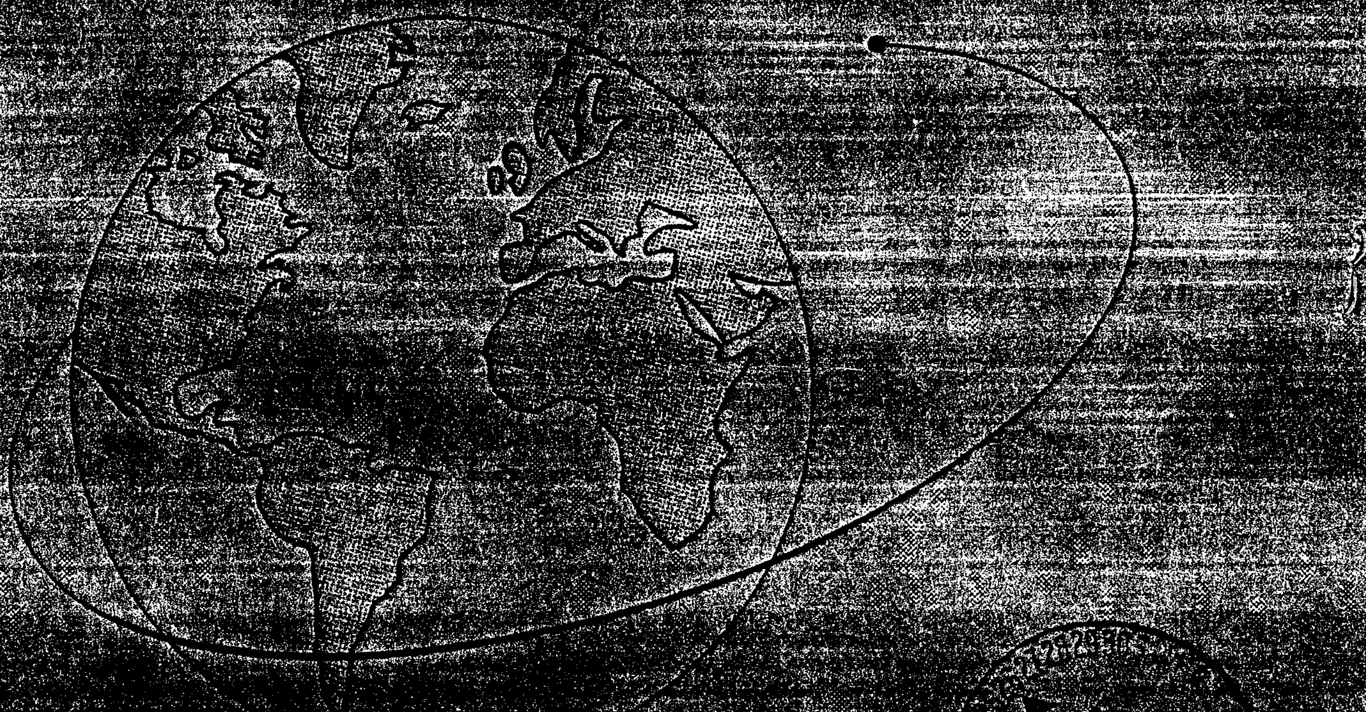
THERMOSPHERIC TEMPERATURE, DENSITY, AND COMPOSITION: NEW MODELS

L. G. JACCHIA



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ABSTRACT

These models represent a thorough revision of those published by the author in 1971, which were incorporated in the COSPAR International Reference Atmosphere 1972. The models essentially consist of two parts: 1) the basic static models, which give temperature and density profiles for the relevant atmospheric constituents for any specified exospheric temperature, and 2) a set of formulae to compute the exospheric temperature and the expected deviations from the static models as a result of all the recognized types of thermospheric variation. For the basic static models, tables are given for heights from 90 to 2500 km and for exospheric temperatures from 500 to 2600 K. In the formulae for the variations, an attempt has been made to represent the changes in composition observed by mass spectrometers on the OGO 6 and ESRO 4 satellites.

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L. G. Jacchia

INTRODUCTION

The models presented herein are a thoroughly revised version of our 1971 models (Jacchia, 1971a), which in turn were a revision of earlier, similarly patterned models (Jacchia, 1965, 1970). Following a widespread custom, we shall refer to these models as J65, J70, and J71. The models essentially consist of two parts: 1) the basic static models, which give temperature and density profiles for the relevant atmospheric constituents for any specified exospheric temperature, and 2) a set of formulae to compute the exospheric temperature and the expected deviations from the static models as a result of all the recognized types of thermospheric variation.

In revising the basic models, we strove to reproduce the results from the OGO 6 satellite concerning the relative concentrations of N_2 and O at 450 km (Taeusch and Carignan, 1972; Hedin, Mayr, Reber, Spencer, and Carignan, 1974), while keeping the total-density profiles anchored to satellite drag. This was also the aim of the Committee for the Extension of the U.S. Standard Atmosphere in constructing the higher altitude end of the U.S. Standard Atmosphere, 1976 (COESA, 1976), which consists of temperature and density profiles for a single exospheric temperature, 1000 K. As a consequence of this common aim and of mutual consultations, our profiles for 1000 K are very similar to the U.S. Standard profiles. In the lower thermosphere, where the U.S. Standard Atmosphere (USSA) relies heavily on the Aladdin experiments, we have tried to keep as close as possible to its O and O_2 profiles. Our helium densities at 1000 km are about 30% smaller than those of the USSA. To obtain the higher

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helium densities, which were thought to be necessary to fit some results from satellite drag, the USSA introduced an ad hoc vertical flux for helium. We have found this flux to be entirely unnecessary to fit our satellite-drag results at 1000 km. The difference in the interpretation of the drag lies in the theory used to compute the drag coefficient in a helium atmosphere. We have followed the formulation given by Cook (1965), according to which the drag coefficient becomes quite high, exceeding even 3.0, when a satellite moves in an atmosphere in which helium is the main constituent.

The densities of earlier models relied almost entirely on satellite drag, for which the coefficient 2.2 had been adopted in the 200- to 400-km region, in accordance with an unwritten agreement among investigators. Table 1 gives mean residuals from the present models of densities computed from the drag of 10 satellites using a value of 2.20 for the drag coefficient in the region where it is nearly independent of height (around 200 to 400 km); $\overline{z}$ is the mean "effective height" — this being the average of the actual height around the satellite's orbit weighted by the local atmospheric drag. The residual observed minus computed (model) (O - C) is given in units of $\log_{10} \rho$; n is the number of density determinations used in the comparison.

Table 1. Residuals from the models of densities from satellite drag.

Satellite	$\overline{z}$ (km)	O - C ($\log \rho$)	n	Interval
1962 $\beta\tau 2$	268	+0.001	1973	1963.0—1967.4
1966 44A	303	-0.020	5094	1966.4—1975.0
1958 Alpha	368	+0.005	5456	1958.1—1970.2
1966 70A	398	-0.001	2601	1969.0—1975.0
1960 ξ1	455	+0.013	5279	1960.9—1975.0
1964 76A	610	-0.042	4126	1964.9—1968.6
1959 α1	614	+0.001	2589	1959.2—1975.0
1963 53A	763	-0.011	6150	1964.0—1968.4
1968 66A	842	+0.001	4172	1968.6—1975.0
1964 4A	999	[+0.036]*	3371	1964.1—1969.4
			Total	Extremes
			40811	1958.1—1975.0

*Uncertain, because the near-circular orbit of the satellite caused the "observed" densities to be closer to the mean global densities than to the densities given by the model for the effective height at the geographic position of perigee.

The description of the models is given in two parts. In Part I, we outline the construction of the static models. Part II deals with the several types of thermospheric variation and with the empirical equations that have been devised to represent them using the static models as a reference frame. Auxiliary tables to illustrate and facilitate the computation of some of the variations are interspersed in the text. A summary of all the equations and a numerical example are to be found at the end of Part II. A detailed tabulation of the basic static models is given in Table 10, following the references: number densities of six atmospheric constituents are given in the range from 90 to 2500 km for 19 temperature profiles ending in exospheric temperatures from 500 to 2600 K; also tabulated are the total number density, the mean molecular mass, and the total density and pressure. The total densities are repeated in a compact summary form (Table 11) following the tables of the basic static models.

PART I

THE STATIC MODELS

1. TEMPERATURE PROFILES

All temperature profiles start from a constant value $T_0 = 188$ K at the height $z_0 = 90$ km with a gradient $G_0 = (dT/dz)_{z=z_0} = 0$, rise to an inflection point at a fixed height $z_x = 125$ km, and become asymptotic to a temperature T_∞ (often referred to as the "exospheric" temperature). Both the temperature T_x and the temperature gradient $G_x = (dT/dz)_{z=z_x}$ at the inflection point are functions of T_∞, defined as follows:

$$T_x - T_0 = 110.5 \sinh^{-1} 0.0045 (T_\infty - T_0) \quad , \tag{1}$$

$$G_x = 1.9 \frac{T_x - T_0}{z_x - z_0} \quad , \qquad (z \text{ in km}) \quad , \tag{2}$$

$$(T_0 = 188 \text{ K}, \; z_0 = 90 \text{ km}, \text{ and } z_x = 125 \text{ km}) \quad .$$

The temperature profiles are given by the following:

<u>For $z < z_x$,</u>

$$T = T_x + \frac{T_x - T_0}{\pi/2} \tan^{-1} \left\{ \frac{G_x}{(T_x - T_0)/(\pi/2)} (z - z_x) \left[1 + 1.7 \left(\frac{z - z_x}{z - z_0} \right)^2 \right] \right\} , \quad (z \text{ in km}) \quad . \tag{3}$$

<u>For $z > z_x$,</u>

$$T = T_x + \frac{T_\infty - T_x}{\pi/2} \tan^{-1} \left\{ \frac{G_x}{(T_\infty - T_x)/(\pi/2)} (z - z_x) \left[1 + 5.5 \times 10^{-5} (z - z_x)^2 \right] \right\} , \quad (z \text{ in km}) \quad . \tag{4}$$

Table 2 shows the dependence of the maximum temperature gradient G_x on the exospheric temperature T_∞. The family of temperature profiles originated by equations (1) to (4) is graphically illustrated in Figure 1.

Table 2. Dependence of the maximum temperature gradient on the exospheric temperature.

T_∞ (°K)	G_x (deg km^{-1})	T_∞ (°K)	G_x (deg km^{-1})
500	6.84	1400	14.38
600	8.26	1600	15.29
800	10.42	1800	16.07
1000	12.04	2000	16.77
1200	13.32	2200	17.39

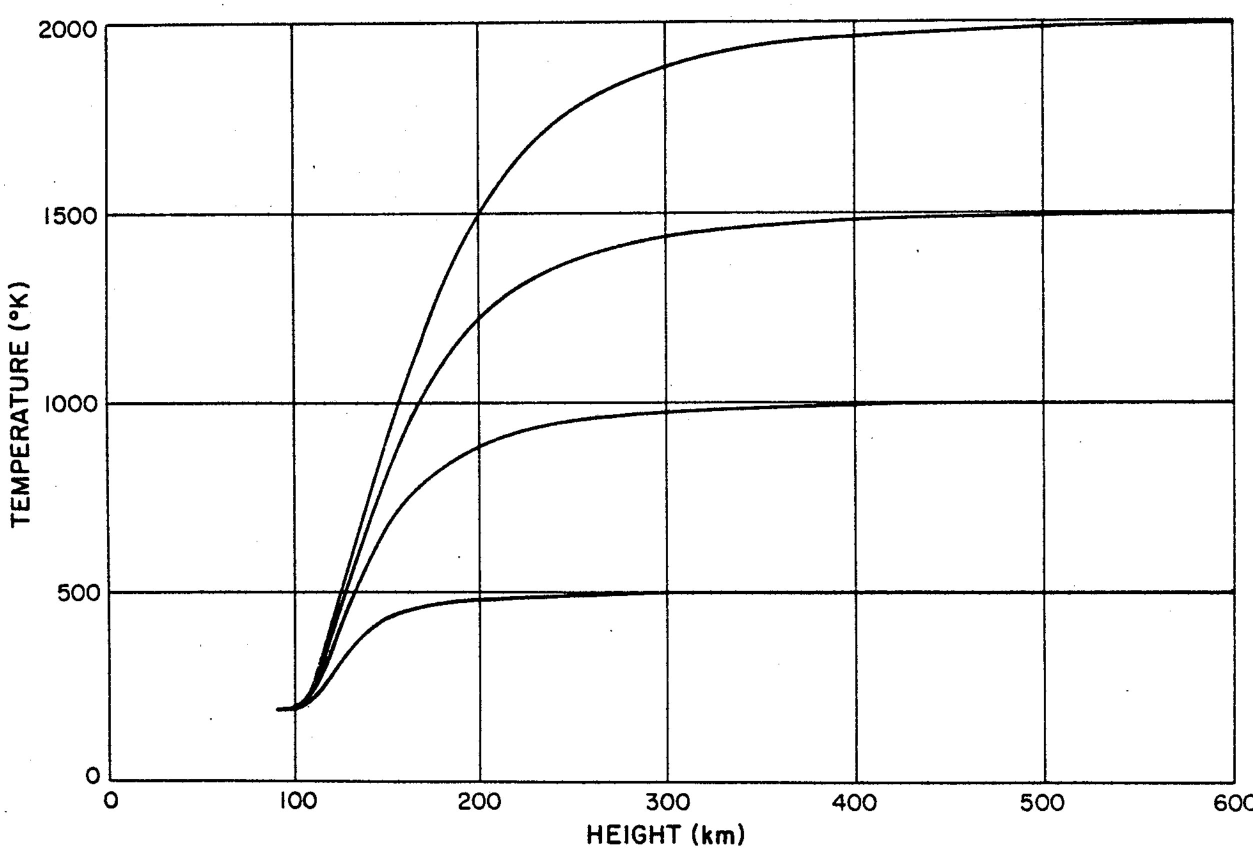


Figure 1. Four temperature profiles from the present models.

2. COMPOSITION

We have assumed that the atmosphere is composed only of nitrogen, oxygen, argon, helium, and hydrogen, in a condition of mixing up to 100 km and in diffusion above this height. We have adopted the sea-level composition of the U.S. Standard Atmosphere 1962 (COESA, 1962) such as would obtain after elimination of the minor constituents and of hydrogen (which is introduced in our models at a height of 150 km). Thus, the assumed sea-level composition is as shown in Table 3. The resulting sea-level mean molecular mass is $\overline{M}_0 = 28.960$.

Table 3. Assumed sea-level composition.

Constituent	Fraction by volume $q_0(i)$	Molecular weight M_i
Nitrogen (N_2)	0.78110	28.0134
Oxygen (O_2)	0.20955	31.9988
Argon (Ar)	0.009343	39.948
Helium (He)	0.000005242	4.0026
Sum	1.00000	

In our 1971 models, we had assumed that at heights below 100 km, any change in the mean molecular mass $\overline{M}$ was caused only by oxygen dissociation. The ratio $n(O)/n(O_2)$ was thus uniquely determined by $\overline{M}$, for which an empirical profile was given for heights between 90 and 100 km. Since above 100 km composition was rigidly determined by molecular diffusion, there was no provision to account for oxygen dissociation or for any departure from diffusion equilibrium. In the present models, we still use an empirical profile of a mean molecular mass $\overline{M}'$ from 90 to 100 km, but we have added independent corrections to the values of $n(O)$ and $n(O_2)$ determined from this profile; these corrections extend right across the homopause. The final mean molecular mass $\overline{M}$ is computed in the usual manner after the corrections to $n(O)$ and $n(O_2)$ have been applied.

The $\overline{M}'$ profile is defined by

$$\overline{M}'(z) = \sum_{n=0}^{5} c_n (z - 90)^n \quad , \qquad (90 < z < 100 \quad ; \quad z \text{ in km}) \quad . \qquad (5)$$

The coefficients c_n are given below:

$c_0 = 28.89122$,

$c_1 = -2.83071 \times 10^{-2}$,

$c_2 = -6.59924 \times 10^{-3}$,

$c_3 = -3.39574 \times 10^{-4}$,

$c_4 = +6.19256 \times 10^{-5}$,

$c_5 = -1.84796 \times 10^{-6}$.

First, a density profile ρ' is computed from $\overline{M}'$ by integrating the barometric equation

$$\frac{d\rho'}{\rho'} = \frac{T}{\overline{M}} \, d\left(\frac{\overline{M}'}{T}\right) - \frac{\overline{M}' g}{R^* T} \, dz \quad , \qquad (6)$$

in which the temperature profiles of equation (3) are used with a fixed boundary value $\rho_0' = 3.43 \times 10^{-6}$ kg m^{-3} at z = 90 km. The acceleration due to gravity, g, is defined by

$$g = 9.80665 \left(1 + \frac{z}{R_e}\right)^2 \text{ m sec}^{-2} \quad , \qquad R_e = 6.356766 \times 10^6 \text{ m} \quad . \qquad (7)$$

This equation (Harrison, 1951; Minzner and Ripley, 1956) is an excellent approximation to the mean value of g (centrifugal acceleration included) at the latitude of 45°32'40". The universal gas constant $R^* = 8.31432 \times 10^3$ kg m (kg-mol)$^{-1}$ K^{-1}.

From ρ' we derive a number density N' by

$$N' = \frac{A\rho'}{\overline{M}'} \quad , \qquad (8)$$

where A is Avogadro's number, 6.02217×10^{26} (mks). For N_2, Ar, and He, the number densities n(i) are computed from

$$n(i) = q_0(i) \frac{\overline{M}'}{\overline{M}'_0} N' \quad , \tag{9}$$

while for O and O_2, we have

$$n'(O) = 2N' \left(1 - \frac{\overline{M}'}{\overline{M}'_0}\right) \quad , \tag{10}$$

$$n'(O_2) = N' \left\{ \frac{\overline{M}'}{\overline{M}'_0} \left[1 + q_0(O_2)\right] - 1 \right\} \quad . \tag{11}$$

To n'(O) and $n'(O_2)$ we apply empirical corrections to account for atomic oxygen production above the homopause, so that the final number densities of O and O_2 become

$$\log n(O) = \log n'(O) + \Delta \log n'(O) \quad , \tag{12}$$

$$\log n(O_2) = \log n'(O_2) + \Delta \log n'(O_2) \quad . \tag{13}$$

The corrections are

$$\Delta \log n'(O) = -0.24 \exp\left[-0.009(z - 97.7)^2\right] \quad , \tag{14}$$

$$\Delta \log n'(O_2) = -0.07 \{1 + \tanh\left[0.18(z - 111)\right]\} \quad , \qquad (z \text{ in km}) \quad . \tag{15}$$

The final values of N and ρ are computed from Σ n(i) and Σ n(i) M_i by using the original values of n(i) for N_2, Ar, and He as computed from equation (9) and the corrected values of n(O) and $n(O_2)$ as computed from equations (10) to (15).

The number densities n(i) at 100 km computed in the manner just described are taken as boundary values in the integration of the diffusion equation, which is used to compute n(i) for heights above 100 km. We can write the equation in the form

$$\frac{dn(i)}{n(i)} + \frac{dT}{T}(1+\alpha_i) + \frac{dz}{H_i} + \frac{\Phi_i}{D}\frac{dz}{n(i)} = 0 \quad , \qquad (z > 100 \text{ km}) \quad . \tag{16}$$

Here, α_i and Φ_i are, respectively, the thermal diffusion coefficient and the vertical flux proper to the species i, D is the mutual diffusion coefficient, and $H_i = R^* T/M_i g$, the scale height of species i. For helium and hydrogen, we assumed $\alpha_i = -0.38$ and -0.25, respectively; for all other constituents, $\alpha_i = 0$. We took Φ_i to be zero for all constituents except hydrogen, for which we used a vertical flux proportional to the number density at a height of 500 km, as given by

$$\log_{10} n_{500}(H) = 5.94 + 28.9\, T_\infty^{-1/4} \quad , \qquad (\text{mks}) \quad , \tag{17}$$

$$\log_{10} \Phi(H) = 6.90 + 28.9\, T_\infty^{-1/4} \quad , \qquad (\text{mks}) \quad , \tag{18}$$

and a diffusion coefficient D taken from the U.S. Standard Atmosphere, 1976:

$$D = 2.0 \times 10^{20} \frac{\sqrt{T}}{N} \quad , \tag{19}$$

where N is the total number density. The hydrogen densities are based mainly on Brinton, Mayr, and Potter (1975), while the absolute term in the equation for $\Phi(H)$ was chosen such as to make the flux for $T_\infty = 1000$ K equal to that used in the U.S. Standard Atmosphere, 1976.

The variations of the number densities of the various atmospheric species and of the total density with temperature and height are illustrated in Figures 2 and 3.

Atomic nitrogen. Mauersberger, Engebretson, Kayser, and Potter (1976) have succeeded in measuring atomic nitrogen with the open-source neutral mass spectrometer on the Atmosphere Explorer C satellite. Introducing their data into our models, we find that for an exospheric temperature of 700 K, n(N)/n(O) increases from 0.012 at 500 km to 0.048 at 1000 km; for 1500 K, the ratio is only 0.0027 at 500 km and increases to 0.0049 at 1000 km. Although not insignificant, N never becomes important enough to justify its introduction into our models at the present state of knowledge about its behavior.

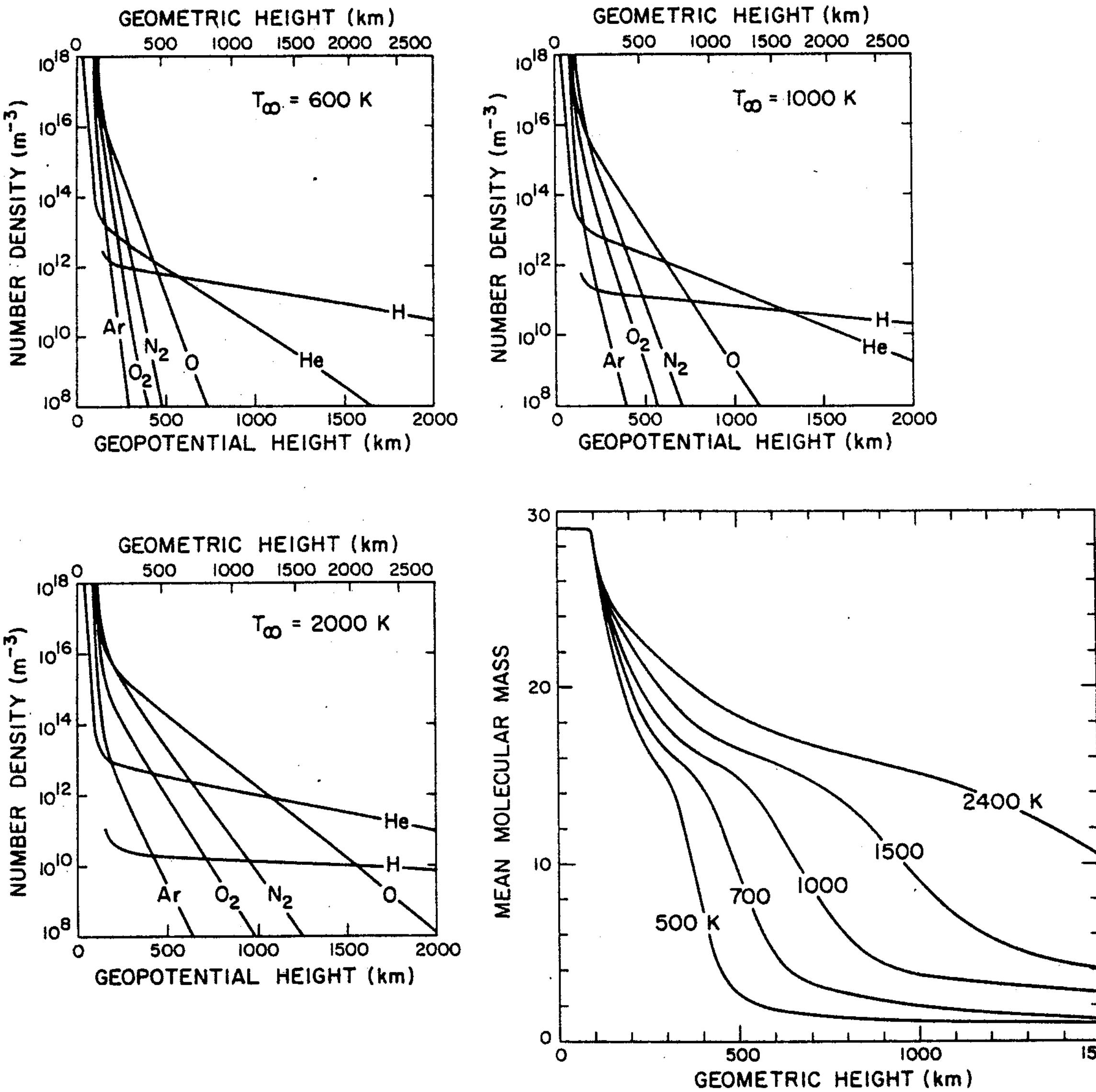


Figure 2. Number densities of individual atmospheric constituents as a function of height for three representative exospheric temperatures. The mean molecular mass as a function of height is shown for various exospheric temperatures in the lower right diagram.

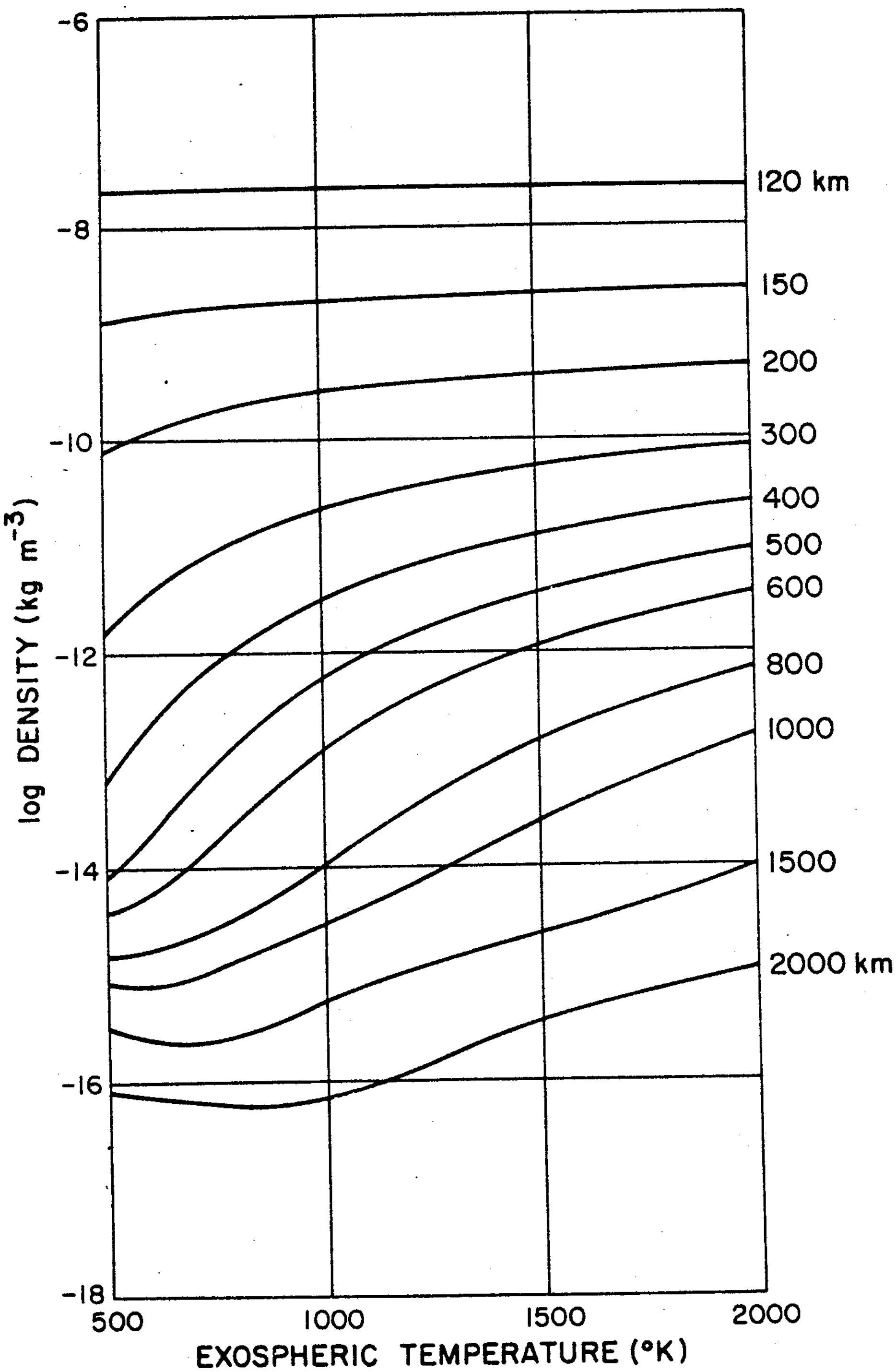


Figure 3. Total density as a function of exospheric temperature for various heights.

PART II

THERMOSPHERIC VARIATIONS

1. VARIATIONS IN THE THERMOSPHERE AND EXOSPHERE

Several types of variation are recognized in the atmospheric regions covered by the present models. They can be classified as follows:

1. Variation with the solar cycle.
2. Variation with the daily change in activity on the visible disk of the sun.
3. The daily, or diurnal, variation.
4. Variation with geomagnetic activity.
5. Seasonal-latitudinal variations.
6. The semiannual variation.
7. Rapid density fluctuations probably connected with gravity waves.

All these variations, with the exception of the last, are subject to some amount of regularity and can be predicted with varying degrees of accuracy on the basis of ground-based observational data. It should be obvious that static models cannot represent all types of variation equally well. They should be quite adequate when the characteristic time of the variation is much longer than the time involved in the conduction, convection, and diffusion processes; when, on the other hand, it is comparable or shorter – as in the daily variation and the geomagnetic effect – we must expect poorer results. By this, we mean that if we try to represent the observed density variations, we may have to introduce temperature variations that are not entirely correct, or vice versa. Since, by far, the largest observational material consists of density measurements, it is the density variation that we have tried to keep correct. We have no direct evidence so far that the resulting temperature variation might be grossly in error; some error, however, must be expected in the daily variation and in the geomagnetic effect.

In the analytic formulation of the different types of variation, we have tried to avoid a proliferation of symbols or the use of numerical subscripts for the many constants. Therefore, we have made no effort to keep the symbolism consistent throughout: the same letters have often been used for exponents or coefficients in equations pertaining to separate types of variation. We have assumed that no confusion would result if it is understood that, apart from such universally accepted symbols as T, ρ, ϕ, and z for temperature, density, latitude, and height, each type of variation has its own separate symbolism.

2. THE VARIATION WITH SOLAR ACTIVITY

The ultraviolet solar radiation that heats the earth's upper atmosphere actually consists of two components, one related to active regions on the solar disk and the other to the disk itself. The active-region component comes from areas of higher temperature and consists mainly of the spectral lines of highly ionized atoms, such as Fe XIV–XVI, Si IX–X, and Mg X; radiation from the clear disk comes from much less ionized atoms, such as He I–II and O IV, and the helium continuum. The active-region component varies rapidly from day to day in correspondence with the appearance and disappearance of active areas caused by the rotation of the sun and by spot formation; the disk component presumably varies more slowly in the course of the 11-year solar cycle. Since the radiation in the two components is different, we must expect the atmosphere to react in a different manner to each of them – and this is actually observed.

The 10.7-cm solar flux F is generally used as a readily available index of solar EUV radiation. It also consists of a disk component and an active-area component, which can be separated statistically by relating the observed values of the flux integrated over the whole solar disk to the corresponding sunspot numbers (Hachenberg, 1965) or, better, to sunspot areas (Jacchia and Slowey, 1973). When the 10.7-cm flux increases, there is an increase in the temperature of the thermosphere and exosphere; for a given increase in the disk component, however, the temperature increases much more than for the same increase in the active-area component. Separate values of the two components of the solar flux are not readily available; fortunately, we have found (Jacchia and Slowey, 1973) that the disk component is, for all practical purposes, linearly related to $\overline{F}$, the flux averaged, or smoothed, over a few solar rotations. We can, therefore, replace the relation between the temperature and the disk component with an equivalent relation between the temperature and the decimetric solar flux.

From an analysis of about 40,000 densities derived from satellite drag in the interval 1958 to 1975, we find that $T_{1/2}$, the arithmetic mean of the global extrema of the diurnal variation in the exospheric temperature under quiet geomagnetic conditions, $K_p = 0$, is related to F and $\overline{F}$ by the equation

$$T_{1/2} = 5.48\,\overline{F}^{0.8} + 101.8\,F^{0.4} \quad . \tag{20}$$

F and $\overline{F}$ are in the customary units of 10^4 Jansky (10^{-22} W m^{-2} Hz^{-1} bandwidth). For a better definition of $T_{1/2}$, see Section 3, including the warning note. In our analysis, we took for $\overline{F}$ the average of F over six solar rotations. A smoother version of $\overline{F}$, which we consider superior and definitely recommend, is obtained by taking a weighted mean of F, in which the weight is a gaussian function of time:

$$\overline{F} = \frac{\Sigma\, wF}{\Sigma\, w} \quad , \tag{21}$$

with

$$w = \exp\left[-\left(\frac{t - t_0}{\tau}\right)^2\right] \quad . \tag{22}$$

Here, t is time and t_0 the instant for which we want to compute $\overline{F}$. A recommended value of τ is three solar rotations, or 71 days. The variation of $T_{1/2}$ as a function of $\overline{F}$ is illustrated in Figure 4, where the extrema of the diurnal variation are also shown. In Table 4, values of $\overline{F}$ computed with equations (21) and (22) are given at 10-day intervals from 1958 to 1976.

Table 5 compares the temperatures of the present models (J) with those of the models of Thuillier, Falin, and Wachtel (1976) (T) and Hedin et al. (1974) (H) for the same values of $\overline{F}$ when $F = \overline{F}$ and $K_p = 0$. It should be remembered that the temperatures of Thuillier et al. are Doppler temperatures, those of Hedin et al. are N_2 temperatures, and those of the present model are mainly atomic oxygen temperatures.

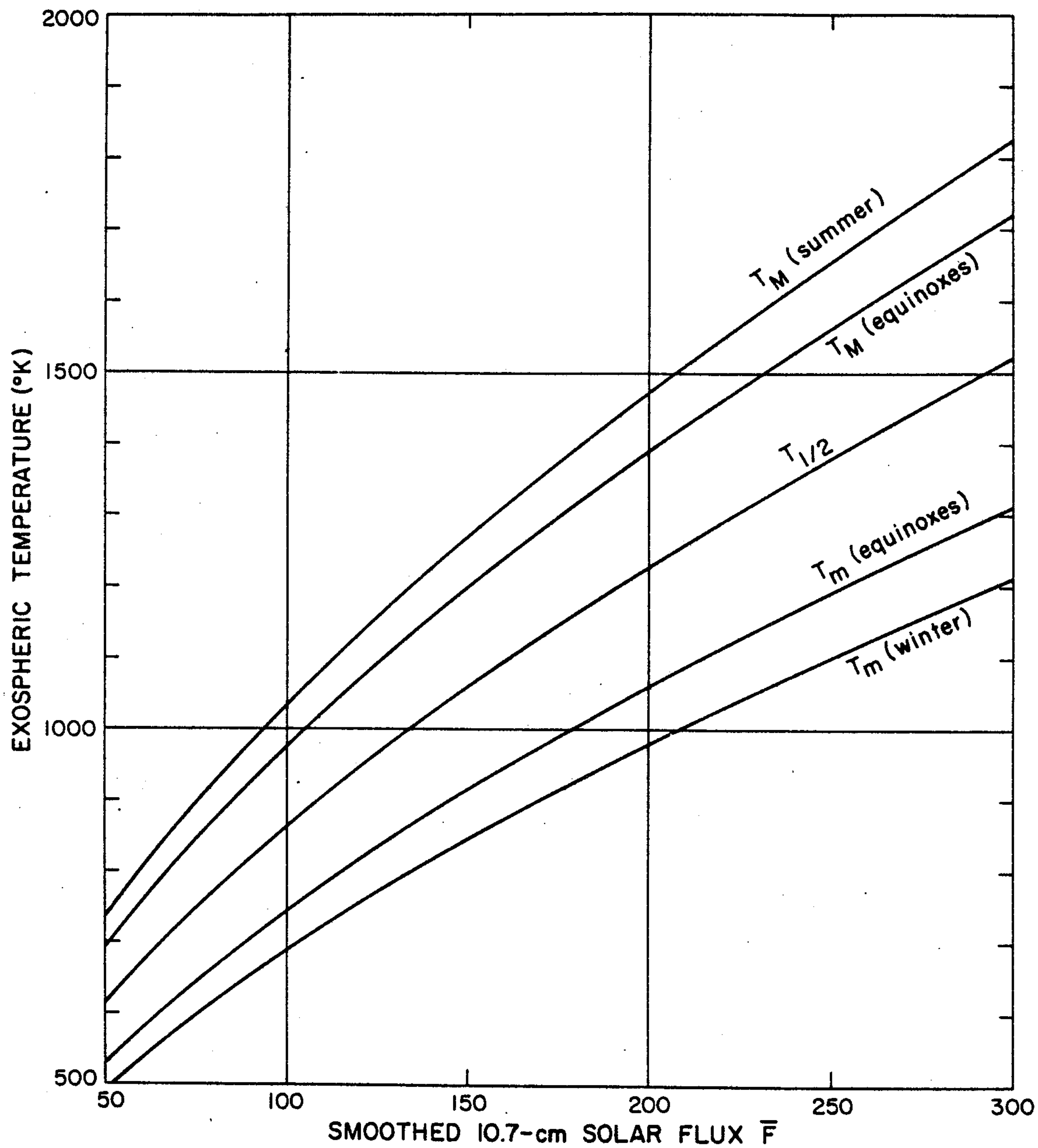


Figure 4. Mean global exospheric temperature $T_{1/2}$ for quiet geomagnetic conditions ($K_p = 0$) as a function of the smoothed 10.7-cm solar flux [$F = \overline{F}$ in equation (20)]. Also given are the corresponding extrema of the global diurnal temperature variation at the time of solstices and equinoxes.

Table 4. The smoothed 10.7-cm solar flux $\overline{F}$, computed from equations (21) and (22).

M.J.D.	FLUX	M.J.D.	FLUX	M.J.D.	FLUX	M.J.D.	FLUX	M.J.D.	FLUX	M.J.D.	FLUX	M.J.D.	FLUX
36330	234.45	36830	197.59	37330	114.87	37830	92.50	38330	80.53	38830	74.12	39330	106.50
36340	233.80	36840	193.60	37340	112.34	37840	91.33	38340	79.84	38840	74.30	39340	107.55
36350	233.09	36850	190.00	37350	110.40	37850	90.18	38350	79.06	38850	74.62	39350	108.33
36360	232.56	36860	186.94	37360	108.64	37860	89.04	38360	78.24	38860	75.01	39360	109.03
36370	232.45	36870	184.23	37370	107.69	37870	88.10	38370	77.44	38870	75.42	39370	109.85
36380	232.61	36880	182.04	37380	106.80	37880	87.20	38380	76.67	38880	75.87	39380	110.45
36390	232.64	36890	180.30	37390	106.33	37890	86.55	38390	75.96	38890	76.33	39390	111.18
36400	233.04	36900	178.94	37400	106.33	37900	86.06	38400	75.38	38900	76.75	39400	112.02
36410	233.76	36910	178.24	37410	106.55	37910	85.60	38410	74.88	38910	77.11	39410	112.98
36420	233.89	36920	176.95	37420	106.90	37920	85.22	38420	74.49	38920	77.40	39420	114.21
36430	234.18	36930	175.97	37430	107.65	37930	84.96	38430	74.22	38930	77.62	39430	115.89
36440	234.12	36940	174.87	37440	108.32	37940	84.45	38440	74.01	38940	77.73	39440	117.36
36450	233.59	36950	173.80	37450	109.16	37950	84.02	38450	73.84	38950	77.74	39450	119.40
36460	232.57	36960	172.16	37460	110.03	37960	83.57	38460	73.70	38960	77.73	39460	121.72
36470	231.41	36970	170.44	37470	110.66	37970	82.81	38470	73.53	38970	77.67	39470	124.19
36480	230.28	36980	168.96	37480	111.31	37980	82.21	38480	73.33	38980	77.57	39480	126.93
36490	229.06	36990	167.50	37490	111.63	37990	81.43	38490	73.11	38990	77.51	39490	129.85
36500	227.95	37000	166.04	37500	111.57	38000	80.65	38500	72.87	39000	77.48	39500	132.31
36510	226.99	37010	165.24	37510	111.52	38010	79.97	38510	72.55	39010	77.43	39510	134.74
36520	226.39	37020	164.82	37520	110.67	38020	79.38	38520	72.24	39020	77.33	39520	137.02
36530	226.28	37030	164.34	37530	109.66	38030	78.80	38530	71.95	39030	77.30	39530	138.74
36540	226.27	37040	164.58	37540	108.52	38040	78.44	38540	71.68	39040	77.23	39540	140.13
36550	226.22	37050	164.78	37550	106.75	38050	78.17	38550	71.39	39050	77.20	39550	141.07
36560	226.53	37060	165.25	37560	105.00	38060	78.07	38560	71.18	39060	77.28	39560	141.48
36570	226.67	37070	165.93	37570	103.03	38070	78.10	38570	71.00	39070	77.33	39570	141.57
36580	226.45	37080	166.46	37580	100.96	38080	78.37	38580	70.87	39080	77.50	39580	141.43
36590	226.23	37090	167.10	37590	99.01	38090	78.64	38590	70.79	39090	77.81	39590	140.90
36600	225.91	37100	167.43	37600	97.24	38100	79.11	38600	70.74	39100	78.27	39600	140.47
36610	224.72	37110	167.77	37610	95.49	38110	79.72	38610	70.77	39110	78.94	39610	139.91
36620	223.90	37120	167.88	37620	94.16	38120	80.42	38620	70.82	39120	79.69	39620	139.42
36630	222.92	37130	167.62	37630	93.16	38130	81.07	38630	70.92	39130	80.67	39630	139.28
36640	222.07	37140	167.14	37640	92.41	38140	81.71	38640	71.03	39140	81.65	39640	139.20
36650	221.29	37150	166.49	37650	92.10	38150	82.33	38650	71.19	39150	82.87	39650	139.53
36660	220.64	37160	165.28	37660	92.01	38160	82.82	38660	71.41	39160	84.23	39660	139.97
36670	220.00	37170	163.94	37670	92.27	38170	83.18	38670	71.58	39170	85.53	39670	140.37
36680	219.43	37180	162.06	37680	92.81	38180	83.38	38680	71.84	39180	87.13	39680	141.46
36690	219.15	37190	159.67	37690	93.38	38190	83.46	38690	72.13	39190	88.52	39690	141.76
36700	218.79	37200	157.14	37700	94.12	38200	83.42	38700	72.34	39200	90.07	39700	142.32
36710	218.48	37210	154.36	37710	94.90	38210	83.29	38710	72.60	39210	91.66	39710	142.77
36720	218.25	37220	151.29	37720	95.52	38220	83.12	38720	72.85	39220	93.11	39720	142.87
36730	218.01	37230	148.16	37730	96.14	38230	82.97	38730	73.08	39230	94.64	39730	143.06
36740	217.66	37240	144.87	37740	96.67	38240	82.84	38740	73.30	39240	96.06	39740	143.01
36750	217.39	37250	141.50	37750	96.94	38250	82.70	38750	73.43	39250	97.40	39750	142.97
36760	216.52	37260	138.07	37760	97.09	38260	82.62	38760	73.55	39260	98.83	39760	143.17
36770	215.11	37270	134.45	37770	97.07	38270	82.53	38770	73.67	39270	99.99	39770	143.67
36780	213.40	37280	130.95	37780	96.74	38280	82.42	38780	73.70	39280	101.19	39780	144.46
36790	211.19	37290	127.50	37790	96.24	38290	82.25	38790	73.73	39290	102.44	39790	146.03
36800	208.47	37300	123.99	37800	95.57	38300	81.99	38800	73.78	39300	103.46	39800	147.61
36810	205.03	37310	120.66	37810	94.68	38310	81.63	38810	73.82	39310	104.64	39810	149.73
36820	201.39	37320	117.56	37820	93.63	38320	81.14	38820	73.92	39320	105.66	39820	152.16

Table 4. (Cont.)

M.J.D.	FLUX	M.J.D.	FLUX	M.J.D.	FLUX	M.J.D.	FLUX	M.J.D.	FLUX	M.J.D.	FLUX	M.J.D.	FLUX
39830	154.45	40280	155.07	40730	161.33	41180	112.18	41630	108.99	42080	81.56	42530	72.84
39840	156.85	40290	156.23	40740	160.13	41190	111.92	41640	107.42	42090	81.80	42540	73.31
39850	158.74	40300	157.16	40750	159.08	41200	111.48	41650	105.92	42100	82.19	42550	73.80
39860	159.91	40310	158.01	40760	157.91	41210	111.34	41660	104.66	42110	82.68	42560	74.56
39870	160.59	40320	158.20	40770	156.39	41220	111.17	41670	103.40	42120	83.45	42570	75.48
39880	160.58	40330	158.19	40780	154.82	41230	111.08	41680	102.37	42130	84.14	42580	76.51
39890	159.65	40340	158.19	40790	153.36	41240	111.41	41690	101.57	42140	85.10	42590	77.57
39900	158.40	40350	157.44	40800	152.00	41250	111.78	41700	100.89	42150	85.89	42600	78.57
39910	156.71	40360	156.69	40810	150.77	41260	112.30	41710	100.45	42160	86.81	42610	79.55
39920	154.67	40370	155.80	40820	149.81	41270	113.15	41720	100.27	42170	87.61	42620	80.30
39930	152.61	40380	154.53	40830	149.10	41280	114.00	41730	99.92	42180	88.23	42630	80.85
39940	150.85	40390	153.29	40840	148.89	41290	115.11	41740	99.96	42190	88.92	42640	81.15
39950	149.30	40400	151.81	40850	148.86	41300	116.24	41750	99.84	42200	89.31	42650	81.23
39960	147.92	40410	150.31	40860	148.87	41310	117.49	41760	99.68	42210	89.63	42660	81.01
39970	147.13	40420	149.03	40870	149.24	41320	118.93	41770	99.69	42220	89.88	42670	80.55
39980	146.55	40430	147.73	40880	149.61	41330	120.21	41780	99.33	42230	89.98	42680	79.97
39990	146.29	40440	146.64	40890	149.90	41340	121.57	41790	98.91	42240	90.04	42690	79.29
40000	146.21	40450	145.67	40900	150.11	41350	122.92	41800	98.46	42250	90.06	42700	78.53
40010	146.15	40460	145.13	40910	149.89	41360	123.84	41810	97.79	42260	89.99	42710	77.76
40020	146.25	40470	144.90	40920	149.62	41370	124.69	41820	97.03	42270	90.00	42720	77.01
40030	146.10	40480	145.00	40930	148.91	41380	125.41	41830	96.34	42280	89.94	42730	76.28
40040	145.85	40490	145.21	40940	147.66	41390	125.90	41840	95.29	42290	89.81	42740	75.63
40050	145.77	40500	145.67	40950	145.99	41400	126.46	41850	94.54	42300	89.70	42750	74.98
40060	145.50	40510	146.47	40960	144.00	41410	126.90	41860	93.76	42310	89.47	42760	74.39
40070	145.49	40520	147.08	40970	141.56	41420	127.11	41870	93.08	42320	89.11	42770	73.89
40080	145.10	40530	147.71	40980	139.09	41430	127.54	41880	92.62	42330	88.62	42780	73.46
40090	145.01	40540	148.60	40990	135.96	41440	128.00	41890	92.18	42340	87.90	42790	73.18
40100	144.93	40550	149.42	41000	133.06	41450	128.36	41900	91.88	42350	87.02	42800	72.97
40110	144.53	40560	150.46	41010	129.98	41460	128.85	41910	91.60	42360	86.05		
40120	144.44	40570	151.45	41020	127.05	41470	129.02	41920	91.29	42370	84.82		
40130	144.30	40580	152.65	41030	124.29	41480	129.08	41930	90.92	42380	83.63		
40140	144.23	40590	154.07	41040	121.92	41490	128.84	41940	90.53	42390	82.26		
40150	144.39	40600	155.33	41050	119.68	41500	128.32	41950	89.84	42400	80.89		
40160	144.38	40610	156.71	41060	117.80	41510	127.58	41960	89.14	42410	79.60		
40170	144.66	40620	158.21	41070	116.31	41520	126.62	41970	88.25	42420	78.41		
40180	144.74	40630	159.44	41080	115.10	41530	125.31	41980	87.18	42430	77.18		
40190	145.01	40640	160.54	41090	114.21	41540	123.91	41990	86.27	42440	76.13		
40200	145.58	40650	161.57	41100	113.70	41550	122.48	42000	85.24	42450	75.19		
40210	146.25	40660	162.19	41110	113.14	41560	120.81	42010	84.35	42460	74.37		
40220	147.02	40670	162.74	41120	112.98	41570	119.24	42020	83.56	42470	73.72		
40230	148.25	40680	163.10	41130	112.85	41580	117.58	42030	82.84	42480	73.20		
40240	149.32	40690	163.01	41140	112.76	41590	115.85	42040	82.31	42490	72.82		
40250	150.74	40700	163.05	41150	112.68	41600	114.12	42050	81.88	42500	72.56		
40260	152.27	40710	162.52	41160	112.70	41610	112.38	42060	81.65	42510	72.51		
40270	153.62	40720	161.97	41170	112.40	41620	110.63	42070	81.55	42520	72.60		

Table 5. Comparison of exospheric temperatures as a function of the smoothed 10.7-cm solar flux $\overline{F}$.

$\overline{F}$	$T_{1/2}$ (°K)		
	J	T	H
70	720.9	784.2	864.0
100	860.5	865.4	944.2
150	1057.2	1000.8	1078.0
200	1227.4	1136.2	1212.0
250	1380.7	1271.6	1345.4
300	1522.2	1406.9	1479.2

These three temperature curves are shown in Figure 5. As can be seen, the slope of the J curve is greater than that of the straight lines T and H. For $\overline{F}$ = 103, the J temperatures are the same as T, while for $\overline{F}$ = 175, they are the same as H. It should be remarked that the slopes of both the H and the T models were derived from relatively short time intervals during 1969 to 1971, when solar activity hovered around a flat maximum without large changes, whereas that of the J models was derived from a 17-year interval that comprised two periods of minimum solar activity and two maxima, of which one was the highest in 200 years.

The reaction of the exospheric temperature to a change in F is not instantaneous. We find (Jacchia, Slowey, and Campbell, 1973) a lag Δt that varies from $0\overset{d}{.}9$ at 12^h noon local solar time (LST) to $1\overset{d}{.}6$ at 0^h LST according to the equation

$$\Delta t = \underset{\pm .12}{1\overset{d}{.}26} + \underset{\pm .17}{0\overset{d}{.}37} \sin (H - \underset{\pm 25}{92°}) \quad , \tag{23}$$

where H is the hour angle of the sun, i.e., LST + 12^h. According to Paul, Volland, and Roemer (1974), the lag is a little greater, although almost exactly in phase with the above expression:

$$\Delta t = 1\overset{d}{.}74 + 0\overset{d}{.}26 \cos H \quad .$$

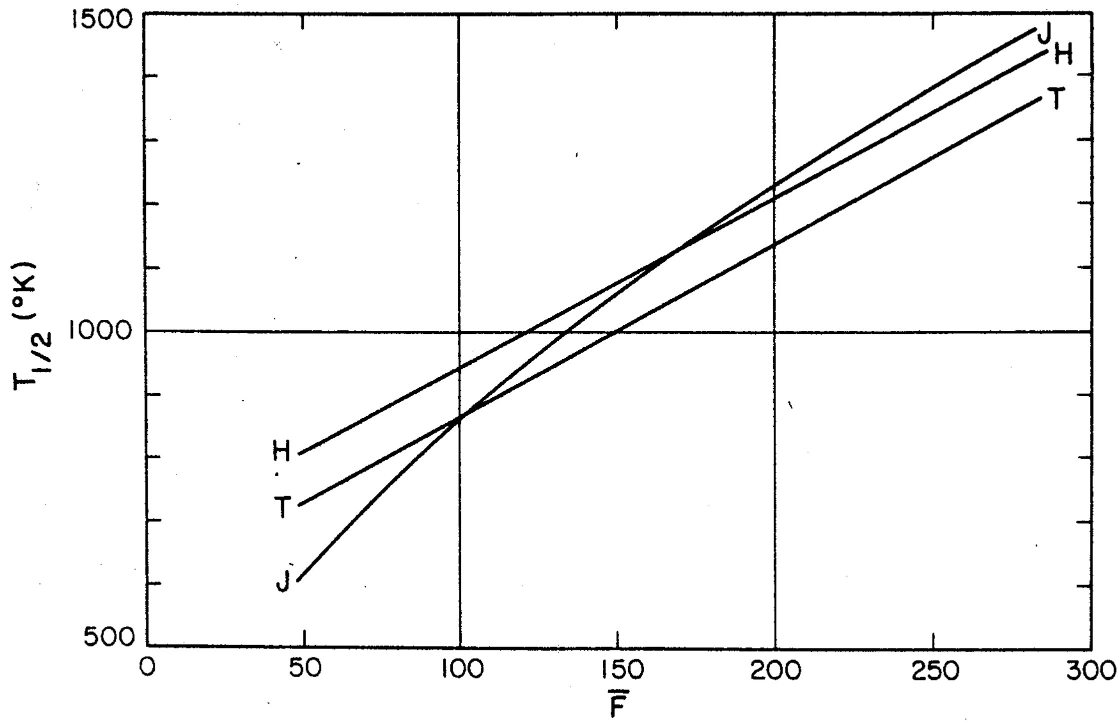


Figure 5. Comparison between the temperatures of the present models (J) with those of the models of Thuillier et al. (1976) (T) and Hedin et al. (1974) (H) as a function of the smoothed 10.7-cm solar flux $\overline{F}$, for $F = \overline{F}$ and $K_p = 0$.

3. THE DIURNAL VARIATION

Our approach in dealing with the diurnal variation follows, in its main lines, the pattern established in our previous models, although a higher degree of sophistication is required to represent the recently discovered height-dependent phase shifts in the variation of the individual atmospheric species. We shall still consider the phenomenon of the diurnal variation in its global aspect, giving equations valid for the whole earth, from which the variation for any given latitude and season can be derived as a particular case.

At any instant, the global distribution of the exospheric temperatures will show a nighttime minimum T_0 and a daytime maximum T_M, in opposite hemispheres; let their arithmetic mean be $T_{1/2}$. In previous models, we had taken T_0 as the basic temperature to relate to the solar flux F and to use in the equations defining the daily variation. Here we shall use $T_{1/2}$ instead.

In the older models, we had assumed that the ratio T/T_0 could be expressed as $T/T_0 = 1 + RD$, where R is a constant, $D = \sin^m \theta + (\cos^m \eta - \sin^m \theta)\, f(H)$ and $\eta = \frac{1}{2} |\phi - \phi_M|$; $\theta = \frac{1}{2} |\phi + \phi_M|$, ϕ being the latitude of a given point and ϕ_M the latitude of the point where the maximum daily temperature occurs; m is a constant close to 2, and f(H) a function of the hour angle H of the sun that varies between the limits 0 and 1. When m = 2, the expression for D reduces to

$$D = \frac{1}{2} \sin \phi_M \sin \phi + \cos \phi_M \cos \phi \, f(H) \quad .$$

As we can see, D consists of two terms, of which the first is seasonal-latitudinal and thus independent of local time. The two terms are mutually constrained by the presence of $\sin \phi_M$ in the first and $\cos \phi_M$ in the second, thus making the seasonal-latitudinal term dependent on the diurnal term. In the present models, we shall eliminate this unnecessary constraint and express $T/T_{1/2}$ as follows:

$$\frac{T}{T_{1/2}} = 1 + c_1 \frac{\delta_\odot}{\epsilon} \sin\phi + c_2 \cos\phi \left[f(H) - \frac{1}{2}\right] \quad , \tag{24}$$

where c_1 and c_2 are two constants, $\delta_\odot$ is the declination of the sun, and ϵ is the obliquity of the ecliptic, 23°.44; f(H) determines the shape of the diurnal temperature curve. We find that both the N_2 temperature curve (Mayr, Hedin, Reber, and Carignan, 1974) and the Doppler temperature curve (Thuillier et al., 1976), obtained from two separate experiments on the OGO 6 satellite, can be remarkably well represented by an equation of the form

$$f(H) = \cos^3 \frac{1}{2}(H + \beta) + c_3 \cos [3(H + \beta) + \chi] \quad . \tag{25}$$

For the N_2 temperature curve, $\beta = -50°$ and $c_3 = 0.14$; for the Doppler temperature curve, $\beta = -72°$ and $c_3 = 0.08$; for both, $\chi = -75°$. The difference in β results in a phase difference of 1.5 hours between the two temperature curves, but this will be of no immediate concern to us, as we shall presently see.

A fit of equation (24) to the spherical-harmonics model by Thuillier et al. (1976) yields $c_1 = 0.15$ and $c_2 = 0.24$. It is noteworthy that, assuming $c_1 = 0.15$, we obtain exactly the same value of c_2, i.e., 0.24, from a least-squares analysis of 30,373 densities derived from the drag of six satellites with perigee heights between 350 and 850 km: this leads to the important conclusion that the Doppler temperatures also account very well for the amplitude of the diurnal variation of atomic oxygen. We have therefore adopted the values

$$c_1 = 0.15 \quad , \qquad c_2 = 0.24 \quad , \qquad c_3 = 0.08 \quad .$$

As for β, the value -72° derived from the Doppler temperatures gives a minimum temperature at $6^h.2$ and a maximum at $17^h.6$ LST, both about 1.5 hours later than incoherent-scatter temperatures (McClure, 1969, 1971; Carru and Waldteufel, 1969; Salah and Evans, 1973). Since the phase of the Doppler temperature, according to Thuillier et al., is very strongly affected by the way the observational material is screened, we prefer to lean in the direction of incoherent-scatter temperatures and have adopted $\beta = -60°$, which gives a minimum at $5^h.4$ and a maximum at $16^h.8$ LST.

The OGO 6 mass-spectrometer analysis (Mayr et al., 1974) has revealed that the density of each atmospheric constituent peaks at a different hour of the day. A comparison with the lower altitude San Marco 3 data (Newton, Kasprzak, Curtis, and Pelz, 1975) shows that the phase shift varies with height, while satellite-drag analysis (Jacchia, Campbell, and Slowey, 1973) indicates that the total density always peaks at the same time, independently of height. To describe such behavior, we must make β variable (Jacchia, 1974) in equation (25):

$$\beta_i = \beta_0 + \beta_1 \left(\frac{\overline{M}}{M_i} - 1 \right) \quad , \qquad (26)$$

where β_0 and β_1 are two constants, $\overline{M}$ is the mean molecular mass, and M_i is the mass of the atmospheric species i (hydrogen excluded); $\overline{M}$ can be evaluated from the models as a function of z and $T_{1/2}$. For the two constants, we have adopted

$$\beta_0 = -35° \quad , \qquad \beta_1 = 27° \quad .$$

Each β_i defines a different $f_i(H)$, so that in equation (24), we are presented with a new parameter, a pseudo-temperature Θ_i, different for each species i:

$$\frac{\Theta_i}{T_{1/2}} = 1 + 0.15 \frac{\delta_\odot}{\epsilon} \sin \phi + 0.24 \cos \phi \left[f_i(H) - \frac{1}{2} \right] \qquad (27)$$

with

$$f_i(H) = \cos^n \frac{1}{2} (H + \beta_i) + 0.08 \cos [3(H + \beta_i) - 75°]$$

and

$$n = 2 + \cos^2 \left(\frac{\phi^2}{90°} \right) \quad .$$

Here we have replaced the exponent 3 in equation (25) with a variable exponent n, which decreases from 3 at the equator to 2 at the poles (where the diurnal term vanishes). This device (Jacchia, 1973) eliminates a discontinuity in $dT/d\phi$ (or $d\Theta_i/d\phi$) at the poles – a feature that seems to have caused some discomfiture to a few investigators (Blum and Harris, 1973).

Figure 6 shows the diurnal variation of the exospheric temperature at the equator at the time of the equinoxes when $T_{1/2}$ = 1000 K. The global distribution of exospheric temperatures for quiet geomagnetic conditions (K_p = 0) for the equinoxes and for the June solstice is given in Table 6 and illustrated in Figure 7. The variation with height in the hour of the maximum density of the individual constituents is shown in Figure 8.

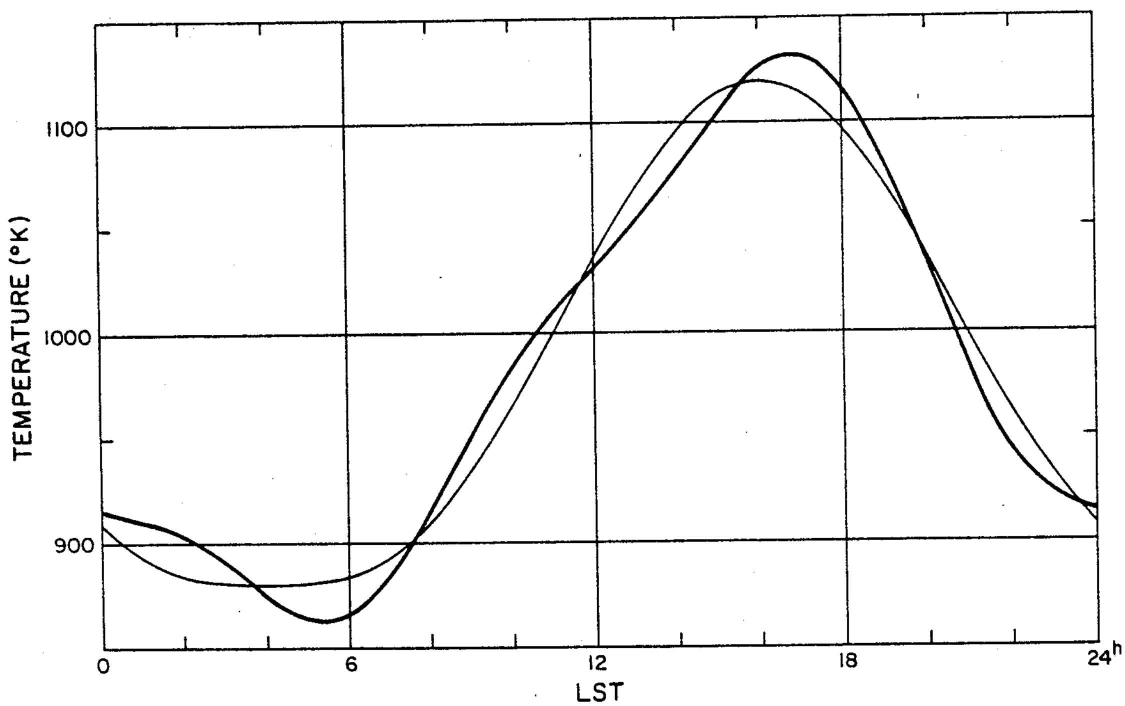


Figure 6. The diurnal variation of the exospheric temperature at the equator at the time of equinoxes, when $T_{1/2}$ = 1000 K, represented by the heavy curve. The light curve represents the variation minus the terdiurnal term.

Table 6. Global distribution of exospheric temperatures at the time of the equinoxes and of the June solstice.

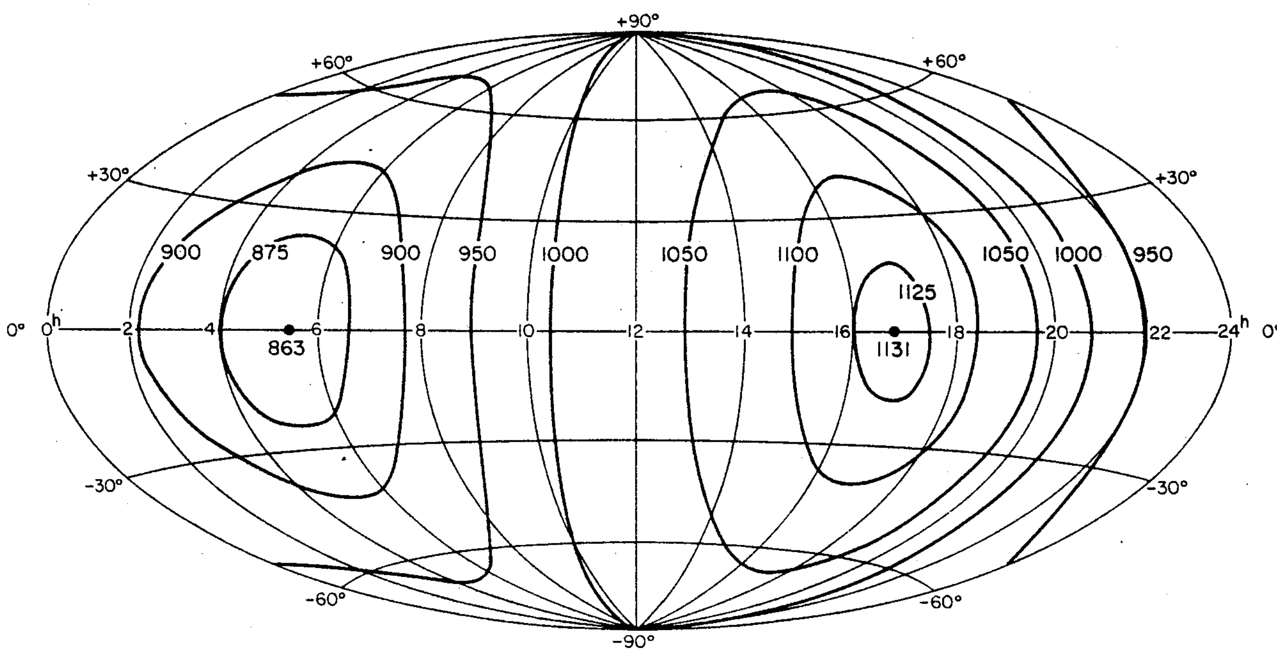
DECLINATION OF SUN = 0.00

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
90.	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
80.	988	985	981	978	977	978	983	990	997	1002	1006	1009	1012	1015	1018	1022	1023	1021	1016	1009	1002	996	992	990
70.	973	969	963	957	954	956	964	977	990	1002	1010	1016	1021	1028	1036	1043	1045	1041	1030	1016	1001	989	981	977
60.	958	953	945	938	932	934	945	962	982	998	1011	1020	1029	1040	1053	1062	1066	1059	1043	1020	998	980	968	962
50.	944	938	930	920	913	915	927	948	972	994	1010	1023	1036	1051	1067	1080	1084	1075	1053	1023	993	970	955	948
40.	932	926	916	904	896	897	912	936	964	989	1009	1025	1041	1060	1080	1096	1100	1089	1061	1025	989	961	944	936
30.	922	916	905	892	882	884	900	927	958	986	1009	1027	1046	1068	1090	1108	1113	1100	1069	1027	986	954	935	927
20.	916	909	897	883	872	874	891	920	954	985	1009	1029	1050	1073	1098	1117	1123	1108	1074	1029	984	950	929	920
10.	911	904	892	877	866	868	886	916	952	984	1009	1030	1052	1077	1103	1123	1129	1113	1078	1030	983	947	926	916
0.	910	903	890	875	864	866	884	915	951	983	1009	1031	1053	1078	1104	1125	1131	1115	1079	1031	983	946	925	915
-10.	911	904	892	877	866	868	886	916	952	984	1009	1030	1052	1077	1103	1123	1129	1113	1078	1030	983	947	926	916
-20.	916	909	897	883	872	874	891	920	954	985	1009	1029	1050	1073	1098	1117	1123	1108	1074	1029	984	950	929	920
-30.	922	916	905	892	882	884	900	927	958	986	1009	1027	1046	1068	1090	1108	1113	1100	1069	1027	986	954	935	927
-40.	932	926	916	904	896	897	912	936	964	989	1009	1025	1041	1060	1080	1096	1100	1089	1061	1025	989	961	944	936
-50.	944	938	930	920	913	915	927	948	972	994	1010	1023	1036	1051	1067	1080	1084	1075	1053	1023	993	970	955	948
-60.	958	953	945	938	932	934	945	962	982	998	1011	1020	1029	1040	1053	1062	1066	1059	1043	1020	998	980	968	962
-70.	973	969	963	957	954	956	964	977	990	1002	1010	1016	1021	1028	1036	1043	1045	1041	1030	1016	1001	989	981	977
-80.	988	985	981	978	977	978	983	990	997	1002	1006	1009	1012	1015	1018	1022	1023	1021	1016	1009	1002	996	992	990
-90.	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000

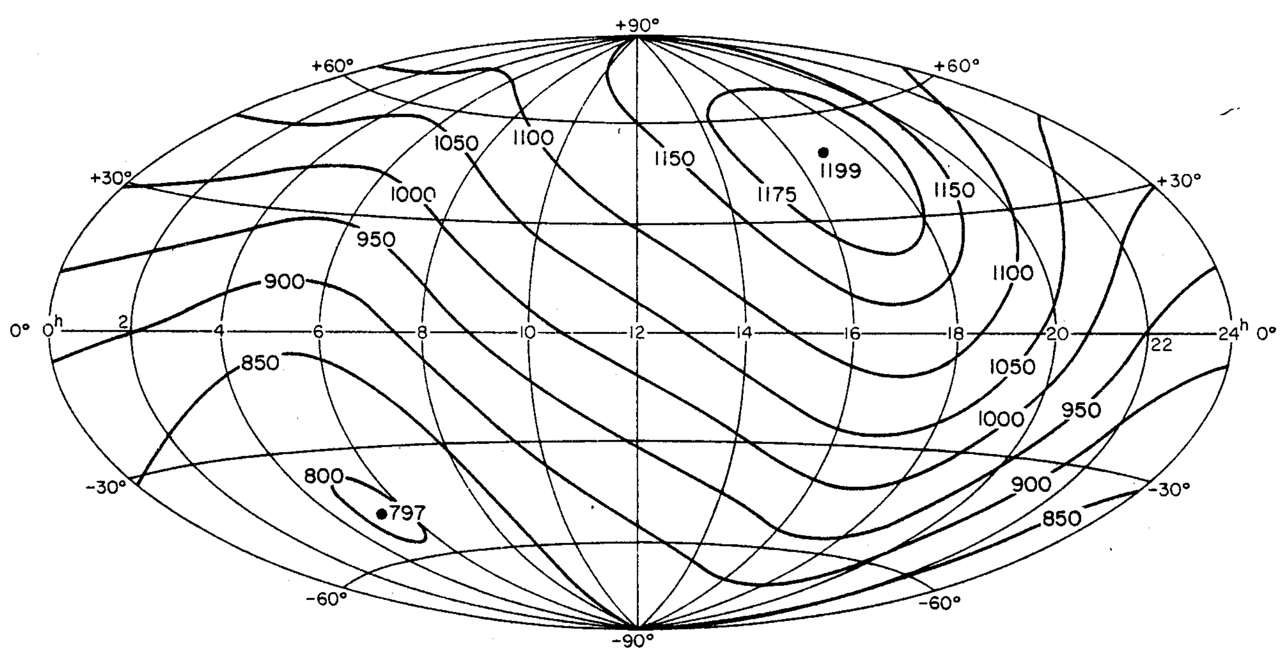
Table 6. (Cont.)

DECLINATION OF SUN = 23.44

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
90.	1150	1150	1150	1150	1150	1150	1150	1150	1150	1150	1150	1150	1150	1150	1150	1150	1150	1150	1150	1150	1150	1150	1150	1150
80.	1135	1133	1129	1126	1125	1126	1131	1137	1144	1150	1154	1157	1159	1162	1166	1169	1171	1169	1164	1157	1150	1144	1140	1137
70.	1114	1110	1104	1098	1095	1097	1105	1118	1131	1143	1151	1157	1162	1169	1177	1184	1186	1182	1171	1157	1142	1130	1122	1118
60.	1088	1083	1075	1067	1062	1064	1075	1092	1111	1128	1141	1150	1159	1170	1182	1192	1196	1189	1172	1150	1128	1110	1098	1092
50.	1059	1053	1044	1035	1028	1029	1042	1063	1087	1108	1125	1138	1151	1166	1182	1195	1199	1190	1168	1138	1108	1085	1070	1063
40.	1028	1022	1012	1001	992	994	1008	1033	1061	1086	1106	1122	1138	1157	1176	1192	1197	1185	1158	1122	1086	1057	1041	1033
30.	997	991	980	967	957	959	975	1002	1033	1061	1084	1102	1121	1143	1165	1183	1188	1175	1144	1102	1061	1029	1010	1002
20.	967	960	948	934	923	925	942	972	1005	1036	1060	1080	1101	1124	1149	1169	1174	1159	1125	1080	1036	1001	981	972
10.	937	930	918	903	892	894	912	942	978	1010	1035	1057	1078	1103	1129	1149	1155	1139	1104	1057	1010	973	952	942
0.	910	903	890	875	864	866	884	915	951	983	1009	1031	1053	1078	1104	1125	1131	1115	1079	1031	983	946	925	915
-10.	885	878	866	851	840	842	860	890	925	958	983	1004	1026	1051	1077	1097	1102	1087	1052	1004	957	921	900	890
-20.	864	857	845	831	821	822	840	869	903	933	958	978	998	1022	1047	1066	1071	1057	1023	978	933	898	878	869
-30.	847	841	830	817	807	809	825	852	883	911	934	952	971	993	1015	1033	1038	1025	994	952	911	879	860	852
-40.	836	829	820	808	799	801	816	840	868	893	913	929	945	964	984	999	1004	992	965	929	893	865	848	840
-50.	829	823	815	805	798	800	812	834	857	879	895	908	921	936	952	965	969	960	938	908	878	855	841	834
-60.	828	823	816	808	802	804	815	833	852	868	881	890	900	911	923	933	936	929	913	890	868	850	839	833
-70.	832	828	822	816	813	815	823	836	849	861	869	875	881	887	895	902	904	900	889	875	860	848	840	836
-80.	840	837	834	831	829	831	835	842	849	855	859	861	864	867	871	874	875	873	868	861	854	848	844	842
-90.	850	850	850	850	850	850	850	850	850	850	850	850	850	850	850	850	850	850	850	850	850	850	850	850



a) Equinoxes.



b) June solstice.

Figure 7. Global distribution of the exospheric temperature for quiet geomagnetic conditions ($K_p = 0$). The coordinates are local solar time and geographic latitude. The modifications introduced by disturbed geomagnetic conditions are illustrated in Figure 10.

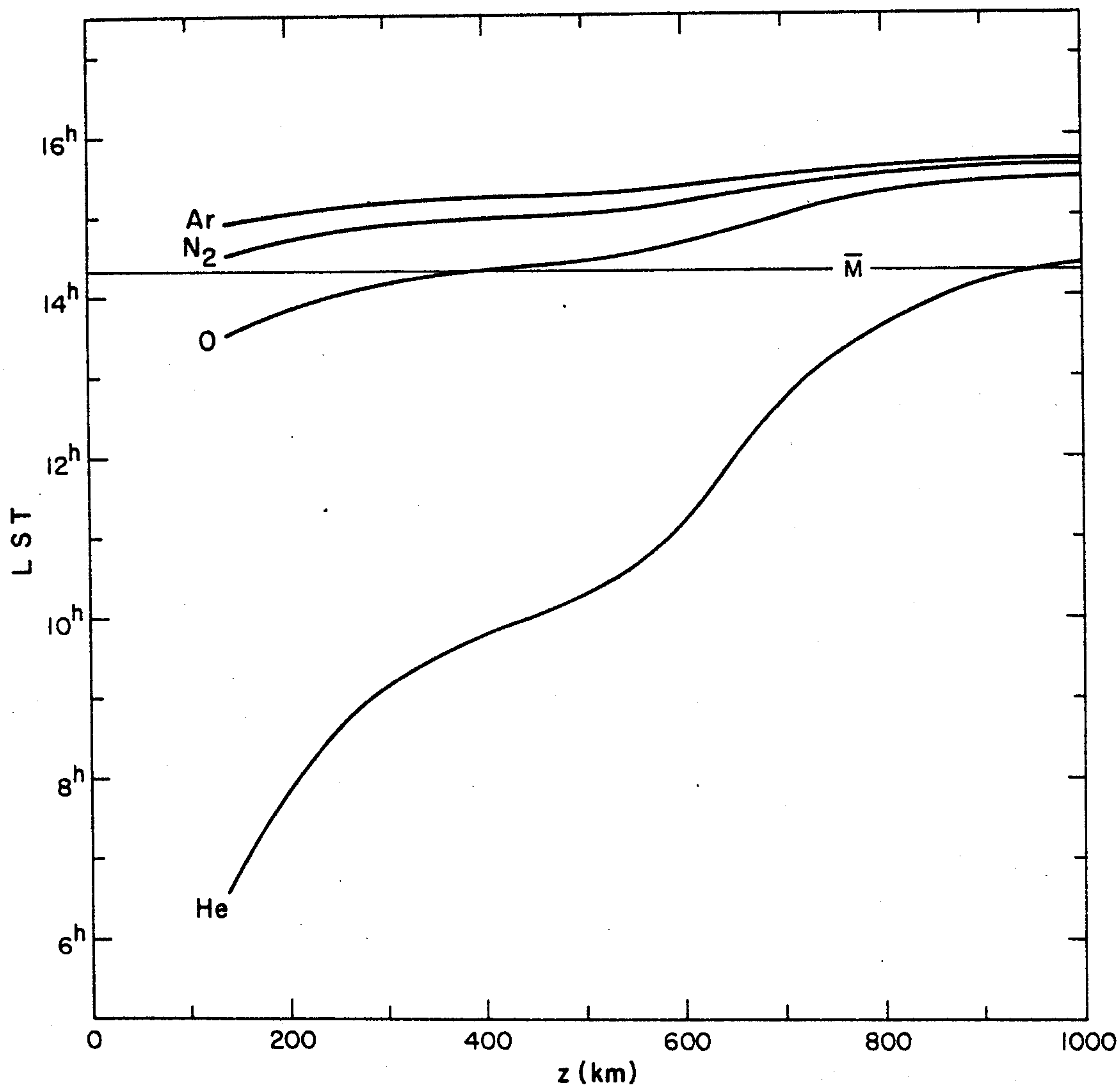


Figure 8. Local solar time of the maximum density of four atmospheric constituents as a function of height, for $T_{1/2}$ = 1000 K.

Warning. Densities derived from satellite drag have a limited resolution in local solar time, especially when the orbital inclination is small and when the density scale height at perigee is large – not to speak of small orbital eccentricities, which make the density insensitive to local solar time. This limited resolution will result in a smaller value of c_3, the amplitude of the terdiurnal term; also, c_2 might be decreased, although to a smaller degree. In some cases, the outright elimination of the terdiurnal term might even be advisable in comparing drag-derived densities with the models.

Notice also that, with the introduction of the terdiurnal term, $T_{1/2}$ is no longer the arithmetic mean between the daytime maximum and the nighttime minimum: it is, rather, the arithmetic mean of the extrema of the diurnal term.

Diurnal variations of hydrogen. Brinton et al. (1975) have inferred the diurnal variation of hydrogen at 250 km using Atmosphere Explorer C measurements around the December solstice 1974–75. They found a variation by a factor of 2 in the time-dependent component at the equator and at midlatitudes, with a maximum around 3^h LST and a minimum around 16^h or 17^h LST. The time-independent component also shows a variation by a factor of 2, with a maximum in middle-high latitudes in the winter hemisphere and a minimum in high latitudes in the summer hemisphere. All of this is in fair agreement with our models if we enter them with the actual temperature, i.e., if we use equations (26) and (27) with β = const = -60°: we obtain a variation by a factor of 2.0 in the time-dependent component and by a factor of 1.6 in the time-independent component [these components are the two terms of equation (24)]. It shows that not only the long-term variations, such as those with the solar cycle, but also the short-term variations can be handled, to a fair degree of approximation, by a hydrogen model in which the density at any given height is controlled by escape.

4. VARIATIONS WITH GEOMAGNETIC ACTIVITY

The formula relating the exospheric temperature to the decimetric solar flux, equation (20), is valid for ideally quiet geomagnetic conditions, $K_p = 0$. In the general case, when $K_p \neq 0$, geomagnetic activity produces a temperature increase $\Delta_G T$, which depends on magnetic latitude. At the same time, atmospheric composition changes, not only because of the change in scale height induced by $\Delta_G T$, but also because of a change in the interface between the regimes of mixing and diffusion. In addition, there is a density wave propagating from high to low magnetic latitudes. In this model of the geomagnetic phenomenon in the upper atmosphere, we follow the analytical formulation given by Jacchia, Slowey, and von Zahn (1976, 1977a).

Let us denote by $\Delta_G \log n_i$ the change in the logarithm of the number density of the species i that occurs as K_p changes from zero to a given value. We assume that $\Delta \log n_i$ is the sum of three separate effects:

$$\Delta_G \log n_i = \Delta_T \log n_i + \Delta_H \log n_i + \Delta_e \log n_i \quad , \tag{28}$$

where $\Delta_T \log n_i$ is the purely thermal component, originated by the change in scale height caused by the temperature increase $\Delta_G T$. In previous models, we had assumed that $\Delta_T \log n_i$ can be evaluated from static models by taking the difference between the value of $\log n_i$ that corresponds to the "quiet" ($K_p = 0$) temperature $T_0(\infty)$ and the one that corresponds to $T_0(\infty) + \Delta_G T_\infty$, $T_0(\infty)$ being the value of T_∞ from equation (24) with $\beta = -60°$. Admittedly this is a shaky assumption, because it implies that the shape of the temperature profiles is not altered by the magnetic disturbance. Since a distortion of the profiles is likely to occur, especially in the 100- to 120-km region, we must expect our model to become poorer as we approach the homopause boundary. The only remedy to such a situation, as we can see it, is to integrate the diffusion equation (16) with new "perturbed" temperature profiles; more about this in Section 4.1. In equation (28), $\Delta_H \log n_i$ is the contribution caused by a change in the height z_H of the homopause as a consequence of the magnetic disturbance, and $\Delta_e \log n_i$ is the contribution of the "equatorial wave," the density pileup in the equatorial regions as a consequence of convection toward the equator; it affects all atmospheric constituents by the same amount.

4.1 The Thermal Component

For a given level of geomagnetic activity, measured by the K_p index, we express the geomagnetic heating, i.e., the increase $\Delta_G T$ in the exospheric temperature above the quiet temperature level corresponding to $K_p = 0$, as a function of the invariant magnetic latitude ϕ_I (McIlwain, 1966), which we have found to give better results than the centered-dipole geomagnetic latitude ϕ'. If ϕ_I is not readily available, ϕ' can be used without too much loss in accuracy. For the convenience of the users of these models, we give here the equation to compute ϕ' assuming geographic coordinates for the north geomagnetic pole of $L = 291°E$, $\phi = +78\overset{\circ}{.}3$:

$$\sin \phi' = 0.9792 \sin \phi + 0.2028 \cos \phi \cos (L - 291°) \quad , \tag{29}$$

where L is the longitude counted eastward from Greenwich.

To account for the propagation time τ, we have introduced a fictitious index K'_p, equal to K_p at the time $t - \tau$; for τ, we use

$$\tau = 0\overset{d}{.}1 + 0\overset{d}{.}2 \cos^2 \phi_I \quad . \tag{30}$$

We then compute

$$\Delta_G T_\infty = A \sin^m \phi_I \quad , \tag{31a}$$

where

$$A = 57\overset{\circ}{.}5\, K'_p \left[1 + 0.027 \exp(0.4\, K'_p)\right] \quad , \qquad (T \text{ in } °K) \quad . \tag{31b}$$

We find that m = 4 gives satisfactory results in most cases, but there is some indication that, as the perturbation extends to lower latitudes, m becomes smaller, perhaps as small as 3.

As we said earlier, a change in T_∞ only will not give satisfactory results in the lower thermosphere: it becomes necessary to modify the whole temperature profile from the boundary upward, adding a correction $\Delta_G T(z)$ to the "quiet" temperatures $T_0(z)$. After some experimenting, we found that an expression of the form

$$\Delta_G T(z) = \Delta_G T_\infty \tanh [c(z - z_0)] \quad , \qquad (z > z_0) \quad , \tag{32}$$

with a proper selection of the constants c and z_0, will provide a disturbed temperature profile capable of representing density observations in the 150- to 200-km region without substantially altering the results obtained at greater heights by using a change in the exospheric temperature only. Expressing z in kilometers, values of

$$c = 0.006 \quad , \qquad z_0 = 90$$

introduced into equation (32) lead to disturbed densities [equation (28)] that are in reasonable agreement with densities of N_2, Ar, and O observed at 160 km by Philbrick, McIsaac, and Faucher (1976) during a magnetic storm.

4.2 Effect of a Change in the Height of the Homopause

We assume that the temperature increase $\Delta_G T$ is accompanied by a change Δz_H in the height of the homopause, where Δz_H is a strongly nonlinear function of $\Delta_G T$:

$$\Delta z_H = 5.0 \times 10^3 \sinh^{-1} (0.010 \, \Delta_G T) \quad , \qquad (z_H \text{ in meters}) \quad . \tag{33}$$

The mean molecular mass at the height of the homopause is very nearly 28, so we assume that a change in z_H does not affect N_2; for all other constituents, we have

$$\Delta_H \log n_i = \left[\frac{\partial \log n(N_2)}{\partial z} - \frac{\partial \log n_i}{\partial z} \right]_{z_{H+}} \Delta z_H = \alpha_i \, \Delta z_H \quad . \tag{34}$$

The subscript z_{H+} indicates that the derivatives in the bracket must be evaluated at a point immediately above the homopause (assumed to be a layer of zero thickness), in diffusive regime. From the models, we obtain

$$\alpha(\text{Ar}) = +3.07 \times 10^{-5} \text{ (mks)} \quad ,$$

$$\alpha(O_2) = +1.03 \times 10^{-5} \text{ (mks)} \quad ,$$

$$\alpha(N_2) = 0$$

$$[\alpha(\text{O}) = -4.03 \times 10^{-5} \text{ (mks)}]^* \quad ,$$

$$\alpha(\text{He}) = -6.30 \times 10^{-5} \text{ (mks)} \quad .$$

---

*Use -4.85×10^{-5} (mks) .

While the observed variations of Ar, N_2, and He are consistent with these theoretical values of α, we find that for atomic oxygen we need a value of α close to -4.85×10^{-5}. This is not surprising, considering that at the height of the homopause, oxygen dissociation is still very active, so that O is very far from being in diffusion equilibrium.

4.3 The Equatorial Wave

The equatorial wave can be represented by

$$\Delta_e \log n_i = \Delta_e \log \rho = 5.2 \times 10^{-4} A \cos^4 \phi_I \quad , \tag{35}$$

where ρ is the total density. By using A [equation (31b)] in equation (35), we automatically assume that the travel time of the equatorial wave is τ, the same as the propagation time for the temperature. Although there is no compelling reason to believe that this assumption is entirely correct, it would be very difficult to disentangle the two propagation times if they were different. All we can say is that at high latitudes, we observe a lag of about $0^d.1$ in the density variations with respect to those in K_p, while in low latitudes, the lag amounts to about $0^d.3$.

The density variation of four atmospheric constituents as a function of the invariant latitude ϕ_I is shown in Figure 9, together with the corresponding variation of the exospheric temperature.

4.4 The Global Temperature Distribution

Owing to its latitude dependence, the geomagnetic effect causes the maximum temperature to be shifted in the direction of the magnetic poles. Figure 10 shows the temperature distribution along the meridional circle crossing the geomagnetic poles at 17^h LST in one hemisphere and 5^h LST in the other, for four levels of geomagnetic activity. As can be seen, it takes only a very moderate degree of magnetic activity ($K_p \approx 2$) to shift the maximum temperature at the time of equinoxes from the equator to the polar regions.

Warning. Mass-spectrometer data show that there is no appreciable smoothing in the variation of n_i when compared with the variation of K_p. In other words, the reaction time of the atmosphere is smaller than the 3-hour resolution of the K_p indices. If these models are compared with observations having a lower degree of resolution, such as some satellite-drag densities, it is essential to use in the equation a set of K_p's smoothed to match the resolution of the data. Also, with a limited resolution such as in satellite drag, the temperature peak at the magnetic poles will appear flattened, with the result that the exponent m in equation (31a) and the numerical coefficient in equation (31b) will both become smaller; the effect will be a complicated function of the orbital inclination and of the density scale height at perigee, which must be evaluated before accurate comparisons can be made between drag-derived densities and those of the models. Another result of limited resolution is that the rotation of the earth under a satellite orbit tends to reduce or cancel the difference between magnetic and geographic coordinates. Whenever the smallest time interval in which drag is detectable is 1 day or more, geographic coordinates should be used.

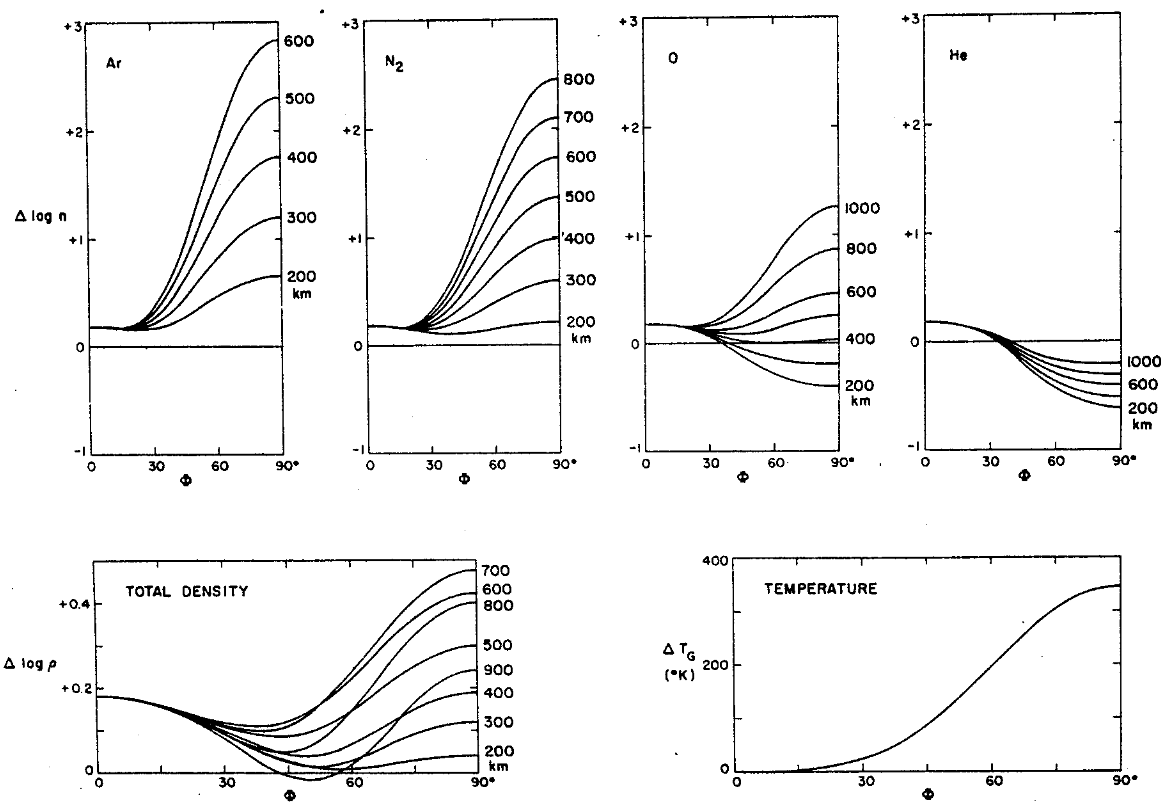


Figure 9. The density variation of four atmospheric constituents as a function of the invariant latitude ϕ_I, for various heights when the geomagnetic index $K_p = 5$. The curves were computed using a "quiet" ($K_p = 0$) exospheric temperature of 900 K. The diagram in the lower left corner depicts the variation of the total density; that in the lower right corner gives the corresponding variation in the exospheric temperature.

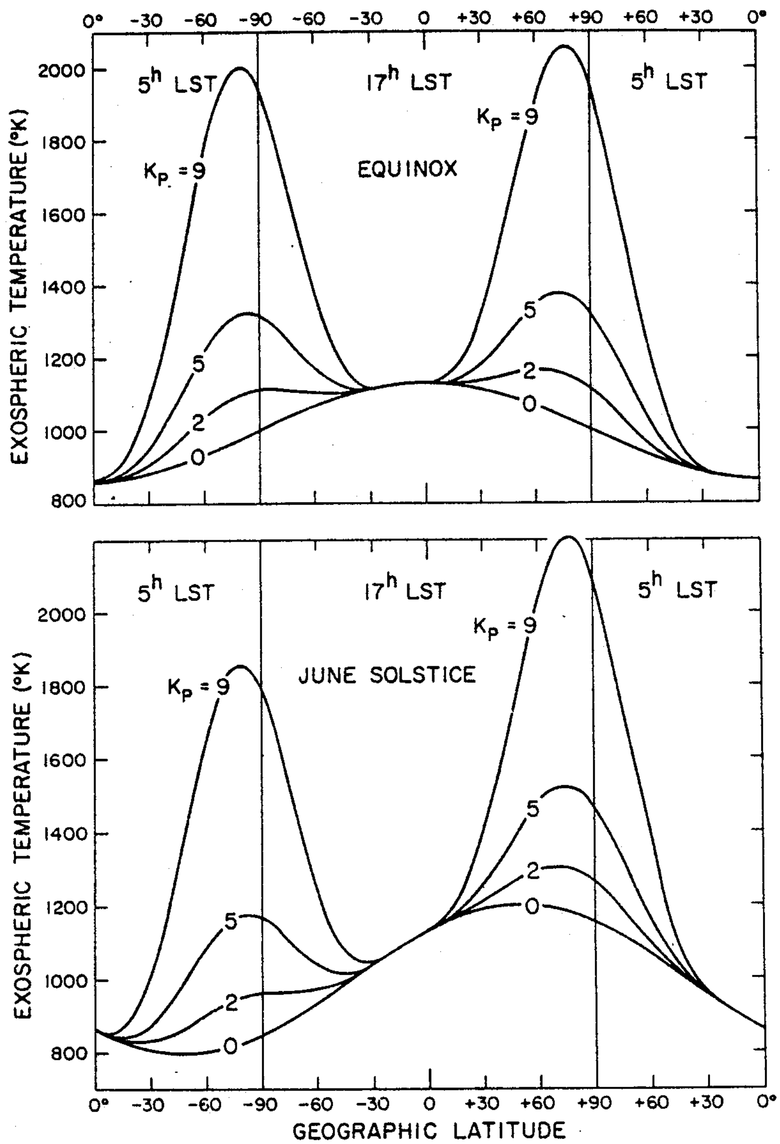


Figure 10. Exospheric temperature profiles along the complete (360°) meridional circle along which the local solar time is 17^h in one hemisphere and 5^h in the other, for various levels of geomagnetic activity. Even a moderate level of activity ($K_p \approx 2$) has the effect of shifting the temperature maximum from the equator to the poles at the time of equinoxes.

5. SEASONAL-LATITUDINAL VARIATIONS

When we deal with seasonal-latitudinal variations, we must first of all distinguish between the large variation of composition that is observed throughout the thermosphere and higher and the seasonal variation of temperature and density in the stratosphere and mesosphere, which spills over into the lower thermosphere and seems to vanish at heights above 140 to 150 km. To avoid confusion, we call the first the "thermospheric" and the second the "mesospheric" seasonal-latitudinal variation.

5.1 The Thermospheric Seasonal-Latitudinal Variation

The observed thermospheric seasonal-latitudinal variation of density and composition is the result of two distinct contributions. The first comes from the seasonal-latitudinal component of the diurnal temperature variation, $c_1(\delta_\odot/\epsilon)\sin\phi$ in equation (24). Its effect is to change the density and composition through a change in the scale height of the individual components; it is, therefore, strongly height dependent. When the contribution from this effect is subtracted, we are left with an intrinsic seasonal-latitudinal variation, essentially independent of height, whose origin must be traced to the lower boundary of the thermosphere. The so-called "winter helium bulge" is the first known example of this type of variation.

This "intrinsic" part of the thermospheric seasonal-latitudinal variation can be represented by a formula similar to the sin term of equation (24). Let $\Delta_{SL}\log n_i$ measure the departure of the number density of the species i from its yearly mean as a result of this variation. We can write

$$\Delta_{SL}\log n_i = c_i\frac{\delta_\odot}{\epsilon}\sin\phi \quad . \qquad (36)$$

Clearly, we cannot determine the c_i's independently of c_1, the corresponding coefficient in equation (24). This means that we must have a good model of the diurnal temperature variation, or at least of its seasonal-latitudinal component, before we can proceed to compute the c_i's.

Using the model of the diurnal variation described in Section 3, with $c_1 = 0.15$ as derived from the OGO 6 Doppler temperatures, we have determined values of c_i from the ESRO 4 data on four species (Jacchia, Slowey, and von Zahn, 1977b), as well as from the drag of six satellites (for O and He only); they are given in Table 7.

Table 7. Parameters of the seasonal-latitudinal variation.

Species	ESRO 4	Satellite drag	Adopted
N_2	+0.06	—	0
O	-0.15	-0.18	-0.16
He	-0.79	-0.76	-0.79
Ar	0.00	—	0
O_2	—	—	[0?]

5.2 The Mesospheric Seasonal-Latitudinal Variation

As is well known, the temperature in the troposphere and stratosphere is warmer in summer and colder in winter; at a height of 66 km, however, the situation reverses, and at the mesopause, around 88 km, the variation reaches its greatest amplitude, with a minimum in summer and a maximum in winter. Proceeding to greater heights, the amplitude decreases and reaches zero at 100 km; above 100 km, it is again warmer in summer and colder in winter. The density, for obvious reasons, follows a phase-shifted pattern: it is higher in summer than in winter throughout the stratosphere and mesosphere, to a height of 91 km, where there is an isopycnic layer. At 100 to 120 km, the density is higher in winter than in summer, but there is a second reversal somewhere around 140 to 160 km, because at a height where the daily variation becomes observable, i.e., at 180 to 200 km, we again have the highest densities in summer. At these heights, the picture merges with the thermospheric variations. There must be a transition layer, but it is difficult to establish with any degree of assurance what its height and thickness are. In a general theory that makes use of solar-energy absorption and reradiation variable with height (or, better, with density and composition), there should be no reason for distinguishing between mesospheric and thermospheric seasonal-latitudinal variations; in the absence of such a theory, however, the distinction becomes a practical necessity.

Tables of monthly temperature, pressure, and density means at heights from 25 to 110 km for latitudes from 0° to 70° have been compiled by Groves for the COSPAR International Reference Atmosphere (CIRA, 1972). Trying to fit a simple and consistent analytical model to these data, even when only heights above 90 km are considered, appears to be a hopeless task. In the 1971 models, we fitted the densities only, leaving the temperatures alone and using our imagination for heights above 120 km. We repeat here the formula, with warnings of caution to the users:

$$\Delta_{s\ell} \log \rho = \frac{\phi}{|\phi|} SP \sin^2 \phi \quad , \tag{37}$$

where the maximum half-range

$$S = 0.014 (z - 91) \exp [-0.0013 (z - 91)^2] \quad , \qquad (z \text{ in km}) \tag{38a}$$

and the phase

$$P = \sin (2\pi\Phi + 1.72) \quad ; \tag{38b}$$

ϕ is the geographic latitude and $\Phi = (t - \text{Jan. } 1)/365$. Values for S and P are tabulated in Table 8.

We find that $\Delta_{s\ell} \log \rho$ as expressed by equations (37) and (38) is roughly consistent with temperature deviations $\Delta_{s\ell} T$ from the basic models given by

$$\Delta_{s\ell} T = -2.9P(z - 102.5) \exp \left(-7.8 \times 10^{-5} |z - 102.5|^{2.7}\right) \quad . \tag{39}$$

Table 8. The "mesospheric" seasonal-latitudinal density variation according to equation (37): $\Delta_{s\ell} \log \rho = (\phi/|\phi|)\ SP \sin^2 \phi$.

a) Maximum half-range $S = 0.014\ (z - 91) \exp [-0.0013\ (z - 91)^2]$

z (km)	S	z (km)	S	z (km)	S
91	0.000	121	0.130	151	0.008
96	0.068	126	0.100	156	0.004
101	0.123	131	0.070	161	0.002
106	0.157	136	0.045	166	0.001
111	0.166	141	0.027	171	0.000
116	0.155	146	0.015		

b) Phase $P = \sin (2\pi \Phi + 1.72)^*$

Day		P	Day		P	Day		P	Day		P
Jan.	1	±0.989	Apr.	1	∓0.129	June	30	∓0.994	Sept.	28	±0.086
	11	±0.948		11	∓0.297	July	10	∓0.961	Oct.	8	±0.255
	21	±0.880		21	∓0.456		20	∓0.900		18	±0.417
	31	±0.786	May	1	∓0.602		30	∓0.812		28	±0.567
Feb.	10	±0.668		11	∓0.730	Aug.	9	∓0.699	Nov.	7	±0.699
	20	±0.531		21	∓0.836		19	∓0.567		17	±0.812
Mar.	2	±0.378		31	∓0.918		29	∓0.417		27	±0.900
	12	±0.214	June	10	∓0.972	Sept.	8	∓0.255	Dec.	7	±0.961
	22	±0.043		20	∓0.998		18	∓0.086		17	±0.994
										27	±0.998

*Take the upper sign for the Northern Hemisphere, the lower for the Southern Hemisphere.

6. THE SEMIANNUAL VARIATION

In the J65 models, the semiannual variation was represented by a temperature oscillation. We abandoned this model in J71 in favor of a density wave without a corresponding temperature variation and discussed the reasons for such a change (see also Jacchia, 1971b). Since then, several papers dealing with the semiannual variation have appeared. Wulf-Mathies (1972) found marginal evidence for a latitudinal dependence of the variation; Hedin et al. (1974) also found a weak latitudinal dependence, different for each atmospheric species; and according to Volland, Wulf-Mathies, and Priester (1972), the height dependence of the amplitude is almost entirely due to the semiannual component, the annual component being nearly independent of height. In all these papers, the analysis is limited to a relatively short time interval, from 1 to 3 years. As has been shown by King-Hele (1966), Jacchia, Slowey, and Campbell (1969), and Jacchia (1971b), the semiannual variation undergoes marked changes from year to year; this being the case, we still prefer to use the model of J71, which was derived from 12 years of satellite-drag data covering a wide range of heights. The pertinent equations are reported here with some minor modifications.

We express the semiannual density variation in log ρ as the product of two functions — one of the height z, and the other of time t:

$$\Delta_{sa} \log \rho = f(z)\, g(t) \quad , \tag{40}$$

with

$$f(z) = \left[0.04 \left(\frac{z}{200}\right)^2 + 0.05\right] \exp\left(-0.25 \frac{z}{100}\right) \quad , \qquad \text{(z in km)} \tag{41}$$

and

$$g(t) = 0.0284 + 0.382 \left[1 + 0.467 \sin(2\pi\tau + 4.14)\right] \sin(4\pi\tau + 4.26) \quad . \tag{42}$$

Here, τ is a periodic function of the fraction of the tropical year T corresponding to the time t

$$\Phi = \frac{t - t_0}{T} \quad , \qquad (t_0 = \text{Jan. } 1.0) \quad , \tag{43}$$

$$\tau = \Phi + 0.0954 \left\{ \left[\frac{1}{2} + \frac{1}{2} \sin (2\pi\Phi + 6.04) \right]^{1.65} - \frac{1}{2} \right\} \quad . \tag{44}$$

The absolute term in g(t), 0.0284, has the purpose of making $\int g(t)\, dt = 0$ over one cycle of the variation. Values of f(z) and g(t) are tabulated in Table 9.

Volland et al. (1972) decomposed the "semiannual variation" into an annual and a semiannual term, both strictly sinusoidal, and – as we mentioned – found that the amplitude of the annual term was nearly independent of height. They were able to reproduce the large observed difference in depth between the January and the July minima, but not the difference in height between the April and the October maxima, which they dismissed as probably not real, on the basis of a paper by Wulf-Mathies (1972). The difference, however, is real, although smaller than that between the minima, as can be seen from the independent analysis of all other investigators. If it is true that the amplitude of the annual component is nearly constant, there might be some advantage in using this feature. Accordingly, we offer here our alternate model constructed along the line of that by Volland et al.:

$$\Delta_{sa} \log \rho = f_1(z)\, g_1(t) + f_2(z)\, g_2(t) \quad . \tag{45}$$

The subscript 1 refers to the annual component, the subscript 2 to the semiannual,

$$f_1(z) = 0.03 \tanh \left(0.6 \frac{z}{100} \right) \quad , \tag{46a}$$

$$f_2(z) = \left[0.017 \left(\frac{z}{100} \right)^2 + 0.015 \right] \exp \left(-0.25 \frac{z}{100} \right) \quad , \tag{46b}$$

and

$$g_1(t) = \cos\, [2\pi(\Phi - 0.047)] \quad , \tag{47a}$$

$$g_2(t) = \cos\, [4\pi(\Phi - 0.296)] \quad . \tag{47b}$$

Table 9. Tables for the computation of the semiannual density variation using equation (40): $\Delta_{sa} \log \rho = f(z)\, g(t)$.

a) f(z)

z (km)	f(z)	z (km)	f(z)	z (km)	f(z)
100	0.070	500	0.301	900	0.347
150	0.096	550	0.319	950	0.340
200	0.127	600	0.332	1000	0.332
250	0.161	650	0.343	1050	0.323
300	0.194	700	0.349	1100	0.313
350	0.225	750	0.353	1150	0.301
400	0.254	800	0.353	1200	0.289
450	0.279	850	0.351		

b) g(t)

Φ	g(t)	Φ	g(t)	Φ	g(t)	Φ	g(t)
0.00	-0.145	0.26	+0.361	0.52	-0.478	0.78	+0.415
0.02	-0.178	0.28	+0.346	0.54	-0.508	0.80	+0.463
0.04	-0.188	0.30	+0.307	0.56	-0.522	0.82	+0.478
0.06	-0.178	0.32	+0.247	0.58	-0.517	0.84	+0.463
0.08	-0.150	0.34	+0.173	0.60	-0.490	0.86	+0.418
0.10	-0.106	0.36	+0.090	0.62	-0.439	0.88	+0.350
0.12	-0.049	0.38	+0.003	0.64	-0.364	0.90	+0.265
0.14	+0.020	0.40	-0.084	0.66	-0.267	0.92	+0.170
0.16	+0.097	0.42	-0.167	0.68	-0.150	0.94	+0.074
0.18	+0.176	0.44	-0.245	0.70	-0.022	0.96	-0.015
0.20	+0.249	0.46	-0.317	0.72	+0.108	0.98	-0.090
0.22	+0.309	0.48	-0.380	0.74	+0.231	1.00	-0.145
0.24	+0.348	0.50	-0.434	0.76	+0.336		

Here we have brought the amplitudes in line with our first model. As we said, this model does not reproduce the difference in the April and October maxima. A comparison between the semiannual variation computed with equations (40) to (44) and that computed with equations (45) to (47) is shown in Figure 11.

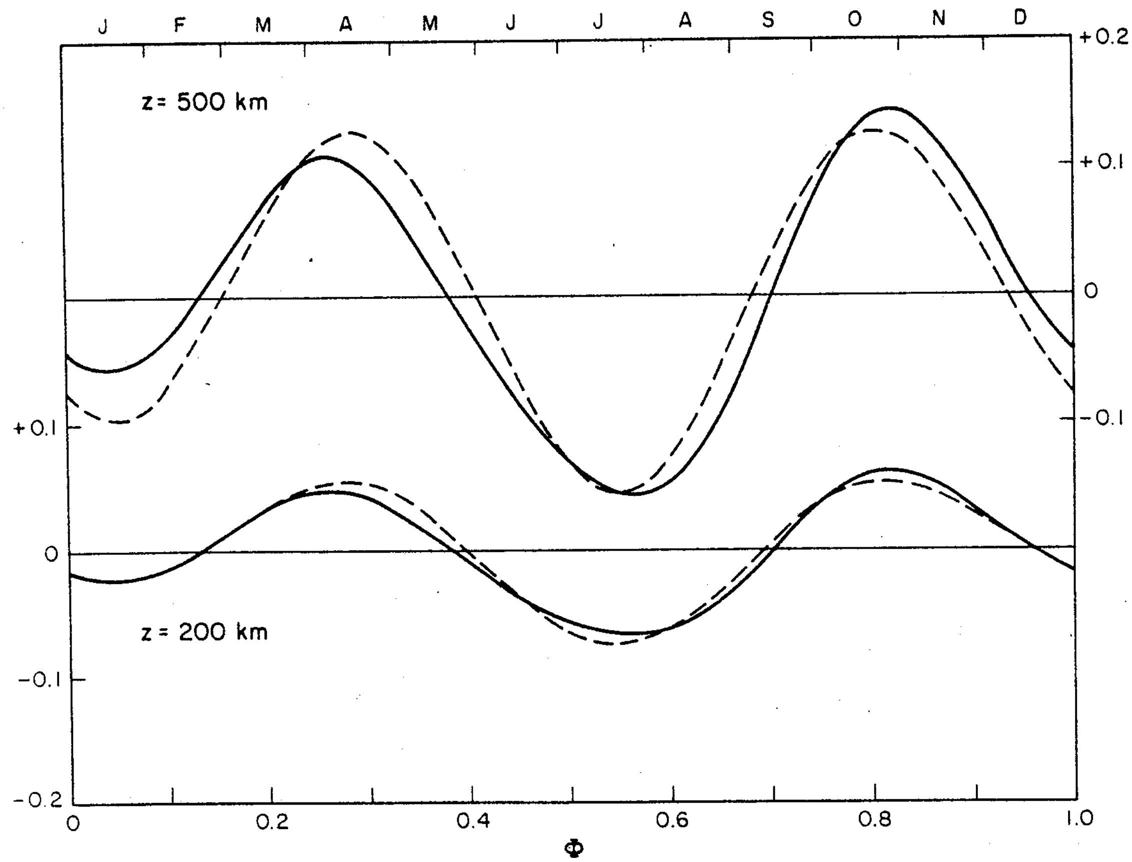


Figure 11. The semiannual density variation at 200 and 500 km, according to equations (40) to (44) (solid line) and according to equations (45) to (47) (dashed line).

It should be pointed out that if drag data from a single satellite are used to derive the semiannual variation, the annual component might get badly contaminated by the seasonal-latitudinal effect. It is only by using satellites in a variety of orbits and over long time intervals that the two effects can be clearly separated.

7. RAPID DENSITY FLUCTUATIONS

Density gauges on the Explorer 32 satellite have detected the existence of waves throughout the upper atmosphere in the height range from 286 (satellite perigee) to at least 510 km (Newton, Pelz, and Volland, 1969). An analysis of these waves indicates that they propagate in the neutral atmosphere. The waves are most prevalent at the higher latitudes near the auroral zone (the orbital inclination of the satellite is 65°) and were observed most frequently in the late evening and early morning hours, but they were not limited to those latitudes and times. The apparent vertical half-wavelengths of the waves increase with altitude from 1 km at 286-km altitude to 70 km at 510-km altitude; their half-amplitudes in density range from the limit of detectability to a maximum of about 50% of the mean density. It appears that some of the observed wavelengths are integrally related, indicating the existence of "fundamental" wavelengths and of second, third, and fourth harmonics.

Analyzing mass-spectrometer data from the Atmosphere Explorer C satellite in the 150- to 350-km region, Reber, Hedin, Pelz, Potter, and Brace (1975) found that the waves are accompanied by a change in composition: to an increase in nitrogen and argon density there corresponds a decrease in the helium density, just as in the geomagnetic phenomenon.

These waves have been interpreted as free internal gravity waves propagating predominantly from north to south or from south to north, with maximum horizontal wavelengths between 130 and 520 km. The altitude dependence of the apparent vertical half-wavelengths results from the satellite moving with varying vertical velocity through a slowly propagating wave pattern with nearly vertical phase planes. It is tempting to visualize these waves as part of the mechanism by which energy deposited in the auroral zones is conveyed to lower latitudes.

8. SUMMARY OF FORMULAE USED IN THE TEXT

Solar activity

$$T_{1/2} = 5.48\, \overline{F}^{0.8} + 101.8\, F^{0.4} \tag{20}$$

F to be taken at time $t - \Delta t$, where

$$\Delta t = 1\overset{d}{.}26 + 0\overset{d}{.}37 \sin (H - 92°) \tag{23}$$

$$\overline{F} = \frac{\Sigma\, wF}{\Sigma\, w} \tag{21}$$

$$w = \exp \left[-\left(\frac{t - t_0}{\tau} \right)^2 \right] , \qquad (\tau = 71 \text{ days}) \tag{22}$$

Diurnal variation

$$\frac{\Theta_i}{T_{1/2}} = 1 + 0.15 \frac{\delta_\odot}{\epsilon} \sin \phi + 0.24 \cos \phi \left[f_i(H) - \frac{1}{2} \right] \tag{27}$$

$$f_i(H) = \cos^n \frac{1}{2} (H + \beta_i) + 0.08 \cos [3(H + \beta_i) - 75°]$$

$$n = 2 + \cos^2 \left(\frac{\phi^2}{90°} \right)$$

$$\beta_i = -35° + 27° \left(\frac{\overline{M}}{M_i} - 1 \right) \tag{26}$$

(for actual temperature, $\beta_T = -60°$)

Geomagnetic activity

$$\Delta_G \log n_i = \Delta_T \log n_i + \Delta_H \log n_i + \Delta_e \log n_i \tag{28}$$

$$\Delta_G T_\infty = A \sin^4 \phi_I \tag{31a}$$

$$A = 57.^\circ5 \, K'_p \left[1 + 0.027 \exp(0.4 \, K'_p)\right] \tag{31b}$$

$K'_p = K_p$ at time $t - \tau$, where

$$\tau = 0.^d1 + 0.^d2 \cos^2 \phi_I \tag{30}$$

$$\Delta_G T(z) = \Delta_G T_\infty \tanh [0.006(z - 90)] \quad , \qquad (z \text{ in km}) \tag{32}$$

$$\Delta_H \log n_i = \alpha_i \Delta z_H \tag{34}$$

$$\Delta z_H = 5.0 \times 10^3 \sinh^{-1} (0.010 \, \Delta_G T) \quad , \qquad (\text{meters}) \tag{33}$$

$\alpha(Ar) = +3.07 \times 10^{-5}$, $\alpha(O_2) = +1.03 \times 10^{-5}(?)$, $\alpha(N_2) = 0$,

$\alpha(O) = -4.85 \times 10^{-5}$, $\alpha(He) = -6.30 \times 10^{-5}$ (mks)

$$\Delta_e \log n_i = 5.2 \times 10^{-4} A \cos^4 \phi_I \tag{35}$$

Seasonal-latitudinal variations

a) Thermospheric:

$$\Delta_{SL} \log n_i = c_i \frac{\delta_\odot}{\epsilon} \sin \phi \tag{36}$$

Values of c_i: $c(N_2) = 0$, $c(O) = -0.16$, $c(He) = -0.79$,

$c(Ar) = 0$

b) "Mesospheric":

$$\Delta_{s\ell} \log \rho = \frac{\phi}{|\phi|} SP \sin^2 \phi \tag{37}$$

$$S = 0.014\,(z - 91)\,\exp\,[-0.0013\,(z - 91)^2] \quad , \qquad (z \text{ in km}) \tag{38a}$$

$$P = \sin\left(2\pi\,\frac{t - t_0}{365} + 1.72\right) \quad , \qquad (t \text{ in days, } t_0 = \text{Jan. 1}) \tag{38b}$$

$$\Delta_{s\ell} T = -2.9P(z - 102.5)\,\exp\left(-7.8 \times 10^{-5}\,|z - 102.5|^{2.7}\right) \tag{39}$$

Semiannual variation

a) J71 model:

$$\Delta_{sa} \log \rho = f(z)\,g(t) \tag{40}$$

$$f(z) = \left[0.04\left(\frac{z}{100}\right)^2 + 0.05\right] \exp\left(-0.25\,\frac{z}{100}\right) \quad , \qquad (z \text{ in km}) \tag{41}$$

$$g(t) = 0.0284 + 0.382\,[1 + 0.467\,\sin\,(2\pi\tau + 4.14)]\,\sin\,(4\pi\tau + 4.26) \tag{42}$$

$$\tau = \Phi + 0.0954\left\{\left[\frac{1}{2} + \frac{1}{2}\,\sin\,(2\pi\Phi + 6.04)\right]^{1.65} - \frac{1}{2}\right\} \tag{44}$$

$$\Phi = (t - \text{Jan. 1})/365 \tag{43}$$

b) Alternate model:

$$\Delta_{sa} \log \rho = f_1(z)\,g_1(t) + f_2(z)\,g_2(t) \tag{45}$$

$$f_1(z) = 0.03\,\tanh\left(0.6\,\frac{z}{100}\right) \tag{46a}$$

$$f_2(z) = \left[0.017\left(\frac{z}{100}\right)^2 + 0.015\right] \exp\left(-0.25\,\frac{z}{100}\right) \tag{46b}$$

$$g_1(t) = \cos\,[2\pi\,(\Phi - 0.047)] \tag{47a}$$

$$g_2(t) = \cos\,[4\pi\,(\Phi - 0.296)] \tag{47b}$$

9. NUMERICAL EXAMPLE

Suppose we want to find the temperature, density, and composition for a point with the following coordinates:

Longitude = 45°W of Greenwich (= 315°E) ,

Latitude = 40°N ,

Height = 320 km ,

on May 4, 1974, at 14^h0^m UT (= MJD 42171.5833). For that instant, we find:

Sun's declination, $\delta_\odot$ = +15°.96 ,

$\delta_\odot/\epsilon$ = +0.6808 ,

Local solar time, LST = $11^h3^m.3$,

Hour angle of the sun, H = -14°.18 ,

Fraction of tropical year, Φ = 0.338 ,

Geomagnetic latitude, ϕ' = 50°.47 .

The 10.7-cm solar flux has to be evaluated at time $t - \Delta t$. With $\Delta t \approx 1$ day, we find $\overline{F} = 87.6$, $F = 114$; with these values, equation (20) gives $T_{1/2} = 873.1$ K. Entering the models with this exospheric temperature and $z = 320$ km, we find $\overline{M} = 16.90$, for use in equation (26). From equations (24) to (27), we find the Θ_i's appropriate for each constituent, with its corresponding number density:

Species	Θ_i	$\log (n_i)_0$
N_2	952.6	13.670
O_2	950.8	12.224
O	963.9	14.587
Ar	948.2	9.765
He	996.8	12.719
H	939.3*	11.265

* = T_0, the "quiet" exospheric temperature.

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We can now proceed to evaluate the geomagnetic effect. Corresponding to $\phi' = 50°47$, equation (30) gives the time lag $\tau = 0.18$ day = 4.3 hours. For $t - \tau = 1974$ May 4.40, we find $K_p' = 5_0$, which, introduced in equations (31a) and (31b), gives $A = 345$ K, $\Delta_G T_\infty = 122$ K. We now must compute the three components of the total "geomagnetic" variation $\Delta_G \log n_i$ [equation (28)]. The quantity $\Delta_T \log n_i$ is the change in $\log n_i$ as the exospheric temperature increases from its "quiet" value $T_0(\infty) = 939.3$ K to $T_0(\infty) + \Delta_G T_\infty = 1061$ K. For simplicity, we shall ignore equation (32) and the integrations it involves; for lower heights, this would not be justified. For $\Delta_H \log n_i$, we must use equations (33) and (34); for $\Delta_e \log n_i$, equation (35). We find

Species	$\Delta_T \log n_i$	$\Delta_H \log n_i$	$\Delta_e \log n_i$	$\Delta_G \log n_i$
N_2	+0.267	0	+0.063	+0.330
O_2	+0.312	+0.080	+0.063	+0.455
O	+0.131	-0.374	+0.063	-0.180
Ar	+0.403	+0.237	+0.063	+0.703
He	+0.014	-0.487	+0.063	-0.410
H	-0.161	?	+0.063	[-0.098]

The effect of the seasonal-latitudinal variation is computed from equation (36):

Species	$\Delta_{SL} \log n_i$
N_2	0
O_2	0(?)
O	-0.070
Ar	0
He	-0.346
H	(?)

The mesospheric seasonal-latitudinal variation is negligible at 320 km.

Finally, we can compute the effect of the semiannual variation from equations (40) to (44) or (45) to (47). Opting for the first set, we obtain $\Delta_{sa} \log \rho = +0.037$. Assembling all the various effects, we have

Species	$\log(n_i)_0$	$\Delta_G \log n_i$	$\Delta_{SL} \log n_i$	$\Delta_{sa} \log n_i$	Final $\log n_i$
N_2	13.670	+0.330	0	+0.037	14.037
O_2	12.224	+0.455	[0]	+0.037	12.716
O	14.587	-0.180	-0.070	+0.037	14.374
Ar	9.765	+0.703	0	+0.037	10.505
He	12.719	-0.410	-0.346	+0.037	12.000
H	11.265	[-0.098]	–	+0.037	[11.204]

The total density is given by $\rho = \Sigma M_i n_i / A$, where A is Avogadro's number, 6.02217×10^{26} (mks); we obtain $\rho = 1.164 \times 10^{-11}$, $\log \rho = -10.934$.

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Table 10. Basic static models.

EXOSPHERIC TEMPERATURE = 500 K

HEIGHT KM	TEMP K	LOG(N(N2) /M3)	LOG(N(O2) /M3)	LOG(N(O) /M3)	LOG(N(A) /M3)	LOG(N(HE) /M3)	LOG(N(H) /M3)	LOG(N /M3)	LOG (PRESSURE NT/M2)	MEAN MOL WT	DENSITY SCALE HT KM	DENSITY KG/M3	LOG(DEN KG/M3)
90	188.0	19.746	19.170	17.390	17.824	14.573		19.854	-.732	28.91	5.63	3.43E-06	-5.465
92	188.1	19.592	19.009	17.547	17.670	14.419		19.700	-.886	28.85	5.59	2.40E-06	-5.620
94	188.3	19.437	18.843	17.646	17.515	14.264		19.545	-1.040	28.76	5.56	1.68E-06	-5.776
96	188.8	19.282	18.674	17.687	17.360	14.109		19.391	-1.193	28.65	5.55	1.17E-06	-5.932
98	189.7	19.128	18.501	17.689	17.206	13.955		19.237	-1.345	28.52	5.57	8.16E-07	-6.088
100	191.2	18.974	18.326	17.668	17.052	13.801		19.084	-1.495	28.36	5.67	5.71E-07	-6.243
102	193.6	18.824	18.153	17.606	16.840	13.777		18.933	-1.640	28.21	5.68	4.01E-07	-6.397
104	197.2	18.674	17.978	17.552	16.629	13.752		18.783	-1.782	28.01	5.70	2.82E-07	-6.549
106	202.4	18.524	17.798	17.500	16.420	13.725		18.634	-1.919	27.78	5.72	1.99E-07	-6.702
108	209.5	18.374	17.613	17.445	16.213	13.696		18.487	-2.052	27.52	5.76	1.40E-07	-6.853
110	218.5	18.226	17.425	17.383	16.009	13.666		18.342	-2.178	27.23	5.87	9.94E-08	-7.002
115	247.7	17.873	16.974	17.203	15.529	13.590		18.002	-2.464	26.51	6.57	4.42E-08	-7.355
120	280.3	17.557	16.599	17.013	15.101	13.519		17.703	-2.709	25.90	7.53	2.17E-08	-7.664
125	314.0	17.275	16.279	16.834	14.720	13.455		17.441	-2.922	25.34	8.50	1.16E-08	-7.935
130	347.3	17.022	15.997	16.671	14.379	13.398		17.210	-3.109	24.80	9.67	6.69E-09	-8.175
135	376.3	16.797	15.744	16.528	14.073	13.350		17.009	-3.275	24.27	10.98	4.12E-09	-8.386
140	399.3	16.595	15.516	16.401	13.795	13.308		16.832	-3.427	23.75	12.26	2.68E-09	-8.573
145	416.8	16.408	15.306	16.286	13.536	13.273		16.672	-3.568	23.24	13.41	1.81E-09	-8.742
150	430.2	16.232	15.107	16.180	13.292	13.241	12.646	16.525	-3.701	22.73	14.42	1.27E-09	-8.898
155	440.5	16.065	14.918	16.080	13.058	13.212	12.595	16.389	-3.827	22.24	15.31	9.04E-10	-9.044
160	448.6	15.903	14.734	15.984	12.831	13.186	12.553	16.260	-3.948	21.75	16.11	6.58E-10	-9.182
170	460.5	15.592	14.380	15.802	12.392	13.136	12.489	16.021	-4.175	20.82	17.55	3.63E-10	-9.440
180	468.8	15.292	14.039	15.627	11.967	13.089	12.443	15.801	-4.388	19.97	18.85	2.10E-10	-9.679
190	474.8	14.999	13.705	15.457	11.552	13.045	12.409	15.594	-4.589	19.22	20.09	1.25E-10	-9.902
200	479.3	14.712	13.378	15.292	11.144	13.002	12.378	15.400	-4.780	18.56	21.26	7.73E-11	-10.112
210	482.9	14.429	13.055	15.129	10.742	12.960	12.356	15.214	-4.962	18.00	22.36	4.89E-11	-10.311
220	485.7	14.149	12.735	14.968	10.344	12.918	12.337	15.036	-5.138	17.52	23.38	3.16E-11	-10.501
230	487.9	13.872	12.419	14.809	9.950	12.878	12.322	14.864	-5.308	17.12	24.31	2.08E-11	-10.683
240	489.7	13.598	12.106	14.651	9.559	12.838	12.307	14.697	-5.473	16.77	25.14	1.39E-11	-10.858
250	491.2	13.325	11.795	14.495	9.171	12.798	12.294	14.535	-5.634	16.46	25.88	9.36E-12	-11.029
260	492.4	13.054	11.485	14.340	8.785	12.759	12.282	14.376	-5.791	16.18	26.52	6.39E-12	-11.194
270	493.5	12.785	11.178	14.186	8.402	12.720	12.271	14.222	-5.945	15.91	27.09	4.40E-12	-11.356
280	494.3	12.517	10.872	14.032	8.020	12.682	12.260	14.071	-6.095	15.62	27.59	3.05E-12	-11.515
290	495.0	12.251	10.568	13.880	7.640	12.643	12.249	13.923	-6.242	15.32	28.05	2.13E-12	-11.671
300	495.6	11.986	10.265	13.728	7.263	12.605	12.239	13.780	-6.385	14.96	28.48	1.50E-12	-11.825
310	496.2	11.722	9.964	13.577	6.886	12.567	12.229	13.641	-6.524	14.55	28.89	1.06E-12	-11.976
320	496.6	11.459	9.664	13.427	6.512	12.529	12.219	13.506	-6.658	14.07	29.32	7.49E-13	-12.125
330	497.0	11.197	9.365	13.277	6.138	12.492	12.209	13.377	-6.787	13.50	29.77	5.34E-13	-12.273
340	497.3	10.936	9.067	13.128		12.454	12.199	13.254	-6.909	12.83	30.27	3.83E-13	-12.417
350	497.6	10.677	8.770	12.980		12.417	12.190	13.138	-7.025	12.08	30.84	2.76E-13	-12.559
360	497.8	10.418	8.474	12.832		12.380	12.180	13.031	-7.132	11.23	31.52	2.00E-13	-12.699
370	498.1	10.160	8.180	12.684		12.343	12.171	12.931	-7.231	10.32	32.34	1.46E-13	-12.835
380	498.2	9.903	7.886	12.538		12.306	12.161	12.841	-7.322	9.37	33.35	1.08E-13	-12.967
390	498.4	9.647	7.594	12.391		12.270	12.152	12.759	-7.403	8.42	34.60	8.03E-14	-13.095
400	498.6	9.391	7.302	12.245		12.233	12.143	12.687	-7.475	7.50	36.16	6.05E-14	-13.218

Table 10. (Cont.)

EXOSPHERIC TEMPERATURE = 500 K

HEIGHT KM	TEMP K	LOG(N(N2) /M3)	LOG(N(O2) /M3)	LOG(N(O) /M3)	LOG(N(A) /M3)	LOG(N(HE) /M3)	LOG(N(H) /M3)	LOG(N /M3)	LOG (PRESSURE NT/M2)	MEAN MOL WT	DENSITY SCALE HT KM	DENSITY KG/M3	LOG(DEN KG/M3)
420	498.8	8.883	6.722	11.955		12.160	12.124	12.566	-7.596	5.86	40.49	3.58E-14	-13.446
440	499.0	8.378	6.145	11.667		12.088	12.106	12.472	-7.690	4.59	47.05	2.26E-14	-13.646
460	499.1	7.876		11.380		12.017	12.088	12.398	-7.763	3.69	56.57	1.53E-14	-13.815
480	499.3	7.378		11.095		11.945	12.070	12.338	-7.823	3.08	69.49	1.11E-14	-13.953
500	499.4	6.882		10.812		11.874	12.052	12.288	-7.874	2.67	85.55	8.59E-15	-14.066
520	499.5	6.390		10.531		11.804	12.034	12.243	-7.918	2.39	103.59	6.94E-15	-14.158
540	499.5			10.251		11.734	12.016	12.204	-7.958	2.19	121.95	5.81E-15	-14.236
560	499.6			9.973		11.664	11.999	12.167	-7.995	2.05	139.15	4.99E-15	-14.302
580	499.6			9.697		11.595	11.981	12.132	-8.029	1.93	154.45	4.35E-15	-14.361
600	499.7			9.422		11.526	11.964	12.100	-8.061	1.84	167.80	3.84E-15	-14.415
620	499.7			9.149		11.458	11.947	12.069	-8.092	1.76	179.61	3.43E-15	-14.465
640	499.7			8.877		11.390	11.930	12.040	-8.121	1.69	190.37	3.07E-15	-14.512
660	499.8			8.607		11.323	11.912	12.012	-8.149	1.63	200.55	2.78E-15	-14.557
680	499.8			8.339		11.255	11.896	11.985	-8.176	1.57	210.51	2.52E-15	-14.599
700	499.8			8.072		11.189	11.879	11.959	-8.202	1.52	220.49	2.30E-15	-14.639
720	499.8			7.806		11.122	11.862	11.935	-8.226	1.47	230.67	2.10E-15	-14.678
740	499.8			7.542		11.056	11.845	11.911	-8.250	1.43	241.17	1.93E-15	-14.715
760	499.9			7.280		10.991	11.829	11.888	-8.273	1.39	252.02	1.78E-15	-14.750
780	499.9			7.019		10.925	11.812	11.865	-8.296	1.35	263.26	1.65E-15	-14.783
800	499.9			6.760		10.860	11.796	11.844	-8.317	1.32	274.89	1.53E-15	-14.816
820	499.9			6.502		10.796	11.780	11.823	-8.338	1.29	286.83	1.42E-15	-14.847
840	499.9			6.245		10.732	11.764	11.802	-8.359	1.26	299.09	1.33E-15	-14.876
860	499.9					10.668	11.747	11.782	-8.379	1.24	311.63	1.25E-15	-14.905
880	499.9					10.604	11.731	11.763	-8.398	1.22	324.40	1.17E-15	-14.932
900	499.9					10.541	11.716	11.744	-8.417	1.20	337.33	1.10E-15	-14.958
920	499.9					10.478	11.700	11.725	-8.436	1.18	350.36	1.04E-15	-14.984
940	499.9					10.416	11.684	11.707	-8.454	1.16	363.42	9.82E-16	-15.008
960	499.9					10.354	11.668	11.689	-8.472	1.15	376.45	9.30E-16	-15.031
980	499.9					10.292	11.653	11.671	-8.490	1.13	389.39	8.83E-16	-15.054
1000	499.9					10.231	11.637	11.654	-8.507	1.12	402.18	8.39E-16	-15.076
1050	500.0					10.079	11.599	11.612	-8.549	1.10	433.10	7.45E-16	-15.128
1100	500.0					9.929	11.561	11.571	-8.590	1.08	462.23	6.66E-16	-15.177
1150	500.0					9.781	11.524	11.532	-8.629	1.06	489.13	5.99E-16	-15.222
1200	500.0					9.634	11.487	11.493	-8.668	1.05	513.56	5.43E-16	-15.266
1250	500.0					9.490	11.451	11.456	-8.705	1.04	535.72	4.93E-16	-15.307
1300	500.0					9.348	11.415	11.419	-8.742	1.03	555.69	4.50E-16	-15.347
1350	500.0					9.208	11.380	11.383	-8.778	1.03	573.67	4.12E-16	-15.385
1400	500.0					9.069	11.345	11.347	-8.814	1.02	589.87	3.78E-16	-15.422
1450	500.0					8.932	11.310	11.312	-8.849	1.02	604.75	3.48E-16	-15.459
1500	500.0					8.797	11.276	11.278	-8.883	1.02	618.44	3.20E-16	-15.494
1600	500.0					8.532	11.210	11.210	-8.951	1.01	642.97	2.73E-16	-15.563
1700	500.0					8.273	11.144	11.145	-9.016	1.01	665.04	2.35E-16	-15.630
1800	500.0					8.021	11.081	11.081	-9.080	1.01	685.30	2.02E-16	-15.694
1900	500.0					7.775	11.019	11.019	-9.142	1.01	704.74	1.75E-16	-15.756
2000	500.0					7.535	10.958	10.959	-9.202	1.01	723.59	1.52E-16	-15.817
2100	500.0					7.300	10.899	10.900	-9.261	1.01	741.92	1.33E-16	-15.876
2200	500.0					7.071	10.842	10.842	-9.319	1.01	760.38	1.16E-16	-15.934
2300	500.0					6.848	10.785	10.785	-9.376	1.01	778.85	1.02E-16	-15.991
2400	500.0					6.629	10.730	10.730	-9.431	1.01	797.22	9.00E-17	-16.046
2500	500.0					6.415	10.677	10.677	-9.484	1.01	815.85	7.95E-17	-16.100

Table 10. (Cont.)

EXOSPHERIC TEMPERATURE = 550 K

HEIGHT KM	TEMP K	LOG(N(N2) /M3)	LOG(N(O2) /M3)	LOG(N(O) /M3)	LOG(N(A) /M3)	LOG(N(HE) /M3)	LOG(N(H) /M3)	LOG(N /M3)	LOG (PRESSURE NT/M2)	MEAN MOL WT	DENSITY SCALE HT KM	DENSITY KG/M3	LOG(DEN KG/M3)
90	188.0	19.746	19.170	17.390	17.824	14.573		19.854	-.732	28.91	5.63	3.43E-06	-5.465
92	188.1	19.592	19.009	17.547	17.670	14.419		19.700	-.886	28.85	5.59	2.40E-06	-5.620
94	188.3	19.437	18.843	17.646	17.515	14.264		19.545	-1.040	28.76	5.56	1.68E-06	-5.776
96	188.9	19.282	18.673	17.687	17.360	14.109		19.391	-1.193	28.65	5.55	1.17E-06	-5.932
98	189.9	19.128	18.500	17.689	17.205	13.954		19.236	-1.345	28.52	5.57	8.16E-07	-6.088
100	191.6	18.974	18.326	17.668	17.052	13.801		19.083	-1.494	28.36	5.66	5.70E-07	-6.244
102	194.2	18.824	18.153	17.605	16.840	13.776		18.932	-1.639	28.21	5.67	4.01E-07	-6.397
104	198.2	18.673	17.977	17.550	16.629	13.750		18.782	-1.781	28.01	5.69	2.82E-07	-6.550
106	204.0	18.522	17.797	17.498	16.419	13.723		18.633	-1.917	27.79	5.71	1.98E-07	-6.703
108	211.8	18.372	17.612	17.442	16.213	13.694		18.486	-2.048	27.52	5.75	1.40E-07	-6.854
110	221.8	18.224	17.424	17.380	16.010	13.663		18.341	-2.173	27.24	5.87	9.91E-08	-7.004
115	254.2	17.873	16.975	17.199	15.534	13.585		18.001	-2.454	26.53	6.61	4.41E-08	-7.355
120	290.4	17.561	16.605	17.009	15.113	13.512		17.705	-2.692	25.94	7.65	2.19E-08	-7.661
125	327.7	17.284	16.293	16.831	14.741	13.448		17.448	-2.897	25.41	8.69	1.18E-08	-7.927
130	364.8	17.038	16.018	16.671	14.411	13.391		17.222	-3.076	24.90	9.92	6.90E-09	-8.161
135	397.6	16.820	15.774	16.531	14.116	13.342		17.026	-3.234	24.40	11.31	4.30E-09	-8.366
140	424.4	16.625	15.555	16.407	13.849	13.300		16.854	-3.379	23.92	12.69	2.84E-09	-8.547
145	445.3	16.446	15.354	16.296	13.604	13.265		16.699	-3.512	23.45	13.96	1.95E-09	-8.710
150	461.5	16.280	15.166	16.194	13.373	13.233	12.507	16.559	-3.637	22.98	15.08	1.38E-09	-8.860
155	474.3	16.122	14.987	16.099	13.152	13.205	12.454	16.428	-3.756	22.52	16.08	1.00E-09	-8.999
160	484.4	15.970	14.815	16.008	12.940	13.179	12.410	16.306	-3.869	22.07	16.97	7.40E-10	-9.130
170	499.5	15.680	14.486	15.837	12.532	13.131	12.342	16.079	-4.083	21.20	18.54	4.22E-10	-9.375
180	509.9	15.402	14.169	15.674	12.139	13.087	12.293	15.870	-4.283	20.39	19.95	2.51E-10	-9.601
190	517.6	15.132	13.862	15.517	11.757	13.046	12.256	15.675	-4.471	19.65	21.26	1.54E-10	-9.811
200	523.4	14.868	13.560	15.364	11.382	13.006	12.221	15.491	-4.650	19.00	22.50	9.77E-11	-10.010
210	527.9	14.608	13.264	15.214	11.013	12.967	12.197	15.316	-4.821	18.43	23.68	6.34E-11	-10.198
220	531.5	14.351	12.972	15.066	10.649	12.929	12.178	15.149	-4.985	17.93	24.80	4.20E-11	-10.377
230	534.4	14.098	12.682	14.921	10.288	12.891	12.161	14.988	-5.144	17.51	25.83	2.83E-11	-10.549
240	536.7	13.847	12.396	14.776	9.931	12.855	12.146	14.832	-5.298	17.14	26.78	1.93E-11	-10.714
250	538.7	13.598	12.112	14.634	9.577	12.818	12.133	14.680	-5.448	16.83	27.63	1.34E-11	-10.873
260	540.2	13.351	11.830	14.492	9.225	12.782	12.121	14.533	-5.595	16.55	28.40	9.37E-12	-11.028
270	541.6	13.105	11.549	14.351	8.875	12.747	12.110	14.388	-5.738	16.30	29.08	6.62E-12	-11.179
280	542.7	12.861	11.271	14.211	8.527	12.711	12.099	14.247	-5.878	16.05	29.69	4.71E-12	-11.327
290	543.6	12.618	10.994	14.073	8.182	12.676	12.089	14.109	-6.016	15.81	30.23	3.37E-12	-11.472
300	544.4	12.377	10.718	13.934	7.837	12.642	12.080	13.973	-6.151	15.56	30.72	2.43E-12	-11.615
310	545.0	12.137	10.443	13.797	7.495	12.607	12.070	13.840	-6.283	15.29	31.17	1.76E-12	-11.755
320	545.6	11.897	10.170	13.660	7.154	12.573	12.061	13.711	-6.412	14.98	31.61	1.28E-12	-11.893
330	546.1	11.659	9.898	13.524	6.814	12.538	12.052	13.585	-6.538	14.63	32.03	9.34E-13	-12.030
340	546.5	11.422	9.627	13.388	6.476	12.504	12.043	13.462	-6.660	14.22	32.46	6.85E-13	-12.165
350	546.9	11.185	9.357	13.253	6.139	12.470	12.034	13.344	-6.778	13.75	32.91	5.04E-13	-12.297
360	547.2	10.950	9.088	13.118		12.437	12.025	13.231	-6.891	13.20	33.40	3.73E-13	-12.428
370	547.5	10.715	8.820	12.984		12.403	12.016	13.123	-6.999	12.59	33.96	2.77E-13	-12.557
380	547.7	10.481	8.553	12.850		12.369	12.008	13.020	-7.101	11.90	34.59	2.07E-13	-12.684
390	548.0	10.248	8.287	12.717		12.336	11.999	12.924	-7.197	11.15	35.34	1.55E-13	-12.808
400	548.1	10.016	8.021	12.585		12.303	11.991	12.835	-7.286	10.35	36.23	1.18E-13	-12.930

Table 10. (Cont.)

EXOSPHERIC TEMPERATURE = 550 K

HEIGHT KM	TEMP K	LOG(N(N2) /M3)	LOG(N(O2) /M3)	LOG(N(O) /M3)	LOG(N(A) /M3)	LOG(N(HE) /M3)	LOG(N(H) /M3)	LOG(N /M3)	LOG (PRESSURE NT/M2)	MEAN MOL WT	DENSITY SCALE HT KM	DENSITY KG/M3	LOG(DEN KG/M3)
420	548.5	9.554	7.493	12.321		12.237	11.974	12.678	-7.443	8.70	38.58	6.88E-14	-13.163
440	548.7	9.095	6.969	12.058		12.171	11.957	12.548	-7.573	7.13	42.03	4.18E-14	-13.379
460	548.9	8.638	6.448	11.798		12.106	11.940	12.443	-7.677	5.78	47.05	2.66E-14	-13.575
480	549.1	8.185		11.539		12.041	11.924	12.359	-7.762	4.72	54.18	1.79E-14	-13.747
500	549.2	7.734		11.281		11.976	11.908	12.289	-7.831	3.94	63.90	1.27E-14	-13.895
520	549.3	7.287		11.025		11.912	11.891	12.231	-7.889	3.38	76.37	9.55E-15	-14.020
540	549.4	6.841		10.771		11.849	11.875	12.181	-7.940	2.99	91.24	7.52E-15	-14.124
560	549.5	6.399		10.518		11.785	11.859	12.136	-7.984	2.71	107.58	6.14E-15	-14.212
580	549.5			10.267		11.723	11.844	12.095	-8.025	2.50	124.14	5.17E-15	-14.287
600	549.6			10.017		11.660	11.828	12.057	-8.063	2.35	139.80	4.44E-15	-14.353
620	549.6			9.769		11.598	11.812	12.022	-8.098	2.22	153.88	3.88E-15	-14.412
640	549.7			9.522		11.536	11.797	11.988	-8.132	2.12	166.23	3.42E-15	-14.466
660	549.7			9.277		11.475	11.781	11.956	-8.164	2.03	177.05	3.04E-15	-14.517
680	549.7			9.033		11.414	11.766	11.926	-8.194	1.95	186.75	2.73E-15	-14.564
700	549.8			8.790		11.353	11.750	11.897	-8.223	1.88	195.70	2.46E-15	-14.610
720	549.8			8.549		11.293	11.735	11.869	-8.251	1.81	204.23	2.22E-15	-14.653
740	549.8			8.309		11.233	11.720	11.843	-8.277	1.75	212.60	2.02E-15	-14.695
760	549.8			8.070		11.173	11.705	11.817	-8.303	1.69	221.01	1.84E-15	-14.735
780	549.8			7.833		11.114	11.690	11.792	-8.328	1.64	229.59	1.68E-15	-14.773
800	549.8			7.597		11.055	11.675	11.768	-8.351	1.59	238.54	1.55E-15	-14.811
820	549.9			7.363		10.996	11.660	11.745	-8.374	1.54	247.74	1.42E-15	-14.846
840	549.9			7.130		10.938	11.646	11.723	-8.396	1.50	257.33	1.32E-15	-14.881
860	549.9			6.898		10.880	11.631	11.702	-8.418	1.46	267.33	1.22E-15	-14.914
880	549.9			6.667		10.822	11.616	11.681	-8.439	1.42	277.75	1.13E-15	-14.946
900	549.9			6.438		10.765	11.602	11.661	-8.459	1.39	288.60	1.06E-15	-14.976
920	549.9			6.210		10.707	11.588	11.641	-8.478	1.36	299.85	9.86E-16	-15.006
940	549.9					10.651	11.573	11.622	-8.497	1.33	311.48	9.24E-16	-15.034
960	549.9					10.594	11.559	11.604	-8.516	1.30	323.46	8.68E-16	-15.062
980	549.9					10.538	11.545	11.586	-8.534	1.28	335.76	8.16E-16	-15.088
1000	549.9					10.482	11.531	11.568	-8.552	1.25	348.34	7.70E-16	-15.113
1050	549.9					10.344	11.496	11.526	-8.594	1.21	380.67	6.71E-16	-15.173
1100	549.9					10.208	11.462	11.485	-8.634	1.17	413.79	5.92E-16	-15.228
1150	550.0					10.073	11.428	11.447	-8.673	1.13	446.91	5.27E-16	-15.278
1200	550.0					9.940	11.394	11.409	-8.710	1.11	479.27	4.73E-16	-15.325
1250	550.0					9.809	11.361	11.373	-8.746	1.09	510.42	4.28E-16	-15.369
1300	550.0					9.680	11.329	11.339	-8.781	1.07	539.90	3.89E-16	-15.410
1350	550.0					9.552	11.297	11.304	-8.815	1.06	567.42	3.55E-16	-15.450
1400	550.0					9.426	11.265	11.271	-8.848	1.05	592.83	3.26E-16	-15.487
1450	550.0					9.302	11.234	11.239	-8.881	1.04	616.36	3.00E-16	-15.523
1500	550.0					9.179	11.203	11.207	-8.913	1.04	637.99	2.77E-16	-15.558
1600	550.0					8.938	11.142	11.145	-8.975	1.03	676.08	2.38E-16	-15.624
1700	550.0					8.703	11.083	11.085	-9.035	1.02	708.87	2.06E-16	-15.686
1800	550.0					8.474	11.025	11.026	-9.093	1.02	737.46	1.79E-16	-15.746
1900	550.0					8.250	10.969	10.970	-9.150	1.01	763.43	1.57E-16	-15.804
2000	550.0					8.032	10.914	10.914	-9.205	1.01	787.49	1.38E-16	-15.860
2100	550.0					7.819	10.860	10.861	-9.259	1.01	810.09	1.22E-16	-15.915
2200	550.0					7.611	10.808	10.808	-9.312	1.01	832.10	1.08E-16	-15.967
2300	550.0					7.407	10.757	10.757	-9.363	1.01	853.61	9.57E-17	-16.019
2400	550.0					7.209	10.707	10.707	-9.413	1.01	874.62	8.53E-17	-16.069
2500	550.0					7.014	10.658	10.658	-9.462	1.01	895.74	7.61E-17	-16.118

Table 10. (Cont.)

EXOSPHERIC TEMPERATURE = 600 K

HEIGHT KM	TEMP K	LOG(N(N2) /M3)	LOG(N(O2) /M3)	LOG(N(O) /M3)	LOG(N(A) /M3)	LOG(N(HE) /M3)	LOG(N(H) /M3)	LOG(N /M3)	LOG (PRESSURE NT/M2)	MEAN MOL WT	DENSITY SCALE HT KM	DENSITY KG/M3	LOG(DEN KG/M3)
90	188.0	19.746	19.170	17.390	17.824	14.573		19.854	-.732	28.91	5.63	3.43E-06	-5.465
92	188.1	19.592	19.009	17.547	17.670	14.418		19.700	-.886	28.85	5.59	2.40E-06	-5.620
94	188.4	19.437	18.843	17.646	17.515	14.264		19.545	-1.040	28.76	5.56	1.68E-06	-5.776
96	189.0	19.282	18.673	17.687	17.360	14.109		19.390	-1.193	28.65	5.55	1.17E-06	-5.932
98	190.1	19.127	18.500	17.689	17.205	13.954		19.236	-1.345	28.52	5.56	8.15E-07	-6.089
100	191.9	18.973	18.326	17.667	17.051	13.800		19.083	-1.494	28.36	5.66	5.70E-07	-6.244
102	194.8	18.823	18.152	17.604	16.839	13.776		18.932	-1.639	28.21	5.66	4.00E-07	-6.398
104	199.2	18.672	17.976	17.549	16.628	13.749		18.781	-1.779	28.02	5.68	2.81E-07	-6.551
106	205.4	18.521	17.796	17.496	16.419	13.721		18.632	-1.915	27.79	5.70	1.98E-07	-6.704
108	213.9	18.371	17.611	17.439	16.212	13.692		18.484	-2.045	27.53	5.75	1.39E-07	-6.856
110	224.8	18.223	17.423	17.377	16.010	13.660		18.339	-2.169	27.24	5.87	9.88E-08	-7.005
115	260.1	17.873	16.976	17.195	15.538	13.580		18.000	-2.445	26.55	6.65	4.41E-08	-7.356
120	299.4	17.564	16.611	17.005	15.123	13.507		17.707	-2.676	25.97	7.75	2.20E-08	-7.658
125	340.1	17.292	16.304	16.829	14.759	13.441		17.453	-2.875	25.46	8.85	1.20E-08	-7.920
130	380.6	17.052	16.036	16.671	14.438	13.384		17.232	-3.047	24.98	10.14	7.08E-09	-8.150
135	417.0	16.839	15.799	16.533	14.152	13.334		17.040	-3.200	24.52	11.59	4.46E-09	-8.350
140	447.4	16.650	15.587	16.412	13.895	13.293		16.872	-3.338	24.06	13.05	2.97E-09	-8.527
145	471.7	16.478	15.393	16.303	13.659	13.257		16.722	-3.465	23.62	14.42	2.07E-09	-8.685
150	490.9	16.318	15.213	16.205	13.439	13.226	12.387	16.586	-3.583	23.18	15.66	1.48E-09	-8.829
155	506.2	16.168	15.043	16.113	13.230	13.198	12.332	16.460	-3.696	22.75	16.76	1.09E-09	-8.963
160	518.5	16.024	14.881	16.026	13.029	13.173	12.286	16.342	-3.803	22.33	17.75	8.15E-10	-9.089
170	536.9	15.751	14.571	15.864	12.646	13.126	12.215	16.125	-4.005	21.51	19.47	4.76E-10	-9.322
180	549.9	15.490	14.275	15.711	12.279	13.084	12.162	15.926	-4.194	20.75	20.99	2.91E-10	-9.537
190	559.4	15.239	13.988	15.564	11.923	13.045	12.122	15.741	-4.371	20.04	22.38	1.83E-10	-9.737
200	566.7	14.993	13.709	15.421	11.576	13.007	12.084	15.567	-4.540	19.40	23.70	1.19E-10	-9.926
210	572.3	14.753	13.434	15.282	11.234	12.971	12.059	15.401	-4.701	18.82	24.94	7.87E-11	-10.104
220	576.8	14.516	13.164	15.145	10.898	12.935	12.038	15.243	-4.856	18.32	26.14	5.32E-11	-10.274
230	580.4	14.282	12.897	15.010	10.565	12.900	12.020	15.091	-5.006	17.88	27.26	3.66E-11	-10.437
240	583.4	14.050	12.633	14.877	10.236	12.866	12.005	14.944	-5.150	17.49	28.31	2.55E-11	-10.593
250	585.8	13.821	12.371	14.745	9.910	12.833	11.992	14.801	-5.291	17.16	29.27	1.80E-11	-10.744
260	587.8	13.593	12.112	14.615	9.586	12.799	11.980	14.662	-5.428	16.87	30.15	1.29E-11	-10.890
270	589.4	13.367	11.854	14.485	9.264	12.767	11.969	14.527	-5.563	16.62	30.94	9.28E-12	-11.032
280	590.8	13.143	11.598	14.357	8.945	12.734	11.958	14.394	-5.694	16.38	31.65	6.74E-12	-11.171
290	592.0	12.920	11.343	14.229	8.627	12.702	11.948	14.264	-5.823	16.16	32.29	4.93E-12	-11.307
300	592.9	12.698	11.090	14.102	8.311	12.670	11.939	14.137	-5.950	15.95	32.87	3.63E-12	-11.440
310	593.8	12.477	10.837	13.975	7.996	12.638	11.930	14.012	-6.074	15.73	33.40	2.68E-12	-11.571
320	594.5	12.257	10.586	13.850	7.683	12.606	11.921	13.889	-6.197	15.50	33.88	1.99E-12	-11.700
330	595.1	12.038	10.337	13.725	7.371	12.575	11.912	13.769	-6.317	15.25	34.34	1.49E-12	-11.828
340	595.6	11.821	10.088	13.600	7.061	12.543	11.904	13.651	-6.434	14.98	34.77	1.11E-12	-11.953
350	596.1	11.604	9.840	13.476	6.751	12.512	11.896	13.536	-6.549	14.66	35.20	8.37E-13	-12.077
360	596.5	11.387	9.593	13.352	6.443	12.481	11.887	13.424	-6.660	14.31	35.64	6.31E-13	-12.200
370	596.9	11.172	9.347	13.229	6.136	12.450	11.879	13.316	-6.769	13.90	36.10	4.77E-13	-12.321
380	597.2	10.958	9.102	13.107		12.420	11.871	13.211	-6.873	13.44	36.59	3.63E-13	-12.441
390	597.4	10.744	8.858	12.984		12.389	11.863	13.110	-6.974	12.92	37.14	2.76E-13	-12.558
400	597.7	10.531	8.615	12.863		12.358	11.856	13.014	-7.070	12.35	37.75	2.12E-13	-12.674

Table 10. (Cont.)

EXOSPHERIC TEMPERATURE = 600 K

HEIGHT KM	TEMP K	LOG(N(N2) /M3)	LOG(N(O2) /M3)	LOG(N(O) /M3)	LOG(N(A) /M3)	LOG(N(HE) /M3)	LOG(N(H) /M3)	LOG(N /M3)	LOG (PRESSURE NT/M2)	MEAN MOL WT	DENSITY SCALE HT KM	DENSITY KG/M3	LOG(DEN KG/M3)
420	598.1	10.107	8.131	12.620		12.298	11.840	12.836	-7.247	11.04	39.26	1.26E-13	-12.900
440	598.4	9.686	7.650	12.380		12.237	11.825	12.681	-7.402	9.61	41.34	7.65E-14	-13.116
460	598.6	9.267	7.172	12.141		12.178	11.809	12.548	-7.534	8.16	44.25	4.79E-14	-13.320
480	598.8	8.852	6.697	11.903		12.118	11.794	12.437	-7.646	6.84	48.34	3.11E-14	-13.508
500	599.0	8.438	6.225	11.667		12.059	11.779	12.345	-7.738	5.71	54.01	2.10E-14	-13.678
520	599.1	8.028		11.433		12.000	11.764	12.268	-7.815	4.82	61.66	1.48E-14	-13.829
540	599.2	7.620		11.200		11.942	11.750	12.203	-7.880	4.14	71.56	1.10E-14	-13.960
560	599.3	7.214		10.968		11.884	11.735	12.147	-7.936	3.64	83.76	8.46E-15	-14.072
580	599.4	6.811		10.737		11.826	11.720	12.097	-7.985	3.27	97.86	6.79E-15	-14.168
600	599.5	6.410		10.508		11.769	11.706	12.052	-8.030	3.00	113.10	5.61E-15	-14.251
620	599.5	6.011		10.281		11.712	11.692	12.011	-8.071	2.79	128.47	4.75E-15	-14.323
640	599.6			10.054		11.655	11.677	11.973	-8.109	2.63	143.10	4.10E-15	-14.387
660	599.6			9.829		11.599	11.663	11.937	-8.145	2.50	156.39	3.59E-15	-14.445
680	599.7			9.606		11.543	11.649	11.902	-8.180	2.39	168.14	3.17E-15	-14.498
700	599.7			9.383		11.487	11.635	11.870	-8.212	2.30	178.44	2.83E-15	-14.549
720	599.7			9.162		11.432	11.621	11.839	-8.243	2.21	187.55	2.54E-15	-14.596
740	599.8			8.942		11.377	11.607	11.809	-8.273	2.14	195.75	2.28E-15	-14.641
760	599.8			8.723		11.322	11.593	11.780	-8.302	2.07	203.36	2.07E-15	-14.685
780	599.8			8.506		11.268	11.580	11.752	-8.330	2.00	210.63	1.88E-15	-14.727
800	599.8			8.290		11.214	11.566	11.726	-8.356	1.93	217.82	1.71E-15	-14.767
820	599.8			8.075		11.160	11.552	11.700	-8.382	1.87	224.95	1.56E-15	-14.807
840	599.8			7.861		11.107	11.539	11.676	-8.406	1.82	232.21	1.43E-15	-14.845
860	599.9			7.648		11.053	11.526	11.652	-8.430	1.76	239.70	1.31E-15	-14.881
880	599.9			7.437		11.000	11.512	11.629	-8.453	1.71	247.46	1.21E-15	-14.917
900	599.9			7.227		10.948	11.499	11.607	-8.475	1.67	255.56	1.12E-15	-14.952
920	599.9			7.018		10.896	11.486	11.585	-8.497	1.62	264.02	1.04E-15	-14.985
940	599.9			6.810		10.844	11.473	11.564	-8.518	1.58	272.85	9.61E-16	-15.017
960	599.9			6.603		10.792	11.460	11.544	-8.538	1.54	282.09	8.94E-16	-15.049
980	599.9			6.397		10.740	11.447	11.525	-8.557	1.50	291.73	8.34E-16	-15.079
1000	599.9			6.193		10.689	11.434	11.506	-8.576	1.46	301.77	7.79E-16	-15.108
1050	599.9					10.562	11.402	11.461	-8.621	1.39	328.57	6.65E-16	-15.177
1100	599.9					10.437	11.370	11.418	-8.664	1.32	357.71	5.75E-16	-15.241
1150	599.9					10.314	11.339	11.378	-8.703	1.27	388.81	5.03E-16	-15.299
1200	600.0					10.192	11.309	11.341	-8.741	1.22	421.32	4.44E-16	-15.352
1250	600.0					10.072	11.278	11.305	-8.777	1.18	454.84	3.96E-16	-15.402
1300	600.0					9.954	11.249	11.270	-8.812	1.15	488.72	3.56E-16	-15.448
1350	600.0					9.837	11.219	11.237	-8.845	1.13	522.36	3.23E-16	-15.491
1400	600.0					9.721	11.190	11.204	-8.877	1.11	555.25	2.94E-16	-15.531
1450	600.0					9.607	11.161	11.173	-8.909	1.09	587.07	2.70E-16	-15.569
1500	600.0					9.495	11.133	11.143	-8.939	1.08	617.46	2.48E-16	-15.605
1600	600.0					9.274	11.077	11.084	-8.998	1.05	673.05	2.12E-16	-15.673
1700	600.0					9.058	11.023	11.028	-9.054	1.04	722.05	1.84E-16	-15.735
1800	600.0					8.848	10.970	10.973	-9.108	1.03	764.67	1.61E-16	-15.793
1900	600.0					8.643	10.918	10.921	-9.161	1.02	802.27	1.42E-16	-15.849
2000	600.0					8.443	10.868	10.870	-9.212	1.02	835.80	1.25E-16	-15.902
2100	600.0					8.248	10.819	10.820	-9.262	1.02	866.06	1.11E-16	-15.953
2200	600.0					8.057	10.771	10.772	-9.310	1.01	894.31	9.95E-17	-16.002
2300	600.0					7.870	10.724	10.724	-9.357	1.01	920.97	8.91E-17	-16.050
2400	600.0					7.688	10.678	10.678	-9.403	1.01	946.23	8.01E-17	-16.097
2500	600.0					7.510	10.633	10.633	-9.448	1.01	971.08	7.21E-17	-16.142

Table 10. (Cont.)

FXOSPHERIC TEMPERATURE = 650 K

HEIGHT KM	TEMP K	LOG(N(N2) /M3)	LOG(N(O2) /M3)	LOG(N(O) /M3)	LOG(N(A) /M3)	LOG(N(HE) /M3)	LOG(N(H) /M3)	LOG(N /M3)	LOG (PRESSURE NT/M2)	MEAN MCL WT	DENSITY SCALE HT KM	DENSITY KG/M3	LOG(DEN KG/M3)
90	188.0	19.746	19.170	17.390	17.824	14.573		19.854	-.732	28.91	5.63	3.43E-06	-5.465
92	188.1	19.592	19.009	17.547	17.669	14.418		19.700	-.886	28.85	5.59	2.40E-06	-5.620
94	188.4	19.437	18.843	17.646	17.515	14.264		19.545	-1.040	28.76	5.56	1.68E-06	-5.776
96	189.0	19.282	18.673	17.686	17.360	14.109		19.390	-1.193	28.65	5.54	1.17E-06	-5.932
98	190.2	19.127	18.500	17.689	17.205	13.954		19.236	-1.345	28.52	5.56	8.15E-07	-6.089
100	192.2	18.973	18.325	17.667	17.051	13.800		19.082	-1.494	28.36	5.65	5.69E-07	-6.245
102	195.3	18.822	18.152	17.604	16.839	13.775		18.931	-1.638	28.21	5.65	4.00E-07	-6.398
104	200.0	18.671	17.975	17.548	16.628	13.748		18.781	-1.778	28.02	5.67	2.81E-07	-6.552
106	206.7	18.520	17.795	17.495	16.419	13.720		18.631	-1.914	27.79	5.69	1.97E-07	-6.705
108	215.8	18.370	17.611	17.437	16.212	13.690		18.483	-2.043	27.53	5.74	1.39E-07	-6.857
110	227.6	18.222	17.423	17.374	16.011	13.657		18.338	-2.165	27.25	5.87	9.85E-08	-7.006
115	265.5	17.872	16.978	17.191	15.541	13.576		18.000	-2.436	26.57	6.69	4.41E-08	-7.356
120	307.7	17.566	16.616	17.002	15.132	13.501		17.709	-2.663	26.01	7.84	2.21E-08	-7.656
125	351.4	17.299	16.314	16.827	14.775	13.436		17.458	-2.856	25.51	8.99	1.22E-08	-7.915
130	395.0	17.063	16.051	16.671	14.460	13.378		17.241	-3.023	25.05	10.33	7.24E-09	-8.140
135	434.7	16.855	15.820	16.534	14.182	13.328		17.052	-3.170	24.61	11.83	4.61E-09	-8.337
140	468.5	16.671	15.613	16.415	13.933	13.286		16.887	-3.302	24.18	13.36	3.09E-09	-8.509
145	496.2	16.504	15.426	16.309	13.705	13.250		16.740	-3.424	23.76	14.82	2.17E-09	-8.664
150	518.4	16.350	15.253	16.213	13.494	13.219	12.279	16.608	-3.537	23.35	16.16	1.57E-09	-8.804
155	536.4	16.205	15.090	16.124	13.294	13.192	12.224	16.486	-3.645	22.95	17.37	1.17E-09	-8.933
160	551.0	16.068	14.935	16.040	13.103	13.166	12.177	16.372	-3.747	22.55	18.45	8.82E-10	-9.054
170	573.0	15.809	14.641	15.885	12.740	13.121	12.102	16.163	-3.938	21.78	20.34	5.27E-10	-9.278
180	588.7	15.563	14.362	15.740	12.395	13.081	12.047	15.973	-4.117	21.06	21.97	3.28E-10	-9.484
190	600.3	15.327	14.093	15.601	12.062	13.043	12.005	15.796	-4.286	20.38	23.46	2.11E-10	-9.675
200	609.1	15.097	13.832	15.467	11.737	13.007	11.964	15.630	-4.446	19.75	24.86	1.40E-10	-9.855
210	616.0	14.872	13.576	15.337	11.419	12.973	11.937	15.472	-4.598	19.18	26.17	9.45E-11	-10.025
220	621.5	14.652	13.324	15.209	11.106	12.939	11.915	15.322	-4.745	18.67	27.43	6.50E-11	-10.187
230	626.0	14.434	13.076	15.083	10.796	12.907	11.896	15.177	-4.886	18.22	28.62	4.55E-11	-10.342
240	629.6	14.219	12.831	14.960	10.491	12.875	11.880	15.038	-5.023	17.83	29.75	3.23E-11	-10.491
250	632.5	14.006	12.588	14.837	10.188	12.843	11.866	14.903	-5.156	17.48	30.81	2.32E-11	-10.634
260	635.0	13.795	12.347	14.716	9.888	12.812	11.854	14.772	-5.285	17.18	31.79	1.69E-11	-10.773
270	637.0	13.586	12.108	14.596	9.590	12.782	11.843	14.644	-5.412	16.91	32.68	1.24E-11	-10.907
280	638.7	13.378	11.871	14.477	9.294	12.752	11.832	14.519	-5.535	16.67	33.50	9.15E-12	-11.039
290	640.1	13.171	11.635	14.358	9.000	12.722	11.823	14.397	-5.657	16.45	34.24	6.81E-12	-11.167
300	641.3	12.966	11.401	14.241	8.708	12.692	11.813	14.277	-5.776	16.24	34.91	5.10E-12	-11.292
310	642.4	12.762	11.168	14.124	8.417	12.662	11.805	14.159	-5.894	16.05	35.52	3.84E-12	-11.416
320	643.2	12.559	10.936	14.007	8.127	12.633	11.796	14.043	-6.009	15.85	36.08	2.90E-12	-11.537
330	644.0	12.356	10.705	13.892	7.839	12.604	11.788	13.929	-6.122	15.65	36.60	2.21E-12	-11.657
340	644.7	12.155	10.475	13.776	7.552	12.575	11.780	13.817	-6.234	15.44	37.08	1.68E-12	-11.774
350	645.2	11.954	10.246	13.662	7.266	12.546	11.772	13.707	-6.344	15.21	37.54	1.29E-12	-11.891
360	645.7	11.755	10.017	13.547	6.981	12.517	11.764	13.599	-6.451	14.96	37.98	9.87E-13	-12.006
370	646.1	11.556	9.790	13.434	6.698	12.489	11.757	13.494	-6.556	14.68	38.42	7.59E-13	-12.119
380	646.5	11.357	9.564	13.320	6.415	12.460	11.749	13.391	-6.659	14.36	38.87	5.86E-13	-12.232
390	646.8	11.160	9.338	13.207	6.134	12.432	11.742	13.291	-6.759	14.01	39.33	4.54E-13	-12.343
400	647.1	10.963	9.113	13.095		12.404	11.734	13.193	-6.856	13.60	39.83	3.53E-13	-12.453

Table 10. (Cont.)

EXOSPHERIC TEMPERATURE = 650 K

HEIGHT KM	TEMP K	LOG(N(N2) /M3)	LOG(N(O2) /M3)	LOG(N(O) /M3)	LOG(N(A) /M3)	LOG(N(HE) /M3)	LOG(N(H) /M3)	LOG(N /M3)	LOG (PRESSURE NT/M2)	MEAN MOL WT	DENSITY SCALE HT KM	DENSITY KG/M3	LOG(DEN KG/M3)
420	647.6	10.572	8.666	12.871		12.348	11.720	13.010	-7.039	12.66	40.97	2.15E-13	-12.668
440	648.0	10.183	8.222	12.649		12.292	11.706	12.841	-7.207	11.54	42.41	1.33E-13	-12.876
460	648.3	9.796	7.781	12.428		12.237	11.691	12.690	-7.358	10.29	44.31	8.38E-14	-13.077
480	648.6	9.412	7.342	12.209		12.182	11.677	12.558	-7.490	8.99	46.87	5.40E-14	-13.268
500	648.8	9.031	6.906	11.991		12.127	11.664	12.444	-7.604	7.74	50.35	3.57E-14	-13.447
520	648.9	8.652	6.473	11.774		12.073	11.650	12.347	-7.701	6.61	55.05	2.44E-14	-13.612
540	649.1	8.275	6.043	11.559		12.019	11.636	12.265	-7.783	5.66	61.29	1.73E-14	-13.762
560	649.2	7.900		11.345		11.965	11.623	12.194	-7.853	4.90	69.38	1.27E-14	-13.895
580	649.3	7.528		11.132		11.912	11.609	12.133	-7.914	4.30	79.47	9.71E-15	-14.013
600	649.4	7.158		10.921		11.859	11.596	12.080	-7.968	3.85	91.48	7.68E-15	-14.115
620	649.4	6.790		10.711		11.807	11.583	12.031	-8.016	3.51	105.04	6.26E-15	-14.203
640	649.5	6.424		10.502		11.754	11.569	11.987	-8.060	3.25	119.52	5.24E-15	-14.281
660	649.5	6.060		10.294		11.702	11.556	11.946	-8.101	3.05	134.12	4.47E-15	-14.349
680	649.6			10.087		11.651	11.543	11.908	-8.139	2.89	148.10	3.88E-15	-14.411
700	649.6			9.882		11.599	11.530	11.872	-8.176	2.76	160.91	3.41E-15	-14.467
720	649.7			9.678		11.548	11.517	11.837	-8.210	2.65	172.35	3.03E-15	-14.519
740	649.7			9.475		11.497	11.505	11.804	-8.243	2.56	182.42	2.70E-15	-14.568
760	649.7			9.273		11.447	11.492	11.772	-8.275	2.47	191.28	2.43E-15	-14.615
780	649.7			9.072		11.397	11.479	11.742	-8.305	2.39	199.17	2.19E-15	-14.659
800	649.8			8.873		11.347	11.467	11.712	-8.335	2.32	206.35	1.99E-15	-14.702
820	649.8			8.674		11.297	11.454	11.684	-8.363	2.25	212.98	1.81E-15	-14.743
840	649.8			8.477		11.248	11.442	11.657	-8.390	2.19	219.32	1.65E-15	-14.783
860	649.8			8.281		11.199	11.429	11.630	-8.417	2.12	225.51	1.50E-15	-14.823
880	649.8			8.085		11.150	11.417	11.605	-8.442	2.06	231.68	1.38E-15	-14.861
900	649.8			7.891		11.101	11.405	11.580	-8.467	2.01	237.93	1.27E-15	-14.898
920	649.9			7.698		11.053	11.392	11.556	-8.491	1.95	244.33	1.17E-15	-14.934
940	649.9			7.506		11.005	11.380	11.533	-8.514	1.90	250.93	1.07E-15	-14.969
960	649.9			7.315		10.957	11.368	11.511	-8.536	1.85	257.79	9.94E-16	-15.003
980	649.9			7.126		10.910	11.356	11.489	-8.558	1.80	264.93	9.20E-16	-15.036
1000	649.9			6.937		10.862	11.344	11.468	-8.579	1.75	272.38	8.54E-16	-15.068
1050	649.9			6.469		10.746	11.315	11.419	-8.628	1.64	292.45	7.16E-16	-15.145
1100	649.9			6.008		10.630	11.286	11.373	-8.674	1.55	314.84	6.07E-16	-15.217
1150	649.9					10.516	11.257	11.330	-8.717	1.47	339.58	5.21E-16	-15.283
1200	649.9					10.404	11.229	11.289	-8.758	1.40	366.57	4.52E-16	-15.345
1250	649.9					10.293	11.201	11.252	-8.795	1.34	395.73	3.96E-16	-15.402
1300	650.0					10.184	11.173	11.216	-8.831	1.29	426.76	3.51E-16	-15.455
1350	650.0					10.076	11.146	11.182	-8.865	1.24	459.29	3.13E-16	-15.504
1400	650.0					9.969	11.119	11.149	-8.898	1.21	492.87	2.82E-16	-15.549
1450	650.0					9.864	11.093	11.118	-8.929	1.17	527.22	2.56E-16	-15.592
1500	650.0					9.760	11.067	11.088	-8.959	1.15	561.78	2.33E-16	-15.632
1600	650.0					9.556	11.015	11.030	-9.017	1.11	629.77	1.97E-16	-15.705
1700	650.0					9.357	10.965	10.976	-9.071	1.08	694.34	1.70E-16	-15.771
1800	650.0					9.163	10.916	10.924	-9.123	1.06	753.51	1.48E-16	-15.830
1900	650.0					8.974	10.869	10.874	-9.173	1.05	807.01	1.30E-16	-15.886
2000	650.0					8.789	10.822	10.826	-9.221	1.04	854.87	1.15E-16	-15.938
2100	650.0					8.609	10.777	10.780	-9.267	1.03	897.50	1.03E-16	-15.988
2200	650.0					8.433	10.732	10.735	-9.312	1.02	936.33	9.22E-17	-16.035
2300	650.0					8.261	10.689	10.691	-9.356	1.02	971.90	8.30E-17	-16.081
2400	650.0					8.092	10.647	10.648	-9.399	1.02	1004.73	7.50E-17	-16.125
2500	650.0					7.928	10.605	10.606	-9.441	1.01	1035.90	6.80E-17	-16.167

Table 10. (Cont.)

EXOSPHERIC TEMPERATURE = 700 K

HEIGHT KM	TEMP K	LOG(N(N2) /M3)	LOG(N(O2) /M3)	LOG(N(O) /M3)	LOG(N(A) /M3)	LOG(N(HE) /M3)	LOG(N(H) /M3)	LOG(N /M3)	LOG (PRESSURE NT/M2)	MEAN MOL WT	DENSITY SCALE HT KM	DENSITY KG/M3	LOG(DEN KG/M3)
90	188.0	19.746	19.170	17.390	17.824	14.573		19.854	-.732	28.91	5.63	3.43E-06	-5.465
92	188.1	19.592	19.009	17.547	17.669	14.418		19.700	-.886	28.85	5.59	2.40E-06	-5.620
94	188.4	19.437	18.843	17.646	17.515	14.264		19.545	-1.040	28.76	5.56	1.68E-06	-5.776
96	189.1	19.282	18.673	17.686	17.360	14.109		19.390	-1.193	28.65	5.54	1.17E-06	-5.932
98	190.4	19.127	18.500	17.688	17.205	13.954		19.236	-1.345	28.52	5.55	8.15E-07	-6.089
100	192.5	18.973	18.325	17.667	17.050	13.799		19.082	-1.494	28.36	5.65	5.69E-07	-6.245
102	195.8	18.822	18.151	17.603	16.839	13.774		18.931	-1.638	28.21	5.65	3.99E-07	-6.399
104	200.7	18.671	17.975	17.547	16.628	13.748		18.780	-1.777	28.02	5.66	2.80E-07	-6.552
106	207.9	18.519	17.795	17.493	16.418	13.719		18.630	-1.912	27.79	5.69	1.97E-07	-6.706
108	217.6	18.369	17.610	17.435	16.212	13.688		18.482	-2.040	27.53	5.74	1.39E-07	-6.858
110	230.1	18.221	17.422	17.371	16.011	13.655		18.337	-2.161	27.25	5.87	9.83E-08	-7.007
115	270.4	17.872	16.978	17.187	15.544	13.572		17.999	-2.429	26.58	6.72	4.40E-08	-7.356
120	315.3	17.569	16.620	16.999	15.140	13.497		17.710	-2.651	26.03	7.92	2.22E-08	-7.654
125	361.7	17.305	16.322	16.825	14.788	13.430		17.463	-2.839	25.56	9.11	1.23E-08	-7.910
130	408.2	17.073	16.064	16.670	14.480	13.372		17.248	-3.001	25.11	10.50	7.38E-09	-8.132
135	451.0	16.869	15.838	16.535	14.208	13.322		17.062	-3.144	24.69	12.04	4.73E-09	-8.325
140	488.1	16.689	15.636	16.418	13.965	13.280		16.900	-3.272	24.28	13.63	3.20E-09	-8.495
145	518.9	16.526	15.454	16.313	13.745	13.244		16.756	-3.389	23.88	15.17	2.26E-09	-8.645
150	544.2	16.376	15.286	16.219	13.540	13.213	12.183	16.627	-3.498	23.50	16.60	1.65E-09	-8.782
155	564.8	16.237	15.129	16.132	13.348	13.185	12.127	16.508	-3.600	23.11	17.90	1.24E-09	-8.908
160	581.8	16.105	14.980	16.051	13.165	13.160	12.079	16.397	-3.698	22.74	19.08	9.43E-10	-9.026
170	607.7	15.857	14.700	15.902	12.820	13.116	12.002	16.196	-3.881	22.02	21.13	5.74E-10	-9.241
180	626.3	15.624	14.435	15.763	12.493	13.076	11.945	16.012	-4.051	21.33	22.90	3.64E-10	-9.439
190	640.2	15.400	14.181	15.631	12.179	13.040	11.901	15.842	-4.211	20.67	24.49	2.39E-10	-9.622
200	650.8	15.184	13.935	15.505	11.873	13.006	11.857	15.683	-4.363	20.07	25.97	1.61E-10	-9.794
210	659.1	14.973	13.695	15.382	11.574	12.973	11.828	15.533	-4.508	19.51	27.35	1.10E-10	-9.957
220	665.7	14.766	13.459	15.262	11.281	12.941	11.805	15.389	-4.648	19.00	28.68	7.73E-11	-10.112
230	671.0	14.562	13.227	15.144	10.992	12.911	11.785	15.251	-4.782	18.55	29.94	5.49E-11	-10.260
240	675.3	14.361	12.998	15.028	10.707	12.880	11.769	15.119	-4.912	18.15	31.15	3.96E-11	-10.402
250	678.9	14.162	12.771	14.913	10.424	12.851	11.754	14.990	-5.038	17.79	32.28	2.89E-11	-10.539
260	681.8	13.966	12.546	14.800	10.144	12.822	11.741	14.866	-5.160	17.47	33.34	2.13E-11	-10.672
270	684.3	13.770	12.324	14.688	9.867	12.793	11.730	14.745	-5.280	17.19	34.33	1.58E-11	-10.800
280	686.3	13.577	12.103	14.577	9.591	12.765	11.719	14.626	-5.397	16.94	35.25	1.19E-11	-10.925
290	688.1	13.384	11.883	14.467	9.317	12.737	11.709	14.510	-5.512	16.71	36.08	8.98E-12	-11.047
300	689.5	13.193	11.665	14.357	9.045	12.709	11.700	14.397	-5.625	16.50	36.85	6.83E-12	-11.166
310	690.8	13.003	11.448	14.248	8.774	12.682	11.692	14.285	-5.736	16.31	37.55	5.22E-12	-11.282
320	691.8	12.814	11.232	14.140	8.505	12.654	11.683	14.175	-5.845	16.13	38.20	4.01E-12	-11.397
330	692.8	12.626	11.017	14.032	8.237	12.627	11.675	14.067	-5.952	15.95	38.78	3.09E-12	-11.510
340	693.5	12.439	10.803	13.925	7.970	12.600	11.668	13.961	-6.058	15.77	39.33	2.39E-12	-11.621
350	694.2	12.252	10.590	13.818	7.704	12.573	11.660	13.856	-6.162	15.59	39.83	1.86E-12	-11.731
360	694.8	12.066	10.378	13.712	7.440	12.547	11.653	13.753	-6.265	15.39	40.32	1.45E-12	-11.839
370	695.3	11.882	10.167	13.606	7.176	12.520	11.646	13.652	-6.365	15.18	40.78	1.13E-12	-11.946
380	695.8	11.697	9.957	13.501	6.913	12.494	11.639	13.553	-6.464	14.94	41.23	8.87E-13	-12.052
390	696.2	11.514	9.747	13.396	6.652	12.467	11.632	13.456	-6.561	14.68	41.68	6.97E-13	-12.157
400	696.5	11.331	9.538	13.291	6.391	12.441	11.625	13.361	-6.656	14.40	42.14	5.49E-13	-12.261

Table 10. (Cont.)

EXOSPHERIC TEMPERATURE = 700 K

HEIGHT KM	TEMP K	LOG(N(N2) /M3)	LOG(N(O2) /M3)	LOG(N(O) /M3)	LOG(N(A) /M3)	LOG(N(HE) /M3)	LOG(N(H) /M3)	LOG(N /M3)	LOG (PRESSURE NT/M2)	MEAN MOL WT	DENSITY SCALE HT KM	DENSITY KG/M3	LOG(DEN KG/M3)
420	697.1	10.967	9.123	13.083		12.389	11.611	13.178	-6.839	13.72	43.12	3.43E-13	-12.464
440	697.6	10.606	8.710	12.877		12.337	11.598	13.006	-7.010	12.89	44.25	2.17E-13	-12.663
460	698.0	10.247	8.300	12.672		12.286	11.584	12.847	-7.169	11.92	45.64	1.39E-13	-12.857
480	698.3	9.890	7.893	12.468		12.235	11.571	12.702	-7.314	10.82	47.41	9.05E-14	-13.044
500	698.5	9.536	7.488	12.266		12.184	11.559	12.572	-7.443	9.65	49.73	5.99E-14	-13.223
520	698.7	9.184	7.085	12.064		12.134	11.546	12.458	-7.557	8.49	52.78	4.05E-14	-13.392
540	698.9	8.834	6.686	11.864		12.084	11.533	12.359	-7.656	7.40	56.81	2.81E-14	-13.551
560	699.0	8.486	6.288	11.666		12.034	11.520	12.273	-7.742	6.44	62.08	2.01E-14	-13.698
580	699.1	8.140		11.468		11.984	11.508	12.199	-7.817	5.63	68.85	1.48E-14	-13.831
600	699.2	7.796		11.272		11.935	11.496	12.134	-7.881	4.96	77.31	1.12E-14	-13.950
620	699.3	7.454		11.077		11.886	11.483	12.077	-7.939	4.44	87.54	8.80E-15	-14.056
640	699.4	7.115		10.883		11.838	11.471	12.025	-7.990	4.03	99.43	7.10E-15	-14.149
660	699.5	6.777		10.690		11.790	11.459	11.979	-8.036	3.72	112.63	5.87E-15	-14.231
680	699.5	6.441		10.498		11.742	11.447	11.936	-8.079	3.47	126.58	4.97E-15	-14.304
700	699.6	6.107		10.307		11.694	11.435	11.896	-8.120	3.28	140.64	4.28E-15	-14.369
720	699.6			10.118		11.646	11.423	11.858	-8.157	3.12	154.18	3.73E-15	-14.428
740	699.6			9.929		11.599	11.411	11.822	-8.193	2.99	166.75	3.30E-15	-14.482
760	699.7			9.742		11.552	11.399	11.787	-8.228	2.89	178.10	2.94E-15	-14.532
780	699.7			9.555		11.506	11.387	11.754	-8.261	2.79	188.15	2.63E-15	-14.580
800	699.7			9.370		11.459	11.375	11.722	-8.293	2.71	197.05	2.37E-15	-14.625
820	699.7			9.186		11.413	11.364	11.692	-8.323	2.63	204.86	2.15E-15	-14.668
840	699.8			9.002		11.367	11.352	11.662	-8.353	2.56	211.85	1.95E-15	-14.710
860	699.8			8.820		11.322	11.341	11.633	-8.382	2.49	218.23	1.78E-15	-14.750
880	699.8			8.639		11.276	11.329	11.605	-8.410	2.43	224.17	1.62E-15	-14.789
900	699.8			8.459		11.231	11.318	11.578	-8.437	2.37	229.83	1.49E-15	-14.828
920	699.8			8.279		11.186	11.307	11.552	-8.463	2.31	235.34	1.36E-15	-14.865
940	699.8			8.101		11.142	11.295	11.527	-8.488	2.25	240.79	1.26E-15	-14.901
960	699.9			7.924		11.097	11.284	11.502	-8.513	2.19	246.27	1.16E-15	-14.937
980	699.9			7.747		11.053	11.273	11.478	-8.537	2.14	251.83	1.07E-15	-14.972
1000	699.9			7.572		11.010	11.262	11.455	-8.560	2.08	257.54	9.86E-16	-15.006
1050	699.9			7.138		10.901	11.235	11.400	-8.615	1.96	272.63	8.17E-16	-15.088
1100	699.9			6.710		10.794	11.208	11.349	-8.666	1.84	289.31	6.83E-16	-15.165
1150	699.9			6.287		10.688	11.181	11.302	-8.713	1.74	307.85	5.78E-16	-15.238
1200	699.9					10.584	11.155	11.258	-8.757	1.64	328.34	4.94E-16	-15.306
1250	699.9					10.481	11.129	11.217	-8.798	1.56	351.00	4.26E-16	-15.370
1300	699.9					10.379	11.103	11.178	-8.837	1.48	375.80	3.71E-16	-15.430
1350	700.0					10.279	11.078	11.142	-8.873	1.42	402.68	3.27E-16	-15.486
1400	700.0					10.180	11.053	11.108	-8.907	1.36	431.51	2.90E-16	-15.538
1450	700.0					10.082	11.028	11.075	-8.940	1.31	462.21	2.59E-16	-15.587
1500	700.0					9.986	11.004	11.044	-8.971	1.27	494.47	2.33E-16	-15.632
1600	700.0					9.796	10.956	10.985	-9.029	1.20	562.35	1.93E-16	-15.715
1700	700.0					9.612	10.910	10.931	-9.084	1.15	632.73	1.63E-16	-15.787
1800	700.0					9.431	10.865	10.880	-9.135	1.11	702.63	1.40E-16	-15.852
1900	700.0					9.256	10.820	10.832	-9.183	1.09	770.02	1.23E-16	-15.911
2000	700.0					9.084	10.777	10.786	-9.229	1.07	833.23	1.08E-16	-15.966
2100	700.0					8.917	10.735	10.741	-9.273	1.05	891.27	9.64E-17	-16.016
2200	700.0					8.753	10.694	10.699	-9.316	1.04	944.64	8.64E-17	-16.063
2300	700.0					8.593	10.653	10.657	-9.358	1.03	993.40	7.80E-17	-16.108
2400	700.0					8.437	10.614	10.617	-9.398	1.03	1037.88	7.07E-17	-16.151
2500	700.0					8.285	10.576	10.578	-9.437	1.02	1079.18	6.43E-17	-16.192

Table 10. (Cont.)

EXOSPHERIC TEMPERATURE = 800 K

HEIGHT KM	TEMP K	LOG(N(N2) /M3)	LOG(N(O2) /M3)	LOG(N(O) /M3)	LOG(N(A) /M3)	LOG(N(HE) /M3)	LOG(N(H) /M3)	LOG(N /M3)	LOG (PRESSURE N1/M2)	MEAN MOL WT	DENSITY SCALE HT KM	DENSITY KG/M3	LOG(DEN KG/M3)
90	188.0	19.746	19.170	17.390	17.824	14.573		19.854	-.732	28.91	5.63	3.43E-06	-5.465
92	188.1	19.592	19.009	17.547	17.669	14.418		19.700	-.886	28.85	5.59	2.40E-06	-5.620
94	188.4	19.437	18.843	17.646	17.515	14.264		19.545	-1.040	28.76	5.55	1.68E-06	-5.776
96	189.2	19.282	18.673	17.686	17.359	14.108		19.390	-1.193	28.65	5.54	1.17E-06	-5.933
98	190.6	19.127	18.499	17.688	17.204	13.953		19.235	-1.344	28.52	5.55	8.14E-07	-6.089
100	192.9	18.972	18.324	17.666	17.050	13.799		19.082	-1.493	28.36	5.64	5.68E-07	-6.246
102	196.6	18.821	18.150	17.602	16.838	13.773		18.930	-1.637	28.21	5.64	3.98E-07	-6.400
104	202.1	18.670	17.974	17.546	16.627	13.746		18.779	-1.776	28.02	5.65	2.79E-07	-6.554
106	210.0	18.518	17.793	17.491	16.418	13.716		18.629	-1.909	27.79	5.67	1.96E-07	-6.707
108	220.7	18.367	17.609	17.432	16.212	13.685		18.480	-2.036	27.54	5.73	1.38E-07	-6.860
110	234.5	18.219	17.421	17.367	16.012	13.651		18.335	-2.155	27.26	5.88	9.79E-08	-7.009
115	279.0	17.872	16.980	17.182	15.549	13.565		17.998	-2.416	26.60	6.78	4.40E-08	-7.357
120	328.7	17.573	16.627	16.994	15.153	13.489		17.713	-2.631	26.08	8.05	2.23E-08	-7.651
125	380.0	17.314	16.336	16.821	14.811	13.422		17.470	-2.811	25.63	9.32	1.25E-08	-7.902
130	431.5	17.089	16.086	16.669	14.513	13.363		17.260	-2.965	25.21	10.78	7.62E-09	-8.118
135	479.9	16.892	15.867	16.537	14.252	13.313		17.079	-3.100	24.82	12.39	4.94E-09	-8.306
140	522.9	16.717	15.673	16.421	14.019	13.270		16.921	-3.220	24.45	14.06	3.38E-09	-8.471
145	559.9	16.561	15.499	16.319	13.809	13.234		16.782	-3.330	24.08	15.72	2.42E-09	-8.616
150	591.1	16.418	15.339	16.228	13.615	13.202	12.017	16.656	-3.432	23.73	17.31	1.79E-09	-8.748
155	617.2	16.286	15.191	16.144	13.435	13.174	11.959	16.543	-3.527	23.39	18.79	1.35E-09	-8.868
160	639.1	16.162	15.052	16.067	13.265	13.149	11.910	16.437	-3.617	23.05	20.14	1.05E-09	-8.980
170	673.3	15.932	14.792	15.926	12.946	13.106	11.830	16.246	-3.785	22.40	22.53	6.56E-10	-9.183
180	698.3	15.719	14.550	15.797	12.648	13.067	11.769	16.074	-3.942	21.77	24.59	4.29E-10	-9.368
190	717.1	15.516	14.320	15.676	12.364	13.033	11.722	15.916	-4.088	21.17	26.41	2.90E-10	-9.538
200	731.7	15.320	14.098	15.561	12.089	13.001	11.674	15.768	-4.227	20.61	28.08	2.01E-10	-9.697
210	743.1	15.131	13.883	15.450	11.822	12.971	11.642	15.629	-4.360	20.08	29.61	1.42E-10	-9.848
220	752.3	14.946	13.673	15.342	11.561	12.942	11.616	15.497	-4.487	19.59	31.07	1.02E-10	-9.991
230	759.6	14.765	13.466	15.237	11.304	12.914	11.595	15.370	-4.609	19.14	32.47	7.45E-11	-10.128
240	765.7	14.587	13.263	15.133	11.051	12.887	11.577	15.249	-4.727	18.73	33.80	5.51E-11	-10.259
250	770.6	14.411	13.062	15.032	10.801	12.860	11.561	15.131	-4.842	18.36	35.06	4.12E-11	-10.385
260	774.7	14.237	12.864	14.931	10.554	12.834	11.547	15.017	-4.953	18.02	36.27	3.11E-11	-10.507
270	778.1	14.065	12.667	14.832	10.310	12.809	11.535	14.907	-5.062	17.72	37.41	2.37E-11	-10.624
280	781.0	13.894	12.473	14.734	10.067	12.784	11.524	14.799	-5.168	17.45	38.49	1.82E-11	-10.739
290	783.4	13.724	12.279	14.637	9.826	12.759	11.514	14.694	-5.272	17.20	39.50	1.41E-11	-10.850
300	785.4	13.556	12.087	14.540	9.586	12.734	11.505	14.591	-5.374	16.98	40.44	1.10E-11	-10.959
310	787.1	13.389	11.897	14.444	9.349	12.710	11.496	14.490	-5.474	16.78	41.31	8.61E-12	-11.065
320	788.6	13.223	11.707	14.349	9.112	12.686	11.488	14.391	-5.573	16.59	42.12	6.77E-12	-11.169
330	789.9	13.058	11.518	14.254	8.877	12.662	11.480	14.293	-5.669	16.42	42.87	5.35E-12	-11.271
340	791.0	12.893	11.331	14.160	8.642	12.638	11.473	14.197	-5.765	16.26	43.57	4.25E-12	-11.372
350	791.9	12.730	11.144	14.067	8.409	12.614	11.466	14.102	-5.859	16.10	44.21	3.38E-12	-11.471
360	792.8	12.567	10.958	13.973	8.177	12.591	11.459	14.009	-5.952	15.95	44.81	2.70E-12	-11.568
370	793.5	12.405	10.772	13.881	7.946	12.567	11.452	13.917	-6.044	15.79	45.37	2.16E-12	-11.665
380	794.1	12.243	10.588	13.788	7.716	12.544	11.446	13.826	-6.134	15.63	45.91	1.74E-12	-11.760
390	794.7	12.082	10.404	13.696	7.486	12.521	11.439	13.736	-6.223	15.47	46.41	1.40E-12	-11.854
400	795.2	11.922	10.221	13.604	7.258	12.498	11.433	13.648	-6.311	15.29	46.90	1.13E-12	-11.947

Table 10. (Cont.)

EXOSPHERIC TEMPERATURE = 800 K

HEIGHT KM	TEMP K	LOG(N(N2) /M3)	LOG(N(O2) /M3)	LOG(N(O) /M3)	LOG(N(A) /M3)	LOG(N(HE) /M3)	LOG(N(H) /M3)	LOG(N /M3)	LOG (PRESSURE NT/M2)	MEAN MOL WT	DENSITY SCALE HT KM	DENSITY KG/M3	LOG(DEN KG/M3)
420	796.0	11.603	9.857	13.422	6.804	12.452	11.421	13.476	-6.483	14.90	47.84	7.41E-13	-12.130
440	796.6	11.287	9.496	13.241	6.352	12.407	11.409	13.310	-6.648	14.43	48.80	4.90E-13	-12.310
460	797.1	10.972	9.137	13.062		12.362	11.397	13.151	-6.807	13.87	49.81	3.26E-13	-12.486
480	797.6	10.660	8.780	12.883		12.317	11.385	13.000	-6.958	13.20	50.94	2.19E-13	-12.659
500	797.9	10.350	8.425	12.706		12.273	11.374	12.858	-7.100	12.43	52.28	1.49E-13	-12.827
520	798.2	10.041	8.073	12.530		12.229	11.363	12.726	-7.232	11.56	53.90	1.02E-13	-12.991
540	798.4	9.735	7.723	12.355		12.185	11.352	12.605	-7.353	10.62	55.91	7.09E-14	-13.149
560	798.6	9.430	7.375	12.181		12.141	11.341	12.494	-7.463	9.64	58.43	5.00E-14	-13.301
580	798.8	9.128	7.030	12.008		12.098	11.330	12.395	-7.562	8.67	61.62	3.58E-14	-13.446
600	798.9	8.827	6.686	11.836		12.055	11.319	12.307	-7.650	7.75	65.65	2.61E-14	-13.583
620	799.0	8.528	6.344	11.665		12.012	11.308	12.229	-7.728	6.92	70.70	1.95E-14	-13.711
640	799.1	8.230	6.005	11.495		11.970	11.297	12.159	-7.798	6.19	76.95	1.48E-14	-13.828
660	799.2	7.935		11.326		11.927	11.286	12.097	-7.860	5.57	84.56	1.16E-14	-13.936
680	799.3	7.641		11.158		11.885	11.276	12.042	-7.916	5.06	93.60	9.25E-15	-14.034
700	799.4	7.349		10.991		11.844	11.265	11.991	-7.966	4.64	104.07	7.55E-15	-14.122
720	799.4	7.058		10.826		11.802	11.255	11.945	-8.012	4.30	115.81	6.29E-15	-14.201
740	799.5	6.769		10.661		11.761	11.244	11.902	-8.055	4.03	128.55	5.34E-15	-14.272
760	799.5	6.482		10.497		11.720	11.234	11.862	-8.095	3.81	141.87	4.61E-15	-14.337
780	799.6	6.196		10.333		11.679	11.224	11.824	-8.133	3.64	155.31	4.03E-15	-14.395
800	799.6			10.171		11.638	11.213	11.788	-8.170	3.49	168.45	3.56E-15	-14.449
820	799.6			10.010		11.598	11.203	11.753	-8.204	3.37	180.83	3.17E-15	-14.499
840	799.7			9.850		11.558	11.193	11.720	-8.237	3.27	192.25	2.85E-15	-14.545
860	799.7			9.690		11.518	11.183	11.687	-8.270	3.19	202.60	2.58E-15	-14.589
880	799.7			9.531		11.478	11.173	11.656	-8.301	3.11	211.86	2.34E-15	-14.631
900	799.7			9.374		11.439	11.163	11.626	-8.331	3.04	220.09	2.13E-15	-14.671
920	799.8			9.217		11.400	11.153	11.596	-8.361	2.97	227.41	1.95E-15	-14.710
940	799.8			9.061		11.360	11.143	11.568	-8.389	2.91	233.97	1.79E-15	-14.748
960	799.8			8.906		11.322	11.134	11.540	-8.417	2.86	239.91	1.64E-15	-14.784
980	799.8			8.751		11.283	11.124	11.512	-8.444	2.80	245.36	1.51E-15	-14.820
1000	799.8			8.598		11.245	11.114	11.486	-8.471	2.75	250.44	1.40E-15	-14.855
1050	799.8			8.218		11.150	11.090	11.422	-8.535	2.62	262.16	1.15E-15	-14.940
1100	799.9			7.843		11.056	11.067	11.362	-8.595	2.49	273.41	9.53E-16	-15.021
1150	799.9			7.473		10.963	11.043	11.306	-8.651	2.37	284.91	7.96E-16	-15.099
1200	799.9			7.109		10.872	11.020	11.253	-8.703	2.25	297.06	6.71E-16	-15.173
1250	799.9			6.748		10.782	10.998	11.204	-8.753	2.14	310.28	5.69E-16	-15.245
1300	799.9			6.393		10.693	10.975	11.158	-8.799	2.04	324.72	4.86E-16	-15.313
1350	799.9			6.042		10.605	10.953	11.114	-8.843	1.94	340.52	4.18E-16	-15.379
1400	799.9					10.519	10.931	11.073	-8.884	1.84	357.80	3.62E-16	-15.441
1450	799.9					10.433	10.910	11.035	-8.922	1.76	376.75	3.16E-16	-15.500
1500	800.0					10.349	10.888	10.999	-8.958	1.68	397.39	2.78E-16	-15.556
1600	800.0					10.183	10.847	10.932	-9.025	1.54	443.86	2.19E-16	-15.660
1700	800.0					10.021	10.806	10.872	-9.085	1.43	497.51	1.77E-16	-15.752
1800	800.0					9.864	10.766	10.818	-9.139	1.34	557.67	1.46E-16	-15.835
1900	800.0					9.710	10.728	10.767	-9.189	1.27	623.66	1.23E-16	-15.908
2000	800.0					9.560	10.690	10.721	-9.236	1.21	693.94	1.06E-16	-15.974
2100	800.0					9.413	10.653	10.677	-9.280	1.17	766.66	9.25E-17	-16.034
2200	800.0					9.270	10.617	10.636	-9.321	1.14	840.47	8.16E-17	-16.088
2300	800.0					9.131	10.582	10.597	-9.360	1.11	913.58	7.28E-17	-16.138
2400	800.0					8.994	10.547	10.559	-9.398	1.09	984.49	6.56E-17	-16.183
2500	800.0					8.860	10.514	10.523	-9.434	1.07	1052.72	5.94E-17	-16.226

Table 10. (Cont.)

EXOSPHERIC TEMPERATURE = 900 K

HEIGHT KM	TEMP K	LOG(N(N2) /M3)	LOG(N(O2) /M3)	LOG(N(O) /M3)	LOG(N(A) /M3)	LOG(N(HE) /M3)	LOG(N(H) /M3)	LOG(N /M3)	LOG (PRESSURE NT/M2)	MEAN MOL WT	DENSITY SCALE HT KM	DENSITY KG/M3	LOG(DEN KG/M3)
90	188.0	19.746	19.170	17.390	17.824	14.573		19.854	-.732	28.91	5.63	3.43E-06	-5.465
92	188.1	19.592	19.009	17.547	17.669	14.418		19.700	-.886	28.85	5.59	2.40E-06	-5.620
94	188.5	19.437	18.843	17.646	17.515	14.263		19.545	-1.040	28.76	5.55	1.68E-06	-5.776
96	189.3	19.281	18.673	17.686	17.359	14.108		19.390	-1.193	28.65	5.53	1.17E-06	-5.933
98	190.8	19.126	18.499	17.688	17.204	13.953		19.235	-1.344	28.52	5.54	8.13E-07	-6.090
100	193.3	18.972	18.324	17.666	17.049	13.798		19.081	-1.493	28.36	5.63	5.67E-07	-6.246
102	197.3	18.820	18.150	17.601	16.837	13.773		18.929	-1.636	28.21	5.63	3.98E-07	-6.400
104	203.2	18.668	17.973	17.544	16.626	13.745		18.778	-1.774	28.02	5.64	2.79E-07	-6.555
106	211.8	18.517	17.792	17.488	16.417	13.714		18.627	-1.907	27.80	5.66	1.96E-07	-6.708
108	223.4	18.366	17.608	17.429	16.212	13.682		18.479	-2.032	27.54	5.72	1.38E-07	-6.861
110	238.3	18.217	17.420	17.363	16.012	13.647		18.333	-2.150	27.27	5.88	9.75E-08	-7.011
115	286.6	17.872	16.981	17.177	15.553	13.560		17.997	-2.406	26.62	6.82	4.39E-08	-7.357
120	340.3	17.576	16.632	16.989	15.163	13.482		17.714	-2.614	26.11	8.16	2.25E-08	-7.648
125	395.9	17.322	16.347	16.818	14.829	13.414		17.475	-2.787	25.69	9.50	1.27E-08	-7.895
130	451.8	17.101	16.103	16.668	14.540	13.355		17.269	-2.936	25.29	11.02	7.81E-09	-8.107
135	504.9	16.909	15.890	16.538	14.286	13.305		17.092	-3.065	24.93	12.67	5.12E-09	-8.291
140	553.2	16.740	15.702	16.424	14.061	13.262		16.938	-3.179	24.57	14.41	3.53E-09	-8.452
145	595.8	16.588	15.533	16.323	13.859	13.225		16.801	-3.284	24.24	16.15	2.55E-09	-8.594
150	632.7	16.450	15.380	16.234	13.673	13.193	11.877	16.679	-3.379	23.91	17.86	1.90E-09	-8.722
155	664.2	16.324	15.238	16.152	13.502	13.164	11.818	16.569	-3.469	23.60	19.48	1.45E-09	-8.838
160	691.1	16.206	15.106	16.077	13.341	13.139	11.768	16.467	-3.553	23.29	20.99	1.13E-09	-8.945
170	734.0	15.989	14.861	15.942	13.042	13.096	11.686	16.284	-3.710	22.69	23.71	7.25E-10	-9.140
180	766.1	15.789	14.636	15.820	12.766	13.058	11.623	16.121	-3.855	22.12	26.06	4.85E-10	-9.314
190	790.5	15.601	14.424	15.707	12.504	13.025	11.573	15.972	-3.990	21.57	28.14	3.35E-10	-9.474
200	809.5	15.422	14.221	15.600	12.253	12.995	11.522	15.833	-4.119	21.04	30.02	2.38E-10	-9.624
210	824.6	15.249	14.024	15.498	12.010	12.966	11.488	15.703	-4.241	20.55	31.73	1.72E-10	-9.764
220	836.6	15.081	13.833	15.400	11.773	12.939	11.460	15.579	-4.358	20.08	33.35	1.27E-10	-9.898
230	846.4	14.917	13.647	15.304	11.541	12.913	11.437	15.461	-4.471	19.65	34.87	9.44E-11	-10.025
240	854.4	14.756	13.463	15.210	11.313	12.888	11.417	15.348	-4.580	19.24	36.32	7.13E-11	-10.147
250	860.9	14.598	13.283	15.118	11.089	12.864	11.400	15.240	-4.685	18.87	37.71	5.44E-11	-10.264
260	866.4	14.442	13.105	15.028	10.867	12.840	11.385	15.134	-4.788	18.52	39.04	4.19E-11	-10.378
270	870.9	14.287	12.929	14.939	10.648	12.817	11.372	15.032	-4.888	18.21	40.30	3.26E-11	-10.487
280	874.7	14.134	12.754	14.850	10.430	12.794	11.360	14.933	-4.985	17.92	41.51	2.55E-11	-10.593
290	877.9	13.983	12.581	14.763	10.215	12.772	11.350	14.836	-5.080	17.66	42.65	2.01E-11	-10.697
300	880.6	13.832	12.410	14.677	10.001	12.750	11.340	14.742	-5.174	17.43	43.73	1.60E-11	-10.797
310	882.9	13.683	12.239	14.591	9.789	12.728	11.331	14.649	-5.265	17.21	44.76	1.27E-11	-10.895
320	884.9	13.535	12.070	14.506	9.578	12.706	11.323	14.558	-5.355	17.01	45.72	1.02E-11	-10.991
330	886.6	13.387	11.902	14.421	9.368	12.685	11.315	14.468	-5.444	16.83	46.62	8.22E-12	-11.085
340	888.0	13.241	11.734	14.337	9.159	12.664	11.308	14.380	-5.531	16.66	47.47	6.64E-12	-11.178
350	889.3	13.095	11.568	14.254	8.951	12.642	11.301	14.294	-5.617	16.51	48.26	5.39E-12	-11.268
360	890.4	12.949	11.402	14.170	8.744	12.621	11.295	14.208	-5.702	16.36	49.00	4.39E-12	-11.358
370	891.3	12.805	11.237	14.088	8.538	12.601	11.288	14.124	-5.786	16.22	49.69	3.58E-12	-11.446
380	892.2	12.661	11.073	14.005	8.333	12.580	11.282	14.041	-5.868	16.08	50.34	2.93E-12	-11.532
390	892.9	12.518	10.909	13.923	8.129	12.559	11.276	13.959	-5.950	15.94	50.95	2.41E-12	-11.618
400	893.6	12.375	10.746	13.842	7.926	12.539	11.270	13.878	-6.031	15.80	51.53	1.98E-12	-11.703

Table 10. (Cont.)

EXOSPHERIC TEMPERATURE = 900 K

HEIGHT KM	TEMP K	LOG(N(N2) /M3)	LOG(N(O2) /M3)	LOG(N(O) /M3)	LOG(N(A) /M3)	LOG(N(HE) /M3)	LOG(N(H) /M3)	LOG(N /M3)	LOG (PRESSURE NT/M2)	MEAN MOL WT	DENSITY SCALE HT KM	DENSITY KG/M3	LOG(DEN KG/M3)
420	894.7	12.091	10.422	13.679	7.521	12.498	11.259	13.719	-6.189	15.52	52.61	1.35E-12	-11.870
440	895.5	11.810	10.100	13.518	7.120	12.457	11.248	13.565	-6.343	15.21	53.63	9.26E-13	-12.033
460	896.2	11.530	9.781	13.358	6.721	12.417	11.237	13.414	-6.493	14.85	54.61	6.40E-13	-12.194
480	896.8	11.252	9.463	13.200	6.325	12.377	11.227	13.269	-6.638	14.44	55.60	4.45E-13	-12.351
500	897.2	10.976	9.148	13.042		12.338	11.216	13.129	-6.778	13.96	56.65	3.12E-13	-12.506
520	897.6	10.702	8.835	12.885		12.299	11.206	12.995	-6.912	13.40	57.81	2.20E-13	-12.658
540	897.9	10.429	8.524	12.730		12.260	11.196	12.867	-7.039	12.76	59.12	1.56E-13	-12.807
560	898.2	10.158	8.214	12.575		12.221	11.186	12.747	-7.159	12.05	60.65	1.12E-13	-12.952
580	898.4	9.889	7.907	12.421		12.182	11.177	12.635	-7.271	11.27	62.49	8.08E-14	-13.093
600	898.6	9.622	7.601	12.268		12.144	11.167	12.531	-7.375	10.45	64.71	5.90E-14	-13.229
620	898.7	9.356	7.297	12.116		12.106	11.157	12.436	-7.470	9.61	67.41	4.35E-14	-13.361
640	898.9	9.091	6.995	11.965		12.068	11.148	12.349	-7.557	8.78	70.72	3.26E-14	-13.487
660	899.0	8.828	6.695	11.815		12.031	11.138	12.271	-7.636	7.99	74.75	2.47E-14	-13.606
680	899.1	8.567	6.397	11.666		11.993	11.129	12.199	-7.707	7.26	79.66	1.91E-14	-13.719
700	899.2	8.307	6.100	11.517		11.956	11.119	12.135	-7.771	6.61	85.57	1.50E-14	-13.824
720	899.3	8.049		11.370		11.919	11.110	12.077	-7.829	6.04	92.60	1.20E-14	-13.922
740	899.3	7.792		11.223		11.883	11.101	12.024	-7.882	5.55	100.82	9.73E-15	-14.012
760	899.4	7.537		11.077		11.846	11.091	11.975	-7.931	5.13	110.28	8.04E-15	-14.094
780	899.4	7.283		10.932		11.810	11.082	11.930	-7.976	4.78	120.91	6.76E-15	-14.170
800	899.5	7.031		10.788		11.774	11.073	11.888	-8.017	4.50	132.60	5.78E-15	-14.238
820	899.5	6.780		10.645		11.738	11.064	11.849	-8.057	4.26	145.06	5.00E-15	-14.301
840	899.6	6.530		10.502		11.702	11.055	11.812	-8.094	4.07	158.02	4.38E-15	-14.358
860	899.6	6.282		10.360		11.667	11.046	11.777	-8.129	3.91	171.13	3.88E-15	-14.411
880	899.6	6.035		10.219		11.631	11.037	11.743	-8.163	3.77	184.07	3.47E-15	-14.460
900	899.7			10.079		11.596	11.028	11.711	-8.195	3.66	196.52	3.12E-15	-14.506
920	899.7			9.940		11.561	11.020	11.679	-8.227	3.57	208.26	2.83E-15	-14.549
940	899.7			9.801		11.527	11.011	11.648	-8.257	3.48	219.11	2.57E-15	-14.589
960	899.7			9.663		11.492	11.002	11.619	-8.287	3.41	229.02	2.35E-15	-14.628
980	899.7			9.526		11.458	10.993	11.590	-8.316	3.35	237.98	2.16E-15	-14.665
1000	899.8			9.390		11.424	10.985	11.562	-8.344	3.29	246.04	1.99E-15	-14.701
1050	899.8			9.052		11.339	10.964	11.493	-8.412	3.16	262.79	1.64E-15	-14.786
1100	899.8			8.719		11.256	10.943	11.429	-8.477	3.05	276.06	1.36E-15	-14.867
1150	899.8			8.390		11.174	10.922	11.367	-8.539	2.94	287.26	1.14E-15	-14.944
1200	899.9			8.066		11.092	10.901	11.309	-8.597	2.84	297.39	9.59E-16	-15.018
1250	899.9			7.745		11.012	10.881	11.253	-8.653	2.73	307.25	8.13E-16	-15.090
1300	899.9			7.429		10.933	10.861	11.200	-8.706	2.63	317.24	6.92E-16	-15.160
1350	899.9			7.118		10.855	10.842	11.150	-8.756	2.53	327.64	5.93E-16	-15.227
1400	899.9			6.810		10.778	10.822	11.102	-8.804	2.43	338.64	5.10E-16	-15.292
1450	899.9			6.506		10.702	10.803	11.057	-8.849	2.33	350.47	4.41E-16	-15.355
1500	899.9			6.206		10.627	10.784	11.014	-8.892	2.24	363.21	3.84E-16	-15.416
1600	899.9					10.480	10.747	10.935	-8.971	2.06	391.70	2.94E-16	-15.531
1700	900.0					10.336	10.711	10.864	-9.042	1.90	425.00	2.30E-16	-15.638
1800	900.0					10.196	10.676	10.800	-9.106	1.75	463.45	1.84E-16	-15.736
1900	900.0					10.060	10.641	10.742	-9.163	1.63	507.74	1.49E-16	-15.825
2000	900.0					9.926	10.608	10.690	-9.216	1.52	557.95	1.24E-16	-15.907
2100	900.0					9.796	10.575	10.642	-9.264	1.44	613.94	1.04E-16	-15.981
2200	900.0					9.669	10.543	10.597	-9.309	1.36	675.68	8.94E-17	-16.049
2300	900.0					9.544	10.511	10.556	-9.350	1.30	742.44	7.76E-17	-16.110
2400	900.0					9.423	10.481	10.517	-9.388	1.25	813.20	6.82E-17	-16.166
2500	900.0					9.304	10.451	10.481	-9.425	1.21	887.43	6.07E-17	-16.217

Table 10. (Cont.)

EXOSPHERIC TEMPERATURE = 1000 K

HEIGHT KM	TEMP K	LOG(N(N2) /M3)	LOG(N(O2) /M3)	LOG(N(O) /M3)	LOG(N(A) /M3)	LOG(N(HE) /M3)	LOG(N(H) /M3)	LOG(N /M3)	LOG (PRESSURE NT/M2)	MEAN MOL WT	DENSITY SCALE HT KM	DENSITY KG/M3	LOG(DEN KG/M3)
90	188.0	19.746	19.170	17.390	17.824	14.573		19.854	-.732	28.91	5.63	3.43E-06	-5.465
92	188.1	19.592	19.009	17.547	17.669	14.418		19.700	-.886	28.85	5.59	2.40E-06	-5.620
94	188.5	19.437	18.843	17.646	17.514	14.263		19.545	-1.040	28.76	5.55	1.67E-06	-5.776
96	189.4	19.281	18.673	17.686	17.359	14.108		19.390	-1.193	28.65	5.53	1.17E-06	-5.933
98	191.0	19.126	18.499	17.687	17.204	13.953		19.235	-1.344	28.52	5.54	8.13E-07	-6.090
100	193.7	18.971	18.323	17.665	17.049	13.798		19.081	-1.492	28.36	5.62	5.67E-07	-6.247
102	197.9	18.820	18.149	17.600	16.837	13.772		18.928	-1.635	28.21	5.62	3.97E-07	-6.401
104	204.3	18.668	17.972	17.543	16.626	13.744		18.777	-1.773	28.02	5.63	2.78E-07	-6.556
106	213.4	18.515	17.792	17.486	16.417	13.713		18.626	-1.905	27.80	5.65	1.95E-07	-6.710
108	225.8	18.364	17.607	17.426	16.212	13.679		18.477	-2.029	27.55	5.72	1.37E-07	-6.862
110	241.7	18.216	17.419	17.360	16.013	13.644		18.332	-2.145	27.28	5.88	9.72E-08	-7.012
115	293.2	17.871	16.982	17.172	15.557	13.555		17.996	-2.397	26.64	6.86	4.39E-08	-7.358
120	350.5	17.578	16.637	16.985	15.172	13.476		17.716	-2.599	26.15	8.26	2.26E-08	-7.646
125	409.8	17.328	16.356	16.816	14.844	13.408		17.480	-2.768	25.73	9.65	1.29E-08	-7.890
130	469.6	17.112	16.117	16.667	14.561	13.349		17.277	-2.911	25.36	11.22	7.97E-09	-8.098
135	526.9	16.924	15.909	16.538	14.314	13.298		17.103	-3.035	25.01	12.91	5.26E-09	-8.279
140	580.0	16.758	15.725	16.425	14.095	13.254		16.951	-3.146	24.68	14.69	3.66E-09	-8.436
145	627.7	16.610	15.561	16.326	13.899	13.217		16.817	-3.245	24.36	16.50	2.66E-09	-8.576
150	669.8	16.476	15.412	16.238	13.720	13.184	11.756	16.698	-3.336	24.06	18.29	1.99E-09	-8.701
155	706.6	16.353	15.276	16.158	13.555	13.156	11.697	16.590	-3.421	23.76	20.02	1.53E-09	-8.814
160	738.5	16.240	15.148	16.085	13.401	13.130	11.646	16.491	-3.501	23.48	21.67	1.21E-09	-8.918
170	790.4	16.032	14.916	15.953	13.118	13.087	11.563	16.314	-3.648	22.93	24.69	7.84E-10	-9.106
180	829.9	15.843	14.703	15.836	12.857	13.050	11.498	16.157	-3.784	22.40	27.34	5.34E-10	-9.273
190	860.4	15.667	14.504	15.729	12.613	13.017	11.446	16.015	-3.911	21.89	29.69	3.76E-10	-9.425
200	884.4	15.501	14.315	15.629	12.381	12.987	11.392	15.883	-4.030	21.40	31.81	2.72E-10	-9.566
210	903.5	15.341	14.134	15.534	12.157	12.960	11.357	15.760	-4.144	20.94	33.71	2.00E-10	-9.699
220	918.8	15.186	13.959	15.442	11.939	12.935	11.327	15.644	-4.253	20.50	35.49	1.50E-10	-9.824
230	931.3	15.036	13.787	15.354	11.727	12.910	11.302	15.533	-4.358	20.08	37.16	1.14E-10	-9.944
240	941.5	14.888	13.620	15.268	11.519	12.887	11.281	15.427	-4.459	19.69	38.74	8.74E-11	-10.058
250	949.9	14.744	13.455	15.183	11.315	12.864	11.262	15.325	-4.557	19.32	40.24	6.79E-11	-10.168
260	956.8	14.601	13.293	15.101	11.113	12.843	11.247	15.227	-4.652	18.98	41.68	5.32E-11	-10.274
270	962.6	14.461	13.133	15.019	10.914	12.821	11.233	15.132	-4.744	18.66	43.06	4.20E-11	-10.377
280	967.5	14.322	12.975	14.939	10.717	12.800	11.220	15.040	-4.835	18.37	44.37	3.34E-11	-10.476
290	971.6	14.185	12.818	14.860	10.522	12.780	11.209	14.949	-4.923	18.10	45.63	2.68E-11	-10.573
300	975.1	14.049	12.663	14.781	10.328	12.760	11.199	14.862	-5.009	17.85	46.83	2.16E-11	-10.667
310	978.0	13.914	12.509	14.704	10.136	12.740	11.190	14.776	-5.094	17.62	47.98	1.75E-11	-10.758
320	980.6	13.779	12.356	14.627	9.945	12.720	11.182	14.691	-5.177	17.41	49.07	1.42E-11	-10.848
330	982.7	13.646	12.204	14.550	9.756	12.701	11.174	14.609	-5.259	17.22	50.10	1.16E-11	-10.935
340	984.6	13.514	12.053	14.474	9.567	12.681	11.166	14.527	-5.339	17.04	51.08	9.53E-12	-11.021
350	986.2	13.382	11.902	14.399	9.380	12.662	11.160	14.447	-5.419	16.87	52.00	7.85E-12	-11.105
360	987.6	13.251	11.753	14.323	9.193	12.643	11.153	14.368	-5.497	16.72	52.88	6.48E-12	-11.188
370	988.9	13.121	11.604	14.249	9.007	12.624	11.147	14.291	-5.574	16.58	53.71	5.37E-12	-11.270
380	990.0	12.991	11.456	14.174	8.822	12.605	11.141	14.214	-5.650	16.44	54.48	4.47E-12	-11.350
390	990.9	12.862	11.308	14.100	8.638	12.587	11.135	14.138	-5.726	16.31	55.22	3.72E-12	-11.429
400	991.7	12.733	11.161	14.027	8.455	12.568	11.129	14.064	-5.800	16.18	55.92	3.11E-12	-11.507

Table 10. (Cont.)

EXOSPHERIC TEMPERATURE = 1000 K

HEIGHT KM	TEMP K	LOG(N(N2) /M3)	LOG(N(O2) /M3)	LOG(N(O) /M3)	LOG(N(A) /M3)	LOG(N(HE) /M3)	LOG(N(H) /M3)	LOG(N /M3)	LOG (PRESSURE NT/M2)	MEAN MOL WT	DENSITY SCALE HT KM	DENSITY KG/M3	LOG(DEN KG/M3)
420	993.1	12.477	10.869	13.880	8.091	12.531	11.118	13.917	-5.946	15.93	57.20	2.18E-12	-11.661
440	994.2	12.223	10.579	13.735	7.729	12.495	11.108	13.773	-6.089	15.68	58.37	1.54E-12	-11.811
460	995.1	11.971	10.291	13.591	7.369	12.459	11.098	13.633	-6.229	15.42	59.46	1.10E-12	-11.959
480	995.8	11.721	10.005	13.448	7.013	12.423	11.089	13.496	-6.365	15.13	60.50	7.88E-13	-12.103
500	996.4	11.472	9.722	13.306	6.658	12.387	11.079	13.363	-6.498	14.81	61.52	5.68E-13	-12.246
520	996.9	11.225	9.439	13.165	6.306	12.352	11.070	13.234	-6.627	14.44	62.56	4.11E-13	-12.386
540	997.3	10.980	9.159	13.025		12.317	11.061	13.110	-6.752	14.02	63.65	3.00E-13	-12.523
560	997.6	10.736	8.881	12.885		12.282	11.052	12.989	-6.872	13.54	64.82	2.19E-13	-12.659
580	997.9	10.494	8.604	12.747		12.247	11.043	12.874	-6.986	13.00	66.13	1.62E-13	-12.791
600	998.2	10.253	8.329	12.609		12.213	11.034	12.765	-7.096	12.40	67.63	1.20E-13	-12.921
620	998.4	10.013	8.055	12.472		12.178	11.025	12.662	-7.199	11.74	69.35	8.95E-14	-13.048
640	998.5	9.775	7.783	12.336		12.144	11.017	12.565	-7.295	11.04	71.38	6.74E-14	-13.172
660	998.7	9.539	7.513	12.201		12.110	11.008	12.475	-7.386	10.32	73.77	5.11E-14	-13.291
680	998.8	9.303	7.244	12.067		12.077	11.000	12.391	-7.469	9.59	76.63	3.92E-14	-13.407
700	998.9	9.070	6.977	11.933		12.043	10.991	12.314	-7.546	8.86	80.02	3.03E-14	-13.518
720	999.0	8.837	6.712	11.800		12.010	10.983	12.244	-7.617	8.17	84.07	2.38E-14	-13.624
740	999.1	8.606	6.448	11.668		11.977	10.974	12.179	-7.682	7.53	88.87	1.89E-14	-13.724
760	999.2	8.376	6.185	11.537		11.944	10.966	12.119	-7.741	6.94	94.52	1.52E-14	-13.819
780	999.3	8.148		11.407		11.911	10.958	12.065	-7.795	6.41	101.12	1.24E-14	-13.908
800	999.3	7.920		11.277		11.879	10.950	12.015	-7.845	5.94	108.75	1.02E-14	-13.991
820	999.4	7.694		11.148		11.847	10.941	11.969	-7.891	5.53	117.43	8.55E-15	-14.068
840	999.4	7.470		11.019		11.815	10.933	11.926	-7.934	5.19	127.16	7.26E-15	-14.139
860	999.5	7.246		10.892		11.783	10.925	11.886	-7.975	4.89	137.89	6.24E-15	-14.205
880	999.5	7.024		10.765		11.751	10.917	11.848	-8.012	4.64	149.50	5.43E-15	-14.265
900	999.6	6.803		10.639		11.719	10.909	11.812	-8.048	4.43	161.80	4.77E-15	-14.321
920	999.6	6.583		10.513		11.688	10.901	11.778	-8.082	4.26	174.56	4.24E-15	-14.373
940	999.6	6.365		10.388		11.657	10.894	11.745	-8.115	4.11	187.53	3.80E-15	-14.421
960	999.6	6.148		10.264		11.626	10.886	11.714	-8.146	3.98	200.42	3.42E-15	-14.466
980	999.7			10.141		11.595	10.878	11.684	-8.176	3.88	213.01	3.11E-15	-14.508
1000	999.7			10.018		11.564	10.870	11.654	-8.206	3.79	225.07	2.84E-15	-14.547
1050	999.7			9.714		11.488	10.851	11.584	-8.276	3.61	252.00	2.30E-15	-14.638
1100	999.8			9.414		11.413	10.832	11.518	-8.342	3.48	273.85	1.90E-15	-14.721
1150	999.8			9.118		11.339	10.813	11.454	-8.406	3.37	291.09	1.59E-15	-14.797
1200	999.8			8.826		11.266	10.795	11.394	-8.466	3.28	304.82	1.35E-15	-14.870
1250	999.9			8.538		11.194	10.777	11.335	-8.525	3.19	316.29	1.15E-15	-14.940
1300	999.9			8.254		11.123	10.759	11.279	-8.581	3.11	326.39	9.82E-16	-15.008
1350	999.9			7.973		11.052	10.741	11.225	-8.635	3.03	335.74	8.45E-16	-15.073
1400	999.9			7.696		10.983	10.724	11.174	-8.686	2.94	344.79	7.29E-16	-15.137
1450	999.9			7.423		10.915	10.706	11.124	-8.736	2.86	353.92	6.32E-16	-15.199
1500	999.9			7.153		10.847	10.689	11.077	-8.783	2.78	363.29	5.50E-16	-15.260
1600	999.9			6.623		10.715	10.656	10.987	-8.873	2.61	383.21	4.20E-16	-15.376
1700	999.9			6.106		10.585	10.623	10.906	-8.954	2.44	405.55	3.26E-16	-15.487
1800	1000.0					10.459	10.592	10.832	-9.028	2.28	430.68	2.57E-16	-15.590
1900	1000.0					10.336	10.561	10.764	-9.096	2.13	459.34	2.05E-16	-15.688
2000	1000.0					10.216	10.530	10.702	-9.158	1.99	491.85	1.66E-16	-15.780
2100	1000.0					10.099	10.501	10.646	-9.214	1.86	528.47	1.37E-16	-15.865
2200	1000.0					9.984	10.472	10.594	-9.266	1.74	569.81	1.14E-16	-15.944
2300	1000.0					9.873	10.444	10.547	-9.313	1.64	615.98	9.61E-17	-16.017
2400	1000.0					9.763	10.416	10.504	-9.356	1.55	667.00	8.22E-17	-16.085
2500	1000.0					9.656	10.390	10.463	-9.397	1.48	723.19	7.12E-17	-16.148

Table 10. (Cont.)

EXOSPHERIC TEMPERATURE = 1100 K

HEIGHT KM	TEMP K	LOG(N(N2) /M3)	LOG(N(O2) /M3)	LOG(N(O) /M3)	LOG(N(A) /M3)	LOG(N(HE) /M3)	LOG(N(H) /M3)	LOG(N /M3)	LOG (PRESSURE NT/M2)	MEAN MOL WT	DENSITY SCALE HT KM	DENSITY KG/M3	LOG(DEN KG/M3)
90	188.0	19.746	19.170	17.390	17.824	14.573		19.854	-.732	28.91	5.63	3.43E-06	-5.465
92	188.1	19.592	19.009	17.547	17.669	14.418		19.700	-.886	28.85	5.58	2.40E-06	-5.620
94	188.5	19.437	18.843	17.646	17.514	14.263		19.545	-1.040	28.76	5.55	1.67E-06	-5.776
96	189.5	19.281	18.672	17.686	17.359	14.108		19.390	-1.193	28.65	5.53	1.17E-06	-5.933
98	191.2	19.126	18.499	17.687	17.204	13.953		19.235	-1.344	28.52	5.53	8.12E-07	-6.090
100	194.0	18.971	18.323	17.665	17.049	13.798		19.080	-1.492	28.36	5.62	5.66E-07	-6.247
102	198.5	18.819	18.149	17.599	16.836	13.771		18.928	-1.634	28.21	5.61	3.97E-07	-6.402
104	205.2	18.667	17.971	17.542	16.625	13.743		18.776	-1.772	28.02	5.62	2.78E-07	-6.556
106	214.8	18.514	17.791	17.485	16.417	13.711		18.625	-1.903	27.80	5.65	1.95E-07	-6.711
108	227.9	18.363	17.606	17.424	16.212	13.677		18.476	-2.026	27.55	5.71	1.37E-07	-6.864
110	244.7	18.215	17.419	17.357	16.013	13.641		18.330	-2.141	27.28	5.88	9.69E-08	-7.014
115	299.1	17.871	16.983	17.169	15.560	13.551		17.996	-2.389	26.65	6.89	4.38E-08	-7.358
120	359.6	17.580	16.640	16.982	15.179	13.471		17.717	-2.587	26.17	8.34	2.27E-08	-7.645
125	422.2	17.333	16.364	16.813	14.857	13.402		17.483	-2.751	25.77	9.78	1.30E-08	-7.885
130	485.4	17.120	16.129	16.666	14.580	13.343		17.284	-2.890	25.42	11.39	8.11E-09	-8.091
135	546.5	16.935	15.925	16.538	14.338	13.292		17.112	-3.011	25.08	13.12	5.39E-09	-8.269
140	603.8	16.773	15.745	16.427	14.124	13.248		16.962	-3.117	24.77	14.93	3.77E-09	-8.424
145	656.1	16.628	15.584	16.328	13.932	13.210		16.830	-3.213	24.47	16.78	2.75E-09	-8.561
150	703.2	16.497	15.439	16.241	13.759	13.177	11.650	16.713	-3.300	24.18	18.64	2.07E-09	-8.684
155	745.0	16.377	15.306	16.162	13.599	13.148	11.591	16.607	-3.381	23.90	20.46	1.60E-09	-8.795
160	781.8	16.267	15.183	16.090	13.450	13.122	11.540	16.510	-3.457	23.64	22.22	1.27E-09	-8.897
170	842.8	16.066	14.959	15.961	13.179	13.078	11.455	16.337	-3.597	23.12	25.50	8.34E-10	-9.079
180	890.0	15.886	14.756	15.848	12.931	13.041	11.389	16.185	-3.725	22.63	28.43	5.76E-10	-9.240
190	927.1	15.719	14.568	15.745	12.701	13.009	11.335	16.049	-3.844	22.16	31.05	4.11E-10	-9.386
200	956.4	15.562	14.391	15.650	12.483	12.980	11.280	15.923	-3.956	21.70	33.43	3.02E-10	-9.520
210	979.9	15.413	14.222	15.560	12.274	12.954	11.243	15.806	-4.063	21.27	35.54	2.26E-10	-9.646
220	998.9	15.269	14.058	15.474	12.073	12.929	11.212	15.695	-4.165	20.85	37.51	1.72E-10	-9.765
230	1014.3	15.129	13.900	15.391	11.876	12.906	11.185	15.591	-4.263	20.45	39.34	1.32E-10	-9.878
240	1027.0	14.993	13.745	15.311	11.685	12.884	11.163	15.491	-4.358	20.08	41.07	1.03E-10	-9.986
250	1037.4	14.860	13.593	15.233	11.496	12.863	11.144	15.395	-4.449	19.72	42.69	8.13E-11	-10.090
260	1046.1	14.729	13.444	15.157	11.311	12.842	11.127	15.302	-4.538	19.39	44.24	6.46E-11	-10.190
270	1053.4	14.600	13.298	15.082	11.129	12.822	11.112	15.213	-4.624	19.07	45.71	5.17E-11	-10.286
280	1059.4	14.473	13.152	15.008	10.948	12.803	11.099	15.126	-4.709	18.78	47.13	4.17E-11	-10.380
290	1064.5	14.347	13.009	14.936	10.770	12.784	11.087	15.042	-4.791	18.51	48.49	3.38E-11	-10.471
300	1068.9	14.222	12.867	14.864	10.593	12.765	11.077	14.959	-4.872	18.25	49.79	2.76E-11	-10.559
310	1072.6	14.099	12.726	14.792	10.417	12.747	11.067	14.879	-4.951	18.01	51.04	2.26E-11	-10.645
320	1075.7	13.976	12.586	14.722	10.243	12.729	11.058	14.800	-5.028	17.79	52.23	1.86E-11	-10.729
330	1078.4	13.854	12.447	14.652	10.070	12.711	11.050	14.723	-5.104	17.59	53.38	1.54E-11	-10.812
340	1080.8	13.734	12.309	14.582	9.898	12.693	11.043	14.647	-5.179	17.40	54.47	1.28E-11	-10.892
350	1082.8	13.613	12.172	14.514	9.727	12.676	11.036	14.572	-5.253	17.23	55.52	1.07E-11	-10.971
360	1084.6	13.494	12.036	14.445	9.557	12.658	11.029	14.499	-5.326	17.06	56.51	8.94E-12	-11.049
370	1086.1	13.375	11.900	14.377	9.388	12.641	11.023	14.427	-5.397	16.91	57.46	7.50E-12	-11.125
380	1087.5	13.257	11.765	14.309	9.219	12.624	11.017	14.355	-5.468	16.77	58.36	6.31E-12	-11.200
390	1088.6	13.139	11.631	14.242	9.051	12.607	11.011	14.285	-5.538	16.63	59.21	5.32E-12	-11.274
400	1089.7	13.022	11.497	14.174	8.884	12.590	11.006	14.216	-5.607	16.51	60.03	4.50E-12	-11.347

Table 10. (Cont.)

EXOSPHERIC TEMPERATURE = 1100 K

HEIGHT KM	TEMP K	LOG(N(N2) /M3)	LOG(N(O2) /M3)	LOG(N(O) /M3)	LOG(N(A) /M3)	LOG(N(HE) /M3)	LOG(N(H) /M3)	LOG(N /M3)	LOG (PRESSURE NT/M2)	MEAN MOL WT	DENSITY SCALE HT KM	DENSITY KG/M3	LOG(DEN KG/M3)
420	1091.4	12.789	11.231	14.041	8.553	12.556	10.995	14.079	-5.743	16.27	61.54	3.24E-12	-11.489
440	1092.8	12.558	10.967	13.909	8.223	12.523	10.985	13.946	-5.876	16.04	62.91	2.35E-12	-11.629
460	1093.9	12.328	10.705	13.778	7.896	12.490	10.976	13.815	-6.006	15.81	64.16	1.72E-12	-11.766
480	1094.8	12.101	10.445	13.648	7.572	12.457	10.967	13.687	-6.133	15.58	65.33	1.26E-12	-11.900
500	1095.5	11.875	10.187	13.518	7.249	12.425	10.958	13.562	-6.258	15.34	66.44	9.30E-13	-12.032
520	1096.1	11.650	9.930	13.390	6.929	12.393	10.950	13.440	-6.380	15.08	67.51	6.90E-13	-12.161
540	1096.6	11.427	9.675	13.262	6.611	12.361	10.941	13.321	-6.499	14.78	68.57	5.14E-13	-12.289
560	1097.0	11.205	9.422	13.136	6.295	12.329	10.933	13.205	-6.614	14.45	69.65	3.85E-13	-12.415
580	1097.4	10.984	9.170	13.010		12.297	10.925	13.093	-6.727	14.07	70.78	2.89E-13	-12.538
600	1097.7	10.765	8.920	12.884		12.266	10.917	12.985	-6.835	13.65	71.99	2.19E-13	-12.660
620	1098.0	10.548	8.671	12.760		12.235	10.909	12.880	-6.939	13.18	73.31	1.66E-13	-12.780
640	1098.2	10.331	8.424	12.636		12.204	10.901	12.780	-7.039	12.66	74.78	1.27E-13	-12.897
660	1098.4	10.116	8.178	12.513		12.173	10.893	12.685	-7.134	12.10	76.44	9.73E-14	-13.012
680	1098.5	9.902	7.934	12.391		12.143	10.885	12.595	-7.224	11.50	78.34	7.51E-14	-13.124
700	1098.7	9.690	7.691	12.270		12.112	10.877	12.510	-7.309	10.87	80.54	5.84E-14	-13.234
720	1098.8	9.478	7.450	12.149		12.082	10.870	12.430	-7.389	10.22	83.09	4.57E-14	-13.340
740	1098.9	9.268	7.210	12.029		12.052	10.862	12.356	-7.463	9.57	86.06	3.61E-14	-13.443
760	1099.0	9.059	6.971	11.910		12.022	10.855	12.287	-7.532	8.94	89.53	2.87E-14	-13.542
780	1099.1	8.851	6.734	11.791		11.992	10.847	12.223	-7.596	8.32	93.57	2.31E-14	-13.637
800	1099.2	8.645	6.498	11.673		11.963	10.840	12.164	-7.655	7.74	98.30	1.87E-14	-13.727
820	1099.2	8.439	6.263	11.556		11.933	10.832	12.109	-7.710	7.20	103.73	1.54E-14	-13.813
840	1099.3	8.235	6.030	11.439		11.904	10.825	12.058	-7.761	6.71	109.98	1.27E-14	-13.895
860	1099.4	8.032		11.323		11.875	10.817	12.011	-7.808	6.27	117.12	1.07E-14	-13.971
880	1099.4	7.830		11.207		11.846	10.810	11.967	-7.851	5.88	125.19	9.06E-15	-14.043
900	1099.4	7.629		11.093		11.818	10.803	11.927	-7.892	5.54	134.20	7.76E-15	-14.110
920	1099.5	7.429		10.979		11.789	10.796	11.888	-7.931	5.24	144.13	6.72E-15	-14.172
940	1099.5	7.230		10.865		11.761	10.789	11.852	-7.967	4.98	154.93	5.88E-15	-14.231
960	1099.6	7.033		10.752		11.732	10.781	11.818	-8.001	4.76	166.50	5.19E-15	-14.285
980	1099.6	6.836		10.640		11.704	10.774	11.785	-8.034	4.57	178.68	4.62E-15	-14.335
1000	1099.6	6.641		10.528		11.676	10.767	11.754	-8.065	4.41	191.31	4.15E-15	-14.382
1050	1099.7	6.157		10.252		11.607	10.750	11.680	-8.138	4.10	223.43	3.26E-15	-14.487
1100	1099.7			9.979		11.539	10.733	11.612	-8.206	3.89	254.00	2.64E-15	-14.578
1150	1099.8			9.710		11.472	10.716	11.548	-8.270	3.74	280.81	2.19E-15	-14.659
1200	1099.8			9.445		11.405	10.699	11.487	-8.331	3.62	303.02	1.85E-15	-14.733
1250	1099.8			9.183		11.340	10.682	11.429	-8.390	3.53	321.08	1.57E-15	-14.803
1300	1099.8			8.925		11.275	10.666	11.372	-8.446	3.46	335.76	1.35E-15	-14.869
1350	1099.9			8.669		11.211	10.650	11.318	-8.501	3.39	348.00	1.17E-15	-14.932
1400	1099.9			8.418		11.148	10.634	11.265	-8.554	3.32	358.55	1.01E-15	-14.994
1450	1099.9			8.169		11.086	10.618	11.214	-8.605	3.25	368.14	8.84E-16	-15.054
1500	1099.9			7.923		11.025	10.603	11.164	-8.654	3.19	377.15	7.73E-16	-15.112
1600	1099.9			7.442		10.904	10.573	11.070	-8.748	3.05	394.48	5.96E-16	-15.225
1700	1099.9			6.972		10.787	10.543	10.983	-8.836	2.92	412.34	4.65E-16	-15.332
1800	1099.9			6.514		10.672	10.514	10.901	-8.917	2.78	431.32	3.67E-16	-15.435
1900	1100.0			6.067		10.560	10.486	10.826	-8.993	2.63	452.15	2.93E-16	-15.534
2000	1100.0					10.451	10.458	10.756	-9.063	2.49	475.12	2.36E-16	-15.627
2100	1100.0					10.344	10.432	10.691	-9.127	2.36	500.43	1.92E-16	-15.716
2200	1100.0					10.240	10.405	10.632	-9.187	2.22	528.62	1.58E-16	-15.801
2300	1100.0					10.139	10.380	10.577	-9.242	2.10	559.88	1.32E-16	-15.881
2400	1100.0					10.039	10.355	10.526	-9.292	1.98	594.32	1.11E-16	-15.956
2500	1100.0					9.942	10.330	10.479	-9.339	1.88	632.59	9.40E-17	-16.027

Table 10. (Cont.)

EXOSPHERIC TEMPERATURE = 1200 K

HEIGHT KM	TEMP K	LOG(N(N2) /M3)	LOG(N(O2) /M3)	LOG(N(O) /M3)	LOG(N(A) /M3)	LOG(N(HE) /M3)	LOG(N(H) /M3)	LOG(N /M3)	LOG (PRESSURE NT/M2)	MEAN MOL WT	DENSITY SCALE HT KM	DENSITY KG/M3	LOG(DEN KG/M3)
90	188.0	19.746	19.170	17.390	17.824	14.573		19.854	-.732	28.91	5.63	3.43E-06	-5.465
92	188.1	19.592	19.009	17.547	17.669	14.418		19.700	-.886	28.85	5.58	2.40E-06	-5.620
94	188.6	19.437	18.843	17.646	17.514	14.263		19.545	-1.040	28.76	5.54	1.67E-06	-5.776
96	189.6	19.281	18.672	17.686	17.359	14.108		19.390	-1.193	28.65	5.52	1.17E-06	-5.933
98	191.3	19.126	18.498	17.687	17.203	13.952		19.234	-1.344	28.52	5.53	8.12E-07	-6.090
100	194.3	18.970	18.323	17.664	17.048	13.797		19.080	-1.492	28.36	5.61	5.66E-07	-6.247
102	199.0	18.819	18.148	17.599	16.836	13.771		18.927	-1.634	28.21	5.60	3.96E-07	-6.402
104	206.0	18.666	17.971	17.541	16.625	13.742		18.775	-1.771	28.02	5.61	2.77E-07	-6.557
106	216.1	18.513	17.790	17.483	16.416	13.710		18.624	-1.901	27.80	5.64	1.94E-07	-6.712
108	229.8	18.362	17.605	17.422	16.212	13.675		18.475	-2.024	27.55	5.71	1.37E-07	-6.865
110	247.4	18.214	17.418	17.354	16.014	13.639		18.329	-2.137	27.29	5.88	9.67E-08	-7.015
115	304.4	17.871	16.984	17.165	15.563	13.547		17.995	-2.382	26.67	6.92	4.38E-08	-7.359
120	367.8	17.582	16.644	16.979	15.186	13.467		17.718	-2.576	26.19	8.41	2.27E-08	-7.643
125	433.4	17.338	16.371	16.811	14.868	13.398		17.486	-2.737	25.81	9.89	1.31E-08	-7.882
130	499.7	17.128	16.139	16.665	14.595	13.338		17.289	-2.872	25.46	11.55	8.23E-09	-8.085
135	564.2	16.946	15.938	16.538	14.358	13.287		17.119	-2.989	25.14	13.30	5.50E-09	-8.260
140	625.2	16.785	15.762	16.428	14.148	13.243		16.972	-3.092	24.84	15.13	3.86E-09	-8.413
145	681.8	16.643	15.604	16.330	13.961	13.204		16.841	-3.185	24.55	17.02	2.83E-09	-8.548
150	733.4	16.514	15.462	16.243	13.791	13.171	11.557	16.725	-3.269	24.28	18.93	2.14E-09	-8.669
155	779.9	16.397	15.332	16.165	13.636	13.142	11.497	16.621	-3.347	24.02	20.81	1.67E-09	-8.778
160	821.5	16.289	15.212	16.093	13.491	13.115	11.445	16.525	-3.420	23.77	22.66	1.32E-09	-8.878
170	891.5	16.095	14.995	15.967	13.229	13.071	11.360	16.356	-3.553	23.28	26.17	8.78E-10	-9.056
180	946.8	15.921	14.800	15.856	12.992	13.033	11.292	16.209	-3.675	22.82	29.37	6.13E-10	-9.213
190	990.7	15.761	14.620	15.757	12.773	13.001	11.238	16.076	-3.788	22.38	32.26	4.43E-10	-9.354
200	1025.8	15.612	14.452	15.665	12.567	12.973	11.181	15.955	-3.894	21.95	34.89	3.29E-10	-9.483
210	1054.0	15.471	14.293	15.580	12.371	12.947	11.142	15.843	-3.994	21.55	37.23	2.49E-10	-9.604
220	1076.9	15.336	14.139	15.498	12.182	12.923	11.110	15.738	-4.090	21.15	39.41	1.92E-10	-9.717
230	1095.6	15.205	13.991	15.421	11.999	12.901	11.083	15.638	-4.182	20.78	41.41	1.50E-10	-9.824
240	1111.0	15.078	13.847	15.345	11.820	12.880	11.059	15.543	-4.271	20.42	43.29	1.18E-10	-9.927
250	1123.7	14.954	13.706	15.272	11.645	12.860	11.039	15.452	-4.357	20.08	45.05	9.44E-11	-10.025
260	1134.3	14.833	13.568	15.201	11.474	12.840	11.021	15.364	-4.441	19.75	46.72	7.59E-11	-10.120
270	1143.1	14.713	13.432	15.132	11.305	12.822	11.006	15.280	-4.522	19.44	48.30	6.15E-11	-10.211
280	1150.5	14.595	13.298	15.063	11.138	12.804	10.992	15.198	-4.601	19.15	49.81	5.01E-11	-10.300
290	1156.7	14.479	13.165	14.996	10.973	12.786	10.980	15.118	-4.679	18.88	51.26	4.11E-11	-10.386
300	1162.0	14.364	13.034	14.929	10.810	12.768	10.969	15.040	-4.754	18.62	52.66	3.39E-11	-10.469
310	1166.5	14.250	12.904	14.863	10.648	12.751	10.959	14.965	-4.828	18.38	53.99	2.81E-11	-10.551
320	1170.4	14.137	12.775	14.798	10.488	12.735	10.950	14.891	-4.901	18.16	55.28	2.34E-11	-10.630
330	1173.7	14.025	12.648	14.734	10.329	12.718	10.941	14.818	-4.973	17.95	56.52	1.96E-11	-10.708
340	1176.5	13.914	12.521	14.670	10.171	12.702	10.934	14.747	-5.043	17.75	57.71	1.64E-11	-10.784
350	1179.0	13.803	12.395	14.606	10.013	12.685	10.926	14.677	-5.112	17.57	58.85	1.39E-11	-10.858
360	1181.2	13.694	12.269	14.543	9.857	12.669	10.920	14.608	-5.180	17.40	59.95	1.17E-11	-10.932
370	1183.0	13.584	12.144	14.481	9.702	12.653	10.913	14.540	-5.247	17.24	61.01	9.92E-12	-11.003
380	1184.7	13.476	12.020	14.418	9.547	12.638	10.907	14.473	-5.313	17.08	62.01	8.43E-12	-11.074
390	1186.1	13.367	11.897	14.356	9.393	12.622	10.901	14.407	-5.379	16.94	62.98	7.19E-12	-11.143
400	1187.4	13.260	11.774	14.295	9.240	12.606	10.896	14.342	-5.443	16.81	63.90	6.14E-12	-11.212

Table 10. (Cont.)

EXOSPHERIC TEMPERATURE = 1200 K

HEIGHT KM	TEMP K	LOG(N(N2) /M3)	LOG(N(O2) /M3)	LOG(N(O) /M3)	LOG(N(A) /M3)	LOG(N(HE) /M3)	LOG(N(H) /M3)	LOG(N /M3)	LOG (PRESSURE NT/M2)	MEAN MCL WT	DENSITY SCALE HT KM	DENSITY KG/M3	LOG(DEN KG/M3)
420	1189.5	13.046	11.530	14.172	8.935	12.575	10.886	14.215	-5.570	16.57	65.63	4.51E-12	-11.346
440	1191.2	12.834	11.288	14.051	8.633	12.545	10.876	14.090	-5.694	16.34	67.21	3.34E-12	-11.477
460	1192.6	12.623	11.047	13.930	8.333	12.514	10.867	13.968	-5.816	16.13	68.66	2.49E-12	-11.605
480	1193.7	12.414	10.809	13.811	8.035	12.484	10.858	13.848	-5.935	15.92	69.99	1.86E-12	-11.730
500	1194.5	12.207	10.572	13.692	7.739	12.455	10.850	13.731	-6.052	15.72	71.24	1.40E-12	-11.853
520	1195.3	12.001	10.336	13.574	7.445	12.425	10.842	13.616	-6.167	15.50	72.42	1.06E-12	-11.974
540	1195.9	11.796	10.102	13.457	7.153	12.396	10.835	13.503	-6.279	15.27	73.56	8.08E-13	-12.093
560	1196.4	11.593	9.870	13.341	6.863	12.366	10.827	13.393	-6.389	15.03	74.66	6.17E-13	-12.210
580	1196.8	11.390	9.639	13.225	6.575	12.337	10.819	13.285	-6.496	14.75	75.77	4.73E-13	-12.325
600	1197.2	11.190	9.410	13.111	6.289	12.309	10.812	13.181	-6.601	14.45	76.89	3.64E-13	-12.439
620	1197.5	10.990	9.182	12.997	6.004	12.280	10.804	13.079	-6.703	14.11	78.06	2.81E-13	-12.551
640	1197.8	10.791	8.955	12.883		12.252	10.797	12.980	-6.802	13.74	79.30	2.18E-13	-12.662
660	1198.0	10.594	8.730	12.770		12.223	10.790	12.885	-6.897	13.32	80.64	1.70E-13	-12.770
680	1198.2	10.398	8.506	12.658		12.195	10.782	12.793	-6.988	12.87	82.10	1.33E-13	-12.877
700	1198.4	10.203	8.283	12.547		12.168	10.775	12.705	-7.076	12.38	83.72	1.04E-13	-12.982
720	1198.5	10.009	8.062	12.436		12.140	10.768	12.621	-7.160	11.86	85.54	8.23E-14	-13.085
740	1198.7	9.817	7.842	12.326		12.112	10.761	12.541	-7.240	11.31	87.59	6.53E-14	-13.185
760	1198.8	9.625	7.623	12.217		12.085	10.754	12.466	-7.315	10.74	89.94	5.21E-14	-13.283
780	1198.9	9.434	7.405	12.108		12.058	10.747	12.395	-7.386	10.16	92.62	4.19E-14	-13.378
800	1199.0	9.245	7.189	12.000		12.031	10.740	12.328	-7.453	9.58	95.71	3.39E-14	-13.470
820	1199.1	9.057	6.974	11.892		12.004	10.734	12.266	-7.515	9.01	99.22	2.76E-14	-13.560
840	1199.1	8.869	6.760	11.785		11.977	10.727	12.207	-7.574	8.45	103.25	2.26E-14	-13.645
860	1199.2	8.683	6.547	11.679		11.950	10.720	12.153	-7.628	7.93	107.87	1.87E-14	-13.728
880	1199.3	8.498	6.336	11.573		11.924	10.713	12.102	-7.679	7.43	113.14	1.56E-14	-13.806
900	1199.3	8.314	6.125	11.468		11.897	10.707	12.055	-7.726	6.98	119.12	1.31E-14	-13.881
920	1199.4	8.131		11.363		11.871	10.700	12.011	-7.770	6.56	125.87	1.12E-14	-13.952
940	1199.4	7.949		11.259		11.845	10.694	11.969	-7.812	6.19	133.44	9.57E-15	-14.019
960	1199.5	7.767		11.156		11.819	10.687	11.930	-7.851	5.85	141.84	8.27E-15	-14.082
980	1199.5	7.587		11.053		11.794	10.681	11.894	-7.887	5.55	151.08	7.21E-15	-14.142
1000	1199.5	7.408		10.951		11.768	10.674	11.859	-7.922	5.29	161.15	6.35E-15	-14.197
1050	1199.6	6.965		10.697		11.705	10.658	11.779	-8.001	4.77	189.44	4.77E-15	-14.322
1100	1199.7	6.527		10.447		11.642	10.642	11.708	-8.073	4.40	220.85	3.73E-15	-14.428
1150	1199.7	6.095		10.201		11.580	10.627	11.642	-8.139	4.15	252.95	3.02E-15	-14.520
1200	1199.7			9.957		11.520	10.611	11.581	-8.200	3.97	283.28	2.51E-15	-14.601
1250	1199.8			9.717		11.459	10.596	11.522	-8.259	3.84	310.28	2.12E-15	-14.674
1300	1199.8			9.480		11.400	10.581	11.466	-8.315	3.74	333.26	1.81E-15	-14.741
1350	1199.8			9.246		11.342	10.567	11.412	-8.369	3.66	352.35	1.57E-15	-14.805
1400	1199.8			9.016		11.284	10.552	11.360	-8.421	3.59	368.14	1.36E-15	-14.865
1450	1199.9			8.788		11.227	10.538	11.309	-8.472	3.53	381.49	1.19E-15	-14.923
1500	1199.9			8.563		11.171	10.523	11.260	-8.521	3.48	393.01	1.05E-15	-14.979
1600	1199.9			8.121		11.060	10.496	11.165	-8.616	3.37	412.62	8.19E-16	-15.087
1700	1199.9			7.691		10.952	10.468	11.076	-8.705	3.27	430.22	6.46E-16	-15.190
1800	1199.9			7.271		10.847	10.442	10.991	-8.789	3.16	447.25	5.14E-16	-15.289
1900	1199.9			6.861		10.745	10.416	10.912	-8.869	3.05	464.87	4.13E-16	-15.384
2000	1200.0			6.461		10.645	10.391	10.837	-8.944	2.93	483.47	3.35E-16	-15.476
2100	1200.0			6.070		10.547	10.366	10.767	-9.014	2.81	503.28	2.73E-16	-15.564
2200	1200.0					10.452	10.342	10.701	-9.079	2.69	524.76	2.25E-16	-15.648
2300	1200.0					10.358	10.319	10.640	-9.141	2.57	548.03	1.87E-16	-15.729
2400	1200.0					10.267	10.296	10.583	-9.198	2.46	573.17	1.56E-16	-15.807
2500	1200.0					10.178	10.273	10.529	-9.251	2.34	600.68	1.32E-16	-15.881

Table 10. (Cont.)

EXOSPHERIC TEMPERATURE = 1300 K

HEIGHT KM	TEMP K	LOG(N(N2) /M3)	LOG(N(O2) /M3)	LOG(N(O) /M3)	LOG(N(A) /M3)	LOG(N(HE) /M3)	LOG(N(H) /M3)	LOG(N /M3)	LOG (PRESSURE NT/M2)	MEAN MOL WT	DENSITY SCALE HT KM	DENSITY KG/M3	LOG(DEN KG/M3)
90	188.0	19.746	19.170	17.390	17.824	14.573		19.854	-.732	28.91	5.63	3.43E-06	-5.465
92	188.1	19.592	19.009	17.547	17.669	14.418		19.700	-.886	28.85	5.58	2.40E-06	-5.620
94	188.6	19.437	18.843	17.646	17.514	14.263		19.545	-1.040	28.76	5.54	1.67E-06	-5.776
96	189.6	19.281	18.672	17.685	17.359	14.108		19.389	-1.193	28.65	5.52	1.17E-06	-5.933
98	191.5	19.125	18.498	17.687	17.203	13.952		19.234	-1.344	28.52	5.52	8.12E-07	-6.091
100	194.6	18.970	18.322	17.664	17.048	13.797		19.080	-1.491	28.36	5.61	5.66E-07	-6.248
102	199.4	18.818	18.148	17.598	16.836	13.770		18.927	-1.633	28.21	5.60	3.96E-07	-6.403
104	206.7	18.665	17.970	17.540	16.625	13.741		18.775	-1.770	28.02	5.61	2.77E-07	-6.558
106	217.3	18.513	17.789	17.482	16.416	13.709		18.623	-1.900	27.80	5.63	1.94E-07	-6.712
108	231.6	18.361	17.604	17.420	16.212	13.674		18.474	-2.021	27.55	5.71	1.36E-07	-6.866
110	249.9	18.213	17.418	17.352	16.014	13.637		18.328	-2.134	27.29	5.88	9.64E-08	-7.016
115	309.2	17.870	16.984	17.162	15.565	13.544		17.994	-2.375	26.68	6.95	4.37E-08	-7.359
120	375.3	17.583	16.647	16.976	15.192	13.463		17.719	-2.567	26.21	8.48	2.28E-08	-7.642
125	443.6	17.341	16.376	16.809	14.878	13.393		17.489	-2.724	25.84	9.99	1.32E-08	-7.878
130	512.7	17.134	16.148	16.664	14.609	13.334		17.294	-2.856	25.50	11.68	8.33E-09	-8.079
135	580.2	16.954	15.950	16.538	14.375	13.282		17.126	-2.970	25.19	13.46	5.59E-09	-8.252
140	644.7	16.796	15.776	16.428	14.170	13.238		16.980	-3.071	24.90	15.31	3.95E-09	-8.404
145	705.1	16.656	15.621	16.331	13.986	13.199		16.851	-3.161	24.63	17.22	2.90E-09	-8.537
150	761.0	16.529	15.481	16.245	13.819	13.166	11.472	16.736	-3.242	24.37	19.16	2.20E-09	-8.657
155	811.9	16.414	15.353	16.167	13.667	13.136	11.413	16.633	-3.318	24.12	21.11	1.72E-09	-8.765
160	858.1	16.308	15.236	16.096	13.526	13.109	11.361	16.539	-3.388	23.88	23.03	1.37E-09	-8.863
170	936.9	16.118	15.024	15.971	13.272	13.064	11.274	16.372	-3.516	23.42	26.73	9.17E-10	-9.038
180	1000.4	15.949	14.836	15.863	13.043	13.026	11.206	16.228	-3.632	22.98	30.17	6.45E-10	-9.190
190	1051.4	15.796	14.663	15.766	12.834	12.994	11.150	16.099	-3.739	22.57	33.31	4.71E-10	-9.327
200	1092.5	15.653	14.503	15.677	12.637	12.965	11.092	15.982	-3.840	22.17	36.21	3.53E-10	-9.452
210	1125.8	15.519	14.351	15.595	12.451	12.940	11.053	15.873	-3.935	21.78	38.78	2.70E-10	-9.568
220	1153.0	15.391	14.206	15.517	12.273	12.917	11.020	15.772	-4.026	21.41	41.17	2.10E-10	-9.677
230	1175.2	15.267	14.067	15.443	12.101	12.895	10.992	15.677	-4.113	21.06	43.37	1.66E-10	-9.779
240	1193.5	15.148	13.931	15.372	11.933	12.875	10.967	15.586	-4.197	20.72	45.42	1.33E-10	-9.877
250	1208.7	15.032	13.799	15.303	11.770	12.856	10.946	15.499	-4.278	20.39	47.32	1.07E-10	-9.971
260	1221.3	14.918	13.670	15.237	11.610	12.837	10.928	15.416	-4.357	20.08	49.12	8.69E-11	-10.061
270	1231.9	14.807	13.543	15.171	11.452	12.820	10.911	15.336	-4.434	19.78	50.81	7.11E-11	-10.148
280	1240.7	14.697	13.418	15.107	11.297	12.802	10.897	15.258	-4.508	19.49	52.43	5.86E-11	-10.232
290	1248.2	14.589	13.295	15.044	11.144	12.786	10.884	15.182	-4.581	19.22	53.96	4.86E-11	-10.314
300	1254.5	14.482	13.173	14.982	10.992	12.769	10.873	15.109	-4.653	18.97	55.45	4.05E-11	-10.393
310	1259.9	14.376	13.053	14.921	10.842	12.753	10.862	15.037	-4.723	18.73	56.87	3.39E-11	-10.470
320	1264.5	14.271	12.933	14.861	10.693	12.738	10.853	14.967	-4.791	18.50	58.24	2.85E-11	-10.546
330	1268.5	14.167	12.815	14.801	10.546	12.722	10.844	14.898	-4.859	18.28	59.55	2.40E-11	-10.620
340	1271.9	14.064	12.697	14.741	10.399	12.707	10.836	14.831	-4.925	18.08	60.83	2.03E-11	-10.692
350	1274.9	13.962	12.580	14.682	10.254	12.692	10.828	14.765	-4.990	17.89	62.06	1.73E-11	-10.762
360	1277.4	13.860	12.464	14.624	10.109	12.677	10.822	14.700	-5.054	17.72	63.25	1.47E-11	-10.832
370	1279.7	13.759	12.349	14.566	9.965	12.662	10.815	14.636	-5.117	17.55	64.39	1.26E-11	-10.900
380	1281.7	13.658	12.234	14.508	9.822	12.647	10.809	14.573	-5.179	17.39	65.49	1.08E-11	-10.967
390	1283.4	13.558	12.120	14.451	9.680	12.633	10.803	14.511	-5.241	17.24	66.55	9.28E-12	-11.032
400	1284.9	13.459	12.006	14.394	9.538	12.618	10.798	14.449	-5.302	17.10	67.57	7.99E-12	-11.097

Table 10. (Cont.)

EXOSPHERIC TEMPERATURE = 1300 K

HEIGHT KM	TEMP K	LOG(N(N2) /M3)	LOG(N(O2) /M3)	LOG(N(O) /M3)	LOG(N(A) /M3)	LOG(N(HE) /M3)	LOG(N(H) /M3)	LOG(N /M3)	LOG (PRESSURE NT/M2)	MEAN MOL WT	DENSITY SCALE HT KM	DENSITY KG/M3	LOG(DEN KG/M3)
420	1287.5	13.261	11.780	14.280	9.256	12.590	10.787	14.329	-5.421	16.85	69.50	5.97E-12	-11.224
440	1289.5	13.065	11.557	14.168	8.977	12.561	10.778	14.212	-5.538	16.62	71.28	4.49E-12	-11.347
460	1291.1	12.870	11.334	14.057	8.700	12.533	10.769	14.097	-5.652	16.41	72.93	3.41E-12	-11.468
480	1292.4	12.677	11.114	13.946	8.424	12.505	10.761	13.984	-5.764	16.21	74.45	2.60E-12	-11.586
500	1293.5	12.486	10.895	13.837	8.151	12.478	10.753	13.874	-5.874	16.01	75.86	1.99E-12	-11.701
520	1294.3	12.295	10.678	13.728	7.880	12.451	10.746	13.766	-5.982	15.82	77.19	1.53E-12	-11.815
540	1295.1	12.106	10.462	13.620	7.610	12.423	10.738	13.660	-6.088	15.63	78.45	1.18E-12	-11.926
560	1295.7	11.918	10.247	13.512	7.343	12.396	10.731	13.555	-6.192	15.43	79.65	9.20E-13	-12.036
580	1296.2	11.732	10.034	13.405	7.076	12.370	10.724	13.453	-6.294	15.22	80.81	7.17E-13	-12.144
600	1296.6	11.546	9.822	13.299	6.812	12.343	10.717	13.353	-6.394	14.98	81.96	5.61E-13	-12.251
620	1297.0	11.362	9.611	13.194	6.549	12.317	10.710	13.255	-6.492	14.73	83.11	4.40E-13	-12.356
640	1297.3	11.178	9.402	13.089	6.288	12.290	10.703	13.160	-6.587	14.45	84.28	3.47E-13	-12.460
660	1297.6	10.996	9.194	12.985	6.028	12.264	10.696	13.067	-6.680	14.15	85.49	2.74E-13	-12.563
680	1297.8	10.815	8.987	12.882		12.238	10.689	12.976	-6.771	13.81	86.76	2.17E-13	-12.663
700	1298.1	10.635	8.782	12.779		12.213	10.683	12.889	-6.858	13.44	88.12	1.73E-13	-12.763
720	1298.2	10.456	8.577	12.677		12.187	10.676	12.804	-6.943	13.04	89.58	1.38E-13	-12.860
740	1298.4	10.278	8.374	12.575		12.162	10.670	12.722	-7.024	12.61	91.18	1.11E-13	-12.957
760	1298.5	10.101	8.172	12.474		12.136	10.663	12.644	-7.102	12.15	92.94	8.89E-14	-13.051
780	1298.7	9.926	7.971	12.374		12.111	10.657	12.569	-7.177	11.67	94.90	7.19E-14	-13.143
800	1298.8	9.751	7.771	12.274		12.086	10.650	12.498	-7.248	11.16	97.12	5.83E-14	-13.234
820	1298.9	9.577	7.573	12.174		12.061	10.644	12.430	-7.316	10.64	99.58	4.76E-14	-13.322
840	1299.0	9.404	7.375	12.076		12.037	10.638	12.366	-7.380	10.12	102.36	3.90E-14	-13.408
860	1299.0	9.232	7.179	11.978		12.012	10.632	12.306	-7.440	9.59	105.50	3.22E-14	-13.492
880	1299.1	9.061	6.984	11.880		11.988	10.625	12.249	-7.497	9.08	109.06	2.67E-14	-13.573
900	1299.2	8.891	6.789	11.783		11.963	10.619	12.195	-7.551	8.58	113.09	2.23E-14	-13.651
920	1299.2	8.722	6.596	11.686		11.939	10.613	12.145	-7.601	8.09	117.64	1.88E-14	-13.727
940	1299.3	8.554	6.404	11.590		11.915	10.607	12.098	-7.648	7.64	122.76	1.59E-14	-13.799
960	1299.3	8.387	6.213	11.495		11.891	10.601	12.053	-7.693	7.22	128.51	1.36E-14	-13.868
980	1299.4	8.220	6.023	11.400		11.867	10.595	12.012	-7.734	6.82	134.93	1.16E-14	-13.934
1000	1299.4	8.055		11.305		11.844	10.589	11.973	-7.774	6.46	142.07	1.01E-14	-13.997
1050	1299.5	7.646		11.071		11.785	10.574	11.884	-7.862	5.70	163.18	7.25E-15	-14.140
1100	1299.6	7.242		10.841		11.728	10.560	11.806	-7.940	5.13	188.93	5.45E-15	-14.263
1150	1299.6	6.843		10.613		11.671	10.545	11.736	-8.010	4.71	218.53	4.26E-15	-14.370
1200	1299.7	6.450		10.388		11.614	10.531	11.672	-8.074	4.41	250.36	3.44E-15	-14.463
1250	1299.7	6.062		10.167		11.559	10.517	11.613	-8.134	4.19	282.47	2.85E-15	-14.545
1300	1299.8			9.948		11.504	10.503	11.556	-8.190	4.03	312.92	2.41E-15	-14.618
1350	1299.8			9.732		11.450	10.490	11.503	-8.243	3.92	340.35	2.07E-15	-14.684
1400	1299.8			9.519		11.397	10.476	11.451	-8.295	3.83	364.15	1.80E-15	-14.746
1450	1299.8			9.309		11.344	10.463	11.401	-8.345	3.75	384.48	1.57E-15	-14.804
1500	1299.9			9.101		11.292	10.450	11.353	-8.393	3.70	401.69	1.38E-15	-14.859
1600	1299.9			8.693		11.190	10.424	11.260	-8.486	3.60	428.94	1.09E-15	-14.963
1700	1299.9			8.296		11.091	10.399	11.172	-8.574	3.51	450.43	8.67E-16	-15.062
1800	1299.9			7.908		10.994	10.375	11.088	-8.658	3.43	468.92	6.97E-16	-15.157
1900	1299.9			7.530		10.899	10.351	11.008	-8.738	3.35	486.38	5.66E-16	-15.248
2000	1299.9			7.161		10.807	10.328	10.931	-8.815	3.26	503.67	4.62E-16	-15.335
2100	1299.9			6.800		10.717	10.305	10.859	-8.887	3.17	521.24	3.80E-16	-15.420
2200	1300.0			6.448		10.629	10.283	10.790	-8.956	3.07	539.70	3.15E-16	-15.502
2300	1300.0			6.104		10.543	10.261	10.725	-9.021	2.97	559.16	2.62E-16	-15.581
2400	1300.0					10.459	10.240	10.664	-9.082	2.87	579.65	2.20E-16	-15.657
2500	1300.0					10.376	10.219	10.606	-9.140	2.77	601.62	1.86E-16	-15.731

Table 10. (Cont.)

EXOSPHERIC TEMPERATURE = 1400 K

HEIGHT KM	TEMP K	LOG(N(N2) /M3)	LOG(N(O2) /M3)	LOG(N(O) /M3)	LOG(N(A) /M3)	LOG(N(HE) /M3)	LOG(N(H) /M3)	LOG(N /M3)	LOG (PRESSURE NT/M2)	MEAN MOL WT	DENSITY SCALE HT KM	DENSITY KG/M3	LOG(DEN KG/M3)
90	188.0	19.746	19.170	17.390	17.824	14.573		19.854	-.732	28.91	5.63	3.43E-06	-5.465
92	188.1	19.592	19.009	17.547	17.669	14.418		19.700	-.886	28.85	5.58	2.40E-06	-5.620
94	188.6	19.436	18.843	17.646	17.514	14.263		19.545	-1.040	28.76	5.54	1.67E-06	-5.776
96	189.7	19.281	18.672	17.685	17.359	14.108		19.389	-1.193	28.65	5.52	1.17E-06	-5.933
98	191.6	19.125	18.498	17.687	17.203	13.952		19.234	-1.344	28.52	5.52	8.11E-07	-6.091
100	194.8	18.970	18.322	17.664	17.048	13.797		19.079	-1.491	28.36	5.60	5.65E-07	-6.248
102	199.9	18.818	18.147	17.598	16.835	13.770		18.926	-1.633	28.21	5.59	3.95E-07	-6.403
104	207.4	18.665	17.970	17.539	16.624	13.740		18.774	-1.769	28.02	5.60	2.77E-07	-6.558
106	218.3	18.512	17.789	17.481	16.416	13.708		18.623	-1.898	27.81	5.63	1.94E-07	-6.713
108	233.2	18.360	17.604	17.418	16.212	13.672		18.473	-2.019	27.56	5.70	1.36E-07	-6.867
110	252.1	18.212	17.417	17.350	16.014	13.635		18.327	-2.131	27.29	5.88	9.62E-08	-7.017
115	313.6	17.870	16.985	17.159	15.567	13.541		17.994	-2.370	26.69	6.97	4.37E-08	-7.360
120	382.1	17.585	16.649	16.973	15.197	13.459		17.720	-2.558	26.23	8.53	2.28E-08	-7.641
125	452.9	17.345	16.382	16.807	14.886	13.390		17.492	-2.712	25.87	10.08	1.33E-08	-7.875
130	524.6	17.140	16.156	16.663	14.621	13.330		17.298	-2.842	25.54	11.80	8.43E-09	-8.074
135	594.9	16.962	15.960	16.538	14.391	13.278		17.132	-2.954	25.24	13.60	5.68E-09	-8.246
140	662.5	16.806	15.789	16.429	14.188	13.234		16.987	-3.052	24.96	15.47	4.02E-09	-8.395
145	726.5	16.667	15.636	16.332	14.007	13.195		16.860	-3.139	24.70	17.40	2.97E-09	-8.528
150	786.2	16.542	15.498	16.246	13.844	13.161	11.396	16.746	-3.219	24.44	19.37	2.26E-09	-8.646
155	841.4	16.428	15.372	16.169	13.694	13.130	11.336	16.643	-3.292	24.21	21.36	1.77E-09	-8.753
160	891.8	16.324	15.257	16.098	13.557	13.103	11.284	16.550	-3.359	23.98	23.34	1.41E-09	-8.850
170	979.4	16.138	15.050	15.975	13.308	13.057	11.197	16.386	-3.483	23.54	27.19	9.51E-10	-9.022
180	1051.1	15.974	14.866	15.867	13.087	13.019	11.128	16.244	-3.594	23.13	30.85	6.74E-10	-9.172
190	1109.3	15.825	14.700	15.772	12.885	12.987	11.072	16.118	-3.697	22.73	34.23	4.95E-10	-9.305
200	1156.8	15.688	14.546	15.686	12.697	12.958	11.013	16.004	-3.793	22.36	37.38	3.75E-10	-9.426
210	1195.5	15.559	14.401	15.607	12.519	12.933	10.973	15.899	-3.883	21.99	40.19	2.89E-10	-9.538
220	1227.1	15.437	14.263	15.532	12.350	12.910	10.938	15.801	-3.970	21.64	42.81	2.27E-10	-9.643
230	1253.1	15.320	14.130	15.461	12.187	12.889	10.909	15.710	-4.052	21.30	45.21	1.81E-10	-9.742
240	1274.6	15.207	14.002	15.393	12.029	12.870	10.884	15.623	-4.132	20.98	47.44	1.46E-10	-9.835
250	1292.4	15.097	13.878	15.328	11.875	12.851	10.862	15.539	-4.209	20.67	49.50	1.19E-10	-9.925
260	1307.3	14.990	13.756	15.265	11.725	12.834	10.843	15.460	-4.284	20.36	51.44	9.75E-11	-10.011
270	1319.7	14.885	13.637	15.203	11.577	12.817	10.826	15.383	-4.356	20.08	53.25	8.05E-11	-10.094
280	1330.1	14.782	13.520	15.143	11.432	12.800	10.811	15.309	-4.427	19.80	54.98	6.69E-11	-10.174
290	1338.9	14.681	13.405	15.084	11.288	12.784	10.798	15.237	-4.496	19.54	56.61	5.60E-11	-10.252
300	1346.3	14.581	13.291	15.026	11.147	12.769	10.786	15.167	-4.564	19.28	58.18	4.70E-11	-10.328
310	1352.7	14.482	13.178	14.969	11.007	12.754	10.775	15.099	-4.630	19.04	59.68	3.97E-11	-10.401
320	1358.1	14.384	13.067	14.912	10.868	12.739	10.765	15.032	-4.695	18.82	61.13	3.36E-11	-10.473
330	1362.8	14.287	12.956	14.856	10.730	12.724	10.756	14.967	-4.759	18.60	62.51	2.86E-11	-10.544
340	1366.9	14.191	12.847	14.800	10.594	12.710	10.748	14.903	-4.822	18.40	63.87	2.44E-11	-10.612
350	1370.3	14.096	12.738	14.745	10.458	12.696	10.740	14.840	-4.883	18.20	65.17	2.09E-11	-10.680
360	1373.4	14.001	12.630	14.691	10.323	12.682	10.733	14.778	-4.944	18.02	66.44	1.80E-11	-10.746
370	1376.0	13.907	12.522	14.637	10.189	12.668	10.726	14.718	-5.004	17.85	67.66	1.55E-11	-10.810
380	1378.4	13.813	12.415	14.583	10.056	12.654	10.720	14.658	-5.063	17.69	68.84	1.34E-11	-10.874
390	1380.4	13.720	12.309	14.530	9.923	12.641	10.714	14.599	-5.121	17.53	69.99	1.16E-11	-10.937
400	1382.2	13.627	12.203	14.476	9.792	12.627	10.709	14.541	-5.178	17.39	71.09	1.00E-11	-10.998

Table 10. (Cont.)

EXOSPHERIC TEMPERATURE = 1400 K

HEIGHT KM	TEMP K	LOG(N(N2) /M3)	LOG(N(O2) /M3)	LOG(N(O) /M3)	LOG(N(A) /M3)	LOG(N(HE) /M3)	LOG(N(H) /M3)	LOG(N /M3)	LOG (PRESSURE NT/M2)	MEAN MCL WT	DENSITY SCALE HT KM	DENSITY KG/M3	LOG(DEN KG/M3)
420	1385.2	13.443	11.993	14.371	9.530	12.601	10.698	14.428	-5.291	17.12	73.19	7.61E-12	-11.119
440	1387.6	13.261	11.785	14.266	9.270	12.574	10.689	14.317	-5.401	16.88	75.16	5.81E-12	-11.236
460	1389.5	13.080	11.579	14.163	9.012	12.548	10.680	14.208	-5.509	16.67	76.99	4.47E-12	-11.350
480	1391.0	12.901	11.374	14.060	8.757	12.522	10.672	14.102	-5.615	16.46	78.70	3.46E-12	-11.461
500	1392.3	12.723	11.170	13.958	8.503	12.496	10.665	13.998	-5.719	16.28	80.29	2.69E-12	-11.571
520	1393.3	12.546	10.968	13.857	8.251	12.471	10.658	13.895	-5.821	16.10	81.78	2.10E-12	-11.678
540	1394.2	12.370	10.767	13.757	8.000	12.446	10.651	13.795	-5.921	15.92	83.17	1.65E-12	-11.783
560	1394.9	12.195	10.568	13.657	7.751	12.421	10.644	13.696	-6.019	15.74	84.50	1.30E-12	-11.887
580	1395.5	12.022	10.370	13.558	7.504	12.396	10.637	13.599	-6.116	15.56	85.77	1.03E-12	-11.989
600	1396.0	11.850	10.173	13.459	7.258	12.371	10.630	13.504	-6.211	15.37	87.00	8.14E-13	-12.089
620	1396.5	11.678	9.978	13.361	7.014	12.347	10.623	13.410	-6.305	15.17	88.21	6.48E-13	-12.188
640	1396.9	11.508	9.783	13.264	6.771	12.322	10.617	13.319	-6.396	14.95	89.40	5.17E-13	-12.286
660	1397.2	11.339	9.590	13.167	6.530	12.298	10.611	13.229	-6.485	14.72	90.59	4.14E-13	-12.383
680	1397.5	11.171	9.398	13.071	6.290	12.274	10.604	13.142	-6.573	14.46	91.80	3.33E-13	-12.478
700	1397.7	11.004	9.207	12.976	6.052	12.250	10.598	13.056	-6.658	14.18	93.06	2.68E-13	-12.572
720	1397.9	10.837	9.017	12.881		12.226	10.592	12.973	-6.742	13.88	94.36	2.16E-13	-12.665
740	1398.1	10.672	8.828	12.786		12.203	10.586	12.892	-6.823	13.55	95.74	1.75E-13	-12.756
760	1398.3	10.508	8.641	12.693		12.179	10.580	12.813	-6.901	13.19	97.22	1.43E-13	-12.846
780	1398.4	10.345	8.454	12.599		12.156	10.574	12.738	-6.977	12.80	98.81	1.16E-13	-12.935
800	1398.6	10.182	8.269	12.507		12.133	10.568	12.665	-7.050	12.40	100.56	9.51E-14	-13.022
820	1398.7	10.021	8.084	12.414		12.109	10.562	12.594	-7.120	11.96	102.44	7.81E-14	-13.108
840	1398.8	9.860	7.901	12.323		12.087	10.556	12.527	-7.187	11.51	104.53	6.43E-14	-13.191
860	1398.9	9.700	7.718	12.231		12.064	10.550	12.463	-7.251	11.05	106.84	5.33E-14	-13.274
880	1399.0	9.542	7.537	12.141		12.041	10.545	12.401	-7.313	10.58	109.41	4.43E-14	-13.354
900	1399.0	9.384	7.357	12.051		12.018	10.539	12.343	-7.371	10.10	112.29	3.69E-14	-13.432
920	1399.1	9.227	7.177	11.961		11.996	10.533	12.288	-7.426	9.62	115.50	3.10E-14	-13.509
940	1399.2	9.071	6.999	11.872		11.974	10.528	12.236	-7.479	9.15	119.09	2.61E-14	-13.583
960	1399.2	8.915	6.822	11.783		11.951	10.522	12.186	-7.528	8.69	123.10	2.22E-14	-13.655
980	1399.3	8.761	6.645	11.695		11.929	10.516	12.139	-7.575	8.25	127.58	1.89E-14	-13.724
1000	1399.3	8.607	6.470	11.607		11.907	10.511	12.095	-7.619	7.83	132.57	1.62E-14	-13.791
1050	1399.4	8.227	6.036	11.390		11.853	10.497	11.996	-7.718	6.89	147.54	1.13E-14	-13.946
1100	1399.5	7.852		11.176		11.800	10.484	11.909	-7.805	6.11	166.56	8.22E-15	-14.085
1150	1399.6	7.482		10.964		11.747	10.470	11.832	-7.882	5.50	189.88	6.21E-15	-14.207
1200	1399.6	7.117		10.756		11.694	10.457	11.764	-7.950	5.03	217.19	4.85E-15	-14.314
1250	1399.7	6.756		10.550		11.643	10.444	11.701	-8.013	4.68	247.68	3.91E-15	-14.408
1300	1399.7	6.401		10.347		11.592	10.431	11.644	-8.070	4.42	279.88	3.23E-15	-14.490
1350	1399.8	6.050		10.146		11.542	10.418	11.589	-8.125	4.23	312.07	2.73E-15	-14.564
1400	1399.8			9.948		11.492	10.406	11.538	-8.176	4.09	342.70	2.34E-15	-14.630
1450	1399.8			9.753		11.444	10.394	11.489	-8.225	3.98	370.75	2.04E-15	-14.691
1500	1399.8			9.560		11.395	10.382	11.441	-8.273	3.90	395.63	1.79E-15	-14.748
1600	1399.9			9.182		11.301	10.358	11.350	-8.363	3.78	435.83	1.41E-15	-14.852
1700	1399.9			8.813		11.208	10.334	11.264	-8.450	3.69	466.10	1.13E-15	-14.948
1800	1399.9			8.453		11.118	10.312	11.182	-8.532	3.62	489.85	9.14E-16	-15.039
1900	1399.9			8.101		11.030	10.290	11.103	-8.611	3.55	510.07	7.49E-16	-15.126
2000	1399.9			7.759		10.945	10.268	11.028	-8.686	3.49	528.50	6.18E-16	-15.209
2100	1399.9			7.424		10.861	10.247	10.956	-8.758	3.42	546.05	5.13E-16	-15.290
2200	1399.9			7.097		10.779	10.226	10.886	-8.828	3.35	563.74	4.28E-16	-15.368
2300	1400.0			6.778		10.699	10.206	10.820	-8.894	3.28	581.77	3.60E-16	-15.444
2400	1400.0			6.465		10.621	10.186	10.757	-8.957	3.20	600.25	3.04E-16	-15.518
2500	1400.0			6.160		10.545	10.167	10.697	-9.017	3.12	619.64	2.58E-16	-15.589

Table 10. (Cont.)

EXOSPHERIC TEMPERATURE = 1500 K

HEIGHT KM	TEMP K	LOG(N(N2) /M3)	LOG(N(O2) /M3)	LOG(N(O) /M3)	LOG(N(A) /M3)	LOG(N(HE) /M3)	LOG(N(H) /M3)	LOG(N /M3)	LOG (PRESSURE NT/M2)	MEAN MOL WT	DENSITY SCALE HT KM	DENSITY KG/M3	LOG(DEN KG/M3)
90	188.0	19.746	19.170	17.390	17.824	14.573		19.854	-.732	28.91	5.63	3.43E-06	-5.465
92	188.1	19.592	19.009	17.547	17.669	14.418		19.700	-.886	28.85	5.58	2.40E-06	-5.620
94	188.6	19.436	18.843	17.645	17.514	14.263		19.545	-1.040	28.76	5.54	1.67E-06	-5.776
96	189.7	19.281	18.672	17.685	17.359	14.108		19.389	-1.193	28.65	5.52	1.17E-06	-5.933
98	191.7	19.125	18.498	17.686	17.203	13.952		19.234	-1.344	28.52	5.52	8.11E-07	-6.091
100	195.0	18.970	18.322	17.664	17.047	13.796		19.079	-1.491	28.36	5.60	5.65E-07	-6.248
102	200.2	18.817	18.147	17.597	16.835	13.769		18.926	-1.632	28.21	5.59	3.95E-07	-6.403
104	208.1	18.664	17.969	17.538	16.624	13.739		18.773	-1.768	28.02	5.60	2.76E-07	-6.559
106	219.3	18.511	17.788	17.479	16.415	13.707		18.622	-1.897	27.81	5.62	1.93E-07	-6.714
108	234.6	18.359	17.603	17.417	16.211	13.671		18.472	-2.017	27.56	5.70	1.36E-07	-6.867
110	254.2	18.211	17.417	17.348	16.014	13.633		18.326	-2.129	27.30	5.88	9.61E-08	-7.017
115	317.7	17.870	16.985	17.157	15.569	13.538		17.993	-2.365	26.70	6.99	4.36E-08	-7.360
120	388.4	17.586	16.652	16.971	15.201	13.456		17.720	-2.550	26.25	8.59	2.29E-08	-7.640
125	461.6	17.348	16.386	16.805	14.894	13.386		17.494	-2.702	25.89	10.16	1.34E-08	-7.873
130	535.6	17.145	16.162	16.662	14.632	13.326		17.302	-2.829	25.57	11.91	8.51E-09	-8.070
135	608.5	16.969	15.969	16.538	14.405	13.275		17.137	-2.939	25.28	13.73	5.76E-09	-8.240
140	678.9	16.814	15.800	16.429	14.205	13.230		16.994	-3.034	25.01	15.62	4.09E-09	-8.388
145	746.2	16.677	15.649	16.333	14.026	13.191		16.867	-3.120	24.75	17.56	3.03E-09	-8.519
150	809.5	16.553	15.513	16.247	13.865	13.156	11.327	16.754	-3.198	24.51	19.56	2.31E-09	-8.636
155	868.6	16.441	15.389	16.170	13.718	13.126	11.267	16.653	-3.269	24.28	21.57	1.81E-09	-8.742
160	923.2	16.339	15.275	16.100	13.583	13.098	11.214	16.560	-3.334	24.06	23.59	1.45E-09	-8.838
170	1019.2	16.155	15.072	15.977	13.340	13.052	11.127	16.398	-3.454	23.64	27.58	9.81E-10	-9.008
180	1099.0	15.994	14.893	15.871	13.124	13.013	11.057	16.258	-3.561	23.25	31.42	6.99E-10	-9.156
190	1164.7	15.849	14.731	15.778	12.929	12.980	11.000	16.134	-3.660	22.88	35.04	5.17E-10	-9.286
200	1218.7	15.717	14.582	15.693	12.747	12.952	10.940	16.023	-3.751	22.52	38.42	3.94E-10	-9.405
210	1263.0	15.593	14.442	15.616	12.577	12.927	10.899	15.921	-3.838	22.17	41.48	3.07E-10	-9.513
220	1299.4	15.475	14.310	15.543	12.415	12.904	10.864	15.826	-3.920	21.84	44.33	2.43E-10	-9.615
230	1329.4	15.364	14.184	15.475	12.260	12.883	10.835	15.737	-3.999	21.52	46.94	1.95E-10	-9.710
240	1354.3	15.256	14.063	15.411	12.111	12.864	10.809	15.653	-4.075	21.21	49.37	1.59E-10	-9.800
250	1374.9	15.152	13.945	15.348	11.965	12.846	10.786	15.574	-4.148	20.91	51.60	1.30E-10	-9.886
260	1392.1	15.051	13.830	15.288	11.823	12.829	10.767	15.497	-4.219	20.62	53.69	1.08E-10	-9.968
270	1406.5	14.952	13.717	15.230	11.684	12.813	10.749	15.424	-4.288	20.34	55.62	8.96E-11	-10.048
280	1418.6	14.855	13.607	15.173	11.547	12.797	10.734	15.352	-4.356	20.08	57.46	7.51E-11	-10.125
290	1428.9	14.759	13.498	15.117	11.412	12.782	10.720	15.284	-4.421	19.82	59.20	6.32E-11	-10.199
300	1437.5	14.665	13.391	15.062	11.279	12.767	10.708	15.217	-4.486	19.57	60.86	5.35E-11	-10.271
310	1444.9	14.573	13.286	15.008	11.148	12.753	10.696	15.152	-4.549	19.34	62.44	4.55E-11	-10.342
320	1451.3	14.481	13.181	14.955	11.017	12.739	10.686	15.088	-4.610	19.11	63.96	3.89E-11	-10.411
330	1456.7	14.390	13.077	14.902	10.888	12.725	10.677	15.026	-4.671	18.90	65.43	3.33E-11	-10.478
340	1461.4	14.300	12.975	14.850	10.760	12.712	10.668	14.965	-4.730	18.69	66.85	2.86E-11	-10.543
350	1465.5	14.210	12.873	14.798	10.633	12.698	10.660	14.905	-4.789	18.50	68.22	2.47E-11	-10.608
360	1469.0	14.121	12.771	14.747	10.507	12.685	10.653	14.846	-4.847	18.31	69.55	2.13E-11	-10.671
370	1472.1	14.033	12.671	14.697	10.382	12.672	10.646	14.789	-4.903	18.14	70.85	1.85E-11	-10.733
380	1474.8	13.946	12.571	14.646	10.257	12.659	10.639	14.732	-4.959	17.97	72.09	1.61E-11	-10.793
390	1477.2	13.858	12.471	14.596	10.133	12.647	10.633	14.676	-5.015	17.82	73.31	1.40E-11	-10.853
400	1479.3	13.772	12.372	14.546	10.010	12.634	10.628	14.621	-5.069	17.67	74.49	1.23E-11	-10.912

Table 10. (Cont.)

EXOSPHERIC TEMPERATURE = 1500 K

HEIGHT KM	TEMP K	LOG(N(N2) /M3)	LOG(N(O2) /M3)	LOG(N(O) /M3)	LOG(N(A) /M3)	LOG(N(HE) /M3)	LOG(N(H) /M3)	LOG(N /M3)	LOG (PRESSURE NT/M2)	MEAN MOL WT	DENSITY SCALE HT KM	DENSITY KG/M3	LOG(DEN KG/M3)
420	1482.8	13.600	12.176	14.448	9.765	12.609	10.617	14.513	-5.176	17.39	76.75	9.40E-12	-11.027
440	1485.5	13.429	11.981	14.350	9.522	12.584	10.607	14.407	-5.281	17.14	78.88	7.27E-12	-11.138
460	1487.8	13.260	11.789	14.253	9.282	12.560	10.599	14.305	-5.383	16.91	80.87	5.66E-12	-11.247
480	1489.6	13.093	11.597	14.157	9.043	12.535	10.591	14.204	-5.483	16.71	82.75	4.43E-12	-11.353
500	1491.0	12.926	11.407	14.062	8.806	12.511	10.584	14.105	-5.582	16.52	84.51	3.49E-12	-11.457
520	1492.2	12.761	11.218	13.967	8.570	12.488	10.577	14.008	-5.678	16.34	86.17	2.76E-12	-11.559
540	1493.2	12.597	11.031	13.874	8.336	12.464	10.570	13.912	-5.773	16.17	87.73	2.19E-12	-11.659
560	1494.1	12.434	10.845	13.780	8.104	12.441	10.564	13.819	-5.867	16.00	89.20	1.75E-12	-11.757
580	1494.8	12.272	10.660	13.688	7.873	12.417	10.557	13.727	-5.959	15.84	90.60	1.40E-12	-11.853
600	1495.4	12.111	10.476	13.596	7.644	12.394	10.551	13.636	-6.049	15.67	91.94	1.13E-12	-11.949
620	1495.9	11.951	10.293	13.504	7.416	12.371	10.544	13.547	-6.138	15.50	93.23	9.07E-13	-12.042
640	1496.3	11.792	10.112	13.414	7.189	12.349	10.538	13.460	-6.225	15.32	94.50	7.33E-13	-12.135
660	1496.7	11.634	9.931	13.323	6.964	12.326	10.532	13.374	-6.311	15.13	95.74	5.94E-13	-12.226
680	1497.0	11.477	9.752	13.234	6.740	12.304	10.526	13.289	-6.395	14.92	96.97	4.83E-13	-12.316
700	1497.3	11.321	9.574	13.144	6.518	12.281	10.520	13.207	-6.478	14.71	98.21	3.93E-13	-12.405
720	1497.6	11.166	9.397	13.056	6.296	12.259	10.514	13.126	-6.559	14.47	99.47	3.21E-13	-12.493
740	1497.8	11.012	9.221	12.968	6.076	12.237	10.509	13.047	-6.637	14.21	100.76	2.63E-13	-12.580
760	1498.0	10.858	9.045	12.880		12.215	10.503	12.970	-6.714	13.93	102.11	2.16E-13	-12.666
780	1498.2	10.706	8.871	12.793		12.193	10.497	12.895	-6.789	13.63	103.52	1.78E-13	-12.750
800	1498.3	10.554	8.698	12.706		12.171	10.492	12.822	-6.862	13.31	105.02	1.47E-13	-12.834
820	1498.5	10.404	8.526	12.620		12.150	10.486	12.751	-6.933	12.97	106.60	1.21E-13	-12.916
840	1498.6	10.254	8.355	12.535		12.128	10.481	12.683	-7.001	12.60	108.30	1.01E-13	-12.996
860	1498.7	10.105	8.185	12.450		12.107	10.475	12.617	-7.067	12.22	110.15	8.39E-14	-13.076
880	1498.8	9.957	8.015	12.365		12.086	10.470	12.553	-7.131	11.82	112.17	7.01E-14	-13.154
900	1498.9	9.809	7.847	12.281		12.065	10.465	12.492	-7.192	11.40	114.38	5.88E-14	-13.231
920	1499.0	9.663	7.680	12.197		12.044	10.459	12.434	-7.251	10.97	116.80	4.94E-14	-13.306
940	1499.0	9.517	7.513	12.114		12.023	10.454	12.378	-7.306	10.53	119.48	4.17E-14	-13.380
960	1499.1	9.372	7.347	12.031		12.002	10.449	12.324	-7.360	10.10	122.43	3.54E-14	-13.451
980	1499.2	9.228	7.183	11.949		11.982	10.444	12.273	-7.411	9.66	125.69	3.01E-14	-13.521
1000	1499.2	9.085	7.019	11.867		11.961	10.438	12.225	-7.459	9.23	129.30	2.57E-14	-13.590
1050	1499.3	8.730	6.614	11.664		11.911	10.426	12.115	-7.569	8.20	140.05	1.77E-14	-13.751
1100	1499.4	8.379	6.214	11.464		11.861	10.413	12.018	-7.666	7.28	153.80	1.26E-14	-13.899
1150	1499.5	8.034		11.267		11.811	10.400	11.933	-7.751	6.50	171.06	9.26E-15	-14.033
1200	1499.6	7.693		11.072		11.762	10.388	11.858	-7.826	5.87	192.16	7.03E-15	-14.153
1250	1499.6	7.357		10.880		11.714	10.376	11.791	-7.893	5.36	217.19	5.50E-15	-14.260
1300	1499.7	7.025		10.690		11.667	10.364	11.730	-7.954	4.97	245.72	4.43E-15	-14.354
1350	1499.7	6.697		10.503		11.620	10.352	11.673	-8.011	4.67	276.83	3.66E-15	-14.437
1400	1499.7	6.374		10.319		11.574	10.341	11.621	-8.063	4.44	309.24	3.08E-15	-14.511
1450	1499.8	6.055		10.136		11.528	10.329	11.571	-8.113	4.27	341.64	2.64E-15	-14.578
1500	1499.8			9.956		11.483	10.318	11.524	-8.160	4.14	372.69	2.30E-15	-14.639
1600	1499.8			9.603		11.395	10.295	11.435	-8.249	3.96	427.37	1.79E-15	-14.747
1700	1499.9			9.259		11.309	10.274	11.351	-8.333	3.85	470.64	1.43E-15	-14.844
1800	1499.9			8.923		11.225	10.252	11.271	-8.413	3.77	503.91	1.17E-15	-14.933
1900	1499.9			8.595		11.143	10.232	11.194	-8.490	3.71	530.48	9.62E-16	-15.017
2000	1499.9			8.275		11.063	10.212	11.121	-8.563	3.65	552.83	8.00E-16	-15.097
2100	1499.9			7.962		10.984	10.192	11.050	-8.634	3.60	572.69	6.70E-16	-15.174
2200	1499.9			7.657		10.908	10.173	10.982	-8.702	3.54	591.47	5.64E-16	-15.249
2300	1499.9			7.359		10.834	10.154	10.916	-8.768	3.49	609.77	4.77E-16	-15.321
2400	1500.0			7.068		10.761	10.136	10.853	-8.831	3.43	627.84	4.06E-16	-15.391
2500	1500.0			6.783		10.689	10.118	10.793	-8.891	3.37	646.40	3.47E-16	-15.459

Table 10. (Cont.)

EXOSPHERIC TEMPERATURE = 1600 K

HEIGHT KM	TEMP K	LOG(N(N2) /M3)	LOG(N(O2) /M3)	LOG(N(O) /M3)	LOG(N(A) /M3)	LOG(N(HE) /M3)	LOG(N(H) /M3)	LOG(N /M3)	LOG (PRESSURE NT/M2)	MEAN MOL WT	DENSITY SCALE HT KM	DENSITY KG/M3	LOG(DEN KG/M3)
90	188.0	19.746	19.170	17.390	17.824	14.573		19.854	-.732	28.91	5.63	3.43E-06	-5.465
92	188.1	19.592	19.009	17.547	17.669	14.418		19.700	-.886	28.85	5.58	2.40E-06	-5.620
94	188.7	19.436	18.843	17.645	17.514	14.263		19.545	-1.040	28.76	5.54	1.67E-06	-5.776
96	189.8	19.281	18.672	17.685	17.359	14.108		19.389	-1.193	28.65	5.51	1.17E-06	-5.933
98	191.8	19.125	18.498	17.686	17.203	13.952		19.234	-1.343	28.52	5.51	8.11E-07	-6.091
100	195.2	18.969	18.322	17.663	17.047	13.796		19.079	-1.491	28.36	5.60	5.64E-07	-6.248
102	200.6	18.817	18.147	17.597	16.835	13.769		18.926	-1.632	28.21	5.58	3.95E-07	-6.404
104	208.7	18.664	17.969	17.537	16.624	13.739		18.773	-1.768	28.03	5.59	2.76E-07	-6.559
106	220.2	18.511	17.788	17.478	16.415	13.706		18.621	-1.896	27.81	5.62	1.93E-07	-6.714
108	236.0	18.359	17.603	17.416	16.211	13.670		18.471	-2.016	27.56	5.70	1.36E-07	-6.868
110	256.2	18.210	17.416	17.346	16.015	13.631		18.325	-2.126	27.30	5.88	9.59E-08	-7.018
115	321.5	17.869	16.985	17.155	15.571	13.536		17.993	-2.360	26.71	7.01	4.36E-08	-7.360
120	394.3	17.587	16.654	16.969	15.206	13.453		17.721	-2.543	26.26	8.63	2.29E-08	-7.640
125	469.6	17.350	16.390	16.804	14.901	13.383		17.496	-2.693	25.91	10.24	1.35E-08	-7.871
130	545.8	17.149	16.169	16.661	14.642	13.323		17.305	-2.818	25.60	12.01	8.59E-09	-8.066
135	621.0	16.975	15.978	16.537	14.417	13.271		17.142	-2.925	25.32	13.85	5.83E-09	-8.235
140	694.1	16.822	15.810	16.429	14.220	13.226		16.999	-3.019	25.05	15.75	4.15E-09	-8.381
145	764.4	16.686	15.660	16.334	14.043	13.187		16.874	-3.103	24.81	17.71	3.08E-09	-8.511
150	831.1	16.564	15.526	16.248	13.885	13.152	11.263	16.762	-3.179	24.57	19.71	2.36E-09	-8.628
155	893.8	16.453	15.404	16.171	13.740	13.121	11.203	16.661	-3.248	24.35	21.75	1.85E-09	-8.732
160	952.3	16.351	15.291	16.102	13.607	13.094	11.150	16.569	-3.312	24.14	23.80	1.49E-09	-8.828
170	1056.5	16.170	15.091	15.979	13.368	13.046	11.062	16.408	-3.428	23.73	27.91	1.01E-09	-8.996
180	1144.4	16.012	14.916	15.874	13.157	13.007	10.992	16.270	-3.532	23.36	31.91	7.22E-10	-9.142
190	1217.6	15.871	14.758	15.781	12.967	12.974	10.934	16.148	-3.626	23.00	35.73	5.37E-10	-9.270
200	1278.3	15.741	14.613	15.698	12.792	12.946	10.874	16.039	-3.715	22.66	39.36	4.11E-10	-9.386
210	1328.4	15.621	14.478	15.623	12.628	12.920	10.832	15.939	-3.798	22.33	42.64	3.22E-10	-9.492
220	1369.9	15.509	14.351	15.553	12.472	12.898	10.797	15.847	-3.876	22.02	45.73	2.57E-10	-9.590
230	1404.1	15.401	14.231	15.487	12.324	12.877	10.766	15.761	-3.952	21.71	48.56	2.08E-10	-9.682
240	1432.5	15.299	14.114	15.424	12.181	12.859	10.740	15.680	-4.024	21.42	51.19	1.70E-10	-9.769
250	1456.2	15.199	14.002	15.365	12.043	12.841	10.717	15.603	-4.094	21.13	53.60	1.41E-10	-9.852
260	1475.9	15.103	13.893	15.307	11.908	12.825	10.697	15.529	-4.162	20.85	55.85	1.17E-10	-9.931
270	1492.5	15.009	13.786	15.251	11.776	12.809	10.679	15.458	-4.228	20.59	57.93	9.82E-11	-10.008
280	1506.4	14.917	13.682	15.197	11.647	12.794	10.663	15.390	-4.292	20.33	59.89	8.29E-11	-10.081
290	1518.1	14.827	13.579	15.144	11.519	12.779	10.649	15.324	-4.354	20.08	61.73	7.03E-11	-10.153
300	1528.1	14.738	13.478	15.092	11.394	12.765	10.636	15.260	-4.416	19.84	63.49	5.99E-11	-10.222
310	1536.6	14.650	13.378	15.041	11.270	12.751	10.624	15.198	-4.476	19.61	65.15	5.13E-11	-10.290
320	1543.9	14.564	13.280	14.991	11.147	12.738	10.614	15.137	-4.535	19.39	66.76	4.41E-11	-10.356
330	1550.2	14.478	13.182	14.941	11.026	12.725	10.604	15.077	-4.592	19.18	68.29	3.80E-11	-10.420
340	1555.6	14.393	13.085	14.892	10.905	12.712	10.595	15.019	-4.649	18.97	69.78	3.29E-11	-10.483
350	1560.3	14.309	12.989	14.843	10.786	12.700	10.587	14.962	-4.705	18.78	71.21	2.85E-11	-10.544
360	1564.3	14.225	12.894	14.795	10.667	12.687	10.579	14.906	-4.760	18.59	72.60	2.48E-11	-10.605
370	1567.9	14.143	12.799	14.747	10.549	12.675	10.572	14.851	-4.814	18.42	73.96	2.17E-11	-10.664
380	1571.0	14.060	12.705	14.700	10.432	12.663	10.566	14.796	-4.867	18.25	75.28	1.90E-11	-10.722
390	1573.7	13.978	12.612	14.653	10.316	12.651	10.559	14.743	-4.920	18.09	76.56	1.66E-11	-10.779
400	1576.1	13.897	12.519	14.606	10.200	12.639	10.553	14.690	-4.972	17.93	77.80	1.46E-11	-10.836

Table 10. (Cont.)

EXOSPHERIC TEMPERATURE = 1600 K

HEIGHT KM	TEMP K	LOG(N(N2) /M3)	LOG(N(O2) /M3)	LOG(N(O) /M3)	LOG(N(A) /M3)	LOG(N(HE) /M3)	LOG(N(H) /M3)	LOG(N /M3)	LOG (PRESSURE NT/M2)	MEAN MOL WT	DENSITY SCALE HT KM	DENSITY KG/M3	LOG(DEN KG/M3)
420	1580.2	13.735	12.335	14.513	9.970	12.615	10.543	14.587	-5.074	17.65	80.19	1.13E-11	-10.946
440	1583.3	13.575	12.152	14.421	9.742	12.592	10.533	14.487	-5.173	17.39	82.46	8.86E-12	-11.052
460	1585.9	13.417	11.971	14.331	9.516	12.569	10.524	14.389	-5.271	17.16	84.61	6.98E-12	-11.156
480	1588.0	13.259	11.791	14.240	9.292	12.546	10.516	14.293	-5.366	16.94	86.65	5.52E-12	-11.258
500	1589.7	13.103	11.613	14.151	9.070	12.523	10.510	14.199	-5.460	16.75	88.57	4.40E-12	-11.357
520	1591.0	12.948	11.436	14.062	8.849	12.501	10.503	14.106	-5.552	16.57	90.39	3.51E-12	-11.454
540	1592.2	12.794	11.260	13.974	8.629	12.479	10.497	14.016	-5.642	16.40	92.10	2.82E-12	-11.549
560	1593.2	12.641	11.085	13.887	8.411	12.457	10.490	13.927	-5.731	16.23	93.72	2.28E-12	-11.643
580	1594.0	12.489	10.912	13.800	8.195	12.435	10.484	13.839	-5.819	16.08	95.26	1.84E-12	-11.735
600	1594.7	12.338	10.740	13.714	7.980	12.413	10.477	13.753	-5.905	15.92	96.74	1.50E-12	-11.825
620	1595.3	12.188	10.568	13.628	7.766	12.392	10.471	13.668	-5.989	15.77	98.15	1.22E-12	-11.914
640	1595.8	12.039	10.398	13.543	7.553	12.371	10.465	13.584	-6.073	15.61	99.52	9.95E-13	-12.002
660	1596.2	11.891	10.229	13.458	7.342	12.349	10.460	13.502	-6.155	15.44	100.84	8.15E-13	-12.089
680	1596.6	11.744	10.061	13.374	7.132	12.328	10.454	13.421	-6.235	15.27	102.13	6.69E-13	-12.174
700	1596.9	11.598	9.894	13.290	6.924	12.307	10.448	13.342	-6.315	15.09	103.41	5.51E-13	-12.259
720	1597.2	11.452	9.727	13.207	6.716	12.287	10.443	13.264	-6.393	14.90	104.69	4.55E-13	-12.342
740	1597.5	11.307	9.562	13.125	6.510	12.266	10.437	13.188	-6.469	14.70	105.97	3.76E-13	-12.425
760	1597.7	11.164	9.398	13.042	6.305	12.245	10.432	13.113	-6.544	14.48	107.28	3.12E-13	-12.506
780	1597.9	11.021	9.235	12.961	6.101	12.225	10.427	13.039	-6.617	14.24	108.61	2.59E-13	-12.587
800	1598.1	10.879	9.072	12.880		12.204	10.421	12.968	-6.689	13.99	110.02	2.16E-13	-12.666
820	1598.2	10.737	8.911	12.799		12.184	10.416	12.898	-6.758	13.71	111.44	1.80E-13	-12.745
840	1598.4	10.597	8.750	12.719		12.164	10.411	12.830	-6.827	13.42	112.94	1.51E-13	-12.822
860	1598.5	10.457	8.591	12.639		12.144	10.406	12.764	-6.893	13.11	114.54	1.26E-13	-12.899
880	1598.6	10.318	8.432	12.559		12.124	10.401	12.699	-6.957	12.78	116.24	1.06E-13	-12.974
900	1598.7	10.180	8.274	12.481		12.105	10.396	12.637	-7.019	12.44	118.06	8.95E-14	-13.048
920	1598.8	10.043	8.117	12.402		12.085	10.391	12.577	-7.079	12.07	120.03	7.57E-14	-13.121
940	1598.9	9.906	7.961	12.324		12.065	10.386	12.519	-7.137	11.70	122.16	6.42E-14	-13.193
960	1599.0	9.770	7.806	12.246		12.046	10.381	12.463	-7.193	11.31	124.47	5.46E-14	-13.263
980	1599.0	9.635	7.652	12.169		12.027	10.376	12.410	-7.247	10.91	126.99	4.65E-14	-13.332
1000	1599.1	9.501	7.498	12.092		12.007	10.371	12.358	-7.298	10.51	129.74	3.98E-14	-13.400
1050	1599.2	9.168	7.118	11.902		11.960	10.359	12.239	-7.417	9.51	137.81	2.74E-14	-13.562
1100	1599.3	8.840	6.743	11.715		11.913	10.347	12.134	-7.522	8.54	147.97	1.93E-14	-13.715
1150	1599.4	8.516	6.373	11.530		11.867	10.335	12.040	-7.616	7.66	160.70	1.39E-14	-13.856
1200	1599.5	8.196	6.008	11.347		11.821	10.324	11.957	-7.699	6.88	176.46	1.04E-14	-13.985
1250	1599.6	7.881		11.167		11.776	10.313	11.883	-7.773	6.23	195.68	7.91E-15	-14.102
1300	1599.6	7.570		10.990		11.731	10.301	11.817	-7.839	5.70	218.52	6.21E-15	-14.207
1350	1599.7	7.262		10.814		11.688	10.290	11.757	-7.899	5.27	244.87	5.00E-15	-14.301
1400	1599.7	6.959		10.641		11.644	10.279	11.702	-7.954	4.93	274.24	4.12E-15	-14.385
1450	1599.7	6.660		10.470		11.601	10.268	11.651	-8.005	4.67	305.84	3.47E-15	-14.460
1500	1599.8	6.364		10.301		11.559	10.258	11.603	-8.053	4.47	338.57	2.97E-15	-14.527
1600	1599.8			9.970		11.476	10.237	11.513	-8.143	4.19	402.66	2.27E-15	-14.644
1700	1599.8			9.647		11.396	10.217	11.431	-8.225	4.02	459.35	1.80E-15	-14.745
1800	1599.9			9.332		11.317	10.197	11.353	-8.303	3.91	505.55	1.46E-15	-14.835
1900	1599.9			9.025		11.240	10.177	11.278	-8.377	3.83	542.36	1.21E-15	-14.918
2000	1599.9			8.725		11.165	10.158	11.207	-8.449	3.77	572.01	1.01E-15	-14.996
2100	1599.9			8.432		11.092	10.140	11.138	-8.517	3.73	596.73	8.51E-16	-15.070
2200	1599.9			8.146		11.020	10.122	11.072	-8.584	3.68	618.70	7.22E-16	-15.142
2300	1599.9			7.866		10.950	10.104	11.008	-8.648	3.64	638.99	6.16E-16	-15.211
2400	1599.9			7.593		10.882	10.087	10.947	-8.709	3.59	658.24	5.28E-16	-15.278
2500	1600.0			7.326		10.815	10.070	10.887	-8.769	3.55	677.32	4.54E-16	-15.343

Table 10. (Cont.)

EXOSPHERIC TEMPERATURE = 1800 K

HEIGHT KM	TEMP K	LOG(N(N2) /M3)	LOG(N(O2) /M3)	LOG(N(O) /M3)	LOG(N(A) /M3)	LOG(N(HE) /M3)	LOG(N(H) /M3)	LOG(N /M3)	LOG (PRESSURE NT/M2)	MEAN MOL WT	DENSITY SCALE HT KM	DENSITY KG/M3	LOG(DEN KG/M3)
90	188.0	19.746	19.170	17.390	17.824	14.573		19.854	-.732	28.91	5.63	3.43E-06	-5.465
92	188.1	19.592	19.009	17.547	17.669	14.418		19.700	-.886	28.85	5.58	2.40E-06	-5.620
94	188.7	19.436	18.843	17.645	17.514	14.263		19.545	-1.040	28.76	5.54	1.67E-06	-5.776
96	189.9	19.281	18.672	17.685	17.358	14.107		19.389	-1.192	28.65	5.51	1.17E-06	-5.934
98	192.0	19.125	18.497	17.686	17.202	13.951		19.233	-1.343	28.52	5.51	8.10E-07	-6.091
100	195.6	18.969	18.321	17.663	17.047	13.796		19.078	-1.490	28.36	5.59	5.64E-07	-6.249
102	201.2	18.816	18.146	17.596	16.834	13.768		18.925	-1.631	28.21	5.57	3.94E-07	-6.404
104	209.7	18.663	17.968	17.536	16.623	13.737		18.772	-1.766	28.03	5.58	2.75E-07	-6.560
106	221.9	18.509	17.787	17.477	16.415	13.704		18.620	-1.894	27.81	5.61	1.93E-07	-6.716
108	238.5	18.357	17.602	17.413	16.211	13.667		18.470	-2.012	27.56	5.69	1.35E-07	-6.869
110	259.7	18.209	17.415	17.343	16.015	13.628		18.324	-2.122	27.31	5.88	9.56E-08	-7.020
115	328.4	17.869	16.986	17.151	15.574	13.531		17.992	-2.352	26.72	7.05	4.35E-08	-7.361
120	404.9	17.588	16.657	16.965	15.213	13.448		17.722	-2.531	26.29	8.72	2.30E-08	-7.638
125	484.1	17.355	16.397	16.801	14.913	13.377		17.499	-2.676	25.95	10.37	1.36E-08	-7.867
130	564.3	17.157	16.179	16.659	14.658	13.317		17.311	-2.797	25.65	12.19	8.72E-09	-8.060
135	643.7	16.985	15.992	16.537	14.438	13.265		17.150	-2.901	25.38	14.06	5.95E-09	-8.225
140	721.6	16.835	15.827	16.430	14.245	13.220		17.009	-2.992	25.13	15.99	4.26E-09	-8.370
145	797.2	16.701	15.680	16.335	14.073	13.181		16.885	-3.073	24.89	17.96	3.17E-09	-8.498
150	869.9	16.581	15.548	16.250	13.918	13.145	11.150	16.775	-3.146	24.67	19.99	2.44E-09	-8.613
155	939.3	16.472	15.429	16.173	13.776	13.114	11.090	16.675	-3.212	24.46	22.06	1.92E-09	-8.716
160	1005.0	16.372	15.319	16.104	13.647	13.086	11.037	16.585	-3.273	24.26	24.16	1.55E-09	-8.810
170	1124.7	16.196	15.124	15.982	13.415	13.037	10.948	16.426	-3.383	23.89	28.42	1.06E-09	-8.976
180	1228.4	16.042	14.954	15.878	13.213	12.997	10.876	16.290	-3.481	23.54	32.67	7.62E-10	-9.118
190	1316.7	15.905	14.802	15.787	13.031	12.963	10.817	16.171	-3.570	23.21	36.85	5.71E-10	-9.243
200	1391.2	15.782	14.664	15.706	12.865	12.934	10.756	16.065	-3.652	22.90	40.89	4.41E-10	-9.355
210	1453.6	15.668	14.537	15.633	12.711	12.908	10.713	15.969	-3.729	22.60	44.64	3.49E-10	-9.457
220	1505.6	15.562	14.418	15.566	12.566	12.886	10.677	15.881	-3.801	22.32	48.19	2.82E-10	-9.550
230	1548.9	15.462	14.306	15.503	12.429	12.866	10.645	15.799	-3.871	22.04	51.48	2.30E-10	-9.638
240	1585.0	15.367	14.199	15.445	12.297	12.847	10.618	15.723	-3.937	21.77	54.53	1.91E-10	-9.719
250	1615.2	15.276	14.095	15.389	12.170	12.830	10.594	15.650	-4.002	21.51	57.32	1.60E-10	-9.797
260	1640.4	15.187	13.996	15.336	12.048	12.815	10.573	15.581	-4.064	21.25	59.92	1.35E-10	-9.871
270	1661.6	15.102	13.899	15.284	11.928	12.800	10.554	15.515	-4.124	21.00	62.32	1.14E-10	-9.942
280	1679.5	15.018	13.804	15.235	11.811	12.786	10.537	15.452	-4.183	20.76	64.56	9.76E-11	-10.011
290	1694.6	14.936	13.711	15.186	11.696	12.772	10.522	15.390	-4.240	20.53	66.63	8.38E-11	-10.077
300	1707.4	14.856	13.620	15.139	11.583	12.759	10.509	15.331	-4.297	20.31	68.60	7.23E-11	-10.141
310	1718.4	14.777	13.530	15.093	11.471	12.746	10.496	15.273	-4.352	20.09	70.45	6.26E-11	-10.204
320	1727.7	14.699	13.441	15.047	11.361	12.734	10.485	15.217	-4.405	19.88	72.22	5.44E-11	-10.264
330	1735.8	14.622	13.353	15.002	11.252	12.722	10.475	15.162	-4.458	19.67	73.90	4.74E-11	-10.324
340	1742.8	14.546	13.267	14.958	11.144	12.710	10.466	15.108	-4.510	19.47	75.52	4.15E-11	-10.382
350	1748.8	14.470	13.181	14.914	11.037	12.699	10.457	15.056	-4.562	19.28	77.08	3.64E-11	-10.439
360	1754.0	14.396	13.095	14.871	10.931	12.688	10.449	15.004	-4.612	19.10	78.59	3.20E-11	-10.495
370	1758.6	14.321	13.011	14.828	10.826	12.677	10.441	14.953	-4.661	18.92	80.06	2.82E-11	-10.549
380	1762.6	14.248	12.927	14.786	10.721	12.666	10.434	14.903	-4.710	18.75	81.48	2.49E-11	-10.603
390	1766.1	14.175	12.843	14.744	10.617	12.655	10.428	14.854	-4.759	18.59	82.87	2.21E-11	-10.656
400	1769.2	14.102	12.760	14.702	10.514	12.644	10.422	14.806	-4.806	18.44	84.23	1.96E-11	-10.708

Table 10. (Cont.)

EXOSPHERIC TEMPERATURE = 1800 K

HEIGHT KM	TEMP K	LOG(N(N2) /M3)	LOG(N(O2) /M3)	LOG(N(O) /M3)	LOG(N(A) /M3)	LOG(N(HE) /M3)	LOG(N(H) /M3)	LOG(N /M3)	LOG (PRESSURE NT/M2)	MEAN MOL WT	DENSITY SCALE HT KM	DENSITY KG/M3	LOG(DEN KG/M3)
420	1774.4	13.958	12.596	14.619	10.308	12.623	10.410	14.712	-4.899	18.14	86.85	1.55E-11	-10.810
440	1778.5	13.815	12.433	14.537	10.105	12.602	10.400	14.619	-4.990	17.87	89.34	1.24E-11	-10.908
460	1781.8	13.674	12.272	14.456	9.904	12.581	10.391	14.530	-5.080	17.63	91.75	9.91E-12	-11.004
480	1784.5	13.533	12.112	14.375	9.704	12.561	10.384	14.442	-5.167	17.40	94.06	7.99E-12	-11.098
500	1786.7	13.394	11.953	14.296	9.506	12.541	10.377	14.356	-5.252	17.19	96.25	6.47E-12	-11.189
520	1788.5	13.256	11.795	14.217	9.310	12.521	10.371	14.271	-5.336	17.00	98.35	5.27E-12	-11.278
540	1790.0	13.119	11.639	14.138	9.114	12.501	10.365	14.188	-5.419	16.82	100.34	4.31E-12	-11.366
560	1791.2	12.983	11.483	14.061	8.921	12.482	10.358	14.107	-5.500	16.65	102.26	3.54E-12	-11.451
580	1792.3	12.848	11.329	13.983	8.728	12.462	10.352	14.027	-5.580	16.50	104.10	2.91E-12	-11.535
600	1793.1	12.714	11.176	13.906	8.537	12.443	10.346	13.948	-5.658	16.35	105.85	2.41E-12	-11.618
620	1793.9	12.580	11.023	13.830	8.346	12.424	10.340	13.870	-5.736	16.20	107.52	2.00E-12	-11.700
640	1794.6	12.448	10.872	13.754	8.157	12.405	10.335	13.794	-5.812	16.07	109.13	1.66E-12	-11.780
660	1795.1	12.316	10.721	13.679	7.970	12.386	10.329	13.719	-5.887	15.93	110.68	1.38E-12	-11.859
680	1795.6	12.185	10.572	13.604	7.783	12.367	10.324	13.645	-5.961	15.79	112.18	1.16E-12	-11.937
700	1796.0	12.055	10.423	13.530	7.597	12.348	10.319	13.572	-6.034	15.65	113.63	9.69E-13	-12.014
720	1796.4	11.926	10.275	13.456	7.413	12.330	10.314	13.500	-6.106	15.51	115.05	8.13E-13	-12.090
740	1796.7	11.797	10.128	13.382	7.230	12.311	10.309	13.429	-6.177	15.36	116.45	6.84E-13	-12.165
760	1797.0	11.669	9.982	13.309	7.047	12.293	10.304	13.359	-6.247	15.21	117.83	5.77E-13	-12.239
780	1797.3	11.542	9.837	13.237	6.866	12.275	10.299	13.290	-6.315	15.05	119.20	4.87E-13	-12.312
800	1797.5	11.416	9.693	13.165	6.686	12.257	10.294	13.223	-6.383	14.88	120.58	4.12E-13	-12.385
820	1797.7	11.290	9.549	13.093	6.507	12.239	10.290	13.156	-6.449	14.70	121.94	3.50E-13	-12.456
840	1797.9	11.165	9.407	13.021	6.329	12.221	10.285	13.091	-6.514	14.50	123.32	2.97E-13	-12.527
860	1798.1	11.041	9.265	12.950	6.151	12.203	10.280	13.027	-6.578	14.30	124.74	2.53E-13	-12.597
880	1798.2	10.917	9.124	12.880		12.186	10.276	12.965	-6.640	14.08	126.19	2.16E-13	-12.666
900	1798.3	10.794	8.983	12.810		12.168	10.271	12.903	-6.702	13.85	127.69	1.84E-13	-12.735
920	1798.5	10.672	8.844	12.740		12.150	10.267	12.844	-6.762	13.61	129.25	1.58E-13	-12.802
940	1798.6	10.551	8.705	12.671		12.133	10.262	12.785	-6.820	13.35	130.88	1.35E-13	-12.869
960	1798.7	10.430	8.567	12.602		12.116	10.258	12.728	-6.877	13.08	132.60	1.16E-13	-12.935
980	1798.8	10.310	8.430	12.533		12.099	10.254	12.673	-6.932	12.80	134.40	1.00E-13	-13.000
1000	1798.8	10.190	8.293	12.465		12.082	10.249	12.619	-6.986	12.50	136.32	8.62E-14	-13.064
1050	1799.0	9.895	7.956	12.296		12.039	10.238	12.491	-7.114	11.70	141.64	6.02E-14	-13.221
1100	1799.2	9.603	7.622	12.129		11.998	10.228	12.373	-7.232	10.86	147.98	4.26E-14	-13.371
1150	1799.3	9.315	7.293	11.965		11.956	10.217	12.266	-7.339	10.00	155.61	3.06E-14	-13.514
1200	1799.4	9.031	6.969	11.802		11.916	10.207	12.169	-7.436	9.15	164.82	2.24E-14	-13.650
1250	1799.5	8.750	6.649	11.642		11.876	10.197	12.081	-7.523	8.34	176.03	1.67E-14	-13.777
1300	1799.5	8.474	6.333	11.484		11.836	10.187	12.003	-7.602	7.60	189.56	1.27E-14	-13.896
1350	1799.6	8.201	6.021	11.328		11.797	10.177	11.932	-7.673	6.94	205.75	9.86E-15	-14.006
1400	1799.6	7.931		11.174		11.759	10.167	11.868	-7.737	6.37	224.87	7.81E-15	-14.107
1450	1799.7	7.665		11.022		11.721	10.158	11.810	-7.795	5.89	247.12	6.32E-15	-14.200
1500	1799.7	7.403		10.872		11.683	10.148	11.756	-7.848	5.50	272.46	5.21E-15	-14.283
1600	1799.8	6.887		10.578		11.610	10.130	11.661	-7.944	4.91	331.17	3.73E-15	-14.428
1700	1799.8	6.385		10.291		11.538	10.112	11.577	-8.028	4.52	396.70	2.83E-15	-14.548
1800	1799.8			10.011		11.468	10.094	11.500	-8.105	4.27	462.49	2.24E-15	-14.649
1900	1799.9			9.738		11.399	10.077	11.428	-8.176	4.11	523.14	1.83E-15	-14.737
2000	1799.9			9.471		11.333	10.060	11.361	-8.244	4.01	575.57	1.53E-15	-14.816
2100	1799.9			9.211		11.267	10.043	11.296	-8.308	3.93	619.30	1.29E-15	-14.889
2200	1799.9			8.956		11.204	10.027	11.234	-8.371	3.88	655.94	1.10E-15	-14.957
2300	1799.9			8.708		11.142	10.012	11.174	-8.430	3.84	687.05	9.52E-16	-15.021
2400	1799.9			8.465		11.081	9.996	11.116	-8.488	3.80	714.06	8.25E-16	-15.083
2500	1799.9			8.228		11.022	9.981	11.060	-8.545	3.77	738.63	7.19E-16	-15.143

Table 10. (Cont.)

EXOSPHERIC TEMPERATURE = 2000 K

HEIGHT KM	TEMP K	LOG(N(N2) /M3)	LOG(N(O2) /M3)	LOG(N(O) /M3)	LOG(N(A) /M3)	LOG(N(HE) /M3)	LOG(N(H) /M3)	LOG(N /M3)	LOG (PRESSURE NT/M2)	MEAN MOL WT	DENSITY SCALE HT KM	DENSITY KG/M3	LOG(DEN KG/M3)
90	188.0	19.746	19.170	17.390	17.824	14.573		19.854	-.732	28.91	5.63	3.43E-06	-5.465
92	188.2	19.592	19.009	17.547	17.669	14.418		19.700	-.886	28.85	5.58	2.40E-06	-5.620
94	188.7	19.436	18.843	17.645	17.514	14.263		19.545	-1.040	28.76	5.53	1.67E-06	-5.776
96	190.0	19.280	18.672	17.685	17.358	14.107		19.389	-1.192	28.65	5.51	1.16E-06	-5.934
98	192.2	19.124	18.497	17.686	17.202	13.951		19.233	-1.343	28.52	5.50	8.10E-07	-6.092
100	195.9	18.968	18.321	17.662	17.046	13.795		19.078	-1.490	28.36	5.58	5.63E-07	-6.249
102	201.8	18.816	18.145	17.595	16.834	13.767		18.924	-1.631	28.21	5.57	3.93E-07	-6.405
104	210.7	18.662	17.967	17.535	16.623	13.736		18.771	-1.765	28.03	5.58	2.75E-07	-6.561
106	223.4	18.508	17.786	17.475	16.414	13.702		18.619	-1.892	27.81	5.60	1.92E-07	-6.717
108	240.7	18.356	17.601	17.411	16.211	13.665		18.469	-2.010	27.57	5.69	1.35E-07	-6.871
110	262.8	18.207	17.415	17.340	16.015	13.626		18.323	-2.118	27.31	5.88	9.53E-08	-7.021
115	334.5	17.868	16.987	17.147	15.576	13.527		17.991	-2.345	26.73	7.08	4.35E-08	-7.362
120	414.3	17.590	16.660	16.962	15.219	13.443		17.723	-2.520	26.31	8.79	2.31E-08	-7.637
125	496.9	17.359	16.403	16.798	14.923	13.372		17.502	-2.662	25.98	10.48	1.37E-08	-7.863
130	580.6	17.163	16.188	16.658	14.673	13.312		17.316	-2.780	25.70	12.34	8.83E-09	-8.054
135	663.8	16.994	16.003	16.536	14.456	13.260		17.157	-2.881	25.43	14.24	6.06E-09	-8.218
140	745.8	16.846	15.841	16.430	14.267	13.215		17.018	-2.970	25.19	16.19	4.36E-09	-8.361
145	826.0	16.714	15.697	16.336	14.098	13.175		16.895	-3.048	24.97	18.18	3.26E-09	-8.487
150	904.0	16.596	15.567	16.251	13.945	13.139	11.051	16.786	-3.118	24.76	20.22	2.51E-09	-8.601
155	979.3	16.488	15.450	16.175	13.807	13.107	10.991	16.687	-3.182	24.56	22.30	1.98E-09	-8.703
160	1051.5	16.390	15.342	16.106	13.680	13.079	10.938	16.597	-3.241	24.37	24.43	1.60E-09	-8.796
170	1185.5	16.216	15.151	15.984	13.454	13.029	10.848	16.440	-3.346	24.02	28.78	1.10E-09	-8.959
180	1304.3	16.065	14.984	15.880	13.257	12.988	10.776	16.305	-3.439	23.69	33.22	7.95E-10	-9.100
190	1407.7	15.932	14.837	15.790	13.082	12.953	10.716	16.188	-3.523	23.39	37.68	5.99E-10	-9.222
200	1496.3	15.813	14.704	15.710	12.922	12.923	10.653	16.085	-3.600	23.10	42.07	4.66E-10	-9.331
210	1571.4	15.704	14.583	15.639	12.776	12.897	10.610	15.992	-3.672	22.82	46.24	3.72E-10	-9.430
220	1634.7	15.603	14.470	15.574	12.639	12.875	10.572	15.907	-3.740	22.56	50.25	3.02E-10	-9.520
230	1687.8	15.509	14.364	15.514	12.511	12.855	10.540	15.828	-3.804	22.30	53.98	2.49E-10	-9.603
240	1732.3	15.419	14.264	15.458	12.388	12.837	10.512	15.755	-3.866	22.05	57.48	2.08E-10	-9.681
250	1769.6	15.334	14.168	15.406	12.271	12.820	10.487	15.686	-3.926	21.81	60.69	1.76E-10	-9.755
260	1800.9	15.252	14.075	15.356	12.157	12.805	10.466	15.621	-3.983	21.58	63.67	1.50E-10	-9.824
270	1827.3	15.173	13.986	15.308	12.047	12.790	10.446	15.559	-4.039	21.35	66.40	1.28E-10	-9.891
280	1849.5	15.096	13.899	15.261	11.939	12.777	10.429	15.500	-4.093	21.13	68.95	1.11E-10	-9.955
290	1868.3	15.021	13.813	15.217	11.834	12.764	10.413	15.442	-4.146	20.91	71.30	9.61E-11	-10.017
300	1884.3	14.947	13.730	15.173	11.731	12.752	10.399	15.387	-4.198	20.70	73.51	8.37E-11	-10.077
310	1898.0	14.875	13.648	15.130	11.629	12.740	10.386	15.333	-4.249	20.49	75.55	7.32E-11	-10.136
320	1909.7	14.804	13.567	15.089	11.529	12.728	10.374	15.280	-4.299	20.29	77.51	6.42E-11	-10.192
330	1919.8	14.734	13.487	15.048	11.430	12.717	10.364	15.229	-4.348	20.10	79.36	5.65E-11	-10.248
340	1928.4	14.665	13.409	15.007	11.332	12.706	10.354	15.179	-4.396	19.91	81.13	4.99E-11	-10.302
350	1936.0	14.596	13.331	14.967	11.235	12.696	10.345	15.130	-4.443	19.73	82.82	4.42E-11	-10.355
360	1942.5	14.528	13.253	14.928	11.139	12.685	10.336	15.082	-4.490	19.55	84.45	3.92E-11	-10.407
370	1948.2	14.461	13.177	14.889	11.044	12.675	10.328	15.035	-4.535	19.38	86.03	3.49E-11	-10.458
380	1953.2	14.394	13.101	14.851	10.949	12.665	10.321	14.989	-4.581	19.21	87.55	3.11E-11	-10.508
390	1957.7	14.328	13.025	14.812	10.855	12.655	10.314	14.943	-4.625	19.05	89.04	2.77E-11	-10.557
400	1961.5	14.262	12.950	14.774	10.761	12.645	10.308	14.898	-4.669	18.89	90.48	2.48E-11	-10.605

Table 10. (Cont.)

EXOSPHERIC TEMPERATURE = 2000 K

HEIGHT KM	TEMP K	LOG(N(N2) /M3)	LOG(N(O2) /M3)	LOG(N(O) /M3)	LOG(N(A) /M3)	LOG(N(HE) /M3)	LOG(N(H) /M3)	LOG(N /M3)	LOG (PRESSURE NT/M2)	MEAN MOL WT	DENSITY SCALE HT KM	DENSITY KG/M3	LOG(DEN KG/M3)
420	1968.0	14.132	12.801	14.699	10.576	12.626	10.296	14.811	-4.755	18.60	93.29	2.00E-11	-10.700
440	1973.2	14.003	12.654	14.625	10.393	12.607	10.285	14.725	-4.840	18.32	95.99	1.62E-11	-10.792
460	1977.3	13.876	12.509	14.552	10.211	12.589	10.276	14.642	-4.922	18.07	98.58	1.32E-11	-10.881
480	1980.6	13.749	12.364	14.479	10.031	12.570	10.268	14.561	-5.002	17.83	101.09	1.08E-11	-10.968
500	1983.3	13.624	12.221	14.407	9.853	12.552	10.262	14.481	-5.081	17.61	103.50	8.86E-12	-11.053
520	1985.6	13.499	12.079	14.336	9.675	12.534	10.256	14.403	-5.159	17.41	105.84	7.32E-12	-11.136
540	1987.4	13.376	11.938	14.266	9.499	12.516	10.250	14.327	-5.235	17.22	108.09	6.07E-12	-11.217
560	1989.0	13.253	11.798	14.195	9.325	12.498	10.243	14.252	-5.310	17.05	110.26	5.05E-12	-11.296
580	1990.3	13.131	11.659	14.126	9.151	12.481	10.237	14.178	-5.383	16.88	112.34	4.22E-12	-11.375
600	1991.4	13.010	11.521	14.056	8.979	12.463	10.231	14.105	-5.456	16.73	114.35	3.54E-12	-11.451
620	1992.4	12.890	11.384	13.988	8.808	12.446	10.226	14.034	-5.527	16.59	116.30	2.98E-12	-11.526
640	1993.2	12.771	11.247	13.919	8.637	12.429	10.221	13.963	-5.597	16.45	118.16	2.51E-12	-11.601
660	1993.9	12.652	11.112	13.852	8.468	12.412	10.215	13.894	-5.667	16.32	119.95	2.12E-12	-11.673
680	1994.5	12.534	10.977	13.784	8.300	12.395	10.210	13.825	-5.735	16.19	121.69	1.80E-12	-11.745
700	1995.0	12.417	10.843	13.717	8.133	12.378	10.205	13.758	-5.802	16.06	123.37	1.53E-12	-11.816
720	1995.5	12.301	10.710	13.651	7.967	12.362	10.201	13.691	-5.869	15.94	125.00	1.30E-12	-11.886
740	1995.9	12.185	10.578	13.585	7.802	12.345	10.196	13.625	-5.934	15.81	126.59	1.11E-12	-11.955
760	1996.3	12.070	10.447	13.519	7.638	12.329	10.191	13.561	-5.999	15.69	128.14	9.47E-13	-12.023
780	1996.6	11.955	10.316	13.453	7.475	12.312	10.187	13.497	-6.063	15.56	129.66	8.11E-13	-12.091
800	1996.9	11.841	10.186	13.388	7.312	12.296	10.182	13.434	-6.126	15.43	131.17	6.96E-13	-12.157
820	1997.1	11.728	10.057	13.324	7.151	12.280	10.178	13.372	-6.188	15.30	132.63	5.98E-13	-12.223
840	1997.4	11.616	9.928	13.259	6.991	12.264	10.174	13.311	-6.249	15.16	134.08	5.15E-13	-12.288
860	1997.6	11.504	9.800	13.196	6.831	12.248	10.170	13.250	-6.309	15.02	135.53	4.44E-13	-12.353
880	1997.8	11.393	9.673	13.132	6.673	12.232	10.166	13.191	-6.368	14.86	136.98	3.83E-13	-12.417
900	1997.9	11.282	9.547	13.069	6.515	12.216	10.161	13.133	-6.427	14.70	138.45	3.31E-13	-12.480
920	1998.1	11.172	9.422	13.006	6.358	12.200	10.157	13.075	-6.484	14.54	139.93	2.87E-13	-12.542
940	1998.2	11.063	9.297	12.944	6.202	12.185	10.153	13.019	-6.540	14.36	141.44	2.49E-13	-12.604
960	1998.3	10.954	9.172	12.882	6.047	12.169	10.149	12.963	-6.596	14.17	142.98	2.16E-13	-12.665
980	1998.5	10.846	9.049	12.820		12.153	10.145	12.909	-6.650	13.97	144.56	1.88E-13	-12.725
1000	1998.6	10.739	8.926	12.758		12.138	10.141	12.856	-6.703	13.77	146.18	1.64E-13	-12.785
1050	1998.8	10.472	8.622	12.606		12.100	10.131	12.728	-6.832	13.20	150.48	1.17E-13	-12.932
1100	1998.9	10.210	8.322	12.456		12.063	10.122	12.607	-6.952	12.57	155.28	8.44E-14	-13.074
1150	1999.1	9.951	8.026	12.308		12.025	10.112	12.494	-7.066	11.89	160.74	6.15E-14	-13.211
1200	1999.2	9.695	7.734	12.162		11.989	10.103	12.388	-7.171	11.16	167.00	4.53E-14	-13.344
1250	1999.3	9.443	7.446	12.018		11.953	10.094	12.291	-7.268	10.42	174.33	3.38E-14	-13.471
1300	1999.4	9.194	7.161	11.876		11.917	10.085	12.202	-7.357	9.67	182.94	2.55E-14	-13.593
1350	1999.5	8.948	6.881	11.735		11.882	10.076	12.120	-7.439	8.94	193.07	1.96E-14	-13.708
1400	1999.5	8.705	6.604	11.597		11.847	10.067	12.046	-7.513	8.25	204.98	1.52E-14	-13.818
1450	1999.6	8.466	6.330	11.460		11.813	10.058	11.978	-7.581	7.61	219.00	1.20E-14	-13.920
1500	1999.6	8.229	6.060	11.325		11.779	10.050	11.916	-7.643	7.04	235.35	9.64E-15	-14.016
1600	1999.7	7.766		11.060		11.713	10.033	11.808	-7.751	6.10	275.75	6.51E-15	-14.187
1700	1999.7	7.313		10.802		11.649	10.017	11.715	-7.844	5.41	326.96	4.66E-15	-14.332
1800	1999.8	6.872		10.550		11.586	10.001	11.634	-7.925	4.92	387.47	3.52E-15	-14.454
1900	1999.8	6.441		10.304		11.524	9.985	11.561	-7.998	4.59	453.97	2.77E-15	-14.557
2000	1999.9	6.021		10.064		11.464	9.970	11.494	-8.065	4.36	521.63	2.26E-15	-14.646
2100	1999.9			9.830		11.405	9.955	11.431	-8.127	4.20	585.93	1.88E-15	-14.725
2200	1999.9			9.601		11.348	9.941	11.372	-8.187	4.09	644.26	1.60E-15	-14.795
2300	1999.9			9.377		11.292	9.927	11.316	-8.243	4.02	695.40	1.38E-15	-14.860
2400	1999.9			9.159		11.238	9.913	11.261	-8.298	3.96	739.48	1.20E-15	-14.921
2500	1999.9			8.945		11.184	9.900	11.208	-8.350	3.92	777.86	1.05E-15	-14.978

Table 10. (Cont.)

EXOSPHERIC TEMPERATURE = 2200 K

HEIGHT KM	TEMP K	LOG(N(N2) /M3)	LOG(N(O2) /M3)	LOG(N(O) /M3)	LOG(N(A) /M3)	LOG(N(HE) /M3)	LOG(N(H) /M3)	LOG(N /M3)	LOG (PRESSURE NT/M2)	MEAN MOL WT	DENSITY SCALE HT KM	DENSITY KG/M3	LOG(DEN KG/M3)
90	188.0	19.746	19.170	17.390	17.824	14.573		19.854	-.732	28.91	5.63	3.43E-06	-5.465
92	188.2	19.592	19.009	17.547	17.669	14.418		19.700	-.886	28.85	5.58	2.40E-06	-5.620
94	188.7	19.436	18.843	17.645	17.514	14.263		19.544	-1.040	28.76	5.53	1.67E-06	-5.776
96	190.0	19.280	18.672	17.685	17.358	14.107		19.389	-1.192	28.65	5.50	1.16E-06	-5.934
98	192.3	19.124	18.497	17.686	17.202	13.951		19.233	-1.343	28.52	5.50	8.09E-07	-6.092
100	196.2	18.968	18.320	17.662	17.046	13.795		19.078	-1.490	28.36	5.58	5.63E-07	-6.250
102	202.3	18.815	18.145	17.595	16.833	13.767		18.924	-1.630	28.21	5.56	3.93E-07	-6.406
104	211.5	18.661	17.967	17.534	16.622	13.736		18.770	-1.764	28.03	5.57	2.74E-07	-6.562
106	224.7	18.507	17.785	17.473	16.414	13.701		18.618	-1.890	27.81	5.60	1.92E-07	-6.717
108	242.6	18.355	17.600	17.409	16.211	13.663		18.468	-2.007	27.57	5.68	1.34E-07	-6.872
110	265.6	18.206	17.414	17.338	16.016	13.623		18.321	-2.114	27.32	5.89	9.51E-08	-7.022
115	339.9	17.868	16.987	17.144	15.579	13.524		17.990	-2.338	26.74	7.10	4.34E-08	-7.362
120	422.7	17.591	16.663	16.959	15.224	13.439		17.723	-2.511	26.33	8.85	2.31E-08	-7.636
125	508.4	17.362	16.408	16.796	14.932	13.368		17.504	-2.650	26.01	10.58	1.38E-08	-7.861
130	595.3	17.168	16.196	16.656	14.685	13.308		17.320	-2.765	25.73	12.47	8.92E-09	-8.049
135	681.7	17.001	16.014	16.536	14.472	13.256		17.162	-2.864	25.48	14.40	6.15E-09	-8.211
140	767.4	16.855	15.854	16.430	14.285	13.210		17.025	-2.950	25.25	16.37	4.44E-09	-8.353
145	851.8	16.725	15.711	16.336	14.119	13.170		16.903	-3.026	25.03	18.37	3.33E-09	-8.478
150	934.4	16.608	15.583	16.252	13.969	13.134	10.964	16.795	-3.095	24.83	20.42	2.57E-09	-8.590
155	1015.0	16.502	15.467	16.176	13.833	13.102	10.905	16.697	-3.157	24.64	22.51	2.04E-09	-8.691
160	1093.0	16.405	15.361	16.107	13.708	13.073	10.851	16.608	-3.213	24.46	24.65	1.65E-09	-8.783
170	1240.1	16.233	15.173	15.985	13.487	13.022	10.761	16.452	-3.315	24.12	29.06	1.13E-09	-8.946
180	1373.2	16.085	15.010	15.882	13.294	12.980	10.687	16.319	-3.404	23.82	33.62	8.23E-10	-9.084
190	1491.3	15.954	14.866	15.792	13.123	12.944	10.626	16.203	-3.484	23.53	38.28	6.23E-10	-9.205
200	1594.2	15.838	14.737	15.713	12.970	12.914	10.563	16.101	-3.557	23.26	42.97	4.87E-10	-9.312
210	1682.5	15.732	14.620	15.643	12.829	12.887	10.519	16.009	-3.625	23.00	47.52	3.90E-10	-9.408
220	1757.6	15.635	14.511	15.579	12.699	12.864	10.480	15.927	-3.688	22.76	51.94	3.19E-10	-9.496
230	1821.1	15.545	14.411	15.521	12.577	12.844	10.447	15.851	-3.749	22.52	56.12	2.65E-10	-9.576
240	1874.6	15.460	14.316	15.467	12.461	12.826	10.419	15.781	-3.806	22.29	60.06	2.23E-10	-9.651
250	1919.6	15.380	14.225	15.417	12.351	12.810	10.393	15.715	-3.862	22.07	63.70	1.90E-10	-9.721
260	1957.5	15.303	14.139	15.369	12.245	12.795	10.371	15.653	-3.916	21.85	67.09	1.63E-10	-9.788
270	1989.5	15.229	14.055	15.324	12.142	12.781	10.351	15.594	-3.968	21.64	70.19	1.41E-10	-9.851
280	2016.5	15.157	13.974	15.280	12.043	12.768	10.333	15.537	-4.018	21.43	73.08	1.23E-10	-9.911
290	2039.4	15.088	13.895	15.239	11.945	12.755	10.317	15.483	-4.067	21.23	75.72	1.07E-10	-9.970
300	2058.9	15.020	13.818	15.198	11.850	12.744	10.302	15.431	-4.116	21.03	78.20	9.41E-11	-10.026
310	2075.5	14.953	13.742	15.158	11.756	12.732	10.289	15.380	-4.163	20.84	80.49	8.30E-11	-10.081
320	2089.8	14.887	13.668	15.120	11.664	12.722	10.277	15.331	-4.209	20.65	82.65	7.34E-11	-10.134
330	2102.0	14.823	13.594	15.082	11.573	12.711	10.266	15.283	-4.255	20.47	84.67	6.51E-11	-10.186
340	2112.6	14.759	13.522	15.044	11.484	12.701	10.256	15.236	-4.299	20.29	86.61	5.80E-11	-10.237
350	2121.8	14.696	13.451	15.008	11.395	12.691	10.246	15.190	-4.343	20.11	88.44	5.17E-11	-10.286
360	2129.8	14.634	13.380	14.971	11.307	12.682	10.237	15.145	-4.387	19.94	90.20	4.62E-11	-10.335
370	2136.8	14.573	13.310	14.936	11.219	12.672	10.229	15.101	-4.429	19.78	91.90	4.14E-11	-10.383
380	2142.9	14.512	13.240	14.900	11.133	12.663	10.221	15.058	-4.471	19.61	93.52	3.72E-11	-10.430
390	2148.3	14.451	13.171	14.865	11.047	12.654	10.214	15.015	-4.513	19.46	95.11	3.34E-11	-10.476
400	2153.0	14.391	13.103	14.831	10.962	12.645	10.207	14.973	-4.554	19.30	96.64	3.01E-11	-10.521

Table 10. (Cont.)

EXOSPHERIC TEMPERATURE = 2200 K

HEIGHT KM	TEMP K	LOG(N(N2) /M3)	LOG(N(O2) /M3)	LOG(N(O) /M3)	LOG(N(A) /M3)	LOG(N(HE) /M3)	LOG(N(H) /M3)	LOG(N /M3)	LOG (PRESSURE NT/M2)	MEAN MCL WT	DENSITY SCALE HT KM	DENSITY KG/M3	LOG(DEN KG/M3)
420	2161.0	14.272	12.967	14.762	10.793	12.627	10.195	14.891	-4.634	19.01	99.62	2.46E-11	-10.609
440	2167.2	14.154	12.833	14.694	10.626	12.609	10.184	14.812	-4.712	18.74	102.47	2.02E-11	-10.695
460	2172.3	14.038	12.700	14.627	10.460	12.592	10.174	14.734	-4.789	18.48	105.23	1.66E-11	-10.779
480	2176.3	13.923	12.568	14.561	10.296	12.575	10.166	14.658	-4.864	18.24	107.91	1.38E-11	-10.861
500	2179.6	13.808	12.438	14.496	10.133	12.559	10.160	14.584	-4.938	18.01	110.49	1.15E-11	-10.940
520	2182.4	13.695	12.309	14.431	9.972	12.542	10.154	14.511	-5.010	17.80	113.01	9.60E-12	-11.018
540	2184.7	13.583	12.180	14.366	9.812	12.526	10.148	14.440	-5.080	17.61	115.46	8.06E-12	-11.094
560	2186.6	13.471	12.053	14.302	9.653	12.510	10.142	14.370	-5.150	17.43	117.83	6.79E-12	-11.168
580	2188.2	13.360	11.926	14.239	9.495	12.494	10.136	14.302	-5.218	17.25	120.13	5.74E-12	-11.241
600	2189.5	13.250	11.801	14.176	9.338	12.478	10.130	14.234	-5.286	17.09	122.37	4.86E-12	-11.313
620	2190.7	13.141	11.676	14.113	9.182	12.462	10.124	14.167	-5.352	16.94	124.53	4.14E-12	-11.383
640	2191.7	13.032	11.552	14.051	9.028	12.447	10.119	14.102	-5.417	16.80	126.64	3.53E-12	-11.452
660	2192.6	12.924	11.429	13.990	8.874	12.431	10.114	14.037	-5.482	16.67	128.68	3.02E-12	-11.521
680	2193.3	12.817	11.306	13.928	8.721	12.416	10.109	13.974	-5.545	16.54	130.66	2.59E-12	-11.588
700	2194.0	12.710	11.184	13.867	8.569	12.401	10.104	13.911	-5.608	16.41	132.57	2.22E-12	-11.654
720	2194.5	12.605	11.063	13.807	8.418	12.385	10.100	13.849	-5.669	16.29	134.43	1.91E-12	-11.719
740	2195.0	12.499	10.943	13.747	8.268	12.370	10.095	13.788	-5.730	16.18	136.24	1.65E-12	-11.783
760	2195.5	12.395	10.823	13.687	8.119	12.355	10.091	13.728	-5.791	16.06	138.00	1.43E-12	-11.846
780	2195.9	12.290	10.705	13.627	7.970	12.340	10.087	13.668	-5.850	15.95	139.72	1.23E-12	-11.909
800	2196.2	12.187	10.586	13.568	7.823	12.326	10.082	13.610	-5.909	15.84	141.40	1.07E-12	-11.970
820	2196.5	12.084	10.469	13.509	7.676	12.311	10.078	13.552	-5.967	15.73	143.03	9.30E-13	-12.032
840	2196.8	11.982	10.352	13.451	7.530	12.296	10.074	13.494	-6.024	15.61	144.64	8.09E-13	-12.092
860	2197.0	11.880	10.236	13.393	7.385	12.282	10.071	13.438	-6.080	15.50	146.22	7.05E-13	-12.152
880	2197.3	11.779	10.120	13.335	7.241	12.267	10.067	13.382	-6.136	15.38	147.79	6.16E-13	-12.211
900	2197.5	11.679	10.006	13.278	7.098	12.253	10.063	13.327	-6.191	15.26	149.35	5.38E-13	-12.269
920	2197.7	11.579	9.891	13.220	6.955	12.238	10.059	13.273	-6.245	15.13	150.90	4.71E-13	-12.327
940	2197.8	11.479	9.778	13.164	6.813	12.224	10.055	13.219	-6.299	15.00	152.45	4.13E-13	-12.384
960	2198.0	11.380	9.665	13.107	6.672	12.210	10.052	13.167	-6.351	14.86	154.01	3.62E-13	-12.441
980	2198.1	11.282	9.553	13.051	6.532	12.196	10.048	13.115	-6.403	14.72	155.57	3.18E-13	-12.497
1000	2198.2	11.184	9.441	12.995	6.393	12.182	10.044	13.064	-6.454	14.57	157.15	2.80E-13	-12.553
1050	2198.5	10.942	9.164	12.857	6.048	12.147	10.035	12.939	-6.578	14.17	161.16	2.05E-13	-12.689
1100	2198.7	10.703	8.892	12.721		12.113	10.026	12.820	-6.697	13.71	165.42	1.51E-13	-12.822
1150	2198.9	10.468	8.623	12.586		12.080	10.018	12.707	-6.811	13.21	170.00	1.12E-13	-12.952
1200	2199.0	10.235	8.357	12.453		12.046	10.009	12.600	-6.918	12.66	174.98	8.36E-14	-13.078
1250	2199.2	10.006	8.095	12.322		12.014	10.001	12.499	-7.019	12.06	180.55	6.31E-14	-13.200
1300	2199.3	9.780	7.836	12.193		11.981	9.993	12.404	-7.114	11.43	186.83	4.81E-14	-13.318
1350	2199.3	9.556	7.581	12.065		11.949	9.984	12.315	-7.203	10.78	193.96	3.70E-14	-13.432
1400	2199.4	9.336	7.329	11.939		11.918	9.976	12.233	-7.285	10.12	202.10	2.87E-14	-13.542
1450	2199.5	9.118	7.081	11.815		11.887	9.969	12.157	-7.361	9.47	211.49	2.25E-14	-13.647
1500	2199.5	8.903	6.835	11.692		11.856	9.961	12.086	-7.431	8.84	222.30	1.79E-14	-13.747
1600	2199.6	8.481	6.354	11.451		11.796	9.945	11.962	-7.555	7.68	248.96	1.17E-14	-13.932
1700	2199.7	8.070		11.216		11.737	9.931	11.857	-7.661	6.72	283.81	8.02E-15	-14.096
1800	2199.7	7.669		10.987		11.680	9.916	11.766	-7.751	5.96	327.84	5.77E-15	-14.238
1900	2199.8	7.277		10.764		11.624	9.902	11.687	-7.830	5.39	381.36	4.35E-15	-14.361
2000	2199.8	6.895		10.546		11.569	9.888	11.617	-7.901	4.97	443.03	3.41E-15	-14.467
2100	2199.8	6.522		10.333		11.516	9.875	11.553	-7.965	4.66	510.10	2.76E-15	-14.558
2200	2199.9	6.158		10.125		11.464	9.862	11.494	-8.024	4.45	579.31	2.30E-15	-14.638
2300	2199.9			9.921		11.413	9.849	11.438	-8.079	4.29	647.06	1.95E-15	-14.709
2400	2199.9			9.723		11.363	9.836	11.386	-8.132	4.18	710.49	1.69E-15	-14.773
2500	2199.9			9.529		11.315	9.824	11.335	-8.182	4.10	768.51	1.47E-15	-14.832

Table 10. (Cont.)

EXOSPHERIC TEMPERATURE = 2400 K

HEIGHT KM	TEMP K	LOG(N(N2) /M3)	LOG(N(O2) /M3)	LOG(N(O) /M3)	LOG(N(A) /M3)	LOG(N(HE) /M3)	LOG(N(H) /M3)	LOG(N - /M3)	LOG (PRESSURE NT/M2)	MEAN MOL WT	DENSITY SCALE HT KM	DENSITY KG/M3	LOG(DEN KG/M3)
90	188.0	19.746	19.170	17.390	17.824	14.573		19.854	-.732	28.91	5.63	3.43E-06	-5.465
92	188.2	19.592	19.009	17.547	17.669	14.418		19.700	-.886	28.85	5.58	2.40E-06	-5.620
94	188.8	19.436	18.843	17.645	17.514	14.263		19.544	-1.040	28.76	5.53	1.67E-06	-5.776
96	190.1	19.280	18.671	17.685	17.358	14.107		19.389	-1.192	28.65	5.50	1.16E-06	-5.934
98	192.5	19.124	18.497	17.685	17.202	13.951		19.233	-1.343	28.52	5.50	8.09E-07	-6.092
100	196.5	18.968	18.320	17.662	17.046	13.795		19.077	-1.489	28.36	5.57	5.63E-07	-6.250
102	202.8	18.815	18.144	17.594	16.833	13.766		18.923	-1.630	28.21	5.55	3.93E-07	-6.406
104	212.3	18.661	17.966	17.533	16.622	13.735		18.770	-1.763	28.03	5.56	2.74E-07	-6.562
106	225.9	18.507	17.785	17.472	16.414	13.700		18.617	-1.889	27.81	5.59	1.91E-07	-6.718
108	244.4	18.354	17.599	17.407	16.211	13.662		18.467	-2.005	27.57	5.68	1.34E-07	-6.873
110	268.1	18.205	17.413	17.336	16.016	13.621		18.320	-2.111	27.32	5.89	9.48E-08	-7.023
115	344.8	17.868	16.988	17.141	15.581	13.521		17.990	-2.333	26.75	7.12	4.34E-08	-7.363
120	430.4	17.592	16.665	16.956	15.229	13.436		17.724	-2.502	26.35	8.91	2.32E-08	-7.635
125	518.8	17.365	16.413	16.794	14.939	13.364		17.506	-2.639	26.03	10.67	1.39E-08	-7.858
130	608.5	17.173	16.203	16.655	14.695	13.304		17.323	-2.752	25.76	12.59	9.01E-09	-8.045
135	698.0	17.008	16.022	16.535	14.485	13.252		17.167	-2.849	25.52	14.54	6.23E-09	-8.206
140	786.9	16.863	15.864	16.430	14.301	13.206		17.031	-2.933	25.29	16.53	4.51E-09	-8.346
145	875.0	16.734	15.724	16.337	14.137	13.166		16.911	-3.007	25.08	18.54	3.39E-09	-8.470
150	961.8	16.619	15.597	16.253	13.989	13.130	10.887	16.803	-3.074	24.89	20.60	2.63E-09	-8.581
155	1047.0	16.514	15.483	16.177	13.855	13.097	10.827	16.706	-3.134	24.71	22.69	2.08E-09	-8.681
160	1130.3	16.418	15.378	16.108	13.733	13.068	10.774	16.617	-3.189	24.53	24.83	1.69E-09	-8.773
170	1289.4	16.248	15.192	15.987	13.515	13.016	10.683	16.462	-3.287	24.21	29.27	1.17E-09	-8.934
180	1436.1	16.101	15.031	15.883	13.326	12.973	10.609	16.330	-3.373	23.92	33.92	8.48E-10	-9.071
190	1568.5	15.973	14.890	15.793	13.159	12.936	10.547	16.215	-3.450	23.65	38.72	6.44E-10	-9.191
200	1685.5	15.858	14.764	15.714	13.009	12.905	10.483	16.114	-3.519	23.40	43.64	5.05E-10	-9.297
210	1787.3	15.755	14.650	15.645	12.873	12.878	10.438	16.024	-3.584	23.16	48.51	4.06E-10	-9.391
220	1874.6	15.661	14.545	15.582	12.748	12.855	10.399	15.943	-3.644	22.93	53.31	3.34E-10	-9.476
230	1949.1	15.574	14.448	15.525	12.631	12.834	10.365	15.869	-3.701	22.71	57.91	2.79E-10	-9.555
240	2012.1	15.493	14.358	15.473	12.521	12.816	10.335	15.801	-3.755	22.49	62.29	2.36E-10	-9.627
250	2065.3	15.417	14.272	15.424	12.417	12.800	10.310	15.737	-3.808	22.29	66.37	2.02E-10	-9.694
260	2110.3	15.344	14.190	15.379	12.317	12.785	10.287	15.678	-3.858	22.08	70.18	1.75E-10	-9.758
270	2148.3	15.274	14.111	15.335	12.221	12.771	10.266	15.621	-3.907	21.89	73.67	1.52E-10	-9.818
280	2180.5	15.207	14.035	15.294	12.127	12.758	10.248	15.567	-3.954	21.69	76.93	1.33E-10	-9.876
290	2207.8	15.141	13.961	15.255	12.037	12.747	10.232	15.516	-4.000	21.50	79.89	1.17E-10	-9.931
300	2231.1	15.078	13.889	15.216	11.948	12.735	10.217	15.466	-4.045	21.32	82.67	1.04E-10	-9.985
310	2251.0	15.016	13.819	15.179	11.861	12.725	10.203	15.418	-4.089	21.14	85.21	9.19E-11	-10.037
320	2268.0	14.955	13.750	15.143	11.775	12.714	10.190	15.372	-4.133	20.96	87.61	8.19E-11	-10.087
330	2282.7	14.895	13.682	15.108	11.691	12.704	10.179	15.326	-4.175	20.79	89.84	7.32E-11	-10.136
340	2295.4	14.836	13.615	15.073	11.608	12.695	10.168	15.282	-4.217	20.62	91.96	6.55E-11	-10.184
350	2306.4	14.778	13.549	15.039	11.526	12.686	10.158	15.239	-4.258	20.45	93.94	5.89E-11	-10.230
360	2316.0	14.720	13.483	15.005	11.445	12.676	10.149	15.197	-4.299	20.29	95.84	5.30E-11	-10.276
370	2324.3	14.663	13.418	14.972	11.364	12.668	10.141	15.155	-4.339	20.13	97.67	4.78E-11	-10.321
380	2331.6	14.607	13.354	14.939	11.285	12.659	10.133	15.114	-4.378	19.97	99.41	4.32E-11	-10.365
390	2338.1	14.551	13.291	14.907	11.205	12.650	10.125	15.074	-4.417	19.82	101.10	3.91E-11	-10.408
400	2343.7	14.496	13.228	14.875	11.127	12.642	10.118	15.035	-4.455	19.67	102.72	3.54E-11	-10.451

Table 10. (Cont.)

EXOSPHERIC TEMPERATURE = 2400 K

HEIGHT KM	TEMP K	LOG(N(N2) /M3)	LOG(N(O2) /M3)	LOG(N(O) /M3)	LOG(N(A) /M3)	LOG(N(HE) /M3)	LOG(N(H) /M3)	LOG(N /M3)	LOG (PRESSURE NT/M2)	MEAN MOL WT	DENSITY SCALE HT KM	DENSITY KG/M3	LOG(DEN KG/M3)
420	2353.2	14.386	13.103	14.811	10.971	12.625	10.105	14.958	-4.530	19.39	105.87	2.92E-11	-10.534
440	2360.8	14.278	12.979	14.749	10.818	12.609	10.094	14.883	-4.604	19.12	108.88	2.43E-11	-10.615
460	2366.8	14.171	12.857	14.687	10.666	12.594	10.083	14.810	-4.675	18.86	111.77	2.02E-11	-10.694
480	2371.6	14.065	12.736	14.627	10.515	12.578	10.076	14.739	-4.746	18.62	114.58	1.70E-11	-10.771
500	2375.6	13.960	12.617	14.566	10.366	12.563	10.069	14.670	-4.814	18.39	117.30	1.43E-11	-10.845
520	2378.9	13.856	12.498	14.507	10.217	12.547	10.063	14.602	-4.882	18.18	119.97	1.21E-11	-10.919
540	2381.6	13.753	12.380	14.447	10.070	12.532	10.057	14.535	-4.948	17.98	122.58	1.02E-11	-10.990
560	2383.9	13.650	12.263	14.389	9.925	12.518	10.051	14.469	-5.013	17.79	125.12	8.70E-12	-11.060
580	2385.8	13.549	12.147	14.330	9.780	12.503	10.045	14.405	-5.077	17.61	127.59	7.43E-12	-11.129
600	2387.5	13.448	12.032	14.273	9.636	12.488	10.039	14.342	-5.140	17.44	130.02	6.36E-12	-11.197
620	2388.9	13.347	11.917	14.215	9.493	12.474	10.033	14.279	-5.202	17.29	132.40	5.46E-12	-11.263
640	2390.1	13.248	11.803	14.158	9.351	12.460	10.028	14.218	-5.264	17.14	134.71	4.70E-12	-11.328
660	2391.1	13.149	11.690	14.102	9.210	12.445	10.023	14.158	-5.324	17.00	136.94	4.06E-12	-11.392
680	2392.0	13.050	11.578	14.045	9.070	12.431	10.018	14.098	-5.383	16.86	139.13	3.51E-12	-11.455
700	2392.8	12.953	11.466	13.990	8.930	12.417	10.014	14.039	-5.442	16.74	141.25	3.04E-12	-11.517
720	2393.4	12.855	11.355	13.934	8.792	12.403	10.009	13.982	-5.499	16.62	143.33	2.64E-12	-11.578
740	2394.0	12.759	11.245	13.879	8.654	12.389	10.005	13.924	-5.556	16.50	145.36	2.30E-12	-11.638
760	2394.6	12.663	11.135	13.824	8.517	12.376	10.000	13.868	-5.613	16.39	147.34	2.01E-12	-11.697
780	2395.0	12.567	11.026	13.769	8.381	12.362	9.996	13.812	-5.668	16.28	149.28	1.75E-12	-11.756
800	2395.5	12.473	10.918	13.715	8.246	12.348	9.992	13.757	-5.723	16.18	151.19	1.54E-12	-11.814
820	2395.8	12.378	10.810	13.661	8.111	12.335	9.988	13.703	-5.777	16.07	153.01	1.35E-12	-11.871
840	2396.2	12.284	10.703	13.608	7.978	12.321	9.985	13.649	-5.831	15.97	154.80	1.18E-12	-11.927
860	2396.5	12.191	10.597	13.554	7.845	12.308	9.981	13.596	-5.884	15.87	156.57	1.04E-12	-11.983
880	2396.7	12.099	10.491	13.501	7.713	12.295	9.977	13.544	-5.936	15.76	158.30	9.16E-13	-12.038
900	2397.0	12.006	10.385	13.449	7.581	12.282	9.974	13.492	-5.988	15.66	160.01	8.08E-13	-12.093
920	2397.2	11.915	10.281	13.396	7.450	12.268	9.970	13.441	-6.039	15.56	161.70	7.13E-13	-12.147
940	2397.4	11.824	10.177	13.344	7.320	12.255	9.967	13.391	-6.089	15.45	163.37	6.31E-13	-12.200
960	2397.6	11.733	10.073	13.293	7.191	12.242	9.963	13.341	-6.139	15.34	165.03	5.58E-13	-12.253
980	2397.7	11.643	9.970	13.241	7.063	12.230	9.960	13.292	-6.188	15.23	166.68	4.95E-13	-12.305
1000	2397.9	11.553	9.868	13.190	6.935	12.217	9.956	13.243	-6.237	15.11	168.33	4.39E-13	-12.357
1050	2398.2	11.331	9.614	13.063	6.618	12.185	9.948	13.125	-6.356	14.81	172.42	3.28E-13	-12.485
1100	2398.5	11.112	9.364	12.938	6.306	12.154	9.940	13.010	-6.470	14.47	176.60	2.46E-13	-12.609
1150	2398.7	10.896	9.117	12.815		12.123	9.932	12.900	-6.580	14.10	180.92	1.86E-13	-12.731
1200	2398.8	10.683	8.874	12.693		12.092	9.924	12.794	-6.686	13.69	185.41	1.42E-13	-12.849
1250	2399.0	10.473	8.634	12.573		12.062	9.916	12.693	-6.787	13.24	190.24	1.08E-13	-12.965
1300	2399.1	10.265	8.397	12.454		12.033	9.908	12.597	-6.883	12.75	195.46	8.37E-14	-13.077
1350	2399.2	10.061	8.163	12.337		12.003	9.901	12.505	-6.975	12.23	201.16	6.50E-14	-13.187
1400	2399.3	9.858	7.932	12.222		11.975	9.894	12.419	-7.061	11.68	207.43	5.09E-14	-13.293
1450	2399.4	9.659	7.704	12.108		11.946	9.886	12.338	-7.142	11.11	214.45	4.02E-14	-13.396
1500	2399.4	9.462	7.479	11.995		11.918	9.879	12.262	-7.218	10.52	222.31	3.19E-14	-13.496
1600	2399.6	9.075	7.037	11.775		11.863	9.865	12.125	-7.355	9.37	241.10	2.07E-14	-13.684
1700	2399.6	8.698	6.607	11.559		11.809	9.851	12.006	-7.474	8.28	265.16	1.39E-14	-13.856
1800	2399.7	8.331	6.187	11.349		11.756	9.838	11.904	-7.576	7.33	295.64	9.75E-15	-14.011
1900	2399.7	7.972		11.144		11.705	9.825	11.815	-7.665	6.54	333.85	7.09E-15	-14.149
2000	2399.8	7.622		10.944		11.655	9.813	11.737	-7.742	5.90	380.42	5.35E-15	-14.271
2100	2399.8	7.280		10.749		11.606	9.800	11.668	-7.811	5.41	435.20	4.18E-15	-14.378
2200	2399.8	6.946		10.558		11.558	9.788	11.606	-7.873	5.03	497.42	3.38E-15	-14.472
2300	2399.9	6.620		10.372		11.512	9.776	11.549	-7.930	4.75	565.00	2.79E-15	-14.554
2400	2399.9	6.301		10.190		11.466	9.765	11.497	-7.983	4.54	635.24	2.37E-15	-14.626
2500	2399.9			10.012		11.422	9.754	11.447	-8.033	4.38	705.68	2.04E-15	-14.691

Table 10. (Cont.)

EXOSPHERIC TEMPERATURE = 2600 K

HEIGHT KM	TEMP K	LOG(N(N2) /M3)	LOG(N(O2) /M3)	LOG(N(O) /M3)	LOG(N(A) /M3)	LOG(N(HE) /M3)	LOG(N(H) /M3)	LOG(N /M3)	LOG (PRESSURE NT/M2)	MEAN MCL WT	DENSITY SCALE HT KM	DENSITY KG/M3	LOG(DEN KG/M3)
90	188.0	19.746	19.170	17.390	17.824	14.573		19.854	-.732	28.91	5.63	3.43E-06	-5.465
92	188.2	19.592	19.009	17.547	17.669	14.418		19.700	-.886	28.85	5.58	2.40E-06	-5.620
94	188.8	19.436	18.843	17.645	17.514	14.263		19.544	-1.040	28.76	5.53	1.67E-06	-5.777
96	190.2	19.280	18.671	17.685	17.358	14.107		19.389	-1.192	28.65	5.50	1.16E-06	-5.934
98	192.6	19.124	18.497	17.685	17.202	13.951		19.233	-1.343	28.52	5.49	8.09E-07	-6.092
100	196.7	18.968	18.320	17.661	17.045	13.794		19.077	-1.489	28.36	5.57	5.62E-07	-6.250
102	203.2	18.814	18.144	17.593	16.833	13.766		18.923	-1.629	28.21	5.55	3.92E-07	-6.406
104	213.0	18.660	17.966	17.532	16.622	13.734		18.769	-1.762	28.03	5.56	2.74E-07	-6.563
106	227.0	18.506	17.784	17.471	16.413	13.699		18.616	-1.888	27.81	5.59	1.91E-07	-6.719
108	246.0	18.353	17.599	17.405	16.211	13.660		18.466	-2.003	27.58	5.68	1.34E-07	-6.873
110	270.4	18.205	17.413	17.334	16.016	13.619		18.319	-2.109	27.32	5.89	9.47E-08	-7.024
115	349.4	17.867	16.988	17.139	15.583	13.518		17.989	-2.328	26.76	7.14	4.33E-08	-7.363
120	437.3	17.593	16.667	16.954	15.233	13.432		17.724	-2.495	26.36	8.96	2.32E-08	-7.635
125	528.3	17.367	16.417	16.792	14.946	13.361		17.508	-2.629	26.06	10.74	1.39E-08	-7.856
130	620.7	17.177	16.208	16.654	14.705	13.300		17.327	-2.741	25.79	12.70	9.08E-09	-8.042
135	712.9	17.014	16.030	16.535	14.497	13.248		17.172	-2.835	25.55	14.67	6.30E-09	-8.201
140	804.7	16.870	15.874	16.430	14.315	13.203		17.037	-2.918	25.33	16.67	4.58E-09	-8.340
145	896.1	16.743	15.735	16.337	14.153	13.162		16.917	-2.990	25.13	18.69	3.45E-09	-8.462
150	986.7	16.628	15.610	16.254	14.007	13.126	10.817	16.810	-3.056	24.94	20.76	2.68E-09	-8.573
155	1076.1	16.524	15.496	16.178	13.875	13.093	10.758	16.714	-3.114	24.76	22.85	2.13E-09	-8.672
160	1164.2	16.429	15.392	16.109	13.754	13.063	10.705	16.626	-3.168	24.60	25.00	1.73E-09	-8.763
170	1334.3	16.260	15.208	15.988	13.539	13.011	10.613	16.471	-3.264	24.29	29.44	1.19E-09	-8.923
180	1493.8	16.115	15.050	15.884	13.353	12.967	10.538	16.339	-3.346	24.01	34.13	8.71E-10	-9.060
190	1639.9	15.988	14.910	15.794	13.189	12.929	10.475	16.225	-3.420	23.75	39.04	6.62E-10	-9.179
200	1771.0	15.876	14.786	15.715	13.043	12.897	10.411	16.125	-3.487	23.51	44.13	5.20E-10	-9.284
210	1886.3	15.775	14.675	15.646	12.910	12.870	10.364	16.036	-3.548	23.29	49.28	4.20E-10	-9.377
220	1986.1	15.683	14.573	15.584	12.789	12.846	10.325	15.956	-3.606	23.07	54.42	3.46E-10	-9.461
230	2071.9	15.599	14.480	15.528	12.677	12.825	10.290	15.884	-3.660	22.87	59.41	2.90E-10	-9.537
240	2144.9	15.520	14.392	15.476	12.571	12.807	10.260	15.817	-3.711	22.67	64.21	2.47E-10	-9.607
250	2207.0	15.447	14.310	15.429	12.472	12.790	10.234	15.756	-3.761	22.47	68.72	2.13E-10	-9.673
260	2259.5	15.377	14.232	15.385	12.377	12.775	10.211	15.698	-3.808	22.28	72.96	1.85E-10	-9.734
270	2303.9	15.311	14.157	15.343	12.286	12.762	10.190	15.644	-3.854	22.10	76.86	1.62E-10	-9.792
280	2341.7	15.247	14.086	15.304	12.198	12.749	10.171	15.592	-3.898	21.92	80.50	1.42E-10	-9.847
290	2373.8	15.185	14.016	15.266	12.112	12.738	10.154	15.543	-3.942	21.74	83.81	1.26E-10	-9.900
300	2401.1	15.125	13.948	15.230	12.029	12.727	10.139	15.495	-3.984	21.57	86.91	1.12E-10	-9.951
310	2424.5	15.067	13.882	15.195	11.948	12.717	10.125	15.450	-4.026	21.40	89.74	1.00E-10	-10.000
320	2444.5	15.010	13.818	15.161	11.868	12.707	10.112	15.405	-4.067	21.23	92.40	8.96E-11	-10.048
330	2461.8	14.954	13.754	15.127	11.789	12.697	10.100	15.362	-4.106	21.07	94.84	8.05E-11	-10.094
340	2476.7	14.899	13.691	15.095	11.712	12.688	10.089	15.320	-4.146	20.91	97.16	7.26E-11	-10.139
350	2489.7	14.845	13.630	15.063	11.636	12.679	10.079	15.279	-4.184	20.75	99.32	6.56E-11	-10.183
360	2501.0	14.791	13.569	15.031	11.560	12.671	10.070	15.239	-4.222	20.59	101.39	5.93E-11	-10.227
370	2510.8	14.738	13.509	15.000	11.485	12.662	10.061	15.200	-4.260	20.44	103.35	5.38E-11	-10.269
380	2519.4	14.686	13.449	14.970	11.411	12.654	10.053	15.162	-4.297	20.29	105.20	4.89E-11	-10.311
390	2527.0	14.634	13.390	14.940	11.338	12.646	10.045	15.124	-4.333	20.15	107.00	4.45E-11	-10.352
400	2533.7	14.583	13.332	14.910	11.265	12.638	10.038	15.087	-4.369	20.00	108.73	4.06E-11	-10.392

Table 10. (Cont.)

EXOSPHERIC TEMPERATURE = 2600 K

HEIGHT KM	TEMP K	LOG(N(N2) /M3)	LOG(N(O2) /M3)	LOG(N(O) /M3)	LOG(N(A) /M3)	LOG(N(HE) /M3)	LOG(N(H) /M3)	LOG(N /M3)	LOG (PRESSURE NT/M2)	MEAN MCL WT	DENSITY SCALE HT KM	DENSITY KG/M3	LOG(DEN KG/M3)
420	2544.9	14.481	13.216	14.851	11.121	12.623	10.024	15.014	-4.440	19.73	112.06	3.38E-11	-10.471
440	2553.7	14.381	13.101	14.793	10.979	12.608	10.012	14.944	-4.509	19.46	115.21	2.84E-11	-10.547
460	2560.8	14.282	12.988	14.736	10.838	12.593	10.002	14.875	-4.577	19.21	118.23	2.39E-11	-10.621
480	2566.6	14.184	12.877	14.680	10.698	12.579	9.994	14.808	-4.643	18.97	121.16	2.02E-11	-10.694
500	2571.3	14.086	12.766	14.624	10.560	12.564	9.987	14.742	-4.708	18.75	124.02	1.72E-11	-10.765
520	2575.1	13.990	12.656	14.569	10.423	12.550	9.982	14.678	-4.771	18.53	126.82	1.47E-11	-10.834
540	2578.3	13.895	12.547	14.514	10.287	12.536	9.975	14.615	-4.834	18.33	129.53	1.25E-11	-10.902
560	2581.0	13.800	12.439	14.460	10.153	12.523	9.969	14.553	-4.895	18.13	132.21	1.08E-11	-10.968
580	2583.3	13.706	12.332	14.406	10.019	12.509	9.963	14.492	-4.955	17.95	134.83	9.26E-12	-11.033
600	2585.2	13.613	12.225	14.352	9.886	12.495	9.957	14.433	-5.015	17.78	137.41	8.00E-12	-11.097
620	2586.9	13.520	12.119	14.299	9.754	12.482	9.951	14.374	-5.073	17.62	139.95	6.92E-12	-11.160
640	2588.3	13.428	12.014	14.247	9.623	12.469	9.946	14.316	-5.131	17.46	142.43	6.01E-12	-11.221
660	2589.5	13.337	11.910	14.194	9.492	12.456	9.941	14.260	-5.187	17.32	144.83	5.23E-12	-11.282
680	2590.5	13.246	11.806	14.142	9.363	12.443	9.936	14.204	-5.243	17.18	147.21	4.56E-12	-11.341
700	2591.5	13.155	11.703	14.091	9.234	12.430	9.931	14.148	-5.298	17.05	149.55	3.98E-12	-11.400
720	2592.3	13.066	11.600	14.039	9.106	12.417	9.927	14.094	-5.352	16.92	151.83	3.49E-12	-11.457
740	2593.0	12.977	11.498	13.988	8.979	12.404	9.922	14.040	-5.406	16.80	154.06	3.06E-12	-11.514
760	2593.6	12.888	11.397	13.938	8.853	12.391	9.918	13.987	-5.459	16.69	156.23	2.69E-12	-11.570
780	2594.2	12.800	11.297	13.887	8.727	12.379	9.914	13.935	-5.511	16.58	158.36	2.37E-12	-11.625
800	2594.6	12.712	11.197	13.837	8.602	12.366	9.910	13.883	-5.563	16.48	160.49	2.09E-12	-11.680
820	2595.1	12.625	11.097	13.787	8.478	12.354	9.907	13.832	-5.614	16.37	162.52	1.85E-12	-11.734
840	2595.5	12.539	10.998	13.738	8.355	12.341	9.903	13.781	-5.664	16.28	164.50	1.63E-12	-11.787
860	2595.8	12.452	10.900	13.689	8.232	12.329	9.900	13.732	-5.714	16.18	166.46	1.45E-12	-11.839
880	2596.1	12.367	10.802	13.640	8.110	12.317	9.896	13.682	-5.763	16.08	168.38	1.28E-12	-11.891
900	2596.4	12.282	10.705	13.591	7.989	12.304	9.893	13.634	-5.812	15.99	170.27	1.14E-12	-11.942
920	2596.7	12.197	10.608	13.543	7.868	12.292	9.889	13.585	-5.860	15.89	172.13	1.02E-12	-11.993
940	2596.9	12.113	10.512	13.495	7.748	12.280	9.886	13.538	-5.908	15.80	173.97	9.05E-13	-12.043
960	2597.1	12.029	10.417	13.447	7.629	12.268	9.883	13.491	-5.955	15.71	175.78	8.07E-13	-12.093
980	2597.3	11.946	10.321	13.399	7.510	12.256	9.879	13.444	-6.001	15.61	177.57	7.21E-13	-12.142
1000	2597.5	11.863	10.227	13.352	7.392	12.245	9.876	13.398	-6.047	15.51	179.35	6.44E-13	-12.191
1050	2597.9	11.658	9.993	13.235	7.100	12.215	9.868	13.286	-6.160	15.27	183.70	4.89E-13	-12.311
1100	2598.2	11.456	9.762	13.120	6.812	12.186	9.860	13.176	-6.269	15.00	188.05	3.74E-13	-12.427
1150	2598.4	11.257	9.534	13.006	6.527	12.158	9.853	13.071	-6.375	14.71	192.42	2.87E-13	-12.542
1200	2598.6	11.060	9.310	12.893	6.247	12.130	9.845	12.968	-6.477	14.40	196.85	2.22E-13	-12.653
1250	2598.8	10.866	9.088	12.783		12.102	9.838	12.870	-6.575	14.06	201.44	1.73E-13	-12.762
1300	2599.0	10.675	8.869	12.673		12.075	9.831	12.775	-6.670	13.69	206.24	1.35E-13	-12.869
1350	2599.1	10.485	8.653	12.565		12.048	9.824	12.684	-6.761	13.28	211.30	1.06E-13	-12.973
1400	2599.2	10.299	8.440	12.459		12.021	9.817	12.597	-6.848	12.85	216.67	8.43E-14	-13.074
1450	2599.3	10.115	8.230	12.353		11.995	9.811	12.514	-6.931	12.39	222.52	6.71E-14	-13.173
1500	2599.3	9.933	8.022	12.249		11.969	9.804	12.435	-7.010	11.90	228.87	5.38E-14	-13.269
1600	2599.5	9.576	7.614	12.046		11.918	9.791	12.290	-7.155	10.88	243.43	3.52E-14	-13.454
1700	2599.6	9.228	7.217	11.847		11.868	9.778	12.161	-7.284	9.84	261.31	2.37E-14	-13.626
1800	2599.6	8.889	6.829	11.653		11.819	9.766	12.048	-7.397	8.84	283.33	1.64E-14	-13.786
1900	2599.7	8.557	6.451	11.464		11.772	9.754	11.949	-7.496	7.92	310.66	1.17E-14	-13.932
2000	2599.7	8.234	6.081	11.279		11.726	9.742	11.862	-7.583	7.12	344.23	8.61E-15	-14.065
2100	2599.8	7.918		11.099		11.681	9.731	11.786	-7.659	6.45	384.77	6.54E-15	-14.185
2200	2599.8	7.610		10.923		11.637	9.720	11.718	-7.727	5.90	432.94	5.11E-15	-14.291
2300	2599.8	7.309		10.751		11.594	9.709	11.657	-7.788	5.46	488.55	4.11E-15	-14.386
2400	2599.9	7.015		10.583		11.552	9.698	11.601	-7.844	5.12	550.69	3.39E-15	-14.469
2500	2599.9	6.727		10.419		11.511	9.688	11.550	-7.895	4.85	618.30	2.86E-15	-14.544

Table 11. Summary of log densities from Table 10.

HEIGHT KM	EXOSPHERIC TEMPERATURE (K) 500	550	600	650	700	800	900	1000	1100	1200
90	-5.465	-5.465	-5.465	-5.465	-5.465	-5.465	-5.465	-5.465	-5.465	-5.465
92	-5.620	-5.620	-5.620	-5.620	-5.620	-5.620	-5.620	-5.620	-5.620	-5.620
94	-5.776	-5.776	-5.776	-5.776	-5.776	-5.776	-5.776	-5.776	-5.776	-5.776
96	-5.932	-5.932	-5.932	-5.932	-5.932	-5.933	-5.933	-5.933	-5.933	-5.933
98	-6.088	-6.088	-6.089	-6.089	-6.089	-6.089	-6.090	-6.090	-6.090	-6.090
100	-6.243	-6.244	-6.244	-6.245	-6.245	-6.246	-6.246	-6.247	-6.247	-6.247
102	-6.397	-6.397	-6.398	-6.398	-6.399	-6.400	-6.400	-6.401	-6.402	-6.402
104	-6.549	-6.550	-6.551	-6.552	-6.552	-6.554	-6.555	-6.556	-6.556	-6.557
106	-6.702	-6.703	-6.704	-6.705	-6.706	-6.707	-6.708	-6.710	-6.711	-6.712
108	-6.853	-6.854	-6.856	-6.857	-6.858	-6.860	-6.861	-6.862	-6.864	-6.865
110	-7.002	-7.004	-7.005	-7.006	-7.007	-7.009	-7.011	-7.012	-7.014	-7.015
115	-7.355	-7.355	-7.356	-7.356	-7.356	-7.357	-7.357	-7.358	-7.358	-7.359
120	-7.664	-7.661	-7.658	-7.656	-7.654	-7.651	-7.648	-7.646	-7.645	-7.643
125	-7.935	-7.927	-7.920	-7.915	-7.910	-7.902	-7.895	-7.890	-7.885	-7.882
130	-8.175	-8.161	-8.150	-8.140	-8.132	-8.118	-8.107	-8.098	-8.091	-8.085
135	-8.386	-8.366	-8.350	-8.337	-8.325	-8.306	-8.291	-8.279	-8.269	-8.260
140	-8.573	-8.547	-8.527	-8.509	-8.495	-8.471	-8.452	-8.436	-8.424	-8.413
145	-8.742	-8.710	-8.685	-8.664	-8.645	-8.616	-8.594	-8.576	-8.561	-8.548
150	-8.898	-8.860	-8.829	-8.804	-8.782	-8.748	-8.722	-8.701	-8.684	-8.669
155	-9.044	-8.999	-8.963	-8.933	-8.908	-8.868	-8.838	-8.814	-8.795	-8.778
160	-9.182	-9.130	-9.089	-9.054	-9.026	-8.980	-8.945	-8.918	-8.897	-8.878
170	-9.440	-9.375	-9.322	-9.278	-9.241	-9.183	-9.140	-9.106	-9.079	-9.056
180	-9.679	-9.601	-9.537	-9.484	-9.439	-9.368	-9.314	-9.273	-9.240	-9.213
190	-9.902	-9.811	-9.737	-9.675	-9.622	-9.538	-9.474	-9.425	-9.386	-9.354
200	-10.112	-10.010	-9.926	-9.855	-9.794	-9.697	-9.624	-9.566	-9.520	-9.483
210	-10.311	-10.198	-10.104	-10.025	-9.957	-9.848	-9.764	-9.699	-9.646	-9.604
220	-10.501	-10.377	-10.274	-10.187	-10.112	-9.991	-9.898	-9.824	-9.765	-9.717
230	-10.683	-10.549	-10.437	-10.342	-10.260	-10.128	-10.025	-9.944	-9.878	-9.824
240	-10.858	-10.714	-10.593	-10.491	-10.402	-10.259	-10.147	-10.058	-9.986	-9.927
250	-11.029	-10.873	-10.744	-10.634	-10.539	-10.385	-10.264	-10.168	-10.090	-10.025
260	-11.194	-11.028	-10.890	-10.773	-10.672	-10.507	-10.378	-10.274	-10.190	-10.120
270	-11.356	-11.179	-11.032	-10.907	-10.800	-10.624	-10.487	-10.377	-10.286	-10.211
280	-11.515	-11.327	-11.171	-11.039	-10.925	-10.739	-10.593	-10.476	-10.380	-10.300
290	-11.671	-11.472	-11.307	-11.167	-11.047	-10.850	-10.697	-10.573	-10.471	-10.386
300	-11.825	-11.615	-11.440	-11.292	-11.166	-10.959	-10.797	-10.667	-10.559	-10.469
310	-11.976	-11.755	-11.571	-11.416	-11.282	-11.065	-10.895	-10.758	-10.645	-10.551
320	-12.125	-11.893	-11.700	-11.537	-11.397	-11.169	-10.991	-10.848	-10.729	-10.630
330	-12.273	-12.030	-11.828	-11.657	-11.510	-11.271	-11.085	-10.935	-10.812	-10.708
340	-12.417	-12.165	-11.953	-11.774	-11.621	-11.372	-11.178	-11.021	-10.892	-10.784
350	-12.559	-12.297	-12.077	-11.891	-11.731	-11.471	-11.268	-11.105	-10.971	-10.858
360	-12.699	-12.428	-12.200	-12.006	-11.839	-11.568	-11.358	-11.188	-11.049	-10.932
370	-12.835	-12.557	-12.321	-12.119	-11.946	-11.665	-11.446	-11.270	-11.125	-11.003
380	-12.967	-12.684	-12.441	-12.232	-12.052	-11.760	-11.532	-11.350	-11.200	-11.074
390	-13.095	-12.808	-12.558	-12.343	-12.157	-11.854	-11.618	-11.429	-11.274	-11.143
400	-13.218	-12.930	-12.674	-12.453	-12.261	-11.947	-11.703	-11.507	-11.347	-11.212

Table 11. (Cont.)

HEIGHT KM	EXOSPHERIC TEMPERATURE (K) 500	550	600	650	700	800	900	1000	1100	1200
420	-13.446	-13.163	-12.900	-12.668	-12.464	-12.130	-11.870	-11.661	-11.489	-11.346
440	-13.646	-13.379	-13.116	-12.876	-12.663	-12.310	-12.033	-11.811	-11.629	-11.477
460	-13.815	-13.575	-13.320	-13.077	-12.857	-12.486	-12.194	-11.959	-11.766	-11.605
480	-13.953	-13.747	-13.508	-13.268	-13.044	-12.659	-12.351	-12.103	-11.900	-11.730
500	-14.066	-13.895	-13.678	-13.447	-13.223	-12.827	-12.506	-12.246	-12.032	-11.853
520	-14.158	-14.020	-13.829	-13.612	-13.392	-12.991	-12.658	-12.386	-12.161	-11.974
540	-14.236	-14.124	-13.960	-13.762	-13.551	-13.149	-12.807	-12.523	-12.289	-12.093
560	-14.302	-14.212	-14.072	-13.895	-13.698	-13.301	-12.952	-12.659	-12.415	-12.210
580	-14.361	-14.287	-14.168	-14.013	-13.831	-13.446	-13.093	-12.791	-12.538	-12.325
600	-14.415	-14.353	-14.251	-14.115	-13.950	-13.583	-13.229	-12.921	-12.660	-12.439
620	-14.465	-14.412	-14.323	-14.203	-14.056	-13.711	-13.361	-13.048	-12.780	-12.551
640	-14.512	-14.466	-14.387	-14.281	-14.149	-13.828	-13.487	-13.172	-12.897	-12.662
660	-14.557	-14.517	-14.445	-14.349	-14.231	-13.936	-13.606	-13.291	-13.012	-12.770
680	-14.599	-14.564	-14.498	-14.411	-14.304	-14.034	-13.719	-13.407	-13.124	-12.877
700	-14.639	-14.610	-14.549	-14.467	-14.369	-14.122	-13.824	-13.518	-13.234	-12.982
720	-14.678	-14.653	-14.596	-14.519	-14.428	-14.201	-13.922	-13.624	-13.340	-13.085
740	-14.715	-14.695	-14.641	-14.568	-14.482	-14.272	-14.012	-13.724	-13.443	-13.185
760	-14.750	-14.735	-14.685	-14.615	-14.532	-14.337	-14.094	-13.819	-13.542	-13.283
780	-14.783	-14.773	-14.727	-14.659	-14.580	-14.395	-14.170	-13.908	-13.637	-13.378
800	-14.816	-14.811	-14.767	-14.702	-14.625	-14.449	-14.238	-13.991	-13.727	-13.470
820	-14.847	-14.846	-14.807	-14.743	-14.668	-14.499	-14.301	-14.068	-13.813	-13.560
840	-14.876	-14.881	-14.845	-14.783	-14.710	-14.545	-14.358	-14.139	-13.895	-13.645
860	-14.905	-14.914	-14.881	-14.823	-14.750	-14.589	-14.411	-14.205	-13.971	-13.728
880	-14.932	-14.946	-14.917	-14.861	-14.789	-14.631	-14.460	-14.265	-14.043	-13.806
900	-14.958	-14.976	-14.952	-14.898	-14.828	-14.671	-14.506	-14.321	-14.110	-13.881
920	-14.984	-15.006	-14.985	-14.934	-14.865	-14.710	-14.549	-14.373	-14.172	-13.952
940	-15.008	-15.034	-15.017	-14.969	-14.901	-14.748	-14.589	-14.421	-14.231	-14.019
960	-15.031	-15.062	-15.049	-15.003	-14.937	-14.784	-14.628	-14.466	-14.285	-14.082
980	-15.054	-15.088	-15.079	-15.036	-14.972	-14.820	-14.665	-14.508	-14.335	-14.142
1000	-15.076	-15.113	-15.108	-15.068	-15.006	-14.855	-14.701	-14.547	-14.382	-14.197
1050	-15.128	-15.173	-15.177	-15.145	-15.088	-14.940	-14.786	-14.638	-14.487	-14.322
1100	-15.177	-15.228	-15.241	-15.217	-15.165	-15.021	-14.867	-14.721	-14.578	-14.428
1150	-15.222	-15.278	-15.299	-15.283	-15.238	-15.099	-14.944	-14.797	-14.659	-14.520
1200	-15.266	-15.325	-15.352	-15.345	-15.306	-15.173	-15.018	-14.870	-14.733	-14.601
1250	-15.307	-15.369	-15.402	-15.402	-15.370	-15.245	-15.090	-14.940	-14.803	-14.674
1300	-15.347	-15.410	-15.448	-15.455	-15.430	-15.313	-15.160	-15.008	-14.869	-14.741
1350	-15.385	-15.450	-15.491	-15.504	-15.486	-15.379	-15.227	-15.073	-14.932	-14.805
1400	-15.422	-15.487	-15.531	-15.549	-15.538	-15.441	-15.292	-15.137	-14.994	-14.865
1450	-15.459	-15.523	-15.569	-15.592	-15.587	-15.500	-15.355	-15.199	-15.054	-14.923
1500	-15.494	-15.558	-15.605	-15.632	-15.632	-15.556	-15.416	-15.260	-15.112	-14.979
1600	-15.563	-15.624	-15.673	-15.705	-15.715	-15.660	-15.531	-15.376	-15.225	-15.087
1700	-15.630	-15.686	-15.735	-15.771	-15.787	-15.752	-15.638	-15.487	-15.332	-15.190
1800	-15.694	-15.746	-15.793	-15.830	-15.852	-15.835	-15.736	-15.590	-15.435	-15.289
1900	-15.756	-15.804	-15.849	-15.886	-15.911	-15.908	-15.825	-15.688	-15.534	-15.384
2000	-15.817	-15.860	-15.902	-15.938	-15.966	-15.974	-15.907	-15.780	-15.627	-15.476
2100	-15.876	-15.915	-15.953	-15.988	-16.016	-16.034	-15.981	-15.865	-15.716	-15.564
2200	-15.934	-15.967	-16.002	-16.035	-16.063	-16.088	-16.049	-15.944	-15.801	-15.648
2300	-15.991	-16.019	-16.050	-16.081	-16.108	-16.138	-16.110	-16.017	-15.881	-15.729
2400	-16.046	-16.069	-16.097	-16.125	-16.151	-16.183	-16.166	-16.085	-15.956	-15.807
2500	-16.100	-16.118	-16.142	-16.167	-16.192	-16.226	-16.217	-16.148	-16.027	-15.881

Table 11. (Cont.)

HEIGHT KM	EXOSPHERIC TEMPERATURE (K) 1200	1300	1400	1500	1600	1800	2000	2200	2400	2600
90	-5.465	-5.465	-5.465	-5.465	-5.465	-5.465	-5.465	-5.465	-5.465	-5.465
92	-5.620	-5.620	-5.620	-5.620	-5.620	-5.620	-5.620	-5.620	-5.620	-5.620
94	-5.776	-5.776	-5.776	-5.776	-5.776	-5.776	-5.776	-5.776	-5.776	-5.777
96	-5.933	-5.933	-5.933	-5.933	-5.933	-5.934	-5.934	-5.934	-5.934	-5.934
98	-6.090	-6.091	-6.091	-6.091	-6.091	-6.091	-6.092	-6.092	-6.092	-6.092
100	-6.247	-6.248	-6.248	-6.248	-6.248	-6.249	-6.249	-6.250	-6.250	-6.250
102	-6.402	-6.403	-6.403	-6.403	-6.404	-6.404	-6.405	-6.406	-6.406	-6.406
104	-6.557	-6.558	-6.558	-6.559	-6.559	-6.560	-6.561	-6.562	-6.562	-6.563
106	-6.712	-6.712	-6.713	-6.714	-6.714	-6.716	-6.717	-6.717	-6.718	-6.719
108	-6.865	-6.866	-6.867	-6.867	-6.868	-6.869	-6.871	-6.872	-6.873	-6.873
110	-7.015	-7.016	-7.017	-7.017	-7.018	-7.020	-7.021	-7.022	-7.023	-7.024
115	-7.359	-7.359	-7.360	-7.360	-7.360	-7.361	-7.362	-7.362	-7.363	-7.363
120	-7.643	-7.642	-7.641	-7.640	-7.640	-7.638	-7.637	-7.636	-7.635	-7.635
125	-7.882	-7.878	-7.875	-7.873	-7.871	-7.867	-7.863	-7.861	-7.858	-7.856
130	-8.085	-8.079	-8.074	-8.070	-8.066	-8.060	-8.054	-8.049	-8.045	-8.042
135	-8.260	-8.252	-8.246	-8.240	-8.235	-8.225	-8.218	-8.211	-8.206	-8.201
140	-8.413	-8.404	-8.395	-8.388	-8.381	-8.370	-8.361	-8.353	-8.346	-8.340
145	-8.548	-8.537	-8.528	-8.519	-8.511	-8.498	-8.487	-8.478	-8.470	-8.462
150	-8.669	-8.657	-8.646	-8.636	-8.628	-8.613	-8.601	-8.590	-8.581	-8.573
155	-8.778	-8.765	-8.753	-8.742	-8.732	-8.716	-8.703	-8.691	-8.681	-8.672
160	-8.878	-8.863	-8.850	-8.838	-8.828	-8.810	-8.796	-8.783	-8.773	-8.763
170	-9.056	-9.038	-9.022	-9.008	-8.996	-8.976	-8.959	-8.946	-8.934	-8.923
180	-9.213	-9.190	-9.172	-9.156	-9.142	-9.118	-9.100	-9.084	-9.071	-9.060
190	-9.354	-9.327	-9.305	-9.286	-9.270	-9.243	-9.222	-9.205	-9.191	-9.179
200	-9.483	-9.452	-9.426	-9.405	-9.386	-9.355	-9.331	-9.312	-9.297	-9.284
210	-9.604	-9.568	-9.538	-9.513	-9.492	-9.457	-9.430	-9.408	-9.391	-9.377
220	-9.717	-9.677	-9.643	-9.615	-9.590	-9.550	-9.520	-9.496	-9.476	-9.461
230	-9.824	-9.779	-9.742	-9.710	-9.682	-9.638	-9.603	-9.576	-9.555	-9.537
240	-9.927	-9.877	-9.835	-9.800	-9.769	-9.719	-9.681	-9.651	-9.627	-9.607
250	-10.025	-9.971	-9.925	-9.886	-9.852	-9.797	-9.755	-9.721	-9.694	-9.673
260	-10.120	-10.061	-10.011	-9.968	-9.931	-9.871	-9.824	-9.788	-9.758	-9.734
270	-10.211	-10.148	-10.094	-10.048	-10.008	-9.942	-9.891	-9.851	-9.818	-9.792
280	-10.300	-10.232	-10.174	-10.125	-10.081	-10.011	-9.955	-9.911	-9.876	-9.847
290	-10.386	-10.314	-10.252	-10.199	-10.153	-10.077	-10.017	-9.970	-9.931	-9.900
300	-10.469	-10.393	-10.328	-10.271	-10.222	-10.141	-10.077	-10.026	-9.985	-9.951
310	-10.551	-10.470	-10.401	-10.342	-10.290	-10.204	-10.136	-10.081	-10.037	-10.000
320	-10.630	-10.546	-10.473	-10.411	-10.356	-10.264	-10.192	-10.134	-10.087	-10.048
330	-10.708	-10.620	-10.544	-10.478	-10.420	-10.324	-10.248	-10.186	-10.136	-10.094
340	-10.784	-10.692	-10.612	-10.543	-10.483	-10.382	-10.302	-10.237	-10.184	-10.139
350	-10.858	-10.762	-10.680	-10.608	-10.544	-10.439	-10.355	-10.286	-10.230	-10.183
360	-10.932	-10.832	-10.746	-10.671	-10.605	-10.495	-10.407	-10.335	-10.276	-10.227
370	-11.003	-10.900	-10.810	-10.733	-10.664	-10.549	-10.458	-10.383	-10.321	-10.269
380	-11.074	-10.967	-10.874	-10.793	-10.722	-10.603	-10.508	-10.430	-10.365	-10.311
390	-11.143	-11.032	-10.937	-10.853	-10.779	-10.656	-10.557	-10.476	-10.408	-10.352
400	-11.212	-11.097	-10.998	-10.912	-10.836	-10.708	-10.605	-10.521	-10.451	-10.392

Table 11. (Cont.)

EXOSPHERIC TEMPERATURE (K)

HEIGHT KM	1200	1300	1400	1500	1600	1800	2000	2200	2400	2600
420	-11.346	-11.224	-11.119	-11.027	-10.946	-10.810	-10.700	-10.609	-10.534	-10.471
440	-11.477	-11.347	-11.236	-11.138	-11.052	-10.908	-10.792	-10.695	-10.615	-10.547
460	-11.605	-11.468	-11.350	-11.247	-11.156	-11.004	-10.881	-10.779	-10.694	-10.621
480	-11.730	-11.586	-11.461	-11.353	-11.258	-11.098	-10.968	-10.861	-10.771	-10.694
500	-11.853	-11.701	-11.571	-11.457	-11.357	-11.189	-11.053	-10.940	-10.845	-10.765
520	-11.974	-11.815	-11.678	-11.559	-11.454	-11.278	-11.136	-11.018	-10.919	-10.834
540	-12.093	-11.926	-11.783	-11.659	-11.549	-11.366	-11.217	-11.094	-10.990	-10.902
560	-12.210	-12.036	-11.887	-11.757	-11.643	-11.451	-11.296	-11.168	-11.060	-10.968
580	-12.325	-12.144	-11.989	-11.853	-11.735	-11.532	-11.375	-11.241	-11.129	-11.033
600	-12.439	-12.251	-12.089	-11.949	-11.825	-11.618	-11.451	-11.313	-11.197	-11.097
620	-12.551	-12.356	-12.188	-12.042	-11.914	-11.700	-11.526	-11.383	-11.263	-11.160
640	-12.662	-12.460	-12.286	-12.135	-12.002	-11.780	-11.601	-11.452	-11.328	-11.221
660	-12.770	-12.563	-12.383	-12.226	-12.089	-11.859	-11.673	-11.521	-11.392	-11.282
680	-12.877	-12.663	-12.478	-12.316	-12.174	-11.937	-11.745	-11.588	-11.455	-11.341
700	-12.982	-12.763	-12.572	-12.405	-12.259	-12.014	-11.816	-11.654	-11.517	-11.400
720	-13.085	-12.860	-12.665	-12.493	-12.342	-12.090	-11.886	-11.719	-11.578	-11.457
740	-13.185	-12.957	-12.756	-12.580	-12.425	-12.165	-11.955	-11.783	-11.638	-11.514
760	-13.283	-13.051	-12.846	-12.666	-12.506	-12.239	-12.023	-11.846	-11.697	-11.570
780	-13.378	-13.143	-12.935	-12.750	-12.587	-12.312	-12.091	-11.909	-11.756	-11.625
800	-13.470	-13.234	-13.022	-12.834	-12.666	-12.385	-12.157	-11.970	-11.814	-11.680
820	-13.560	-13.322	-13.108	-12.916	-12.745	-12.456	-12.223	-12.032	-11.871	-11.734
840	-13.645	-13.408	-13.191	-12.996	-12.822	-12.527	-12.288	-12.092	-11.927	-11.787
860	-13.728	-13.492	-13.274	-13.076	-12.899	-12.597	-12.353	-12.152	-11.983	-11.839
880	-13.806	-13.573	-13.354	-13.154	-12.974	-12.666	-12.417	-12.211	-12.038	-11.891
900	-13.881	-13.651	-13.432	-13.231	-13.048	-12.735	-12.480	-12.269	-12.093	-11.942
920	-13.952	-13.727	-13.509	-13.306	-13.121	-12.802	-12.542	-12.327	-12.147	-11.993
940	-14.019	-13.799	-13.583	-13.380	-13.193	-12.869	-12.604	-12.384	-12.200	-12.043
960	-14.082	-13.868	-13.655	-13.451	-13.263	-12.935	-12.665	-12.441	-12.253	-12.093
980	-14.142	-13.934	-13.724	-13.521	-13.332	-13.000	-12.725	-12.497	-12.305	-12.142
1000	-14.197	-13.997	-13.791	-13.590	-13.400	-13.064	-12.785	-12.553	-12.357	-12.191
1050	-14.322	-14.140	-13.946	-13.751	-13.562	-13.221	-12.932	-12.689	-12.485	-12.311
1100	-14.428	-14.263	-14.085	-13.899	-13.715	-13.371	-13.074	-12.822	-12.609	-12.427
1150	-14.520	-14.370	-14.207	-14.033	-13.856	-13.514	-13.211	-12.952	-12.731	-12.542
1200	-14.601	-14.463	-14.314	-14.153	-13.985	-13.650	-13.344	-13.078	-12.849	-12.653
1250	-14.674	-14.545	-14.408	-14.260	-14.102	-13.777	-13.471	-13.200	-12.965	-12.762
1300	-14.741	-14.618	-14.490	-14.354	-14.207	-13.896	-13.593	-13.318	-13.077	-12.869
1350	-14.805	-14.684	-14.564	-14.437	-14.301	-14.006	-13.708	-13.432	-13.187	-12.973
1400	-14.865	-14.746	-14.630	-14.511	-14.385	-14.107	-13.818	-13.542	-13.293	-13.074
1450	-14.923	-14.804	-14.691	-14.578	-14.460	-14.200	-13.920	-13.647	-13.396	-13.173
1500	-14.979	-14.859	-14.748	-14.639	-14.527	-14.283	-14.016	-13.747	-13.496	-13.269
1600	-15.087	-14.963	-14.852	-14.747	-14.644	-14.428	-14.187	-13.932	-13.684	-13.454
1700	-15.190	-15.062	-14.948	-14.844	-14.745	-14.548	-14.332	-14.096	-13.856	-13.626
1800	-15.289	-15.157	-15.039	-14.933	-14.835	-14.649	-14.454	-14.238	-14.011	-13.786
1900	-15.384	-15.248	-15.126	-15.017	-14.918	-14.737	-14.557	-14.361	-14.149	-13.932
2000	-15.476	-15.335	-15.209	-15.097	-14.996	-14.816	-14.646	-14.467	-14.271	-14.065
2100	-15.564	-15.420	-15.290	-15.174	-15.070	-14.889	-14.725	-14.558	-14.378	-14.185
2200	-15.648	-15.502	-15.368	-15.249	-15.142	-14.957	-14.795	-14.638	-14.472	-14.291
2300	-15.729	-15.581	-15.444	-15.321	-15.211	-15.021	-14.860	-14.709	-14.554	-14.386
2400	-15.807	-15.657	-15.518	-15.391	-15.278	-15.083	-14.921	-14.773	-14.626	-14.469
2500	-15.881	-15.731	-15.589	-15.459	-15.343	-15.143	-14.978	-14.832	-14.691	-14.544

NOTICE

This series of Special Reports was instituted under the supervision of Dr. F. L. Whipple, Director of the Astrophysical Observatory of the Smithsonian Institution, shortly after the launching of the first artificial earth satellite on October 4, 1957. Contributions come from the Staff of the Observatory.

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