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Using Artificial Sky Glow to Retrieve Night Time Aerosol Optical Depth

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Measuring the Aerosol Optical Depth (AOD) is of particular importance in monitoring aerosol contributions to global radiative forcing. Most measuring methods are based on direct or indirect observation of sunlight and thus are only available for use during daylight hours. Attempts have been made to measure AOD behavior at night from star photometry, and more recently moon photometry. Star photometry method uses spectrally calibrated stars as reference targets this provides somewhat more flexibility than a sunphotometer but there are low-signal and calibration issues which can make these measurements problematic. Moon photometry is only possible when the moon is present in the sky. We suggest a complementary method, based on the observation of artificial hemispheric sky glow generated by light pollution. The methodology requires (1) the implementation of an heterogeneous 3D light pollution model and (2) the design of an automated light pollution spectrometer. This instrument designated as the Spectrometer for Aerosol Night Detection (SAND) is now in it's third version. Basically, SAND-3 is a CCD based, long-slit spectrometer with a non imaging optical head. SAND-3 is protected from inclement weather by a transparent acrylic dome; it can run autonomously with minimal maintenance. The system can be remotely controlled via a web browser or via a secure shell client. Preliminary field measurements acquired at the Mont-Mégantic astronomical observatory (Québec, Canada) and in Sherbrooke (Québec, Canada) will be reported. We will also show preliminary day/night (continuity) comparisons with AERONET/AEROCAN sunphotometer AOD measurements and nightime comparisons with aerosol backscatter lidar profiles acquired at the nearby optical observatory in Sherbrooke Québec, Canada. The performance and the potential of this approach will be discussed in conjunction with the implementation of the light pollution model.