Solar Resources for Concentrating Systems

This data (units are in watt hours) provides monthly average daily total solar resource information on grid cells of approximately 40 km by 40 km in size. The insolation values represent the resource available to concentrating systems that track the sun throughout the day. Such systems include concentrating solar power stations such as trough collectors or dishes. The values are also useful for assessing the resource available to solar hot water systems.

The data was developed from the Climatological Solar Radiation (CSR) Model. The CSR model was developed by the National Renewable Energy Laboratory for the U.S. Department of Energy. Specific information about this model can be found in Maxwell, George and Wilcox (1998) and George and Maxwell (1999). This model uses information on cloud cover, atmospheric water vapor and trace gases, and the amount of aerosols in the atmosphere, to calculate the monthly average daily total insolation (sun and sky) falling on a horizontal surface. The cloud cover data used as input to the CSR model are an 8-year histogram (1985 – 1992) of monthly average cloud fraction provided for grid cells of approximately 40 km x 40 km in size. Thus, the spatial resolution of the CSR model output is defined by this database. The data are obtained from the National Climatic Data Center in Asheville, North Carolina, and were developed from the U.S. Air Force Real Time Nephanalysis (RTNEPH) program. Atmospheric water vapor, trace gases, and aerosols are derived from a variety of sources, as summarized in the references.

Where possible, existing ground measurement stations are used to validate the model. Nevertheless, there is uncertainty associated with the meteorological input to the model, since some of the input parameters are not available at a 40 km resolution. As a result, it is believed that the modeled values are accurate to approximately 10% of a true measured value within the grid cell. Due to terrain effects and other microclimate influences, the local cloud cover can vary significantly even within a single grid cell. Furthermore, the uncertainty of the modeled estimates increases with distance from reliable measurement sources and with the complexity of the terrain. Concentrating solar collectors are much more sensitive to solar resource characteristics than flat plate collectors, so that these sources of uncertainty are more important to concentrator applications.

George, R, and E. Maxwell, 1999: "High-Resolution Maps of Solar Collector Performance Using A Climatological Solar Radiation Model", Proceedings of the 1999 Annual Conference, American Solar Energy Society, Portland, ME.

Maxwell, E, R. George and S. Wilcox, "A Climatological Solar Radiation Model", Proceedings of the 1998 Annual Conference, American Solar Energy Society, Albuquerque NM.