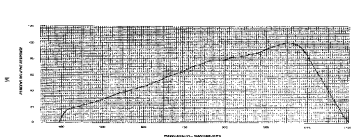
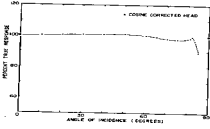


Rotating Shadowband Radiometer

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Operation of Rotating Shadowband Radiometer

A Rotating Shadowband Radiometer (RSR) takes the place of two distinct instruments: a Pyranometer and a Pyrhemeliometer. Basically, a Pyranometer measures diffuse radiation, and a Pyrhemeliometer measures direct radiation. The Radiometer uses a silicon photodiode sensor to measure the energy flux of the direct and diffuse radiation. The photodiode is excited by the photons in an electromagnetic wave. These photons generate a current in the photodiode. This current is then amplified and sent to a data-logger, which in turn calculates the energy-flux corresponding to the voltage generated.

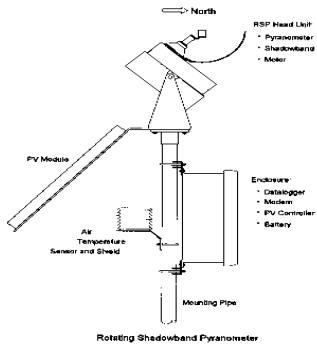


Source of Error in data generated by the Shadowband Radiometer

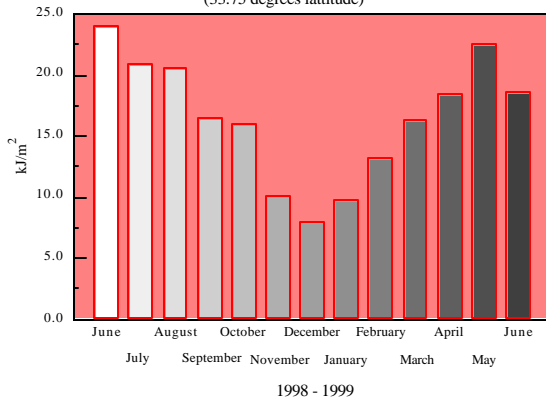
The RSR has a maximum error under natural daylight conditions of 5%. This error can be attributed mainly to two different aspects. First, the spectral response curve (shown below) illustrates a linear increase in response from 400 nm to 950 nm, then a linear decrease to 1200 nm. This does not cause serious error when used in a broad spectrum of data, and when averaged over a 24 hour day, the error is almost insignificant. Second, the cosine response curve (shown below) shows the instability of the collector at high angles of incidence. Usually for angles less than 80° there is less than a five percent error, this is due to the cosine correction performed by the unit. At 90° the collector response would be zero and the error would be infinite. There are only two places on earth where the angle of incidence will be 90°. These are the Tropic of Cancer, and the Tropic of Capricorn. For intended use of this RSR at our latitude, there is a very small margin of error.

Applications of the Rotating Shadowband Radiometer

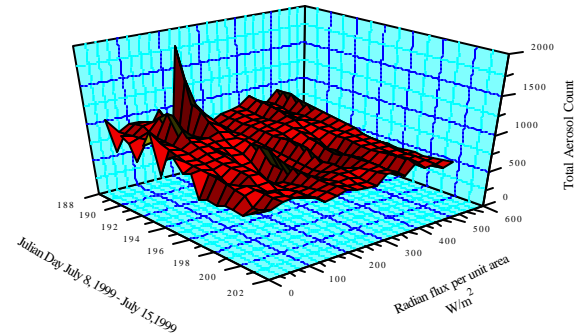
The data generated by the RSR is presented in the form of radian t flux densities per unit area (W/m^2) This data by itself can be used to either infer about the solar radiation at a certain time or to calculate the Average Monthly Radiation (shown below). If this data is combined with the data from other instruments, one can see the effect of aerosol levels. Modeling experiments performed by my fellow REU colleagues, for the time period: June 8, 1999 through June 20, 1999; illustrate a correlation between aerosol levels and the weather. This is evident in the graph shown below.



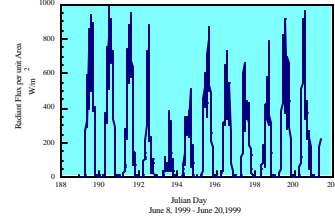
Monthly Averages of Total Solar Radiation
(33.75 degrees latitude)



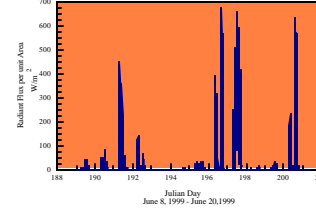
Total and Aerosol data for period of the Modeling Experiment



Total Diffuse Radiation for the Time Period of the Modeling Experiment.



Total Direct Radiation for the Time Period of the Modeling Experiment.



Total Incident Radiation for the Time Period of the Modeling Experiment.

