Research Paper Environment

A Study on Variation of Bright Sunshine Hours in Kolkata and Port Blair

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ABSTRACT

In the present study, variation of Bright Sunshine Hours has been analyzed with reference to the following Stations ofclimato logical importance : Kolkata and Port Blair. Mostly below normal and also mostly declining trends have been obtained in different cases. The matter has impact on environment and climate.

KEYWORDS Bright Sunshine Hours, Pollutants, Brown Cloud, Meteorological Clouds.

Introduction:
Solar spectrum consists of wave lengths less than fraction of one micron. Strongest radiation occurs near 0.5 micron. Solar radiation is short wave radiation. Ultraviolet radiation is absorbed by Ozone layer in the upper atmosphere (about 30 km above the Earth surface). Only a small fraction of Solar energy is intercepted by the Earth. Let us consider that 100 units of Solar radiation are incident at the top of the atmosphere. Out of this, in standard ideal case:-

16 units – absorbed by Ozone and dust particles in the atmosphere,

03 units - absorbed by Meteorological Clouds in the atmosphere,

20 units- reflected by Meteorological Clouds to the top of the atmosphere,

06 units - back scattered by air to the top of the atmosphere,

04 units - reflected by the Earth surface to the top of the atmosphere,

51 units - transmitted through the atmosphere and absorbed by the Earth surface.

Methodology:
The study has been carried out by the observational data of Kolkata(Alipore Observatory, lat-long 22˚ 32´N, 88˚20´E) and Port Blair (Sadipur Observatory, lat-long 11˚40´N, 92˚43´E), both situated in the tropical zone. Percentage of total Sunshine duration relative to the normal (period of normal: 1971-1990) has been computed month-wise and year-wise. Bright Sunshine Hours data were collected from charred Sunshine cards of Campbell Stokes Sunshine recorder. Now a days, Jordan Sunshine recorder, Electronic Sunshine recorder etc. are used in different Observatories. Electronic Sunshine recorder is sensitivity stable. Our period of study is 2000-2014 (fifteen years).Separate Tabular representations have been made for data of Kolkata and Port Blair. Graphs have been plotted for representative effectively Meteorological Cloudless month-January and representative effectively Meteorological Cloudy-month – July, for Kolkata and Port Blair.

Discussion:
Although Solar constant depends on the number and extent of Sunspots, we do not like to link the number and extent of Sunspots in this regard in the time scale of a month or a year. In accordance with measurements done in the Smithsonian Institution,the mean values of the Solar constant were:-

1902-1912: 1.933 cal /sq.cm/min,

1912-1920:1.946 cal/sq. cm/min.

Hence, corresponding effect in the time scale of a month or a year is insignificant. It is worth mentioning that the strongest solar radiation corresponds to a mean temperature of 6000˚C. A huge quantity of heat is received from the Sun over the tropical zone – the region over which the Sun is overhead at some time of the year. It is worth mentioning that, atmospheric motion serves as the chief compensating mechanism and also oceanic circulation in addition. We also do not intend to relate Outgoing Longwave Radiation in this regard as Bright Sunshine Hours do not represent total incoming Solar radiation.

Conclusion:
Mostly below normal and also mostly declining trends (in respect of Bright Sunshine Hours) signify adverse effect on Heat balance of the Earth and the atmosphere. Further, weather promotes different diseases (e.g. – delayed or less Rainfall promotes reproduction of Mosquitoes and develop Mosquito – borne diseases). Moderation in Bright Sunshine Hours may promote activity of some viruses causing different viral diseases. Solar energy storage may also be hampered. Pollutants as well as Brown Cloud are responsible for the trends as mentioned above.The paper "Methodology to Monitor Effective Optical Strength of Brown Cloud Layer": PARIPEX – Indian Journal of Research, August 2013 may be seen in this regard.

Specific analysis is as follows. During the entire period of study, most of the Bright Sunshine Hours values are below normal (Kolkata: 78%, Port Blair: 78%) and month-wise mean values are also mostly below normal (Kolkata: 92%, Port

Blair: 92%), as evident from the Tables. From the Trend Lines in the Graphs, it is obvious that trends are mostly below normal during the entire period of corresponding study (January and July). From the Tables, Kolkata: Mean max. = 101 (month September), Mean min. = 77 (month January), SD max. = 25.2(month December), SD min. = 7.6 (month April), negative Slope max. = 3.2 (month December), positive Slope max. = 0.3 (month June); Port Blair:Mean max. = 111 (month November), Mean min. = 70 (month July), SD max. = 27.1(month June), SD min. = 7.8 (month February), negative Slope max. = 2.6 (month July), positive Slope max. = 1.0 (month October).

January being the representative effectively Meteorological Cloudless month, it is evident from the relevant Graph that cause of declining Bright Sunshine Hours trend is severe and intensifying in respect of Kolkata in comparison to Port Blair, i.e. It may be inferred from above analysis that presence of more Pollutants as well as Brown Cloud over Kolkata are responsible for the said declining trend in respect of Kolkata in comparison to Port Blair in effectively Meteorological Cloudless month. On the other hand, the trend is severe and intensifying in respect of Port Blair in comparison to Kolkata in effectively Meteorological Cloudy month July; further study may be carried on for the relevant cause in the light of large scale deforestation and / or variation in Meteorological Cloudiness in respect of Port Blair and also Bay Islands. Above all, it is obvious that Pollutants as well as Brown Cloud play the key role in declining trends in Bright Sunshine Hours in effectively Meteorological Cloudless month.

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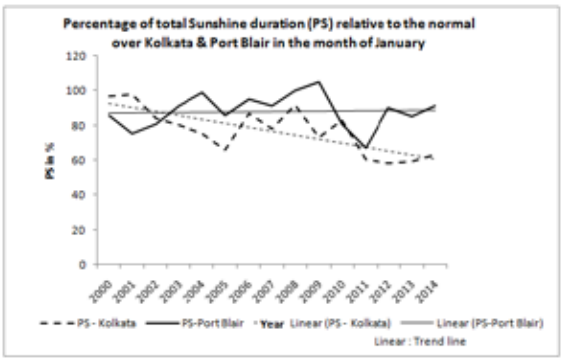
Percentage of total Sunshine duration relative to the normal over Kolkata

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2000	97	62	96	94	90	88	129	123	102	78	107	94
2001	98	87	102	99	99	56	87	114	124	94	73	96
2002	84	102	109	99	88	91	99	88	111	95	103	100
2003	80	92	99	97	100	78	115	128	106	61	118	150
2004	75	99	94	89	100	70	86	75	89	89	82	68
2005	66	104	87	99	106	121	112	69	106	54	109	87
2006	87	75	76	79	86	98	92	91	120	75	85	85
2007	78	72	95	98	93	125	81	83	82	92	87	83
2008	92	97	85	92	88	84	48	91	122	96	108	40
2009	73	104	90	97	83	114	96	73	108	105	90	74
2010	83	77		94	77	83	134	106	87	80	74	76
2011	60	77	85	79	85	76	107	63	69	81	80	55
2012	58	101	82	87	95	76	91	90	97	99	81	76
2013	59	84	87	78	47	78	100	81	85	38	101	
2014	63	85	94	89	91					85		73
Mean	77	88	92	91	89	88	98	91	101	81	93	83
SD	13.6	13.3	8.7	7.6	13.8	19.8	21.4	19.9	16.5	18.3	14.6	25.2
Slope	-2.3	0.1	-1.1	-1.0	-1.6	0.3	-0.6	-2.5	-2.0	-0.3	-1.0	-3.2

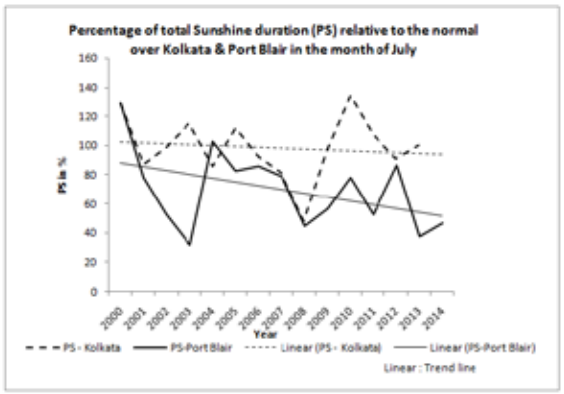
Table – I
Percentage of total Sunshine duration relative to the normal over Port Blair

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2000	86	85	85	75	83	47	129	98	99	72	130	93
2001	75	92	70	100	45	72	78	77	97	77	94	79
2002	81	89	91	89	76	69	53	97	66	119	93	77
2003	91	91	82	115	78	130	32	101	82	73	136	88
2004	99	95	95	101	55	65	103	71	94	88	120	111
2005	86	104	96	94	76	63	83	127	79	79	109	61
2006	95	93	76	73	107	79	86	94	47	118	132	104
2007	91	100	99	98	88	117	79	84	69	81	100	93
2008	100	81	71	72	68	107	45	102	84	98	103	108
2009	105	91	82	84	69	66	57	134	70	94	126	89
2010	81	103		85	99	67	78	68	106	79	88	68
2011	67	82	59	83	79	94	53	78	45	92	145	77
2012	90	96	87	90	76	58	87	71	99	111	80	73
2013	85	77	96	79	67	28	38	124	61	100	104	85
2014	91	91	101	87	83	97	47	109	77	91	98	85
Mean	88	91	85	88	77	77	70	96	78	91	111	86
SD	9.9	7.8	12.5	11.8	15.4	27.1	26.5	21.2	18.8	15.4	19.6	14.3
Slpoe	0.1	-0.2	0.3	-0.8	0.8	-0.3	-2.6	0.5	-1.1	1.0	-1.0	-0.5

Table – II
N.B. – Blank stands for data not available.



Graph – I



Graph - II

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