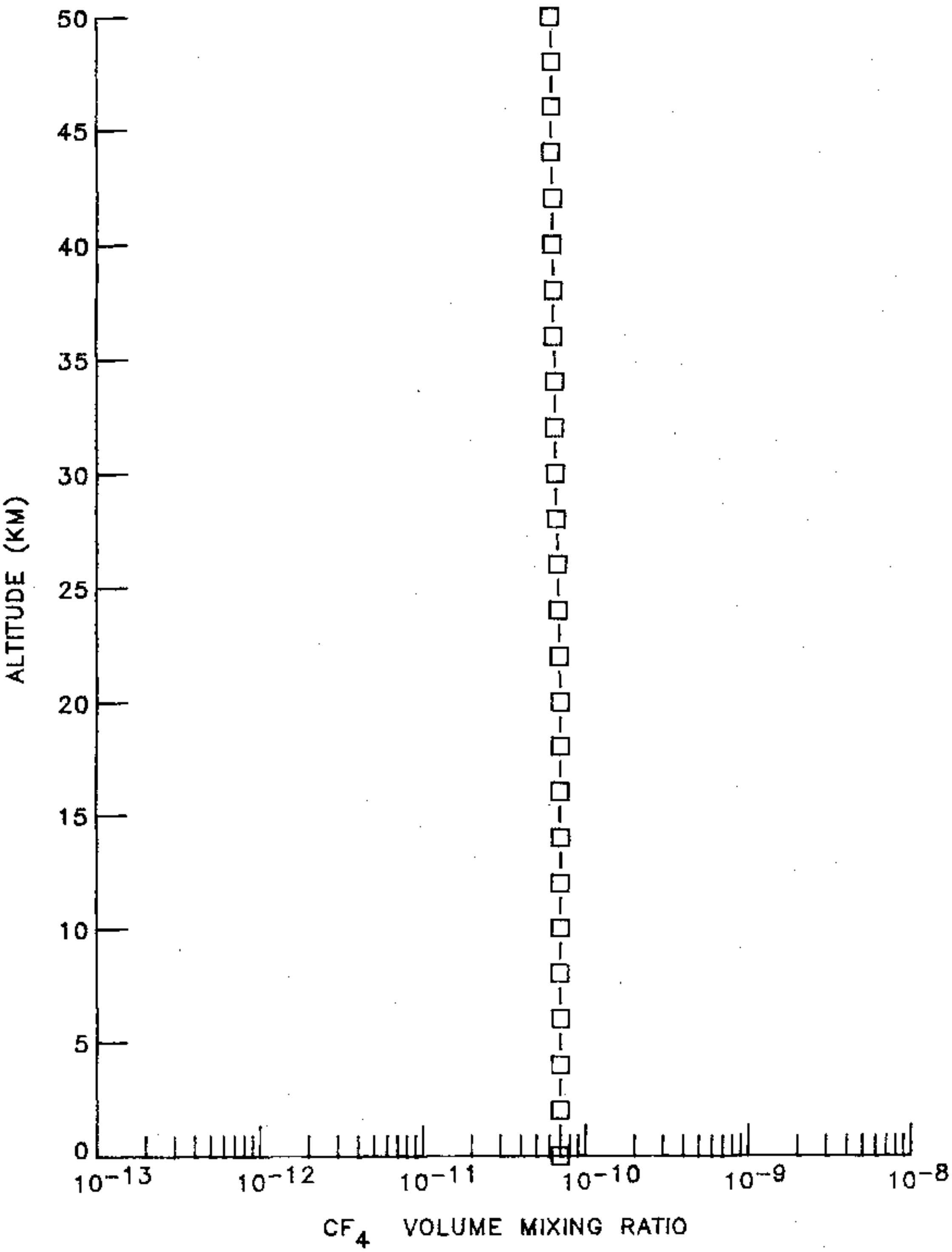
CCl_4 VOLUME MIXING RATIO



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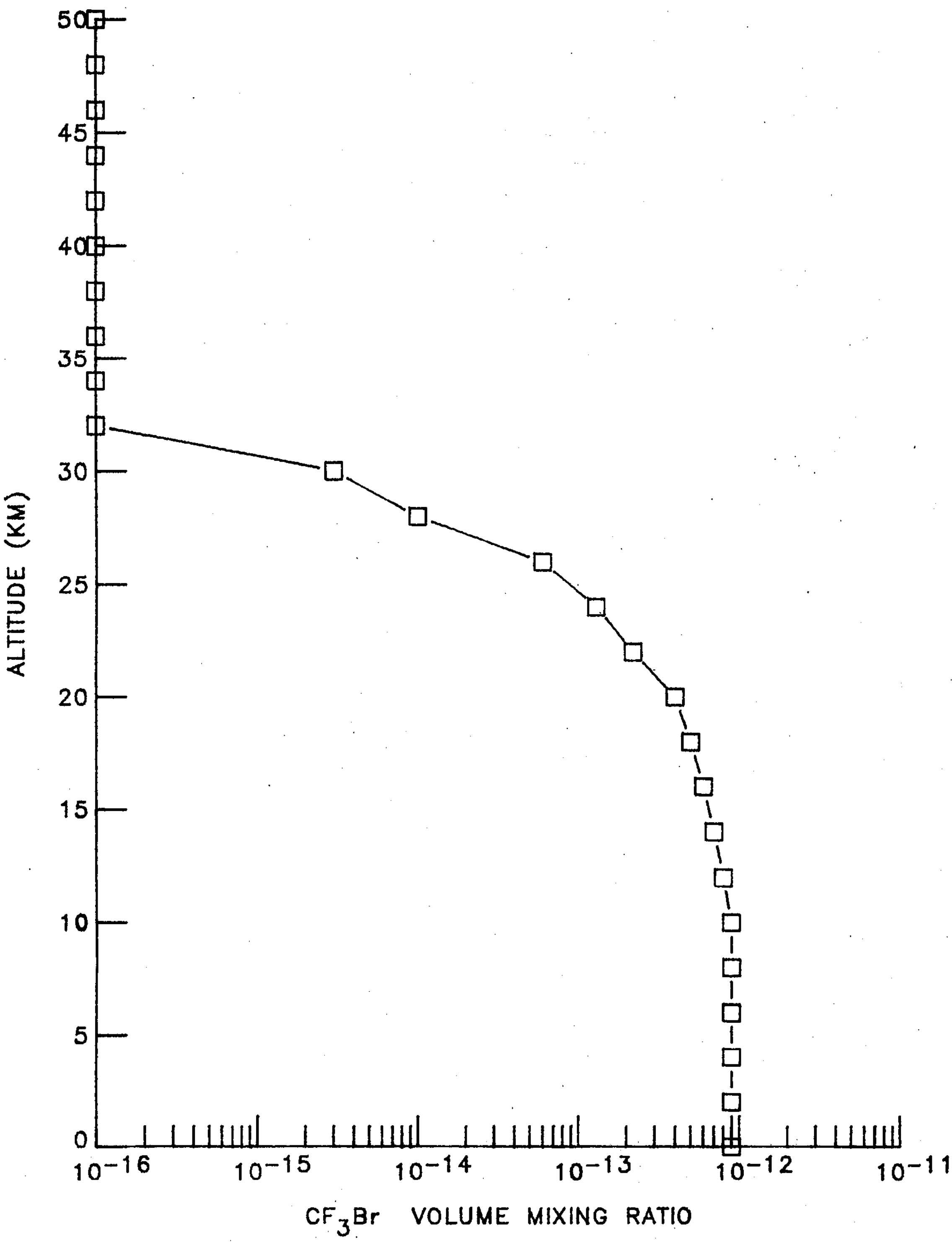
CF_4 VOLUME MIXING RATIO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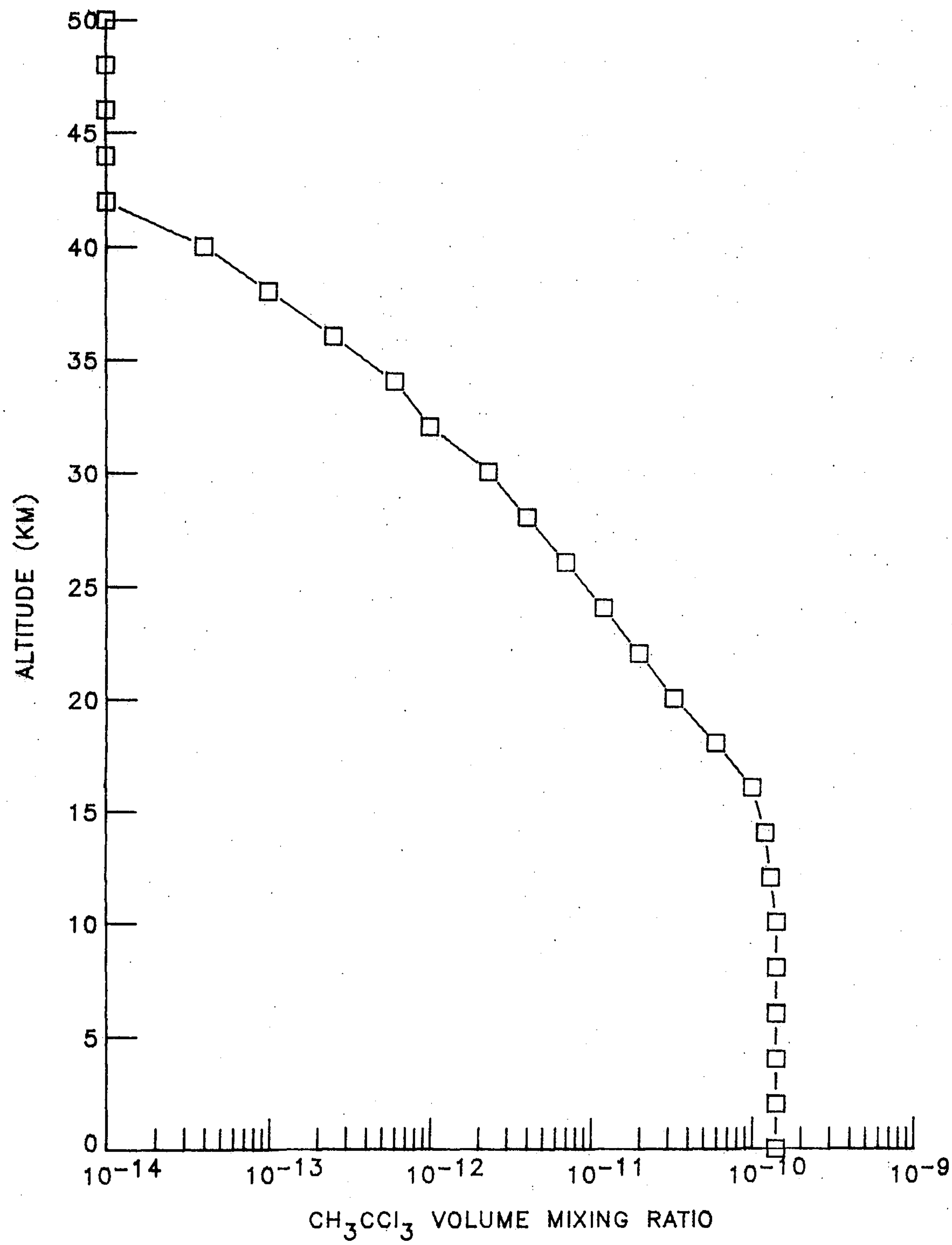
CF_3Br VOLUME MIXING RATIO



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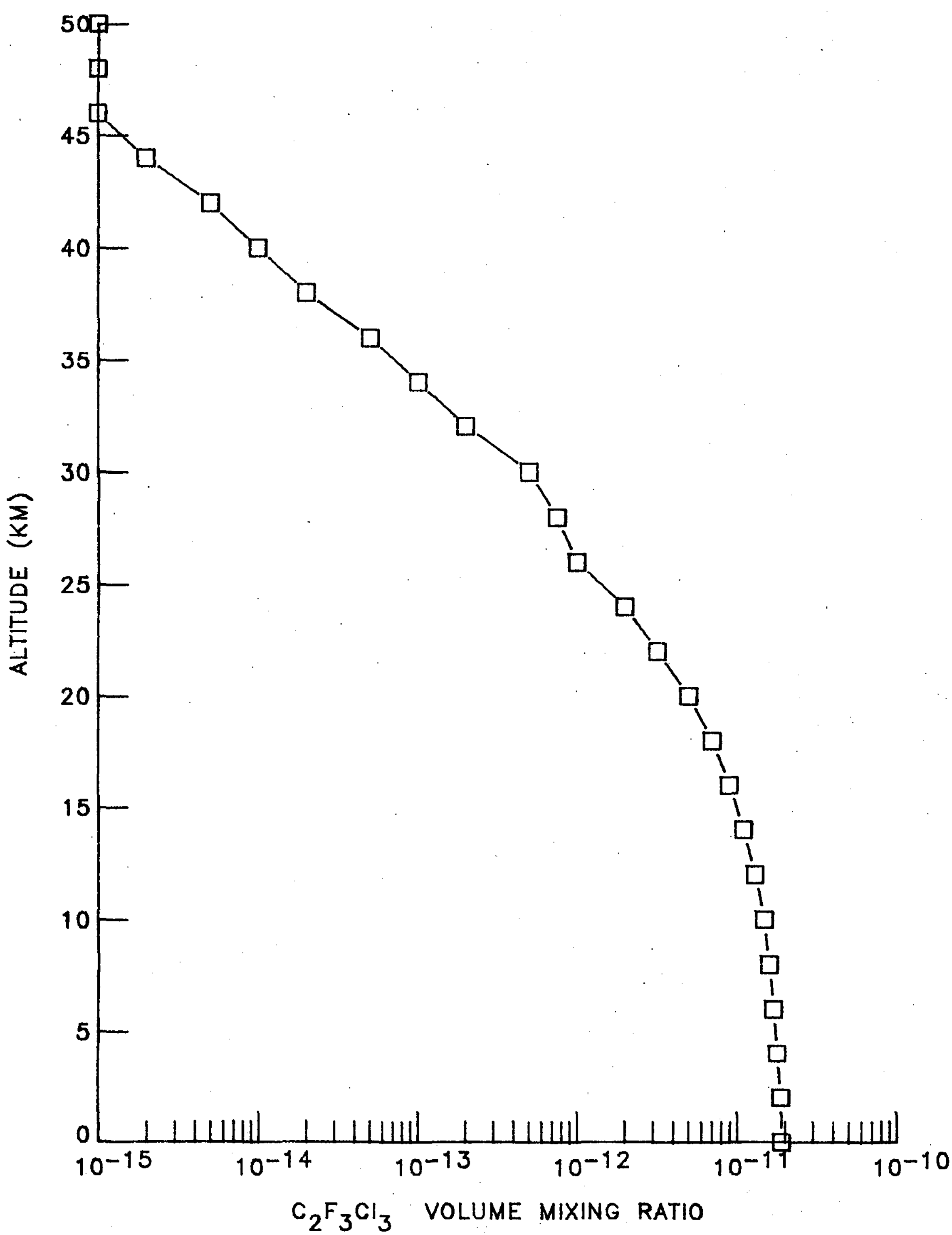
CH_3CCl_3 VOLUME MIXING RATIO



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ALTITUDE (KM)
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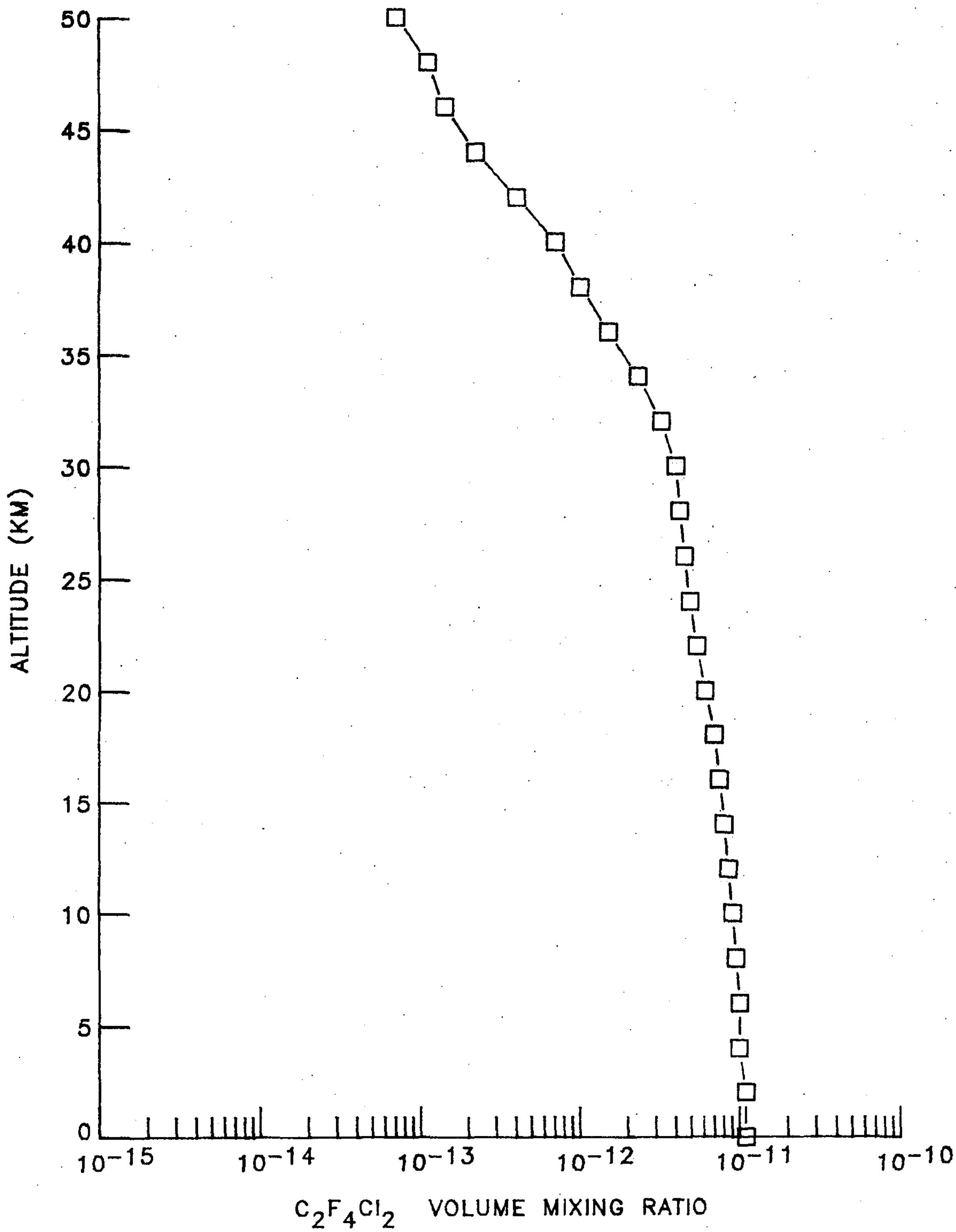
$C_2F_3Cl_3$ VOLUME MIXING RATIO



ALTITUDE (KM)
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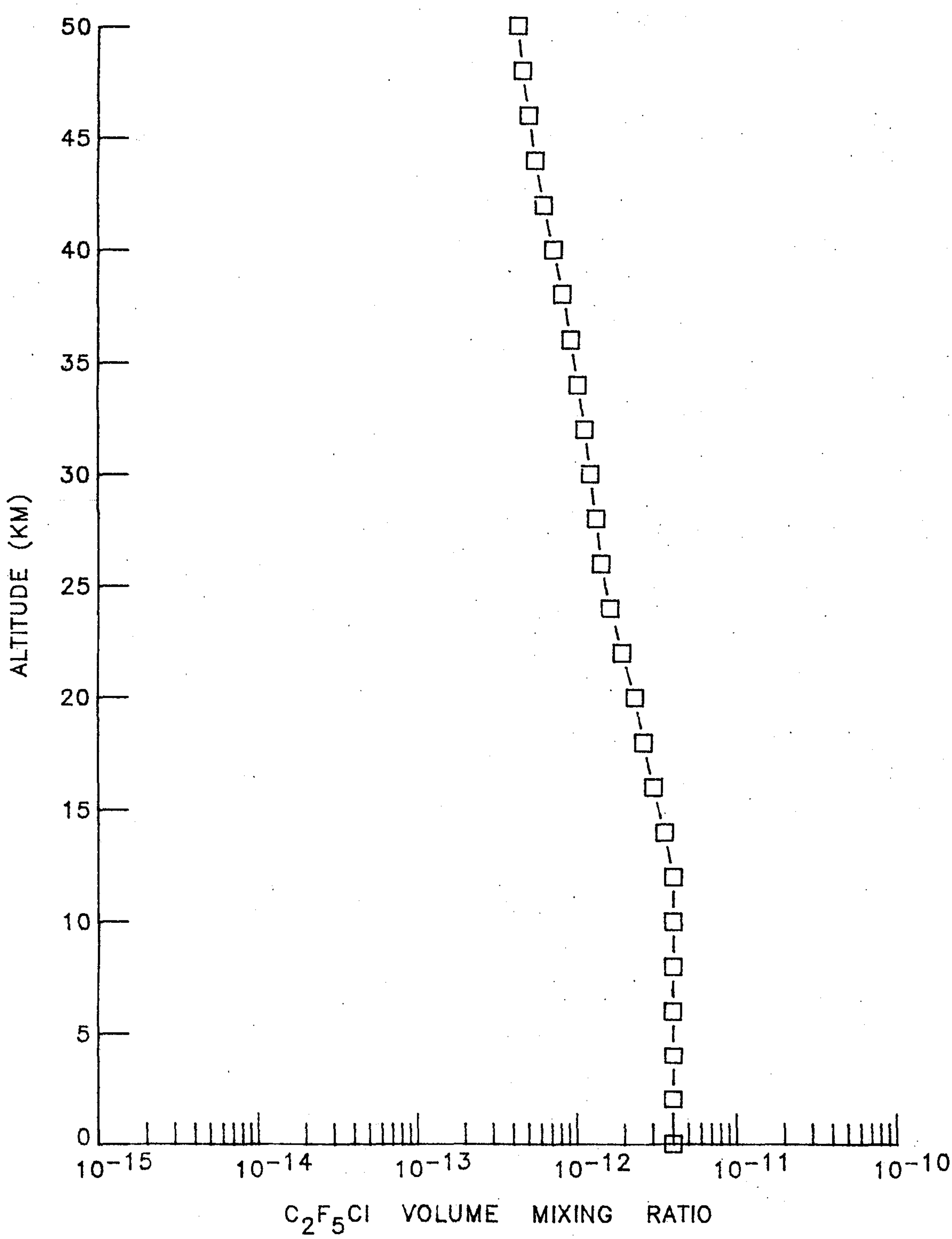
$C_2F_4Cl_2$ VOLUME MIXING RATIO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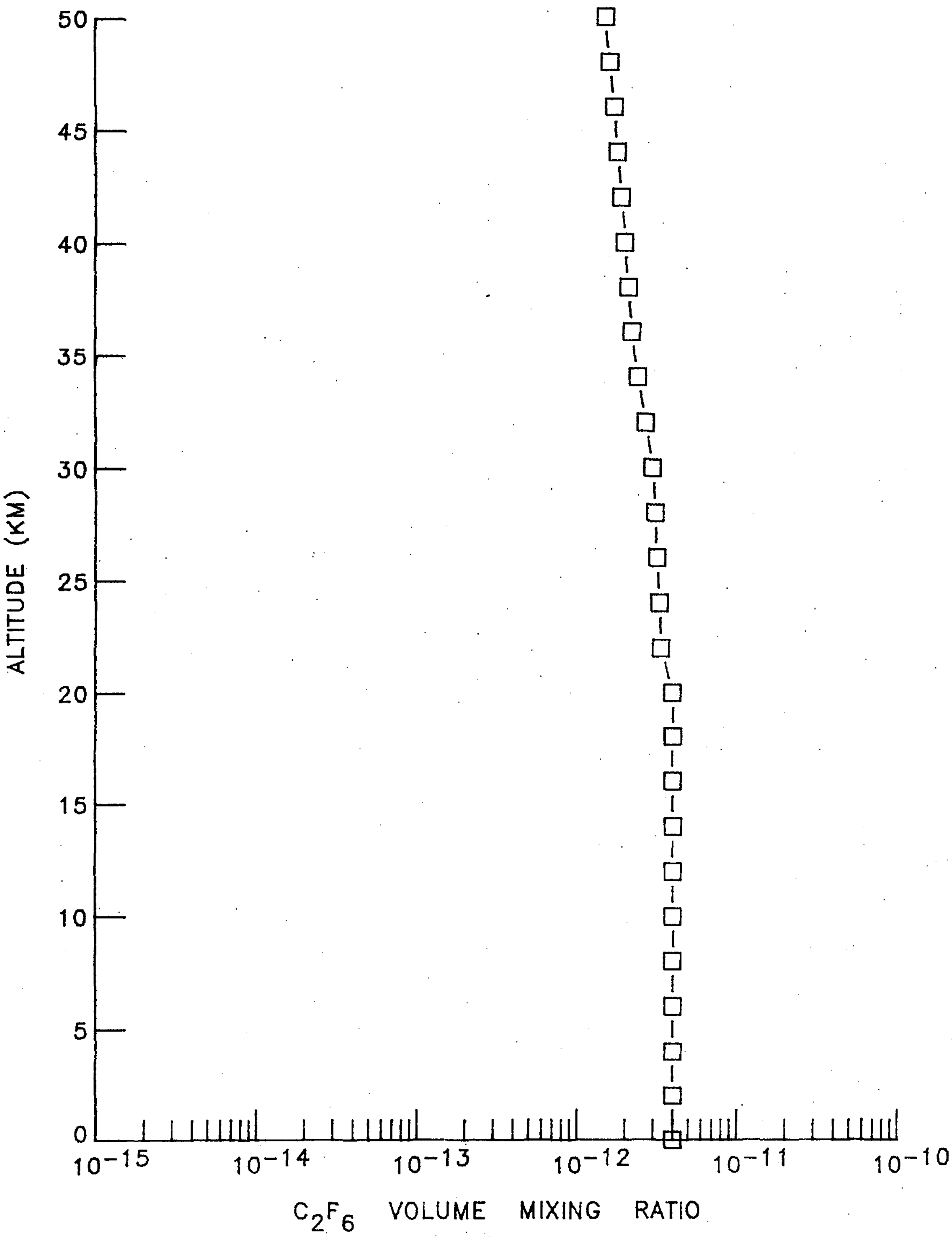
C_2F_5Cl VOLUME MIXING RATIO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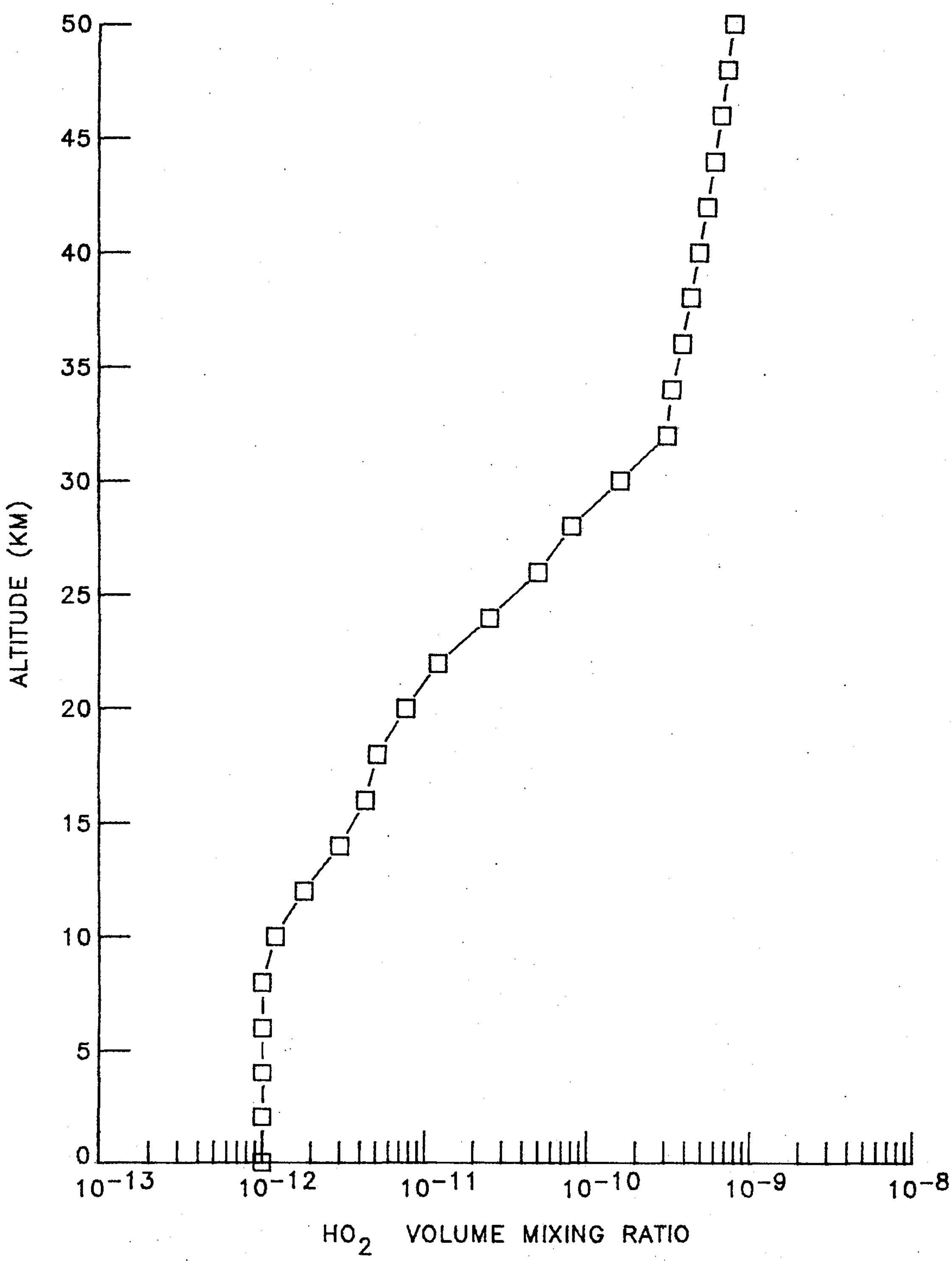
C_2F_6 VOLUME MIXING RATIO



ALTITUDE (KM)
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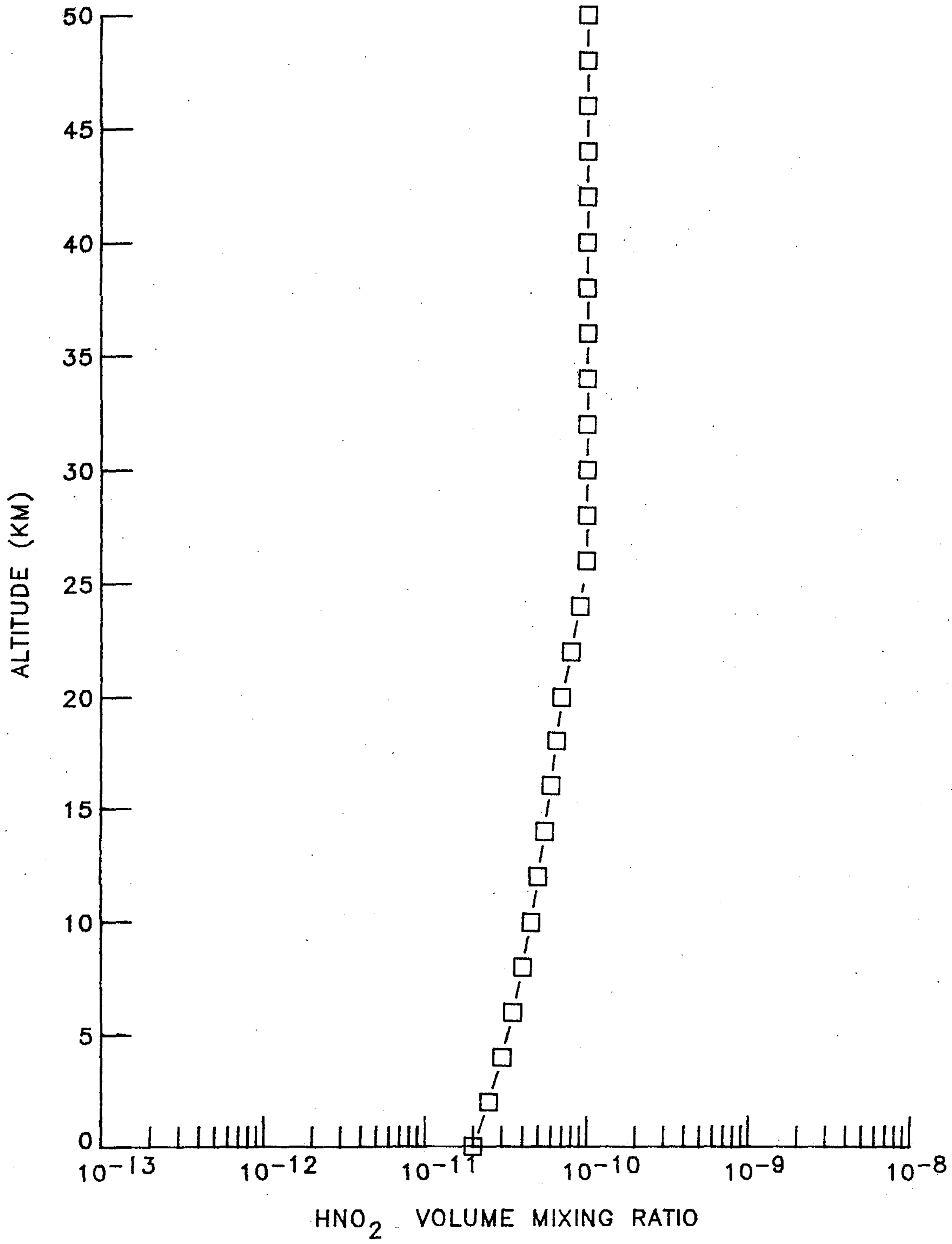
HO_2 VOLUME MIXING RATIO


ALTITUDE (KM)
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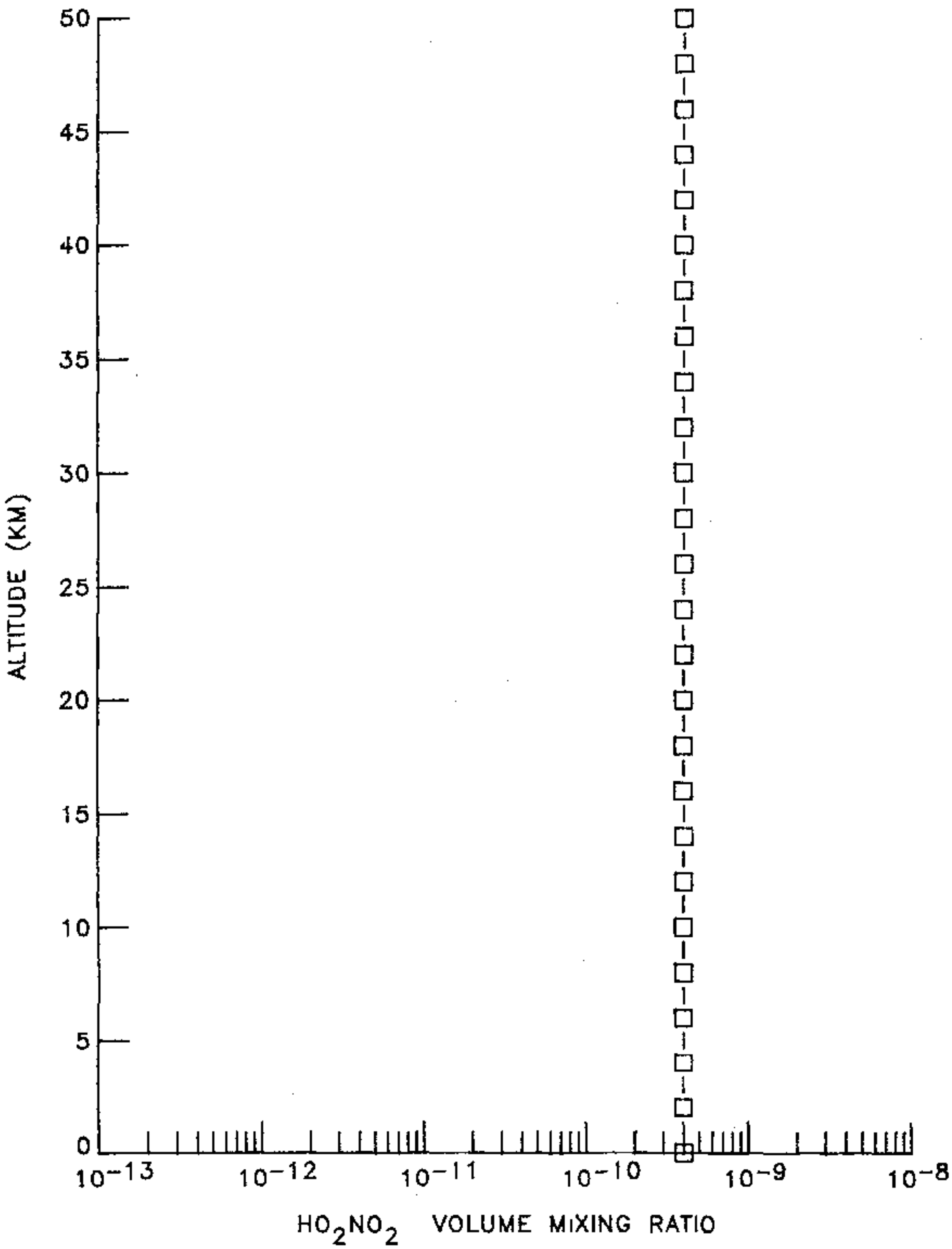
HNO_2 VOLUME MIXING RATIO


ALTITUDE (KM)
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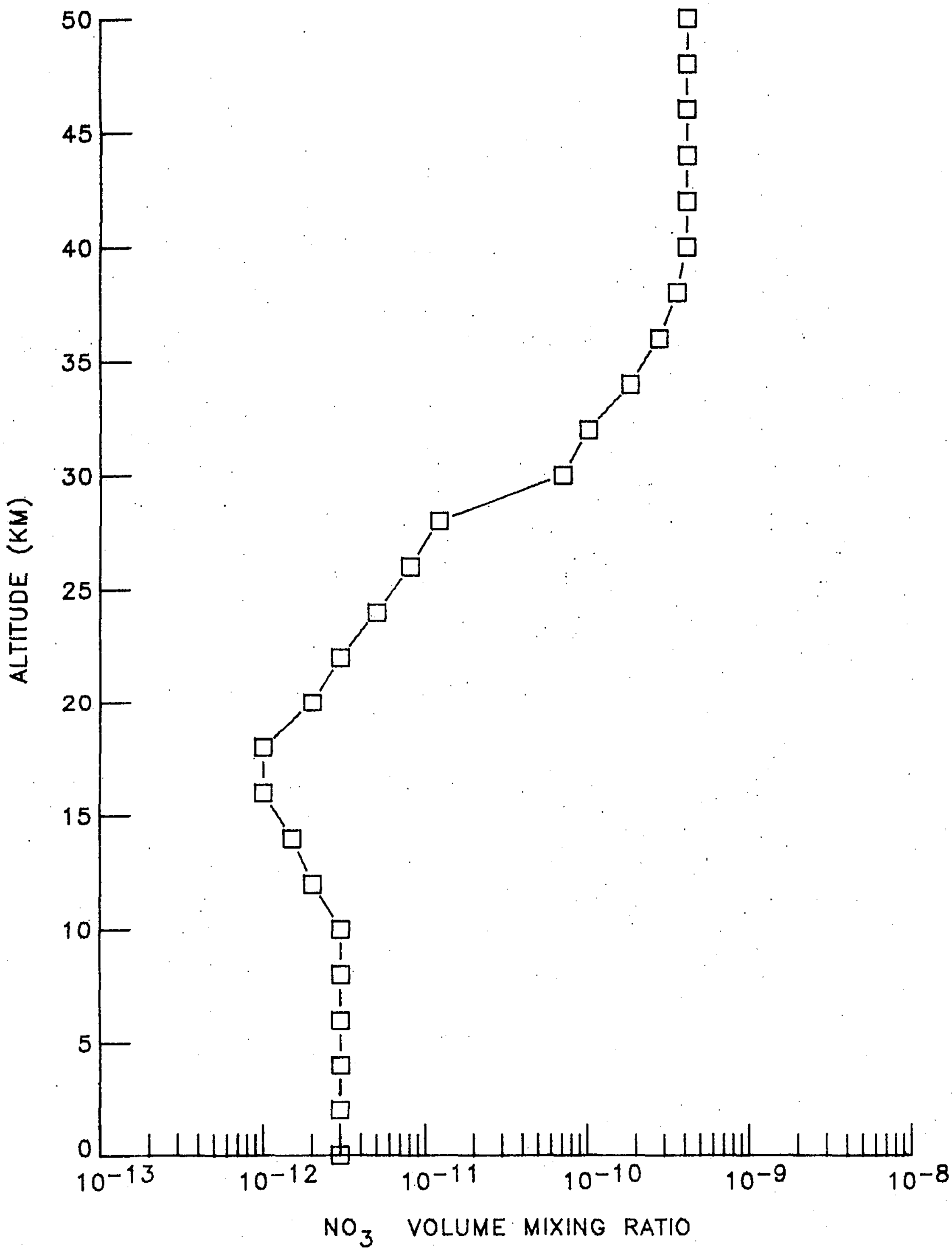
HO_2NO_2 VOLUME MIXING RATIO



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ALTITUDE (KM)
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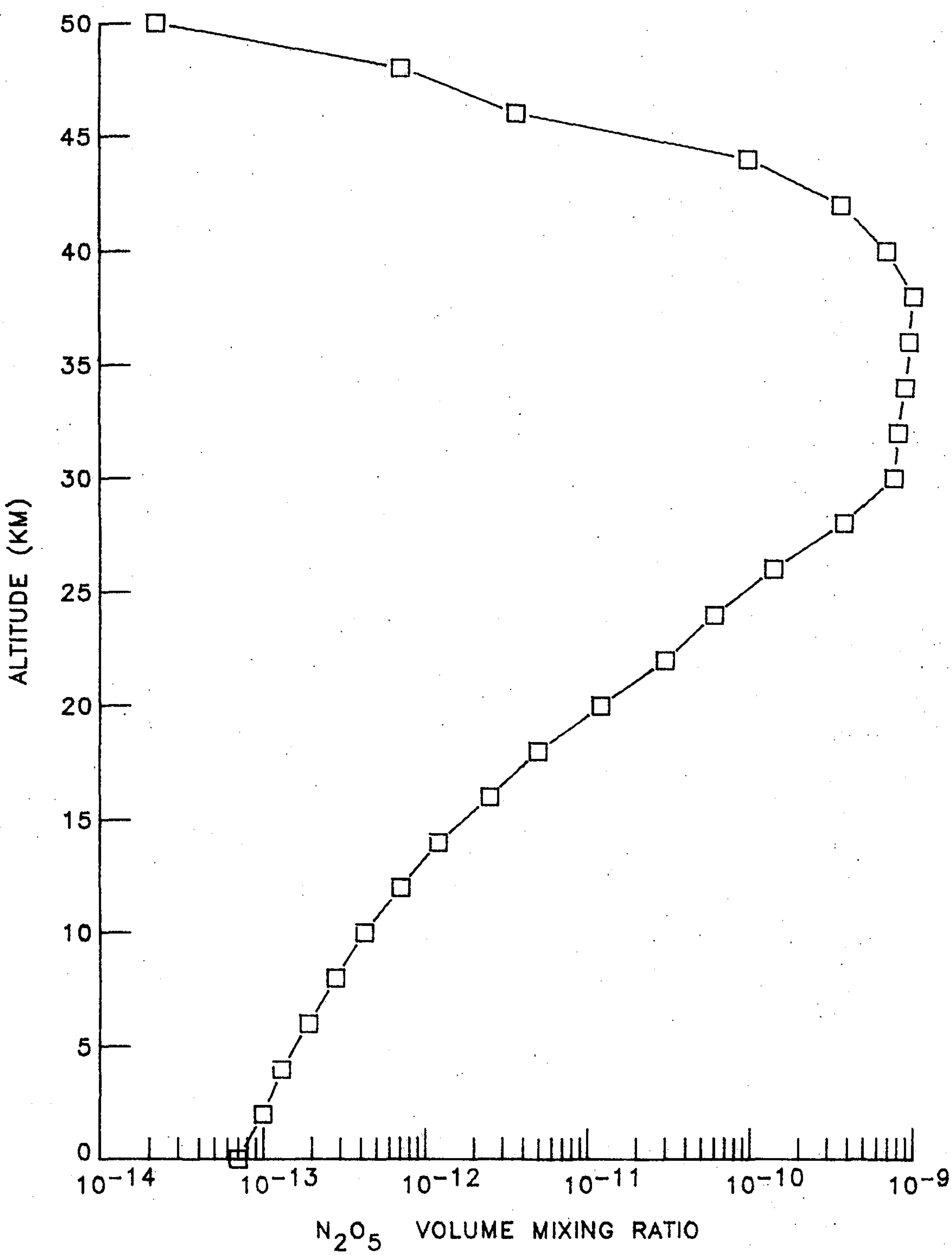
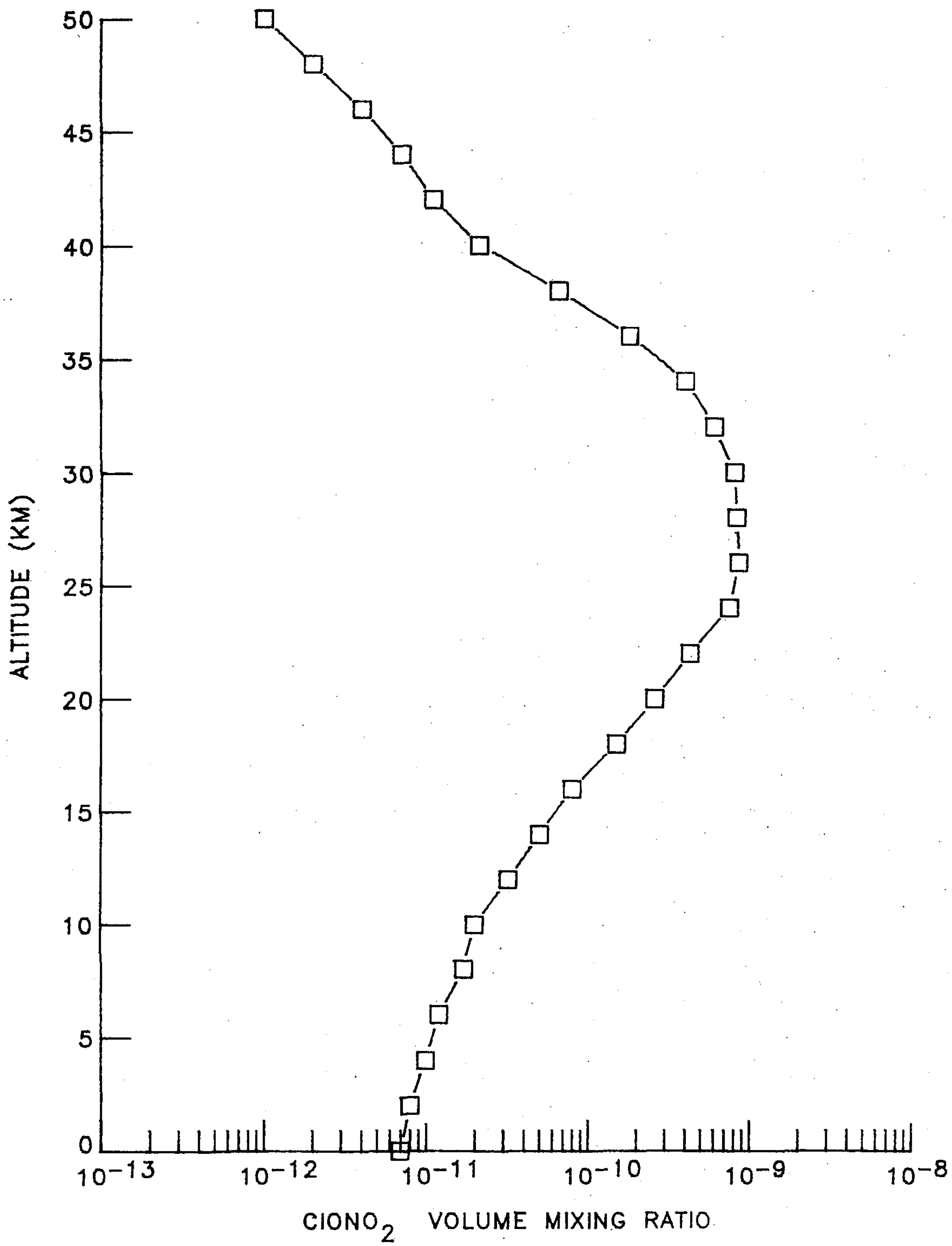
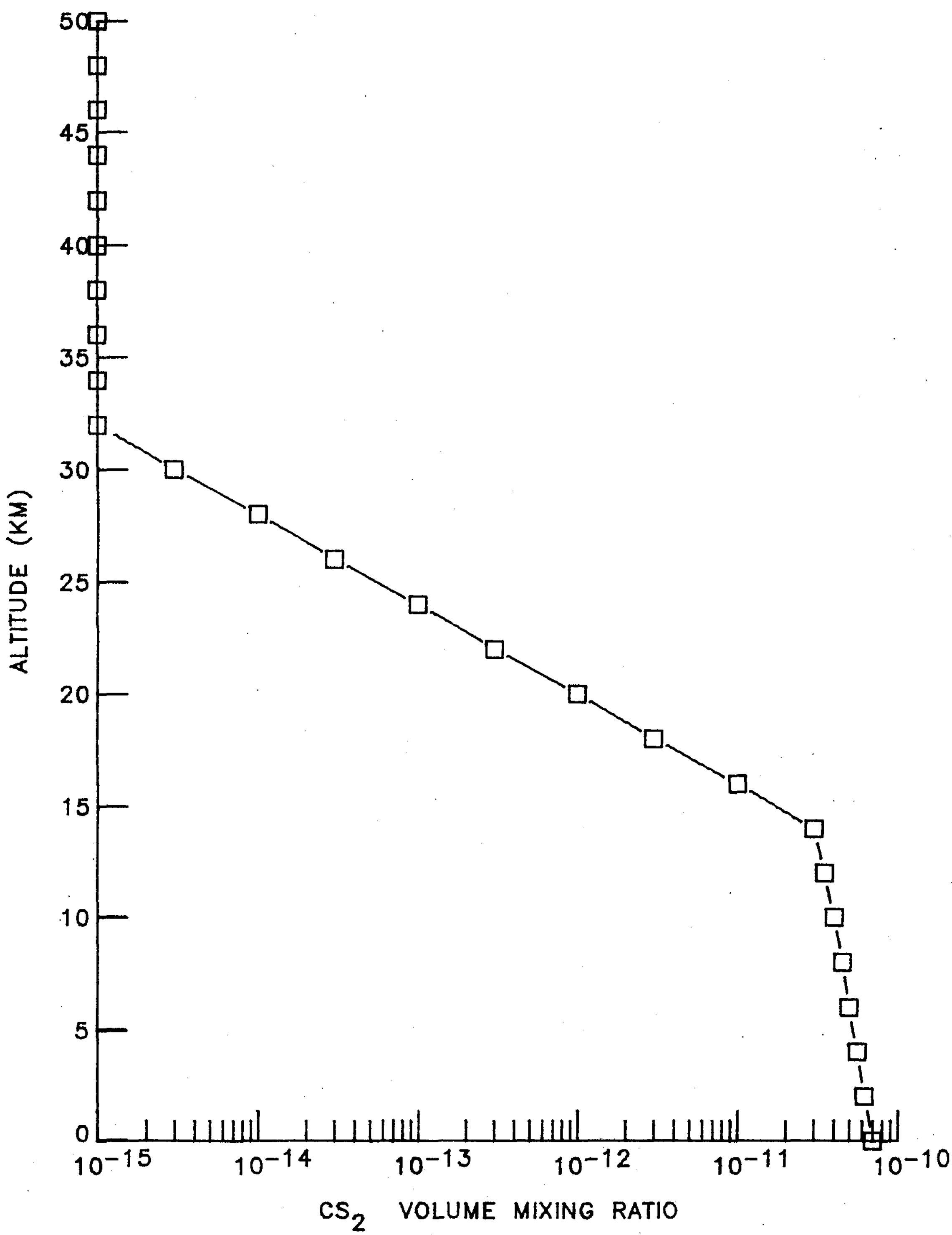
10^{-10}
10^{-9}
10^{-8}
NO_3 VOLUME MIXING RATIO

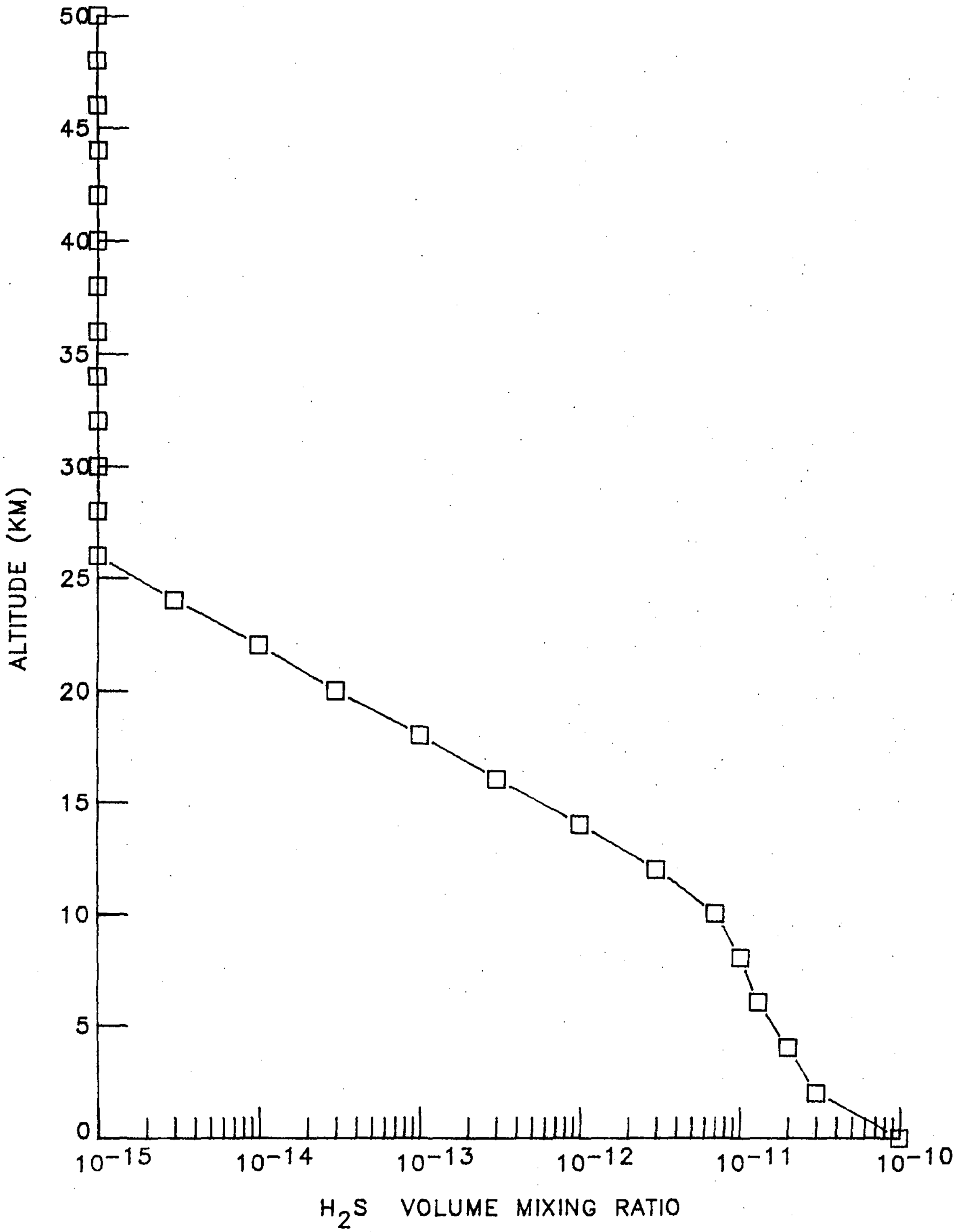


ALTITUDE (KM)
0
5
10
15
20
25
30
35
40
45
50
10^{-14}
10^{-13}
10^{-12}
10^{-11}
10^{-10}
10^{-9}
N_2O_5 VOLUME MIXING RATIO

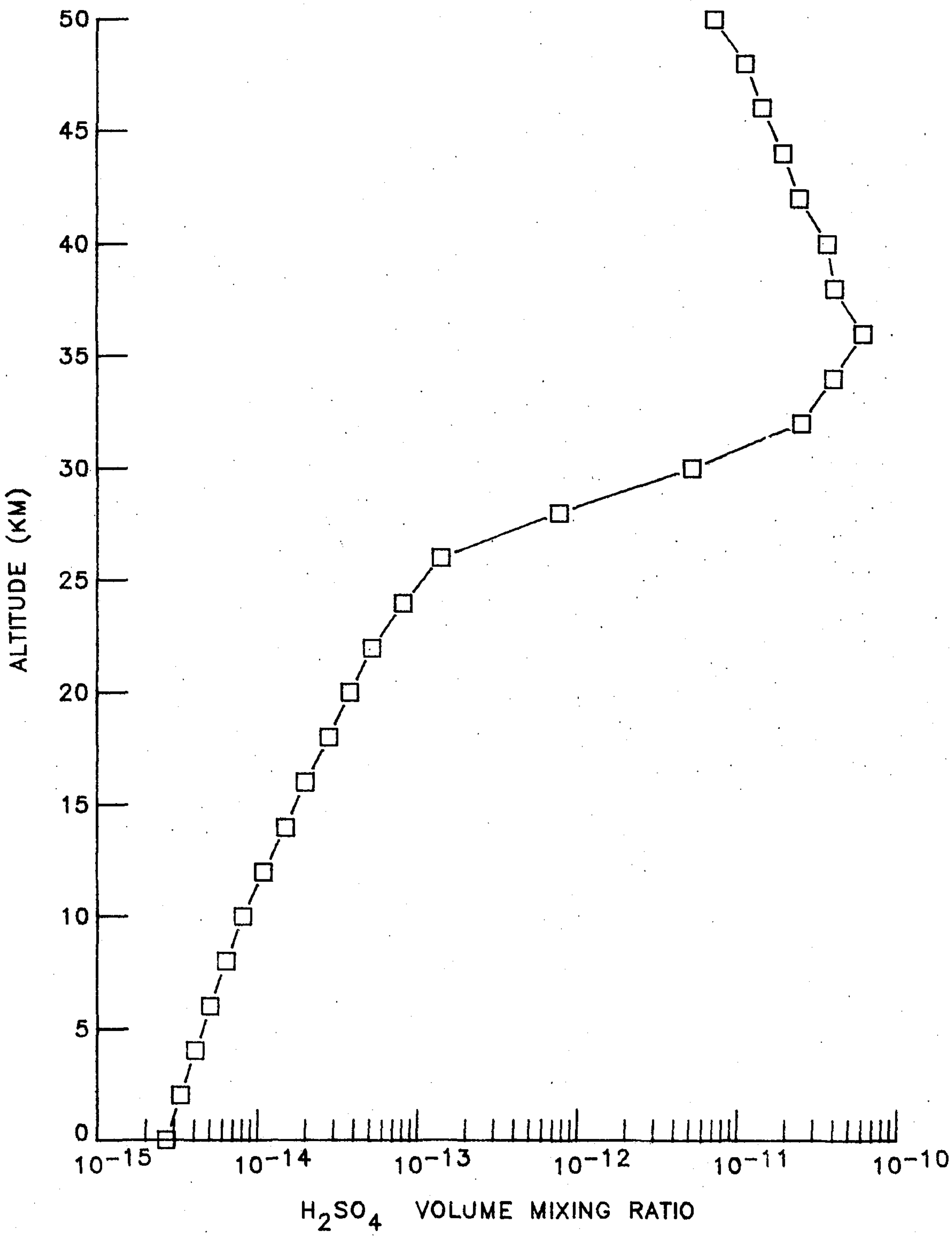

ALTITUDE (KM)
0
5
10
15
20
25
30
35
40
45
50
10^{-13}
10^{-12}
10^{-11}
10^{-10}
10^{-9}
10^{-8}
$ClONO_2$ VOLUME MIXING RATIO



ALTITUDE (KM)
50
45
40
35
30
25
20
15
10
5
0
10^{-15}
10^{-14}
10^{-13}
10^{-12}
10^{-11}
10^{-10}
CS_2 VOLUME MIXING RATIO



ALTITUDE (KM)
0
5
10
15
20
25
30
35
40
45
50
10^{-15}
10^{-14}
10^{-13}
10^{-12}
10^{-11}
10^{-10}
H_2S VOLUME MIXING RATIO


50
45
40
35
30
25
20
15
10
5
0
ALTITUDE (KM)
10^{-15}
10^{-14}
10^{-13}
10^{-12}
10^{-11}
10^{-10}
H_2SO_4 VOLUME MIXING RATIO

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16. Abstract

A set of 52 atmospheric gas concentration profiles between 0 and 50 km has been compiled as a convenient reference data set for calculation of atmospheric infrared absorption or emission signals and for initialization of iterative procedures for retrieval of gas concentrations from measured data. The distributions of volume mixing ratio as a function of altitude generally correspond to typical diurnally averaged, seasonally averaged Northern Hemisphere midlatitude gas concentration profiles. Profiles are given for all gases included in current infrared atmospheric absorption line parameter compilations, and for a number of additional important trace gases.

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