



Significant Decadal Brightening of Downwelling Shortwave in the Continental US

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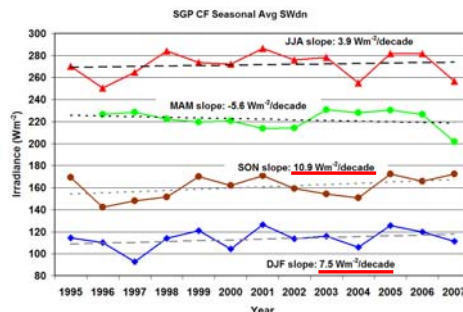
OBJECTIVE:

Determine the extent and causes of recent decadal changes in downwelling SW radiation reaching the surface for the continental US.

1. ARM (green) and SURFRAD (blue) sites used in study



3. Largest SGP CF All-Sky SW increases in Fall and Winter

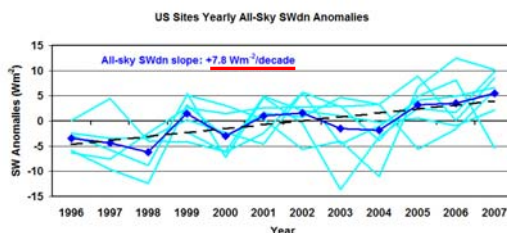


Seasonal averages of all-sky SW for SGP CF.

CONCLUSIONS:

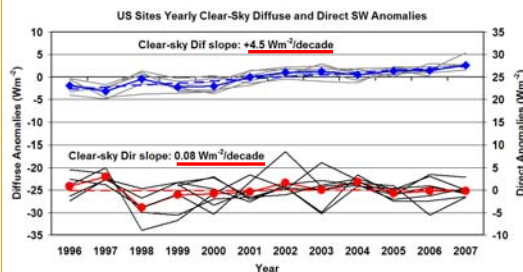
Downwelling SW has increased by $8 \text{ Wm}^{-2}/\text{decade}$ since 1996 over the US. This is 3 times the corresponding wide-spread $2-3 \text{ Wm}^{-2}$ LW increase reported from GEBA records spanning 1986-2000. The notion that this SW brightening for the US is predominantly caused by direct aerosol effects is shown to be false, but rather changes in cloudiness play a major role.

2. US All-sky Yearly SW increase of $8 \text{ Wm}^{-2}/\text{decade}$ associated with decreasing Sky Cover



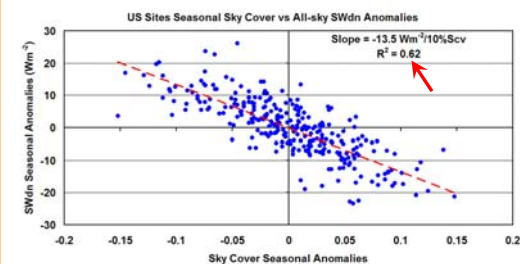
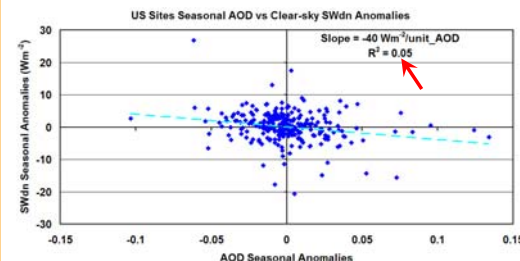
Aggregate yearly average all-sky SW (blue) and linear trend (dashed) from 1996 through 2007.

4. Clear-sky SW increase of $4.6 \text{ Wm}^{-2}/\text{decade}$ virtually all in diffuse SW, correlated with increased air traffic over US.



Aggregate yearly average diffuse and direct SW (top) and corresponding monthly record of commercial flight hours (bottom) for continental US.

5. Little relationship between AOD and clear-sky SW anomalies, but significant relationship between sky cover and all-sky SW anomalies.



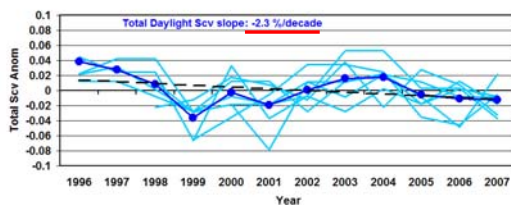
Seasonal anomalies of AOD versus clear-sky SW (top) and sky cover versus all-sky SW (bottom) for the US sites.

Reference:

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*, doi:10.1029/2008JD011263, in press.

Available at: <http://www.agu.org/journals/pip/jd/2008JD011263-pip.pdf>

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Aggregate yearly average daylight sky cover (blue) and linear trend (dashed) 1996-2007.