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Characterization of atmospheric aerosols and columnar water vapor using MFRSR network measurements

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The Multi-Filter Rotating Shadowband Radiometer (MFRSR) measures direct and diffuse irradiances in visible and near IR spectral range. Our recently updated analysis algorithm for MFRSR data allows partitioning of the spectral aerosol optical depth (AOD) into fine and coarse mode AOD, and retrieval of the fine mode effective radius. In this approach we utilize climatological NO_2 (based on SCIAMACHY satellite retrievals) and column ozone from TOMS measurements. In addition to characteristics of atmospheric aerosols, MFRSR data also allows to retrieve precipitable water vapor (PWV) column amounts, which are determined from the direct normal irradiances in the 940 nm spectral channel. The HITRAN 2004 spectral database was used in our retrievals to model the water vapor absorption. We present our retrievals of aerosol parameters and PWV column amounts from a long-term dataset obtained by local MFRSR network (21 instrument) at the Southern Great Plains (SGP) site operated by the U.S. Department of Energy Atmospheric Radiation Measurement (ARM) Program. Our inter-comparison between retrievals from the two MFRSRs located at the SGP's Central Facility and the correlative AERONET Sun-sky inversions (Version 2) derived from a co-located CIMEL sun-photometer shows remarkably good agreement. The differences in total, fine, and coarse mode AOD do not exceed the expected measurement accuracy of 0.01, while the retrieved values of fine mode effective radius show no relative bias and only 0.03 micron random error. We show, that if only data with large enough AOD (more than 0.06 at 870 nm) are selected, this error is reduced by a factor of two, becoming about 10% of a typical fine mode effective radius value. The results of our PWV retrievals were compared with correlative standard measurements by Microwave Radiometers (MWR) and GPS stations, as well as with retrievals

from other solar radiometers (AERONET's CIMEL, AATS-6). Some of these data are routinely available at the SGP's Central Facility, however, we also used measurements from a wider array of instrumentation deployed at this site during the Water Vapor Intensive Observation Period (WVIOP2000) in September - October 2000. We used an interpolation technique to determine spatial structure of water vapor field from SGP's MFRSR network data and to create a 2D dataset comparable with MODIS satellite PWV product.