EE5343 - Solar Cell Device Physics and Materials Technology

ASSIGNMENT-01

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1.(a)
Solar Irradiance spectrum (For both AM0 and AM 1.5) in W m\(^{-2}\) nm\(^{-1}\).

Total power density : 1347.95 W m\(^{-2}\)

1.(b)
Total power in Atmosphere : 997.612 W m\(^{-2}\)
Power in UV spacecraft : 111.317 W m\(^{-2}\)
Power in UV Earth : 51.7451 W m\(^{-2}\)
Power in visible spacecraft : 528.46 W m\(^{-2}\)
Power in visible Earth : 428.315 W m\(^{-2}\)
1. What happens to the solar spectrum during rainy seasons as compared to winter on earth?

Fig. 2 Net radiation

Fig. 3 Incoming solar radiation spectrum (wavelength 351-1050 nm) in summer, winter and rainy season.
Fig. 4 Decreasing percentage (%) of solar spectrum (wavelength 351-1050 nm) in rainy season compare to summer time.

Fig. 5 Decreasing percentage (%) of solar spectrum (wavelength 351-1050 nm) in winter season compare to summer time.
S-R = % decreasing of net radiation in rainy season compared to summer
S-W = % decreasing of net radiation in winter season compared to summer
R-W = % decreasing of net radiation in winter compared to rainy season

Fig. 6 Decreasing percentage (%) of net radiation in winter and rainy season compared to summer time.

- The net radiation is lowest in any rainy season and higher in summer and winter.
- In rainy season massive cloud and humidity in the air could absorb net radiation and causes net radiation decreasing at wavelength range (700-1050nm) in rainy season.
ii). when we move from equator to polar regions?

Fig. 7 Variation in solar spectrum when we move from equator to polar region.

- On earth sun rays hit the equator at pretty much a 90 degree angle. Which means all the solar radiation is concentrated in a small area and keeps it warm all year around.
- The polar regions, however, get the same amount of solar radiation as equator. But its spread out over a large area because the angle is much less direct. So, the amount of warmth covers a greater area making it much colder these regions.
- Equator retains more heat than it radiates back to space, we would expect the temperature close to the equator to go up faster than anywhere else. Instead we see that the two trends are never more than a few Tenth’s of a degree apart. This is not big news to the climate debate. It has been well known for a long time that northern zone temperatures are going up faster than the global average. The reasons are well known, and not hard to understand. Both the ocean
and the atmosphere generate natural processes that move heat from the equator to the temperate zones and the poles. The atmosphere for example, is driven by convection. Air heats up at the equator causing it to rise. Cooler air from the temperate zones must flow in underneath to replace it, and that pulls still cooler air from the arctic zones down into the temperate.

iii) When the temperature of the sun is reduced to half of its original value?

Fig. 8 Variation of solar spectrum as sun temperature reduces to half.

- "The current prediction for Sunspot Cycle 24 gives a smoothed sunspot number maximum of about 69 in the late Summer. The smoothed sunspot number reached 68.9. So the official maximum will be at least this high. Many cycles are double peaked but this is the first in which the second peak in sunspot number was larger than the first. We are currently over five years into Cycle 24. The current predicted and observed size makes this the smallest sunspot cycle since Cycle 14 which had a maximum of 64.2"