Long-term Variations in Surface Solar Irradiance at 5 Ground-Based Sites

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GCM global-mean global solar irradiance

NCAR fully coupled GCM control run for 550 years (CCSM, B. Briegleb)

GFDL GCM Surface Solar Irradiance (Fully forced)

-2% dec\(^{-1}\) trend for 3 decades

0.15 % dec\(^{-1}\)

5% decade\(^{-1}\) (sig. at 99%)
NOAA/CMDL background climate monitoring sites

Note: CMDL and SRRB (SURFRAD) have been combined into one group within the Global Monitoring Division (GMD) of the Earth System Science Research Laboratory (ESRL) – all of NOAA research in Boulder, CO

A new merged network and mission will likely emerge – Surface Energy Budget Network SEBN – 2 to 3 years
Station SW data x-correlated with ISCCP annual averages 1984 - 2000

Units are X-Corr. Coef. / S. E.
Combined xcc/s.e. (summed if abs(cc/s.e.) gt 2.)

Area of Earth
23% positive,
21% negative,
56% ~ 0
Conclusions

• There is autocorrelated interannual variability in the CMDL surface solar irradiance records that in some cases exceeds the variability of the basic calibration references.

• Multi-decade, statistical significant trends at individual grid cells or regions are not outside the physical realm of GCMs.

• The CDML 5-station record maybe representative of up to 25% of the earth on an interannual basis and is consistent with other reports that suggest a “dimming” prior to about 1990, and a “brightening” into the 2000s, with no suggestion of an extension of brightening beyond ~2000.

• Clear-sky aerosols at the 5 sites do not explain the interannual variability in solar irradiance.
END
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Barrow
71 N

Boulder
40 N

Mauna Loa
19 N

Am. Samoa
14 S

South Pole
90 S