



## **The environmental Sky Imager-Radiometer (eSIR) and its application in Atmospheric Observation**

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The environmental Sky Imager-Radiometer (eSIR) was developed for New York State Mesonet by Atmospheric Science Research Center, SUNY at Albany. The eSIR is a smart sensor system that measures accurate spectral and angular solar radiation, cloud distribution and motion, and meteorological parameters for monitoring solar radiation and weather conditions. It contains three sub-sensor modules: spectral radiometer (with seven channels at 415, 500, 610, 665, 870, 940, and 1020 nm), sky imager (180° view), and meteorology sensors. Both the radiometer and sky imager share a scanning shadowband with controlled rotation. With the scanning shadowband technique, the radiometer not only measures spectral direct and diffuse irradiance simultaneously, but also the forward scattering lobe of the solar aureole. With an advanced analytics package, the eSIR enables accurate retrievals of optical properties of aerosol, cloud, ozone, and water vapor in the atmosphere. The shared scanning shadowband blocks the sun for the sky imager, which enhances the dynamic range of the sky imager to detect optically thin clouds for cloud distribution and motion. With its on-board processing power for analytics of spectral solar radiation and sky image processing, the eSIR enables real-time output of the processed atmospheric data to the weather forecast system and the scientific community. In addition, the eSIR is modular designed, GPS-enabled, web-enabled, and motion-tracked with solar powered operation. Currently, eSIR instruments have been deployed at NYS Mesonet enhanced sites for routine operation, and they work stable in various harsh environment.