Where We’ve Been and Where We’re Going

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Outline of talk

• Overview of the SRML
• Description of the Eugene monitoring station
• Available data
• A few studies over the past 40 years
• Current activities and future plans
Overview of the SRML

The SMRL is the Pacific Northwest’s regional solar radiation data center

Support for the lab comes from regional utilities with assistance from NREL and other entities.
The Eugene Monitoring Station

• Data collection started at the University of Oregon in Eugene with global horizontal irradiance measurements in 1975. Direct normal irradiance measurements were added in 1977.

• The Eugene station is also our primary research facility used to characterize and evaluate solar monitoring equipment and to calibrate our instruments.
Eugene monitoring station, then and now

The GHI, DNI, DHI sensors, and pyrgeometer are on the automatic tracker.

Roughly 10 years after inception.

Tilted, auxiliary, and spectral sensors.
Key features of the SRML website

• Data - Irradiance and Metrological
  • All data is publicly available
  • http://solardata.uoregon.edu

• Stations in the network

• Publications

• Sponsors

• Educational Information
Available data files

• **Station data files**
  • One-minute to hourly interval data from stations in monthly blocks.
    
    http://solardata.uoregon.edu/SelectArchival.html

• **Spectral data files**: Yankee MFRSR and EKO Spectroradiometer files
  • EKO spectral data comes with corresponding broadband and other metrological information
    
    http://solardat.uoregon.edu/SelectMFR.html
    http://solardat.uoregon.edu/SelectEKO.html
38 plus years of DNI data

- 1982 Eruption of El Chichón (Mexico)
- 1991 Eruption of Mt. Pinatubo (Philippines)
A few of the SRML studies

1. Spectral biases of a photodiode pyranometers
2. Deviation for lambert cosine response
3. Thermal offset effects
Spectral biases of a LI-200SA Pyranometer

- Comparison of two DHI sensors
  - **Photodiode**: A LI200SA with a rotating shadowband
  - **Thermopile**: A Schenk Star pyranometer with a shadeball

- The LI-200SA responsivity depends on the spectral composition of incident radiation that changes over the day. The DHI dependence is significant for the LI-200SA ~30%.

- The Schenk does not have a spectral dependence

Vignola, Michalsky, Stoffel: 2012
GHI Ref = DNI * Cos(SZA) + DHI
DNI = CHP1
DHI = Schenk with shadeball

The responsivity of the PSP has a large cosine response. What is its uncertainty?

Note the SZA scale of the winter plot
Thermal Offset of an Eppley PSP

• Pyrgeometer data was used to calculate the thermal offset.
• The most negative values are obtained during clear sky periods.
• Larger offsets in the afternoon than in the morning.

Younkin and Long: 2003
Vignola, Michalsky, Stoffel: 2012, Figure 5.6
Current Activities

1. Provide calibration information for each instrument on the website
2. Reformat the data files with enhanced information
3. Investigate the effects of spectral data on various systems
Current Activities - Calibrations

- The SRML performs yearly calibrations of instruments.
- Plans are to provide detailed calibration information for each instrument on the website.
- The calibration process has been streamlined and formalized with new software.
- Absolute Cavity Radiometer obtained in 2010.
Current Activities - Comprehensive Data Format

The new format offers significantly more information about the data contained within each file.
Current Activities - Spectral Measurements

Clear sky spectral data from a Multi-Filter Rotating Shadowband Radiometer

Predominate DNI colors are 501 – 674 nm. The Sun is “white”.

Predominate DHI colors are 414 – 501 nm. The sky is “blue”.

![Graph showing spectral irradiance and broadband data for DNI and DHI](image)
Conclusions

The Solar Radiation Monitoring Lab at the University of Oregon has been making high quality GHI and DNI measurements since the late 1970’s.

Characterizing the bias and uncertainties in irradiance measurement is essential. Spectral measurements are becoming increasingly important.

Thank you for your attention!

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Measuring the sun every day it rises.

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