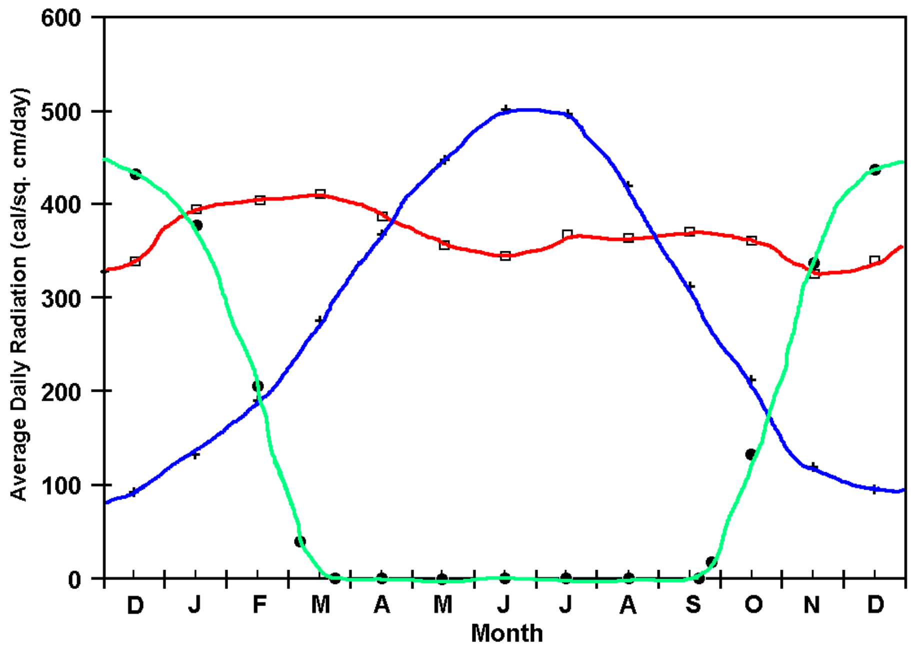
AMS Peer Training Module

Sunlight and Seasons

Activity: Sunlight Throughout the Year

1. See graph 1.

Variation of Solar Radiation Received on Horizontal Surfaces at Different Latitudes



Average Daily Solar Radiation Per Month (cal/sq.cm/day)

	□	+	●	NP
Jan.	394	132	376	
Feb.	403	190	205	
Mar.	410	274	40	
Apr.	354	365	0	
May	386	446	0	
Jun.	342	500	0	
Jul.	365	495	0	
Aug.	361	418	0	
Sep.	368	310	18	
Oct.	359	210	129	
Nov.	323	117	333	
Dec.	337	92	433	

2. Singapore (1.5° N)
3. At equatorial locations, day length is 12 hours every day of year. Variation of solar radiation (*insolation*) occurs from angle of sun in sky. On equinoxes, sun is directly overhead at noon while on solstices the sun is 23.5 degrees to north or south. So more direct sunlight on equinoxes.
4. During the May – August period, the solar elevation angles increase approaching the equatorial values. But more importantly, the period of daylight increases well beyond 12 hours approaching 15 hours per day. This combination gives more insolation.
5. At the South Pole (Antarctica, 90° S), lasts for six months
6. The South Pole is in the opposite hemisphere from Brockport, seasons are out of phase by six months.
7. See graph 2.

8. The North Pole curve would have Sun appearing on horizon for first time at March equinox, spiraling increasingly higher around the sky until the June solstice, then spiraling back down to the horizon at the September equinox. Result is one six-month long "day".
9. The greater the latitude (further toward pole), the greater the range of annual insolation (difference between greatest and least).
10. See graph 2.

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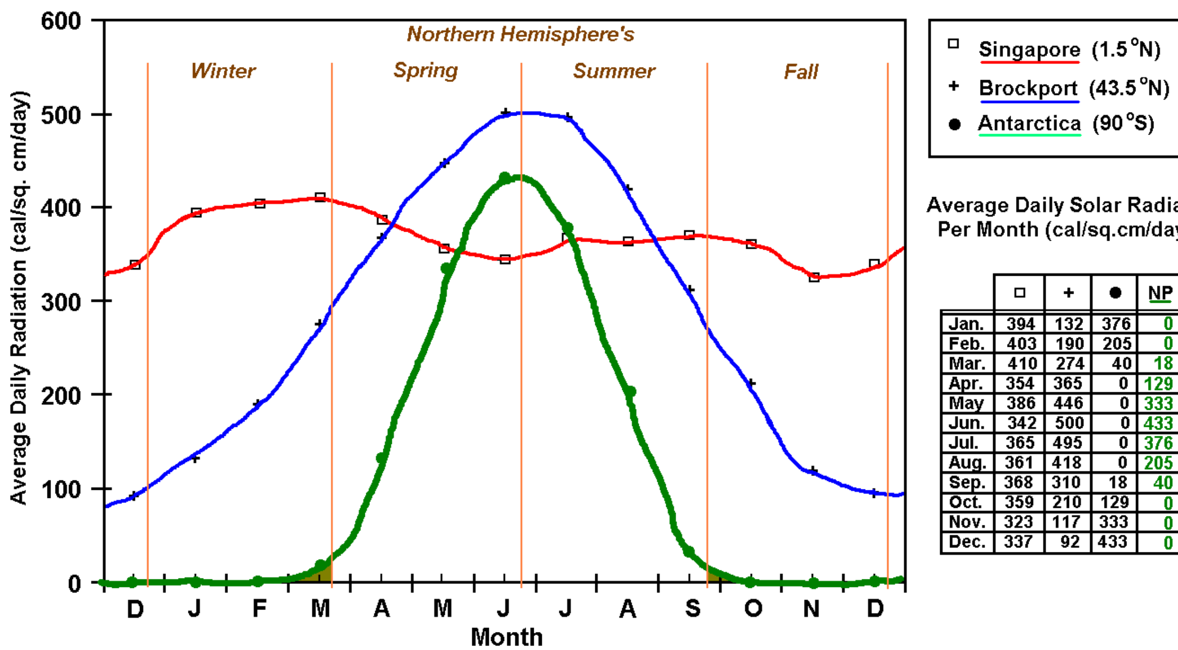

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11. equatorial (Singapore) location
12. Spring and summer receive the most, fall and winter receive the least. [While the amounts are equal for each seasonal pair, the delivery differs. For example, in spring the amounts are increasing daily while in summer the amounts show a daily decrease.]
13. Fall and winter
14. The totals may be found by two methods using these daily averages. The simplest is merely totaling the values for each month at each location. A more accurate accounting involves the varying number of days per month in finding monthly totals. The resulting ratios are nearly equal.

Method 1

Average Daily Solar Radiation Per Month (cal/sq.cm/day)

	Eq	ML	NP
Jan.	394	132	0
Feb.	403	190	0
Mar.	410	274	18
Apr.	354	365	129
May	386	446	333
Jun.	342	500	433
Jul.	365	495	376
Aug.	361	418	205
Sep.	368	310	40
Oct.	359	210	0
Nov.	323	117	0
Dec.	337	92	0
Total	*4402*	*3549*	*1534*

Eq: (4402/1534) = 2.87
ML: (3549/1534) = 2.31
times polar energy

> CLIMATE

Method 2

Total Daily Solar Radiation Per Month (cal/sq.cm/day)

	Days	Eq		ML		NP	
Jan.	31	394	12,214	132	4,092	0	0
Feb.	28+	403	11,385	190	5,368	0	0
Mar.	31	410	12,710	274	8,494	18	558
Apr.	30	354	10,620	365	10,950	129	3,870
May	31	386	11,966	446	13,826	333	10,323
Jun.	30	342	10,260	500	15,000	433	12,990
Jul.	31	365	11,315	495	15,345	376	11,656
Aug.	31	361	11,191	418	12,958	205	6,355
Sep.	30	368	11,040	310	9,300	40	1,200
Oct.	31	359	11,129	210	6,510	0	0
Nov.	30	323	9,690	117	3,510	0	0
Dec.	31	337	10,447	92	2,852	0	0
Total			*133,967*		*108,205*		*46,952*

Eq: (133,967/46,952 = 2.85
ML: (108,205/46,952) = 2.30

Real World Applications

1. Maximum: June, minimum: December
2. are
3. do, decrease
4. would, both of these