A Comparison of Photodiode and LED Based Sunphotometer-derived AOD with NASA AERONET

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Regional and global studies of aerosol direct radiative forcing (DRF) and, more recently, surface-level particulate matter concentrations (PM2.5), rely on aerosol optical depth (AOD) measurements from satellite-based platforms such as NASA's Moderate Resolution Imaging Spectroradiometer (MODIS) aboard Terra and Aqua due to near-global coverage daily. However, recent comparisons of MODIS-measured AOD with "ground-truth" AOD measurements at NASA AERONET sites located in mountainous regions around the world demonstrated a weaker agreement (Levy et al., 2010), with a small negative AOD bias over the Southern Appalachian Mountain Region (Sherman et al., 2016). To aid in validation of MODIS-retrieved AOD over these regions, networks of inexpensive handheld sunphotometers may be deployed to increase the spatial density of measurements where research-level instrumentation is otherwise unavailable (Brooks and Mims, 2001). Currently, few (if any) assessments of sunphotometer sensitivities or uncertainties have been conducted; to this end, the primary research goals are to quantify these unknowns and begin deployment to establish a mountainous citizen science network. Initial results from a multi-year comparison of AOD measured at Appalachian State University's NASA AERONET site with AOD measured by handheld sunphotometers using LEDs as detectors (Brooks and Mims, 2001) and a modified design using filtered photodiodes will be presented. A modified handheld sunphotometer with a microcontroller interface has been developed at Appalachian State to simplify data collection and transfer by citizen scientists; initial results of its performance are also presented.

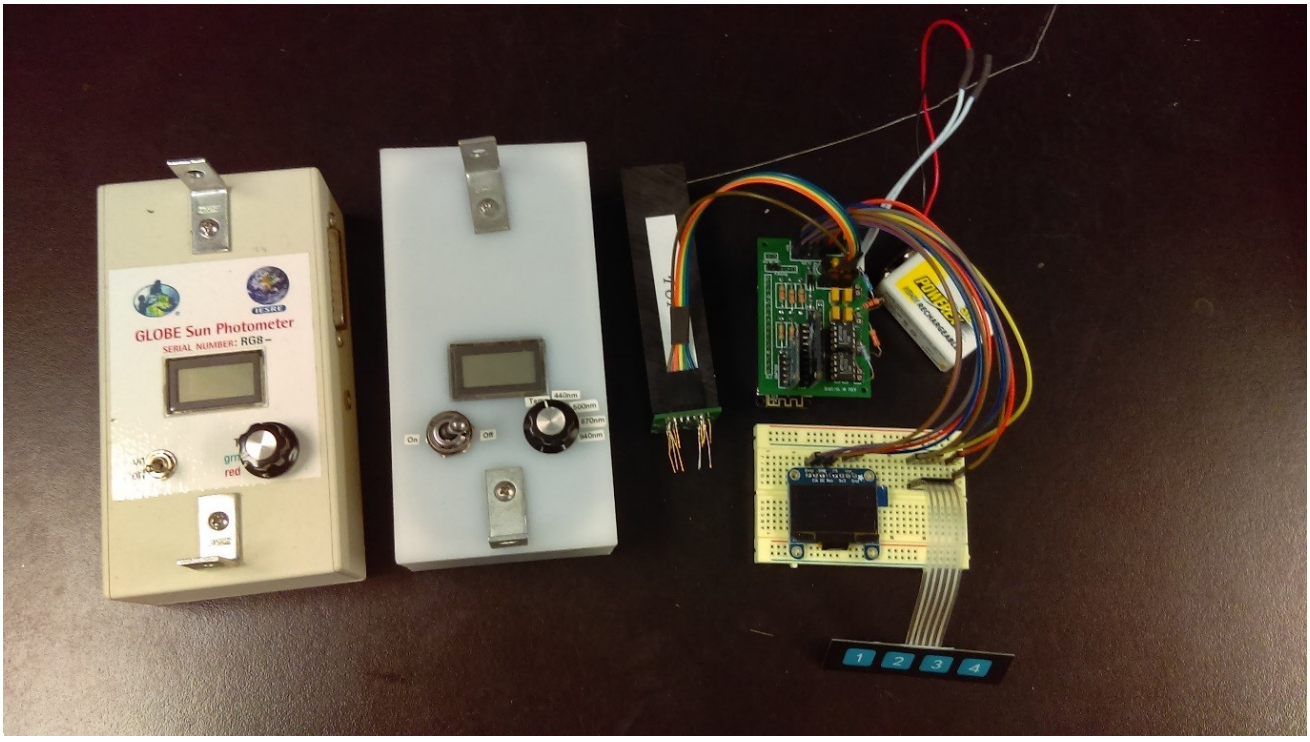

Figure 1. Three "generations" of sunphotometers have been used/developed at Appalachian State University. The first (left) is the GLOBE sunphotometer featuring LED detectors, followed by the filtered photodiode model (middle). The first microcontroller-based model is in the final stages of development (right).