

Analysis of the Diurnal Cycle of Cloud Effects on the Surface Radiation Budget of the SURFRAD Network

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ESRL/GMD operates a network of seven surface radiation budget sites (SURFRAD) across the continental United States. The SURFRAD network was established in 1993 with the primary objective to support climate research with accurate, continuous, long-term measurements of the surface radiation budget over the United States. The data from these sites have been used in many studies including trend analyses of surface solar brightening (Long et al, 2009; Augustine and Dutton, 2013; Gan et al., 2015). These studies have focused mostly on long term aggregate trends. We will present studies that take a closer look across the years of the cloud influence on the surface radiation components partitioned by seasonal and diurnal analyses.

Augustine, John A. and Ellsworth G Dutton, (2013), Variability of the surface radiation budget over United States from 1996 through 2011 from high-quality measurements, *Journal of Geophysical Research*, 118, DOI: 10.1029/2012JD018551

Gan, C.-M., Pleim, J., Mathur, R., Hogrefe, C., Long, C. N., Xing, J., Wong, D., Gilliam, R., and Wei, C.: Assessment of multi-decadal WRF-CMAQ simulations for understanding direct aerosol effects on radiation "brightening" in the United States, *Atmos. Chem. Phys. Discuss.*, 15, 17711-17742, doi:10.5194/acpd-15-17711-2015, 2015.

Long, C. N., E. G. Dutton, J. A. Augustine, W. Wiscombe, M. Wild, S. A. McFarlane, and C. J. Flynn (2009): Significant Decadal Brightening of Downwelling Shortwave in the Continental US, *JGR*, 114, D00D06, doi:10.1029/2008JD011263.



Figure 1. Graphic illustration of overall relative surface downwelling all-sky shortwave brightening trends at the U.S. SURFRAD and ARM sites from 1996 through 2007 (Long et al., 2009).

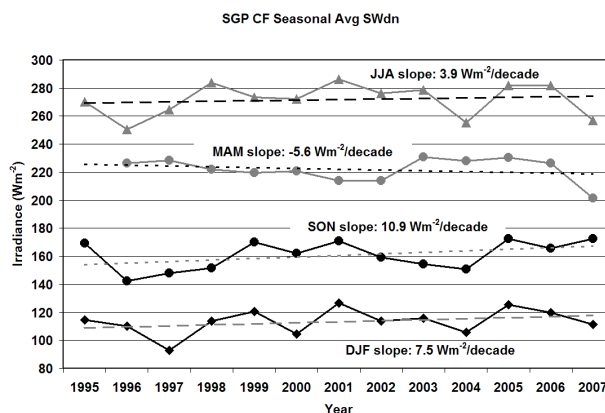


Figure 2. Seasonal trends in yearly average downwelling shortwave at the ARM U.S. site from 1996 through 2007 (Long et al., 2009).