A Note on the Analysis of Solar Insolation over Karachi – Pakistan

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Raja, Twidell and Abidi [1] studied the Ångström correlation for global radiation and sunshine duration data recorded at Karachi with a view to employing this to estimate solar radiation at nearby locations. They obtained monthly values of the correlation parameters a and b for the relation

$$H/H_0 = a + b\ (n/N) \tag{1}$$

where H is the daily extraterrestrial radiation, H_0 is the daily global insolation, n is the duration (in hours) of daily bright sunshine and N is the day length. The authors found that the parameter a has monthly values in the range 0.031-0.200 while b has values between 0.565 and 0.914. The sum $a+b$ exceeds unity for some months, the correlation coefficient r varies from 0.57 to 0.89 and the r.m.s. error is 0.40 MJ/m^2-day.

We find that the monthly data presented by the authors give an Ångström type fit over the year with $a = 0.323$, $b = 0.385$, $r = 0.89$ and r.m.s. error = 0.43 MJ/m^2-day. As it has been found [2-4] that seasonal effects may be taken into consideration for precise estimations we prefer to divide the year into monsoon and off-monsoon months for Karachi region. For monsoon months i.e., July, August and September, we obtain $a = 0.366$, $b = 0.282$, and $r = 0.90$ and for the rest of the year $a = 0.316$, $b = 0.396$, $r = 0.92$ while the r.m.s. error over the year is 0.40 MJ/m^2-day.

As is well known, the relation (1) leads to the conclusion that $a + b$ represents H/H_0 for clear sky condition and hence the sum can not exceed unity. Again a equals H/H_0 under an overcast sky and this normally has a value above 0.2. Hence some of the figures for a and b obtained by Raja et al. are not consistent with above interpretations of the Ångström parameters. Both the fits using average monthly data over the year with and without seasonal effects agree with such interpretations. The seasonal fits give slightly smaller errors. Again temporal variations in atmospheric turbidity, precipitable water amount and surface albedo call for seasonal partitioning of data [2].

REFERENCES

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