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Vertical temperature profiles of the troposphere and stratosphere on punched cards. By BARWELL,B.R. and HOSKIN,G.C.

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Vertical temperature profiles of the troposphere and stratosphere on punched cards

B R Barwell and G C Hoskin

VERTICAL TEMPERATURE PROFILES OF THE TROPOSPHERE AND STRATOSPHERE ON PUNCHED CARDS

A study is currently being made by staff of the High Atmosphere Branch of methods of deducing vertical temperature profiles in the troposphere and stratosphere from radiance observations made by satellite-borne radiometers. For this purpose it has been found useful to have many rocket - and radio-sonde soundings of the vertical temperature profile transferred to I.B.M. data cards in a format suitable for use with FORTRAN.

The rocket-and radio-sonde soundings (451 altogether) have been obtained from American, British and Russian data (refs. 1, 2 and 3) for twenty-two launch sites throughout the world. They span the period from January 1964 to January 1972 and have been chosen to give an adequate coverage of the seasonal and latitudinal variability of the atmosphere.

Each sounding, which is identified by the name, latitude and longitude of the launch site and the date and time of launch, consists of the temperature in ^{o}K at fifty pressure levels defined by

$$p = p_o \exp(-N/5) \quad (N = 0,1,2 \text{ ---},49)$$

where po = 1013.246 mb. The uppermost pressure is 0.056 mb (approximately 70 km geopotential altitude) and the pressure levels are separated by 1.1 to 1.8 km. The temperatures have been obtained by linear interpolation on a log (pressure) scale between data at standard pressure levels. Many of the soundings required extrapolation to the highest levels as few rockets reach 0.056 mb - only those soundings which reached a height of 0.2 mb or greater were used and the U.S. Standard Atmosphere Supplements 1966 (ref.4) were used as a guide to extrapolate them to 0.056 mb. In the same way downward extrapolations to 1013.246 mb were also made where necessary.

On the following page is a summary of the launch sites in order of latitude, their geographical coordinates and the number of soundings used from each site. The subsequent pages contain a tabulation of the year, month, day, hour and minute (UT) of the soundings. On the final page is a list of model atmospheres from the U.S. Standard Atmosphere Supplements 1966 (ref. 4) which have been processed in the same

way as the soundings. A few more soundings may be added from time to time.

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References:-

1) "Meteorological rocket network firings" - monthly data reports of the W.D.C."A" for meteorology. (U.S. Dept. of Commerce, E.S.S.A.)

2) Rocket soundings made by the High Atmosphere Branch of the Meteorological Office, Bracknell, U.K.

3) "Results of rocket soundings of the atmosphere" - bulletins issued by the Central Aerological Observatory, Moscow.

4) U.S. Standard Atmosphere Supplements 1966, publ. by U.S. Govt. Printing Office, Washington, D.C.

	LAT.	LONG.	NO. OF SOUNDINGS
Molodezhnaya, Antarctica	67.6S	45.8E	16
Mar Chiquita, Argentina	37.8S	57.4W	3
Ascension Is.	8.0S	14.4W	11
Gan, Maldive Is.	0.7S	73.1E	5
Natal, Brazil	5.9N	35.2W	1
Kwajalein, Marshall Is.	8.7N	167.7E	9
Fort Sherman, Canal Zone	9.3N	80.0W	9
Antigua, B.W.I.	17.2N	61.8W	8
Barking Sands, Hawaii	22.0N	159.7W	8
Cape Kennedy, Florida	28.5N	80.5W	13
White Sands, New Mexico	32.4N	106.5W	17
Point Mugu, California	34.1N	119.1W	18
Wallops Is., Virginia	37.8N	75.5W	14
Volgograd, U.S.S.R.	48.7N	44.3E	25
Aberporth, S. Wales	52.1N	4.6W	3
Primrose Lake, Alberta	54.8N	110.1W	27
West Geirinish, Scotland	57.4N	7.4W	126
Fort Churchill, Canada	58.7N	93.8W	48
Fort Greely, Alaska	64.0N	145.7W	26
Kiruna, Sweden	67.9N	20.3E	8
Thule, Greenland	76.6N	68.8W	9
Heiss Is., U.S.S.R.	80.6N	58.1E	47

MOLODEZHNAYA, ANTARCTICA

69	Aug.	13	0200
	Sep.	17	0200
	Oct.	15	0200
	Nov.	5	0207
	Dec.	10	0155
70	Jan.	21	0200
	Feb.	18	0200
	Mar.	25	0200
70	Apr.	29	0200
	May	20	0150
	Jun.	17	0200
	Aug.	5	0220
	Aug.	26	0155
	Oct.	14	0200
	Nov.	18	0320
	Dec.	9	0200

MAR CHIQUITA, ARGENTINA

69	Jan.	30	0345
	May	29	1855
	Sep.	18	0425

ASCENSION IS.

69	Jan.	15	1445
	Feb.	28	1445
	Jul.	31	2228
	Sep.	10	1445
	Oct.	6	1445
	Nov.	17	1430
	Dec.	29	1430
70	Feb.	4	1404
	Mar.	4	1400
	May	15	1400
	Jun	17	1400

GAN, MALDIVE IS.

68	Sep. 28	1410	
69	May 1	2028	
	Sep. 23	1440	
70	Mar. 13	1436	
	Sep. 8	1415	

NATAL, BRAZIL

69	Feb. 12	1520	

KWAJALEIN, MARSHALL IS.

69	Aug. 23	0121	
	Sep. 11	0149	
	Oct. 3	0246	
	Nov. 13	0214	
	Dec. 4	0115	
70	Jan 6	0115	
	Feb. 8	1318	
	Mar. 31	0139	
	Jun. 2	0130	

FORT SHERMAN, CANAL ZONE

69	Jan 10	1600	
	Feb. 17	1603	
	Mar. 19	1601	
	Apr. 11	1600	
	Jun. 2	1615	
	Jun. 18	1657	
	Aug. 29	1600	
70	Jan. 16	1725	
	Jun. 29	1500	

ANTIGUA, B.W.I.

69	Feb.	19	1335
	Sep.	24	1748
	Nov.	5	1830
	Dec.	10	1605
70	Jan.	14	1655
	Mar.	11	1500
	Apr.	13	1420
	Jun.	1	1330

BARKING SANDS, HAWAII

69	Jan.	31	2047
	Jun.	6	2150
	Sep.	15	2134
	Oct.	20	2142
	Nov.	21	2200
70	Jan.	12	2104
	Feb.	16	2131
	May	15	2200

CAPE KENNEDY, FLORIDA

69	Jan.	20	1530
	Jul.	2	1730
	Aug.	1	1400
	Aug.	27	1400
	Sep.	24	1615
	Oct.	20	1430
	Nov.	19	1500
	Dec.	18	1500
70	Jan.	22	1500
	Feb.	10	1507
	Mar.	23	1500
	Apr.	29	1748
	Jun.	26	1500

WHITE SANDS, NEW MEXICO

69	Jan.	17	2115
	Feb.	14	0350
	Apr.	2	1800
	May	14	1900
	Jun.	6	0505
	Jul.	14	1845
	Aug.	18	1930
	Sep.	26	1900
	Oct.	16	1900
	Dec.	1	2040

70	Jan.	5	1945
	Feb.	9	1706
	Mar.	4	1930
	Mar.	20	2000
	Apr.	10	2000
	May	15	1700
	Jun.	10	1808

POINT MUGU, CALIFORNIA

69	Jan.	17	1738
	Feb.	14	1755
	Mar.	21	1845
	Apr.	21	1942
	May	23	1730
	Jun.	26	2147
	Jul.	22	2138
	Aug.	20	1540
	Sep.	16	1728
	Oct.	1	1619
	Oct.	14	1621
	Nov.	4	2000
	Dec.	2	2240

70	Jan.	7	2053
	Feb.	11	2202
	Mar.	11	1833
	Apr.	15	2003
	May	25	2132

WALLOPS IS., VIRGINIA

69	Mar.	27	0332
	Apr.	23	1835
	May	28	1415
	Jun.	20	1840
	Jul.	25	0956
	Aug.	15	1435
	Sep.	9	1626
	Dec.	15	1528
70	Jan.	23	1536
	Jan.	26	2023
	Feb.	27	1442
	Mar.	25	1653
	Apr.	20	1857
	May	15	1519

VOLGOGRAD, U.S.S.R.

67	Dec.	20	0901
68	Jan.	17	0028
	Jan.	17	1228
	Jan.	31	1003
	Feb.	5	1001
	Feb.	29	2050
	Mar.	15	0300
	Apr.	29	1000
	May	6	1006
	Jun.	12	0302
	Jul.	10	0332
	Sep.	18	1003
	Oct.	9	1403
	Nov.	15	0603
	Dec.	20	1100
69	Jan.	15	0808
	Feb.	5	0802
	Mar.	29	1530
	Apr.	20	1554
	May	21	1103
	Jun.	4	0400
	Jul.	23	2100
	Sep.	24	0408
	Oct.	16	1002
	Dec.	11	1001

ABERPORTH, S. WALES

64	Sep.	23	1102
66	Jun.	3	0848
71	Jan	22	1903

PRIMROSE LAKE, ALBERTA

69	Jan.	31	1830
	Feb.	5	1751
	Feb.	12	1829
	Feb.	26	1800
	Mar.	5	1800
	Mar.	19	1810
	Mar.	28	1840
	Apr.	3	1814
	Apr.	8	1828
	Apr.	11	1830
	Apr.	14	1837
	Apr.	28	1807
	May	28	1823
	Jun.	27	1801
	Aug.	15	1804
	Sep.	15	1800
	Oct.	3	1801
	Oct.	17	1800
	Oct.	27	1836
	Nov.	3	1808
	Nov.	19	1800
70	Jan.	7	1849
	Jan.	21	1800
	Feb.	6	1801
	Feb.	16	1806
	Feb.	27	1807
	Mar.	2	1822

WEST GEIRINISH, SCOTLAND

64	Jan.	15	1837
	Jan.	17	2007
	Feb.	5	1925
65	Jan.	15	2150
	Jan.	18	2137
	Jan.	20	1948
	Jan.	26	1950
	Jan.	28	1917
	Feb.	18	1936
	Feb.	23	1942
	Mar.	1	2008
	Mar.	18	2121
	Mar.	19	2112
	Mar.	25	2056
	Apr.	13	2207
	Apr.	26	2246
	Nov.	2	2250
66	Feb.	8	2202
	Feb.	10	2010
	Feb.	12	2020
	Feb.	14	2002
	Feb.	18	2020
	Feb.	21	2156
	Feb.	23	1952
	Feb.	28	2022
	Mar.	2	2022
	Mar.	4	1949
66	Mar.	7	2005
	Mar.	9	2014
	Apr.	21	2203
	Oct.	3	1945
	Oct.	14	1925
	Oct.	17	1904
	Oct.	19	1857
	Oct.	22	1932
	Oct.	25	2046
	Oct.	27	1900
	Oct.	29	1908
	Nov.	3	2014
	Nov.	5	2025
	Nov.	9	1907
	Nov.	11	1901
	Nov.	14	1958
	Nov.	21	1745
	Nov.	25	1736
	Dec.	5	1730
67	Feb.	17	1909
	Feb.	21	2208
	Feb.	23	1924
	Mar.	18	1400
	Mar.	23	2000
	Mar.	25	2000
	Mar.	29	2031
	Apr.	1	2148
	Apr.	8	2053

WEST GEIRINISH (cont.)

67	Apr.	10	2241
	Apr.	11	2141
	Apr.	12	2100
	Apr.	14	2103
	Apr.	21	2141
	Jun.	2	2332
	Jul.	7	0023
	Dec.	7	1728
	Dec.	13	1858
	Dec.	19	1718
	Dec.	21	1731
	Dec.	23	1724
68	Jan.	1	1724
	Jan.	4	1728
	Jan.	6	1727
	Jan.	10	1732
	Jan.	15	1802
	Jan.	17	1800
	Jan.	22	1824
	Jan.	25	1809
	Jan.	30	1811
	Feb.	1	1823
	Feb.	2	1828
	Feb.	5	1830
	Feb.	7	1836
	Feb.	10	1829
	Feb.	12	1831
	Feb.	14	1853
68	Feb.	19	1904
	Feb.	21	1909
	Feb.	23	1909
	Feb.	24	1910
	Feb.	26	1927
	Dec.	7	1820
	Dec.	9	1728
69	Jan.	13	1802
	Nov.	29	1743
	Dec.	8	1754
	Dec.	11	1800
	Dec.	15	1755
	Dec.	19	1735
	Dec.	23	1720
	Dec.	30	1745
70	Jan.	3	1755
	Jan.	6	1756
	Jan.	12	1752
	Jan.	29	1814
	Nov.	28	1931
	Nov.	30	1734
	Dec.	4	1801
	Dec.	12	1855
	Dec.	29	1750
	Dec.	31	1742

WEST GEIRINISH (cont.)

71	Jan.	2	1821
	Jan.	11	1806
	Jan.	12	1800
	Jan.	14	1844
	Jan.	16	1749
	Jan.	20	1757
	Jan.	22	1755
	Jan.	25	1720
	Feb.	3	1825
	Feb.	5	1859
71	Feb.	10	1839
	Feb.	19	1930
	Dec.	2	1850
	Dec.	6	1819
	Dec.	28	2130
	Dec.	31	1905
72	Jan.	3	1805
	Jan.	20	1809

FORT CHURCHILL, CANADA

69	Jan.	7	1755
	Jan.	9	1747
	Jan.	10	2144
	Feb.	6	1024
	Mar.	13	0430
	Mar.	21	0359
	Mar.	27	0132
	Mar.	28	0021
	Mar.	29	0112
	Apr.	1	0100
	Apr.	10	0240
	Apr.	13	1524
	Apr.	26	0231
	May	2	1619
	Jun.	4	1645
69	Jul.	16	1646
	Aug.	18	1650
	Sep.	11	0215
	Oct.	1	1648
	Oct.	16	0328
	Oct.	18	0155
	Oct.	23	0245
	Nov.	3	1311
	Nov.	3	2130
	Nov.	15	0424
	Nov.	18	1751
	Nov.	26	1744
	Dec.	2	1747
	Dec.	10	0046
	Dec.	12	0233

FORT CHURCHILL (cont.)

69	Dec.	13	0202
	Dec.	16	1748
	Dec.	17	1756
	Dec.	19	1747
	Dec.	31	1841
70	Jan.	3	0634
	Jan.	4	0603
	Jan.	5	1749
	Jan.	5	2201
70	Jan.	6	0601
	Jan.	7	2303
	Jan.	20	0326
	Jan.	21	0302
	Feb.	4	0258
	Feb.	7	0329
	Feb.	17	0027
	Feb.	26	0214
	Mar.	14	0229

FORT GREELY, ALASKA

69	Jan.	6	2052
	Jan.	22	2000
	Jan.	24	2000
	Jan.	29	2045
	Feb.	1	2000
	Feb.	2	2017
	Feb.	4	2000
	Feb.	7	2013
	Feb.	14	2000
	Feb.	20	2030
	Feb.	24	2015
	Feb.	26	2000
	Feb.	28	2000
	Mar.	5	2000
	Mar.	7	2002
69	Mar.	14	2000
	Mar.	26	2000
	Apr.	18	2000
	May	8	1930
	Jun.	18	1915
	Jul.	17	1915
	Dec.	30	1945
70	Jan.	28	2000
	Feb.	20	2000
	Apr.	22	2000
	Apr.	29	2030

KIRUNA, SWEDEN

70	Jan.	30	1527
71	Jan.	19	1520
	Jan.	21	1507
	Jan.	25	1610
71	Jan.	29	1721
	Feb.	3	1912
	Feb.	9	1900
	Feb.	11	1850

THULE, GREENLAND

69	Mar.	14	1449
	Mar.	19	1508
	Mar.	28	1447
	Apr.	1	1430
	Apr.	3	1359
69	Apr.	4	1430
	Jun.	30	1445
	Sep.	11	1530
	Oct.	17	1630

HEISS IS., U.S.S.R.

64	May	15	2008
66	Jan.	19	1230
	Feb.	7	1200
	Mar.	10	1200
	Apr.	22	1205
	May	18	1200
	Jun.	16	1213
	Jul.	15	1200
	Aug.	17	1202
	Sep.	12	1200
66	Oct.	5	1200
67	Mar.	22	1020
	Apr.	17	1200
	May	15	0900
	Jun.	24	0900
	Jul.	15	0900
	Aug.	21	0900
	Sep.	20	0909
	Nov.	22	1130
	Dec.	20	0901

HEISS IS., U.S.S.R.

68	Jan.	17	0100
	Jan.	17	1300
	Feb.	19	0902
	Mar.	13	0900
	Apr.	19	0900
	May	8	0913
	June	12	0928
	Jul.	3	0504
	Jul.	3	1700
	Aug.	14	0900
	Sep.	11	0900
	Nov.	13	0915
	Nov.	20	0925
	Dec.	11	0900

70	Jan.	14	0917
	Jan.	25	0900
	Feb.	16	0900
	Mar.	18	0900
	Apr.	15	0911
	May	13	0900
	June	17	0900
	Jul.	15	0900
	Aug.	12	0900
	Sep.	6	0900
	Oct.	14	0955
	Nov.	11	0900
	Dec.	16	0900

U.S. STANDARD ATMOSPHERE SUPPLEMENTS 1966

LAT.	15°	ANNUAL
	30°	JANUARY
	30°	JULY
	45°	JANUARY
	45°	JULY
	30°-60°	SPRING/FALL
	60°	JANUARY
	60°	JANUARY - COLD
	60°	JANUARY - WARM
	60°	JULY