Introduction

Insolation (**solar irradiation**) refers to the amount of solar radiation (energy) reaching a given cross-sectional area over a specific amount of time. This may also be characterized in terms of **solar irradiance**, which is the rate at which the solar energy reaches a given cross-sectional area (i.e. – the power per unit area received from the sun).

Insolation and irradiance are often measured both in space as a function of the distance from the sun and at the Earth's surface after the atmosphere has absorbed/scattered a portion of the energy.

In this exercise you will investigate the rate at which energy is available from the sun for direct conversion to other forms on the surface of the earth.

Procedure

1. Perform an online study to complete the following tasks:

a) Determine the **solar irradiance** (**W/m^2**) that is arriving at the top of the Earth's atmosphere.

b) Determine the **total** (direct and indirect) **solar irradiance** (**W/m^2**) that is arriving at the Earth's surface (sea level) when the sun is at the zenith (directly overhead) in a cloudless sky.

c) Determine the **direct solar irradiance** (**W/m^2**) that is arriving at the Earth's surface (sea level) when the sun is at the zenith (directly overhead) in a cloudless sky.

Although there are some "rule of thumb" numbers that you may find online relating to these values, be sure to reference your sources because different numbers may be found.

2. The city of Marietta Georgia sits roughly at 34°N latitude 84.5°W longitude. Take into account both the location of **Marietta** and the day of the year (use **Monday September 24th**) to determine the **solar zenith angle** in degrees of the sun at both **noon** and **4pm**.

Note that there are a variety of online solar position calculator tools. If you utilize one of these tools, reference the webpage and capture an image of the results shown on the webpage.

3. Apply the angle data from the previous step to determine the **direct solar irradiance** (**W/m^2**) that will be arriving at the Earth's surface in Marietta Georgia at both noon and 4pm on the 24th of September assuming a cloudless sky.

4. Submit your results in the form of a "memo-style" report.

Atmosphere ~ 8,000km

Earth's Diameter 12,800km

Atmosphere

Solar Constant:
Entry point into atmosphere:

Solar radiation 100%

30% lost to space by reflection and scattering

5% backscattered to space by the atmosphere

20% reflected from clouds

20% of radiation absorbed by atmosphere and clouds

50% of direct and diffused radiation absorbed by land and sea

5% reflected from land-sea surface

X   Y

θ