



## **Developing Surface Radiation Budget Climatologies from Ground-based Observations**

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Traditional methods for establishing climatologies of surface meteorological parameters typically use 30-year averages over various intervals, e.g., days or months. These methods have not been widely applied to surface radiation budget quantities for various reasons. Most notably, few consistent, routinely-collected, quality-controlled and -assured, observational records of the related quantities have been made or if so, are not readily available with sufficient time resolution. The quantities of primary interest are the upward and downward solar and thermal infrared irradiances at high-time resolution (on the order of a few minutes or less), preferably with the downwelling solar separated into diffuse and direct components. Such observations and subsequent climatologies are desirable to document the past, present, and future state of fundamental atmospheric system variables and from which anticipated, or unanticipated, significant changes can be evaluated. In this paper we will demonstrate and examine various surface radiation climatological quantities that have been developed from well-maintained observational records of up to 35-years in length from several of the NOAA global baseline and U.S. SURFRAD networks that contribute to the U.S. component of the international Baseline Surface Radiation Network (BSRN), along with consideration for the applicability of the methodology to other sites. Because these ground-based radiometer measurements are made on a near-continuous basis (typically 1-Hz sampling) they provide the complete integral energy budget information for a wide range of temporal resolutions from minutes to years. However, when interpreting these results, the land surface and terrain surrounding any given surface radiation observing site must be considered and will impact the spatial representativeness of the results. Example climatological radiation quantities that can be derived include overall, annual, seasonal, monthly, and daily means, along with the associated variability and extremes. Other observationally derived climatic features could include characteristics of observed anomalies and statistics of relationships between surface radiation and other variables. Some of these climatological variables are dependent on the absolute calibration of irradiance values, while others are not that relate to relative changes on various time scales and can help to observationally describe and bound elements of the climate system for which little else is understood, such as the multi-decadal bounds on the magnitude of diurnal to annual cycles and other surface irradiance variability.