



Understanding of the Observed Trend in Radiation at the ARM SGP Site

M. Duan (1) and Q. Min (2)

(1) Chinese Academy of Science, Institute of Atmospheric Physics, Beijing, China (dmz@mail.iap.ac.cn, 86 10 82995073),

(2) Atmospheric Science Research Center, State University of New York at Albany, Albany, NY, 12203

The broadband radiometer measurements at the ARM SGP site show an increasing trend during the past 16 years, consistent with the global brightening. There are multiple reasons for the increased trend in radiation, such as changes in aerosols, clouds, aerosol-cloud interaction, and atmospheric dynamics. To better understand this phenomenon, we analyze optical properties of aerosols and clouds derived from the well-calibrated Multifilter Rotating Shadowband Radiometer (MFRSR) and Microwave Radiometer (MWR) measurements from 1993 to 2008, together with measurements of the BBSS and MMCR. We find that there is a long-term decreasing trend of cloud occurrence frequency, corresponding with the broadband radiation trend. Changes in aerosol loading and column water vapor amount cannot directly explain the observed trend in radiation. Further, we detect a decreasing trend in water vapor at the stratosphere and near the tropopause, and a reduction of cloud-top height. We speculate that our observed trend in broadband radiation could be due to the strengthening of the Hadley Circulation for the past 16 years. The strengthening of the Hadley Circulation dries up water vapor near the tropopause at the latitude of the SGP site that limits the high cloud formation and lowers the cloud-top height.