Int. J. Biometeor. 1967, vol. 11, number 2, pp. 151-162

Meteorological Factors Affecting Physical Comfort (with Special Reference to Alice Springs, Australia)

by
C. E. Hounam*

INTRODUCTION

The meteorological variables affecting the thermal balance of warm blooded animals are radiation, air temperature, water vapour and air movement.

Under radiation must be considered long and short wave radiation received by the body, the albedo of clothing and the back radiation emitted by the body and clothing. Normally a state of non-equilibrium exists, even indoors where short wave radiation is zero, because of temperature differences between the radiating surfaces. The nature of clothing exerts an influence on the radiation balance through the influence of its colour and insulating properties on surface temperature.

The exchange of sensible heat between the atmosphere and the body is influenced by both conduction and convection. Conduction is normally an inefficient means of adding to the body's heat store but it is an important factor in reducing heat loss by virtue of the low thermal conductivity of many substances, e.g. woollen clothing and insulating building materials. Convective or turbulent transfer of heat in the atmosphere can be several orders higher than the transfer by conduction.

Under normal circumstances the rate of transfer of latent heat depends on the vapour pressure of the atmosphere which controls the gradient between the body and its environment. The process is complicated by the presence of clothing as this maintains a thin layer of nearly saturated air close to the skin. Part of the energy for evaporation is drawn from the body which is consequently cooled.

Wind is important because it accelerates heat transfer by turbulence and by evaporative cooling. For example, it can prevent the accumulation of high moisture content next to the skin and thus helps to maintain evaporative cooling near the potential rate. Wind can restore comfort to an overheated body whilst at the cooler end of the scale it can remove heat from a body and induce chill; it can also increase the heat load if the air temperature exceeds skin temperature.

BIOMETEOROLOGICAL INDICES

A comprehensive index should include both meteorological and non-meteorological factors. The first group has been discussed above; the second includes clothing characteristics (such as albedo, thermal conductivity and opportunity for convective heat exchange near the skin) and respiratory and metabolic rates. Unfortunately representative meteorological observations and virtually all non-meteorological measurements are difficult to make accurately. Radiation in particular is difficult because it involves measurement of incoming short wave and both incoming and outgoing long wave; furthermore it is difficult to use the radiation balance in a general working formula for physical comfort. Nevertheless the importance of radiation remains and the fact that reasonable results have been obtained using equations from which radiation is omitted is probably because dry-bulb temperature follows to a considerable degree the same general variations as those of net radiation.

---

*) Bureau of Meteorology, Central Office, 2 Drummond Street, Melbourne, C.1., Vic., Australia.
Received 10 October 1966.

Biometeorological indices amenable to practical application by the climatologist include:

- EFFECTIVE TEMPERATURE (ET). This may be computed from the Houghton and Yagloglou (1923) type nomogram or from a mathematical relationship developed to fit the empirically derived curves, e.g. Seifert (1958).The meteorological variables are dry and wet bulb temperature (or humidity)and wind speed but for indoor assessment it is usually more realistic to adopt a fixed value of speed appropriate to indoor conditions.

- DISCOMFORT INDEX (I).This represents an attempt by Thom (1959) to obtain an estimate of effective temperature from a linear relationship based on dry- and wet-bulb temperature (or other forms of humidity).

- THERMAL STRAIN. Lee (1958)presented an equation which related G,the thermal strain, to metabolic rate, energy expenditure, resistance of clothing and air to the passage of heat and water vapour but,of the many variables in the equation, the climatologist is usually able to substitute data for air temperature and humidity only. Radiation is not included nor does wind speed appear explicitly although a fixed value is incorporated in the nomogram used for the evaluation of G.

- HEAT STRESS INDEX. Belding and Hatch (1955) use the ratio between the amount of sweat which must be evaporated to maintain thermal equilibrium and the maximum amount of evaporation which can occur under the particular conditions.Making certain assumptions and approximations this can be reduced to an equation which gives strain as a function of metabolic rate, wall and air temperature, wind speed and vapour pressure. Recently Lee and Henschel (1963) have modified the Belding-Hatch index and have produced a nomogram of "relative strain"which incorporates net radiation in addition to the above variables.

Some special instruments have been developed which provide data relative to heat stress. Two of note are the globe thermometer and the kata-thermometer but instrumentation is of such limited extent that the climatologist cannot make more than localised use of the data.

COMPARISON OF EFFECTIVE TEMPERATURE WITH STRAIN INDICES

Given values for all variables in the equations for thermal strain indices it would be expected that these indices would represent physiological reactions to atmospheric conditions more closely than would T_E values based on the same meteorological data. However, the climatologist is frequently required to present the broadscale picture, e.g. maps showing comfort zones, but lacks data on non-meteorological variables and must make assumptions.

If constant values for clothing and physiological parameters are substituted in the thermal strain equations, then the latter indices bear a simple relationship to effective temperature because the only variables are meteorological. Fig. 1(a)shows the relationship between ET and thermal strain and Fig. 1(b)that between ET and the Lee-Henschel (1963, Fig. 11) relative strain index(RSI)for wind speed of 200 ft/min (60 m/min). However,at higher values of RSI there is not a unique relationship with ET, e.g. at RSI of 1.0 the ET values have a range of about 4°F (2.2°C)for different combinations of dry- and wet-bulb at constant wind speed.However,for low to moderate strain, i.e. for ET below 80°F (27°C) or perhaps as high at 85°F (29°C) effective temperature is interchangeable with the strain indices when the only variables are meteorological. ET may be preferable as a comfort index because it is readily adjustable for wind speed and because the correlation with physiological reactions appears to have been studied extensively.This does not overlook other deficiencies in the use of ET as a comfort indicator.

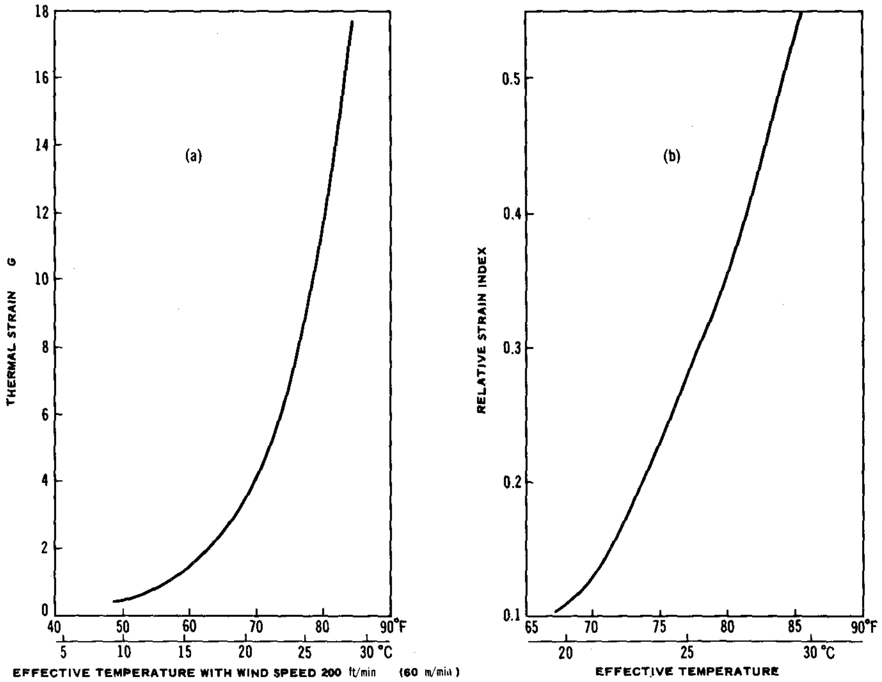

Fig. 1. Comparison of effective temperature with strain indices

CRITERIA FOR COMFORT

The American Society of Heating, Refrigerating and Air Conditioning Engineers ASHVE (1960) Guide states that in the United States the most popular ET value ranges between about 60°F (19°C) in the winter and 73°F (23°C) in the summer with variations according to sex, clothing, occupation, geographical location and degree of acclimatization.

Lee (1958) tabulates thermal strain (G) values and indicates their physiological significance. He says that most people are comfortable at G = 4 to 4½ which corresponds to ET 71° to 72°F (22°C) for wind speed 20 ft/min (6 m/min) and 69 to 70°F (21°C) at 200 ft/min (60 m/min).

Lee and Henschel (1963) using the relative strain index (RSI) state that 100% of individuals will be comfortable in the range 0.1 to 0.2 until environmental conditions reach the 0.2 level when at least 85% will consider conditions acceptable. The range 0.1, to 0.2 corresponds to ET 67 to 74°F (19° to 23°C) with air movement at 200 ft/min (60 m/min).

Thom (1959) has found that 10% of the population becomes uncomfortable when his index I reaches 70 whilst 50% are uncomfortable at 75. At 79 everybody is uncomfortable. The Thom equation is designed for use with temperature in the Fahrenheit scale and values are in effect ET in °F.

MEAN MONTHLY PHYSICAL COMFORT INDICES AT ALICE SPRINGS

In examining climatological data for a station it is convenient to start with observations at a particular hour and where discomfort results primarily from heat as at Alice Springs, the 15:00 hr observations are most suitable for a first look.

Table 1 shows values of ET (V = 20 ft/min) (6 m/min), G, I -(the Thom index using dew point) and RSI for Alice Springs computed from average dry- and wet-bulb screen temperature at 15:00 hr.

TABLE 1. Comparison of ET, G, I and RSI at Alice Springs based on average screen temperatures at 15:00 hr

	Jan.	Febr.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
ET, °F	79	79	77	72	67	62	61	64	69	74	77	78
ET, °C	26	26	25	22	19	17	16	18	21	23	25	26
G	9.0	8,2	6.8	4.5	2.4	1.0	0.9	1.6	3.0	5.2	6.8	8.0
I	79	79	76	70	66	62	61	64	69	74	77	79
RSI	0.30	0.28	0.24	0.14	0.1	0.1	0.1	0.1	0.10	0.18	0.24	0.28

Thus accepting the criteria quoted above (for lightly clothed persons performing equivalence of office work) it would be assumed that most persons would be uncomfortable at 15:00 hr from November to March with some uncomfortable in October. Acclimatization might result in a more restricted period of discomfort, perhaps as short as December to February for some persons.

However, such conclusions based on mean monthly values could be unreliable because the high variability of daily temperature suggests that there are likely to be many uncomfortable days in the autumn and spring months. The distribution of daily effective temperature is shown in the next section.

Table 2 shows the influence of wind speed on effective temperature. ET is derived from 15:00 hr observations.

TABLE 2. Effect of wind speed on effective temperature. Average ET for Alice Springs with speeds of 20 to 500 ft/min (6 to 150 m/min)

Wind speed in ft/min (m/min)		Jan.	Febr.	March	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
20	°F	79	79	77	72	67	62	61	64	69	74	77	78
(6)	°C	26	26	25	22	19	17	16	18	21	23	25	26
200	°F	78	77	75	70	63	58	57	61	67	72	75	77
(60)	°C	26	25	24	21	17	14	14	16	19	22	24	25
500	°F	77	76	74	68	60	54	53	58	65	71	74	75
(150)	°C	25	24	23	20	16	12	12	14	18	22	23	24

Speeds of 250 ft/min (75 m/min) and over would be too high for convenience indoors in most circumstances.

Table 2 indicates that increased wind speed in the summer months produces a very small decrease in effective temperature. This would be the compromise result of a hot air mass, say over 90°F or 32°C, adding heat to a body and a heat loss due to a low humidity.

VARIABILITY OF DAILY EFFECTIVE TEMPERATURE

Frequency distribution of daily ET (15:00 hr)are shown in Table 3 for each month. These have been computed from Seifert (1958).

TABLE 3. Percentage (cumulated) frequency of occurrence of ET (15:00 hr)values during each month at Alice Springs (V = 20 ft/min or 6 m/min)based on period 1950-1959

ET (15:00 hr) °F	Jan.	Febr.	March	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	ET (15:00 hr) °C
86	3	1	1								1	2	30.0
84	12	9	4							1	5	12	28.9
82	32	28	11	1					1	5	17	30	27.8
80	56	50	24	5					2	15	34	48	26.7
78	76	66	42	14	1			1	4	28	50	62	25.6
76	88	78	62	29	3	1		2	8	40	64	76	24.4
74	94	87	78	44	9	2	1	5	20	54	76	86	23.3
72	97	92	90	60	19	6	3	11	38	66	85	93	22.2
70	*	95	96	72	30	13	7	19	51	78	92	96	21.1
68		*	*	83	45	20	13	29	62	88	96	*	20.0
66				90	60	31	21	40	72	95	*		18.9
64					73	43	32	54	83				17.8

*) Higher per cent frequencies unreliable.

It would be helpful if a line could be drawn on Table 3, corresponding to the most popular value of ET for each person. For example, 76°F (24°C) might be an acceptable summer level for acclimatized persons at Alice Springs whilst a winter optimum of 66°F (19°C) is a reasonable estimate (ASHRAE Guide, 1960). The table indicates a pronounced need for afternoon cooling in the summer; for example, in January 88% of ET values at 15:00 hr exceed the assumed comfort level of 76°F (24°C) indoors. The winter picture is less positive but, using 66°F (19°C)as a reference level, there would be requirements for both heating and cooling indoors.

COMPARISON OF DISTRIBUTIONS BETWEEN STATIONS. Annual distributions have been computed for a number of the major Australian centres and some of the differences noted between different climatic areas could have a significant effect in planning.

If the critical design value of ET were chosen at 75°F(24°C)then it is found that this is exceeded with average annual frequency of 97 at Brisbane in a warm moist climate and 66 at Perth in a warm dry climate, i.e. Brisbane experiences more uncomfortable days than Perth. However, if the criterion is raised to 79°F (26°C) then the position is reversed with annual frequencies of 13 at Brisbane and 26 at Perth. A similar situation is found with Cairns in the humid tropics and Cloncurry in the semi arid tropics: frequencies above 75°F (24°C) are respectively 227 and 225 and above 79°F (26°C) 97 and 149.

Thus considerable care must be taken in selecting a design value particularly in cases where it is required to assess relative comfort levels at a number of stations in different climatic zones.

DIURNAL VARIATION OF EFFECTIVE TEMPERATURE

DIURNAL VARIATION AS A COMFORT FACTOR. Physical comfort cannot be satisfactorily summarized by references to a single average monthly value because of the variability of ET at a fixed hour as demonstrated in Table 3 and the diurnal variation in ET. The physiological effect of the cool night/hot day sequence is important in day time comfort because after a comfortable night one is better able to stand up to an uncomfortable day.

Stations with approximately the same average January ET at 15:00 hr (79°F or 26°C) as Alice Springs are Townsville, Kalgoorlie and Wilcannia. The minimum (early morning) values of ET at these places are 75°, 62° and 64°F (29°, 17° and 18°C) respectively compared with Alice Springs 67°F (19°C). Thus nights are more comfortable on the average at southern inland arid centres than in the north coastal districts.

AVERAGE DIURNAL VARIATION. Curves showing the diurnal variations of the average ET for each month can be readily constructed and the average number of hours per day during which ET exceeds specified levels can be computed. However, this approach is inadequate because the relevant periods are those during which ET exceeds the critical level and only these should be used in determining averages. If averages are based on all days they are reduced by ET values below the critical level and are thus underestimates of the heat stress.

ENVELOPE POLYGONS BASED ON VARIATIONS. The psychrometric diagram has been used in more than one form to compute effective temperature but it can also be used for a pictorial display of station data. Fig. 2 shows a set of polygons for Alice Springs based on the 12 monthly means for the hours 06:00, 09:00, 12:00 and 15:00 and the displacement of polygons across the ET isotherms is a measure of diurnal variation of ET.

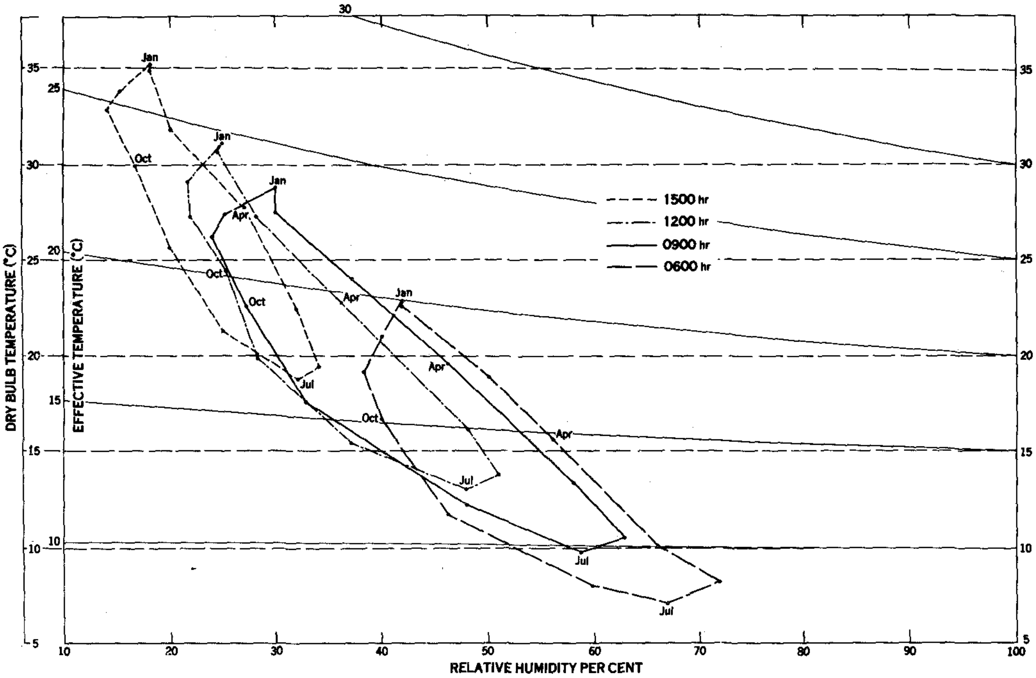

Fig. 2. Effective temperature diagram showing average monthly ET at 06:00, 09:00, 12:00 and 15:00 hr for Alice Springs, based on 10-year period (1955-1964). Wind speed 20 ft/min or 6 m/min.

Part of each polygon is common to a number of other hourly polygons, that is, there is climatic similarity between average temperature and humidity at different hours and months, e.g. April 15:00 hr = March 12:00 hr = December 09:00 hr. This concept can be taken one step further by constructing an enveloping polygon which contains average values for all months and all hours. Starting with Fig. 2 a banana-shaped figure can be drawn extending from summer 15:00-hr values (approaching the maximum values) to winter 06:00-hr values (approaching the minima). The shape of this curve would be characteristic of the climate of the station.

The same figure would be arrived at by connecting all hourly values for January (in the case of Alice Springs by a straight line) and similarly for each of the other months. The figure enveloping these 12 lines would be the same as that derived above.

DISTRIBUTION OF HOURLY VALUES ON PSYCHROMETRIC DIAGRAM. The above considerations are based on average values of ET but for many design purposes it is necessary to examine individual daily values. A scatter diagram was therefore prepared on a psychrometric base using each of 8 three hourly observations for each day, of the 10-year period 1955-1964. The computer printout shows frequencies of ET as well as dry-bulb and relative humidity.

Fig. 3 shows the envelope polygon for Alice Springs and a set of ET lines corresponding to specified exceedance values both derived from the same set of three hourly observations. This shows that 25% of the observations correspond with ET values of 72°F (22°C) and over, 10% with 77°F (25°C) and over whilst 5% of all ET values equal or exceed 79°F (26°C). The critical level of 73°F (23°C) is exceeded on 22% of the year whilst the assumed 76°F (24°C) for acclimatized persons is exceeded on 13% of the year; this latter frequency would be concentrated in the day-time of the summer months, tapering off to a rare occurrence between May and September.

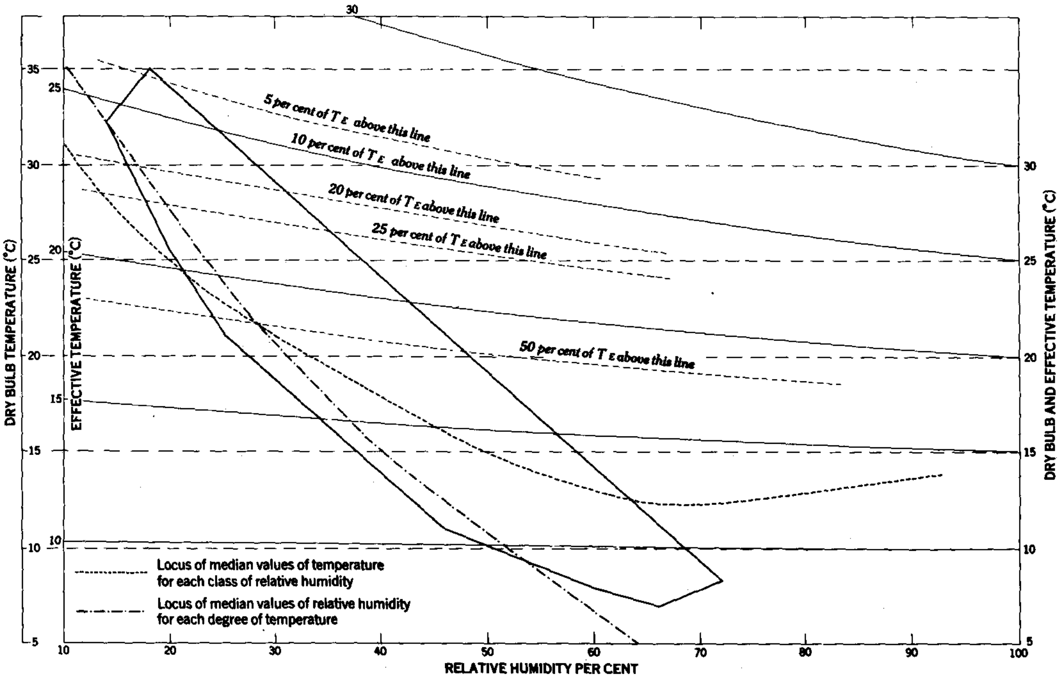

Fig. 3. Distribution of effective temperature at Alice Springs (1955-1964) showing: (1) envelope of all hourly values of dry-bulb, humidity and effective temperature; (2) per cent frequency of effective temperature above specified levels (based on all hours of observation); (3) loci of median values of air temperature and relative humidity (based on all hours of observation) wind speed 20 ft/min or 6 m/min)

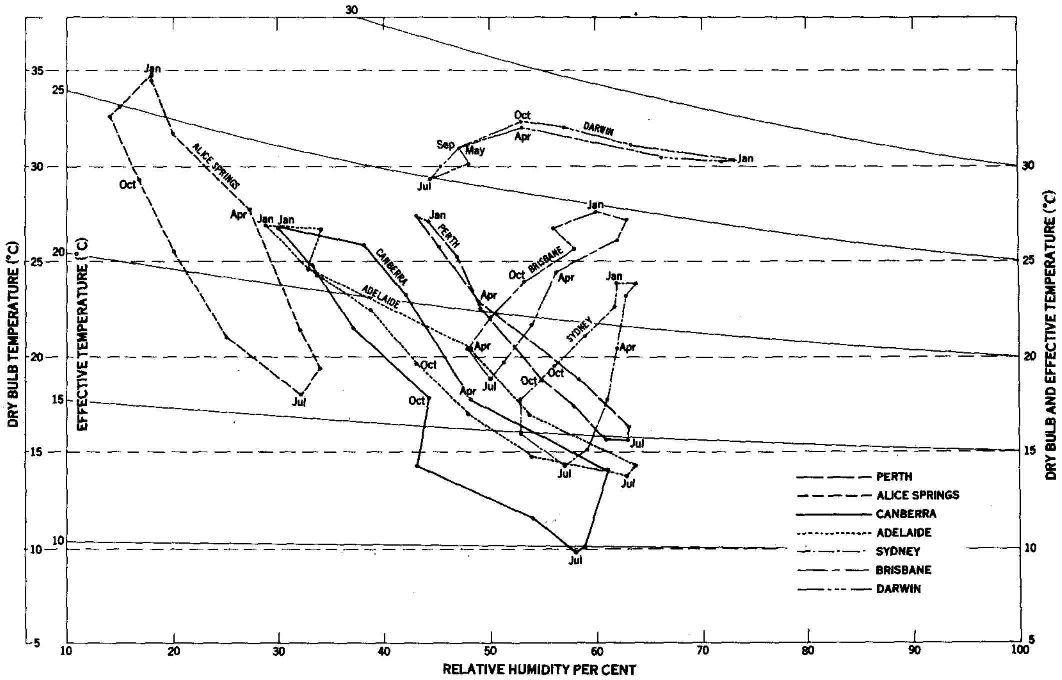

Fig. 4. Average effective temperature at 15:00 hr for each month for Australian cities. Wind speed 20 ft/min or 6 m/min

COMPARISON OF ET AT ALICE SPRINGS WITH OTHER CENTRES

Fig. 4 compares average ET at 15:00 hr at Alice Springs with corresponding values at selected Australian cities.

On the basis of these average values the summer afternoon indoor climate of Alice Springs is only slightly more uncomfortable than that at Brisbane. It is appreciably worse than that at the other State capitals with the exception of Darwin which is by far the most uncomfortable of the places shown in Fig. 4. The continental influence on climate is more noticeable in the winter months; ET values are 1 or 2°F lower at Alice Springs than at Brisbane whilst the comfort margin between Alice Springs and Darwin increases from 3°F (1.7°C) in summer to 16°F (9°C) in winter.

It is interesting to compare climatic discomfort at Alice Springs with arid centres in some other countries. ET (max.) was calculated from average maximum dry-bulb temperatures and relative humidity observations made at an afternoon hour which was not the same in each case. These average values are shown in Fig. 5.

For Alice Springs the maximum temperature gives ET values up to 3°F(1.7°C) higher than those for 15:00 hr. There is a fair similarity between the climates of Alice Springs, Cairo and Phoenix although the latter place is more uncomfortable in summer. The climates of Alice Springs, Karachi and Touggourt (Algeria) are distinctly different, the latter two being particularly uncomfortable in summer.

DEVELOPMENT OF AN INTEGRATED COMFORT INDEX

Although a number of techniques for assessing heat stress can be applied to a single location, particularly when special physiological and meteorological data are available, assessment becomes difficult when large areas are involved. It is then

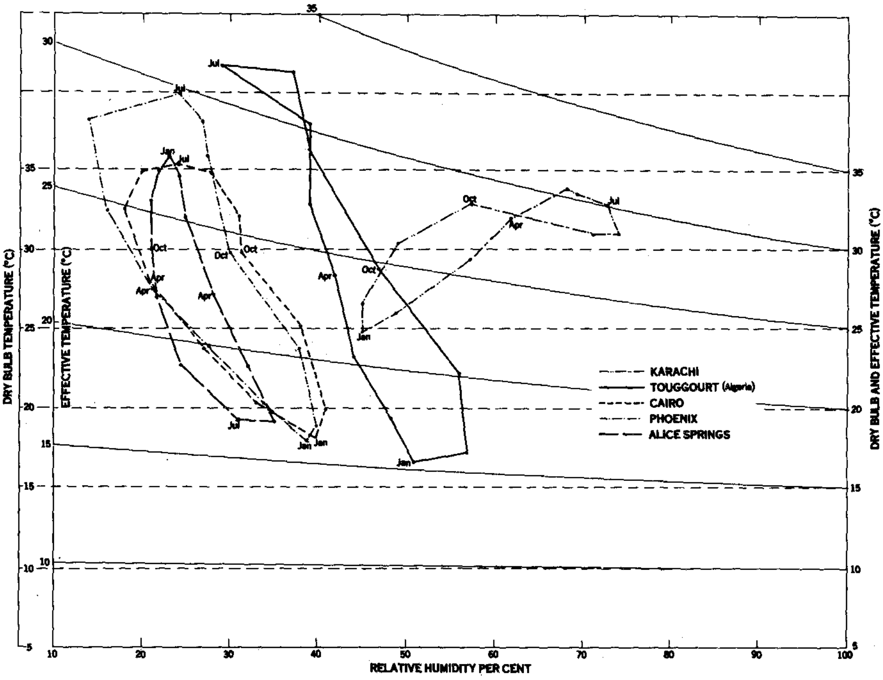

Fig. 5. Average effective temperature at selected arid zone stations(based on maximum dry-bulb temperature, afternoon humidity and wind speed 20 ft/min or 6 m/min)

usually necessary to make assumptions, e.g. constant values for clothing characteristics and assessment of comfort then devolves upon the meteorological variables dry-bulb temperature, humidity and wind speed.

Average effective temperature and thermal strain (G) for the hottest month of the year have been used in Australia in an attempt to determine relative comfort zones across the continent. Use of January data only is a great simplification but the assumption that relativity is maintained throughout the year is not sound;this can be overcome partly by examining supplementary data for the colder months.

However, as indicated above, the use of average data in assessing heat stress can be misleading and the distribution of the sample should be examined.Another approach has been to determine the number of days per year when the effective temperature at 15:00 hr exceeds specified levels and sample frequencies are shown in Table 4.

Maps have been constructed from these data showing the distribution over Australia of annual frequencies of ET over 70°, 75° and 80°F (21°, 24° and 27°C), and it is easy to define zones on the assumption that equal ET frequencies mean equal discomfort. That this is not necessarily so is obvious from a look at the Brisbane and Perth data.

It has therefore been proposed by a physiologist currently working on an Australian committee, which is investigating the weight which should be given to climate in the assessment of allowances,that the frequencies in various ranges of effective temperature should be given linear weighting factors. This has the advantage that greater weight can be given to the higher values of effective temperature. Consider, for example, Cairns and Cloncurry at which frequencies of days of ET exceeding 75°F (24°C) are 227 and 225 per year respectively (Table 4).

TABLE 4. Average number of days per year when ET (15:00 hr)exceeds specified levels in Australia

	Effective temperature									
	50	55	60	65	70	75	80	85	90	°F
	10.0	12.8	15.6	18.3	21.1	23.9	26.7	29.4	32.2	°C
Adelaide	361	319	222	143	77	33	9	1	0	
Alice Springs	363	354	322	269	210	134	54	3	0	
Brisbane	365	364	354	293	187	97	7	0	0	
Cairns			365	364	339	227	73	0	0	
Canberra	318	247	192	134	73	25	3	0	0	
Cloncurry		365	363	345	300	225	132	23	0	
Darwin				365	364	336	200	5	0	
Melbourne	342	259	174	104	54	23	7	0	0	
Perth	365	363	305	209	129	66	20	2	0	
Sydney	364	348	274	180	84	22	4	0	0	

Table 5 shows actual and weighed frequencies in 5°F class intervals.

TABLE 5. Weighed frequencies of ET in class intervals

	75°-79°F 24°-26°C	80°-84°F 27°-29°C	85°-89°F 30°-32°C	Total
CAIRNS				
Actual frequency	154	73	0	227
Weighted frequency	154	146	0	300
CLONCURRY				
Actual frequency	93	109	23	225
Weighted frequency	93	218	69	380

Frequencies have been given linear weights of 1, 2 and 3.Weighted frequencies give a total of 300 for Cairns compared with 380 for Cloncurry.

Although increasing the number of class intervals leads to a higher weighted total this is of no consequence but it does effect the relativity between stations depending on the distribution of data within the sample. Linear weights may also be used in fractional rather than integral steps.

The method shows promise as it takes greater account of the extremes than the simple frequency count does but it requires a good deal more trial in selection of class intervals and weighting factors.

OTHER METEOROLOGICAL ASPECTS OF PHYSICAL COMFORT

Listed below are some additional meteorological factors and their effects which warrant consideration in a complete study of weather and physical comfort.

- SEQUENCE OF HOT DAYS. A concentration of consecutive extreme days may result in an accumulated physiological strain.

- WIND SPEED. Although it reduces ET a higher wind speed may result in discomfort if dust or fine sand is lifted, e.g. on the foreshore in a strong sea breeze.

- PERSISTENCE OF A WEATHER TYPE. There may be a psychological reaction to extended periods of the same weather even within the limits of comfortable ET.

- WEATHER AND INSECTS. Mosquitoes, sandflies etc. affect comfort and their life cycle is dependent on meteorological conditions.

- WEATHER AND AIR POLLUTION. Meteorological conditions in the first few hundred feet control the degree of pollution of the atmosphere by industrial plants. Man's health can suffer significantly in this environment which is polluted by his own efforts to increase his comfort.

REFERENCES

AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR CONDITIONING ENGINEERS (1960): Heating, Ventilating and Air Conditioning Guide. Amer. Soc. Heat. Air Cond. Eng., Washington, D.C. Chapter 6. Physiological Principles, 38 : 63-74.

BELDING, H.S. and HATCH, T.F. (1955): Index for evaluating heat stress in forms of resulting physiological strains. Heat. Piping Air Condit., 27 : 129-136.

HOUGHTEN, F.C. and YAGLOGLOU, C.P. (1923): Determining lines of equal comfort. J. Amer. Soc. Heat. Vent. Eng., 29 : 165-176.

LEE, D.H.K. (1958) : Proprioclimates of man and domestic animals. Australia - Unesco Symp. Canberra, 1956. Climatology and Microclimatology. Arid Zone Res. (Unesco), 10 : 102-125.

LEE, D.H.K. and HENSCHEL, A. (1963): Evaluation of thermal environment in shelters. Techn. Rep. 8, U.S. Dept. of Health, Education and Welfare. Division of Occupational Health, Cincinnati, Ohio, p. 58.

SEIFERT, Gerda (1958) : Das Klima der DDR - dargestellt durch Effektiv-temperaturen. Z. Meteor., 12 : 328-338.

THOM, E.C. (1959) : The discomfort index. Weatherwise, 12 : 57-60.

ABSTRACT.- The concept of effective temperature appears to have certain advantages for indoor use and is applied as an example to the climatological data for Alice Springs, Australia. Average values of effective temperature for the hottest hour of the day are compared with those for certain Australian and overseas locations and it is concluded that, although Alice Springs is uncomfortable for a substantial part of the warm season, the climate is more comfortable than the tropical north of Australia and some overseas arid areas. The larger diurnal range at Alice Springs means more comfortable nights than in areas near the tropical coast. It is stressed that mean values can be misleading, and for adequate treatment it is necessary to examine the distribution of daily values.

ZUSAMMENFASSUNG.- Das Konzept der effektiven Temperatur scheint gewisse Vorteile für die Anwendung im geschlossenen Raum zu besitzen und wird als Beispiel für die klimatologischen Daten von Alice Springs angewandt. Durchschnittswerte der effektiven Temperatur für die heisseste Stunde des Tages werden mit denen für bestimmte australische und überseeische Orte verglichen. Es wird gefolgert, dass, obwohl Alice Springs für einen bestimmten Teil der warmen Jahreszeit ein unbekömmliches Milieu hat, das Klima trotzdem bekömmlicher ist als der tropische Norden Australiens und einige aride Gebiete in Übersee. Die grössere Tagesschwankung in Alice Springs ist gleichbedeutend mit bekömmlicheren Nächten, als sie in den Gebieten nahe der tropischen Küste vorhanden sind. Es muss gefolgert werden, dass Mittelwerte zu falschen Deutungen führen und dass es für einen genauen Vergleich notwendig ist,die Verteilung der täglichen Werte hinzuzuziehen.

RESUME.- Le concept de la température effective semble présenter certains avantages pour caractériser le climat intérieur des habitations.Il est appliqué ici par exemple aux données climatologiques d'Alice Springs (Australie). On compare des valeurs moyennes de la température effective des heures les plus chaudes de la journée avec des valeurs similaires provenant d'autres lieux d'Australie ou d'ailleurs.On en conclut bien qu'à Alice Springs le climat soit peu propice durant une bonne partie de la saison chaude; mais il est, en général, moins éprouvant que dans le nord tropical de l'Australie ou que dans des régions arides d'autres continents. La grande variation diurne que l'on observe à Alice Springs rend les nuits plus supportables que dans le voisinage de la côte tropicale.Il faut en conclure que les valeurs moyennes peuvent conduir à de fausses interprêtations et que, pour établir des comparaisons valables, il faut tenir compte aussi de la répartition des valeurs journalières.