551.556 : 551.586

STUDY OF DISCOMFORT INDEX AND WIND CHILL FACTOR AT SRINAGAR

1. Bio-meteorological assessments with the help of combination of meteorological parameters in terms of Discomfort and Wind chill indices for Srinagar (34.65° N/ 74.5° E) in last 17 years (1988-2003) have been investigated.

2. The study of human comfort of different regions of a state or country is useful in locating health resorts, discovering places of tourist interest and for providing the essential information to the humankind (Parthasarathy and Dhar 1973). Over the past several years, a large body of climatological research has been devoted to the development and improvement of indices, which attempt to measure human discomfort (Quayle and Doehring, 1981; Steadman, 1979a & 1979b). Chill factors measure the chilling effect (Siple & Passel, 1945 and Walker, 1993) of the winds. The wind chill equivalent temperature varies approximately with the square root of the wind speed. Siple's wind chill index implies that absolute conditions are more significant than relative, as his algorithms are based on measurements taken in cold environments. Both Discomfort Index (D.I.) and Chill index 'K' both have non-linear function of temperature and humidity (Srivastava, *et al*. 2001).

3. The data used for the present study have been taken from Meteorological Centre (M.C.) Srinagar. The data includes the surface observations (0300 UTC and 1200 UTC) of minimum temperatures, maximum temperature, relative humidity and wind speed etc. during the years 1988-2003.

4. The Discomfort Index (DI) or Temperature Humidity Index (THI) and Chill Index ('K') used in this study are given below:

$$\text{D.I.} = T_a - (0.55 - 0.0055 \times \text{R.H}) (T_a - 14.5) \ ^\circ\text{C} \quad \text{(Thom, 1959 and Besancenot, 1990)} \qquad (1)$$

Where, T_a = Air temperature (°C)

R.H. = Relative Humidity

TABLE 1

Classification according to Besancenot (D.I.)

Class	Classification of Discomfort Index	Discomfort Index (°C)
6	Very cold	< 5
5	Cold	5 D.I. ≤ 10
4	Cool	D.I. =10
3	Comfortable	10 < D.I. ≤ 15
2	Hot	15 < D.I. ≤ 20
1	Very hot	20 < D.I. ≤ 25
0	Torrid	> 25

TABLE 2

Chill index 'K' by Siple & Passel (1945) and modified scheme of Besancenot (1990)

Class	Classification of human comfort	Chill Index 'K' (watt/m^2)
0	Endothermal – very hot discomfort	K ≤ 200
1	Atonic – hot discomfort	200 < K ≤ 400
2	Hypotonic – hot sub comfort	400 <K ≤ 600
3	Cold - comfort	600 <K ≤ 800
4	Tonic – very cold sub comfort	800 < K≤ 1000
5	Very cold discomfort	1000 <K

$$K = 1.163 \times [(10.45 + 10\ U^{1/2} - U)\ (33 - T_a)] \quad \text{(Siple \& Passel 1945; Steadman, 1971 and Walker, 1993)} \qquad (2)$$

Where, U = Wind speed in m/s

T_a = Air temperature (°C)

5. The classification based on the above formulas is given in Tables 1 and 2. The seasonal, monthly, 10 days and pentad scale analysis are given in Tables 3 (a-c).

6. During statistical analysis of D.I. and 'K' it has been observed that 95 % population comes under very hot category of D.I. during Monsoon season and 91 % comes under very cold category during winter season.

7. The wind chill factor indicates that [Table 3(a)] that 98 % population comes under very hot discomfort in monsoon season and very cold sub-comfort type of climate. Pre-monsoon season is almost cool and comfortable.

8. Pentad analysis shows that coldness and chilling effects are more prominent in January followed by February and December [Tables 3 (b&c)]. November

TABLE 3 (a)

Season-wise frequency distribution (%) of Discomfort Index (D.I. in °C) and Chill Index ('K', watt/m^2) during the period (1988-2003)

Season	Range (°C)	Frequency of D.I. (%)	Range of 'K' (Watt/m^2)	Frequency of 'K' (%)
Winter	00 -05	91	000-200	–
	05-10	34	200-400	–
	10-15	–	400-600	–
	15-20	–	600-800	41
	20-25	–	800-1000	98
Pre-Monsoon	00-05	06	000-200	–
	05-10	28	200-400	12
	10-15	51	400-600	55
	15-20	42	600-800	30
	20-25	–	800-1000	–
Monsoon	00-05	–	000-200	98
	05-10	–	200-400	88
	10-15	07	400-600	09
	15-20	54	600-800	–
	20-25	95	800-1000	–
Post-Monsoon	00-05	03	000-200	–
	05-10	39	200-400	–
	10-15	49	400-600	36
	15-20	36	600-800	29
	20-25	02	800-1000	–

TABLE 3 (b)

Monthly, 10-day and 5-day frequency distribution (separated by coma) of Discomfort Index (D.I.) in °C during the period (1988-2003) for Srinagar

Month	Range of D.I. (00-05) °C	Range of D.I. (05-10) °C	Range of D.I. (10-15) °C	Range of D.I. (15-20) °C	Range of D.I. (20-25) °C
January	33, 37, 39	09, 11, 12	–	–	–
February	19, 13, 23	20, 27, 26	–	–	–
March	06, –, 03	23, 14, 10	13, 23, 08	–	–
April	–	05, –, 03	32, 19, 25	08, 19, 16	–
May	–	–, –, 03	06, 05, 03	34, 38, 44	–, 04, 03
June	–	–	–, 05, 03	12, 03, 03	28, 30, 25
July	–	–	–, 05, 03	05, –, 03	35, 33, 25
August	–	–	–, 05, 03	05, –, 06	35, 33, 25
September	–	–	07, 07, 07	32, 40, 28	02, –, 22
October	–	05, 11, 03	32, 11, 15	04, –, –	–
November	03, 07, 03	34, 31, 25	10, 20, 38	–	–
December	39, 43, 32	05, 07, 18	–	–	–

TABLE 3 (c)

Monthly, 10-day and 5-day frequency distribution (separated by coma) of Chill Index 'K' in watt/m^2 during the period (1988-2003) for Srinagar

Month	Range of 'K' (000-200) (watt/m^2)	Range of 'K' (200-400) (watt/m^2)	Range of 'K' (400-600) (watt/m^2)	Range of 'K' (600-800) (watt/m^2)	Range of 'K' (800-1000) (watt/m^2)
January	–	–	–	14, 13, 14	35, 32, 40
February	–	–	–	20, 17, 18	22, 20, 30
March	–	–	–, 02, 04	29, 21, 21	–, 08, 10
April	–	–	33, 34, 26	02, 03, 04	–
May	–	10, 13, 11	20, 19, 15	–, 03, –	–
June	–	24, 25, 23	05, 05, 06	–, –, 02	–
July	71, 90, 67	18, 12, 19	–, 05, 02	–, –, 03	–
August	29, 10, 33	24, 25, 22	–, 04, 04	–, 02, –	–
September	–	24, 25, 25	05, 00, 06	–, 03, –	–
October	–	–	32, 20, 26	–, 03, 04	–
November	–	–	–, 14, 13	28, 24, 16	–, 04, –
December	–	–	–	07, 11, 21	43, 36, 20

month is most comfortable and lesser chilling as compared to other months.

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