

Observed Multi-decadal Variations in Surface Irradiance (radiation budget) Records

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As key components of the earth's energy budget, which is involved in the maintenance and perturbation of global climate, variations in the incoming solar and terrestrial radiant energy (irradiance) at the earth's surface are of considerable importance. For over three decades (50 years in some cases), GMD and its predecessors have continually observed radiation quantities at selected surface sites with the intention of documenting and understanding their magnitude, variability, and broader-scale implications. With known astro-geometrical causes dominating the solar irradiance variations that drive diurnal to seasonal weather and climate variations, identification of inter-decadal irradiance variations is a daunting task, which was embarked upon those decades ago following a much earlier recognition of the scientific problem. Sufficient data now exist to begin investigations of potential inter-decadal variations in annual means. Anticipated variations are small to non-existent on the global scale but numerous reports of interannual and inter-decadal variations of 2% to 4 % dec⁻¹ at various surface observing sites have been made. The data from the GMD program show some autocorrelated variability that tends to support those reports but over limited time scales thereby more realistically bounding the earlier reported variations. The value of those observations on a broader-scale is examined. The spatial representativeness of the solar data is indicated as autocorrelations between the sites' and shorter global satellite records, figure below. Further observations to document the evolving state of this fundamental climate and weather component are needed to better understand underlying and related climate variations and feedbacks.

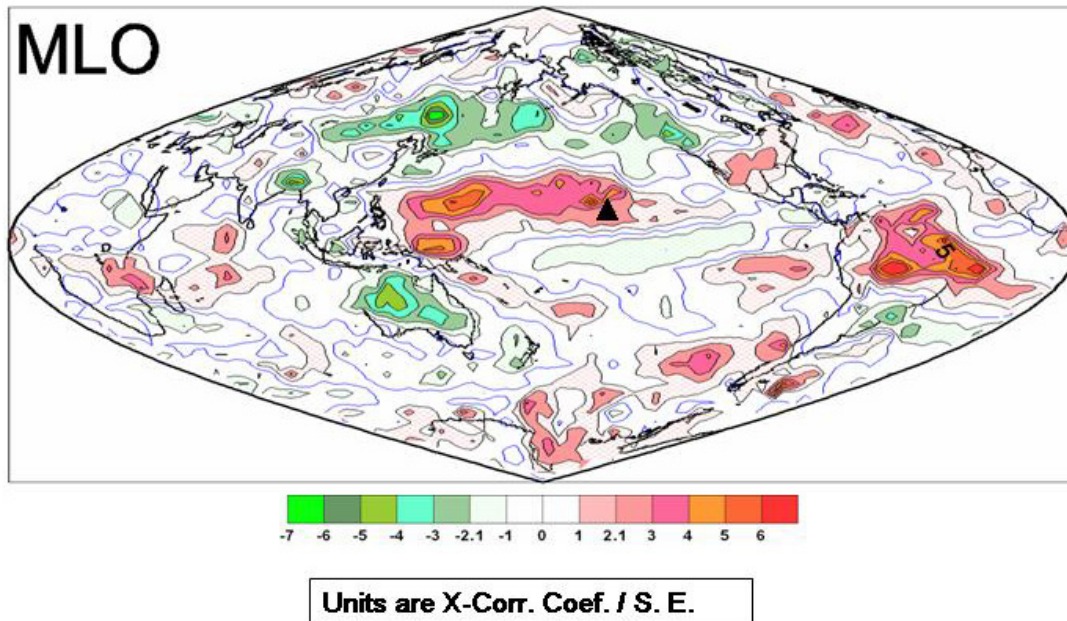


Figure 1. Cross correlation between a subset (1984-2000) of annual-mean surface solar irradiance at Mauna Loa and those from the longest available satellite record (ISCCP) for the entire planet. Plotted quantity is the ratio of cross-correlation to its standard error at each grid point. Note the black triangle at the Mauna Loa location.