INTERNATIONAL STANDARD ISO 2533

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION • МЕЖДУНАРОДНАЯ ОРГАНИЗАЦИЯ ПО СТАНДАРТИЗАЦИИ • ORGANISATION INTERNATIONALE DE NORMALISATION

Standard Atmosphere

(identical with the ICAO and WMO Standard Atmospheres from – 2 to 32 km)

Atmosphère Type
(identique aux atmosphères standard de l'OACI et de l'OMM entre – 2 et 32 km)

Стандартная атмосфера
(от — 2 до 32 км идентична стандартным атмосферам ИКАО и ВМО)

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FOREWORD

ISO (the International Organization for Standardization) is a worldwide federation of national standards institutes (ISO Member Bodies). The work of developing International Standards is carried out through ISO Technical Committees. Every Member Body interested in a subject for which a Technical Committee has been set up has the right to be represented on that Committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work.

Draft International Standards adopted by the Technical Committees are circulated to the Member Bodies for approval before their acceptance as International Standards by the ISO Council.

International Standard ISO 2533 was drawn up by Technical Committee ISO/TC 20, *Aircraft and space vehicles,* and circulated to the Member Bodies in April 1972. [The tables of the ISO Interim Standard Atmosphere (see page iii) were circulated separately to the Member Bodies in August 1972 as Addendum 1 and have now been incorporated in the present document.]

It has been approved by the Member Bodies of the following countries :

Austria*
Belgium*
Brazil
Czechoslovakia*
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France*
Germany*
India*
Ireland*
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Netherlands*
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South Africa, Rep. of*
Thailand*
Turkey*
United Kingdom*
U.S.A.*
U.S.S.R.*

* Also approved Addendum 1.

No Member Body has expressed disapproval of the document.

NOTE — The following International Organizations took part in the discussion of this International Standard at all stages of its development :

International Civil Aviation Organization (ICAO).

World Meteorological Organization (WMO).

Printed in Switzerland

The characteristics of the ISO Standard Atmosphere have been calculated as functions of geometric and geopotential altitudes for altitudes from − 2 000 to 50 000 m based on the standard atmospheres of ICAO 1964 and USA 1962, which for these altitudes were recognized as the most representative when comparing the current national and international standards and recommendations on the atmosphere [1-4], [6-7] with the results of recent research.

Data from this recent research have been used for calculation of the atmospheric characteristics for altitudes from 50 000 to 80 000 m, representing the ISO Interim Standard Atmosphere.

CONTENTS

Standard Atmosphere

(identical with the ICAO and WMO Standard Atmospheres from −2 to 32 km)

1 SCOPE AND FIELD OF APPLICATION

This International Standard specifies the characteristics of an ISO Standard Atmosphere and is intended for use in calculations and design of flying vehicles, to present the test results of flying vehicles and their components under identical conditions, and to allow unification in the field of development and calibration of instruments. Its use is also recommended in the processing of data from geophysical and meteorological observations.

2 BASIC PRINCIPLES AND CALCULATION FORMULAE

2.1 Primary constants and characteristics

The tables of the ISO Standard Atmosphere have been calculated assuming the air to be a perfect gas free from moisture and dust and based on conventional initial values of temperature, pressure and density of the air for mean sea level. The following constants and characteristics are used for calculations and their numerical values are given in table 1 :

g_n — standard acceleration of free fall. It conforms with latitude $\varphi = 45° 32' 33''$ using Lambert's equation of the acceleration of free fall as a function of latitude φ [5] :

$$g_\varphi = 9{,}806\,16\,(1 - 0{,}002\,637\,3 \cos 2\varphi + 0{,}000\,005\,9 \cos^2 2\varphi)$$

M — air molar mass at sea level, as obtained from the perfect gas law (2) when introducing the adopted values p_n, ρ_n, T_n, R^* (see table 1);

N_A — Avogadro constant, based on the value of the nuclide ^{12}C, atomic mass = 12,000, as adopted in 1961 by the Conference of the International Union of Pure and Applied Chemistry as the basic atomic mass unity;

p_n — standard air pressure;

R^* — universal gas constant;

R — specific gas constant;

S and β_s — Sutherland's empirical coefficients in the equation for dynamic viscosity;

T_o — thermodynamic ice-point temperature, at mean sea level;

T_n — standard thermodynamic air temperature at mean sea level;

t_o — Celsius ice-point temperature at mean sea level;

t_n — standard Celsius air temperature at mean sea level;

$\kappa = \dfrac{c_p}{c_v}$ — adiabatic index, the ratio of the specific heat of air at constant pressure to its specific heat at constant volume;

ρ_n — standard air density;

σ — effective collision diameter of an air molecule; taken as constant with altitude.

TABLE 1 — **Main constants and characteristics adopted for the calculation of the ISO Standard Atmosphere**

Symbol	Value	Unit of measurement
g_n	9,806 65	$m \cdot s^{-2}$
M	28,964 420	$kg \cdot kmol^{-1}$
N_A	$602{,}257 \times 10^{24}$	$kmol^{-1}$
p_n	$101{,}325 \times 10^3$	Pa
	$1{,}013\,250 \times 10^3$	mbar
	760	mmHg
R^*	8 314,32	$J \cdot K^{-1} \cdot kmol^{-1}$ or $kg \cdot m^2 \cdot s^{-2} \cdot K^{-1} \cdot kmol^{-1}$
R	287,052 87	$J \cdot K^{-1} \cdot kg^{-1}$ or $m^2 \cdot K^{-1} \cdot s^{-2}$
S	110,4	K
T_o	273,15	K
T_n	288,15	K
t_o	0,00	°C
t_n	15,00	°C
β_s	$1{,}458 \times 10^{-6}$	$kg \cdot m^{-1} \cdot s^{-1} \cdot K^{-1/2}$
κ	1,4	dimensionless
ρ_n	1,225	$kg \cdot m^{-3}$
σ	$0{,}365 \times 10^{-9}$	m

2.2 The equation of the static atmosphere and the perfect gas law

Being static with respect to the earth, the atmosphere is subject to gravity. The conditions of air static equilibrium are determined by the equation of the static atmosphere which relates air pressure p, density ρ, acceleration of free fall g and altitude h as follows :

$$-\mathrm{d}p = \rho g \mathrm{d}h \qquad \ldots (1)$$

The perfect gas law relates air pressure to density and temperature as follows :

$$p = \frac{\rho R^* T}{M} \qquad \ldots (2)$$

At the altitudes considered in this International Standard,

$\frac{R^*}{M}$ = constant = R, then

$$p = \rho R T \qquad \ldots (3)$$

2.3 Geopotential and geometric altitudes; acceleration of free fall

In considering pressure distribution in the atmosphere it is convenient to introduce the gravity potential or geopotential Φ, which characterizes the potential energy of an air particle at a given point.

Any point with x, y, z co-ordinates may be characterized by a single value of gravity potential Φ (x, y, z) in it. The surface defined by the equation

$$\Phi\ (x, y, z) = \text{constant}$$

is of the same potential in all points and is called an isopotential or geopotential surface. When moving along an external normal from any point on the surface Φ_1, to the infinitely close point where the value of the potential is $\Phi_2 = \Phi_1 + \mathrm{d}\Phi$, the work performed for shifting a unit mass from the first surface to the second one will be

$$\mathrm{d}\Phi = g(h)\mathrm{d}h \qquad \ldots (4)$$

hence

$$\Phi = \int_0^h g(h)\mathrm{d}h \qquad \ldots (5)$$

By dividing the geopotential Φ by the standard acceleration of free fall g_n, one obtains the value of a length dimension which, symbolized as H, will be :

$$H = \frac{\Phi}{g_n} = \frac{1}{g_n}\int_0^h g(h)\mathrm{d}h \qquad \ldots (6)$$

Expressed in metres, the value H is numerically equal to the geopotential altitude, which in meteorology is measured in so-called standard geopotential metres[1)]; hence, this value will be called geopotential altitude. The mean sea level is taken as a reference for readings for both geopotential and geometrical altitudes.

From equation (6) it can be seen that, in order to relate geopotential and geometric altitudes, it is necessary first to find a relation between acceleration of free fall g and geometric altitude h.

It is known that gravity is a vectorial summation of the gravitational attraction and the centrifugal force induced by the earth's rotation; it is therefore a complex function of a latitude and a radial distance from the earth's centre and the expression for acceleration of free fall is generally awkward and unpractical for use. However, the acceleration g may be obtained with sufficient accuracy for the purpose of this standard atmosphere by formally neglecting centrifugal acceleration and using only Newton's gravitation law. In this case :

$$g = g_n\left(\frac{r}{r+h}\right)^2 \qquad \ldots (7)$$

where r = 6 356 766 m is the nominal earth's radius [5], for which acceleration of free fall and the vertical gradient of acceleration at mean sea level are very close to true values at the latitude 45° 32′ 33″.

The values of g as calculated using the simplified equation (7) with $g_n = 9{,}806\ 65\ \mathrm{m \cdot s^{-2}}$ for the altitude of 60 000 m does not differ by more than 0,001 % from the values calculated using the more accurate equation of [6].

Integration of equation (6), substituting for g with its function from (7), gives the following relationship between geopotential and geometric altitudes :

$$H = \frac{rh}{r+h} \qquad \ldots (8)$$

$$h = \frac{rH}{r-H} \qquad \ldots (9)$$

2.4 Atmospheric composition and air molar mass

The earth's atmosphere is a mixture of gas, water vapour and a certain quantity of aerosol. Under certain conditions the quantity of water vapour, carbon dioxide, ozone and some

1) The standard geopotential metre (m′) which is equal to 9,806 65 $\mathrm{m^2 \cdot s^{-2}}$ has been adopted by the World Meteorological Organization (see Technical Regulations, WMO, No. 49, vol. I, ed. 1971-Appendix C) and from the 1st July 1972 replaces the geopotential metre formerly in use. Its value was 1 gpm = 9,8 $\mathrm{m^2 \cdot s^{-2}}$.

other ingredients the contents of which in the atmosphere is not significant, may vary. The water vapour content undergoes the greatest variations; its concentration at the earth's surface may reach 4 % under high temperature conditions and abruptly diminishes when altitude increases and temperature decreases. Dry clean air composition up to altitudes of 90 to 95 km remains practically constant and corresponds to that given in table 2 [6].

The air molar mass is determined from the perfect gas law (2) using the adopted standard values of pressure p_n, density ρ_n and temperature T_n for mean sea level, as well as the universal gas constant R^*.

TABLE 2 — **Dry clean air composition near sea level**

Gas	Content of volume %	Molar mass M, $kg \cdot kmol^{-1}$
Nitrogen (N_2)	78,084	28,013 4
Oxygen (O_2)	20,947 6	31,998 8
Argon (Ar)	0,934	39,948
Carbon dioxide (CO_2)	0,031 4 *	44,009 95
Neon (Ne)	$1,818 \times 10^{-3}$	20,183
Helium (He)	$524,0 \times 10^{-6}$	4,002 6
Krypton (Kr)	$114,0 \times 10^{-6}$	83,80
Xenon (Xe)	$8,7 \times 10^{-6}$	131,30
Hydrogen (H_2)	$50,0 \times 10^{-6}$	2,015 94
Nitrogen monoxide (N_2O)	$50,0 \times 10^{-6}$*	44,012 8
Methane (CH_4)	$0,2 \times 10^{-3}$	16,043 03
Ozone (O_3) in summer	up to $7,0 \times 10^{-6}$*	47,998 2
in winter	up to $2,0 \times 10^{-6}$*	47,998 2
Sulphur dioxide (SO_2)	up to $0,1 \times 10^{-3}$*	64,062 8
Nitrogen dioxide (NO_2)	up to $2,0 \times 10^{-6}$*	46,005 5
Iodine (I_2)	up to $1,0 \times 10^{-6}$*	253,808 8
Air	100	28,964 420**

* The content of the gas may undergo significant variations from time to time or from place to place.

** This value is obtained from the perfect gas law (2).

2.5 Physical characteristics of the atmosphere at mean sea level

For the calculation of the ISO Standard Atmosphere the mean sea level is defined as zero altitude for which the initial characteristics g_n, p_n, ρ_n and T_n given in table 1 apply. The remaining characteristics have been calculated using the initial ones as a basis and are presented in table 3 :

a_n — speed of sound;

H_{pn} — pressure scale height;

l_n — mean free path of air particles;

n_n — air number density;

$\bar{v}_n$ — mean air-particle speed;

γ_n — specific weight;

ν_n — kinematic viscosity;

λ_n — thermal conductivity;

μ_n — dynamic viscosity;

ω_n — air-particle collision frequency.

TABLE 3 — **Physical characteristics of the atmosphere at mean sea level**

Symbol	Value	Unit of measurement
a_n	340,294	$m \cdot s^{-1}$
H_{pn}	8 434,5	m
l_n	$66,328 \times 10^{-9}$	m
n_n	$25,471 \times 10^{24}$	m^{-3}
$\bar{v}_n$	458,94	$m \cdot s^{-1}$
γ_n	12,013	$N \cdot m^{-3}$
ν_n	$14,607 \times 10^{-6}$	$m^2 \cdot s^{-1}$
λ_n	$25,343 \times 10^{-3}$	$W \cdot m^{-1} \cdot K^{-1}$
μ_n	$17,894 \times 10^{-6}$	$Pa \cdot s$
ω_n	$6,919\,3 \times 10^{9}$	s^{-1}

2.6 Temperature and vertical temperature gradient

Thermodynamic temperature for the melting point of ice under a pressure of 101 325,0 Pa is taken as T_o =273,15 K. Thermodynamic temperature T (in kelvins, K) is :

$$T = T_o + t \qquad \dots (10)$$

where t is the Celsius temperature.

According to the temperature variations with altitude, the atmosphere is divided into several layers.

The transitional zones between these layers are called tropopause, stratopause and mesopause respectively.

For calculating a standard atmosphere, the temperature of each layer is taken as a linear function of geopotential altitude, so that

$$T = T_b + \beta(H - H_b) \qquad \dots (11)$$

where T_b and H_b are respectively the temperature and the geopotential altitude of the lower limit of the layer concerned and β is the vertical temperature gradient, $\frac{dT}{dH}$.

The values of temperature and its vertical gradients adopted for the ISO Standard Atmosphere are given in table 4.

TABLE 4 — **Temperatures and vertical temperature gradients**

Geopotential altitude H, km	Temperature T, K	Temperature gradient β, K·km^{-1}
− 2,00	301,15	
		− 6,50
0,00	288,15	
		− 6,50
11,00	216,65	
		0,00
20,00	216,65	
		+ 1,00
32,00	228,65	
		+ 2,80
47,00	270,65	
		0,00
51,00	270,65	
		− 2,80
71,00	214,65	
		− 2,00
80,00	196,65	

2.7 Pressure

Assuming a linear variation of the temperature with geopotential altitude, the simultaneous solution of the equation of static atmosphere (1) and the perfect gas law (2) yields the following expression for pressure :

$$\ln p = \ln p_b - \frac{g_n}{\beta R} \ln \frac{T_b + \beta (H - H_b)}{T_b}$$

or $p = p_b \left[1 + \frac{\beta}{T_b} (H - H_b) \right]^{-g_n/\beta R}$ for $\beta \neq 0$ . . . (12)

and $\ln p = \ln p_b - \frac{g_n}{RT} (H - H_b)$

or $p = p_b \exp \left[-\frac{g_n}{RT} (H - H_b) \right]$ for $\beta = 0$ . . . (13)

Here subscript "b" refers the values of the pertinent characteristics to the lower limit of the layer concerned.

2.8 Density and specific weight

The density ρ is calculated from the pressure and the temperature using the perfect gas law :

$$\rho = \frac{p}{RT} \quad . . . (14)$$

The specific weight γ is the weight per unit volume of air, that is :

$$\gamma = \rho g \quad . . . (15)$$

2.9 Pressure scale height

Pressure scale height H_p is determined by the equation

$$H_p = \frac{R^*}{M} \cdot \frac{T}{g} = \frac{RT}{g} \quad . . . (16)$$

2.10 Air number density

The air number density n, i.e. the number of neutral air particles per unit volume, is given by the equation

$$n = \frac{N_A p}{R^* T} \quad . . . (17)$$

2.11 Mean air-particle speed

The mean air-particle speed $\bar{v}$ is defined as the arithmetic average of air-particle speeds obtained from Maxwell's distribution of molecular speeds in the monatomic perfect gas under thermodynamical equilibrium conditions disregarding any exterior force, hence

$$\bar{v} = \left(\frac{8}{\pi} RT \right)^{1/2} = 1{,}595\,769 \sqrt{RT} \quad . . . (18)$$

2.12 Mean free path of air particles

An air particle between two successive collisions moves uniformly along a straight line, passing a certain average distance l called a mean free path of air particles. Taking into account the distribution of relative speeds of colliding particles, the mean free path of air particles is defined by the expression

$$l = \frac{R^*}{\sqrt{2}\pi N_A \sigma^2} \cdot \frac{T}{p} = \frac{1}{\sqrt{2}\pi \sigma^2 n} \quad . . . (19)$$

2.13 Air-particle collision frequency

The air-particle collision frequency ω is the mean air-particle speed divided by the mean free path of air particles at the same altitude, i.e. $\omega = \frac{\bar{v}}{l}$; hence, taking into account equations (18) and (19)

$$\omega = 4\sigma^2 N_A \left(\frac{\pi}{R^* M} \right)^{1/2} \cdot \frac{p}{T^{1/2}} = 0{,}944\,541 \times 10^{-18} n \sqrt{RT} \quad . . . (20)$$

2.14 Speed of sound

The speed of sound a is given by the expression

$$a = (\kappa RT)^{1/2} = 20{,}046\,796 \sqrt{T} \quad . . . (21)$$

where $\kappa = \frac{c_p}{c_v} = 1{,}4$.

This expression (21) presents the speed of propagation of an infinitesimal perturbation in a gas. That is why this formula may not be used for calculation, for example, of the speed of propagation of shock waves induced by blast, detonation, body motion in the air at supersonic speed, etc.

The concept of speed of sound loses its meaning with very intensive attenuation of sound pulses which occurs above the altitude limits considered for the ISO Standard Atmosphere.

2.15 Dynamic viscosity

The dynamic viscosity μ is defined as the value of internal friction between two neighbouring layers of air moving at different speeds. The tables are established using the following equation based on the kinetic theory with, however, constants derived from experiments :

$$\mu = \frac{\beta_s T^{3/2}}{T + S} \qquad \dots (22)$$

In this equation β_s and S are Sutherland's empirical coefficients (see table 1).

Equation (22) is invalid for very high or very low temperatures and under conditions occurring at altitudes above 90 km.

2.16 Kinematic viscosity

The kinematic viscosity ν is defined as the ratio of the air dynamic viscosity to the air density, i.e. :

$$\nu = \frac{\mu}{\rho} \qquad \dots (23)$$

The limits for the use of this equation are similar to those of the dynamic viscosity.

2.17 Thermal conductivity

The thermal conductivity λ is calculated from the following empirical formula :

$$\lambda = \frac{2{,}648\,151 \times 10^{-3} \cdot T^{3/2}}{T + [245{,}4 \times 10^{-(12/T)}]} \qquad \dots (24)$$

where λ is expressed $W{\cdot}m^{-1}{\cdot}K^{-1}$ and T in kelvins.

3 TABLES OF THE ISO STANDARD ATMOSPHERE

The following tables were calculated using the constants, coefficients and equations given in clause 2.

Calculations were made on a Minsk-22 digital computer and the calculation of separate control points was made on other machines. The tables were established directly by digital printing devices on the computers and have been reproduced by duplicating machines in order to reduce the possibility of errors to a minimum.

Data in the tables are given in SI units except in table 5 in which temperatures are given in Celsius degrees and pressures are given in millibars and millimetres of mercury.

NOTE — A one- or two-digit number (preceded by a plus or a minus sign) following the initial entry of each block indicates the power of ten by which that entry and each succeeding entry of that block should be multiplied. A change of power occurring within a block is indicated by a similar notation.

TABLE 5 — Temperature (T and t), Pressure (p), Density (ρ) and Acceleration of free fall (g) in terms of geometrical altitude (h) and geopotential altitude (H)

TABLEAU 5 — Température (T et t), Pression (p), Masse volumique (ρ) et Accélération due à la pesanteur (g) en fonction de l'altitude géométrique (h) et de l'altitude géopotentielle (H)

ТАБЛИЦА 5 — Температура (T и t), давление (p), плотность (ρ) и ускорение свободного падения (g) в функции геометрической (h) и геопотенциальной (H) высот

Values in terms of geometrical altitude. Valeurs en fonction de l'altitude géométrique.
Значения величин в функции геометрической высоты.

h, m	H, m	T, K	t, °C	p, mbar	p, mm Hg	ρ, kg·m^{-3}	g, m·s^{-2}
-2000	-2001	301,154	28,004	1,27783 +3	9,58450 +2	1,47816 +0	9,8128
-1950	-1951	300,829	27,679	1,27059	9,53023	1,47138	9,8127
-1900	-1901	300,504	27,354	1,26339	9,47621	1,46462	9,8125
-1850	-1851	300,179	27,029	1,25622	9,42243	1,45789	9,8124
-1800	-1801	299,853	26,703	1,24908	9,36891	1,45118	9,8122
-1750	-1750	299,528	26,378	1,24198	9,31563	1,44449	9,8121
-1700	-1700	299,203	26,053	1,23491	9,26260	1,43783	9,8119
-1650	-1650	298,878	25,728	1,22787	9,20981	1,43119	9,8117
-1600	-1600	298,553	25,403	1,22087	9,15727	1,42458	9,8116
-1550	-1550	298,227	25,077	1,21390	9,10497	1,41799	9,8114
-1500	-1500	297,902	24,752	1,20696 +3	9,05292 +2	1,41142 +0	9,8113
-1450	-1450	297,577	24,427	1,20005	9,00111	1,40487	9,8111
-1400	-1400	297,252	24,102	1,19317	8,94953	1,39835	9,8110
-1350	-1350	296,927	23,777	1,18633	8,89820	1,39185	9,8108
-1300	-1300	296,602	23,452	1,17952	8,84711	1,38538	9,8107
-1250	-1250	296,277	23,127	1,17274	8,79626	1,37893	9,8105
-1200	-1200	295,951	22,801	1,16599	8,74564	1,37250	9,8104
-1150	-1150	295,626	22,476	1,15927	8,69526	1,36609	9,8102
-1100	-1100	295,301	22,151	1,15259	8,64512	1,35971	9,8100
-1050	-1050	294,976	21,826	1,14593	8,59521	1,35335	9,8099
-1000	-1000	294,651	21,501	1,13931 +3	8,54554 +2	1,34702 +0	9,8097
- 950	- 950	294,326	21,176	1,13272	8,49610	1,34070	9,8096
- 900	- 900	294,001	20,851	1,12616	8,44689	1,33441	9,8094
- 850	- 850	293,676	20,526	1,11963	8,39792	1,32814	9,8093
- 800	- 800	293,351	20,201	1,11313	8,34917	1,32190	9,8091
- 750	- 750	293,026	19,876	1,10666	8,30066	1,31567	9,8090
- 700	- 700	292,701	19,551	1,10023	8,25238	1,30947	9,8088
- 650	- 650	292,375	19,225	1,09382	8,20432	1,30330	9,8087
- 600	- 600	292,050	18,900	1,08744	8,15649	1,29714	9,8085
- 550	- 550	291,725	18,575	1,08110	8,10889	1,29101	9,8083
- 500	- 500	291,400	18,250	1,07478 +3	8,06151 +2	1,28490 +0	9,8082
- 450	- 450	291,075	17,925	1,06849	8,01436	1,27881	9,8080
- 400	- 400	290,750	17,600	1,06224	7,96744	1,27274	9,8079
- 350	- 350	290,425	17,275	1,05601	7,92073	1,26670	9,8077
- 300	- 300	290,100	16,950	1,04981	7,87425	1,26067	9,8076
- 250	- 250	289,775	16,625	1,04365	7,82799	1,25467	9,8074
- 200	- 200	289,450	16,300	1,03751	7,78196	1,24869	9,8073
- 150	- 150	289,125	15,975	1,03140	7,73614	1,24274	9,8071
- 100	- 100	288,800	15,650	1,02532	7,69054	1,23680	9,8070
- 50	- 50	288,475	15,325	1,01927	7,64516	1,23089	9,8068
0	0	288,150	15,000	1,01325 +3	7,60000 +2	1,22500 +0	9,8066
50	50	287,825	14,675	1,00726	7,55506	1,21913	9,8065
100	100	287,500	14,350	1,00129	7,51033	1,21328	9,8063
150	150	287,175	14,025	9,95360 +2	7,46581	1,20746	9,8062
200	200	286,850	13,700	9,89454	7,42152	1,20165	9,8060
250	250	286,525	13,375	9,83576	7,37743	1,19587	9,8059
300	300	286,200	13,050	9,77727	7,33356	1,19011	9,8057
350	350	285,875	12,725	9,71907	7,28990	1,18437	9,8056
400	400	285,550	12,400	9,66114	7,24645	1,17865	9,8054
450	450	285,225	12,075	9,60350	7,20321	1,17295	9,8053
500	500	284,900	11,750	9,54613 +2	7,16019 +2	1,16727 +0	9,8051
550	550	284,575	11,425	9,48904	7,11737	1,16162	9,8050
600	600	284,250	11,100	9,43223	7,07476	1,15598	9,8048
650	650	283,925	10,775	9,37570	7,03235	1,15037	9,8046
700	700	283,601	10,451	9,31944	6,99016	1,14478	9,8045
750	750	283,276	10,126	9,26346	6,94817	1,13921	9,8043
800	800	282,951	9,801	9,20775	6,90638	1,13366	9,8042
850	850	282,626	9,476	9,15231	6,86480	1,12813	9,8040
900	900	282,301	9,151	9,09715	6,82342	1,12261	9,8039
950	950	281,976	8,826	9,04225	6,78225	1,11713	9,8037

Values in terms of geopotential altitude. Valeurs en fonction de l'altitude géopotentielle.
Значения величин в функции геопотенциальной высоты.

H, m	*h*, m	*T*, K	*t*, °C	*p*, mbar	*p*, mm Hg	ρ, kg·m⁻³	*g*, m·s⁻²
-2000	-1999	301,150	28,000	1,27774 +3	9,58382 +2	1,47808 +0	9,8128
-1950	-1949	300,825	27,675	1,27051	9,52958	1,47130	9,8127
-1900	-1899	300,500	27,350	1,26331	9,47559	1,46455	9,8125
-1850	-1849	300,175	27,025	1,25614	9,42186	1,45782	9,8124
-1800	-1799	299,850	26,700	1,24901	9,36836	1,45111	9,8122
-1750	-1750	299,525	26,375	1,24191	9,31512	1,44443	9,8121
-1700	-1700	299,200	26,050	1,23485	9,26212	1,43777	9,8119
-1650	-1650	298,875	25,725	1,22781	9,20936	1,43114	9,8117
-1600	-1600	298,550	25,400	1,22081	9,15685	1,42452	9,8116
-1550	-1550	298,225	25,075	1,21384	9,10458	1,41794	9,8114
-1500	-1500	297,900	24,750	1,20691 +3	9,05255 +2	1,41137 +0	9,8113
-1450	-1450	297,575	24,425	1,20000	9,00076	1,40483	9,8111
-1400	-1400	297,250	24,100	1,19313	8,94922	1,39831	9,8110
-1350	-1350	296,925	23,775	1,18629	8,89791	1,39182	9,8108
-1300	-1300	296,600	23,450	1,17948	8,84684	1,38535	9,8107
-1250	-1250	296,275	23,125	1,17270	8,79601	1,37890	9,8105
-1200	-1200	295,950	22,800	1,16596	8,74541	1,37247	9,8104
-1150	-1150	295,625	22,475	1,15924	8,69505	1,36607	9,8102
-1100	-1100	295,300	22,150	1,15256	8,64493	1,35969	9,8100
-1050	-1050	294,975	21,825	1,14591	8,59504	1,35333	9,8099
-1000	-1000	294,650	21,500	1,13929 +3	8,54538 +2	1,34700 +0	9,8097
- 950	- 950	294,325	21,175	1,13270	8,49596	1,34068	9,8096
- 900	- 900	294,000	20,850	1,12614	8,44677	1,33439	9,8094
- 850	- 850	293,675	20,525	1,11961	8,39781	1,32813	9,8093
- 800	- 800	293,350	20,200	1,11312	8,34908	1,32188	9,8091
- 750	- 750	293,025	19,875	1,10665	8,30058	1,31566	9,8090
- 700	- 700	292,700	19,550	1,10022	8,25230	1,30946	9,8088
- 650	- 650	292,375	19,225	1,09381	8,20426	1,30329	9,8087
- 600	- 600	292,050	18,900	1,08744	8,15644	1,29713	9,8085
- 550	- 550	291,725	18,575	1,08109	8,10884	1,29100	9,8083
- 500	- 500	291,400	18,250	1,07477 +3	8,06148 +2	1,28489 +0	9,8082
- 450	- 450	291,075	17,925	1,06849	8,01433	1,27880	9,8080
- 400	- 400	290,750	17,600	1,06223	7,96741	1,27274	9,8079
- 350	- 350	290,425	17,275	1,05601	7,92072	1,26669	9,8077
- 300	- 300	290,100	16,950	1,04981	7,87424	1,26067	9,8076
- 250	- 250	289,775	16,625	1,04364	7,82798	1,25467	9,8074
- 200	- 200	289,450	16,300	1,03751	7,78195	1,24869	9,8073
- 150	- 150	289,125	15,975	1,03140	7,73613	1,24274	9,8071
- 100	- 100	288,800	15,650	1,02532	7,69054	1,23680	9,8070
- 50	- 50	288,475	15,325	1,01927	7,64516	1,23089	9,8068
0	0	288,150	15,000	1,01325 +3	7,60000 +2	1,22500 +0	9,8066
50	50	287,825	14,675	1,00726	7,55505	1,21913	9,8065
100	100	287,500	14,350	1,00129	7,51033	1,21328	9,8063
150	150	287,175	14,025	9,95359 +2	7,46581	1,20746	9,8062
200	200	286,850	13,700	9,89453	7,42151	1,20165	9,8060
250	250	286,525	13,375	9,83575	7,37742	1,19587	9,8059
300	300	286,200	13,050	9,77726	7,33355	1,19011	9,8057
350	350	285,875	12,725	9,71904	7,28988	1,18436	9,8056
400	400	285,550	12,400	9,66111	7,24643	1,17864	9,8054
450	450	285,225	12,075	9,60346	7,20319	1,17295	9,8053
500	500	284,900	11,750	9,54608 +2	7,16015 +2	1,16727 +0	9,8051
550	550	284,575	11,425	9,48899	7,11733	1,16161	9,8050
600	600	284,250	11,100	9,43217	7,07471	1,15598	9,8048
650	650	283,925	10,775	9,37562	7,03230	1,15036	9,8046
700	700	283,600	10,450	9,31936	6,99009	1,14477	9,8045
750	750	283,275	10,125	9,26336	6,94809	1,13919	9,8043
800	800	282,950	9,800	9,20764	6,90630	1,13364	9,8042
850	850	282,625	9,475	9,15219	6,86471	1,12811	9,8040
900	900	282,300	9,150	9,09701	6,82332	1,12260	9,8039
950	950	281,975	8,825	9,04210	6,78213	1,11711	9,8037

TABLE 5 *(continued)*

TABLEAU 5 *(suite)*

ТАБЛИЦА 5 *(продолжение)*

Values in terms of geometrical altitude. Valeurs en fonction de l'altitude géométrique.
Значения величин в функции геометрической высоты.

h, m	*H*, m	*T*, K	*t*, °C	*p*, mbar	*p*, mm Hg	ρ, kg·m⁻³	*g*, m·s⁻²
1000	1000	281,651	8,501	9,98763 +2	6,74128 +2	1,11166 +0	9,8036
1050	1050	281,326	8,176	8,93327	6,70050	1,10621	9,8034
1100	1100	281,001	7,851	8,87918	6,65993	1,10079	9,8033
1150	1150	280,676	7,526	8,82536	6,61956	1,09538	9,8031
1200	1200	280,351	7,201	8,77180	6,57939	1,08999	9,8029
1250	1250	280,027	6,877	8,71851	6,53942	1,08463	9,8028
1300	1300	279,702	6,552	8,66548	6,49964	1,07928	9,8026
1350	1350	279,377	6,227	8,61271	6,46006	1,07396	9,8025
1400	1400	279,052	5,902	8,56020	6,42068	1,06865	9,8023
1450	1450	278,727	5,577	8,50795	6,38149	1,06337	9,8022
1500	1500	278,402	5,252	8,45597 +2	6,34250 +2	1,05810 +0	9,8020
1550	1550	278,077	4,927	8,40424	6,30370	1,05286	9,8019
1600	1600	277,753	4,603	8,35277	6,26589	1,04764	9,8017
1650	1650	277,428	4,278	8,30155	6,22668	1,04243	9,8016
1700	1700	277,103	3,953	8,25059	6,18845	1,03725	9,8014
1750	1750	276,778	3,628	8,19989	6,15042	1,03208	9,8013
1800	1799	276,453	3,303	8,14943	6,11258	1,02694	9,8011
1850	1849	276,128	2,979	8,09923	6,07493	1,02181	9,8009
1900	1899	275,804	2,654	8,04929	6,03746	1,01671	9,8008
1950	1949	275,479	2,329	7,99959	6,00019	1,01162	9,8006
2000	1999	275,154	2,004	7,95014 +2	5,96310 +2	1,00655 +0	9,8005
2050	2049	274,829	1,679	7,90094	5,92619	1,00151	9,8003
2100	2099	274,505	1,355	7,85199	5,88948	9,96479 -1	9,8002
2150	2149	274,180	1,030	7,80329	5,85294	9,91471	9,8000
2200	2199	273,855	0,705	7,75483	5,81660	9,86483	9,7999
2250	2249	273,530	0,380	7,70661	5,78043	9,81513	9,7997
2300	2299	273,205	0,055	7,65864	5,74445	9,76563	9,7996
2350	2349	272,881	- 0,269	7,61091	5,70865	9,71632	9,7994
2400	2399	272,556	- 0,594	7,56342	5,67304	9,66721	9,7992
2450	2449	272,231	- 0,919	7,51618	5,63760	9,61828	9,7991
2500	2499	271,906	- 1,244	7,46917 +2	5,60234 +2	9,56954 -1	9,7989
2550	2549	271,582	- 1,568	7,42241	5,56726	9,52100	9,7988
2600	2599	271,257	- 1,893	7,37588	5,53236	9,47264	9,7986
2650	2649	270,932	- 2,218	7,32959	5,49764	9,42447	9,7985
2700	2699	270,607	- 2,543	7,28353	5,46310	9,37649	9,7983
2750	2749	270,283	- 2,867	7,23771	5,42873	9,32870	9,7982
2800	2799	269,958	- 3,192	7,19213	5,39454	9,28110	9,7980
2850	2849	269,633	- 3,517	7,14678	5,36052	9,23368	9,7979
2900	2899	269,309	- 3,841	7,10166	5,32668	9,18645	9,7977
2950	2949	268,984	- 4,166	7,05677	5,29301	9,13940	9,7976
3000	2999	268,659	- 4,491	7,01212 +2	5,25952 +2	9,09254 -1	9,7974
3050	3049	268,335	- 4,815	6,96769	5,22620	9,04587	9,7972
3100	3098	268,010	- 5,140	6,92349	5,19304	8,99938	9,7971
3150	3148	267,685	- 5,465	6,87952	5,16006	8,95307	9,7969
3200	3198	267,360	- 5,790	6,83578	5,12725	8,90694	9,7968
3250	3248	267,036	- 6,114	6,79226	5,09461	8,86100	9,7966
3300	3298	266,711	- 6,439	6,74897	5,06214	8,81524	9,7965
3350	3348	266,386	- 6,764	6,70590	5,02984	8,76967	9,7963
3400	3398	266,062	- 7,088	6,66306	4,99770	8,72427	9,7962
3450	3448	265,737	- 7,413	6,62044	4,96574	8,67905	9,7960
3500	3498	265,413	- 7,737	6,57804 +2	4,93393 +2	8,63402 -1	9,7959
3550	3548	265,088	- 8,062	6,53586	4,90230	8,58916	9,7957
3600	3598	264,763	- 8,387	6,49390	4,87083	8,54449	9,7956
3650	3648	264,439	- 8,711	6,45216	4,83952	8,49999	9,7954
3700	3698	264,114	- 9,036	6,41064	4,80837	8,45567	9,7952
3750	3748	263,789	- 9,361	6,36933	4,77739	8,41153	9,7951
3800	3798	263,465	- 9,685	6,32825	4,74658	8,36756	9,7949
3850	3848	263,140	-10,010	6,28737	4,71592	8,32377	9,7948
3900	3898	262,816	-10,334	6,24672	4,68542	8,28016	9,7946
3950	3948	262,491	-10,659	6,20627	4,65509	8,23673	9,7945

Values in terms of geopotential altitude. Valeurs en fonction de l'altitude géopotentielle.
Значения величин в функции геопотенциальной высоты.

H, m	*h*, m	*T*, K	*t*, °C	*p*, mbar	*p*, mm Hg	ρ, kg·m^{-3}	*g*, m·s^{-2}
1000	1000	281,650	8,500	8,98746 +2	6,74115 +2	1,11164 +0	9,8036
1050	1050	281,325	8,175	8,93308	6,70036	1,10619	9,8034
1100	1100	281,000	7,850	8,87898	6,65978	1,10076	9,8033
1150	1150	280,675	7,525	8,82513	6,61940	1,09536	9,8031
1200	1200	280,350	7,200	8,77156	6,57921	1,08997	9,8029
1250	1250	280,025	6,875	8,71824	6,53922	1,08460	9,8028
1300	1300	279,700	6,550	8,66519	6,49943	1,07925	9,8026
1350	1350	279,375	6,225	8,61241	6,45984	1,07393	9,8025
1400	1400	279,050	5,900	8,55988	6,42044	1,06862	9,8023
1450	1450	278,725	5,575	8,50761	6,38123	1,06333	9,8022
1500	1500	278,400	5,250	8,45560 +2	6,34222 +2	1,05807 +0	9,8020
1550	1550	278,075	4,925	8,40385	6,30340	1,05282	9,8019
1600	1600	277,750	4,600	8,35235	6,26478	1,04759	9,8017
1650	1650	277,425	4,275	8,30111	6,22635	1,04239	9,8016
1700	1700	277,100	3,950	8,25013	6,18811	1,03720	9,8014
1750	1750	276,775	3,625	8,19940	6,15006	1,03203	9,8013
1800	1801	276,450	3,300	8,14892	6,11219	1,02688	9,8011
1850	1851	276,125	2,975	8,09870	6,07452	1,02176	9,8009
1900	1901	275,800	2,650	8,04872	6,03704	1,01665	9,8008
1950	1951	275,475	2,325	7,99900	5,99974	1,01156	9,8006
2000	2001	275,150	2,000	7,94952 +2	5,96263 +2	1,00649 +0	9,8005
2050	2051	274,825	1,675	7,90029	5,92571	1,00144	9,8003
2100	2101	274,500	1,350	7,85131	5,88897	9,96410 −1	9,8002
2150	2151	274,175	1,025	7,80258	5,85242	9,91399	9,8000
2200	2201	273,850	0,700	7,75409	5,81605	9,86407	9,7999
2250	2251	273,525	0,375	7,70584	5,77986	9,81434	9,7997
2300	2301	273,200	0,050	7,65784	5,74385	9,76481	9,7996
2350	2351	272,875	− 0,275	7,61008	5,70803	9,71547	9,7994
2400	2401	272,550	− 0,600	7,56257	5,67239	9,66632	9,7992
2450	2451	272,225	− 0,925	7,51529	5,63693	9,61736	9,7991
2500	2501	271,900	− 1,250	7,46825 +2	5,60165 +2	9,56859 −1	9,7989
2550	2551	271,575	− 1,575	7,42145	5,56655	9,52001	9,7988
2600	2601	271,250	− 1,900	7,37489	5,53162	9,47161	9,7986
2650	2651	270,925	− 2,225	7,32857	5,49688	9,42341	9,7985
2700	2701	270,600	− 2,550	7,28248	5,46231	9,37540	9,7983
2750	2751	270,275	− 2,875	7,23663	5,42792	9,32757	9,7982
2800	2801	269,950	− 3,200	7,19101	5,39370	9,27992	9,7980
2850	2851	269,625	− 3,525	7,14562	5,35966	9,23247	9,7979
2900	2901	269,300	− 3,850	7,10047	5,32579	9,18520	9,7977
2950	2951	268,975	− 4,175	7,05555	5,29209	9,13812	9,7976
3000	3001	268,650	− 4,500	7,01085 +2	5,25857 +2	9,09122 −1	9,7974
3050	3051	268,325	− 4,825	6,96639	5,22522	9,04450	9,7972
3100	3102	268,000	− 5,150	6,92216	5,19204	8,99797	9,7971
3150	3152	267,675	− 5,475	6,87815	5,15904	8,95162	9,7969
3200	3202	267,350	− 5,800	6,83437	5,12620	8,90546	9,7968
3250	3252	267,025	− 6,125	6,79082	5,09353	8,85948	9,7966
3300	3302	266,700	− 6,450	6,74749	5,06103	8,81368	9,7965
3350	3352	266,375	− 6,775	6,70438	5,02870	8,76806	9,7963
3400	3402	266,050	− 7,100	6,66150	4,99654	8,72262	9,7962
3450	3452	265,725	− 7,425	6,61884	4,96454	8,67736	9,7960
3500	3502	265,400	− 7,750	6,57641 +2	4,93271 +2	8,63229 −1	9,7959
3550	3552	265,075	− 8,075	6,53419	4,90105	8,58739	9,7957
3600	3602	264,750	− 8,400	6,49219	4,86955	8,54267	9,7955
3650	3652	264,425	− 8,725	6,45041	4,83821	8,49813	9,7954
3700	3702	264,100	− 9,050	6,40885	4,80704	8,45376	9,7952
3750	3752	263,775	− 9,375	6,36751	4,77603	8,40958	9,7951
3800	3802	263,450	− 9,700	6,32638	4,74518	8,36557	9,7949
3850	3852	263,125	−10,025	6,28547	4,71449	8,32174	9,7948
3900	3902	262,800	−10,350	6,24478	4,68397	8,27808	9,7946
3950	3952	262,475	−10,675	6,20429	4,65360	8,23460	9,7945

TABLE 5 *(continued)*

TABLEAU 5 *(suite)*

ТАБЛИЦА 5 *(продолжение)*

Values in terms of geometrical altitude. Valeurs en fonction de l'altitude géométrique.
Значения величин в функции геометрической высоты.

h, m	*H*, m	*T*, K	*t*, °C	*p*, mbar	*p*, mm Hg	ρ, kg·m^{-3}	*g*, m·s^{-2}
4000	3997	262,166	-10,984	6,16604 +2	4,62491 +2	8,19347 -1	9,7943
4050	4047	261,842	-11,308	6,12602	4,59490	8,15038	9,7942
4100	4097	261,517	-11,633	6,08622	4,56504	8,10747	9,7940
4150	4147	261,193	-11,957	6,04662	4,53534	8,06473	9,7939
4200	4197	260,868	-12,282	6,00723	4,50579	8,02216	9,7937
4250	4247	260,543	-12,607	5,96805	4,47641	7,97977	9,7936
4300	4297	260,219	-12,931	5,92908	4,44718	7,93755	9,7934
4350	4347	259,894	-13,256	5,89032	4,41810	7,89550	9,7932
4400	4397	259,570	-13,580	5,85176	4,38918	7,85363	9,7931
4450	4447	259,245	-13,905	5,81340	4,36041	7,81192	9,7929
4500	4497	258,921	-14,229	5,77526 +2	4,33180 +2	7,77038 -1	9,7928
4550	4547	258,596	-14,554	5,73731	4,30334	7,72902	9,7926
4600	4597	258,272	-14,878	5,69957	4,27503	7,68782	9,7925
4650	4647	257,947	-15,203	5,66203	4,24687	7,64679	9,7923
4700	4697	257,623	-15,527	5,62469	4,21886	7,60593	9,7922
4750	4746	257,298	-15,852	5,58755	4,19101	7,56524	9,7920
4800	4796	256,974	-16,176	5,55061	4,16330	7,52472	9,7919
4850	4846	256,649	-16,501	5,51387	4,13574	7,48436	9,7917
4900	4896	256,325	-16,825	5,47732	4,10833	7,44417	9,7915
4950	4946	256,000	-17,150	5,44098	4,08107	7,40415	9,7914
5000	4996	255,676	-17,474	5,40483 +2	4,05395 +2	7,36429 -1	9,7912
5050	5046	255,351	-17,799	5,36887	4,02698	7,32459	9,7911
5100	5096	255,027	-18,123	5,33311	4,00016	7,28506	9,7909
5150	5146	254,702	-18,448	5,29754	3,97348	7,24570	9,7908
5200	5196	254,378	-18,772	5,26217	3,94695	7,20649	9,7906
5250	5246	254,053	-19,097	5,22699	3,92056	7,16745	9,7905
5300	5296	253,729	-19,421	5,19200	3,89432	7,12858	9,7903
5350	5346	253,404	-19,746	5,15720	3,86822	7,08986	9,7902
5400	5395	253,080	-20,070	5,12259	3,84225	7,05131	9,7900
5450	5445	252,755	-20,395	5,08816	3,81644	7,01292	9,7899
5500	5495	252,431	-20,719	5,05393 +2	3,79076 +2	6,97469 -1	9,7897
5550	5545	252,106	-21,044	5,01988	3,76522	6,93662	9,7895
5600	5595	251,782	-21,368	4,98602	3,73982	6,89871	9,7894
5650	5645	251,458	-21,692	4,95235	3,71457	6,86095	9,7892
5700	5695	251,133	-22,017	4,91886	3,68945	6,82336	9,7891
5750	5745	250,809	-22,341	4,88555	3,66447	6,78593	9,7889
5800	5795	250,484	-22,666	4,85243	3,63962	6,74865	9,7888
5850	5845	250,160	-22,990	4,81949	3,61492	6,71153	9,7886
5900	5895	249,836	-23,314	4,78673	3,59035	6,67457	9,7885
5950	5944	249,511	-23,639	4,75416	3,56591	6,63776	9,7883
6000	5994	249,187	-23,963	4,72176 +2	3,54161 +2	6,60111 -1	9,7882
6050	6044	248,862	-24,288	4,68955	3,51745	6,56462	9,7880
6100	6094	248,538	-24,612	4,65751	3,49342	6,52828	9,7879
6150	6144	248,214	-24,936	4,62565	3,46952	6,49210	9,7877
6200	6194	247,889	-25,261	4,59396	3,44576	6,45607	9,7875
6250	6244	247,565	-25,585	4,56246	3,42212	6,42019	9,7874
6300	6294	247,241	-25,909	4,53113	3,39863	6,38447	9,7872
6350	6344	246,916	-26,234	4,49997	3,37526	6,34890	9,7871
6400	6394	246,592	-26,558	4,46899	3,35202	6,31348	9,7869
6450	6443	246,267	-26,883	4,43818	3,32891	6,27821	9,7868
6500	6493	245,943	-27,207	4,40755 +2	3,30593 +2	6,24310 -1	9,7866
6550	6543	245,619	-27,531	4,37708	3,28308	6,20813	9,7865
6600	6593	245,294	-27,856	4,34679	3,26036	6,17332	9,7863
6650	6643	244,970	-28,180	4,31667	3,23777	6,13866	9,7862
6700	6693	244,646	-28,504	4,28672	3,21530	6,10415	9,7860
6750	6743	244,322	-28,828	4,25693	3,19296	6,06978	9,7859
6800	6793	243,997	-29,153	4,22732	3,17075	6,03557	9,7857
6850	6843	243,673	-29,477	4,19787	3,14866	6,00150	9,7855
6900	6893	243,349	-29,801	4,16859	3,12670	5,96758	9,7854
6950	6942	243,024	-30,126	4,13947	3,10486	5,93381	9,7852

Values in terms of geopotential altitude. Valeurs en fonction de l'altitude géopotentielle.
Значения величин в функции геопотенциальной высоты.

H, m	*h*, m	*T*, K	*t*, °C	*p*, mbar	*p*, mm Hg	ρ, kg·m⁻³	*g*, m·s⁻²
4000	4003	262,150	-11,000	6,16402 +2	4,62340 +2	8,19129 -1	9,7943
4050	4053	261,825	-11,325	6,12396	4,59335	8,14816	9,7942
4100	4103	261,500	-11,650	6,08412	4,56346	8,10520	9,7940
4150	4153	261,175	-11,975	6,04448	4,53373	8,06242	9,7938
4200	4203	260,850	-12,300	6,00505	4,50416	8,01981	9,7937
4250	4253	260,525	-12,625	5,96583	4,47474	7,97737	9,7935
4300	4303	260,200	-12,950	5,92682	4,44548	7,93510	9,7934
4350	4353	259,875	-13,275	5,88801	4,41637	7,89300	9,7932
4400	4403	259,550	-13,600	5,84941	4,38742	7,85108	9,7931
4450	4453	259,225	-13,925	5,81102	4,35862	7,80933	9,7929
4500	4503	258,900	-14,250	5,77283 +2	4,32998 +2	7,76774 -1	9,7928
4550	4553	258,575	-14,575	5,73484	4,30149	7,72633	9,7926
4600	4603	258,250	-14,900	5,69706	4,27315	7,68508	9,7925
4650	4653	257,925	-15,225	5,65948	4,24496	7,64401	9,7923
4700	4703	257,600	-15,550	5,62210	4,21692	7,60310	9,7922
4750	4754	257,275	-15,875	5,58492	4,18903	7,56236	9,7920
4800	4804	256,950	-16,200	5,54794	4,16129	7,52178	9,7918
4850	4854	256,625	-16,525	5,51115	4,13371	7,48138	9,7917
4900	4904	256,300	-16,850	5,47457	4,10626	7,44114	9,7915
4950	4954	255,975	-17,175	5,43818	4,07897	7,40106	9,7914
5000	5004	255,650	-17,500	5,40199 +2	4,05183 +2	7,36116 -1	9,7912
5050	5054	255,325	-17,825	5,36599	4,02482	7,32141	9,7911
5100	5104	255,000	-18,150	5,33019	3,99797	7,28183	9,7909
5150	5154	254,675	-18,475	5,29458	3,97126	7,24242	9,7908
5200	5204	254,350	-18,800	5,25917	3,94470	7,20316	9,7906
5250	5254	254,025	-19,125	5,22394	3,91828	7,16407	9,7905
5300	5304	253,700	-19,450	5,18891	3,89200	7,12515	9,7903
5350	5355	253,375	-19,775	5,15407	3,86587	7,08638	9,7901
5400	5405	253,050	-20,100	5,11942	3,83988	7,04778	9,7900
5450	5455	252,725	-20,425	5,08495	3,81403	7,00934	9,7898
5500	5505	252,400	-20,750	5,05068 +2	3,78832 +2	6,97105 -1	9,7897
5550	5555	252,075	-21,075	5,01659	3,76275	6,93293	9,7895
5600	5605	251,750	-21,400	4,98269	3,73732	6,89497	9,7894
5650	5655	251,425	-21,725	4,94897	3,71203	6,85717	9,7892
5700	5705	251,100	-22,050	4,91544	3,68688	6,81952	9,7891
5750	5755	250,775	-22,375	4,88210	3,66187	6,78204	9,7889
5800	5805	250,450	-22,700	4,84893	3,63700	6,74471	9,7888
5850	5855	250,125	-23,025	4,81595	3,61226	6,70754	9,7886
5900	5905	249,800	-23,350	4,78315	3,58766	6,67053	9,7885
5950	5956	249,475	-23,675	4,75054	3,56320	6,63367	9,7883
6000	6006	249,150	-24,000	4,71810 +2	3,53887 +2	6,59697 -1	9,7881
6050	6056	248,825	-24,325	4,68584	3,51467	6,56042	9,7880
6100	6106	248,500	-24,650	4,65377	3,49061	6,52403	9,7878
6150	6156	248,175	-24,975	4,62186	3,46668	6,48780	9,7877
6200	6206	247,850	-25,300	4,59014	3,44289	6,45171	9,7875
6250	6256	247,525	-25,625	4,55859	3,41923	6,41579	9,7874
6300	6306	247,200	-25,950	4,52722	3,39570	6,38001	9,7872
6350	6356	246,875	-26,275	4,49603	3,37230	6,34439	9,7871
6400	6406	246,550	-26,600	4,46501	3,34903	6,30892	9,7869
6450	6457	246,225	-26,925	4,43416	3,32589	6,27360	9,7868
6500	6507	245,900	-27,250	4,40348 +2	3,30288 +2	6,23844 -1	9,7866
6550	6557	245,575	-27,575	4,37298	3,28000	6,20342	9,7865
6600	6607	245,250	-27,900	4,34265	3,25725	6,16856	9,7863
6650	6657	244,925	-28,225	4,31249	3,23463	6,13384	9,7861
6700	6707	244,600	-28,550	4,28249	3,21214	6,09928	9,7860
6750	6757	244,275	-28,875	4,25267	3,18977	6,06486	9,7858
6800	6807	243,950	-29,200	4,22302	3,16752	6,03060	9,7857
6850	6857	243,625	-29,525	4,19353	3,14541	5,99648	9,7855
6900	6907	243,300	-29,850	4,16421	3,12342	5,96251	9,7854
6950	6958	242,975	-30,175	4,13506	3,10155	5,92868	9,7852