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DETERMINATION OF ATMOSPHERIC WATER VAPOR
FROM DEWPOINT MEASUREMENT

H. H. Grote

Research Facilities Center
Miami, Florida
April 1980

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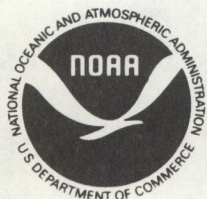
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1. INTRODUCTION

In Atmospheric Physics water vapor is one of the most important parameters besides temperature and pressure. There is, however, no method to measure the water vapor content of the atmosphere directly with the accuracy required. Thus atmospheric water vapor is frequently determined by the measurement of the dewpoint. [1], [2]. The formation of dew on a mirror surface can be controlled automatically by electro-optical means and provides a very precise measurement of the dewpoint.

This report compiles frequently used information on parameters related to water vapor and dewpoint. First the saturation vapor pressure over water is expressed by an equation that has the dewpoint as input and approximates the values given in the Smithsonian Tables. This equation forms the basis for all further discussions. An equation is given for the conversion of a measured dewpoint to equivalent dewpoint at sea level. For aircraft measurements the error in dewpoint is tabulated for differences between the actual static pressure and the measured value. Then equations for absolute and relative humidity and virtual temperature are derived. Finally curves for the Poisson constant are given.

2. DEWPOINT

2.1 General Equation

The dewpoint is defined as that temperature to which air must be cooled adiabatically at constant pressure to become saturated. At this temperature the maximum vapor pressure of water is equal to the actual partial pressure of the water vapor in the atmosphere. The relationship between the dewpoint and the saturation water vapor pressure has been tabulated by the Smithsonian Institution ([3] table 1, fig. 1), according to equations given by Goff and Gratch [4]. These equations are quite elaborate, and a simpler version is generally in use for practical computations [5], [6], [7]. This equation can be derived from the simplified equation of state

$$p \cdot v = RT \quad (1)$$

and the definition of a thermodynamic factor [2]

$$\gamma = Tv_s \frac{dp_s}{dT} \quad (2)$$

where v_s is the specific volume of the saturated vapor and p_s its pressure. This thermodynamic factor was measured by the Bureau of Standards by withdrawing saturated vapor at constant temperature through the addition of electric energy to an adiabatic calorimeter containing water in both liquid and vapor phases.

By substituting $v = \frac{RT}{p}$ from (1) in (2) we obtain

$$\frac{\gamma}{RT^2} = \frac{1}{P_s} \frac{dP_s}{dT}$$

$$\frac{d \ln P_s}{dT} = \frac{\gamma}{RT^2} \quad (3)$$

In rough approximation γ is a constant. (It varies by 10% in the region from 0° to 100°C, (as shown in table 2.) Then equation (3) can be integrated, with the saturation water vapor pressure e_o at 0°C as the reference:

$$\begin{aligned} \ln e_w - \ln e_o &= -\frac{\gamma}{R} \left(\frac{1}{T} - \frac{1}{T_o} \right) \\ \frac{e_w}{e_o} &= \varepsilon \frac{\gamma}{R} \left(\frac{1}{T_o} - \frac{1}{T} \right) \\ \frac{e_w}{e_o} &= \varepsilon \frac{\gamma}{R} \frac{T - T_o}{T * T_o} \\ \frac{e_w}{e_o} &= \varepsilon \frac{\gamma}{RT_o} \frac{t}{(T_o + t)} \end{aligned} \quad (4)$$

One could insert γ , R , and T_o into this equation. But since it was derived under simplified conditions, it is sufficient to adapt the form

$$\frac{e_w}{e_o} = \varepsilon \frac{a * t}{b + t} \quad (5)$$

and determine a and b by fitting equation (5) to the data of the Smithsonian Institution [3].

2.2 Determination of Constants

To obtain a first approximation of the constants a and b , equation (5) can be split [8]:

$$\ln \frac{e_w}{e_o} = t \frac{1}{\frac{b}{a} + \frac{t}{a}}$$

$$A + Bt = \frac{t}{\ln \frac{e_w}{e_o}} \quad (6)$$

The right side function is tabulated in table 3 and plotted in fig. 2.

Inserting values for t and p in the vicinity of $t = 0$ results in

$A = 13,762^\circ\text{C}$, $B = 0.0568$ or $a = 17.6$, $b = 242^\circ\text{C}$.

Rather than trying different constants a and b to obtain an optimum fit, it is more descriptive to change the zero crossing temperatures D_1 and D_2 . It is

$$(b + D_1) \ln \frac{e'_1}{e'_o} = a * D_1 ,$$

$$(b + D_2) \ln \frac{e'_2}{e'_o} = a * D_2 ,$$

which results in

$$b = \frac{D_1 \cdot D_2 \ln \frac{e_1}{e_o} - D_2 \cdot D_1 \ln \frac{e_2}{e_o}}{D_1 \ln \frac{e_2}{e_o} - D_2 \ln \frac{e_1}{e_o}} , \quad (7)$$

$$a = \left(1 + \frac{b}{D_1}\right) \ln \frac{e_1}{e_o} . \quad (8)$$

Some computer printouts are reproduced in Appendix 1; together with the generating program. Fig. 3 shows some error curves.

Different values of the zero crossing temperatures D_1 and D_2 have been selected. For each pair a table of the computed saturation pressure versus the dew point temperature is presented. For each value the dewpoint as determined by the Smithsonian Institution is given and the error (the difference in dewpoint values) as well as the relative error (the error divided by the dewpoint temperature) is presented.

At the top of the table the zero crossing dewpoint temperatures D_1 and D_2 are listed together with the values A, B, and C as well as E_1 and E_2 . They represent

A = e_0 from equation (5)

B = a from equation (5)

C = b from equation (5)

$E_1 = \left. \begin{array}{l} \text{saturation vapor pressure over water in millibar for dewpoint} \\ \text{temperatures } D_1 \text{ and } D_2 \end{array} \right\}$

$E_2 = \left. \begin{array}{l} \text{saturation vapor pressure over water in millibar for dewpoint} \\ \text{temperatures } D_1 \text{ and } D_2 \end{array} \right\}$

For temperatures below crossover temperature D_1 the errors are negative. For temperatures between the two crossover points D_1 and zero, the errors are positive; they become negative between zero and crossover temperature D_2 . For temperature values above D_2 the errors become positive again.

Since the largest error depends upon the selected crossover temperatures a wide selection of tables is presented, so that each user can select the table and the values of a and b best suited for his operational range.

A fairly well balanced error curve for the temperature range from - 50°C to 50°C is the one that is adjusted for zero error at -40°C and +30°C. One maximum is at 24°C with 0.15% error and the other at 17°C with - 0.08% error. Even at -50°C the error is only -0.34%. The constants for this curve are $a = 17,6459$, $b = 243.116$ [°C].

2.3 Reduction to Sea-Level

Frequently the dewpoint is referenced for sea level pressure (1013.25 mb). For a constant mixing ratio r (ratio of the mass of water vapor to the mass of dry air with which the water is associated) the relation between the saturation water vapor pressure e'_w in moist air at the total pressure P is

$$e'_w = \frac{r_w}{\alpha + r_w} P \quad (9)$$

where the constant $\alpha = 0.62198$ represents the ratio of the molecular weight of the vapor to the molecular weight of the air (18.01534/38.9645).

Combining equations (5) and (9) provides the conversion of a dewpoint D_1 measured at pressure P_1 to the dewpoint D_0 at sea level pressure P_0 :

$$\frac{P_1}{P_o} = \frac{e'}{e_o} = \frac{\epsilon \frac{a * D_1}{b + D_1}}{\epsilon \frac{a * D_o}{b + D_o}}$$

$$\ln P_1 - \ln P_o = \frac{a D_o}{b + D_o} - \frac{a D_1}{b + D_o}$$

$$D_o = \frac{b}{\frac{a}{\ln P_o - \ln P_1 + \frac{a}{\frac{b}{D_1} + 1}} - 1} \quad (10)$$

The relation is drawn in figs. 4 and 5. Polynomial approximations were tried:

$$DC = C_o + C_1 * D + C_2 * D^2 \quad (11)$$

with $C_o = E_o + E_1 * Q + E_2 * Q^2$,

$$C_1 = F_o + F_1 * Q + F_2 * Q^2$$

and $C_2 = G_o + G_1 * Q + G_2 * Q^2$

where DC is the dewpoint correction, i.e., the difference between the sea level corrected dewpoint ($P_o = 1013.25$ mbar) and the measured dewpoint at an altitude with pressure P_1 ; D is the dewpoint; and Q is the pressure ratio P_o/P_1 . The numerical values were determined to be the following:

$$E_o = -15.867$$

$$E_1 = 19.060$$

$$E_2 = -3.1102$$

$$F_o = -0.12997$$

$$F_1 = 0.15496$$

$$F_2 = -0.024356$$

$$G_o = -0.00026359$$

$$G_1 = 0.00030701$$

$$G_2 = -0.000042441.$$

With these values equation (10) is approximated by less than $\pm 0.0029^{\circ}\text{C}$ for the dewpoint temperature range from -50°C to $+50^{\circ}\text{C}$ and the pressure ratio $Q = 1.0$ through $Q = 1.3$.

Since the fit of the second-order polynomial is so excellent, a first-order approximation of the temperature relation was tried with equation (11). The result is

$$DC = C_0 + C_1 * D \quad (12)$$

with

$$C_0 = E_0 + E_1 * Q + E_2 * Q^2$$

and

$$C_1 = F_0 + F_1 * Q + F_2 * Q^2 .$$

The numerical values in equation (12) are now:

$$E_0 = -16.108$$

$$E_1 = 19.341$$

$$E_2 = -3.1491$$

$$F_0 = -0.12997$$

$$F_1 = 0.15496$$

$$F_2 = -0.024356.$$

The errors are less than $+0.106^{\circ}\text{C}$ and -0.058°C for the dewpoint temperature range from -50°C to $+50^{\circ}\text{C}$ and the pressure ration $Q = 1.0$ through $Q = 1.3$.

The computer printouts for these approximations are presented in Appendix 2 together with the generating program.

2.4 Aircraft Measurement

In aircraft measurement the pressure P at the dewpoint sensor does not generally agree with the atmospheric pressure P_a at the aircraft level because of the compression of the flow lines. The dewpoint sensor has provisions for measurement of the sensor pressure [9]. Thus, either a pressure sensor is constantly connected and monitored, or the relation between the pressure in the dewpoint sensor and the atmospheric pressure is established by test flights for different altitudes, flight speeds, angles of attack, and angles of sideslip.

The error in dewpoint for an error in total pressure can be found from equation (9):

$$e_w = \frac{r_w}{\alpha + r_w} P \quad (9)$$

$$de_w = \frac{r_w}{\alpha + r_w} P \frac{dp}{p}$$

$$\frac{de_w}{e_w} = \frac{dp}{p} \quad (13)$$

Replacing e_w by the value from equation (5) we obtain

$$e_w = e_o \varepsilon^{\frac{a * t}{b + t}}$$

$$\frac{de_w}{de} = \frac{ab}{(b + t)^2} e_w$$

and then (13) reads

$$dt = \frac{(b + t)^2}{ab} \frac{dp}{p} . \quad (14)$$

With $a = 17.6459$ and $b = 243.116^\circ\text{C}$ this becomes

$$dt = \frac{(243.116 + t)^2}{4290} \frac{dp}{p}$$

$$dt = C(t) \frac{dp}{p} . \quad (15)$$

The factor $C(t)$ is tabulated in the following.

t ($^\circ\text{C}$)	$C(t)$
30	17.39
20	16.14
10	14.93
0	13.78
-10	12.67
-20	11.60
-30	10.59
-40	9.62
-50	8.69

Pressure deviations of up to 15% can be encountered for angles of attack or sideslip of 10 degrees. The error in dewpoint is then 2.6°C for a dewpoint of 30°C and 1.3°C for a dewpoint of -50°C .

3. DETERMINATION OF ABSOLUTE HUMIDITY

Frequently the absolute humidity (the ratio of the mass of water vapor to the volume occupied by the mixture) is of interest. It can be derived from the specific humidity q (ratio of the mass m_v of water vapor to the mass $m_v + m_a$ of moist air in which the mass of water vapor m_v is contained):

$$q = \frac{m_v}{m_v + m_a} \quad (16)$$

This can be expressed as

$$q = \frac{r}{1 + r} \quad (17)$$

with r being the mixing ratio (ratio of the mass m_v of water vapor to the mass m_a of dry air). We can extract r from (9):

$$r = \frac{\alpha e}{p - e} \quad (18)$$

Inserting e'_w from equation (5) yields

$$r_w = \frac{0.62198}{\frac{p}{e_o} \epsilon - \frac{aD}{B+D} - 1} \quad (19)$$

If D is converted to sea level pressure the saturation mixing ratio over water r_w becomes

$$r_w = \frac{0.62198}{165.89 \epsilon - \frac{aD_o}{b+D_o} - 1} \quad (20)$$

This is drawn in fig. 6. Figure 7 represents the saturation mixing ratio over water for the standard atmosphere. The absolute humidity ρ (the density of water vapor in a mixture) can be approximated from the perfect gas law.

The following symbols will be used:

- e water vapor pressure
- v volume of the moist air per mass unit of dry air
- R gas constant for dry air
- R_v gas constant for water vapor
- T absolute temperature
- r mixing ratio (mass of water vapor/mass of dry air)
- α ratio of the molecular weight of water vapor M_v to that of dry air M_d .

$$\alpha = \frac{M_v}{M_d} = \frac{R}{R_v} = 0.62198 . \quad (21)$$

The equation of state for the water vapor part of the moist air is

$$e v = r R_v T = \frac{r}{\alpha} R T . \quad (22)$$

The water vapor density is then

$$\alpha = \frac{r}{v} \frac{\text{mass of water vapor}}{\text{mass of dry air}} \frac{\text{mass of dry air}}{\text{mass of moist air}} \quad (23)$$

$$\text{so that } \rho = \frac{\alpha e}{R t} . \quad (24)$$

For T in degrees K and

$$R = 2871 * 10^{-6} \frac{\text{mb m}^3}{\text{g } ^\circ\text{K}}$$

ρ is obtained in $\frac{\text{g}}{\text{m}^3}$.

Inserting (5) for ϵ results in

$$\rho = \frac{\alpha e_o}{RT} \epsilon^{\frac{a*D}{b+D}}$$

with

$$\alpha = 0.62198$$

$$e_o = 6.1078 \text{ [mb]}$$

$$r = 2871 * 10^{-6} \text{ [mbm}^3/(\text{g } ^\circ\text{K})]$$

$$t_o = 273.16 \text{ [}^\circ\text{C]}$$

$$t = \text{air temperature [}^\circ\text{C]} .$$

Equation (24) can be written

$$\rho = \frac{A'}{T_o + t} \epsilon^{\frac{a*D}{d+D}} \quad (25)$$

where

$$A' = 1323.2 \text{ [g } ^\circ\text{K/m}^3]$$

For water vapor saturation $t = D$ the Smithsonian Institution [3] gives a water content of 4.847 g/m^3 for $t = 0^\circ\text{C}$. This results in a value of $A = 1324.0 \text{ [g } ^\circ\text{K/m}^3]$. This constant will then be used for further calculations.

Equation (25) was then compared at water vapor saturation ($t = D$) against the Smithsonian Institution [3]. For the previously used

constants $a = 17.6459$ and $b = 243.116$ ($^{\circ}\text{C}$), the error in water vapor density is $\begin{matrix} + 0.29 \\ - 0.18 \end{matrix} \frac{\text{g}}{\text{m}^3}$ for temperatures from -50°C to $+50^{\circ}\text{C}$ (see tables 5a and 5b and Figs. 8 and 9). Thus, the same constants can be used for water vapor pressure e and densities. If both are computed in the same process we can write

$$e = e_o \varepsilon^{\frac{a*D}{b+D}} \quad (5)$$

$$\rho = \frac{Ce}{T_o + t} \quad (26)$$

with $C = 216.77$ [$\text{g } ^{\circ}\text{C}/\text{m}^3\text{mb}$].

If only the saturation vapor density ρ_s is computed the simpler approximation

$$\rho_s = E \varepsilon^{\frac{c*D}{d+D}} \quad (27)$$

can be used with $E = 4.847$ [g/m^3].

For $c = 16.3282$ and $d = 236.88$ ($^{\circ}\text{C}$) the error in saturation vapor density is less than $\pm 0.5\%$ for temperatures from -50°C to $+50^{\circ}\text{C}$. (see table 6).

The sensitivity in the determination of the water vapor density with the temperature is drawn fig. 10 in absolute values of the water vapor density; fig. 11 shows the percentage change in water vapor density for a temperature change.

4. DETERMINATION OF RELATIVE HUMIDITY

For some purposes the relative humidity U (in percent of moist air) has to be known. It is defined by

$$U = 100 \frac{r}{r_w} \quad (28)$$

where r is the mixing ratio of moist air at pressure P and temperature t , and r_w is the saturation mixing ratio at the same temperature and pressure. For constant pressure the mixing ratio r of the moist air at temperature t is equal to the saturation mixing ratio r_d at the dewpoint. Thus, equation (28) can be written

$$U = 100 \frac{r_d}{r_w} \quad (29)$$

With (18) this can be reformulated:

$$U = 100 \frac{\alpha e}{p-e} \frac{P-e_w}{\alpha e_w}$$

$$U = 100 \frac{e}{e_w} \frac{P-e_w}{P-e} \quad (30)$$

For the standard atmosphere, $\frac{e_w}{P}$ is about 1.7% at sea level and diminishes to 0.2% at 500 mbar (fig. 12). Thus, the second quotient can be neglected:

$$U = 100 \frac{e}{e_w} \quad (31)$$

Combined with (5) this results in

$$U + 100 * \varepsilon \frac{ab(D-t)}{(b+D)(b+t)} \quad (32)$$

when D is the dew point in °C, t the air temperature in °C, and ε the basis of the natural logarithm.

In fig. 13 the dewpoint depression D-t is drawn for different relative humidities.

5. VIRTUAL TEMPERATURE

The virtual temperature T_v is defined as the temperature that dry air must have at a given barometric pressure P in order to have the same density as moist air at the same pressure P and given temperature T.

If the dry and moist air behave in accordance with the perfect gas equation of state,

$$T_v = T \frac{1+\frac{r}{\alpha}}{1+r} \quad (33)$$

where r is the mixing ratio (mass of water vapor per mass of dry air), and α is the ratio of the molecular weight of water vapor to that of dry air.

With equation (18) this can be expressed by

$$T_v = \frac{T}{1 - (1-\alpha) \frac{e}{p}} \quad (34)$$

For saturated air the virtual temperature increment $T_v - T$ can thus be determined. More accurate determinations of the virtual temperature increment are described in Smithsonian tables [3] under consideration of the deviations from the perfect gas law. From these tables the virtual temperature increment y of saturated air can be determined for the standard atmosphere. This relation is plotted in fig. 14, and an approximation of

$$Y = 1.9 * 10^{-6} P^2 - 0.147 \quad (35)$$

is found for the region of interest, with P being the atmospheric pressure in [mbar] and Y in degrees [K].

6. POISSON CONSTANT

In the determination of the air speed of an airplane from the measured static and dynamic pressure, the thermodynamic properties of the air have to be considered by the Poisson Constant γ . For dry air γ is the ratio of the specific heat at constant pressure c_{pd} to the specific heat at constant volume c_{vd} . For moist air

$$\gamma = \frac{c_{pd} + c_{pv} \frac{e}{p-e} \frac{rd}{rv}}{c_{vd} + c_{vv} \frac{e}{p-e} \frac{rd}{rv}} \quad (36)$$

where c_{pv} is the specific heat at constant pressure of water vapor

c_{vd} is the specific heat at constant volume of water vapor

r_d is the specific gas constant for dry air

r_v is the specific gas constant for water vapor

e is the water vapor pressure

p is the barometric pressure

with $c_{pd} = 1006$ [joule/kg]

$c_{pv} = 1931$ [joule/kg]

$c_{vd} = 717$ [joule/kg]

$c_{vv} = 1470$ [joule/kg]

$r_d = 287.04$ [m²/(sec² K)]

$r_v = 461.50$ [m²/(sec² K)].

Figure 15 presents the Poisson Constant as a function of the ratio $\frac{p}{e}$.

Since saturation pressure e_w and dewpoint D are uniquely related, static pressure/dewpoint curves can be drawn for constant ratios of static pressure p to saturation vapor pressure e_w (fig. 16). The curve for the standard atmosphere is shown in dashed lines. Each $p e_w$ curve contains the value of the Poisson Constant γ .

7. REFERENCES

1. Tetens, Otto: Über einige meteorologische Begriffe. Zeitschrift für Geophysik. Vol. 6, pp. 297-309, 1930.
2. Parish, O. D., and T. W. Putnam: Equation for the Determination of Humidity from Dewpoint and Psychrometric Data. NASA Technical Note NASA TN-D-8401, January 1977. Dryden Flight Research Center, Edwards, Calif. 93523.
3. Smithsonian Institution: Smithsonian Meteorological Tables, Sixth Revised Edition, 1966. Smithsonian Institution, Washington, D.C.
4. Goff, J. A., and S. Gratch: Low-Pressure Properties of Water from -160 to 212 F. pp. 95-123. Proceedings of the 52 Annual Meeting of the American Society of Heating and Ventilating Engineers, New York, January 1946.
5. Shaw, Napier: Manual of Meteorology, Volume III (the Physical Processes of Weather). pp. 236-242. The University Press, Cambridge, 1930.
6. Belinski, V. A.: Dynamic Meteorology. pp. 54.57. State Publishing House of Technical Theoretical Literature, Moscow, 1948.
7. Sternzat, M. S.: Instruments and Methods for Meteorological Observation. pp. 207-210. Israel Program for Scientific Translations, Jerusalem, 1963.

8. Thayer, G.: National Oceanic and Atmospheric Administration, Environmental Laboratories, Boulder, Colo. 80303. Private communication. 1974.
9. Ruskin, Robert E.: Measurement of Atmospheric Dewpoint from Aircraft. NRL 6725. 16 pages. Naval Research Lab., Washington, D. C. 1968.

RELATED TABLES AND FIGURES

SATURATION VAPOR PRESSURE OVER WATER

Temperature °C.	Metric units									
	.0	.1	.2	.3	.4	.5	.6	.7	.8	.9
	mb.	mb.	mb.	mb.	mb.	mb.	mb.	mb.	mb.	mb.
-50	0.06356									
-49	0.07124	0.07044	0.06964	0.06885	0.06807	0.06730	0.06654	0.06578	0.06503	0.06429
-48	0.07975	0.07886	0.07797	0.07710	0.07624	0.07538	0.07453	0.07370	0.07287	0.07205
-47	0.08918	0.08819	0.08722	0.08625	0.08530	0.08435	0.08341	0.08248	0.08156	0.08065
-46	0.09961	0.09852	0.09744	0.09637	0.09531	0.09426	0.09322	0.09220	0.09118	0.09017
-45	0.1111	0.1099	0.1087	0.1075	0.1063	0.1052	0.1041	0.1030	0.1018	0.1007
-44	0.1239	0.1226	0.1213	0.1200	0.1187	0.1174	0.1161	0.1149	0.1136	0.1123
-43	0.1379	0.1364	0.1350	0.1335	0.1321	0.1307	0.1293	0.1279	0.1266	0.1252
-42	0.1534	0.1518	0.1502	0.1486	0.1470	0.1455	0.1440	0.1424	0.1409	0.1394
-41	0.1704	0.1686	0.1669	0.1651	0.1634	0.1617	0.1600	0.1583	0.1567	0.1550
-40	0.1891	0.1872	0.1852	0.1833	0.1815	0.1796	0.1777	0.1759	0.1740	0.1722
-39	0.2097	0.2076	0.2054	0.2033	0.2013	0.1992	0.1971	0.1951	0.1931	0.1911
-38	0.2323	0.2299	0.2276	0.2253	0.2230	0.2207	0.2185	0.2162	0.2140	0.2119
-37	0.2571	0.2545	0.2520	0.2494	0.2469	0.2444	0.2419	0.2395	0.2371	0.2347
-36	0.2842	0.2814	0.2786	0.2758	0.2730	0.2703	0.2676	0.2649	0.2623	0.2597
-35	0.3139	0.3108	0.3077	0.3047	0.3017	0.2987	0.2957	0.2928	0.2899	0.2870
-34	0.3463	0.3429	0.3396	0.3362	0.3330	0.3297	0.3265	0.3233	0.3201	0.3170
-33	0.3818	0.3781	0.3745	0.3708	0.3673	0.3637	0.3602	0.3567	0.3532	0.3497
-32	0.4205	0.4165	0.4125	0.4085	0.4046	0.4007	0.3968	0.3930	0.3893	0.3855
-31	0.4628	0.4584	0.4541	0.4497	0.4454	0.4412	0.4370	0.4328	0.4287	0.4246
-30	0.5088	0.5040	0.4993	0.4946	0.4899	0.4853	0.4807	0.4762	0.4717	0.4672
-29	0.5589	0.5537	0.5485	0.5434	0.5383	0.5333	0.5283	0.5234	0.5185	0.5136
-28	0.6134	0.6077	0.6021	0.5966	0.5911	0.5856	0.5802	0.5748	0.5694	0.5642
-27	0.6727	0.6666	0.6605	0.6544	0.6484	0.6425	0.6366	0.6307	0.6249	0.6191
-26	0.7371	0.7304	0.7238	0.7172	0.7107	0.7042	0.6978	0.6914	0.6851	0.6789
-25	0.8070	0.7997	0.7926	0.7854	0.7783	0.7713	0.7643	0.7574	0.7506	0.7438
-24	0.8827	0.8748	0.8671	0.8593	0.8517	0.8441	0.8366	0.8291	0.8217	0.8143
-23	0.9649	0.9564	0.9479	0.9396	0.9313	0.9230	0.9148	0.9067	0.8986	0.8906
-22	1.0538	1.0446	1.0354	1.0264	1.0173	1.0084	0.9995	0.9908	0.9821	0.9734
-21	1.1500	1.1400	1.1301	1.1203	1.1106	1.1009	1.0913	1.0818	1.0724	1.0631
-20	1.2540	1.2432	1.2325	1.2219	1.2114	1.2010	1.1906	1.1804	1.1702	1.1600
-19	1.3664	1.3548	1.3432	1.3318	1.3204	1.3091	1.2979	1.2868	1.2758	1.2648
-18	1.4877	1.4751	1.4627	1.4503	1.4381	1.4259	1.4138	1.4018	1.3899	1.3781
-17	1.6186	1.6051	1.5916	1.5783	1.5650	1.5519	1.5389	1.5259	1.5131	1.5003
-16	1.7597	1.7451	1.7306	1.7163	1.7020	1.6879	1.6738	1.6599	1.6460	1.6323
-15	1.9118	1.8961	1.8805	1.8650	1.8496	1.8343	1.8191	1.8041	1.7892	1.7744
-14	2.0755	2.0586	2.0418	2.0251	2.0085	1.9921	1.9758	1.9596	1.9435	1.9276
-13	2.2515	2.2333	2.2153	2.1973	2.1795	2.1619	2.1444	2.1270	2.1097	2.0925
-12	2.4409	2.4213	2.4019	2.3826	2.3635	2.3445	2.3256	2.3069	2.2883	2.2698
-11	2.6443	2.6233	2.6024	2.5817	2.5612	2.5408	2.5205	2.5004	2.4804	2.4606
-10	2.8627	2.8402	2.8178	2.7956	2.7735	2.7516	2.7298	2.7082	2.6868	2.6655
-9	3.0971	3.0729	3.0489	3.0250	3.0013	2.9778	2.9544	2.9313	2.9082	2.8854
-8	3.3484	3.3225	3.2967	3.2711	3.2457	3.2205	3.1955	3.1706	3.1459	3.1214
-7	3.6177	3.5899	3.5623	3.5349	3.5077	3.4807	3.4539	3.4272	3.4008	3.3745
-6	3.9061	3.8764	3.8468	3.8175	3.7883	3.7594	3.7307	3.7021	3.6738	3.6456
-5	4.2148	4.1830	4.1514	4.1200	4.0888	4.0579	4.0271	3.9966	3.9662	3.9361
-4	4.5451	4.5111	4.4773	4.4437	4.4103	4.3772	4.3443	4.3116	4.2791	4.2468
-3	4.8981	4.8617	4.8256	4.7897	4.7541	4.7187	4.6835	4.6486	4.6138	4.5794
-2	5.2753	5.2364	5.1979	5.1595	5.1214	5.0836	5.0460	5.0087	4.9716	4.9347
-1	5.6780	5.6365	5.5953	5.5544	5.5138	5.4734	5.4333	5.3934	5.3538	5.3144
-0	6.1078	6.0636	6.0196	5.9759	5.9325	5.8894	5.8466	5.8040	5.7617	5.7197

(continued)

SMITHSONIAN METEOROLOGICAL TABLES

Table 1a

SATURATION VAPOR PRESSURE OVER WATER

Temperature °C.	Metric units									
	.0	.1	.2	.3	.4	.5	.6	.7	.8	.9
0	6.1078	6.1523	6.1971	6.2422	6.2876	6.3333	6.3793	6.4256	6.4721	6.5190
1	6.5662	6.6137	6.6614	6.7095	6.7579	6.8065	6.8556	6.9049	6.9545	7.0044
2	7.0547	7.1053	7.1562	7.2074	7.2590	7.3109	7.3631	7.4157	7.4685	7.5218
3	7.5753	7.6291	7.6833	7.7379	7.7928	7.8480	7.9036	7.9595	8.0158	8.0724
4	8.1294	8.1868	8.2445	8.3026	8.3610	8.4198	8.4789	8.5384	8.5983	8.6586
5	8.7192	8.7802	8.8416	8.9033	8.9655	9.0280	9.0909	9.1542	9.2179	9.2820
6	9.3465	9.4114	9.4766	9.5423	9.6083	9.6748	9.7416	9.8089	9.8765	9.9446
7	10.013	10.082	10.151	10.221	10.291	10.362	10.433	10.505	10.577	10.649
8	10.722	10.795	10.869	10.943	11.017	11.092	11.168	11.243	11.320	11.397
9	11.474	11.552	11.630	11.708	11.787	11.867	11.947	12.027	12.108	12.190
10	12.272	12.355	12.438	12.521	12.606	12.690	12.775	12.860	12.946	13.032
11	13.119	13.207	13.295	13.383	13.472	13.562	13.652	13.742	13.833	13.925
12	14.017	14.110	14.203	14.297	14.391	14.486	14.581	14.678	14.774	14.871
13	14.969	15.067	15.166	15.266	15.365	15.466	15.567	15.669	15.771	15.874
14	15.977	16.081	16.186	16.291	16.397	16.503	16.610	16.718	16.826	16.935
15	17.044	17.154	17.264	17.376	17.487	17.600	17.713	17.827	17.942	18.057
16	18.173	18.290	18.407	18.524	18.643	18.762	18.882	19.002	19.123	19.245
17	19.367	19.490	19.614	19.739	19.864	19.990	20.117	20.244	20.372	20.501
18	20.630	20.760	20.891	21.023	21.155	21.288	21.422	21.556	21.691	21.827
19	21.964	22.101	22.240	22.379	22.518	22.659	22.800	22.942	23.085	23.229
20	23.373	23.518	23.664	23.811	23.959	24.107	24.256	24.406	24.557	24.709
21	24.861	25.014	25.168	25.323	25.479	25.635	25.792	25.950	26.109	26.269
22	26.430	26.592	26.754	26.918	27.082	27.247	27.413	27.580	27.748	27.916
23	28.086	28.256	28.428	28.600	28.773	28.947	29.122	29.298	29.475	29.652
24	29.831	30.011	30.191	30.373	30.555	30.739	30.923	31.109	31.295	31.483
25	31.671	31.860	32.050	32.242	32.434	32.627	32.821	33.016	33.212	33.410
26	33.608	33.807	34.008	34.209	34.411	34.615	34.820	35.025	35.232	35.440
27	35.649	35.859	36.070	36.282	36.495	36.709	36.924	37.140	37.358	37.576
28	37.796	38.017	38.239	38.462	38.686	38.911	39.137	39.365	39.594	39.824
29	40.055	40.287	40.521	40.755	40.991	41.228	41.466	41.705	41.945	42.187
30	42.430	42.674	42.919	43.166	43.414	43.663	43.913	44.165	44.418	44.672
31	44.927	45.184	45.442	45.701	45.961	46.223	46.486	46.750	47.016	47.283
32	47.551	47.820	48.091	48.364	48.637	48.912	49.188	49.466	49.745	50.025
33	50.307	50.590	50.874	51.160	51.447	51.736	52.026	52.317	52.610	52.904
34	53.200	53.497	53.796	54.096	54.397	54.700	55.004	55.310	55.617	55.926
35	56.236	56.548	56.861	57.176	57.492	57.810	58.129	58.450	58.773	59.097
36	59.422	59.749	60.077	60.407	60.739	61.072	61.407	61.743	62.081	62.421
37	62.762	63.105	63.450	63.796	64.144	64.493	64.844	65.196	65.550	65.906
38	66.264	66.623	66.985	67.347	67.712	68.078	68.446	68.815	69.186	69.559
39	69.934	70.310	70.688	71.068	71.450	71.833	72.218	72.605	72.994	73.385
40	73.777	74.171	74.568	74.966	75.365	75.767	76.170	76.575	76.982	77.391
41	77.802	78.215	78.630	79.046	79.465	79.885	80.307	80.731	81.157	81.585
42	82.015	82.447	82.881	83.316	83.754	84.194	84.636	85.079	85.525	85.973
43	86.423	86.875	87.329	87.785	88.243	88.703	89.165	89.629	90.095	90.564
44	91.034	91.507	91.981	92.458	92.937	93.418	93.901	94.386	94.874	95.363
45	95.855	96.349	96.845	97.343	97.844	98.347	98.852	99.359	99.869	100.38
46	100.89	101.41	101.93	102.45	102.97	103.50	104.03	104.56	105.09	105.62
47	106.16	106.70	107.24	107.78	108.33	108.88	109.43	109.98	110.54	111.10
48	111.66	112.22	112.79	113.36	113.93	114.50	115.07	115.65	116.23	116.81
49	117.40	117.99	118.58	119.17	119.77	120.37	120.97	121.57	122.18	122.79
50	123.40	124.01	124.63	125.25	125.87	126.49	127.12	127.75	128.38	129.01

(continued)

SMITHSONIAN METEOROLOGICAL TABLES

Table 1b

Values of γ (Int.Joule/G)

$t(^{\circ}\text{C})$	NBS (Weighted Mean)
0	2500.72
1	2497.92
5	2488.34
10	2476.73
15	2464.81
20	2453.36
25	2441.31
30	2429.43
40	2405.87
50	2381.85
60	2357.65
70	2333.40
80	2308.51
90	2283.45
100	2257.73

Table 2 Thermodynamic Factor.

Approximation Curve for Values of
the Dew Point in the Smithsonian Tables

t $^{\circ}\text{C}$	e mb	$\frac{t}{\ln \frac{e}{e_0}}$ $^{\circ}\text{C}$
-3.5	4.7187	13.5641
-3.0	4.8981	13.5919
-2.5	5.0836	13.6205
-2.0	5.2753	13.6490
-1.5	5.4734	13.6778
-1.0	5.6780	13.7047
-0.8	5.7617	13.7141
-0.6	5.8466	13.7280
-0.5	5.8894	13.7315
-0.4	5.9325	13.7358
-0.3	5.9759	13.7413
-0.2	6.1096	13.7496
-0.1	6.0636	13.7685
0	6.1078	
0.1	6.1523	13.7753
0.2	6.1971	13.7790
0.3	6.2422	13.7829
0.4	6.2876	13.7870
0.5	6.3333	13.7913
0.6	6.3793	13.7957
0.8	6.4721	13.8088
1.0	6.5662	13.8181
1.5	6.8066	13.8471
2.0	7.0547	13.8766
2.5	7.3109	13.9044
3.0	7.5753	13.9323
3.5	7.8480	13.9614

Table 3

TABLE 108

DENSITY OF PURE WATER VAPOR AT SATURATION OVER WATER

Tem- pera- ture °C.	.0	.1	.2	.3	.4	.5	.6	.7	.8	.9
	g. m. ⁻³	g. m. ⁻³	g. m. ⁻³	g. m. ⁻³	g. m. ⁻³	g. m. ⁻³	g. m. ⁻³	g. m. ⁻³	g. m. ⁻³	g. m. ⁻³
-50	0.06171									
-49	0.06886	0.06812	0.06738	0.06664	0.06592	0.06520	0.06449	0.06378	0.06309	0.06240
-48	0.07675	0.07592	0.07510	0.07430	0.07350	0.07270	0.07191	0.07115	0.07038	0.06961
-47	0.08544	0.08453	0.08364	0.08274	0.08187	0.08099	0.08013	0.07927	0.07842	0.07758
-46	0.09501	0.09402	0.09303	0.09205	0.09107	0.09011	0.08915	0.08822	0.08728	0.08635
-45	0.1055	0.1044	0.1033	0.1022	0.1011	0.1001	0.09912	0.09812	0.09702	0.09601
-44	0.1172	0.1160	0.1148	0.1136	0.1124	0.1112	0.1101	0.1090	0.1078	0.1066
-43	0.1298	0.1285	0.1272	0.1258	0.1246	0.1233	0.1220	0.1208	0.1196	0.1183
-42	0.1438	0.1424	0.1409	0.1395	0.1380	0.1367	0.1353	0.1339	0.1325	0.1312
-41	0.1590	0.1574	0.1559	0.1543	0.1528	0.1512	0.1497	0.1482	0.1468	0.1452
-40	0.1757	0.1740	0.1723	0.1706	0.1690	0.1673	0.1656	0.1640	0.1623	0.1606
-39	0.1940	0.1922	0.1902	0.1884	0.1866	0.1847	0.1829	0.1811	0.1793	0.1775
-38	0.2141	0.2119	0.2099	0.2079	0.2058	0.2038	0.2019	0.1998	0.1979	0.1960
-37	0.2359	0.2336	0.2314	0.2291	0.2269	0.2247	0.2225	0.2204	0.2183	0.2162
-36	0.2597	0.2572	0.2548	0.2523	0.2499	0.2475	0.2451	0.2428	0.2405	0.2382
-35	0.2856	0.2829	0.2802	0.2776	0.2750	0.2723	0.2697	0.2672	0.2647	0.2621
-34	0.3138	0.3108	0.3080	0.3050	0.3022	0.2993	0.2966	0.2938	0.2910	0.2883
-33	0.3445	0.3413	0.3382	0.3350	0.3320	0.3289	0.3258	0.3228	0.3198	0.3167
-32	0.3779	0.3744	0.3710	0.3675	0.3642	0.3608	0.3574	0.3542	0.3510	0.3477
-31	0.4141	0.4104	0.4067	0.4029	0.3992	0.3956	0.3920	0.3884	0.3849	0.3814
-30	0.4534	0.4493	0.4453	0.4413	0.4373	0.4334	0.4295	0.4256	0.4218	0.4179
-29	0.4960	0.4916	0.4872	0.4829	0.4785	0.4743	0.4700	0.4659	0.4617	0.4575
-28	0.5422	0.5374	0.5327	0.5280	0.5234	0.5187	0.5141	0.5096	0.5050	0.5006
-27	0.5922	0.5871	0.5820	0.5768	0.5718	0.5668	0.5618	0.5568	0.5519	0.5470
-26	0.6463	0.6407	0.6351	0.6296	0.6242	0.6187	0.6133	0.6079	0.6026	0.5974
-25	0.7047	0.6986	0.6927	0.6867	0.6808	0.6749	0.6691	0.6633	0.6576	0.6519
-24	0.7678	0.7612	0.7548	0.7483	0.7420	0.7357	0.7294	0.7232	0.7170	0.7108
-23	0.8359	0.8289	0.8218	0.8150	0.8081	0.8012	0.7944	0.7877	0.7810	0.7743
-22	0.9093	0.9017	0.8941	0.8867	0.8792	0.8719	0.8645	0.8573	0.8501	0.8429
-21	0.9884	0.9802	0.9720	0.9640	0.9560	0.9481	0.9402	0.9323	0.9246	0.9170
-20	1.074	1.065	1.056	1.047	1.039	1.030	1.022	1.013	1.005	0.9966
-19	1.165	1.156	1.146	1.137	1.128	1.119	1.109	1.100	1.091	1.082
-18	1.264	1.253	1.243	1.233	1.223	1.214	1.204	1.194	1.184	1.175
-17	1.369	1.359	1.348	1.337	1.326	1.316	1.305	1.295	1.284	1.274
-16	1.483	1.471	1.460	1.448	1.437	1.425	1.414	1.403	1.392	1.381
-15	1.605	1.592	1.580	1.568	1.555	1.543	1.531	1.519	1.507	1.495
-14	1.736	1.722	1.709	1.696	1.682	1.669	1.656	1.643	1.630	1.618
-13	1.876	1.861	1.847	1.833	1.819	1.805	1.791	1.777	1.763	1.749
-12	2.026	2.010	1.995	1.980	1.965	1.949	1.934	1.920	1.905	1.890
-11	2.186	2.170	2.153	2.137	2.121	2.105	2.089	2.073	2.057	2.041
-10	2.358	2.340	2.323	2.305	2.288	2.271	2.254	2.237	2.220	2.203
-9	2.541	2.522	2.504	2.485	2.466	2.448	2.430	2.412	2.394	2.376
-8	2.737	2.717	2.697	2.677	2.657	2.638	2.618	2.599	2.579	2.560
-7	2.946	2.925	2.903	2.882	2.861	2.840	2.819	2.798	2.778	2.758
-6	3.169	3.146	3.123	3.101	3.078	3.056	3.034	3.012	2.990	2.968
-5	3.407	3.383	3.358	3.334	3.310	3.286	3.263	3.239	3.216	3.193
-4	3.660	3.634	3.609	3.583	3.557	3.532	3.507	3.481	3.456	3.432
-3	3.930	3.902	3.875	3.847	3.820	3.793	3.766	3.740	3.713	3.687
-2	4.217	4.188	4.159	4.129	4.100	4.072	4.043	4.015	3.986	3.958
-1	4.523	4.491	4.460	4.429	4.398	4.368	4.337	4.307	4.277	4.247
0	4.847	4.814	4.781	4.748	4.715	4.683	4.650	4.618	4.586	4.554
0	4.847	4.881	4.915	4.948	4.983	5.017	5.052	5.087	5.122	5.157
1	5.192	5.228	5.264	5.300	5.336	5.373	5.409	5.446	5.483	5.521
2	5.559	5.597	5.635	5.673	5.711	5.750	5.789	5.828	5.868	5.907
3	5.947	5.987	6.028	6.068	6.109	6.150	6.192	6.233	6.275	6.317
4	6.360	6.402	6.445	6.488	6.531	6.575	6.619	6.663	6.707	6.752

(continued)

SMITHSONIAN METEOROLOGICAL TABLES

Table 4a

TABLE 108 (CONCLUDED)

DENSITY OF PURE WATER VAPOR AT SATURATION OVER WATER

Temperature °C.	.0	.1	.2	.3	.4	.5	.6	.7	.8	.9
	g. m. ⁻³	g. m. ⁻³	g. m. ⁻³	g. m. ⁻³	g. m. ⁻³	g. m. ⁻³	g. m. ⁻³	g. m. ⁻³	g. m. ⁻³	g. m. ⁻³
5	6.797	6.842	6.887	6.933	6.979	7.025	7.071	7.118	7.165	7.212
6	7.260	7.307	7.355	7.404	7.452	7.501	7.550	7.600	7.649	7.699
7	7.750	7.801	7.851	7.902	7.954	8.006	8.058	8.110	8.163	8.216
8	8.270	8.324	8.377	8.431	8.485	8.540	8.595	8.650	8.706	8.762
9	8.819	8.875	8.932	8.989	9.046	9.104	9.163	9.221	9.280	9.339
10	9.399	9.459	9.519	9.579	9.641	9.702	9.763	9.825	9.887	9.949
11	10.01	10.08	10.14	10.20	10.27	10.33	10.40	10.46	10.53	10.59
12	10.66	10.73	10.79	10.86	10.93	11.00	11.07	11.14	11.21	11.27
13	11.35	11.42	11.49	11.56	11.63	11.70	11.77	11.85	11.92	11.99
14	12.07	12.14	12.22	12.29	12.37	12.44	12.52	12.60	12.67	12.75
15	12.83	12.91	12.99	13.07	13.14	13.23	13.31	13.39	13.47	13.55
16	13.63	13.72	13.80	13.88	13.97	14.05	14.14	14.22	14.31	14.39
17	14.48	14.57	14.65	14.74	14.83	14.92	15.01	15.10	15.19	15.28
18	15.37	15.46	15.55	15.65	15.74	15.83	15.93	16.02	16.12	16.21
19	16.31	16.41	16.50	16.60	16.70	16.80	16.90	17.00	17.10	17.20
20	17.30	17.40	17.50	17.60	17.71	17.81	17.91	18.02	18.12	18.23
21	18.34	18.44	18.55	18.66	18.77	18.88	18.99	19.10	19.21	19.32
22	19.43	19.54	19.65	19.77	19.88	20.00	20.11	20.23	20.34	20.46
23	20.58	20.70	20.81	20.93	21.05	21.17	21.29	21.42	21.54	21.66
24	21.78	21.91	22.03	22.16	22.28	22.41	22.54	22.66	22.79	22.92
25	23.05	23.18	23.31	23.44	23.58	23.71	23.84	23.97	24.11	24.24
26	24.38	24.52	24.66	24.79	24.93	25.07	25.21	25.35	25.49	25.63
27	25.78	25.92	26.06	26.21	26.35	26.50	26.65	26.79	26.94	27.09
28	27.24	27.39	27.54	27.69	27.85	28.00	28.15	28.31	28.46	28.62
29	28.78	28.93	29.09	29.25	29.41	29.57	29.73	29.89	30.05	30.22
30	30.38	30.55	30.71	30.88	31.05	31.22	31.38	31.55	31.72	31.89
31	32.07	32.24	32.41	32.59	32.76	32.94	33.11	33.29	33.47	33.65
32	33.83	34.01	34.19	34.38	34.56	34.74	34.93	35.11	35.30	35.49
33	35.68	35.87	36.06	36.25	36.44	36.63	36.83	37.02	37.22	37.41
34	37.61	37.81	38.01	38.21	38.41	38.61	38.81	39.01	39.22	39.42
35	39.63	39.84	40.05	40.26	40.47	40.68	40.89	41.10	41.31	41.53
36	41.75	41.96	42.18	42.40	42.62	42.84	43.06	43.28	43.50	43.73
37	43.96	44.18	44.41	44.64	44.87	45.09	45.33	45.56	45.79	46.02
38	46.26	46.50	46.74	46.97	47.21	47.45	47.69	47.94	48.18	48.42
39	48.67	48.92	49.17	49.42	49.66	49.92	50.17	50.42	50.67	50.93
40	51.19	51.45	51.70	51.96	52.22	52.49	52.75	53.01	53.28	53.54
41	53.82	54.09	54.36	54.63	54.90	55.17	55.44	55.72	56.00	56.27
42	56.56	56.84	57.12	57.40	57.68	57.97	58.25	58.54	58.83	59.12
43	59.41	59.70	60.00	60.29	60.59	60.88	61.18	61.48	61.78	62.08
44	62.39	62.70	63.00	63.31	63.62	63.92	64.23	64.55	64.86	65.17
45	65.50	65.81	66.13	66.45	66.77	67.10	67.42	67.74	68.07	68.40
46	68.73	69.06	69.39	69.73	70.06	70.40	70.73	71.07	71.41	71.75
47	72.10	72.45	72.79	73.13	73.49	73.84	74.18	74.53	74.89	75.25
48	75.61	75.96	76.33	76.69	77.05	77.41	77.77	78.14	78.51	78.88
49	79.26	79.63	80.01	80.38	80.76	81.14	81.52	81.90	82.28	82.67
50	83.06	83.45	83.84	84.23	84.62	85.01	85.41	85.81	86.20	86.60
51	87.01	87.41	87.82	88.22	88.63	89.04	89.45	89.86	90.27	90.69
52	91.12	91.54	91.96	92.38	92.80	93.23	93.66	94.09	94.52	94.95
53	95.39	95.83	96.27	96.71	97.14	97.59	98.03	98.47	98.92	99.37
54	99.83	100.3	100.7	101.2	101.7	102.1	102.6	103.0	103.5	104.0
55	104.4	104.9	105.4	105.9	106.3	106.8	107.3	107.8	108.2	108.7
56	109.2	109.7	110.2	110.7	111.2	111.7	112.2	112.7	113.2	113.7
57	114.2	114.7	115.2	115.7	116.2	116.8	117.3	117.8	118.3	118.8
58	119.4	119.9	120.4	121.0	121.5	122.0	122.6	123.1	123.6	124.2
59	124.7	125.3	125.8	126.4	126.9	127.5	128.0	128.6	129.1	129.7
60	130.3									

SMITHSONIAN METEOROLOGICAL TABLES

Table 4b

SATURATION WATER VAPOR DENSITY

A = 1324

B = 273.16

C = 17.6459

D = 243.1160

TEMP DEG	SAT VAPOR DEN G/M3	COMPUTED G/M3	ERROR G/M3	ERROR %
-50.	.06171	.06153	.00018	.29
-45.	.10550	.10543	.00007	.07
-40.	.17570	.17581	-.00011	-.06
-35.	.28560	.28589	-.00029	-.10
-30.	.45340	.45417	-.00077	-.17
-25.	.70470	.70596	-.00126	-.18
-20.	1.07400	1.07532	-.00132	-.12
-15.	1.60500	1.60722	-.00222	-.14
-10.	2.35800	2.36007	-.00207	-.09
-5.	3.40700	3.40859	-.00159	-.05
0.	4.84700	4.84698	.00002	.00
5.	6.79700	6.79247	.00453	.07
10.	9.39900	9.38908	.00992	.11
15.	12.83000	12.81172	.01828	.14
20.	17.30000	17.27044	.02956	.17
25.	23.05000	23.01493	.03507	.15
30.	30.33000	30.33913	.00907	.13
35.	39.63000	39.58590	.04410	.11
40.	51.19000	51.15175	.03825	.07
45.	65.50000	65.49148	.00852	.01
50.	83.06000	83.12282	-.06282	-.08

Table 5a

SATURATION WATER VAPOR DENSITY (SIMPLIFIED)

A = 1324 B = 273.16 C = 16.3282 D = 236.8833
 C1=30.0 C2=-40.0 D1=30.38 D2= .1757

TEMP DEG	SAT VAPOR DEN G/M3	COMPUTED G/M3	ERROR G/M3	ERROR %
-50.	.06171	.06141	.00030	.49
-45.	.10550	.10531	.00019	.18
-40.	.17570	.17570	.00000	.00
-35.	.28560	.28581	-.00021	-.07
-30.	.45340	.45412	-.00072	-.16
-25.	.70470	.70596	-.00126	-.18
-20.	1.07400	1.07535	-.00135	-.13
-15.	1.60500	1.60724	-.00224	-.14
-10.	2.35800	2.36005	-.00205	-.09
-5.	3.40700	3.40852	-.00152	-.04
0.	4.84700	4.84698	.00002	.00
5.	6.79700	6.79289	.00411	.06
10.	9.39900	9.39077	.00823	.09
15.	12.83000	12.81634	.01366	.11
20.	17.30000	17.28101	.01899	.11
25.	23.05000	23.03655	.01345	.06
30.	30.38000	30.38000	.00000	.00
35.	39.63000	39.65868	-.02868	-.07
40.	51.19000	51.27530	-.08530	-.17
45.	65.50000	65.69316	-.19316	-.29
50.	83.06000	83.44129	-.38129	-.46

Table 5b

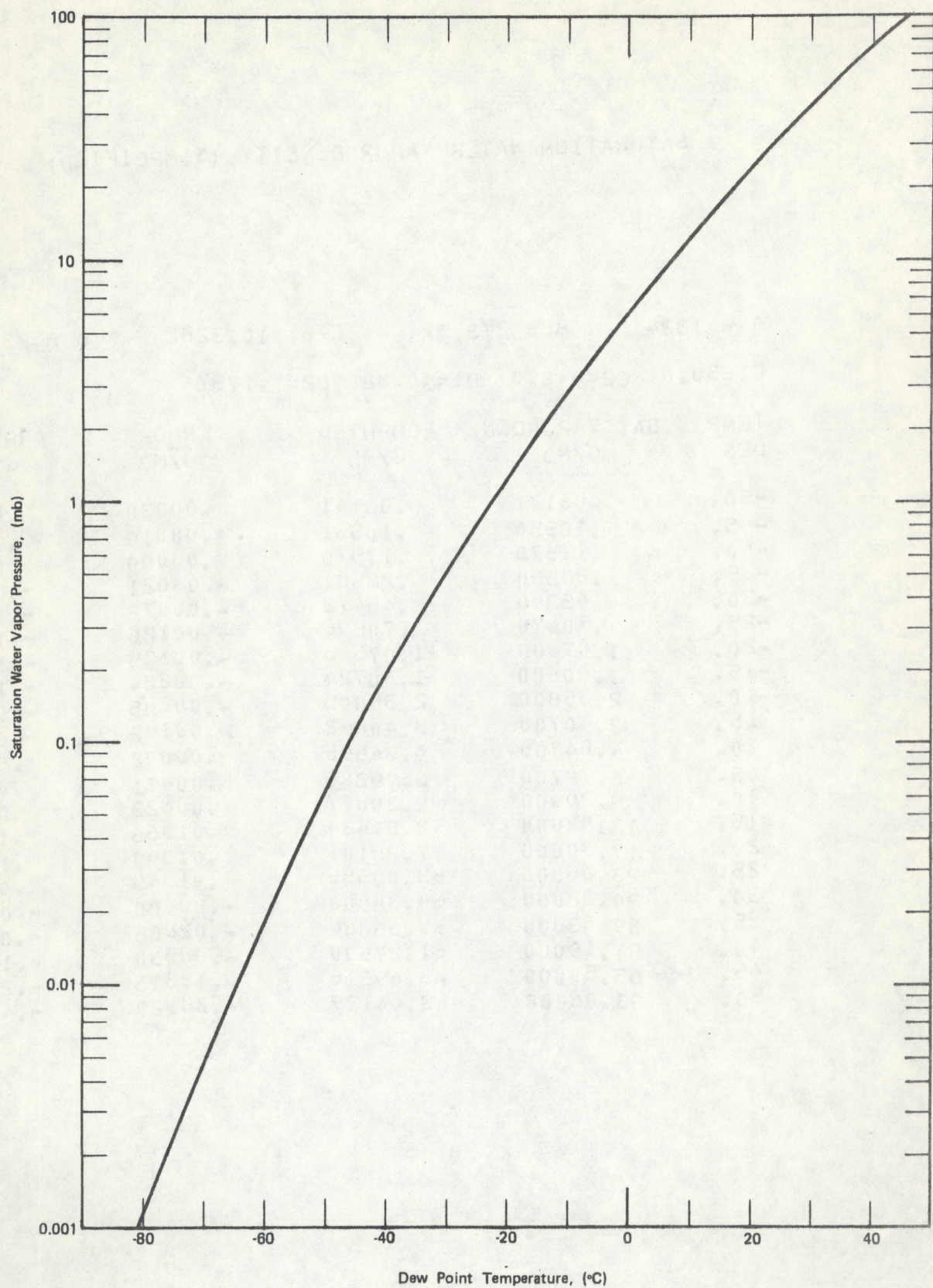


Figure 1. Saturation water vapor pressure as a function of dewpoint temperature.

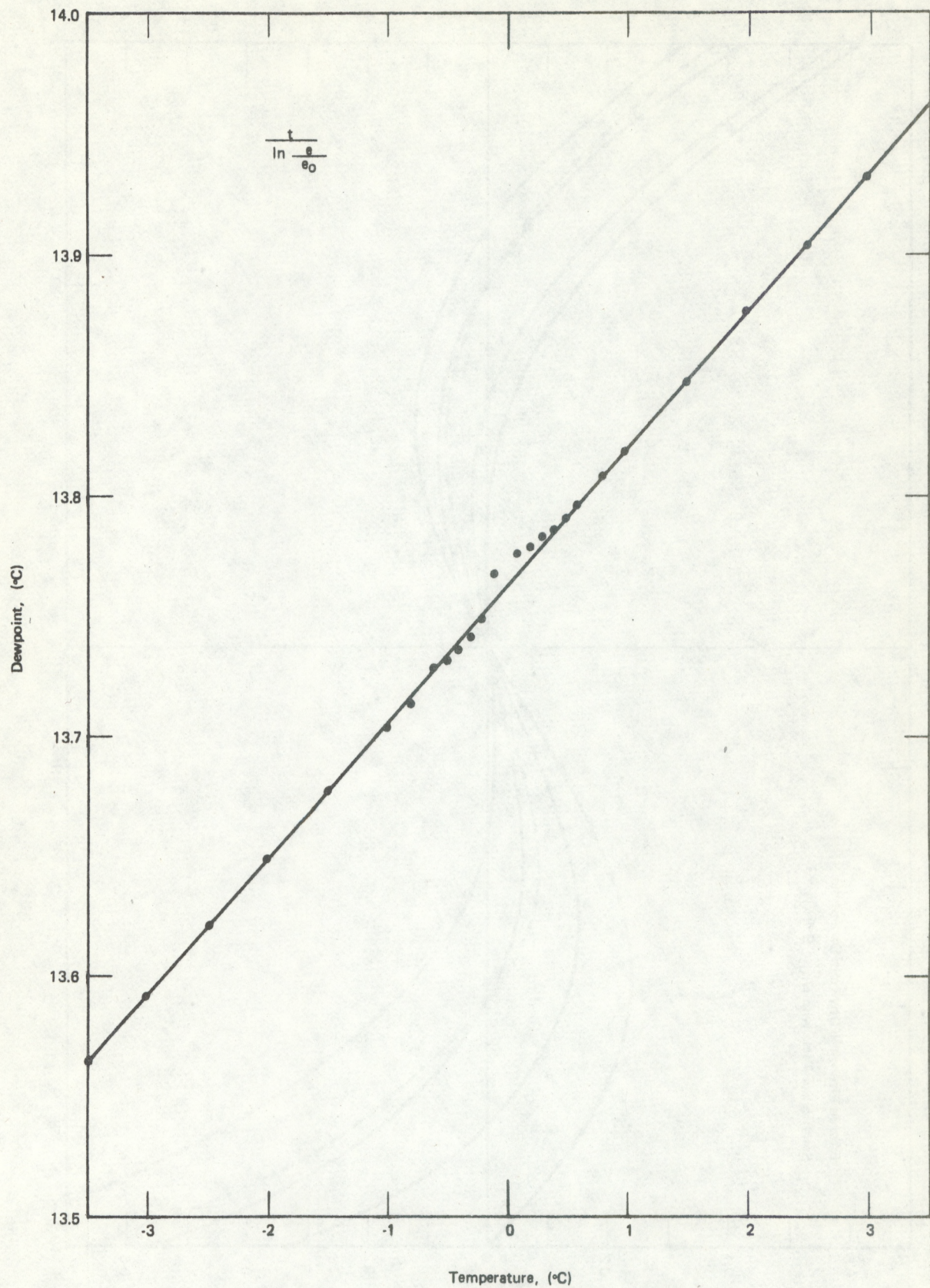


Figure 2. Dewpoint normalized for the relative saturation vapor pressure.

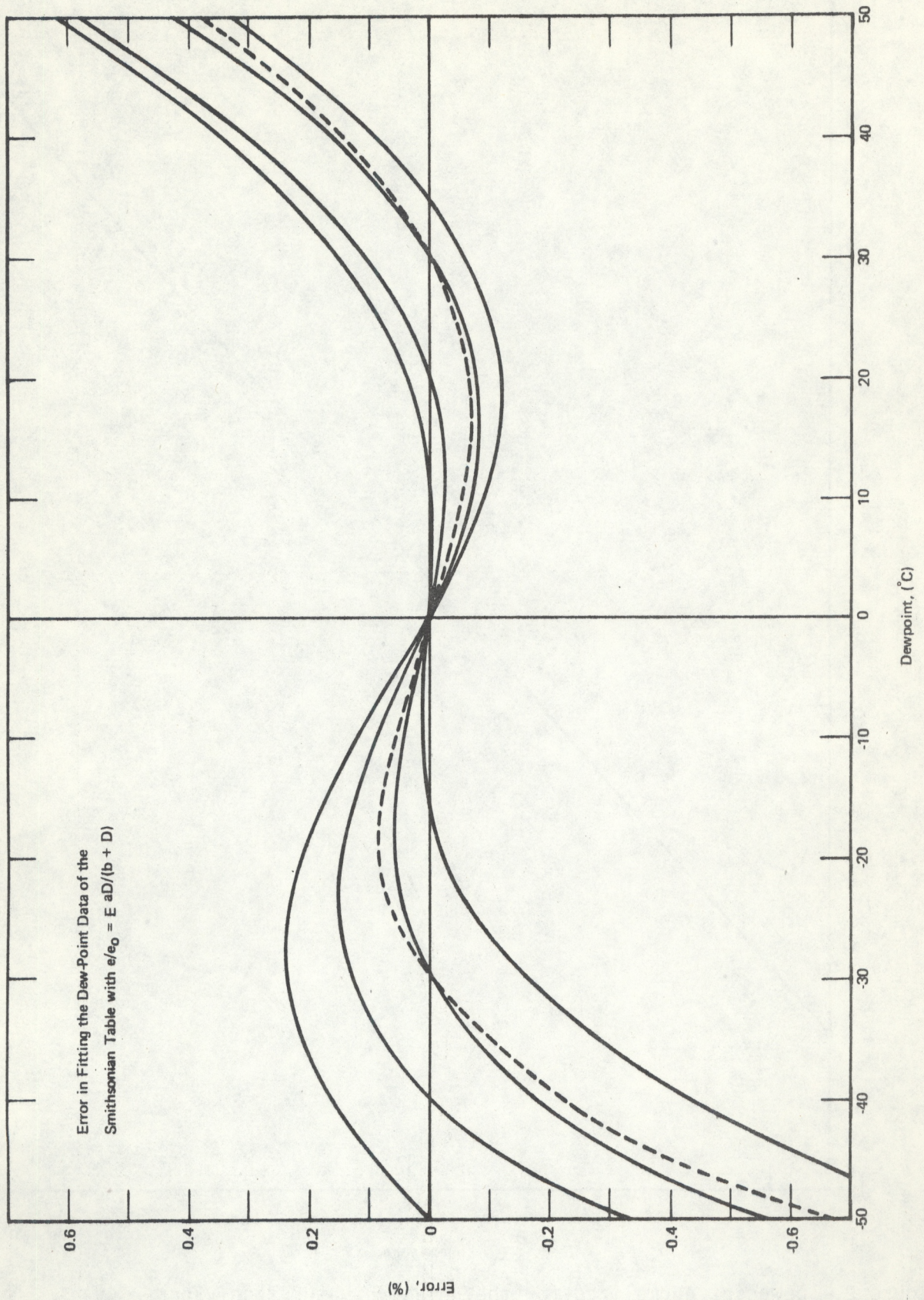


Figure 3. Error in fitting the dewpoint data of the Smithsonian table with $e/e_0 = \epsilon \frac{aD}{b + D}$.

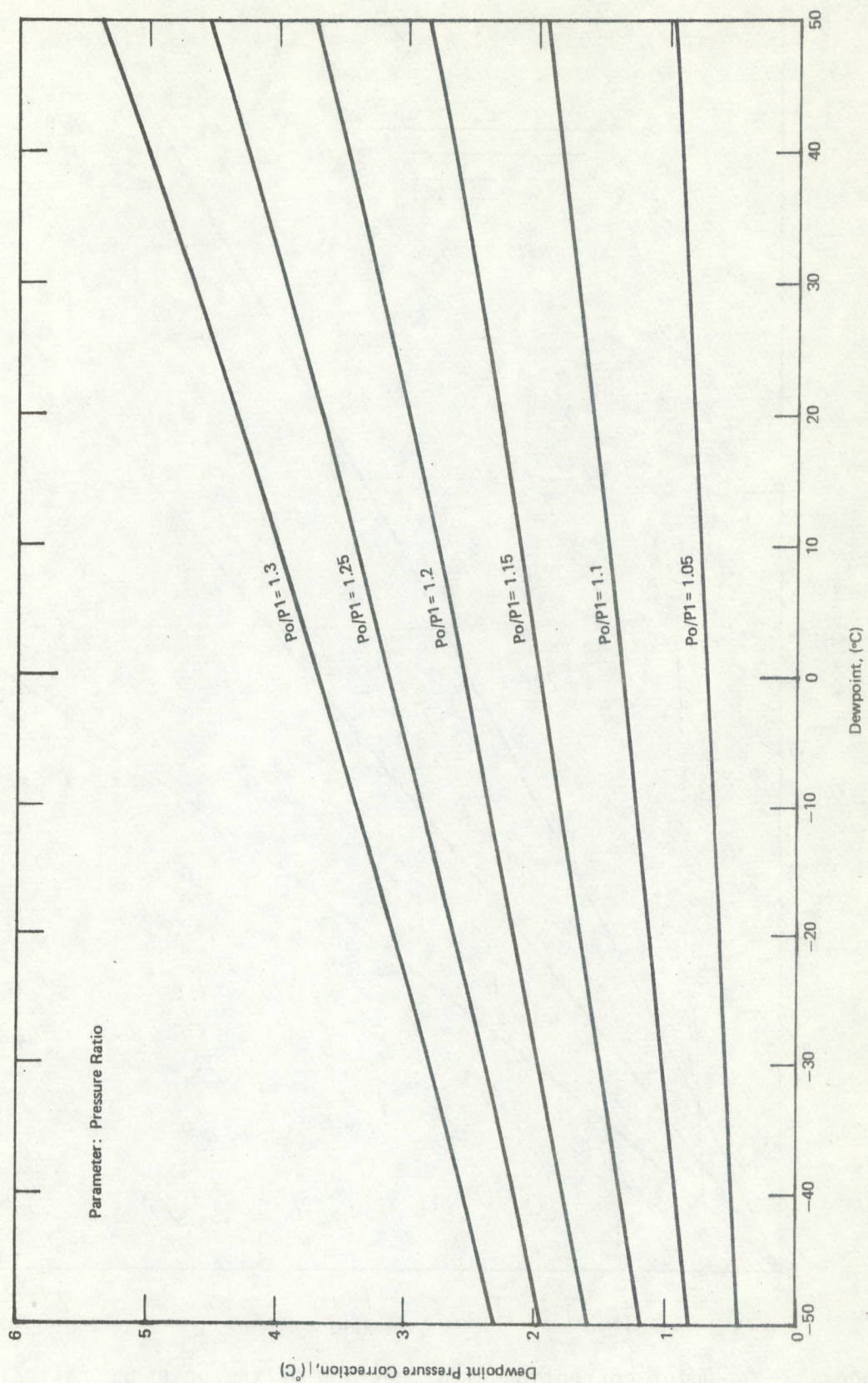


Figure 4. Dewpoint correction for different pressure ratios.

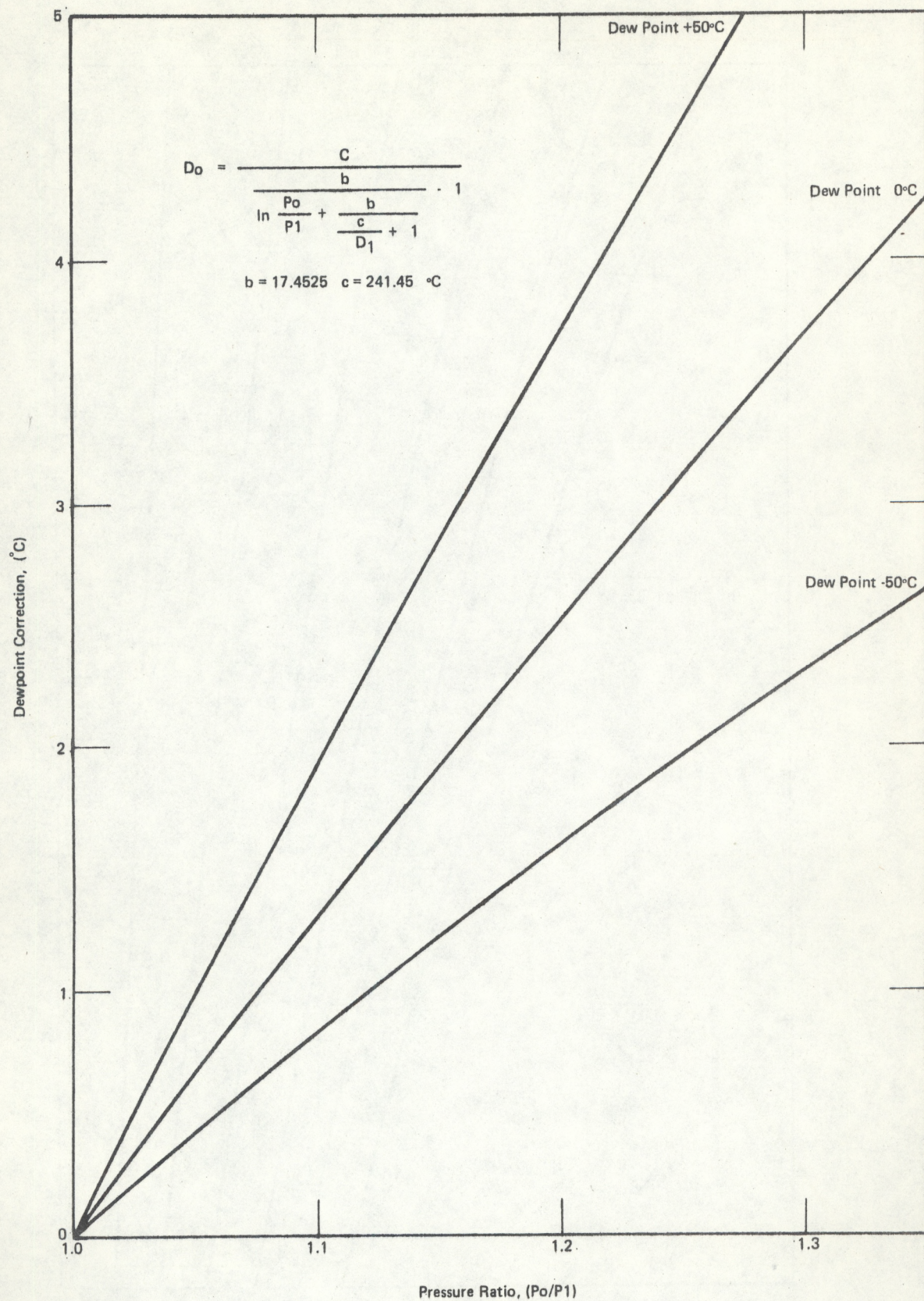


Figure 5. Dewpoint correction as a function of the pressure ratio for different dewpoints.

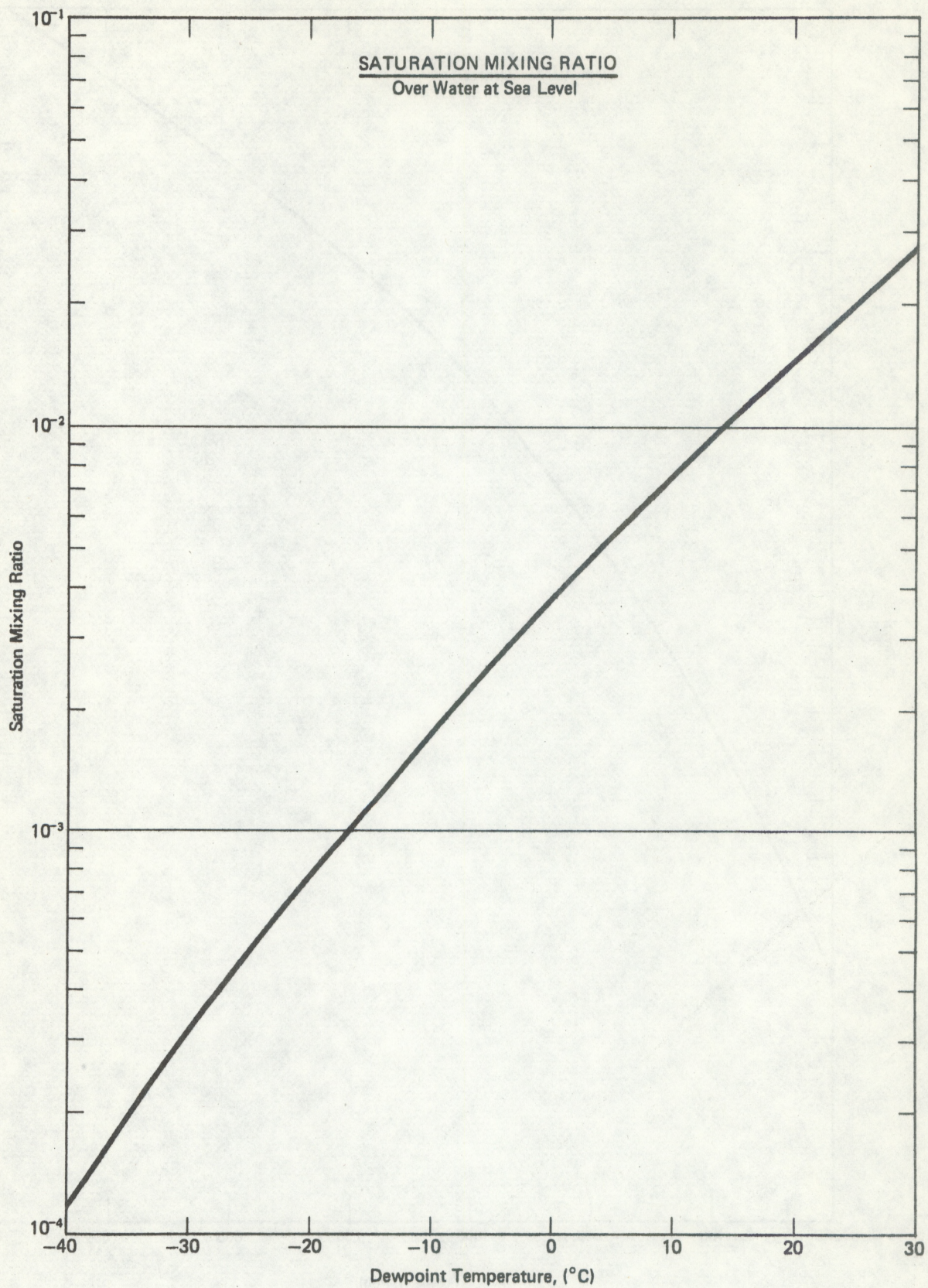


Figure 6. Saturation mixing ratio over water at sea level.

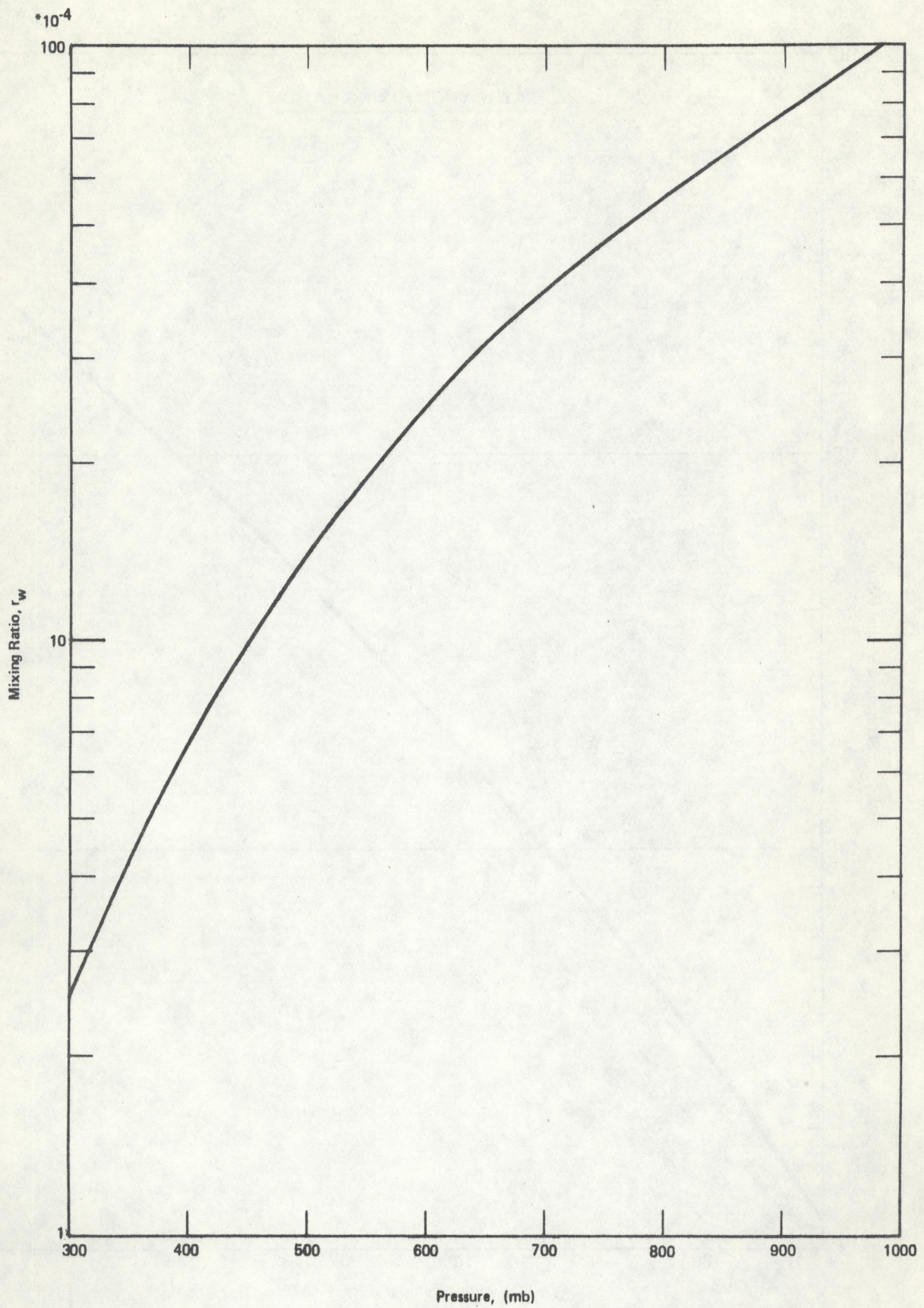


Figure 7. Saturation mixing ratio over water for standard atmosphere.

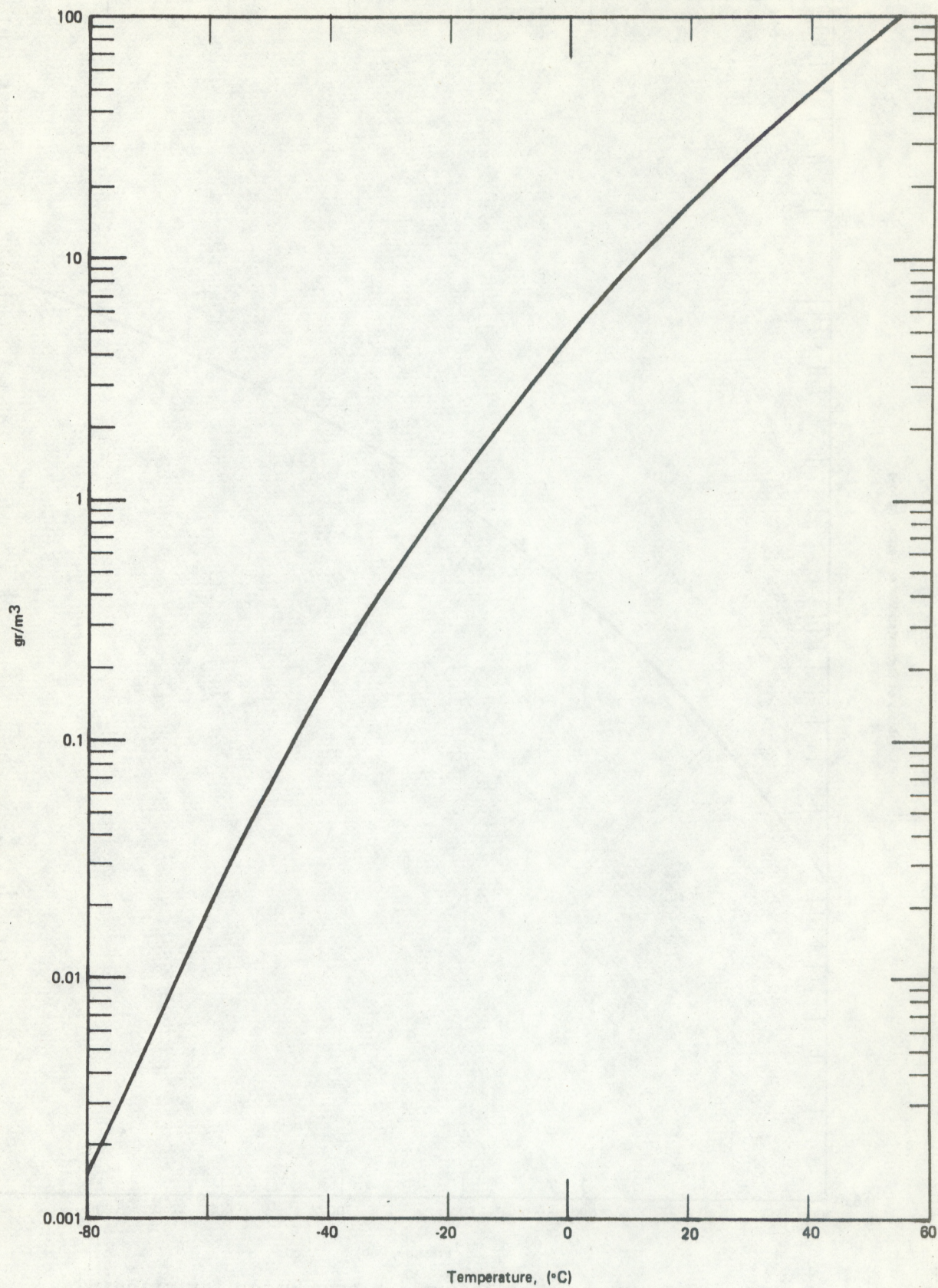


Figure 8. Density of water vapor at saturation over water.

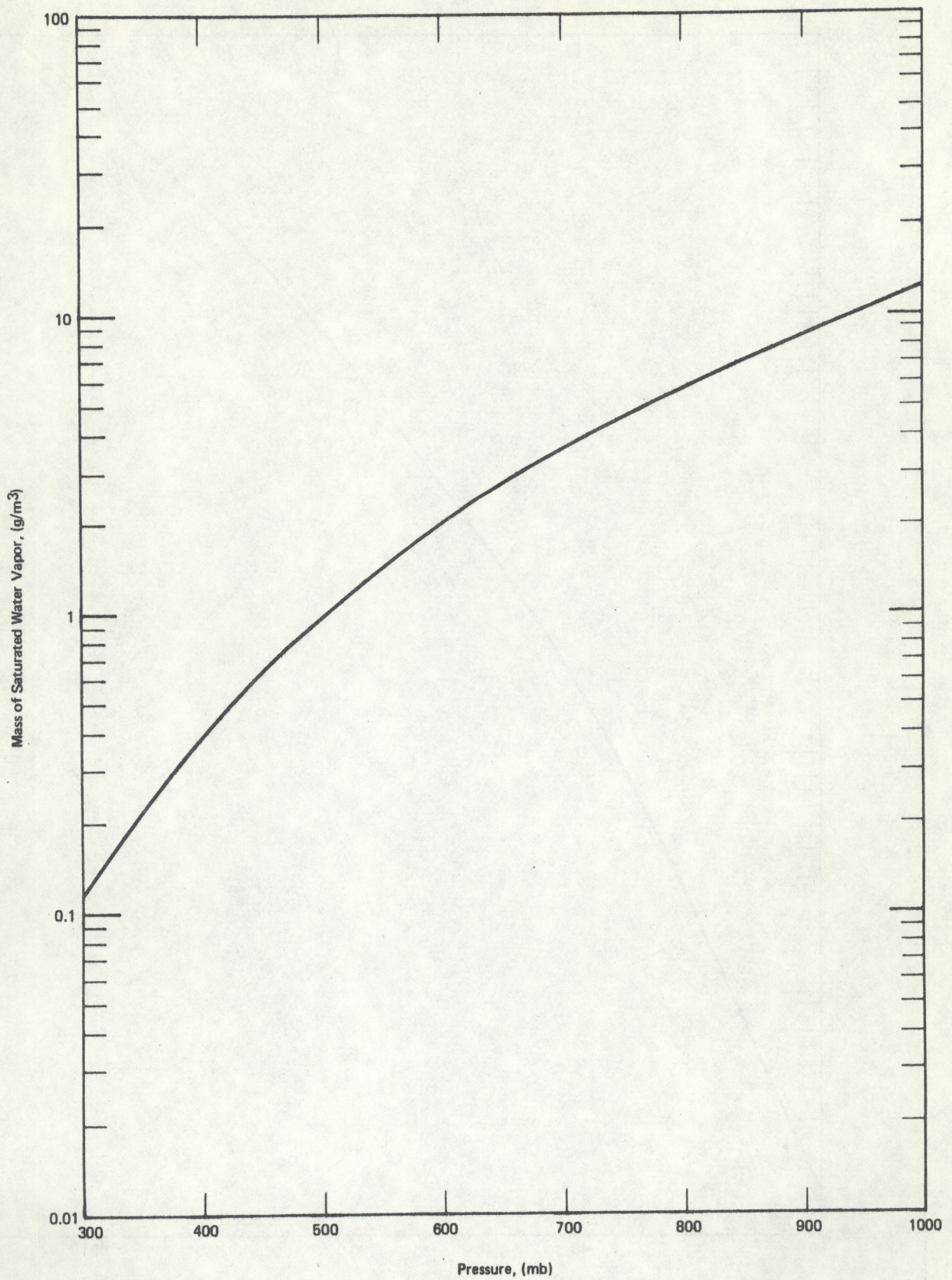


Figure 9. Density of water vapor at saturation over water for standard atmosphere.

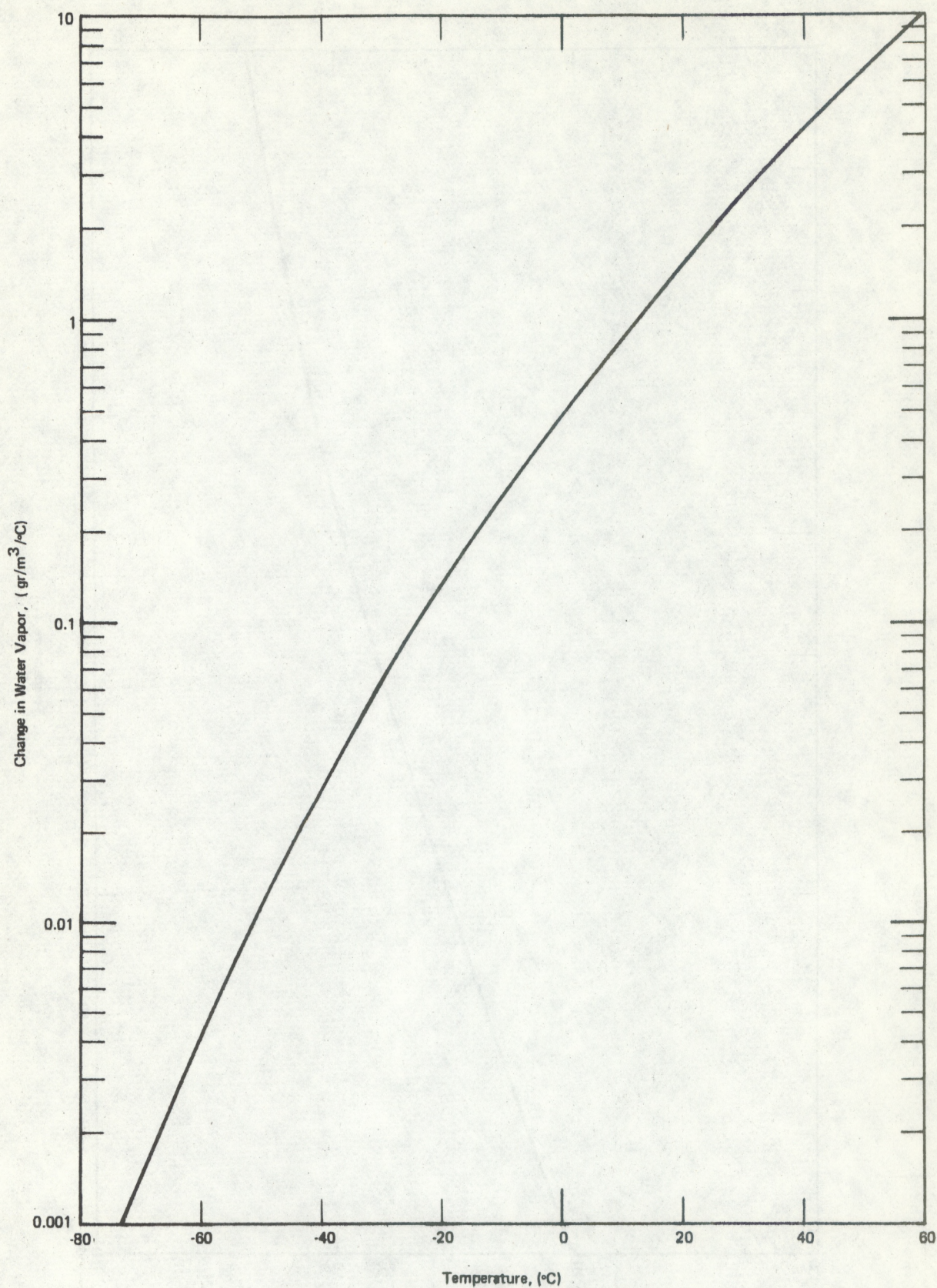


Figure 10. Change in water vapor density for one °C at constant mixing ratio.

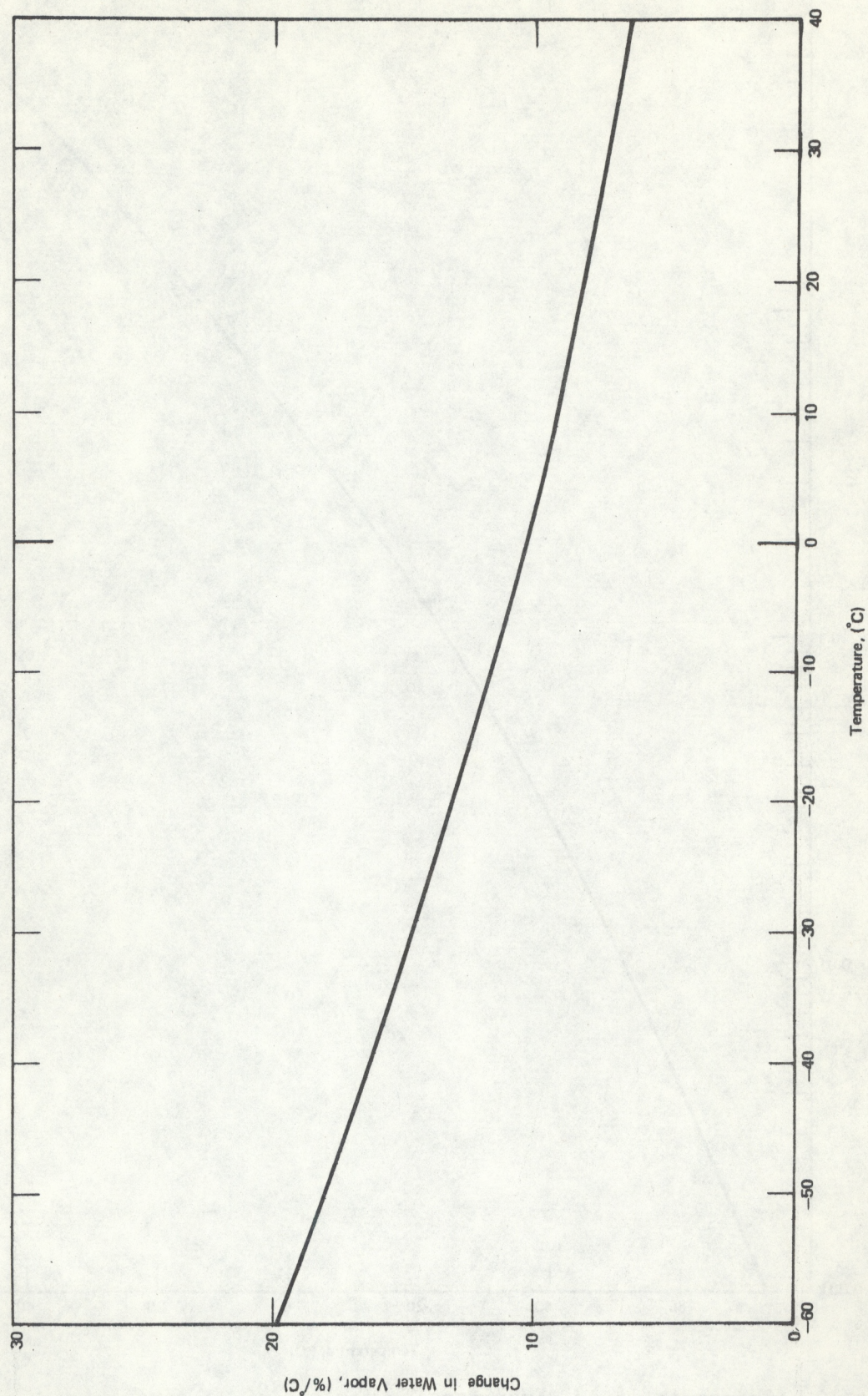


Figure 11. Relative change in water vapor density for one °C change in temperature at constant mixing ratio.

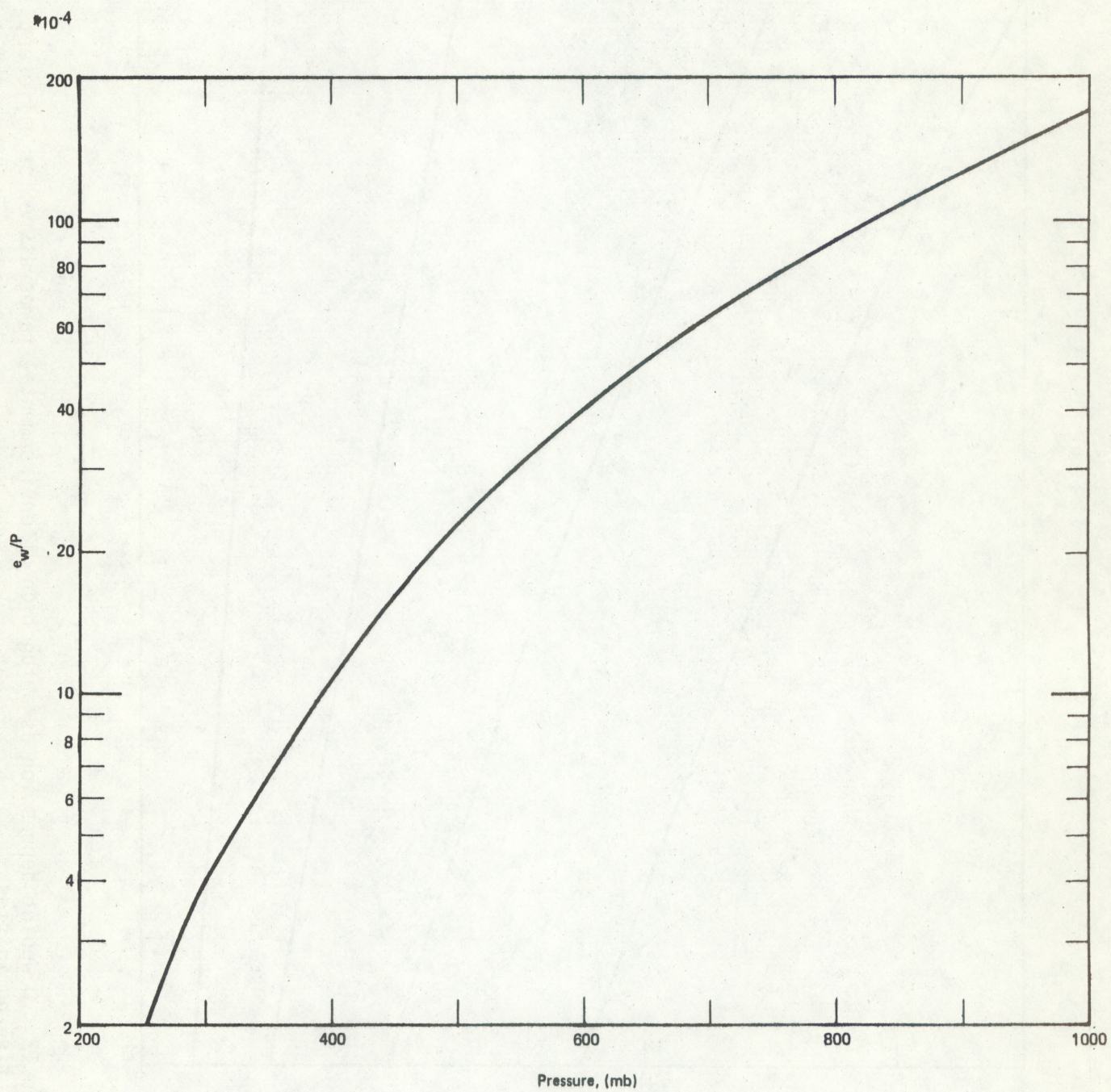


Figure 12. Ratio of saturation water vapor pressure e_w to atmospheric pressure p .

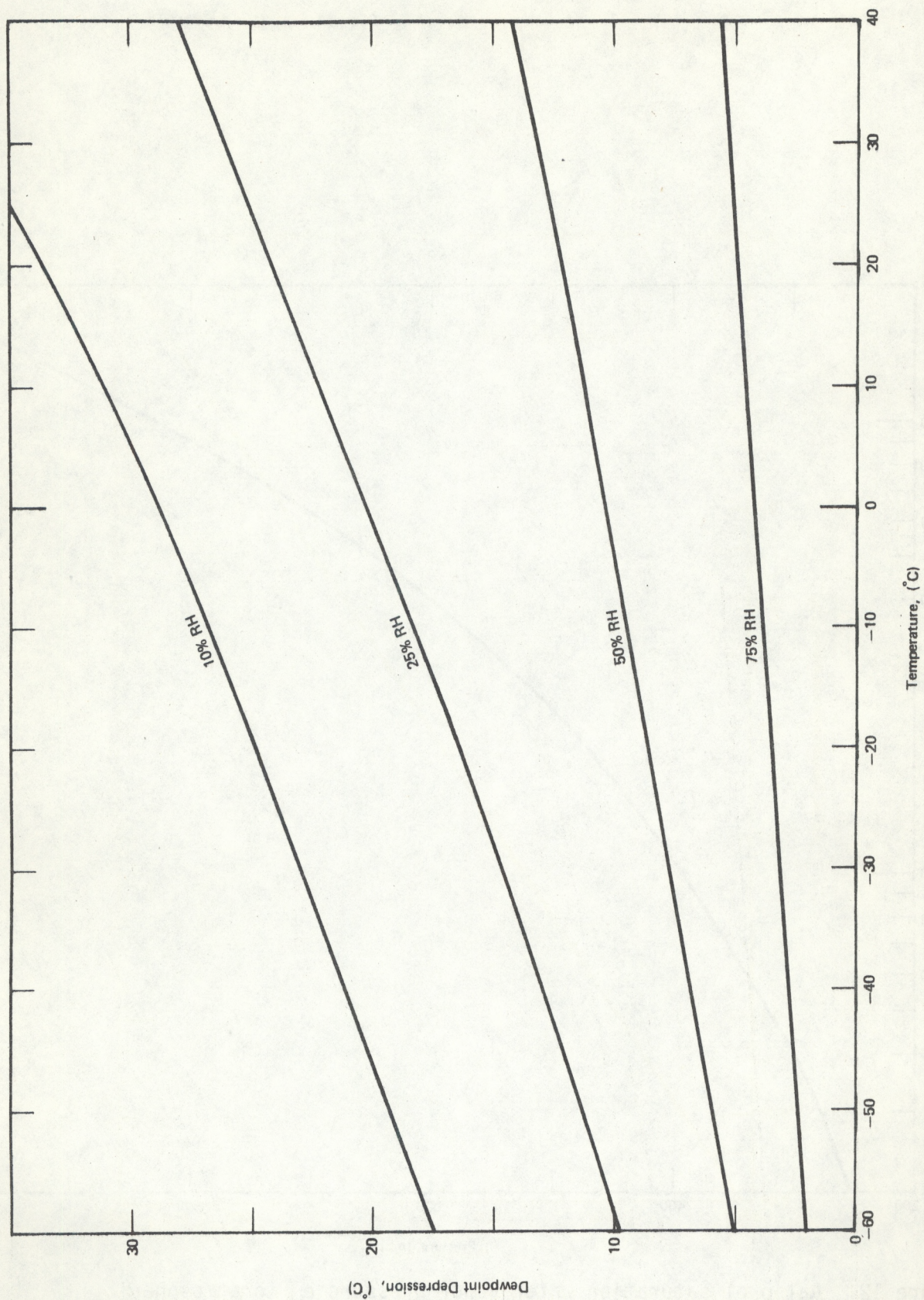


Figure 13. Dewpoint depression as a function of environmental temperature for different relative humidities.

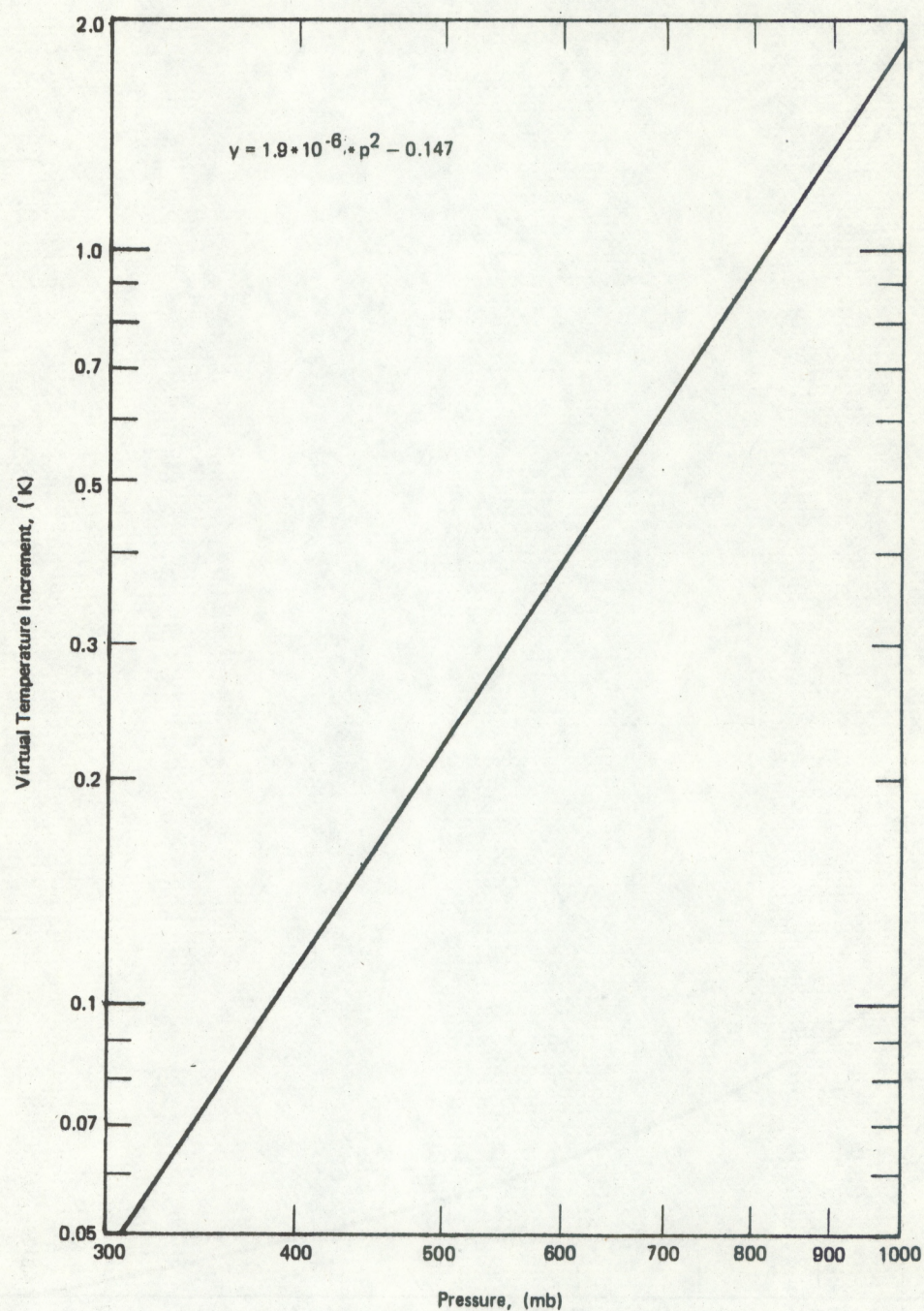


Figure 14. Virtual temperature increment of saturated air for standard atmosphere.

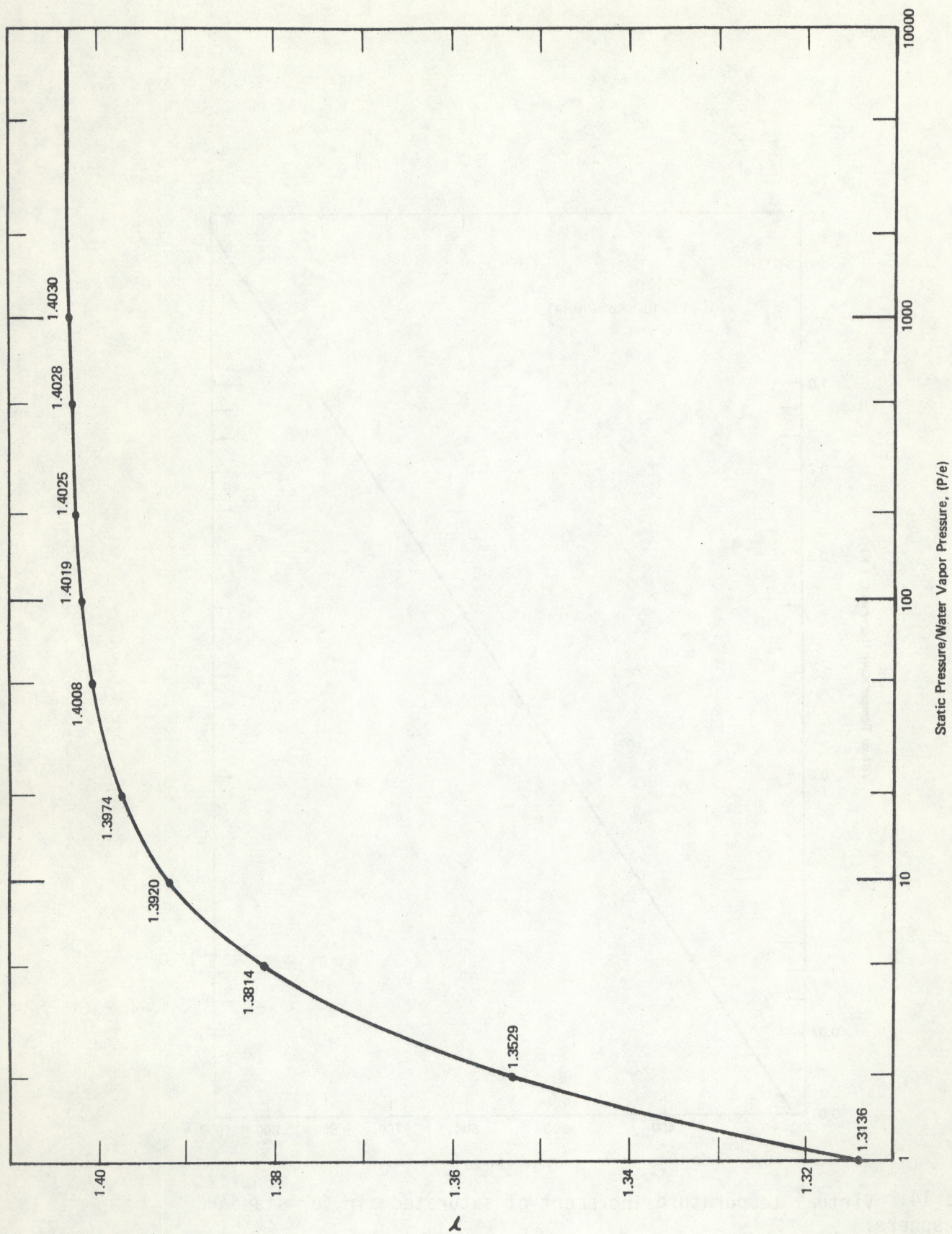


Figure 15. Poisson constant as a function of the ratio of atmospheric to water vapor pressure.

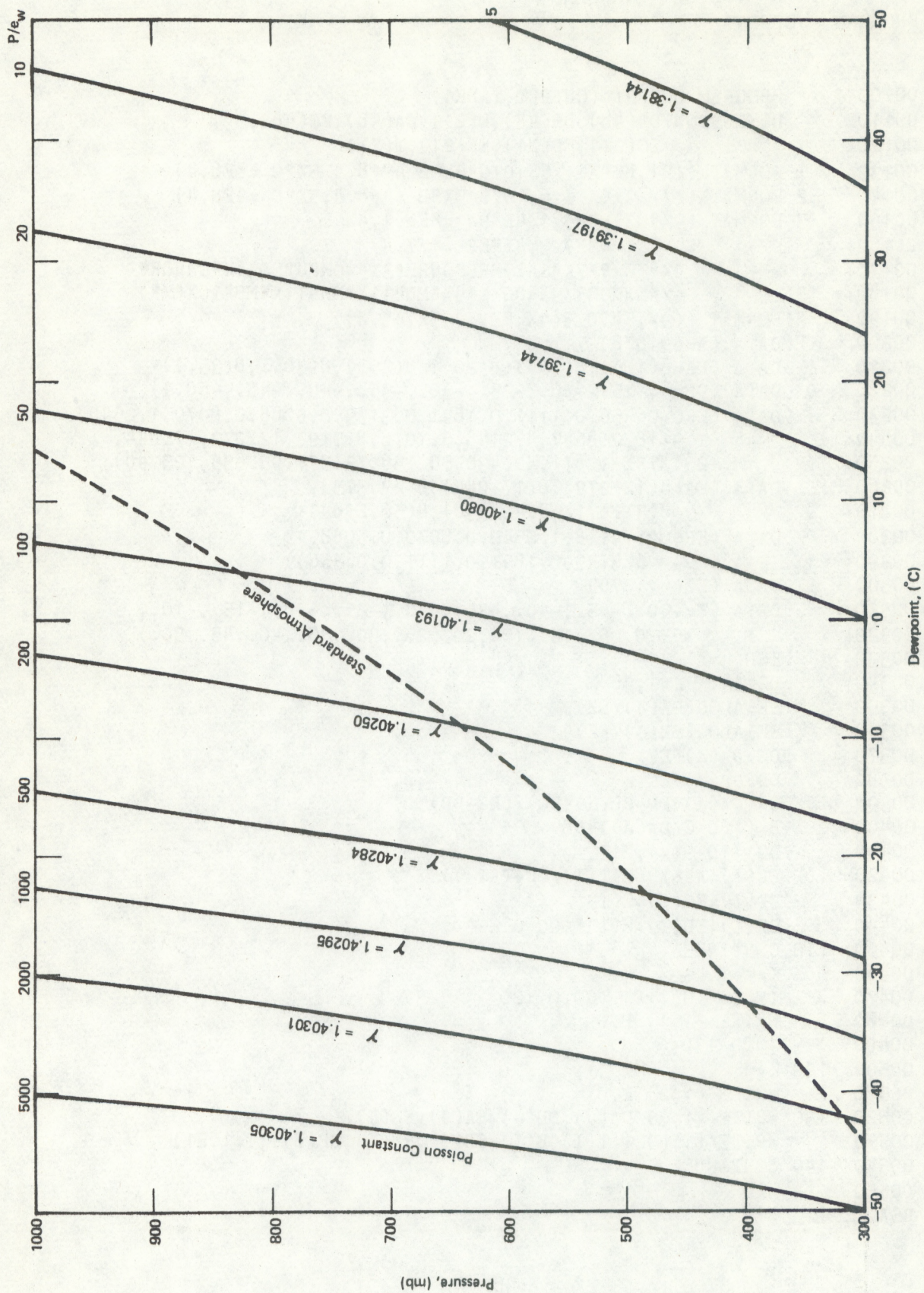


Figure 16. Relation between barometric pressure p and dewpoint with the ratio of barometric pressure to water vapor saturation pressure and the Poisson constant γ as parameter.

APPENDIX 1

PROGRAM DEWPNT

```

00100      PROGRAM DEWPNT (OUTPUT,TAPE1)
00110      DIMENSION DA(48),DB(48),E(21),EA(48),EB(48),
00120+      EC(21),ED(21),EP(21),T(21)
00130      1 FORMAT (1H1,8X*A = 6.1078*5X*B =*F8.4,5X*C =*F8.4)
00140      2 FORMAT (/// 9X*A = 6.1078*5X*B =*F8.4,5X*C =*F8.4)
00150      3 FORMAT (9X*D1 =*F5.1,4X*D2 =*F6.1,4X
00160+      *E1 =*F7.3,4X*E2 =*F7.4//
00170+      9X*TEMP*3X*SAT PRESSURE*3X*COMPUTED*8X*ERROR*
00180+      6X*ERROR*/9X*DG C*9X*MB*11X*MB*11X*MB*10X*/*)
00190      4 FORMAT ((9X,F4.0,3(4X,F9.5),5X,F5.2))
00200      DATA (A=6.1078)
00210      DATA (DA=8(10.),8(15.),8(20.),8(25.),8(30.),8(35.))
00220      DATA (DB=6(-15.,-20.,-25.,-30.,-35.,-40.,-45.,-50.))
00230      DATA (E=0.06356,0.1111,0.1891,0.3139,0.5088,0.8070,1.2540,
00240+      1.9118,2.8627,4.2148,6.1078,8.7192,12.272,17.044,
00250+      23.373,31.671,42.430,56.236,73.777,95.855,123.40)
00260      DATA (EA=8(12.272),8(17.044),8(23.373),
00270+      8(31.671),8(42.430),8(56.236))
00280      DATA (EB=6(1.9118,1.2540,0.8070,0.5088,
00290+      0.3139,0.1891,0.1111,0.06356))
00300      DATA (EZ=6.1078)
00310      DATA (T=-50.,-45.,-40.,-35.,-30.,-25.,-20.,-15.,-10.,
00320+      -5.,0.,5.,10.,15.,20.,25.,30.,35.,40.,45.,50.)
00330      K=0
00340      DO 140 J=1,48
00350      EE=ALOG(EA(J)/EZ)
00360      EF=ALOG(EB(J)/EZ)
00370      DC=DA(J)*EF
00380      DD=DB(J)*EE
00390      C=(DA(J)*DD-DB(J)*DC)/(DC-DD)
00400      B=(1.0+C/DA(J))*EE
00410      DO 110 I=1,21
00420      EC(I)=A*EXP(B*T(I)/(C+T(I)))
00430      ED(I)=EC(I)-E(I)
00440      EP(I)=ED(I)/E(I)*100.0
00450      110 CONTINUE
00460      K=K+1
00470      IF (K .GE. 2) GOTO 120
00480      WRITE (1,1) B,C
00490      GOTO 130
00500      120 K=0
00510      WRITE (1,2) B,C
00520      130 WRITE (1,3) DA(J),DB(J),EA(J),EB(J)
00530      WRITE (1,4) ((T(I),E(I),EC(I),ED(I),EP(I)),I=1,21)
00540      140 CONTINUE
00550      END
READY.

```


A = 6.1078 B = 17.6353 C = 242.7441
D1 = 10.0 D2 = -15.0 E1 = 12.272 E2 = 1.9118

TEMP DG C	SAT PRESSURE MB	COMPUTED MB	ERROR MB	ERROR %
-50.	.06356	.06296	-.00060	-.94
-45.	.11110	.11040	-.00070	-.63
-40.	.18910	.18829	-.00081	-.43
-35.	.31390	.31299	-.00091	-.29
-30.	.50880	.50800	-.00080	-.16
-25.	.80700	.80637	-.00063	-.08
-20.	1.25400	1.25371	-.00029	-.02
-15.	1.91180	1.91180	.00000	.00
-10.	2.86270	2.86295	.00025	.01
-5.	4.21480	4.21512	.00032	.01
0.	6.10780	6.10780	0.00000	0.00
5.	8.71920	8.71883	-.00037	-.00
10.	12.27200	12.27200	-.00000	-.00
15.	17.04400	17.04562	.00162	.01
20.	23.37300	23.38187	.00887	.04
25.	31.67100	31.69706	.02606	.08
30.	42.43000	42.49265	.06265	.15
35.	56.23600	56.36708	.13108	.23
40.	73.77700	74.02820	.25120	.34
45.	95.85500	96.30638	.45138	.47
50.	123.40000	124.16807	.76807	.62

A = 6.1078 B = 17.6544 C = 243.0183
D1 = 10.0 D2 = -20.0 E1 = 12.272 E2 = 1.2540

TEMP DG C	SAT PRESSURE MB	COMPUTED MB	ERROR MB	ERROR %
-50.	.06356	.06306	-.00050	-.79
-45.	.11110	.11053	-.00057	-.51
-40.	.18910	.18847	-.00063	-.33
-35.	.31390	.31321	-.00069	-.22
-30.	.50880	.50826	-.00054	-.11
-25.	.80700	.80666	-.00034	-.04
-20.	1.25400	1.25400	.00000	.00
-15.	1.91180	1.91206	.00026	.01
-10.	2.86270	2.86316	.00046	.02
-5.	4.21480	4.21523	.00043	.01
0.	6.10780	6.10780	0.00000	0.00
5.	8.71920	8.71876	-.00044	-.01
10.	12.27200	12.27200	-.00000	-.00
15.	17.04400	17.04599	.00199	.01
20.	23.37300	23.38317	.01017	.04
25.	31.67100	31.70023	.02923	.09
30.	42.43000	42.49920	.06920	.16
35.	56.23600	56.37930	.14330	.25
40.	73.77700	74.04944	.27244	.37
45.	95.85500	96.34140	.48640	.51
50.	123.40000	124.22346	.82346	.67

A = 6.1078 B = 17.6775 C = 243.3488
D1 = 10.0 D2 = -25.0 E1 = 12.272 E2 = .8070

TEMP DG C	SAT PRESSURE MB	COMPUTED MB	ERROR MB	ERROR %
-50.	.06356	.06318	-.00038	-.60
-45.	.11110	.11069	-.00041	-.37
-40.	.18910	.18868	-.00042	-.22
-35.	.31390	.31348	-.00042	-.14
-30.	.50880	.50857	-.00023	-.05
-25.	.80700	.80700	.00000	.00
-20.	1.25400	1.25435	.00035	.03
-15.	1.91180	1.91238	.00058	.03
-10.	2.86270	2.86340	.00070	.02
-5.	4.21480	4.21536	.00056	.01
0.	6.10780	6.10780	0.00000	0.00
5.	8.71920	8.71868	-.00052	-.01
10.	12.27200	12.27200	-.00000	-.00
15.	17.04400	17.04643	.00243	.01
20.	23.37300	23.38472	.01172	.05
25.	31.67100	31.70404	.03304	.10
30.	42.43000	42.50708	.07708	.18
35.	56.23600	56.39400	.15800	.28
40.	73.77700	74.07499	.29799	.40
45.	95.85500	96.38354	.52854	.55
50.	123.40000	124.29014	.89014	.72

A = 6.1078 B = 17.6947 C = 243.5947
D1 = 10.0 D2 = -30.0 E1 = 12.272 E2 = .5088

TEMP DG C	SAT PRESSURE MB	COMPUTED MB	ERROR MB	ERROR %
-50.	.06356	.06326	-.00030	-.47
-45.	.11110	.11081	-.00029	-.26
-40.	.18910	.18883	-.00027	-.14
-35.	.31390	.31367	-.00023	-.07
-30.	.50880	.50880	.00000	.00
-25.	.80700	.80725	.00025	.03
-20.	1.25400	1.25461	.00061	.05
-15.	1.91180	1.91262	.00082	.04
-10.	2.86270	2.86358	.00088	.03
-5.	4.21480	4.21545	.00065	.02
0.	6.10780	6.10780	0.00000	0.00
5.	8.71920	8.71862	-.00058	-.01
10.	12.27200	12.27200	-.00000	-.00
15.	17.04400	17.04676	.00276	.02
20.	23.37300	23.38588	.01288	.06
25.	31.67100	31.70687	.03587	.11
30.	42.43000	42.51293	.08293	.20
35.	56.23600	56.40492	.16892	.30
40.	73.77700	74.09398	.31698	.43
45.	95.85500	96.41485	.55985	.58
50.	123.40000	124.33967	.93967	.76

A = 6.1078 B = 17.7149 C = 243.8845
D1 = 10.0 D2 = -35.0 E1 = 12.272 E2 = .3139

TEMP	SAT PRESSURE	COMPUTED	ERROR	ERROR
DG C	MB	MB	MB	%
-50.	.06356	.06336	-.00020	-.31
-45.	.11110	.11095	-.00015	-.13
-40.	.18910	.18902	-.00008	-.04
-35.	.31390	.31390	.00000	.00
-30.	.50880	.50907	.00027	.05
-25.	.80700	.80755	.00055	.07
-20.	1.25400	1.25491	.00091	.07
-15.	1.91180	1.91289	.00109	.06
-10.	2.86270	2.86379	.00109	.04
-5.	4.21480	4.21556	.00076	.02
0.	6.10780	6.10780	0.00000	0.00
5.	8.71920	8.71854	-.00066	-.01
10.	12.27200	12.27200	-.00000	-.00
15.	17.04400	17.04715	.00315	.02
20.	23.37300	23.38724	.01424	.06
25.	31.67100	31.71020	.03920	.12
30.	42.43000	42.51982	.08982	.21
35.	56.23600	56.41776	.18176	.32
40.	73.77700	74.11631	.33931	.46
45.	95.85500	96.45168	.59668	.62
50.	123.40000	124.39796	.99796	.81

A = 6.1078 B = 17.7238 C = 244.0121
D1 = 10.0 D2 = -40.0 E1 = 12.272 E2 = .1891

TEMP	SAT PRESSURE	COMPUTED	ERROR	ERROR
DG C	MB	MB	MB	%
-50.	.06356	.06341	-.00015	-.24
-45.	.11110	.11102	-.00008	-.08
-40.	.18910	.18910	.00000	.00
-35.	.31390	.31400	.00010	.03
-30.	.50880	.50919	.00039	.08
-25.	.80700	.80768	.00068	.08
-20.	1.25400	1.25504	.00104	.08
-15.	1.91180	1.91302	.00122	.06
-10.	2.86270	2.86388	.00118	.04
-5.	4.21480	4.21561	.00081	.02
0.	6.10780	6.10780	0.00000	0.00
5.	8.71920	8.71851	-.00069	-.01
10.	12.27200	12.27200	-.00000	-.00
15.	17.04400	17.04732	.00332	.02
20.	23.37300	23.38784	.01484	.06
25.	31.67100	31.71166	.04066	.13
30.	42.43000	42.52284	.09284	.22
35.	56.23600	56.42341	.18741	.33
40.	73.77700	74.12613	.34913	.47
45.	95.85500	96.46788	.61288	.64
50.	123.40000	124.42360	1.02360	.83

A = 6.1078 B = 17.7359 C = 244.1857
D1 = 10.0 D2 = -45.0 E1 = 12.272 E2 = .1111

TEMP DG C	SAT PRESSURE MB	COMPUTED MB	ERROR MB	ERROR %
-50.	.06356	.06347	-.00009	-.14
-45.	.11110	.11110	.00000	.00
-40.	.18910	.18921	.00011	.06
-35.	.31390	.31414	.00024	.08
-30.	.50880	.50935	.00055	.11
-25.	.80700	.80786	.00086	.11
-20.	1.25400	1.25523	.00123	.10
-15.	1.91180	1.91318	.00138	.07
-10.	2.86270	2.86401	.00131	.05
-5.	4.21480	4.21568	.00088	.02
0.	6.10780	6.10780	0.00000	0.00
5.	8.71920	8.71847	-.00073	-.01
10.	12.27200	12.27200	-.00000	-.00
15.	17.04400	17.04755	.00355	.02
20.	23.37300	23.38865	.01565	.07
25.	31.67100	31.71365	.04265	.13
30.	42.43000	42.52696	.09696	.23
35.	56.23600	56.43109	.19509	.35
40.	73.77700	74.13948	.36248	.49
45.	95.85500	96.48991	.63491	.66
50.	123.40000	124.45846	1.05846	.86

A = 6.1078 B = 17.7535 C = 244.4380
D1 = 10.0 D2 = -50.0 E1 = 12.272 E2 = .0636

TEMP DG C	SAT PRESSURE MB	COMPUTED MB	ERROR MB	ERROR %
-50.	.06356	.06356	0.00000	0.00
-45.	.11110	.11122	.00012	.11
-40.	.18910	.18937	.00027	.14
-35.	.31390	.31434	.00044	.14
-30.	.50880	.50958	.00078	.15
-25.	.80700	.80812	.00112	.14
-20.	1.25400	1.25549	.00149	.12
-15.	1.91180	1.91342	.00162	.08
-10.	2.86270	2.86420	.00150	.05
-5.	4.21480	4.21578	.00098	.02
0.	6.10780	6.10780	0.00000	0.00
5.	8.71920	8.71841	-.00079	-.01
10.	12.27200	12.27200	-.00000	-.00
15.	17.04400	17.04788	.00388	.02
20.	23.37300	23.38983	.01683	.07
25.	31.67100	31.71654	.04554	.14
30.	42.43000	42.53293	.10293	.24
35.	56.23600	56.44224	.20624	.37
40.	73.77700	74.15887	.38187	.52
45.	95.85500	96.52188	.66688	.70
50.	123.40000	124.50906	1.10906	.90

A = 6.1078 B = 17.6213 C = 242.5629
D1 = 15.0 D2 = -15.0 E1 = 17.044 E2 = 1.9118

TEMP DG C	SAT PRESSURE MB	COMPUTED MB	ERROR MB	ERROR %
-50.	.06356	.06292	-.00064	-1.01
-45.	.11110	.11035	-.00075	-.68
-40.	.18910	.18823	-.00087	-.46
-35.	.31390	.31292	-.00098	-.31
-30.	.50880	.50793	-.00087	-.17
-25.	.80700	.80631	-.00069	-.09
-20.	1.25400	1.25367	-.00033	-.03
-15.	1.91180	1.91180	.00000	.00
-10.	2.86270	2.86299	.00029	.01
-5.	4.21480	4.21517	.00037	.01
0.	6.10780	6.10780	0.00000	0.00
5.	8.71920	8.71863	-.00057	-.01
10.	12.27200	12.27133	-.00067	-.01
15.	17.04400	17.04400	-.00000	-.00
20.	23.37300	23.37854	.00554	.02
25.	31.67100	31.69085	.01985	.06
30.	42.43000	42.48182	.05182	.12
35.	56.23600	56.34912	.11312	.20
40.	73.77700	73.99959	.22259	.30
45.	95.85500	96.26228	.40728	.42
50.	123.40000	124.10196	.70196	.57

A = 6.1078 B = 17.6397 C = 242.8315
D1 = 15.0 D2 = -20.0 E1 = 17.044 E2 = 1.2540

TEMP DG C	SAT PRESSURE MB	COMPUTED MB	ERROR MB	ERROR %
-50.	.06356	.06302	-.00054	-.85
-45.	.11110	.11049	-.00061	-.55
-40.	.18910	.18841	-.00069	-.36
-35.	.31390	.31316	-.00074	-.24
-30.	.50880	.50821	-.00059	-.12
-25.	.80700	.80663	-.00037	-.05
-20.	1.25400	1.25400	.00000	.00
-15.	1.91180	1.91210	.00030	.02
-10.	2.86270	2.86323	.00053	.02
-5.	4.21480	4.21531	.00051	.01
0.	6.10780	6.10780	0.00000	0.00
5.	8.71920	8.71850	-.00070	-.01
10.	12.27200	12.27115	-.00085	-.01
15.	17.04400	17.04400	-.00000	-.00
20.	23.37300	23.37917	.00617	.03
25.	31.67100	31.69288	.02188	.07
30.	42.43000	42.48655	.05655	.13
35.	56.23600	56.35852	.12252	.22
40.	73.77700	74.01661	.23961	.32
45.	95.85500	96.29114	.43614	.45
50.	123.40000	124.14855	.74855	.61

A = 6.1078 B = 17.6616 C = 243.1529
D1 = 15.0 D2 = -25.0 E1 = 17.044 E2 = .8070

TEMP	SAT PRESSURE	COMPUTED	ERROR	ERROR
DG C	MB	MB	MB	%
-50.	.06356	.06314	-.00042	-.66
-45.	.11110	.11065	-.00045	-.40
-40.	.18910	.18864	-.00046	-.25
-35.	.31390	.31344	-.00046	-.15
-30.	.50880	.50854	-.00026	-.05
-25.	.80700	.80700	.00000	.00
-20.	1.25400	1.25439	.00039	.03
-15.	1.91180	1.91247	.00067	.03
-10.	2.86270	2.86352	.00082	.03
-5.	4.21480	4.21547	.00067	.02
0.	6.10780	6.10780	0.00000	0.00
5.	8.71920	8.71834	-.00086	-.01
10.	12.27200	12.27094	-.00106	-.01
15.	17.04400	17.04400	-.00000	-.00
20.	23.37300	23.37991	.00691	.03
25.	31.67100	31.69531	.02431	.08
30.	42.43000	42.49219	.06219	.15
35.	56.23600	56.36975	.13375	.24
40.	73.77700	74.03694	.25994	.35
45.	95.85500	96.32561	.47061	.49
50.	123.40000	124.20422	.80422	.65

A = 6.1078 B = 17.6786 C = 243.4012
D1 = 15.0 D2 = -30.0 E1 = 17.044 E2 = .5088

TEMP	SAT PRESSURE	COMPUTED	ERROR	ERROR
DG C	MB	MB	MB	%
-50.	.06356	.06324	-.00032	-.51
-45.	.11110	.11078	-.00032	-.29
-40.	.18910	.18881	-.00029	-.16
-35.	.31390	.31365	-.00025	-.08
-30.	.50880	.50880	.00000	.00
-25.	.80700	.80729	.00029	.04
-20.	1.25400	1.25469	.00069	.05
-15.	1.91180	1.91275	.00095	.05
-10.	2.86270	2.86375	.00105	.04
-5.	4.21480	4.21560	.00080	.02
0.	6.10780	6.10780	0.00000	0.00
5.	8.71920	8.71822	-.00098	-.01
10.	12.27200	12.27078	-.00122	-.01
15.	17.04400	17.04400	-.00000	-.00
20.	23.37300	23.38048	.00748	.03
25.	31.67100	31.69718	.02618	.08
30.	42.43000	42.49654	.06654	.16
35.	56.23600	56.37841	.14241	.25
40.	73.77700	74.05261	.27561	.37
45.	95.85500	96.35220	.49720	.52
50.	123.40000	124.24716	.84716	.69

A = 6.1078 B = 17.6984 C = 243.6902
D1 = 15.0 D2 = -35.0 E1 = 17.044 E2 = .3139

TEMP DG C	SAT PRESSURE MB	COMPUTED MB	ERROR MB	ERROR %
-50.	.06356	.06334	-.00022	-.34
-45.	.11110	.11093	-.00017	-.15
-40.	.18910	.18900	-.00010	-.05
-35.	.31390	.31390	.00000	.00
-30.	.50880	.50910	.00030	.06
-25.	.80700	.80762	.00062	.08
-20.	1.25400	1.25504	.00104	.08
-15.	1.91180	1.91308	.00128	.07
-10.	2.86270	2.86401	.00131	.05
-5.	4.21480	4.21575	.00095	.02
0.	6.10780	6.10780	0.00000	0.00
5.	8.71920	8.71808	-.00112	-.01
10.	12.27200	12.27059	-.00141	-.01
15.	17.04400	17.04400	-.00000	-.00
20.	23.37300	23.38115	.00815	.03
25.	31.67100	31.69935	.02835	.09
30.	42.43000	42.50159	.07159	.17
35.	56.23600	56.38846	.15246	.27
40.	73.77700	74.07082	.29382	.40
45.	95.85500	96.38309	.52809	.55
50.	123.40000	124.29705	.89705	.73

A = 6.1078 B = 17.7080 C = 243.8302
D1 = 15.0 D2 = -40.0 E1 = 17.044 E2 = .1891

TEMP DG C	SAT PRESSURE MB	COMPUTED MB	ERROR MB	ERROR %
-50.	.06356	.06340	-.00016	-.26
-45.	.11110	.11101	-.00009	-.08
-40.	.18910	.18910	.00000	.00
-35.	.31390	.31402	.00012	.04
-30.	.50880	.50924	.00044	.09
-25.	.80700	.80778	.00078	.10
-20.	1.25400	1.25520	.00120	.10
-15.	1.91180	1.91323	.00143	.07
-10.	2.86270	2.86413	.00143	.05
-5.	4.21480	4.21582	.00102	.02
0.	6.10780	6.10780	0.00000	0.00
5.	8.71920	8.71801	-.00119	-.01
10.	12.27200	12.27050	-.00150	-.01
15.	17.04400	17.04400	-.00000	-.00
20.	23.37300	23.38147	.00847	.04
25.	31.67100	31.70040	.02940	.09
30.	42.43000	42.50403	.07403	.17
35.	56.23600	56.39333	.15733	.28
40.	73.77700	74.07963	.30263	.41
45.	95.85500	96.39803	.54303	.57
50.	123.40000	124.32119	.92119	.75

A = 6.1078 B = 17.7204 C = 244.0114
D1 = 15.0 D2 = -45.0 E1 = 17.044 E2 = .1111

TEMP DG C	SAT PRESSURE MB	COMPUTED MB	ERROR MB	ERROR %
-50.	.06356	.06346	-.00010	-.15
-45.	.11110	.11110	.00000	.00
-40.	.18910	.18922	.00012	.07
-35.	.31390	.31418	.00028	.09
-30.	.50880	.50943	.00063	.12
-25.	.80700	.80799	.00099	.12
-20.	1.25400	1.25542	.00142	.11
-15.	1.91180	1.91344	.00164	.09
-10.	2.86270	2.86430	.00160	.06
-5.	4.21480	4.21591	.00111	.03
0.	6.10780	6.10780	0.00000	0.00
5.	8.71920	8.71792	-.00128	-.01
10.	12.27200	12.27038	-.00162	-.01
15.	17.04400	17.04400	-.00000	-.00
20.	23.37300	23.38189	.00889	.04
25.	31.67100	31.70176	.03076	.10
30.	42.43000	42.50720	.07720	.18
35.	56.23600	56.39962	.16362	.29
40.	73.77700	74.09103	.31403	.43
45.	95.85500	96.41737	.56237	.59
50.	123.40000	124.35242	.95242	.77

A = 6.1078 B = 17.7378 C = 244.2660
D1 = 15.0 D2 = -50.0 E1 = 17.044 E2 = .0636

TEMP DG C	SAT PRESSURE MB	COMPUTED MB	ERROR MB	ERROR %
-50.	.06356	.06356	.00000	.00
-45.	.11110	.11123	.00013	.12
-40.	.18910	.18940	.00030	.16
-35.	.31390	.31440	.00050	.16
-30.	.50880	.50969	.00089	.17
-25.	.80700	.80829	.00129	.16
-20.	1.25400	1.25573	.00173	.14
-15.	1.91180	1.91372	.00192	.10
-10.	2.86270	2.86452	.00182	.06
-5.	4.21480	4.21604	.00124	.03
0.	6.10780	6.10780	0.00000	0.00
5.	8.71920	8.71780	-.00140	-.02
10.	12.27200	12.27021	-.00179	-.01
15.	17.04400	17.04400	-.00000	-.00
20.	23.37300	23.38247	.00947	.04
25.	31.67100	31.70367	.03267	.10
30.	42.43000	42.51163	.08163	.19
35.	56.23600	56.40845	.17245	.31
40.	73.77700	74.10702	.33002	.45
45.	95.85500	96.44449	.58949	.61
50.	123.40000	124.39624	.99624	.81

A = 6.1078 B = 17.5980 C = 242.2616
D1 = 20.0 D2 = -15.0 E1 = 23.373 E2 = 1.9118

TEMP DG C	SAT PRESSURE MB	COMPUTED MB	ERROR MB	ERROR %
-50.	.06356	.06285	-.00071	-1.12
-45.	.11110	.11026	-.00084	-.76
-40.	.18910	.18812	-.00098	-.52
-35.	.31390	.31280	-.00110	-.35
-30.	.50880	.50781	-.00099	-.19
-25.	.80700	.80621	-.00079	-.10
-20.	1.25400	1.25362	-.00038	-.03
-15.	1.91180	1.91180	.00000	.00
-10.	2.86270	2.86305	.00035	.01
-5.	4.21480	4.21526	.00046	.01
0.	6.10780	6.10780	0.00000	0.00
5.	8.71920	8.71829	-.00091	-.01
10.	12.27200	12.27020	-.00180	-.01
15.	17.04400	17.04130	-.00270	-.02
20.	23.37300	23.37300	-.00000	-.00
25.	31.67100	31.68051	.00951	.03
30.	42.43000	42.46380	.03380	.08
35.	56.23600	56.31924	.08324	.15
40.	73.77700	73.95199	.17499	.24
45.	95.85500	96.18891	.33391	.35
50.	123.40000	123.99197	.59197	.48

A = 6.1078 B = 17.6169 C = 242.5441
D1 = 20.0 D2 = -20.0 E1 = 23.373 E2 = 1.2540

TEMP DG C	SAT PRESSURE MB	COMPUTED MB	ERROR MB	ERROR %
-50.	.06356	.06296	-.00060	-.94
-45.	.11110	.11041	-.00069	-.62
-40.	.18910	.18833	-.00077	-.41
-35.	.31390	.31307	-.00083	-.26
-30.	.50880	.50813	-.00067	-.13
-25.	.80700	.80658	-.00042	-.05
-20.	1.25400	1.25400	.00000	.00
-15.	1.91180	1.91217	.00037	.02
-10.	2.86270	2.86335	.00065	.02
-5.	4.21480	4.21544	.00064	.02
0.	6.10780	6.10780	0.00000	0.00
5.	8.71920	8.71809	-.00111	-.01
10.	12.27200	12.26984	-.00216	-.02
15.	17.04400	17.04093	-.00307	-.02
20.	23.37300	23.37300	-.00000	-.00
25.	31.67100	31.68156	.01056	.03
30.	42.43000	42.46705	.03705	.09
35.	56.23600	56.32652	.09052	.16
40.	73.77700	73.96605	.18905	.26
45.	95.85500	96.21374	.35874	.37
50.	123.40000	124.03320	.63320	.51

A = 6.1078 B = 17.6389 C = 242.8723
D1 = 20.0 D2 = -25.0 E1 = 23.373 E2 = .8070

TEMP DG C	SAT PRESSURE MB	COMPUTED MB	ERROR MB	ERROR %
-50.	.06356	.06309	-.00047	-.73
-45.	.11110	.11060	-.00050	-.45
-40.	.18910	.18857	-.00053	-.28
-35.	.31390	.31338	-.00052	-.17
-30.	.50880	.50851	-.00029	-.06
-25.	.80700	.80700	.00000	.00
-20.	1.25400	1.25445	.00045	.04
-15.	1.91180	1.91259	.00079	.04
-10.	2.86270	2.86370	.00100	.04
-5.	4.21480	4.21564	.00084	.02
0.	6.10780	6.10780	0.00000	0.00
5.	8.71920	8.71786	-.00134	-.02
10.	12.27200	12.26941	-.00259	-.02
15.	17.04400	17.04051	-.00349	-.02
20.	23.37300	23.37300	-.00000	-.00
25.	31.67100	31.68278	.01178	.04
30.	42.43000	42.47082	.04082	.10
35.	56.23600	56.33497	.09897	.18
40.	73.77700	73.98236	.20536	.28
45.	95.85500	96.24255	.38755	.40
50.	123.40000	124.08104	.68104	.55

A = 6.1078 B = 17.6564 C = 243.1334
D1 = 20.0 D2 = -30.0 E1 = 23.373 E2 = .5088

TEMP DG C	SAT PRESSURE MB	COMPUTED MB	ERROR MB	ERROR %
-50.	.06356	.06320	-.00036	-.57
-45.	.11110	.11074	-.00036	-.32
-40.	.18910	.18877	-.00033	-.18
-35.	.31390	.31362	-.00028	-.09
-30.	.50880	.50880	.00000	.00
-25.	.80700	.80733	.00033	.04
-20.	1.25400	1.25480	.00080	.06
-15.	1.91180	1.91293	.00113	.06
-10.	2.86270	2.86398	.00128	.04
-5.	4.21480	4.21581	.00101	.02
0.	6.10780	6.10780	0.00000	0.00
5.	8.71920	8.71767	-.00153	-.02
10.	12.27200	12.26908	-.00292	-.02
15.	17.04400	17.04017	-.00383	-.02
20.	23.37300	23.37300	-.00000	-.00
25.	31.67100	31.68375	.01275	.04
30.	42.43000	42.47382	.04382	.10
35.	56.23600	56.34167	.10567	.19
40.	73.77700	73.99531	.21831	.30
45.	95.85500	96.26542	.41042	.43
50.	123.40000	124.11903	.71903	.58

A = 6.1078 B = 17.6764 C = 243.4306
D1 = 20.0 D2 = -35.0 E1 = 23.373 E2 = .3139

TEMP DG C	SAT PRESSURE MB	COMPUTED MB	ERROR MB	ERROR %
-50.	.06356	.06332	-.00024	-.38
-45.	.11110	.11091	-.00019	-.18
-40.	.18910	.18898	-.00012	-.06
-35.	.31390	.31390	.00000	.00
-30.	.50880	.50913	.00033	.07
-25.	.80700	.80771	.00071	.09
-20.	1.25400	1.25520	.00120	.10
-15.	1.91180	1.91332	.00152	.08
-10.	2.86270	2.86430	.00160	.06
-5.	4.21480	4.21599	.00119	.03
0.	6.10780	6.10780	0.00000	0.00
5.	8.71920	8.71746	-.00174	-.02
10.	12.27200	12.26870	-.00330	-.03
15.	17.04400	17.03979	-.00421	-.02
20.	23.37300	23.37300	-.00000	-.00
25.	31.67100	31.68484	.01384	.04
30.	42.43000	42.47722	.04722	.11
35.	56.23600	56.34929	.11329	.20
40.	73.77700	74.01002	.23302	.32
45.	95.85500	96.29141	.43641	.46
50.	123.40000	124.16220	.76220	.62

A = 6.1078 B = 17.6870 C = 243.5885
D1 = 20.0 D2 = -40.0 E1 = 23.373 E2 = .1891

TEMP DG C	SAT PRESSURE MB	COMPUTED MB	ERROR MB	ERROR %
-50.	.06356	.06338	-.00018	-.28
-45.	.11110	.11099	-.00011	-.10
-40.	.18910	.18910	.00000	.00
-35.	.31390	.31405	.00015	.05
-30.	.50880	.50931	.00051	.10
-25.	.80700	.80792	.00092	.11
-20.	1.25400	1.25541	.00141	.11
-15.	1.91180	1.91352	.00172	.09
-10.	2.86270	2.86446	.00176	.06
-5.	4.21480	4.21609	.00129	.03
0.	6.10780	6.10780	0.00000	0.00
5.	8.71920	8.71735	-.00185	-.02
10.	12.27200	12.26849	-.00351	-.03
15.	17.04400	17.03959	-.00441	-.03
20.	23.37300	23.37300	-.00000	-.00
25.	31.67100	31.68543	.01443	.05
30.	42.43000	42.47903	.04903	.12
35.	56.23600	56.35333	.11733	.21
40.	73.77700	74.01782	.24082	.33
45.	95.85500	96.30520	.45020	.47
50.	123.40000	124.18510	.78510	.64

A = 6.1078 B = 17.7000 C = 243.7827
D1 = 20.0 D2 = -45.0 E1 = 23.373 E2 = .1111

TEMP DG C	SAT PRESSURE MB	COMPUTED MB	ERROR MB	ERROR %
-50.	.06356	.06346	-.00010	-.16
-45.	.11110	.11110	.00000	.00
-40.	.18910	.18924	.00014	.08
-35.	.31390	.31423	.00033	.10
-30.	.50880	.50953	.00073	.14
-25.	.80700	.80816	.00116	.14
-20.	1.25400	1.25568	.00168	.13
-15.	1.91180	1.91377	.00197	.10
-10.	2.86270	2.86467	.00197	.07
-5.	4.21480	4.21621	.00141	.03
0.	6.10780	6.10780	0.00000	0.00
5.	8.71920	8.71721	-.00199	-.02
10.	12.27200	12.26825	-.00375	-.03
15.	17.04400	17.03934	-.00466	-.03
20.	23.37300	23.37300	-.00000	-.00
25.	31.67100	31.68614	.01514	.05
30.	42.43000	42.48124	.05124	.12
35.	56.23600	56.35829	.12229	.22
40.	73.77700	74.02741	.25041	.34
45.	95.85500	96.32215	.46715	.49
50.	123.40000	124.21326	.81326	.66

A = 6.1078 B = 17.7176 C = 244.0449
D1 = 20.0 D2 = -50.0 E1 = 23.373 E2 = .0636

TEMP DG C	SAT PRESSURE MB	COMPUTED MB	ERROR MB	ERROR %
-50.	.06356	.06356	.00000	.00
-45.	.11110	.11124	.00014	.13
-40.	.18910	.18943	.00033	.18
-35.	.31390	.31447	.00057	.18
-30.	.50880	.50982	.00102	.20
-25.	.80700	.80850	.00150	.19
-20.	1.25400	1.25603	.00203	.16
-15.	1.91180	1.91411	.00231	.12
-10.	2.86270	2.86494	.00224	.08
-5.	4.21480	4.21637	.00157	.04
0.	6.10780	6.10780	0.00000	0.00
5.	8.71920	8.71702	-.00218	-.02
10.	12.27200	12.26791	-.00409	-.03
15.	17.04400	17.03901	-.00499	-.03
20.	23.37300	23.37300	-.00000	-.00
25.	31.67100	31.68710	.01610	.05
30.	42.43000	42.48423	.05423	.13
35.	56.23600	56.36498	.12898	.23
40.	73.77700	74.04034	.26334	.36
45.	95.85500	96.34498	.48998	.51
50.	123.40000	124.25120	.85120	.69

A = 6.1078 B = 17.5765 C = 241.9849
D1 = 25.0 D2 = -15.0 E1 = 31.671 E2 = 1.9118

TEMP	SAT PRESSURE	COMPUTED	ERROR	ERROR
DG C	MB	MB	MB	%
-50.	.06356	.06279	-.00077	-1.22
-45.	.11110	.11018	-.00092	-.83
-40.	.18910	.18802	-.00108	-.57
-35.	.31390	.31270	-.00120	-.38
-30.	.50880	.50771	-.00109	-.22
-25.	.80700	.80612	-.00088	-.11
-20.	1.25400	1.25356	-.00044	-.03
-15.	1.91180	1.91180	.00000	.00
-10.	2.86270	2.86311	.00041	.01
-5.	4.21480	4.21534	.00054	.01
0.	6.10780	6.10780	0.00000	0.00
5.	8.71920	8.71799	-.00121	-.01
10.	12.27200	12.26917	-.00283	-.02
15.	17.04400	17.03881	-.00519	-.03
20.	23.37300	23.36790	-.00510	-.02
25.	31.67100	31.67100	-.00000	-.00
30.	42.43000	42.44721	.01721	.04
35.	56.23600	56.29174	.05574	.10
40.	73.77700	73.90820	.13120	.18
45.	95.85500	96.12142	.26642	.28
50.	123.40000	123.89081	.49081	.40

A = 6.1078 B = 17.5957 C = 242.2763
D1 = 25.0 D2 = -20.0 E1 = 31.671 E2 = 1.2540

TEMP	SAT PRESSURE	COMPUTED	ERROR	ERROR
DG C	MB	MB	MB	%
-50.	.06356	.06291	-.00065	-1.02
-45.	.11110	.11035	-.00075	-.68
-40.	.18910	.18825	-.00085	-.45
-35.	.31390	.31299	-.00091	-.29
-30.	.50880	.50806	-.00074	-.14
-25.	.80700	.80653	-.00047	-.06
-20.	1.25400	1.25400	.00000	.00
-15.	1.91180	1.91223	.00043	.02
-10.	2.86270	2.86347	.00077	.03
-5.	4.21480	4.21556	.00076	.02
0.	6.10780	6.10780	0.00000	0.00
5.	8.71920	8.71771	-.00149	-.02
10.	12.27200	12.26861	-.00339	-.03
15.	17.04400	17.03807	-.00593	-.03
20.	23.37300	23.36724	-.00576	-.02
25.	31.67100	31.67100	-.00000	-.00
30.	42.43000	42.44886	.01886	.04
35.	56.23600	56.29666	.06066	.11
40.	73.77700	73.91889	.14189	.19
45.	95.85500	96.14156	.28656	.30
50.	123.40000	123.92563	.52563	.43

A = 6.1078 B = 17.6176 C = 242.6089
D1 = 25.0 D2 = -25.0 E1 = 31.671 E2 = .8070

TEMP DG C	SAT PRESSURE MB	COMPUTED MB	ERROR MB	ERROR %
-50.	.06356	.06305	-.00051	-.80
-45.	.11110	.11054	-.00056	-.50
-40.	.18910	.18851	-.00059	-.31
-35.	.31390	.31332	-.00058	-.18
-30.	.50880	.50847	-.00033	-.06
-25.	.80700	.80700	.00000	.00
-20.	1.25400	1.25450	.00050	.04
-15.	1.91180	1.91271	.00091	.05
-10.	2.86270	2.86387	.00117	.04
-5.	4.21480	4.21580	.00100	.02
0.	6.10780	6.10780	0.00000	0.00
5.	8.71920	8.71740	-.00180	-.02
10.	12.27200	12.26798	-.00402	-.03
15.	17.04400	17.03723	-.00677	-.04
20.	23.37300	23.36650	-.00650	-.03
25.	31.67100	31.67100	-.00000	-.00
30.	42.43000	42.45074	.02074	.05
35.	56.23600	56.30227	.06627	.12
40.	73.77700	73.93106	.15406	.21
45.	95.85500	96.16449	.30949	.32
50.	123.40000	123.96530	.56530	.46

A = 6.1078 B = 17.6354 C = 242.8797
D1 = 25.0 D2 = -30.0 E1 = 31.671 E2 = .5088

TEMP DG C	SAT PRESSURE MB	COMPUTED MB	ERROR MB	ERROR %
-50.	.06356	.06316	-.00040	-.63
-45.	.11110	.11070	-.00040	-.36
-40.	.18910	.18873	-.00037	-.20
-35.	.31390	.31360	-.00030	-.10
-30.	.50880	.50880	0.00000	0.00
-25.	.80700	.80738	.00038	.05
-20.	1.25400	1.25491	.00091	.07
-15.	1.91180	1.91311	.00131	.07
-10.	2.86270	2.86420	.00150	.05
-5.	4.21480	4.21600	.00120	.03
0.	6.10780	6.10780	0.00000	0.00
5.	8.71920	8.71715	-.00205	-.02
10.	12.27200	12.26747	-.00453	-.04
15.	17.04400	17.03654	-.00746	-.04
20.	23.37300	23.36590	-.00710	-.03
25.	31.67100	31.67100	-.00000	-.00
30.	42.43000	42.45226	.02226	.05
35.	56.23600	56.30682	.07082	.13
40.	73.77700	73.94095	.16395	.22
45.	95.85500	96.18313	.32813	.34
50.	123.40000	123.99754	.59754	.48

A = 6.1078 B = 17.6554 C = 243.1833
D1 = 25.0 D2 = -35.0 E1 = 31.671 E2 = .3139

TEMP DG C	SAT PRESSURE MB	COMPUTED MB	ERROR MB	ERROR %
-50.	.06356	.06329	-.00027	-.43
-45.	.11110	.11088	-.00022	-.20
-40.	.18910	.18896	-.00014	-.07
-35.	.31390	.31390	.00000	.00
-30.	.50880	.50917	.00037	.07
-25.	.80700	.80780	.00080	.10
-20.	1.25400	1.25536	.00136	.11
-15.	1.91180	1.91355	.00175	.09
-10.	2.86270	2.86457	.00187	.07
-5.	4.21480	4.21622	.00142	.03
0.	6.10780	6.10780	0.00000	0.00
5.	8.71920	8.71687	-.00233	-.03
10.	12.27200	12.26689	-.00511	-.04
15.	17.04400	17.03578	-.00822	-.05
20.	23.37300	23.36522	-.00778	-.03
25.	31.67100	31.67100	-.00000	-.00
30.	42.43000	42.45397	.02397	.06
35.	56.23600	56.31192	.07592	.13
40.	73.77700	73.95203	.17503	.24
45.	95.85500	96.20399	.34899	.36
50.	123.40000	124.03362	.63362	.51

A = 6.1078 B = 17.6668 C = 243.3560
D1 = 25.0 D2 = -40.0 E1 = 31.671 E2 = .1891

TEMP DG C	SAT PRESSURE MB	COMPUTED MB	ERROR MB	ERROR %
-50.	.06356	.06336	-.00020	-.31
-45.	.11110	.11098	-.00012	-.11
-40.	.18910	.18910	.00000	.00
-35.	.31390	.31407	.00017	.06
-30.	.50880	.50938	.00058	.11
-25.	.80700	.80804	.00104	.13
-20.	1.25400	1.25562	.00162	.13
-15.	1.91180	1.91380	.00200	.10
-10.	2.86270	2.86478	.00208	.07
-5.	4.21480	4.21635	.00155	.04
0.	6.10780	6.10780	0.00000	0.00
5.	8.71920	8.71670	-.00250	-.03
10.	12.27200	12.26657	-.00543	-.04
15.	17.04400	17.03534	-.00866	-.05
20.	23.37300	23.36484	-.00816	-.03
25.	31.67100	31.67100	-.00000	-.00
30.	42.43000	42.45494	.02494	.06
35.	56.23600	56.31481	.07881	.14
40.	73.77700	73.95831	.18131	.25
45.	95.85500	96.21583	.36083	.38
50.	123.40000	124.05411	.65411	.53

A = 6.1078 B = 17.6803 C = 243.5613
D1 = 25.0 D2 = -45.0 E1 = 31.671 E2 = .1111

TEMP	SAT PRESSURE	COMPUTED	ERROR	ERROR
DG C	MB	MB	MB	%
-50.	.06356	.06345	-.00011	-.18
-45.	.11110	.11110	.00000	.00
-40.	.18910	.18926	.00016	.08
-35.	.31390	.31428	.00038	.12
-30.	.50880	.50963	.00083	.16
-25.	.80700	.80833	.00133	.16
-20.	1.25400	1.25592	.00192	.15
-15.	1.91180	1.91410	.00230	.12
-10.	2.86270	2.86503	.00233	.08
-5.	4.21480	4.21650	.00170	.04
0.	6.10780	6.10780	0.00000	0.00
5.	8.71920	8.71651	-.00269	-.03
10.	12.27200	12.26618	-.00582	-.05
15.	17.04400	17.03482	-.00918	-.05
20.	23.37300	23.36439	-.00861	-.04
25.	31.67100	31.67100	-.00000	-.00
30.	42.43000	42.45609	.02609	.06
35.	56.23600	56.31825	.08225	.15
40.	73.77700	73.96578	.18878	.26
45.	95.85500	96.22990	.37490	.39
50.	123.40000	124.07846	.67846	.55

A = 6.1078 B = 17.6980 C = 243.8301
D1 = 25.0 D2 = -50.0 E1 = 31.671 E2 = .0636

TEMP	SAT PRESSURE	COMPUTED	ERROR	ERROR
DG C	MB	MB	MB	%
-50.	.06356	.06356	.00000	.00
-45.	.11110	.11126	.00016	.14
-40.	.18910	.18947	.00037	.20
-35.	.31390	.31455	.00065	.21
-30.	.50880	.50996	.00116	.23
-25.	.80700	.80870	.00170	.21
-20.	1.25400	1.25632	.00232	.19
-15.	1.91180	1.91448	.00268	.14
-10.	2.86270	2.86536	.00266	.09
-5.	4.21480	4.21670	.00190	.05
0.	6.10780	6.10780	0.00000	0.00
5.	8.71920	8.71626	-.00294	-.03
10.	12.27200	12.26567	-.00633	-.05
15.	17.04400	17.03415	-.00985	-.06
20.	23.37300	23.36379	-.00921	-.04
25.	31.67100	31.67100	-.00000	-.00
30.	42.43000	42.45760	.02760	.07
35.	56.23600	56.32274	.08674	.15
40.	73.77700	73.97554	.19854	.27
45.	95.85500	96.24829	.39329	.41
50.	123.40000	124.11028	.71028	.58

A = 6.1078 B = 17.5543 C = 241.6982
D1 = 30.0 D2 = -15.0 E1 = 42.430 E2 = 1.9118

TEMP DG C	SAT PRESSURE MB	COMPUTED MB	ERROR MB	ERROR %
-50.	.06356	.06272	-.00084	-1.32
-45.	.11110	.11009	-.00101	-.91
-40.	.18910	.18792	-.00118	-.62
-35.	.31390	.31258	-.00132	-.42
-30.	.50880	.50759	-.00121	-.24
-25.	.80700	.80603	-.00097	-.12
-20.	1.25400	1.25350	-.00050	-.04
-15.	1.91180	1.91180	.00000	.00
-10.	2.86270	2.86317	.00047	.02
-5.	4.21480	4.21542	.00062	.01
0.	6.10780	6.10780	0.00000	0.00
5.	8.71920	8.71767	-.00153	-.02
10.	12.27200	12.26809	-.00391	-.03
15.	17.04400	17.03623	-.00777	-.05
20.	23.37300	23.36260	-.01040	-.04
25.	31.67100	31.66113	-.00987	-.03
30.	42.43000	42.43000	-.00000	-.00
35.	56.23600	56.26321	.02721	.05
40.	73.77700	73.86277	.08577	.12
45.	95.85500	96.05143	.19643	.20
50.	123.40000	123.78591	.38591	.31

A = 6.1078 B = 17.5738 C = 241.9991
D1 = 30.0 D2 = -20.0 E1 = 42.430 E2 = 1.2540

TEMP DG C	SAT PRESSURE MB	COMPUTED MB	ERROR MB	ERROR %
-50.	.06356	.06285	-.00071	-1.11
-45.	.11110	.11028	-.00082	-.74
-40.	.18910	.18817	-.00093	-.49
-35.	.31390	.31291	-.00099	-.32
-30.	.50880	.50799	-.00081	-.16
-25.	.80700	.80649	-.00051	-.06
-20.	1.25400	1.25400	.00000	.00
-15.	1.91180	1.91229	.00049	.03
-10.	2.86270	2.86358	.00088	.03
-5.	4.21480	4.21568	.00088	.02
0.	6.10780	6.10780	0.00000	0.00
5.	8.71920	8.71732	-.00188	-.02
10.	12.27200	12.26734	-.00466	-.04
15.	17.04400	17.03510	-.00890	-.05
20.	23.37300	23.36128	-.01172	-.05
25.	31.67100	31.66005	-.01095	-.03
30.	42.43000	42.43000	-.00000	-.00
35.	56.23600	56.26571	.02971	.05
40.	73.77700	73.87000	.09300	.13
45.	95.85500	96.06675	.21175	.22
50.	123.40000	123.81417	.41417	.34

A = 6.1078 B = 17.5956 C = 242.3373
D1 = 30.0 D2 = -25.0 E1 = 42.430 E2 = .8070

TEMP DG C	SAT PRESSURE MB	COMPUTED MB	ERROR MB	ERROR %
-50.	.06356	.06300	-.00056	-.88
-45.	.11110	.11049	-.00061	-.55
-40.	.18910	.18845	-.00065	-.34
-35.	.31390	.31327	-.00063	-.20
-30.	.50880	.50843	-.00037	-.07
-25.	.80700	.80700	.00000	.00
-20.	1.25400	1.25456	.00056	.04
-15.	1.91180	1.91283	.00103	.05
-10.	2.86270	2.86405	.00135	.05
-5.	4.21480	4.21597	.00117	.03
0.	6.10780	6.10780	0.00000	0.00
5.	8.71920	8.71693	-.00227	-.03
10.	12.27200	12.26650	-.00550	-.04
15.	17.04400	17.03384	-.01016	-.06
20.	23.37300	23.35979	-.01321	-.06
25.	31.67100	31.65884	-.01216	-.04
30.	42.43000	42.43000	-.00000	-.00
35.	56.23600	56.26851	.03251	.06
40.	73.77700	73.87811	.10111	.14
45.	95.85500	96.08393	.22893	.24
50.	123.40000	123.84587	.44587	.36

A = 6.1078 B = 17.6137 C = 242.6180
D1 = 30.0 D2 = -30.0 E1 = 42.430 E2 = .5088

TEMP DG C	SAT PRESSURE MB	COMPUTED MB	ERROR MB	ERROR %
-50.	.06356	.06313	-.00043	-.68
-45.	.11110	.11066	-.00044	-.40
-40.	.18910	.18869	-.00041	-.22
-35.	.31390	.31357	-.00033	-.11
-30.	.50880	.50880	.00000	.00
-25.	.80700	.80743	.00043	.05
-20.	1.25400	1.25501	.00101	.08
-15.	1.91180	1.91329	.00149	.08
-10.	2.86270	2.86443	.00173	.06
-5.	4.21480	4.21620	.00140	.03
0.	6.10780	6.10780	0.00000	0.00
5.	8.71920	8.71661	-.00259	-.03
10.	12.27200	12.26580	-.00620	-.05
15.	17.04400	17.03279	-.01121	-.07
20.	23.37300	23.35856	-.01444	-.06
25.	31.67100	31.65783	-.01317	-.04
30.	42.43000	42.43000	-.00000	-.00
35.	56.23600	56.27083	.03483	.06
40.	73.77700	73.88483	.10783	.15
45.	95.85500	96.09816	.24316	.25
50.	123.40000	123.87212	.47212	.38

A = 6.1078 B = 17.6338 C = 242.9287
D1 = 30.0 D2 = -35.0 E1 = 42.430 E2 = .3139

TEMP	SAT PRESSURE	COMPUTED	ERROR	ERROR
DG C	MB	MB	MB	%
-50.	.06356	.06326	-.00030	-.47
-45.	.11110	.11085	-.00025	-.22
-40.	.18910	.18895	-.00015	-.08
-35.	.31390	.31390	.00000	.00
-30.	.50880	.50921	.00041	.08
-25.	.80700	.80790	.00090	.11
-20.	1.25400	1.25552	.00152	.12
-15.	1.91180	1.91379	.00199	.10
-10.	2.86270	2.86486	.00216	.08
-5.	4.21480	4.21647	.00167	.04
0.	6.10780	6.10780	0.00000	0.00
5.	8.71920	8.71625	-.00295	-.03
10.	12.27200	12.26503	-.00697	-.06
15.	17.04400	17.03163	-.01237	-.07
20.	23.37300	23.35720	-.01580	-.07
25.	31.67100	31.65672	-.01428	-.05
30.	42.43000	42.43000	-.00000	-.00
35.	56.23600	56.27339	.03739	.07
40.	73.77700	73.89225	.11525	.16
45.	95.85500	96.11389	.25889	.27
50.	123.40000	123.90114	.50114	.41

A = 6.1078 B = 17.6459 C = 243.1155
D1 = 30.0 D2 = -40.0 E1 = 42.430 E2 = .1891

TEMP	SAT PRESSURE	COMPUTED	ERROR	ERROR
DG C	MB	MB	MB	%
-50.	.06356	.06334	-.00022	-.34
-45.	.11110	.11097	-.00013	-.12
-40.	.18910	.18910	.00000	.00
-35.	.31390	.31410	.00020	.06
-30.	.50880	.50945	.00065	.13
-25.	.80700	.80818	.00118	.15
-20.	1.25400	1.25583	.00183	.15
-15.	1.91180	1.91409	.00229	.12
-10.	2.86270	2.86511	.00241	.08
-5.	4.21480	4.21662	.00182	.04
0.	6.10780	6.10780	0.00000	0.00
5.	8.71920	8.71604	-.00316	-.04
10.	12.27200	12.26457	-.00743	-.06
15.	17.04400	17.03094	-.01306	-.08
20.	23.37300	23.35639	-.01661	-.07
25.	31.67100	31.65606	-.01494	-.05
30.	42.43000	42.43000	-.00000	-.00
35.	56.23600	56.27493	.03893	.07
40.	73.77700	73.89670	.11970	.16
45.	95.85500	96.12333	.26833	.28
50.	123.40000	123.91855	.51855	.42

A = 6.1078 B = 17.6599 C = 243.3319
D1 = 30.0 D2 = -45.0 E1 = 42.430 E2 = .1111

TEMP DG C	SAT PRESSURE MB	COMPUTED MB	ERROR MB	ERROR %
-50.	.06356	.06344	-.00012	-.19
-45.	.11110	.11110	.00000	.00
-40.	.18910	.18928	.00018	.09
-35.	.31390	.31433	.00043	.14
-30.	.50880	.50973	.00093	.18
-25.	.80700	.80850	.00150	.19
-20.	1.25400	1.25618	.00218	.17
-15.	1.91180	1.91443	.00263	.14
-10.	2.86270	2.86541	.00271	.09
-5.	4.21480	4.21680	.00200	.05
0.	6.10780	6.10780	0.00000	0.00
5.	8.71920	8.71579	-.00341	-.04
10.	12.27200	12.26403	-.00797	-.06
15.	17.04400	17.03013	-.01387	-.08
20.	23.37300	23.35545	-.01755	-.08
25.	31.67100	31.65529	-.01571	-.05
30.	42.43000	42.43000	-.00000	-.00
35.	56.23600	56.27671	.04071	.07
40.	73.77700	73.90186	.12486	.17
45.	95.85500	96.13425	.27925	.29
50.	123.40000	123.93871	.53871	.44

A = 6.1078 B = 17.6777 C = 243.6078
D1 = 30.0 D2 = -50.0 E1 = 42.430 E2 = .0636

TEMP DG C	SAT PRESSURE MB	COMPUTED MB	ERROR MB	ERROR %
-50.	.06356	.06356	0.00000	0.00
-45.	.11110	.11127	.00017	.15
-40.	.18910	.18951	.00041	.22
-35.	.31390	.31462	.00072	.23
-30.	.50880	.51009	.00129	.25
-25.	.80700	.80892	.00192	.24
-20.	1.25400	1.25663	.00263	.21
-15.	1.91180	1.91487	.00307	.16
-10.	2.86270	2.86578	.00308	.11
-5.	4.21480	4.21704	.00224	.05
0.	6.10780	6.10780	0.00000	0.00
5.	8.71920	8.71548	-.00372	-.04
10.	12.27200	12.26335	-.00865	-.07
15.	17.04400	17.02911	-.01489	-.09
20.	23.37300	23.35425	-.01875	-.08
25.	31.67100	31.65431	-.01669	-.05
30.	42.43000	42.43000	-.00000	-.00
35.	56.23600	56.27898	.04298	.08
40.	73.77700	73.90841	.13141	.18
45.	95.85500	96.14815	.29315	.31
50.	123.40000	123.96436	.56436	.46

A = 6.1078 B = 17.5332 C = 241.4251
D1 = 35.0 D2 = -15.0 E1 = 56.236 E2 = 1.9118

TEMP DG C	SAT PRESSURE MB	COMPUTED MB	ERROR MB	ERROR %
-50.	.06356	.06266	-.00090	-1.42
-45.	.11110	.11001	-.00109	-.98
-40.	.18910	.18782	-.00128	-.68
-35.	.31390	.31247	-.00143	-.45
-30.	.50880	.50748	-.00132	-.26
-25.	.80700	.80594	-.00106	-.13
-20.	1.25400	1.25345	-.00055	-.04
-15.	1.91180	1.91180	.00000	.00
-10.	2.86270	2.86323	.00053	.02
-5.	4.21480	4.21550	.00070	.02
0.	6.10780	6.10780	0.00000	0.00
5.	8.71920	8.71737	-.00183	-.02
10.	12.27200	12.26707	-.00493	-.04
15.	17.04400	17.03377	-.01023	-.06
20.	23.37300	23.35755	-.01545	-.07
25.	31.67100	31.65171	-.01929	-.06
30.	42.43000	42.41358	-.01642	-.04
35.	56.23600	56.23600	-.00000	-.00
40.	73.77700	73.81944	.04244	.06
45.	95.85500	95.98467	.12967	.14
50.	123.40000	123.68587	.28587	.23

A = 6.1078 B = 17.5527 C = 241.7334
D1 = 35.0 D2 = -20.0 E1 = 56.236 E2 = 1.2540

TEMP DG C	SAT PRESSURE MB	COMPUTED MB	ERROR MB	ERROR %
-50.	.06356	.06280	-.00076	-1.20
-45.	.11110	.11021	-.00089	-.80
-40.	.18910	.18809	-.00101	-.53
-35.	.31390	.31282	-.00108	-.34
-30.	.50880	.50792	-.00088	-.17
-25.	.80700	.80644	-.00056	-.07
-20.	1.25400	1.25400	.00000	.00
-15.	1.91180	1.91235	.00055	.03
-10.	2.86270	2.86370	.00100	.03
-5.	4.21480	4.21580	.00100	.02
0.	6.10780	6.10780	0.00000	0.00
5.	8.71920	8.71695	-.00225	-.03
10.	12.27200	12.26612	-.00588	-.05
15.	17.04400	17.03225	-.01175	-.07
20.	23.37300	23.35554	-.01746	-.07
25.	31.67100	31.64953	-.02147	-.07
30.	42.43000	42.41189	-.01811	-.04
35.	56.23600	56.23600	-.00000	-.00
40.	73.77700	73.82308	.04608	.06
45.	95.85500	95.99495	.13995	.15
50.	123.40000	123.70721	.30721	.25

A = 6.1078 B = 17.5745 C = 242.0761
D1 = 35.0 D2 = -25.0 E1 = 56.236 E2 = .8070

TEMP DG C	SAT PRESSURE MB	COMPUTED MB	ERROR MB	ERROR %
-50.	.06356	.06296	-.00060	-.95
-45.	.11110	.11043	-.00067	-.60
-40.	.18910	.18839	-.00071	-.37
-35.	.31390	.31321	-.00069	-.22
-30.	.50880	.50840	-.00040	-.08
-25.	.80700	.80700	.00000	.00
-20.	1.25400	1.25461	.00061	.05
-15.	1.91180	1.91295	.00115	.06
-10.	2.86270	2.86422	.00152	.05
-5.	4.21480	4.21612	.00132	.03
0.	6.10780	6.10780	0.00000	0.00
5.	8.71920	8.71648	-.00272	-.03
10.	12.27200	12.26507	-.00693	-.06
15.	17.04400	17.03057	-.01343	-.08
20.	23.37300	23.35332	-.01968	-.08
25.	31.67100	31.64712	-.02388	-.08
30.	42.43000	42.41002	-.01998	-.05
35.	56.23600	56.23600	-.00000	-.00
40.	73.77700	73.82712	.05012	.07
45.	95.85500	96.00636	.15136	.16
50.	123.40000	123.73088	.33088	.27

A = 6.1078 B = 17.5928 C = 242.3650
D1 = 35.0 D2 = -30.0 E1 = 56.236 E2 = .5088

TEMP DG C	SAT PRESSURE MB	COMPUTED MB	ERROR MB	ERROR %
-50.	.06356	.06309	-.00047	-.74
-45.	.11110	.11062	-.00048	-.43
-40.	.18910	.18865	-.00045	-.24
-35.	.31390	.31354	-.00036	-.11
-30.	.50880	.50880	0.00000	0.00
-25.	.80700	.80747	.00047	.06
-20.	1.25400	1.25512	.00112	.09
-15.	1.91180	1.91346	.00166	.09
-10.	2.86270	2.86465	.00195	.07
-5.	4.21480	4.21640	.00160	.04
0.	6.10780	6.10780	0.00000	0.00
5.	8.71920	8.71609	-.00311	-.04
10.	12.27200	12.26419	-.00781	-.06
15.	17.04400	17.02916	-.01484	-.09
20.	23.37300	23.35146	-.02154	-.09
25.	31.67100	31.64508	-.02592	-.08
30.	42.43000	42.40845	-.02155	-.05
35.	56.23600	56.23600	-.00000	-.00
40.	73.77700	73.83052	.05352	.07
45.	95.85500	96.01596	.16096	.17
50.	123.40000	123.75080	.35080	.28

A = 6.1078 B = 17.6129 C = 242.6818
D1 = 35.0 D2 = -35.0 E1 = 56.236 E2 = .3139

TEMP DG C	SAT PRESSURE MB	COMPUTED MB	ERROR MB	ERROR %
-50.	.06356	.06324	-.00032	-.51
-45.	.11110	.11082	-.00028	-.25
-40.	.18910	.18893	-.00017	-.09
-35.	.31390	.31390	0.00000	0.00
-30.	.50880	.50924	.00044	.09
-25.	.80700	.80798	.00098	.12
-20.	1.25400	1.25568	.00168	.13
-15.	1.91180	1.91402	.00222	.12
-10.	2.86270	2.86513	.00243	.09
-5.	4.21480	4.21670	.00190	.05
0.	6.10780	6.10780	0.00000	0.00
5.	8.71920	8.71566	-.00354	-.04
10.	12.27200	12.26322	-.00878	-.07
15.	17.04400	17.02761	-.01639	-.10
20.	23.37300	23.34942	-.02358	-.10
25.	31.67100	31.64286	-.02814	-.09
30.	42.43000	42.40673	-.02327	-.05
35.	56.23600	56.23600	-.00000	-.00
40.	73.77700	73.83423	.05723	.08
45.	95.85500	96.02646	.17146	.18
50.	123.40000	123.77259	.37259	.30

A = 6.1078 B = 17.6255 C = 242.8810
D1 = 35.0 D2 = -40.0 E1 = 56.236 E2 = .1891

TEMP DG C	SAT PRESSURE MB	COMPUTED MB	ERROR MB	ERROR %
-50.	.06356	.06333	-.00023	-.37
-45.	.11110	.11095	-.00015	-.13
-40.	.18910	.18910	.00000	.00
-35.	.31390	.31413	.00023	.07
-30.	.50880	.50952	.00072	.14
-25.	.80700	.80831	.00131	.16
-20.	1.25400	1.25603	.00203	.16
-15.	1.91180	1.91437	.00257	.13
-10.	2.86270	2.86543	.00273	.10
-5.	4.21480	4.21689	.00209	.05
0.	6.10780	6.10780	0.00000	0.00
5.	8.71920	8.71539	-.00381	-.04
10.	12.27200	12.26262	-.00938	-.08
15.	17.04400	17.02664	-.01736	-.10
20.	23.37300	23.34813	-.02487	-.11
25.	31.67100	31.64147	-.02953	-.09
30.	42.43000	42.40565	-.02435	-.06
35.	56.23600	56.23600	-.00000	-.00
40.	73.77700	73.83657	.05957	.08
45.	95.85500	96.03305	.17805	.19
50.	123.40000	123.78628	.38628	.31

A = 6.1078 B = 17.6399 C = 243.1072
D1 = 35.0 D2 = -45.0 E1 = 56.236 E2 = .1111

TEMP DG C	SAT PRESSURE MB	COMPUTED MB	ERROR MB	ERROR %
-50.	.06356	.06343	-.00013	-.20
-45.	.11110	.11110	.00000	.00
-40.	.18910	.18930	.00020	.10
-35.	.31390	.31438	.00048	.15
-30.	.50880	.50983	.00103	.20
-25.	.80700	.80867	.00167	.21
-20.	1.25400	1.25643	.00243	.19
-15.	1.91180	1.91476	.00296	.16
-10.	2.86270	2.86578	.00308	.11
-5.	4.21480	4.21710	.00230	.05
0.	6.10780	6.10780	0.00000	0.00
5.	8.71920	8.71509	-.00411	-.05
10.	12.27200	12.26193	-.01007	-.08
15.	17.04400	17.02554	-.01846	-.11
20.	23.37300	23.34668	-.02632	-.11
25.	31.67100	31.63989	-.03111	-.10
30.	42.43000	42.40442	-.02558	-.06
35.	56.23600	56.23600	-.00000	-.00
40.	73.77700	73.83921	.06221	.08
45.	95.85500	96.04053	.18553	.19
50.	123.40000	123.80180	.40180	.33

A = 6.1078 B = 17.6578 C = 243.3897
D1 = 35.0 D2 = -50.0 E1 = 56.236 E2 = .0636

TEMP DG C	SAT PRESSURE MB	COMPUTED MB	ERROR MB	ERROR %
-50.	.06356	.06356	0.00000	0.00
-45.	.11110	.11128	.00018	.16
-40.	.18910	.18954	.00044	.23
-35.	.31390	.31470	.00080	.25
-30.	.50880	.51022	.00142	.28
-25.	.80700	.80913	.00213	.26
-20.	1.25400	1.25693	.00293	.23
-15.	1.91180	1.91526	.00346	.18
-10.	2.86270	2.86620	.00350	.12
-5.	4.21480	4.21737	.00257	.06
0.	6.10780	6.10780	0.00000	0.00
5.	8.71920	8.71471	-.00449	-.05
10.	12.27200	12.26107	-.01093	-.09
15.	17.04400	17.02416	-.01984	-.12
20.	23.37300	23.34487	-.02813	-.12
25.	31.67100	31.63792	-.03308	-.10
30.	42.43000	42.40290	-.02710	-.06
35.	56.23600	56.23600	-.00000	-.00
40.	73.77700	73.84251	.06551	.09
45.	95.85500	96.04985	.19485	.20
50.	123.40000	123.82114	.42114	.34

APPENDIX 2

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00100      PROGRAM DEWRED (OUTPUT,TAPE1)
00110      DIMENSION C(3),CA(3),CC(3),CF(8,3),CK(8),CS(3,3),
00120+        D(21),DC(21,8),DF(21),Q(8),W(21),WK(8)
00130      1 FORMAT (///5X*PRESSURE RATIO P0/P1 =*F5.1)
00140      2 FORMAT (5X*C0 =*E10.4,2X*C1 =*E10.4,2X*C2 =*E10.4)
00150      3 FORMAT (5X*C0 =*E10.4,2X*C1 =*E10.4)
00160      4 FORMAT (/5X*DEW POINT*3X*MEASURED*4X*COMPUTED*5X
00170+        *ERROR*/7X*DEG C*7X*DEG C*7X*DEG C*6X*DEG C*/)
00180      5 FORMAT (F12.0,F12.4,F12.4,F12.5)
00190      6 FORMAT (///5X*COEFFICIENT*6X*C(0)*8X*C(1)*8X*C(2)*/)
00200      7 FORMAT (I11,6X,3(E12.5))
00210      DATA (A=17.6459),(B=243.116)
00220      DATA (D=-50.,-45.,-40.,-35.,-30.,-25.,-20.,-15.,-10.,
00230+        -5.,0.,5.,10.,15.,20.,25.,30.,35.,40.,45.,50.)
00240      DATA (Q=1.1,1.2,1.3,1.4,1.5,1.6,1.7,1.8)
00250      DATA (W=21(1.0)),(WK=8(1.0))
00260      M=2
00270      100 DO 200 J=1,8
00280          DO 200 I=1,21
00290              IF (D(I) .NE. -B) GOTO 110
00300              DC(I,J)=-B-D(I)
00310              GOTO 200
00320      110 IF (D(I) .NE. 0.) GOTO 120
00330          DF=0.
00340          GOTO 130
00350      120 DF=A/(B/D(I)+1.0)
00360      130 DG=ALOG(Q(J))+DF
00370          IF (DG .NE. 0.0) GOTO 140
00380          DC(I,J)=-D(I)
00390          GOTO 200
00400      140 DC(I,J)=B/(A/DG-1.0)-D(I)
00410      200 CONTINUE
00420          DO 600 J=1,8
00430              DO 250 I=1,21
00440                  DF(I)=DC(I,J)
00450      250 CONTINUE
00460          WRITE (1,1) Q(J)
00470          CALL CSTLSTS (M,21,D,DF,W,0,0.0,0.0,C,IE)
00480          CF(J,1)=C(1)
00490          CF(J,2)=C(2)
00500          IF (M .GE. 2) GOTO 300
00510          WRITE (1,3) (C(K),K=1,2)
00520          GOTO 400
00530      300 CF(J,3)=C(3)
00540          WRITE (1,2) (C(K),K=1,3)
00550      400 WRITE (1,4)
00560          DO 500 I=1,21
00570              DE=C(1)+C(2)*D(I)
00580              IF (M.EQ.2) DE=DE+C(3)*D(I)*D(I)
00590              DD=DF(I)-DE
00600              WRITE (1,5) D(I),DF(I),DE,DD
00610      500 CONTINUE

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00620 600 CONTINUE
00630     WRITE (1,6)
00640     MC=M+1
00650     DO 720 K=1,MC
00660     DO 650 J=1,8
00670     CK(J)=CF(J,K)
00680 650 CONTINUE
00690     CALL CSTLSTS (2,8,Q,CK,WK,0,0.0,0.0,CA,IE)
00700     DO 700 L=1,3
00710     CS(K,L)=CA(L)
00720 700 CONTINUE
00730     WRITE (1,7) K,(CA(N),N=1,3)
00740 720 CONTINUE
00750     DO 800 J=1,8
00760     DO 750 K=1,MC
00770     CC(K)=CS(K,1)+CS(K,2)*Q(J)+CS(K,3)*Q(J)*Q(J)
00780 750 CONTINUE
00790     WRITE (1,1) Q(J)
00791     IF (M.EQ. 2) GOTO 770
00800     WRITE (1,3) (CC(K),K=1,MC)
00801     GOTO 780
00802 770 WRITE (1,2) CC
00810 780 WRITE (1,4)
00820     DO 800 I=1,21
00830     DK=CC(1)+CC(2)*D(I)
00840     IF (M.EQ.2) DK=DK+CC(3)*D(I)*D(I)
00850     DL=DC(I,J)-DK
00860     WRITE (1,5) D(I),DC(I,J),DK,DL
00870 800 CONTINUE
00880     M=M-1
00890     IF (M.EQ. 1) GOTO 100
00900     END
00910     SUBROUTINE CSTLSTS (M,N,X,Y,W,MC,XO,YO,C,IERR)
00920C
00930C --- N E E D S   S U B R O U T I N E   S I M Q ---
00940C     LEAST-SQUARES APPROXIMATION TO FIT A POLYNOMIAL TO A GIVEN SET
00950C     OF DATA POINTS WITH CONSTRAINT POINTS
00960C     PARAMETERS ARE IN SINGLE PRECISION, CALCULATIONS ARE IN DOUBLE
00970C     M     DEGREE OF POLYNOMIAL (MIN=1, MAX=9)
00980C     N     NUMBER OF POINTS (MIN=M+1, MAX=5000)
00990C     X     X COORDINATES OF POINTS (NOT NECESSARILY EVENLY SPACED)
01000C     Y     Y COORDINATES OF POINTS
01010C     MC    NUMBER OF CONSTRAINT POINTS
01020C     XO,YO CONSTRAINT POINTS (MIN=0) (MAX=M)
01030C     W     1/SIGMA SQUARED OF EACH POINT
01040C     FOR EQUAL WEIGHTING ALL W(I)=1.0
01050C     C     COEFFICIENTS OF GENERATED EQUATION
01060C     Y = C(1) + C(2)*X + C(3)*X**2 + C(4)*X**3 + .....
01070C     IE    NORMALLY IE=0    IF AN ERROR OCCURRED IE=1
01080C ----- MAKE SURE THAT N IS GREATER THAN M
01090C

```



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01100      DIMENSION C(11),CI(11),E(10,11),S(18),W(N),X(N),Y(N),XO(MC),YO(MC)
01110      TYPE DOUBLE CI,E,S
01120      1 FORMAT (5X,I4,1X*POINTS INSUFFICIENT TO DETERMINE A *I1* DEGREE *
01130+      *POLYNOMIAL*//)
01140      IERR=0
01150      IF (N .GT. M) GOTO 100
01160      PRINT 1, N,M
01170      IERR=1
01180      RETURN
01190      100 MP1=M+1
01200      MP2=M+2
01210      MS=M+M
01220      IF (MC .EQ. 0) GOTO 250
01230      DO 200 I=1,MC
01240      E(I,1)=1.0
01250      E(I,MP2)=YO(I)
01260      DO 200 J=2,MP1
01270      E(I,J)=XO(I)**(J-1)
01280      200 CONTINUE
01290      250 MD=MC+1
01300      280 E(MD,1)=0.0
01310      DO 290 L=1,N
01320      E(MD,L)=E(MD,L)+W(L)
01330      290 CONTINUE
01340      DO 300 K=1,MS
01350      S(K)=0.0
01360      DO 300 L=1,N
01370      S(K)=S(K)+(X(L)**K)*W(L)
01380      300 CONTINUE
01390      IF (K.EQ.1) E(MD,1)=E(MD,1)+W(L)
01400      DO 400 I=MD,MP1
01410      DO 400 J=1,MP1
01420      IF ((I.EQ.MD).AND.(J.EQ.1)) GOTO 400
01430      E(I,J)=S(I+J-MC-2)
01440      400 CONTINUE
01450      DO 500 I=MD,MP1
01460      E(I,MP2)=0.0
01470      DO 500 L=1,N
01480      XE=1.0
01490      IF (I .NE. MD) XE=X(L)**(I-MD)
01500      E(I,MP2)=E(I,MP2)+XE*Y(L)*W(L)
01510      500 CONTINUE
01520      CALL SIMQ (MP1,E,CI,IERR)
01530      DO 600 I=1,MP1
01540      C(I)=CI(I)
01550      600 CONTINUE
01560      700 CONTINUE
01570      RETURN
01580      END

```



```

01590      SUBROUTINE SIMQ(NN,E,AN,IERR)
01600C
01610C          THE LAST COLUMN OF THE AUGMENTED MATRIX, E  CONTAINS THE
01620C          RIGHT HAND SIDE OF THE SIMULTANEOUS SYSTEM OF EQUATIONS
01630C
01640      TYPE DOUBLE E,AN
01650      DIMENSION E(10,11),M(10),AN(10)
01660      N=NN
01670      L=N+1
01680      IERR=0
01690      DO 1 J=1,N
01700  1 M(J) = J
01710      DO 11 I=1,N
01720      MP=M(I)
01730      IF(E(MP,I))3,4,3
01740  4 JD=I+1
01750      DO 21 J=JD,N
01760      MN=M(J)
01770 23 IF(E(MN,I))20,21,20
01780 21 CONTINUE
01790 24 FORMAT (38H NO SOLUTION TO SIMULTANEOUS EQUATIONS)
01800      IERR=1
01810      RETURN
01820 20 MP=M(J)
01830      M(J)=M(I)
01840      M(I)=MP
01850  3 K=L
01860  5 E(MP,K)=E(MP,K)/E(MP,I)
01870      K=K-1
01880      IF(K-I)6,5,5
01890  6 DO 11 J=1,N
01900  9 IF(J-I)7,11,7
01910  7 K=L
01920      MQ=M(J)
01930 10 E(MQ,K)=E(MQ,K)-E(MQ,I)*E(MP,K)
01940      K=K-1
01950      IF (K-I)11,10,10
01960 11 CONTINUE
01970      DO 2 J=1,N
01980      MP=M(J)
01990  2 AN(J)=E(MP,L)
02000      RETURN
02010      END

```


PRESSURE RATIO P0/P1 = 1.1
 C0 = .1320E+01 C1 = .1089E-01 C2 = .2258E-04

DEW POINT DEG C	MEASURED DEG C	COMPUTED DEG C	ERROR DEG C
-50.	.8321	.8321	-.00002
-45.	.8759	.8759	-.00001
-40.	.9207	.9207	.00000
-35.	.9667	.9667	.00001
-30.	1.0139	1.0138	.00001
-25.	1.0621	1.0621	.00001
-20.	1.1115	1.1115	.00001
-15.	1.1620	1.1620	.00001
-10.	1.2136	1.2136	.00001
-5.	1.2664	1.2664	.00000
0.	1.3203	1.3203	.00000
5.	1.3753	1.3753	-.00000
10.	1.4314	1.4314	-.00001
15.	1.4887	1.4887	-.00001
20.	1.5471	1.5471	-.00001
25.	1.6067	1.6067	-.00001
30.	1.6673	1.6673	-.00001
35.	1.7291	1.7291	-.00001
40.	1.7921	1.7921	-.00000
45.	1.8561	1.8561	.00001
50.	1.9213	1.9213	.00002

PRESSURE RATIO P0/P1 = 1.2
 C0 = .2538E+01 C1 = .2099E-01 C2 = .4384E-04

DEW POINT DEG C	MEASURED DEG C	COMPUTED DEG C	ERROR DEG C
-50.	1.5981	1.5982	-.00008
-45.	1.6823	1.6823	-.00003
-40.	1.7686	1.7686	.00000
-35.	1.8572	1.8571	.00003
-30.	1.9479	1.9478	.00004
-25.	2.0408	2.0408	.00005
-20.	2.1359	2.1358	.00005
-15.	2.2332	2.2331	.00004
-10.	2.3326	2.3326	.00003
-5.	2.4343	2.4343	.00002
0.	2.5382	2.5382	.00000
5.	2.6442	2.6442	-.00002
10.	2.7524	2.7525	-.00003
15.	2.8629	2.8629	-.00004
20.	2.9755	2.9755	-.00005
25.	3.0903	3.0904	-.00005
30.	3.2073	3.2074	-.00004
35.	3.3266	3.3266	-.00003
40.	3.4480	3.4480	-.00000
45.	3.5716	3.5716	.00003
50.	3.6975	3.6974	.00008

PRESSURE RATIO P0/P1 = 1.3
 C0 = .3669E+01 C1 = .3042E-01 C2 = .6397E-04

DEW POINT DEG C	MEASURED DEG C	COMPUTED DEG C	ERROR DEG C
-50.	2.3080	2.3082	-.00017
-45.	2.4299	2.4299	-.00007
-40.	2.5548	2.5548	.00001
-35.	2.6829	2.6829	.00006
-30.	2.8143	2.8143	.00009
-25.	2.9489	2.9488	.00010
-20.	3.0866	3.0865	.00010
-15.	3.2275	3.2274	.00008
-10.	3.3715	3.3715	.00006
-5.	3.5188	3.5188	.00003
0.	3.6693	3.6693	.00000
5.	3.8229	3.8230	-.00003
10.	3.9798	3.9799	-.00006
15.	4.1399	4.1400	-.00008
20.	4.3032	4.3033	-.00010
25.	4.4696	4.4697	-.00010
30.	4.6393	4.6394	-.00009
35.	4.8123	4.8123	-.00006
40.	4.9884	4.9884	-.00001
45.	5.1678	5.1677	.00007
50.	5.3504	5.3502	.00017

PRESSURE RATIO P0/P1 = 1.4
 C0 = .4726E+01 C1 = .3927E-01 C2 = .8310E-04

DEW POINT DEG C	MEASURED DEG C	COMPUTED DEG C	ERROR DEG C
-50.	2.9700	2.9703	-.00028
-45.	3.1270	3.1271	-.00011
-40.	3.2882	3.2882	.00001
-35.	3.4534	3.4533	.00010
-30.	3.6228	3.6227	.00015
-25.	3.7963	3.7961	.00017
-20.	3.9739	3.9738	.00017
-15.	4.1557	4.1556	.00014
-10.	4.3416	4.3415	.00010
-5.	4.5317	4.5316	.00005
0.	4.7259	4.7259	.00000
5.	4.9242	4.9243	-.00005
10.	5.1267	5.1268	-.00010
15.	5.3334	5.3335	-.00014
20.	5.5442	5.5444	-.00017
25.	5.7593	5.7594	-.00017
30.	5.9785	5.9786	-.00015
35.	6.2019	6.2020	-.00010
40.	6.4294	6.4295	-.00001
45.	6.6612	6.6611	.00011
50.	6.8972	6.8969	.00028

PRESSURE RATIO P0/P1 = 1.5
 C0 = .5718E+01 C1 = .4761E-01 C2 = .1013E-03

DEW POINT DEG C	MEASURED DEG C	COMPUTED DEG C	ERROR DEG C
-50.	3.5903	3.5907	-.00042
-45.	3.7805	3.7806	-.00017
-40.	3.9756	3.9756	.00002
-35.	4.1758	4.1756	.00014
-30.	4.3809	4.3807	.00022
-25.	4.5911	4.5909	.00025
-20.	4.8063	4.8061	.00024
-15.	5.0266	5.0264	.00021
-10.	5.2519	5.2517	.00015
-5.	5.4823	5.4822	.00008
0.	5.7177	5.7177	.00000
5.	5.9581	5.9582	-.00008
10.	6.2037	6.2039	-.00015
15.	6.4543	6.4546	-.00021
20.	6.7101	6.7103	-.00024
25.	6.9709	6.9711	-.00025
30.	7.2368	7.2370	-.00022
35.	7.5079	7.5080	-.00014
40.	7.7840	7.7840	-.00002
45.	8.0653	8.0651	.00017
50.	8.3517	8.3513	.00042

PRESSURE RATIO P0/P1 = 1.6
 C0 = .6653E+01 C1 = .5550E-01 C2 = .1188E-03

DEW POINT DEG C	MEASURED DEG C	COMPUTED DEG C	ERROR DEG C
-50.	4.1741	4.1747	-.00057
-45.	4.3955	4.3958	-.00023
-40.	4.6228	4.6228	.00002
-35.	4.8559	4.8557	.00020
-30.	5.0949	5.0946	.00030
-25.	5.3398	5.3394	.00034
-20.	5.5905	5.5902	.00033
-15.	5.8472	5.8469	.00029
-10.	6.1098	6.1095	.00021
-5.	6.3782	6.3781	.00011
0.	6.6527	6.6527	.00000
5.	6.9330	6.9331	-.00011
10.	7.2193	7.2195	-.00021
15.	7.5116	7.5119	-.00028
20.	7.8098	7.8102	-.00033
25.	8.1140	8.1144	-.00034
30.	8.4243	8.4246	-.00030
35.	8.7405	8.7407	-.00020
40.	9.0627	9.0627	-.00002
45.	9.3909	9.3907	.00023
50.	9.7252	9.7246	.00057

PRESSURE RATIO P0/P1 = 1.7
 C0 = .7537E+01 C1 = .6300E-01 C2 = .1356E-03

DEW POINT DEG C	MEASURED DEG C	COMPUTED DEG C	ERROR DEG C
-50.	4.7257	4.7265	-.00074
-45.	4.9768	4.9771	-.00030
-40.	5.2345	5.2344	.00003
-35.	5.4988	5.4986	.00025
-30.	5.7699	5.7695	.00038
-25.	6.0476	6.0472	.00044
-20.	6.3321	6.3317	.00043
-15.	6.6233	6.6229	.00037
-10.	6.9212	6.9210	.00027
-5.	7.2259	7.2258	.00014
0.	7.5374	7.5374	.00000
5.	7.8556	7.8557	-.00014
10.	8.1806	8.1809	-.00027
15.	8.5124	8.5128	-.00037
20.	8.8511	8.8515	-.00043
25.	9.1966	9.1970	-.00044
30.	9.5489	9.5493	-.00039
35.	9.9080	9.9083	-.00026
40.	10.2741	10.2741	-.00003
45.	10.6470	10.6467	.00030
50.	11.0268	11.0261	.00074

PRESSURE RATIO P0/P1 = 1.8
 C0 = .8377E+01 C1 = .7014E-01 C2 = .1517E-03

DEW POINT DEG C	MEASURED DEG C	COMPUTED DEG C	ERROR DEG C
-50.	5.2486	5.2495	-.00092
-45.	5.5278	5.5282	-.00037
-40.	5.8144	5.8144	.00004
-35.	6.1085	6.1082	.00031
-30.	6.4101	6.4096	.00048
-25.	6.7191	6.7186	.00055
-20.	7.0357	7.0352	.00053
-15.	7.3598	7.3593	.00046
-10.	7.6914	7.6910	.00033
-5.	8.0305	8.0304	.00018
0.	8.3773	8.3773	.00000
5.	8.7316	8.7317	-.00017
10.	9.0935	9.0938	-.00033
15.	9.4630	9.4635	-.00046
20.	9.8402	9.8407	-.00054
25.	10.2250	10.2255	-.00055
30.	10.6174	10.6179	-.00048
35.	11.0176	11.0179	-.00032
40.	11.4254	11.4255	-.00004
45.	11.8410	11.8406	.00037
50.	12.2643	12.2634	.00092

COEFFICIENT

	C(0)	C(1)	C(2)
1	-.15867E+02	.19060E+02	-.31102E+01
2	-.12997E+00	.15496E+00	-.24356E-01
3	-.26359E-03	.30701E-03	-.42441E-04

PRESSURE RATIO P0/P1 = 1.1
 C0 = .1336E+01 C1 = .1101E-01 C2 = .2276E-04

DEW POINT DEG C	MEASURED DEG C	COMPUTED DEG C	ERROR DEG C
-50.	.8321	.8421	-.00996
-45.	.8759	.8863	-.01044
-40.	.9207	.9317	-.01093
-35.	.9667	.9782	-.01144
-30.	1.0139	1.0258	-.01196
-25.	1.0621	1.0746	-.01249
-20.	1.1115	1.1245	-.01303
-15.	1.1620	1.1756	-.01358
-10.	1.2136	1.2278	-.01414
-5.	1.2664	1.2811	-.01471
0.	1.3203	1.3356	-.01529
5.	1.3753	1.3912	-.01588
10.	1.4314	1.4479	-.01648
15.	1.4887	1.5058	-.01708
20.	1.5471	1.5648	-.01770
25.	1.6067	1.6250	-.01832
30.	1.6673	1.6863	-.01895
35.	1.7291	1.7487	-.01959
40.	1.7921	1.8123	-.02023
45.	1.8561	1.8770	-.02088
50.	1.9213	1.9428	-.02153

PRESSURE RATIO P0/P1 = 1.3
 C0 = .3655E+01 C1 = .3031E-01 C2 = .6379E-04

DEW POINT DEG C	MEASURED DEG C	COMPUTED DEG C	ERROR DEG C
-50.	2.3080	2.2987	.00936
-45.	2.4299	2.4199	.00994
-40.	2.5548	2.5443	.01050
-35.	2.6830	2.6720	.01104
-30.	2.8143	2.8028	.01157
-25.	2.9489	2.9368	.01209
-20.	3.0866	3.0740	.01261
-15.	3.2275	3.2143	.01312
-10.	3.3715	3.3579	.01364
-5.	3.5188	3.5047	.01415
0.	3.6693	3.6546	.01467
5.	3.8229	3.8077	.01520
10.	3.9798	3.9641	.01574
15.	4.1399	4.1236	.01630
20.	4.3032	4.2863	.01688
25.	4.4696	4.4522	.01747
30.	4.6393	4.6213	.01809
35.	4.8123	4.7935	.01873
40.	4.9884	4.9690	.01941
45.	5.1678	5.1476	.02012
50.	5.3504	5.3295	.02086

PRESSURE RATIO P0/P1 = 1.2
 C0 = .2526E+01 C1 = .2090E-01 C2 = .4370E-04

DEW POINT DEG C	MEASURED DEG C	COMPUTED DEG C	ERROR DEG C
-50.	1.5981	1.5904	.00771
-45.	1.6823	1.6741	.00814
-40.	1.7686	1.7600	.00857
-35.	1.8572	1.8482	.00900
-30.	1.9479	1.9385	.00942
-25.	2.0408	2.0310	.00984
-20.	2.1359	2.1256	.01026
-15.	2.2332	2.2225	.01069
-10.	2.3326	2.3215	.01111
-5.	2.4343	2.4228	.01154
0.	2.5382	2.5262	.01198
5.	2.6442	2.6318	.01242
10.	2.7524	2.7396	.01287
15.	2.8629	2.8495	.01333
20.	2.9755	2.9617	.01380
25.	3.0903	3.0760	.01429
30.	3.2073	3.1926	.01479
35.	3.3266	3.3113	.01530
40.	3.4480	3.4322	.01583
45.	3.5716	3.5552	.01638
50.	3.6975	3.6805	.01695

PRESSURE RATIO P0/P1 = 1.4
 C0 = .4721E+01 C1 = .3923E-01 C2 = .8303E-04

DEW POINT DEG C	MEASURED DEG C	COMPUTED DEG C	ERROR DEG C
-50.	2.9700	2.9670	.00298
-45.	3.1270	3.1237	.00331
-40.	3.2882	3.2846	.00361
-35.	3.4534	3.4496	.00386
-30.	3.6228	3.6187	.00408
-25.	3.7963	3.7920	.00428
-20.	3.9739	3.9695	.00445
-15.	4.1557	4.1511	.00461
-10.	4.3416	4.3368	.00476
-5.	4.5317	4.5268	.00490
0.	4.7259	4.7208	.00503
5.	4.9242	4.9190	.00517
10.	5.1267	5.1214	.00532
15.	5.3334	5.3279	.00548
20.	5.5442	5.5386	.00566
25.	5.7593	5.7534	.00586
30.	5.9785	5.9724	.00609
35.	6.2019	6.1955	.00636
40.	6.4294	6.4228	.00666
45.	6.6612	6.6542	.00700
50.	6.8972	6.8898	.00739

PRESSURE RATIO P0/P1 = 1.5
 C0 = .5725E+01 C1 = .4766E-01 C2 = .1014E-03

DEW POINT DEG C	MEASURED DEG C	COMPUTED DEG C	ERROR DEG C
-50.	3.5903	3.5954	-.00508
-45.	3.7805	3.7855	-.00506
-40.	3.9756	3.9807	-.00511
-35.	4.1758	4.1810	-.00522
-30.	4.3809	4.3863	-.00539
-25.	4.5911	4.5967	-.00561
-20.	4.8063	4.8122	-.00587
-15.	5.0266	5.0327	-.00616
-10.	5.2519	5.2584	-.00648
-5.	5.4823	5.4891	-.00681
0.	5.7177	5.7248	-.00716
5.	5.9581	5.9657	-.00752
10.	6.2037	6.2116	-.00787
15.	6.4543	6.4626	-.00821
20.	6.7101	6.7186	-.00853
25.	6.9709	6.9797	-.00883
30.	7.2368	7.2459	-.00909
35.	7.5079	7.5172	-.00932
40.	7.7840	7.7935	-.00949
45.	8.0653	8.0749	-.00962
50.	8.3517	8.3614	-.00967

PRESSURE RATIO P0/P1 = 1.7
 C0 = .7546E+01 C1 = .6306E-01 C2 = .1357E-03

DEW POINT DEG C	MEASURED DEG C	COMPUTED DEG C	ERROR DEG C
-50.	4.7257	4.7322	-.00649
-45.	4.9768	4.9831	-.00634
-40.	5.2345	5.2408	-.00631
-35.	5.4988	5.5052	-.00638
-30.	5.7699	5.7764	-.00655
-25.	6.0476	6.0544	-.00681
-20.	6.3321	6.3392	-.00713
-15.	6.6233	6.6308	-.00751
-10.	6.9212	6.9292	-.00794
-5.	7.2259	7.2343	-.00839
0.	7.5374	7.5462	-.00887
5.	7.8556	7.8650	-.00935
10.	8.1806	8.1904	-.00982
15.	8.5124	8.5227	-.01028
20.	8.8511	8.8618	-.01070
25.	9.1966	9.2076	-.01107
30.	9.5489	9.5603	-.01138
35.	9.9080	9.9197	-.01162
40.	10.2741	10.2859	-.01178
45.	10.6470	10.6588	-.01184
50.	11.0268	11.0386	-.01178

PRESSURE RATIO P0/P1 = 1.6
 C0 = .6667E+01 C1 = .5561E-01 C2 = .1190E-03

DEW POINT DEG C	MEASURED DEG C	COMPUTED DEG C	ERROR DEG C
-50.	4.1741	4.1838	-.00965
-45.	4.3955	4.4053	-.00976
-40.	4.6228	4.6328	-.00997
-35.	4.8559	4.8662	-.01027
-30.	5.0949	5.1055	-.01064
-25.	5.3398	5.3509	-.01108
-20.	5.5905	5.6021	-.01159
-15.	5.8472	5.8593	-.01214
-10.	6.1098	6.1225	-.01272
-5.	6.3782	6.3916	-.01334
0.	6.6527	6.6666	-.01398
5.	6.9330	6.9476	-.01462
10.	7.2193	7.2346	-.01527
15.	7.5116	7.5275	-.01590
20.	7.8098	7.8263	-.01651
25.	8.1140	8.1311	-.01709
30.	8.4243	8.4419	-.01762
35.	8.7405	8.7586	-.01811
40.	9.0627	9.0812	-.01853
45.	9.3909	9.4098	-.01888
50.	9.7252	9.7443	-.01915

PRESSURE RATIO P0/P1 = 1.8
 C0 = .8364E+01 C1 = .7003E-01 C2 = .1515E-03

DEW POINT DEG C	MEASURED DEG C	COMPUTED DEG C	ERROR DEG C
-50.	5.2486	5.2407	.00793
-45.	5.5278	5.5189	.00892
-40.	5.8144	5.8047	.00977
-35.	6.1085	6.0980	.01051
-30.	6.4101	6.3990	.01114
-25.	6.7191	6.7075	.01168
-20.	7.0357	7.0236	.01215
-15.	7.3598	7.3472	.01256
-10.	7.6914	7.6784	.01293
-5.	8.0305	8.0173	.01328
0.	8.3773	8.3636	.01362
5.	8.7316	8.7176	.01397
10.	9.0935	9.0791	.01434
15.	9.4630	9.4483	.01476
20.	9.8402	9.8249	.01523
25.	10.2250	10.2092	.01577
30.	10.6174	10.6010	.01640
35.	11.0176	11.0005	.01713
40.	11.4254	11.4075	.01799
45.	11.8410	11.8220	.01899
50.	12.2643	12.2442	.02014

PRESSURE RATIO P0/P1 = 1.1
 C0 = .1341E+01 C1 = .1089E-01

DEW POINT DEG C	MEASURED DEG C	COMPUTED DEG C	ERROR DEG C
-50.	.8321	.7964	.03573
-45.	.8759	.8508	.02502
-40.	.9207	.9053	.01543
-35.	.9667	.9598	.00697
-30.	1.0139	1.0142	-.00037
-25.	1.0621	1.0687	-.00657
-20.	1.1115	1.1231	-.01165
-15.	1.1620	1.1776	-.01561
-10.	1.2136	1.2320	-.01843
-5.	1.2664	1.2865	-.02013
0.	1.3203	1.3410	-.02070
5.	1.3753	1.3954	-.02014
10.	1.4314	1.4499	-.01845
15.	1.4887	1.5043	-.01563
20.	1.5471	1.5588	-.01168
25.	1.6067	1.6133	-.00660
30.	1.6673	1.6677	-.00039
35.	1.7291	1.7222	.00695
40.	1.7921	1.7766	.01543
45.	1.8561	1.8311	.02504
50.	1.9213	1.8855	.03577

PRESSURE RATIO P0/P1 = 1.3
 C0 = .3728E+01 C1 = .3042E-01

DEW POINT DEG C	MEASURED DEG C	COMPUTED DEG C	ERROR DEG C
-50.	2.3080	2.2069	.10111
-45.	2.4299	2.3590	.07083
-40.	2.5548	2.5111	.04372
-35.	2.6830	2.6632	.01978
-30.	2.8143	2.8153	-.00098
-25.	2.9489	2.9674	-.01856
-20.	3.0866	3.1195	-.03295
-15.	3.2275	3.2716	-.04416
-10.	3.3715	3.4237	-.05218
-5.	3.5188	3.5758	-.05701
0.	3.6693	3.7279	-.05864
5.	3.8229	3.8800	-.05707
10.	3.9798	4.0321	-.05230
15.	4.1399	4.1842	-.04433
20.	4.3032	4.3363	-.03315
25.	4.4696	4.4884	-.01876
30.	4.6393	4.6405	-.00116
35.	4.8123	4.7926	.01967
40.	4.9884	4.9447	.04370
45.	5.1678	5.0968	.07097
50.	5.3504	5.2489	.10145

PRESSURE RATIO P0/P1 = 1.2
 C0 = .2578E+01 C1 = .2099E-01

DEW POINT DEG C	MEASURED DEG C	COMPUTED DEG C	ERROR DEG C
-50.	1.5981	1.5287	.06934
-45.	1.6823	1.6337	.04856
-40.	1.7686	1.7387	.02996
-35.	1.8572	1.8436	.01355
-30.	1.9479	1.9486	-.00069
-25.	2.0408	2.0535	-.01274
-20.	2.1359	2.1585	-.02261
-15.	2.2332	2.2635	-.03029
-10.	2.3326	2.3684	-.03578
-5.	2.4343	2.4734	-.03908
0.	2.5382	2.5783	-.04019
5.	2.6442	2.6833	-.03911
10.	2.7524	2.7883	-.03584
15.	2.8629	2.8932	-.03037
20.	2.9755	2.9982	-.02270
25.	3.0903	3.1032	-.01284
30.	3.2073	3.2081	-.00077
35.	3.3266	3.3131	.01349
40.	3.4480	3.4180	.02996
45.	3.5716	3.5230	.04863
50.	3.6975	3.6280	.06950

PRESSURE RATIO P0/P1 = 1.4
 C0 = .4802E+01 C1 = .3927E-01

DEW POINT DEG C	MEASURED DEG C	COMPUTED DEG C	ERROR DEG C
-50.	2.9700	2.8387	.13129
-45.	3.1270	3.0350	.09198
-40.	3.2882	3.2314	.05679
-35.	3.4534	3.4277	.02572
-30.	3.6228	3.6240	-.00124
-25.	3.7963	3.8204	-.02407
-20.	3.9739	4.0167	-.04277
-15.	4.1557	4.2130	-.05733
-10.	4.3416	4.4094	-.06776
-5.	4.5317	4.6057	-.07404
0.	4.7259	4.8020	-.07617
5.	4.9242	4.9984	-.07415
10.	5.1267	5.1947	-.06796
15.	5.3334	5.3910	-.05762
20.	5.5442	5.5873	-.04310
25.	5.7593	5.7837	-.02441
30.	5.9785	5.9800	-.00153
35.	6.2019	6.1763	.02552
40.	6.4294	6.3727	.05677
45.	6.6612	6.5690	.09221
50.	6.8972	6.7653	.13185

PRESSURE RATIO PO/P1 = 1.5
 C0 = .581E+01 C1 = .4761E-01

DEW POINT DEG C	MEASURED DEG C	COMPUTED DEG C	ERROR DEG C
-50.	3.5903	3.4303	-16004
-45.	3.7805	3.6683	-11215
-40.	3.9756	3.9063	-06927
-35.	4.1758	4.1444	-03139
-30.	4.3809	4.3824	-.00147
-25.	4.5911	4.6204	-.02931
-20.	4.8063	4.8584	-.05212
-15.	5.0266	5.0965	-.06989
-10.	5.2519	5.3345	-.08261
-5.	5.4823	5.5725	-.09028
0.	5.7177	5.8106	-.09290
5.	5.9581	6.0486	-.09044
10.	6.2037	6.2866	-.08291
15.	6.4543	6.5246	-.07030
20.	6.7101	6.7627	-.05260
25.	6.9709	7.0007	-.02981
30.	7.2368	7.2387	-.00191
35.	7.5079	7.4768	-.03110
40.	7.7840	7.7148	-.06929
45.	8.0653	7.9528	-.11249
50.	8.3517	8.1909	-.16083

PRESSURE RATIO PO/P1 = 1.7
 C0 = .7662E+01 C1 = .6300E-01

DEW POINT DEG C	MEASURED DEG C	COMPUTED DEG C	ERROR DEG C
-50.	4.7257	4.5118	-.21390
-45.	4.9768	4.8268	-.14995
-40.	5.2345	5.1418	-.09266
-35.	5.4988	5.4568	-.04205
-30.	5.7699	5.7718	-.00187
-25.	6.0476	6.0867	-.03910
-20.	6.3321	6.4017	-.06961
-15.	6.6233	6.7167	-.09339
-10.	6.9212	7.0317	-.11044
-5.	7.2259	7.3467	-.12073
0.	7.5374	7.6616	-.12426
5.	7.8556	7.9766	-.12101
10.	8.1806	8.2916	-.11097
15.	8.5124	8.6066	-.09413
20.	8.8511	8.9216	-.07047
25.	9.1966	9.2365	-.03998
30.	9.5489	9.5515	-.00265
35.	9.9080	9.8665	-.04154
40.	10.2741	10.1815	-.09260
45.	10.6470	10.4965	-.15054
50.	11.0268	10.8114	-.21538

PRESSURE RATIO PO/P1 = 1.6
 C0 = .6762E+01 C1 = .5550E-01

DEW POINT DEG C	MEASURED DEG C	COMPUTED DEG C	ERROR DEG C
-50.	4.1741	3.9866	-.18754
-45.	4.3955	4.2641	-.13145
-40.	4.6228	4.5416	-.08121
-35.	4.8559	4.8191	-.03683
-30.	5.0949	5.0966	-.00168
-25.	5.3398	5.3741	-.03431
-20.	5.5905	5.6516	-.06105
-15.	5.8472	5.9291	-.08189
-10.	6.1098	6.2066	-.09682
-5.	6.3782	6.4841	-.10582
0.	6.6527	6.7616	-.10890
5.	6.9330	7.0391	-.10604
10.	7.2193	7.3166	-.09723
15.	7.5116	7.5940	-.08246
20.	7.8098	7.8715	-.06172
25.	8.1140	8.1490	-.03499
30.	8.4243	8.4265	-.00228
35.	8.7405	8.7040	-.03643
40.	9.0627	8.9815	-.08116
45.	9.3909	9.2590	-.13190
50.	9.7252	9.5365	-.18868

PRESSURE RATIO PO/P1 = 1.8
 C0 = .8516E+01 C1 = .7014E-01

DEW POINT DEG C	MEASURED DEG C	COMPUTED DEG C	ERROR DEG C
-50.	5.2486	5.0094	-.23924
-45.	5.5278	5.3601	-.16774
-40.	5.8144	5.7108	-.10368
-35.	6.1085	6.0615	-.04708
-30.	6.4101	6.4121	-.00205
-25.	6.7191	6.7628	-.04369
-20.	7.0357	7.1135	-.07783
-15.	7.3598	7.4642	-.10445
-10.	7.6914	7.8149	-.12354
-5.	8.0305	8.1656	-.13507
0.	8.3773	8.5163	-.13904
5.	8.7316	8.8670	-.13542
10.	9.0935	9.2177	-.12420
15.	9.4630	9.5684	-.10537
20.	9.8402	9.9191	-.07890
25.	10.2250	10.2698	-.04479
30.	10.6174	10.6205	-.00301
35.	11.0176	10.9711	-.04645
40.	11.4254	11.3218	-.10361
45.	11.8410	11.6725	-.16848
50.	12.2643	12.0232	-.24108

COEFFICIENT C(0) C(1) C(2)
 1 -.16108E+02 .19341E+02 -.31491E+01
 2 -.12997E+00 .15496E+00 -.24356E-01

PRESSURE RATIO $P_0/P_1 = 1.1$
 $C_0 = .1356E+01$ $C_1 = .1101E-01$

DEW POINT DEG C	MEASURED DEG C	COMPUTED DEG C	ERROR DEG C
-50.	.8321	.8060	.02608
-45.	.8759	.8611	.01479
-40.	.9207	.9161	.00462
-35.	.9667	.9712	-.00442
-30.	1.0139	1.0262	-.01234
-25.	1.0621	1.0812	-.01913
-20.	1.1115	1.1363	-.02479
-15.	1.1620	1.1913	-.02932
-10.	1.2136	1.2463	-.03273
-5.	1.2664	1.3014	-.03501
0.	1.3203	1.3564	-.03616
5.	1.3753	1.4115	-.03618
10.	1.4314	1.4665	-.03507
15.	1.4887	1.5215	-.03283
20.	1.5471	1.5766	-.02946
25.	1.6067	1.6316	-.02496
30.	1.6673	1.6867	-.01933
35.	1.7291	1.7417	-.01257
40.	1.7921	1.7967	-.00467
45.	1.8561	1.8518	.00435
50.	1.9213	1.9068	.01451

PRESSURE RATIO $P_0/P_1 = 1.3$
 $C_0 = .3713E+01$ $C_1 = .3031E-01$

DEW POINT DEG C	MEASURED DEG C	COMPUTED DEG C	ERROR DEG C
-50.	2.3080	2.1977	.11037
-45.	2.4299	2.3492	.08064
-40.	2.5548	2.5008	.05409
-35.	2.6830	2.6523	.03071
-30.	2.8143	2.8038	.01051
-25.	2.9489	2.9554	-.00651
-20.	3.0866	3.1069	-.02035
-15.	3.2275	3.2585	-.03100
-10.	3.3715	3.4100	-.03846
-5.	3.5188	3.5615	-.04273
0.	3.6693	3.7131	-.04380
5.	3.8229	3.8646	-.04168
10.	3.9798	4.0162	-.03635
15.	4.1399	4.1677	-.02782
20.	4.3032	4.3192	-.01608
25.	4.4696	4.4708	-.00114
30.	4.6393	4.6223	.01703
35.	4.8123	4.7739	.03840
40.	4.9884	4.9254	.06300
45.	5.1678	5.0769	.09082
50.	5.3504	5.2285	.12187

PRESSURE RATIO $P_0/P_1 = 1.2$
 $C_0 = .2566E+01$ $C_1 = .2090E-01$

DEW POINT DEG C	MEASURED DEG C	COMPUTED DEG C	ERROR DEG C
-50.	1.5981	1.5212	.07690
-45.	1.6823	1.6257	.05658
-40.	1.7686	1.7302	.03844
-35.	1.8572	1.8347	.02247
-30.	1.9479	1.9392	.00869
-25.	2.0408	2.0437	-.00291
-20.	2.1359	2.1482	-.01232
-15.	2.2332	2.2527	-.01954
-10.	2.3266	2.3572	-.02458
-5.	2.4243	2.4617	-.02743
0.	2.5382	2.5662	-.02808
5.	2.6442	2.6707	-.02655
10.	2.7524	2.7753	-.02282
15.	2.8629	2.8798	-.01690
20.	2.9755	2.9843	-.00878
25.	3.0903	3.0888	.00154
30.	3.2073	3.1933	.01406
35.	3.3266	3.2978	.02878
40.	3.4480	3.4023	.04570
45.	3.5716	3.5068	.06482
50.	3.6975	3.6113	.08615

PRESSURE RATIO $P_0/P_1 = 1.4$
 $C_0 = .4797E+01$ $C_1 = .3923E-01$

DEW POINT DEG C	MEASURED DEG C	COMPUTED DEG C	ERROR DEG C
-50.	2.9700	2.8355	.13445
-45.	3.1270	3.0317	.09534
-40.	3.2882	3.2278	.06035
-35.	3.4534	3.4240	.02946
-30.	3.6228	3.6201	.00270
-25.	3.7963	3.8162	-.01994
-20.	3.9739	4.0124	-.03845
-15.	4.1557	4.2085	-.05282
-10.	4.3416	4.4047	-.06305
-5.	4.5317	4.6008	-.06914
0.	4.7259	4.7969	-.07108
5.	4.9242	4.9931	-.06887
10.	5.1267	5.1892	-.06249
15.	5.3334	5.3853	-.05195
20.	5.5442	5.5815	-.03724
25.	5.7593	5.7776	-.01836
30.	5.9785	5.9738	.00471
35.	6.2019	6.1699	.03196
40.	6.4294	6.3660	.06340
45.	6.6612	6.5622	.09903
50.	6.8972	6.7583	.13887

PRESSURE RATIO P0/P1 = 1.5
 C0 = .5818E+01 C1 = .4766E-01

DEW POINT DEG C	MEASURED DEG C	COMPUTED DEG C	ERROR DEG C
-50.	3.5903	3.4348	.15552
-45.	3.7805	3.6731	.10736
-40.	3.9756	3.9114	.06420
-35.	4.1758	4.1497	.02605
-30.	4.3809	4.3880	-.00708
-25.	4.5911	4.6263	-.03519
-20.	4.8063	4.8646	-.05827
-15.	5.0266	5.1029	-.07631
-10.	5.2519	5.3412	-.08931
-5.	5.4823	5.5795	-.09725
0.	5.7177	5.8178	-.10014
5.	5.9581	6.0561	-.09796
10.	6.2037	6.2944	-.09070
15.	6.4543	6.5327	-.07836
20.	6.7101	6.7710	-.06093
25.	6.9709	7.0093	-.03841
30.	7.2368	7.2476	-.01078
35.	7.5079	7.4859	.02196
40.	7.7840	7.7242	.05982
45.	8.0653	7.9625	.10280
50.	8.3517	8.2008	.15092

PRESSURE RATIO P0/P1 = 1.7
 C0 = .7671E+01 C1 = .6306E-01

DEW POINT DEG C	MEASURED DEG C	COMPUTED DEG C	ERROR DEG C
-50.	4.7257	4.5174	.20831
-45.	4.9768	4.8327	.14403
-40.	5.2345	5.1481	.08640
-35.	5.4988	5.4634	.03545
-30.	5.7699	5.7787	-.00881
-25.	6.0476	6.0940	-.04638
-20.	6.3321	6.4093	-.07722
-15.	6.6233	6.7246	-.10135
-10.	6.9212	7.0400	-.11873
-5.	7.2259	7.3553	-.12936
0.	7.5374	7.6706	-.13323
5.	7.8556	7.9859	-.13032
10.	8.1806	8.3012	-.12062
15.	8.5124	8.6166	-.10411
20.	8.8511	8.9319	-.08079
25.	9.1966	9.2472	-.05064
30.	9.5489	9.5625	-.01364
35.	9.9080	9.8778	.03021
40.	10.2741	10.1932	.08093
45.	10.6470	10.5085	.13853
50.	11.0268	10.8238	.20303

PRESSURE RATIO P0/P1 = 1.6
 C0 = .6776E+01 C1 = .5561E-01

DEW POINT DEG C	MEASURED DEG C	COMPUTED DEG C	ERROR DEG C
-50.	4.1741	3.9954	.17872
-45.	4.3955	4.2735	.12210
-40.	4.6228	4.5515	.07133
-35.	4.8559	4.8295	.02642
-30.	5.0949	5.1075	-.01262
-25.	5.3398	5.3856	-.04578
-20.	5.5905	5.6636	-.07305
-15.	5.8472	5.9416	-.09442
-10.	6.1098	6.2196	-.10989
-5.	6.3782	6.4977	-.11943
0.	6.6527	6.7757	-.12304
5.	6.9330	7.0537	-.12071
10.	7.2193	7.3318	-.11243
15.	7.5116	7.6098	-.09819
20.	7.8098	7.8878	-.07798
25.	8.1140	8.1658	-.05179
30.	8.4243	8.4439	-.01960
35.	8.7405	8.7219	.01858
40.	9.0627	8.9999	.06277
45.	9.3909	9.2779	.11298
50.	9.7252	9.5560	.16923

PRESSURE RATIO P0/P1 = 1.8
 C0 = .8503E+01 C1 = .7003E-01

DEW POINT DEG C	MEASURED DEG C	COMPUTED DEG C	ERROR DEG C
-50.	5.2486	5.0008	.24783
-45.	5.5278	5.3510	.17685
-40.	5.8144	5.7011	.11331
-35.	6.1085	6.0513	.05722
-30.	6.4101	6.4015	.00861
-25.	6.7191	6.7517	-.03251
-20.	7.0357	7.1018	-.06613
-15.	7.3598	7.4520	-.09224
-10.	7.6914	7.8022	-.11080
-5.	8.0305	8.1524	-.12182
0.	8.3773	8.5025	-.12526
5.	8.7316	8.8527	-.12113
10.	9.0935	9.2029	-.10939
15.	9.4630	9.5531	-.09004
20.	9.8402	9.9032	-.06306
25.	10.2250	10.2534	-.02842
30.	10.6174	10.6036	.01387
35.	11.0176	10.9537	.06385
40.	11.4254	11.3039	.12153
45.	11.8410	11.6541	.18692
50.	12.2643	12.0043	.26003