An Investigation Of Pyranometer Zero-Offset Effects on the Historical CMDL Surface Radiation Measurement Data

D. W. Nelson[1], E. Dutton[1], and D. Longenecker[2]

[1]NOAA Climate Monitoring and Diagnostics Laboratory, 325 Broadway, Boulder, CO 80305;
303-497-6662, Fax: 303-497-5590, E-mail: dnelson@cmdl.noaa.gov
[2]Cooperative Institute for Research in Environmental Sciences, University of Colorado,
Boulder, CO 80309

Current CMDL practice in surface radiation budget monitoring relies on the component-summation method to achieve accuracy and precision requirements of the Baseline Surface Radiation Network (BSRN). The component-summation method measures the diffuse-sky irradiance and the direct solar-beam irradiance separately using a pyranometer shaded from the direct solar beam in combination with a pyrheliometer that measures only the direct solar beam [Nelson, D., NOAA Tech Memo., *OAR CMDL-15*, 2000]. It has been suggested that although the component-summation method is capable of achieving the accuracy required by the BSRN protocol, care must be exercised when measuring diffuse-sky radiation using shaded pyranometers. Measurable zero offsets can occur in the shaded pyranometers and are most evident under clear sky with the detector continuously shaded. The offsets are attributed to cooling of the detector surface via thermal radiative losses to the cold sky. Methods to correct for the zero offsets have been suggested and tested with some success [Dutton, E.G., et al., *J. Atmos. and Oceanic Technol.*, 18, 297-314, 2001]. Alternatively, the diffuse-sky irradiance can be measured using pyranometers equipped with black and white detectors, which effectively reduce the zero offset effects to negligible values. This investigation examines the magnitude of the zero-offset effects present in the long-term surface radiation data records maintained by CMDL. Calibration methods that incorporate zero-offset corrections and previous methods that did not incorporate zero-offset considerations were applied to a common group of sensors. Data collected with the same group of sensors were scaled using calibration factors generated by calibrations that did or did not incorporate zero offset effects. Analysis of the differences in irradiance values generated by the nonoffset corrected calibration factors and the offset corrected calibration factors allow estimates of the uncertainties present in the historical CMDL broadband pyranometer measurements.