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FURTHER SOLAR DADIATION TABLES FOR THAILAND

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Summary

Tables are given of the observed diurnal variation of mean global solar radiation at Chiang Mai and Bangkok, and of the probabilities, estimated from daily sunshine measurements, of the transitions in the daily sequence of radiation levels at four stations in Thailand.

Detailed solar radiation tables for Thailand have been published in a previous paper[1]. The present short report gives additional results recently obtained.

Table I gives more detailed information on the diurnal variation of global solar radiation than that previously reported. It contains hourly totals of global solar radiation between 7 h and 17 h apparent solar time averaged over each of the 1½ month periods used in the study. These averages were computed from measurements[2] during the five years 1968 to 1972. The mean radiation flux is roughly proportional to the cosine of the hour angle of the sun.

In the previous paper the first and second order probabilities describing the day to day sequence of solar radiation amounts obtained from radiation measurements at Bangkok were tabulated. Estimates of these probabilities have since been made from daily records of the duration of sunshine[2] at four stations during the five years 1968 to 1972.

Table II gives the probabilities of occurrence of the three radiation classes A containing values greater than 500 cal cm^{-2} day^{-1}, B containing values from 500 to 300 cal $cm^{-2}day^{-1}$, and C containing values less than 300 cal $cm^{-2}day^{-1}$. The probabilities were estimated with the help of the known regression parameters relating solar radiation to sunshine duration as mentioned in the previous paper.

Table III gives the second order (Markov) probabilities of the transitions between the radiation classes on successive days estimated from the observed transitions between durations of sunshine as follows. Given the initial and final sunshine duration in a transition, one calculates from the regression parameters the initial and final probabilities of the radiation classes A, B, and C and hence the probabilities of the nine possible transitions. The required transition probabilities between radiation classes in each 1½ month period are then obtained by summing the contributions from all the observed sunshine transitions in the period.

Table I. Diurnal variation of mean global solar radiation (cal $cm^{-2}h^{-1}$)

	Apparent solar time (h)									
	7–8	8–9	9–10	10–11	11–12	12–13	13–14	14–15	15–16	16–17
Chiang Mai										
Jan 14 – Feb 26	16	32	47	59	65	65	58	45	30	14
Feb 27 – Apr 12	18	34	48	61	67	67	60	46	31	16
Apr 13 – May 28	25	42	56	65	72	69	60	46	33	19
May 29 – Jul 15	23	36	48	54	57	58	53	43	30	17
Jul 16 – Aug 31	20	34	44	49	51	51	47	38	26	14
Sep 1 – Oct 15	19	34	48	57	63	61	55	46	31	17
Oct 16 – Nov 29	14	29	43	55	62	61	55	43	29	14
Nov 30 – Jan 13	11	27	42	53	58	57	52	41	27	13
Bangkok										
Jan 14 – Feb 26	15	30	43	52	58	59	54	44	30	14
Feb 27 – Apr 12	20	35	48	58	64	65	60	50	34	17
Apr 13 – May 28	22	36	47	56	60	60	55	47	34	18
May 29 – Jul 15	20	33	43	51	53	50	47	38	28	17
Jul 16 – Aug 31	20	34	45	51	53	50	45	37	26	14
Sep 1 – Oct 15	19	33	44	50	51	49	44	38	25	13
Oct 16 – Nov 29	16	31	45	54	58	56	50	42	29	12
Nov 30 – Jan 13	15	31	43	54	59	59	53	42	27	13

Table II

Probabilities of solar radiation classes estimated from duration of sunshine.

Radiation class cal cm^{-2} day^{-1}	Jan 14 to Feb 26	Feb 27 to Apr 12	Apr 13 to May 28	May 29 to Jul 15	Jul 16 to Aug 31	Sep 1 to Oct 15	Oct 16 to Nov 29	Nov 30 to Jan 13
Chiang Mai								
A (over 500)	.01	.32	.55	.25	.14	.28	.08	.00
B (300 to 500)	.95	.63	.41	.62	.56	.58	.72	.86
C (under 300)	.04	.05	.05	.15	.30	.14	.19	.14
Khon Kaen								
A (over 500)	.04	.22	.42	.24	.18	.26	.12	.01
B (300 to 500)	.86	.70	.54	.63	.56	.54	.77	.89
C (under 300)	.11	.09	.04	.14	.26	.19	.11	.11
Bangkok								
A (over 500)	.07	.32	.37	.15	.10	.14	.09	.03
B (300 to 500)	.84	.61	.54	.67	.69	.63	.75	.84
C (under 300)	.09	.06	.09	.18	.21	.23	.17	.13
Songkhla								
A (over 500)	.23	.43	.30	.11	.18	.19	.11	.08
B (300 to 500)	.73	.52	.64	.73	.69	.64	.54	.66
C (under 300)	.04	.05	.06	.16	.13	.17	.35	.26

Table III

Probabilities of transitions between solar radiation classes on successive days estimated from duration of sunshine.

	Transition								
	AA	AB	AC	BA	BB	BC	CA	CB	CC
Chiang Mai									
Jan 14 – Feb 26	.02	.97	.00	.01	.96	.03	.00	.84	.16
Feb 27 – Apr 12	.37	.62	.01	.30	.65	.05	.15	.54	.31
Apr 13 – May 28	.69	.30	.00	.39	.53	.08	.14	.60	.26
May 29 – Jul 15	.41	.53	.07	.21	.65	.14	.10	.62	.25
Jul 16– Aug 31	.29	.58	.14	.14	.60	.27	.07	.50	.44
Sep 1 – Oct 15	.42	.51	.07	.25	.59	.16	.11	.64	.25
Oct 16 – Nov 29	.15	.81	.04	.09	.76	.15	.02	.57	.42
Nov 30 – Jan 13	—	—	—	.00	.91	.09	.00	.55	.46
Khon Kaen									
Jan 14 – Feb 26	.04	.91	.05	.04	.88	.08	.01	.69	.30
Feb 27 – Apr 12	.26	.70	.05	.21	.70	.09	.13	.67	.19
Apr 13 – May 28	.47	.50	.02	.38	.56	.06	.32	.66	.03
May 29 – Jul 15	.35	.58	.07	.22	.64	.14	.12	.64	.23
Jul 16 – Aug 31	.36	.54	.10	.18	.59	.23	.07	.50	.43
Sep 1 – Oct 15	.39	.54	.07	.25	.56	.18	.13	.50	.37
Oct 16 – Nov 29	.16	.80	.04	.13	.78	.09	04	.69	.27
Nov 30 – Jan 13	.02	.99	.00	.01	.91	.08	.00	.68	.32
Bangkok									
Jan 14 – Feb 26	.09	.86	.04	.07	.84	.08	.05	.76	.20
Feb 27 – Apr 12	.39	.59	.03	.31	.62	.07	.15	.64	.19
Apr 13 – May 28	.51	.46	.03	.31	.57	.12	.16	.67	.17
May – Jul 15	.23	.69	.08	.14	.68	.18	.09	.62	.30
Jul 16 – Aug 31	.23	.72	.05	.11	.71	.18	.02	.58	.41
Sep 1 – Oct 15	.20	.65	.16	.15	.64	.22	.09	.58	.33
Oct 16 – Nov 29	.13	.81	.06	.09	.77	.13	.04	.58	.38
Nov 30 – Jan 13	.04	.91	.05	.03	.86	.11	.01	.66	.34
Songkhla									
Jan 14 – Feb 26	.25	.72	.03	.23	.73	.04	.13	.76	.11
Feb 27 – Apr 12	.48	.50	.01	.41	.53	.07	.23	.70	.07
Apr 13 – May 28	.36	.60	.03	.28	.66	.06	.21	.58	.21
May 29 – Jul 15	.23	.71	.06	.10	.74	.16	.08	.70	.22
Jul 16 – Aug 31	.29	.65	.07	.17	.70	.13	.10	66	.25
Sep 1 – Oct 15	.24	.65	.12	.18	.65	.17	.14	.61	.24
Oct 16 – Nov 29	.21	.60	.19	.13	.57	.30	.05	.48	.46
Nov 30 – Jan 13	.13	.78	.09	.09	.72	.19	.04	.49	.48

The probabilities estimated for Bangkok are in good agreement with the observed probabilities previously reported[1], except for some rather large differences in the case of transitions with initial radiation class A.

The probabilities were calculated by automatic computer; they are subject to rounding errors up to one unit in the second decimal place.

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บทคัดย่อ

ตารางตัวเลขที่ปรากฏนี้ เป็นตัวเลขสถิติของการผันแปรของพลังแสงอาทิตย์จากเช้าจดเย็นโดยเฉลี่ย ตามที่ได้สังเกตุ ณ ที่เชียงใหม่และกรุงเทพ และเป็นตัวเลขของการประเมินการแปรเปลี่ยนของพลังแสงอาทิตย์ของแต่ละวัน ในระดับต่าง ๆ โดยประมาณ ผลได้จากการวัดการส่องแสงของดวงอาทิตย์เป็นรายวันของสถานีสังเกตุการณ์สี่แห่งด้วยกันในประเทศไทย