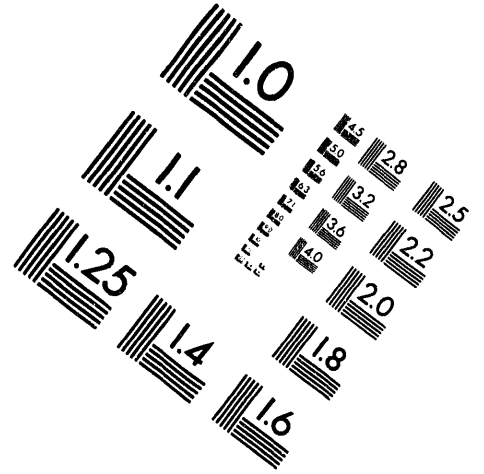
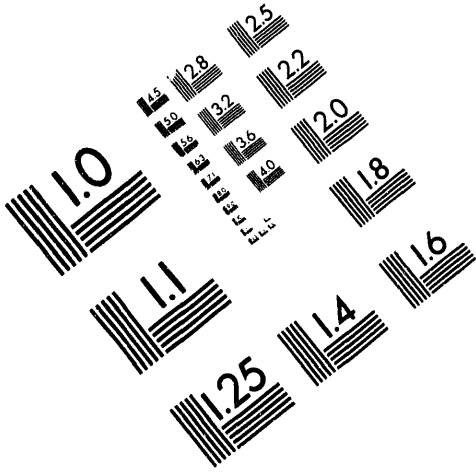




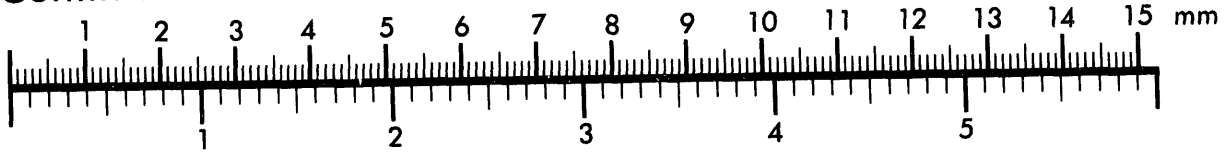
**AIM**

**Association for Information and Image Management**

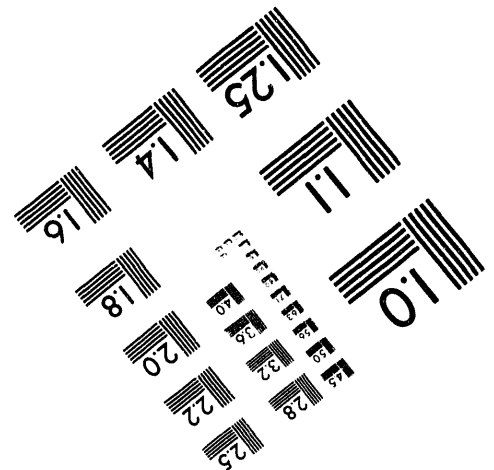
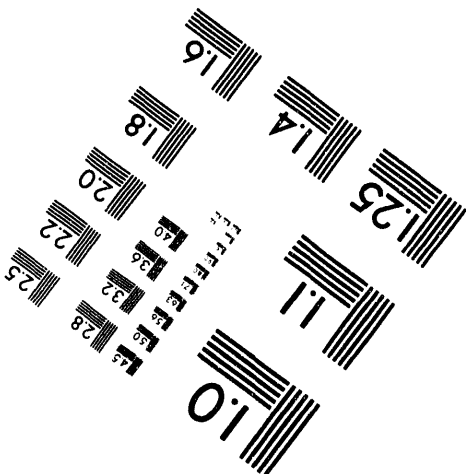
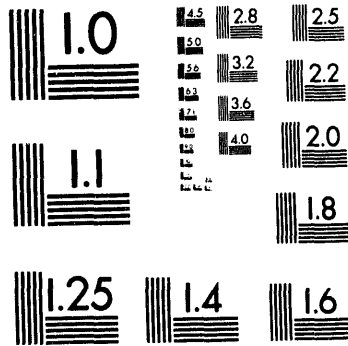
1100 Wayne Avenue, Suite 1100  
Silver Spring, Maryland 20910  
301/587-8202



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LETTER TO THE EDITOR:

It has been reported<sup>1</sup> in your pages that the Bush administration's views and actions regarding how or whether to react to possible global warming due to greenhouse gases have been influenced by the so-called Marshall report<sup>2</sup>. This unrefereed report, released by the George C. Marshall Institute, had as its principal conclusion the finding that the 0.5° C global warming of the last century was mostly due to solar variability (see page 33 of the report) and, thus, the greenhouse warming of the 21st century can be expected to be a relatively small 1° C or so. The authors support this finding by comparing the 33-year running average sunspot number with the trend in annual average global temperature (Figure 7 of their report) and noting the parallel between the two, especially during the 1940s – 1960s when the temperature trend was downward. Subsequent letters to *Science* debated the merits of this and other conclusions contained in the report.<sup>3</sup>

I now present additional technical evidence which shows that, quite aside from the question of whether the data presented in the report support its conclusions, the actual figure (their Figure 7) on which the above conclusion is based is in error. That figure shows a slow rise in the 33-year running average sunspot numbers from about 1890 to 1920, then a sharper rise up to the absolute maximum about 1945, then a steady decline until about 1970, followed by a rise into the early 1980s. Imbedded in the sharp rise are relative minima around 1930 and 1940. A look at the actual yearly average sunspot numbers<sup>4</sup> made me suspicious about the mid 1940s peak and 1950s decline portrayed in the Marshall sunspot figure. The two actual sunspot maxima in the late 1940s and late 1950s were much higher than any maxima of the previous 60 years; the mid 1950s peak is the highest of the period covered by the Marshall figure.

The Marshall report does not explain why a 33-year average was used or any other details of how the sunspot figure was derived, however one can assume that the average

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corresponding to a given year is for the previous 33 years, since the plotted data go to the early 1980s. Using this assumption and Wolf sunspot numbers obtained from the Carbon Dioxide Information Analysis Center of Oak Ridge National Laboratory and updated by the NOAA National Geophysical Data Center, I produced the 33-year running average of Figure 1. The absolute peak occurs around 1970 and there is no evidence of a decline corresponding to that of the temperature trend. The total lack of correspondence between this figure and that of the Marshall report makes me think they have made an error in their data or method which negates their main conclusion. If one instead uses a centered moving average then a relative peak is seen in the 1940s, but the curve then increases slightly in the 1950s and remains high through the early 1970s. In either case, it is clear that average sunspot numbers (and thus solar activity, if one accepts the Marshall argument) were, in fact, increasing during a large portion of the period in which the temperature was decreasing.

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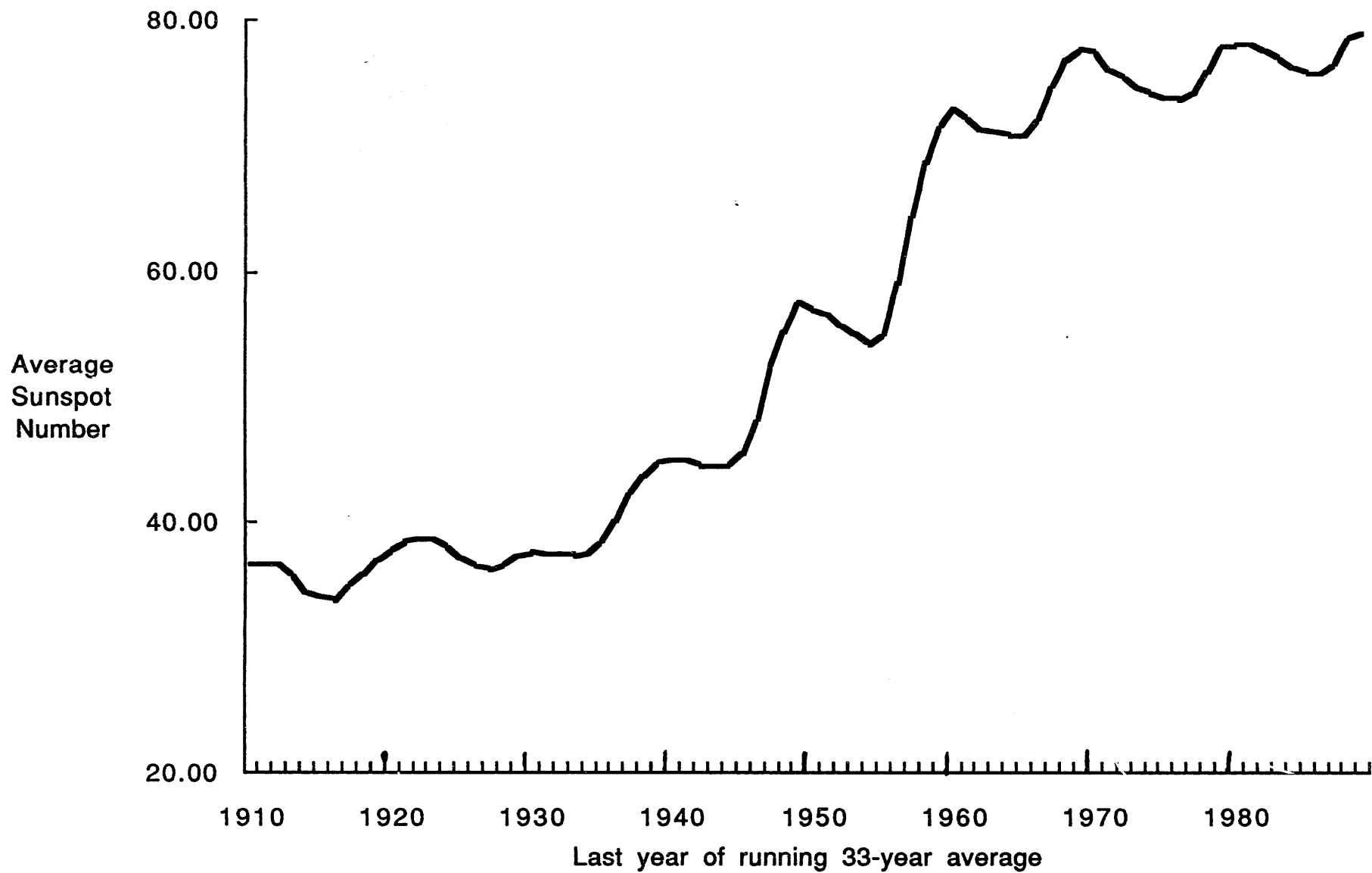
1. L. Roberts, *Science* 246, 992 (1989).
2. W.A. Nierenberg, R. Jastrow and F. Seitz, *Scientific Perspectives on the Greenhouse Problem* (Marshall Institute, Washington, DC, 1989).
3. Letters by R.S. Lindzen, W.A. Nierenberg, R. Jastrow, etc. in *Science* 247, 14 (1990).

4. Wallace, J.M. & Hobbs, P.V. *Atmospheric Science, An Introductory Survey*  
(Academic Press, New York, NY, 1977).

Figure 1. 33-year running average of annual mean sunspot numbers. Value for a given year is based on the 33 years up to and including that year.

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