UV-B MONITORING AND RESEARCH PROGRAM

DATA COLLECTION

UVMRP measures the following ground-level solar irradiances at each of our locations. The data are provided in 3-minute intervals for a combined daily size of 60K bytes. This data are downloaded nightly.

- UV direct normal, diffuse horizontal, and total irradiance (watts per square meter per nanometer) with a 2 nm full width at half maximum (FWHM) at nominal 300, 305, 311, 317, 325, 332, 368 nm wavelengths
- Visible direct normal, diffuse horizontal, and total irradiance (watts per square meter per nanometer) with a 10 nm FWHM at nominal 415, 500, 615, 673, 870, 940 nm wavelengths
- Erythemal weighted irradiance (watts per square meter) determined from broadband measurements between 280 to 320 nm wavelengths
- Photosynthetically Active Radiation between 400 to 700 nm wavelengths. The measurement is of Photosynthetic Photon Flux Density (PPFD), which has units of quanta (photons) per unit time per unit surface area, which for this sensor is in micromoles per second per square meter.

INSTRUMENTATION

To measure these irradiances, each of our locations is equipped with a set of instruments, including:

- Yankee Environmental Systems Ultraviolet Multifilter Rotating Shadowband Radiometer (UV-MFRSR) measures solar irradiance at seven narrowband wavelengths (nominal 300, 305, 311, 317, 325, 332, and 368 nm; each 2 nm FWHM) in the UV-B and UV-A regions.
- Yankee Environmental Systems Visible Multifilter Rotating Shadowband Radiometer (vis-MFRSR) measures solar irradiance at six narrowband wavelengths (nominal 415, 500, 615, 673, 870, and 940 nm; each 10 nm FWHM) plus one unfiltered (open) silicon photodiode of 300-1040 nm.
- The UVB-1 Pyranometer, manufactured by Yankee Environmental Systems, measures global irradiance in the UVB spectral range of 280-320 nm.
- The LI-COR model LI-190SA Quantum Sensor measures photosynthetically active radiation (PAR) in the 400 nm to 700 nm wavelength range.

DATA ACQUISITION

At each location, a small device with a Linux OS is co-located with the instrumentation. A driver program (written in C language) contacts the instrumentation and downloads the data to this device. Once the voltage data has been downloaded from the instrumentation, a process then transfers the data using the https protocol to a data server at Colorado State University.
These files are stored in folders on our data server by year and instrument type.

DATA PROCESSING

Once the raw voltage is downloaded to our data server folders, it is loaded into our database on our database server located at Colorado State University. During this loading process, the quality control protocol, including range checks and statistical analysis, is applied to verify the validity of the data and to alert our field engineers of instrumentation issues. Quality control codes, if any, are added to this data in the database.
Leval 1 data is the raw voltage and is the basis for creating and recreating our irradiance data.
Level 2 data is still a voltage but has been corrected for anomalies found in the instrumentation. This data also provides a level of quality control processing and is stored in our database along with the quality control codes.
Level 3 data is our irradiance data. This is provided on a monthly basis by running various software programs to derive a calibration factor, along with more quality control.

This data is then packaged into files in csv format and put in our data repository on our web page readily available to our users. All these processes to create the final irradiance are also stored and documented on our data server.

DOCUMENTATION AND META DATA

Our data is readily available from our website. This website has an explanation of our monitoring locations, our instrumentation, and all our data processing procedures. It provides a synopsis of our quality control codes as well. The data is also available for download from this website. This download is available from an interactive tool while examining the data or from our data repository. The format of the data is a CSV file with a header that describes the location and type of data along with the format of the data.
During the creation of the download data, our processes examine the quality control codes and alert the user to potential problems or omit the data if the code is severe.

ETHICS AND LEGAL COMPLIANCE

Our data comes from instrumentation and is in the public domain.

This project is funded by NIFA and the data is public domain for use by agricultural, and other, researchers, and by the general public.

STORAGE AND BACKUP

Our raw voltage data and database is backed up nigthly at Colorado State University.
Yearly, USB drives are created with the raw voltage, along with the software to create the irradiance, and our database and kept off site.

Our servers are located at Colorado State University. The IT department at Colorado State University provides the security.

SELECTION AND PRESERVATION

In reality, the nearly 30 years of data accumulated to date by the UVMRP is a small dataset when compared to that from one year of one Earth observing satellite, so it is preferable to preserve in perpetuity the entirety of the UVMRP data. Similar to using archaeological findings, climate change scientists of the (far) future would likely find a gold-mine of analyses possible using the UVMRP data to retroactively study and understand our current climate conditions.

Maintained in perpetuity at Colorado State University, Fort Collins, CO, with possible duplicate maintained in perpetuity at USDA NIFA office in Kansas City, MO.

DATA SHARING

We have a website that allows our users to interactively display and download our irradiance data.
From our website, we also have a data repository for our various irradiance data. They can download all locations by year or one location for all years.
All files are CSV formatted with a header describing the data, potential issues found in the data, and the format of the data/