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Percentage frequencies of hourly values of dry bulb
and wet bulb temperatures at Singapore/Changi

1957 - 71

by Joyce Laing and K. Grant

Climatological Services (Met.0.3)

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PERCENTAGE FREQUENCY OF HOURLY VALUES OF DRY-BULB AND WET-BULB TEMPERATURES

AT SINGAPORE/CHANGI 1957-71

BY JOYCE LAING AND K GRANT

Introduction

Hourly observations of dry-bulb and wet-bulb temperature were made at Singapore, Changi Lat. $01^{\circ} 22' N$ Long. $103^{\circ} 59' E$ during the 14 years July 1957-June 1971. The thermometers were exposed in the standard louvered screen 4 feet (1.25 metres approximately) above the ground. An analysis has been made by computer of these observations to give monthly and annual tables showing the percentage frequency of combinations of dry- and wet-bulb readings in ranges of one degree Celsius. Tables are also given showing the frequency of dry-bulb and wet-bulb temperatures separately.

Explanation of Tables

Tables 1 to 13 contain for each month and for the year the distribution of combined dry-bulb and wet-bulb temperature. The ranges of dry-bulb temperature are shown down the left hand side: the ranges of wet-bulb temperatures, across the page, are for the sake of brevity given as T (the dry-bulb temperature range for the row) $T-1$ degC, $T-2$ degC etc. Thus if T is 30.1 to 31.0 then $T-1$ is 29.1 to 30.0 and so on.

For any given range of dry-bulb temperature and associated wet-bulb temperature two values are given. The upper figure is the percentage frequency of occurrence within the given range calculated to two places of decimals; the lower figure is the cumulative percentage frequency of occurrence of dry-bulb temperature and associated wet-bulb temperature greater than or equal to the lower values in the appropriate range as indicated, calculated to one place of decimals, (cumulative values of 0.0 indicate values of less than 0.05 per cent but greater than zero). Entries of 0.00^{+} in the annual table indicate values of less than 0.005 per cent, but greater than zero.

Example. In table 1 for January, the percentage frequency of the number of hours with dry-bulb temperature within the range 31.1 to 32.0 deg C and the associated wet-bulb temperature within the range 25.1 to 26.0 deg C (column $T-6$) is 0.85. The cumulative value in this 'box', 1.7, indicates that a dry-bulb temperature of 31.1 deg C or more and an associated wet-bulb temperature of 25.1 deg C or more occurred on 1.7 per cent of the hours. This value is derived from the sum of the upper figures in each box below and to the left of a diagonal through the box concerned to the bottom right of the table thus:

0.44	0.85	0.54	0.15
0.01	0.12	0.17	0.15
		0.02	0.05

Slight discrepancies may occur in the last place of decimals due to the rounding off of figures when the percentage frequencies were calculated; the printed cumulative figures are correct rather than those obtained by simple addition of the figures in the table.

Table 14 gives the frequency of dry-bulb temperatures alone and table 15 gives the frequency of wet-bulb mean of the monthly figures. In these tables an entry of 0.0^{+} indicates a value of less than 0.05 per cent, but greater than zero.

Average of accumulated temperature

Accumulated temperatures are the integrated excess or deficit from a stated base temperature, and are expressed as degree-days or degree-hours. From data given in table 14 the degree-hours can be calculated using the following method.

The average number of degree-hours in any month **above** a base temperature ($b^{\circ}\text{C}$) is given by the sum of the products obtained by multiplying the entries for that month which refer to temperatures greater than $b^{\circ}\text{C}$ (ie those values lying beneath the entry referring to the range of temperature whose upper limit is b) by $(1/2) \times (N/100)$, $(3/2) \times (N/100)$, $(5/2) \times (N/100)$ etc. respectively, where N is the number of hours in the month. This assumes, in effect, that the entries in the ranges $(b + 0.1)$ to $(b + 1)$, $(b + 1.1)$ to $(b + 2)$ etc are concentrated at mid-point of the range $(b + 0.5)$, $(b + 1.5)$ etc.

Example. In May (number of hours 744) the average number of degree-hours above 30°C is (from Table 14):

$$7.8 \times (1/2) \times (744/100) = 29.0$$

$$7.5 \times (3/2) \times (744/100) = 83.7$$

$$3.4 \times (5/2) \times (744/100) = 63.2$$

$$0.5 \times (7/2) \times (744/100) = 13.0$$

188.9

To obtain the number of degree-hours **below** base $b^{\circ}\text{C}$ the procedure is the same except that the percentages used are those for the temperature ranges **below and including** the range of temperature which has $b^{\circ}\text{C}$ as its upper limit.

0.15	0.04	0.05	0.44
0.12	0.11	0.12	0.01
0.08	0.02		

Table 1 PERCENTAGE FREQUENCIES OF DRY-BULB AND ASSOCIATED WET-BULB TEMPERATURES
SINGAPORE (CHANGI)
JANUARY 1958-71

ASSOCIATED WET-BULB TEMPERATURES (DEG C)

DRY-BULB	T	T-1	T-2	T-3	T-4	T-5	T-6	T-7	T-8
T (DEG C)									
21.1 to 22.0	0.11 99.6	0.02 100.0							
22.1 to 23.0	2.20 95.0	1.23 99.5	0.17 99.9						
23.1 to 24.0	5.10 74.6	7.44 92.8	1.66 96.1	0.13 96.3					
24.1 to 25.0	2.73 37.6	14.74 69.5	5.29 80.2	1.00 81.9	0.06 81.9				
25.1 to 26.0	0.08 10.2	6.39 34.9	6.87 52.1	2.47 57.5	0.21 58.1	0.01 58.1			
26.1 to 27.0	0.0 1.8	0.68 10.2	6.23 28.4	4.07 38.7	1.23 41.7	0.18 42.1			
27.1 to 28.0		0.01 1.8	1.26 9.5	3.98 21.5	2.75 27.8	0.76 29.5	0.18 29.7		
28.1 to 29.0		0.01 0.0	0.20 1.8	1.72 8.2	3.37 16.2	1.96 19.8	0.60 20.7	0.05 20.8	0.01 20.8
		T-9							
29.1 to 30.0	0.01 12.9			0.41 1.5	2.03 6.3	2.77 10.9	1.04 12.5	0.24 12.8	0.01 12.8
30.1 to 31.0				0.01 0.0	0.54 1.1	1.63 3.8	1.20 5.7	0.36 6.3	0.09 6.3
31.1 to 32.0	0.01 2.5					0.44 0.6	0.85 1.7	0.54 2.4	0.15 2.5
32.1 to 33.0	0.01 0.5					0.01 0.0	0.12 0.1	0.17 0.4	0.15 0.5
33.1 to 34.0								0.02 0.0	0.05 0.1

TABLE 2 PERCENTAGE FREQUENCIES OF DRY-BULB AND ASSOCIATED WET-BULB TEMPERATURES

FEBRUARY 1958-71

SINGAPORE (CHANGI)

ASSOCIATED WET-BULB TEMPERATURE (DEG C)

DRY-BULB T (DEG C)	T	T-1	T-2	T-3	T-4	T-5	T-6	T-7	T-8
21.1 to 22.0	0.08 100.0	0.01 100.0							
22.1 to 23.0	0.98 98.2	0.62 99.9							
23.1 to 24.0	3.17 86.6	3.63 97.2	0.54 98.3						
24.1 to 25.0	2.24 48.4	15.63 83.4	3.89 90.4	0.37 91.0					
25.1 to 26.0	0.15 13.9	8.52 46.2	9.13 65.5	1.64 68.6	0.06 68.8				
26.1 to 27.0	0.0 3.0	1.07 13.7	8.27 37.5	4.13 47.7	0.62 49.2	0.06 49.3			
27.1 to 28.0	0.0 0.1	0.07 3.0	1.35 12.7	4.49 28.2	2.20 34.3	0.37 35.1	0.03 35.2		
28.1 to 29.0		0.0 0.1	0.23 2.9	2.03 11.2	3.36 22.3	1.54 26.2	0.23 26.6	0.03 26.7	
29.1 to 30.0			0.01 0.1	0.54 2.7	2.30 9.0	3.48 16.7	1.23 19.0	0.08 19.2	
30.1 to 31.0	0.02 11.6			0.01 0.1	0.84 2.2	2.07 6.1	2.71 10.3	0.75 11.5	0.07 11.6
31.1 to 32.0	0.05 5.1			0.01 0.0	0.03 0.0	0.87 1.3	1.41 3.2	1.20 4.7	0.32 5.1
32.1 to 33.0	0.04 1.2						0.31 0.4	0.41 0.9	0.28 1.2
33.1 to 34.0	0.02 0.2							0.07 0.1	0.07 0.2
34.1 to 35.0									0.01 0.0

TABLE 3 PERCENTAGE FREQUENCIES OF DRY-BULB AND ASSOCIATED WET-BULB TEMPERATURES

MARCH 1958-71

SINGAPORE (CHANGI)

ASSOCIATED WET-BULB TEMPERATURE (DEG C)

DRY-BULB T (DEG C)	T	T-1	T-2	T-3	T-4	T-5	T-6	T-7	T-8
21.1 to 22.0	0.09 100.0								
22.1 to 23.0	0.29 99.6	0.18 99.9							
23.1 to 24.0	1.85 95.9	1.43 99.3	0.06 99.4						
24.1 to 25.0	3.38 72.0	10.52 94.1	1.34 96.1	0.04 96.1					
25.1 to 26.0	0.79 29.4	12.89 68.6	6.47 80.2	0.31 80.8					
26.1 to 27.0	0.07 8.4	3.30 28.6	11.87 54.9	2.74 60.0	0.12 60.4				
27.1 to 28.0	0.0 0.5	0.31 8.3	3.57 25.3	5.72 39.7	1.01 42.0	0.08 42.3			
28.1 to 29.0		0.0 0.5	0.76 8.0	3.47 21.4	3.12 30.1	0.52 31.4	0.04 31.6		
29.1 to 30.0			0.04 0.5	1.60 7.2	3.16 17.2	2.21 22.7	0.26 23.6	0.05 23.7	
30.1 to 31.0				0.12 0.4	2.03 5.6	2.87 12.4	1.74 15.7	0.23 16.3	0.02 16.4
		T-9							
31.1 to 32.0	0.04 9.4				0.15 0.3	2.01 3.5	2.53 7.3	1.08 9.0	0.23 9.3
32.1 to 33.0	0.11 3.3					0.13 0.1	0.88 1.3	1.17 2.7	0.44 3.2
33.1 to 34.0	0.12 0.6							0.27 0.3	0.17 0.5
34.1 to 35.0	0.01 0.0								0.01 0.0

TABLE 4 PERCENTAGE FREQUENCIES OF DRY-BULB AND ASSOCIATED WET-BULB TEMPERATURES

APRIL 1958-71

SINGAPORE (CHANGI)

ASSOCIATED WET-BULB TEMPERATURE (DEG C)

DRY-BULB	T	T-1	T-2	T-3	T-4	T-5	T-6	T-7	T-8
T (DEG C)									
21.1 to 22.0	0.01 100.0								
22.1 to 23.0	0.06 100.0	0.02 100.0							
23.1 to 24.0	1.00 99.3	0.36 99.9							
24.1 to 25.0	3.93 89.8	5.19 98.3	0.19 98.6						
25.1 to 26.0	2.59 55.1	12.71 85.9	1.82 89.2	0.01 89.2					
26.1 to 27.0	0.42 20.8	9.35 52.5	10.29 70.6	0.95 72.1					
27.1 to 28.0	0.01 2.4	1.86 20.4	9.12 42.8	4.09 50.5	0.26 51.1	0.01 51.1			
28.1 to 29.0		0.04 2.4	2.83 18.5	4.89 31.8	1.68 35.4	0.13 35.7			
29.1 to 30.0			0.20 2.4	4.04 15.6	3.08 24.0	0.79 26.0	0.07 26.2	0.02 26.2	
30.1 to 31.0				0.58 2.2	3.81 11.4	2.05 16.7	0.53 17.9	0.05 18.0	0.01 18.0
31.1 to 32.0				0.03 0.0	1.03 1.6	3.61 7.0	1.91 10.3	0.38 10.9	0.06 11.0
	T-9								
32.1 to 33.0	0.01 4.0				0.01 0.0	0.45 0.5	1.45 2.3	1.15 3.7	0.22 4.0
33.1 to 34.0	0.05 0.7					0.01 0.0	0.06 0.1	0.32 0.4	0.21 0.6
34.1 to 35.0								0.02 0.0	0.02 0.0

TABLE 5 PERCENTAGE FREQUENCIES OF DRY-BULB AND ASSOCIATED WET-BULB TEMPERATURES

MAY 1958-71

SINGAPORE (CHANGI)

ASSOCIATED WET-BULB TEMPERATURE (DEG C)

DRY-BULB	T	T-1	T-2	T-3	T-4	T-5	T-6	T-7	T-8
T (DEG C)									
22.1 to 23.0	0.13 99.9	0.03 100.0							
23.1 to 24.0	0.58 99.2	0.38 99.8	0.01 99.8						
24.1 to 25.0	2.96 94.4	2.59 98.7	0.13 98.8						
25.1 to 26.0	3.30 69.8	8.86 91.4	1.19 93.1	0.03 93.2	0.02 93.2				
26.1 to 27.0	1.00 32.2	11.18 66.5	7.35 79.3	0.34 79.8	0.01 79.8				
27.1 to 28.0	0.02 6.0	4.91 31.2	11.01 54.3	2.74 59.7	0.07 59.9	0.01 59.9			
28.1 to 29.0	0.01 0.2	0.15 6.0	5.53 26.3	5.83 38.4	1.28 41.1	0.06 41.2			
29.1 to 30.0		0.0 0.1	0.62 5.9	5.12 20.6	2.69 26.9	0.56 28.3	0.02 28.3		
30.1 to 31.0			0.0 0.1	1.58 5.2	4.23 14.9	1.70 18.4	0.31 19.3	0.02 19.3	
31.1 to 32.0				0.06 0.1	2.41 3.7	3.51 9.0	1.12 10.9	0.37 11.4	
		T-9							
32.1 to 33.0	0.01 4.0				0.08 0.1	0.96 1.2	1.63 3.1	0.64 3.8	0.12 4.0
33.1 to 34.0	0.03 0.5					0.01 0.0	0.14 0.2	0.24 0.4	0.11 0.5

TABLE 6 PERCENTAGE FREQUENCIES OF DRY-BULB AND ASSOCIATED WET-BULB TEMPERATURES
JUNE 1958-71 SINGAPORE (CHANGI)

ASSOCIATED WET-BULB TEMPERATURE (DEG C)

DRY-BULB

	T	T-1	T-2	T-3	T-4	T-5	T-6	T-7	T-8
T (DEG C)									
21.1 to 22.0	0.01 100.0								
22.1 to 23.0	0.39 99.8	0.17 100.0	0.01 100.0						
23.1 to 24.0	1.20 98.0	0.87 99.4	0.03 99.4						
24.1 to 25.0	2.98 88.2	4.32 96.8	0.31 97.3						
25.1 to 26.0	1.64 56.5	8.18 85.2	1.98 89.5	0.09 89.7	0.01 89.7				
26.1 to 27.0	0.34 23.3	6.67 54.8	9.22 75.4	1.34 77.7	0.06 77.8	0.01 77.8			
27.1 to 28.0	0.01 3.9	2.52 22.9	11.13 47.8	6.32 59.2	0.46 60.1				
28.1 to 29.0	0.0 0.1	0.05 3.8	4.04 20.4	6.00 34.2	2.66 39.2	0.26 39.7	0.02 39.8		
29.1 to 30.0		0.0 0.1	0.37 3.8	4.26 16.3	3.62 24.1	1.17 26.4	0.09 26.7	0.03 26.7	
30.1 to 31.0			0.0 0.1	0.99 3.4	4.33 11.7	2.23 15.8	0.77 17.0	0.06 17.2	0.01 17.2
31.1 to 32.0				0.04 0.1	1.69 2.4	3.07 6.4	1.55 8.3	0.35 8.7	0.09 8.8
32.1 to 33.0					0.04 0.0	0.61 0.7	0.85 1.6	0.31 1.9	0.08 2.0
33.1 to 34.0							0.07 0.1	0.03 0.1	0.04 0.1

TABLE 7

PERCENTAGE FREQUENCIES OF DRY-BULB AND ASSOCIATED WET-BULB TEMPERATURES

JULY 1957-70

SINGAPORE (CHANGI)

ASSOCIATED WET-BULB TEMPERATURE (DEG C)

DRY-BULB

	T	T-1	T-2	T-3	T-4	T-5	T-6	T-7	T-8
T (DEG C)									
21.1 to 22.0	0.04 100.0	0.01 100.0	0.01 100.0						
22.1 to 23.0	0.52 99.5	0.21 99.9	0.02 99.9						
23.1 to 24.0	1.53 97.1	1.20 99.0	0.10 99.2						
24.1 to 25.0	2.97 84.1	5.35 95.6	0.54 96.3	0.05 96.4					
25.1 to 26.0	0.64 44.7	7.81 81.2	2.51 87.3	0.05 87.4	0.03 87.5				
26.1 to 27.0	0.16 16.2	5.49 44.1	13.33 72.7	1.93 76.3	0.02 76.4	0.02 76.4			
27.1 to 28.0	0.0 1.9	1.66 16.0	8.77 38.4	8.54 53.7	1.07 55.4	0.02 55.5			
28.1 to 29.0		0.01 1.9	2.50 14.4	5.07 28.0	3.33 34.8	0.24 35.4	0.02 35.4		
29.1 to 30.0			0.28 1.9	3.52 11.9	4.01 20.4	1.78 23.8	0.18 24.2	0.01 24.3	
30.1 to 31.0			0.01 0.0	0.32 1.6	3.05 8.1	2.49 12.6	0.79 14.3	0.13 14.5	
31.1 to 32.0				0.04 0.0	0.78 1.3	2.49 4.7	1.56 6.7	0.67 7.6	0.07 7.7
		T-9							
32.1 to 33.0	0.01 2.1					0.38 0.5	0.79 1.4	0.47 1.9	0.20 2.1
33.1 to 34.0	0.01 0.2						0.09 0.1	0.10 0.2	0.02 0.2
34.1 to 35.0								0.02 0.0	

TABLE 8 PERCENTAGE FREQUENCIES OF DRY-BULB AND ASSOCIATED WET-BULB TEMPERATURES
AUGUST 1957-70 SINGAPORE (CHANGI)

ASSOCIATED WET-BULB TEMPERATURE (DEG C)

DRY-BULB

	T	T-1	T-2	T-3	T-4	T-5	T-6	T-7	T-8
T (DEG C)									
21.1 to 22.0	0.06 100.0	0.02 100.0							
22.1 to 23.0	0.55 99.7	0.14 99.9	0.01 99.9						
23.1 to 24.0	1.59 96.6	1.56 99.1	0.04 99.2						
24.1 to 25.0	2.11 80.7	5.55 95.0	0.63 96.0						
25.1 to 26.0	0.53 37.4	8.18 78.6	3.25 87.4	0.13 87.7					
26.1 to 27.0	0.04 12.3	4.38 36.9	17.01 69.9	3.49 75.4	0.08 75.6	0.01 75.6			
27.1 to 28.0	0.0 1.1	0.72 12.2	7.39 32.4	8.95 48.5	1.11 50.5	0.06 50.6	0.01 50.6		
28.1 to 29.0	0.01 0.0	0.0 1.1	1.51 11.5	4.58 24.3	3.45 31.4	0.44 32.3	0.03 32.4		
29.1 to 30.0		0.01 0.0	0.12 1.1	3.12 10.0	3.67 18.2	1.98 21.9	0.25 22.3	0.01 22.4	
30.1 to 31.0				0.39 1.0	2.77 6.7	2.60 11.3	1.03 13.0	0.11 13.2	0.04 13.2
31.1 to 32.0					0.48 0.6	2.43 3.6	1.68 5.5	0.50 6.2	0.10 6.3
32.1 to 33.0						0.11 0.1	0.55 0.7	0.23 1.0	0.12 1.1
33.1 to 34.0	0.02 0.1							0.02 0.0	0.05 0.1

TABLE 9 PERCENTAGE FREQUENCIES OF DRY-BULB AND ASSOCIATED WET-BULB TEMPERATURES
SEPTEMBER 1957-70 SINGAPORE (CHANGI)

ASSOCIATED WET-BULB TEMPERATURE (DEG C)

DRY BULB

T (DEG C)	T	T-1	T-2	T-3	T-4	T-5	T-6	T-7	T-8
21.1 to 22.0	0.07 100.0								
22.1 to 23.0	0.22 99.8	0.09 99.9							
23.1 to 24.0	2.26 97.7	0.75 99.6	0.02 99.6						
24.1 to 25.0	3.25 80.2	7.05 95.4	0.74 96.5	0.01 96.6					
25.1 to 26.0	0.66 36.2	7.73 76.9	2.78 85.1	0.14 85.5	0.01 85.5				
26.1 to 27.0	0.11 11.5	4.51 35.6	14.39 68.6	2.49 73.9	0.06 74.2				
27.1 to 28.0	0.0 0.8	0.82 11.4	6.15 31.0	9.64 49.5	1.50 52.4	0.07 52.6			
28.1 to 29.0		0.02 0.8	1.38 10.6	4.36 24.0	3.93 32.9	0.68 34.3	0.01 34.4	0.01 34.5	
29.1 to 30.0			0.11 0.8	2.38 9.2	3.63 18.2	2.30 23.2	0.28 23.9	0.07 24.0	
30.1 to 31.0				0.30 0.7	2.90 6.7	2.68 12.1	1.25 14.8	0.25 15.2	0.01 15.3
31.1 to 32.0				0.01 0.0	0.28 0.4	2.52 3.5	2.24 6.2	1.10 7.7	0.12 7.9
32.1 to 33.0						0.11 0.1	0.56 0.7	0.46 1.2	0.32 1.5
33.1 to 34.0							0.02 0.0	0.02 0.0	0.03 0.1
		T-9	T-10	T-11					
31.1 to 32.0	0.01 7.9								
32.1 to 33.0	0.05 1.6	0.02 1.6	0.02 1.6						
33.1 to 34.0	0.03 0.1	0.0 0.1	0.01 0.1						

TABLE 10 PERCENTAGE FREQUENCIES OF DRY-BULB AND ASSOCIATED WET-BULB TEMPERATURES
OCTOBER 1957-70 SINGAPORE (CHANGI)

ASSOCIATED WET BULB TEMPERATURE (DEG C)

DRY-BULB T (DEG C)	T	T-1	T-2	T-3	T-4	T-5	T-6	T-7	T-8
21.1 to 22.0	0.05 100.0								
22.1 to 23.0	0.40 99.7	0.17 100.0							
23.1 to 24.0	3.13 97.0	1.37 99.3	0.03 99.4						
24.1 to 25.0	5.41 76.5	10.30 93.8	0.72 94.8	0.01 94.8					
25.1 to 26.0	1.05 33.5	10.97 71.1	3.47 78.1	0.15 78.4					
26.1 to 27.0	0.07 9.2	4.87 32.4	11.49 59.1	1.63 62.7	0.06 62.8				
27.1 to 28.0	0.0 0.5	0.50 9.2	5.41 27.5	6.81 42.6	0.80 44.6	0.02 44.7			
28.1 to 29.0		0.01 0.5	0.97 8.7	3.89 21.6	3.72 29.9	0.43 31.1	0.02 31.1		
29.1 to 30.0			0.02 0.5	1.94 7.7	3.52 16.7	1.75 21.3	0.26 22.1		
30.1 to 31.0				0.13 0.5	2.18 5.7	2.76 11.2	1.22 14.1	0.18 14.6	
31.1 to 32.0	0.01 8.1	T-9			0.22 0.4	2.06 3.4	1.92 6.1	1.26 7.8	0.15 8.1
32.1 to 33.0	0.10 2.5	T-10			0.02 0.0	0.11 0.1	0.97 1.1	0.76 1.9	0.36 2.4
33.1 to 34.0	0.06 0.1	0.03 0.2					0.01 0.0	0.03 0.0	0.05 0.1
34.1 to 35.0			T-11						
			0.01 0.0						

TABLE 11 PERCENTAGE FREQUENCIES OF DRY-BULB AND ASSOCIATED WET-BULB TEMPERATURES
NOVEMBER 1957-70 SINGAPORE (CHANGI)

ASSOCIATED WET-BULB TEMPERATURE (DEG C)

DRY-BULB T (DEG C)	T	T-1	T-2	T-3	T-4	T-5	T-6	T-7	T-8
21.1 to 22.0	0.04 100.0								
22.1 to 23.0	0.67 99.7	0.18 100.0							
23.1 to 24.0	4.62 95.3	2.65 99.1	0.02 99.1						
24.1 to 25.0	6.11 68.4	15.80 90.7	0.87 91.8	0.01 91.8					
25.1 to 26.0	0.88 26.4	13.17 62.3	3.82 68.8	0.08 69.0					
26.1 to 27.0	0.02 6.4	3.57 25.6	10.48 48.2	1.54 50.9	0.04 51.0				
27.1 to 28.0	0.0 0.3	0.29 6.4	3.99 22.0	5.47 34.2	0.51 35.3	0.02 35.4			
28.1 to 29.0		0.01 0.3	0.78 6.1	3.84 17.7	3.03 24.4	0.15 25.0	0.03 25.1	0.01 25.1	
29.1 to 30.0			0.02 0.3	1.79 5.3	3.60 13.1	1.78 16.8	0.15 17.2	0.01 17.3	
30.1 to 31.0			0.01 0.0	0.05 0.3	1.68 3.5	2.42 7.6	0.99 9.6	0.13 9.9	0.04 10.0
31.1 to 32.0				0.01 0.0	0.15 0.2	1.22 1.8	1.50 3.5	0.63 4.4	0.10 4.6
		T-9	T-10	T-11					
32.1 to 33.0	0.06 1.0	0.0 1.0	0.01 1.0			0.05 0.1	0.28 0.4	0.23 0.6	0.30 0.9
33.1 to 34.0	0.02 0.1	0.03 0.1				0.01 0.0		0.04 0.0	0.01 0.1

TABLE 12 PERCENTAGE FREQUENCIES OF DRY-BULB AND ASSOCIATED WET-BULB TEMPERATURES
DECEMBER 1957-70 SINGAPORE (CHANGI)

ASSOCIATED WET-BULB TEMPERATURE (DEG C)

DRY-BULB	T	T-1	T-2	T-3	T-4	T-5	T-6	T-7	T-8
T (DEG C)									
21.1 to 22.0	0.43 100.0	0.01 100.0							
22.1 to 23.0	2.23 99.0	0.53 99.6							
23.1 to 24.0	7.77 88.7	5.39 96.8	0.05 96.8						
24.1 to 25.0	5.26 49.7	19.91 80.9	2.29 83.6						
25.1 to 26.0	0.41 15.9	9.42 44.4	5.97 55.7	0.20 56.1					
26.1 to 27.0	0.02 3.8	1.60 15.5	7.87 34.6	2.92 39.9	0.12 40.1				
27.1 to 28.0	0.0 0.1	0.22 3.8	2.49 13.9	4.56 25.1	1.24 27.5	0.03 27.6			
28.1 to 29.0		0.0 0.1	0.59 3.6	2.68 11.2	2.98 17.8	0.67 19.0	0.03 19.1		
29.1 to 30.0			0.01 0.1	1.15 3.0	2.77 7.9	2.26 11.6	0.36 12.1	0.02 12.1	
30.1 to 31.0				0.05 0.1	0.98 1.8	1.57 4.0	0.96 5.4	0.12 5.6	0.01 5.6
31.1 to 32.0					0.04 0.0	0.64 0.8	0.56 1.4	0.45 1.8	0.04 1.9
32.1 to 33.0							0.08 0.1	0.03 0.1	0.02 0.1
33.1 to 34.0								0.02 0.0	

TABLE 13
ANNUAL 1957-71

PERCENTAGE FREQUENCIES OF DRY-BULB AND ASSOCIATED WET-BULB TEMPERATURES
SINGAPORE (CHANGI)

DRY-BULB		ASSOCIATED WET-BULB TEMPERATURE (DEG C)							
T (DEG C)	T	T-1	T-2	T-3	T-4	T-5	T-6	T-7	T-8
21.1 to 22.0	0.08 100.0	0.01 100.0	0.00+ 100.0						
22.1 to 23.0	0.72 99.2	0.30 99.9	0.02 99.9						
23.1 to 24.0	2.82 93.8	2.25 98.4	0.21 98.9	0.01 98.9					
24.1 to 25.0	3.61 72.5	9.75 91.0	1.41 93.4	0.12 93.6	0.00+ 93.6				
25.1 to 26.0	1.06 35.8	9.57 68.9	4.10 77.7	0.44 78.6	0.03 78.7	0.00+ 78.7			
26.1 to 27.0	0.19 12.4	4.72 34.7	10.65 58.3	2.30 62.9	0.20 63.4	0.02 63.5			
27.1 to 28.0	0.00+ 1.5	1.16 12.2	5.97 29.8	5.94 42.7	1.08 45.1	0.12 45.4	0.02 45.4		
28.1 to 29.0	0.00+ 0.0	0.03 1.5	1.78 11.1	4.03 22.7	2.99 29.6	0.59 30.9	0.09 31.1	0.01 31.1	0.00+ 31.1
29.1 to 30.0		0.00+ 0.0	0.15 1.4	2.49 9.3	3.17 16.8	1.90 20.8	0.35 21.5	0.04 21.6	0.00+ 21.6
30.1 to 31.0			0.00+ 0.0	0.38 1.3	2.44 6.6	2.26 11.0	1.12 13.1	0.20 13.5	0.02 13.5
31.1 to 32.0				0.02 0.0	0.60 0.9	2.07 3.8	1.57 5.9	0.71 6.9	0.12 7.0
32.1 to 33.0					0.01 0.0	0.24 0.3	0.70 1.1	0.50 1.7	0.22 1.9
33.1 to 34.0						0.00+ 0.0	0.03 0.0	0.10 0.1	0.07 0.2
34.1 to 35.0								0.00+ 0.0	0.00+ 0.0

TABLE 13

(continued)

PERCENTAGE FREQUENCIES OF DRY BULB AND ASSOCIATED WET-BULB TEMPERATURES

ANNUAL 1957-71

ASSOCIATED WET-BULB TEMPERATURE (DEG C)

SINGAPORE (CHANGI)

DRY-BULB

T (DEG C)	T-9	T-10	T-11
29.1 to 30.0	0.00+ 21.6		
30.1 to 31.0	0.00+ 13.5		
31.1 to 32.0	0.01 7.1		
32.1 to 33.0	0.03 2.0	0.00+ 2.0	0.00+ 2.0
33.1 to 34.0	0.03 0.2	0.00+ 0.2	0.00+ 0.2
34.1 to 35.0	0.00+ 0.0	0.0 0.0	0.00+ 0.0

TABLE 14 PERCENTAGE FREQUENCY OF HOURLY DRY-BULB TEMPERATURE AT SINGAPORE (CHANGI) JULY 1957 - JUNE 1971

Dry-Bulb Temperature (°C)	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG.	SEP	OCT	NOV	DEC	YEAR
21.1 to 22.0	0.1	0.1	0.1	0.0+	0.0	0.0+	0.1	0.1	0.1	0.0+	0.0+	0.4	0.1
22.1 to 23.0	3.6	1.6	0.5	0.1	0.2	0.6	0.7	0.7	0.3	0.6	0.9	2.8	1.0
23.1 to 24.0	14.3	7.3	3.3	1.4	1.0	2.1	2.8	3.2	3.0	4.5	7.3	13.2	5.3
24.1 to 25.0	23.8	22.1	15.3	9.3	5.7	7.6	8.9	8.3	11.1	16.4	22.8	27.5	14.9
25.1 to 26.0	16.0	19.5	20.5	17.1	13.4	11.9	11.0	12.1	11.3	15.6	18.0	16.0	15.2
26.1 to 27.0	12.4	14.2	18.1	21.0	19.9	17.6	21.0	25.0	21.6	18.1	15.6	12.5	18.1
27.1 to 28.0	8.9	8.5	10.7	15.3	18.8	20.4	20.1	18.2	18.2	13.5	10.3	8.5	14.3
28.1 to 29.0	7.9	7.4	7.9	9.6	12.9	13.0	11.2	10.0	10.4	9.0	7.8	6.9	9.5
29.1 to 30.0	6.5	7.7	7.3	8.2	9.0	9.5	9.8	9.2	8.8	7.5	7.3	6.6	8.1
30.1 to 31.0	3.8	6.5	7.0	7.0	7.8	8.4	6.8	6.9	7.4	6.5	5.3	3.7	6.4
31.1 to 32.0	2.0	3.9	6.0	7.0	7.5	6.8	5.6	5.2	6.3	5.6	3.6	1.7	5.1
32.1 to 33.0	0.5	1.0	2.7	3.3	3.4	1.9	1.9	1.0	1.5	2.3	0.9	0.1	1.7
33.1 to 34.0	0.1	0.2	0.6	0.6	0.5	0.1	0.2	0.1	0.1	0.2	0.1	0.0+	0.2
34.1 to 35.0	0.0	0.0+	0.0+	0.0+	0.0	0.0	0.0+	0.0	0.0	0.0+	0.0	0.0	0.0+

8

TABLE 15 PERCENTAGE FREQUENCY OF HOURLY WET-BULB TEMPERATURE AT SINGAPORE (CHANGI) JULY 1957 0 JUNE 1971

Wet-Bulb Temperature (°C)	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	YEAR
19.1 to 20.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0+	0.0	0.0	0.0	0.0	0.0	0.0+
20.1 to 21.0	0.4	0.0+	0.0	0.0	0.0	0.0+	0.0+	0.0+	0.0	0.0	0.0	0.0+	0.0+
21.1 to 22.0	4.6	1.8	0.4	0.0+	0.1	0.2	0.4	0.3	0.2	0.3	0.3	1.0	0.8
22.1 to 23.0	20.3	11.6	3.7	0.7	0.7	1.8	2.4	3.1	2.1	2.8	4.4	10.3	5.3
23.1 to 24.0	37.0	38.1	23.9	9.5	4.9	9.8	13.0	15.9	17.5	20.5	26.9	39.0	21.3
24.1 to 25.0	27.4	34.6	42.6	34.7	24.6	31.7	39.4	43.3	43.9	43.0	42.0	33.8	36.7
25.1 to 26.0	8.5	10.9	21.0	34.3	37.6	33.2	28.5	25.1	24.7	24.2	20.0	12.1	23.4
26.1 to 27.0	1.7	2.9	7.9	18.3	26.2	19.4	14.3	11.2	10.7	8.7	6.1	3.7	11.0
27.1 to 28.0	0.0+	0.1	0.5	2.4	5.9	3.8	1.9	1.1	0.8	0.5	0.3	0.1	1.4
28.1 to 29.0	0.0+	0.0+	0.0+	0.0+	0.2	0.1	0.0+	0.0+	0.0+	0.0+	0.0+	0.0	0.0+

0.0+ indicates less than .05 per cent

