The ROLE *of the* SUN *in* CLIMATE CHANGE

Douglas V. Hoyt

Kenneth H. Schatten

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- The thermometer used could change due to replacement for breakage or aging. This problem is less likely now than 100 years ago.
- The thermometer shelter could change, either through design or condition. Identical thermometers placed in different shelters next to each other can give different readings. Replacing an entire network of shelters might produce an apparent regional climatic shift, although none actually occurred. The shelters need not even be replaced to produce such erroneous events. Shelters are painted white and if the brand of paint is changed for the entire network from an oil-based to a latex pigment, the paint's emissive properties might cause a shift in the mean temperatures. The effect would be the same as a change in shelter structure, but would be more difficult to track. Careful records are made of changes in shelter design, but no records may be kept of changes in the kind of paint used.
- Even small changes in thermometer location and surroundings can cause an apparent change in climate. About 1930, in Denver, the thermometer was moved from the first to the second floor. During the following years, the recorded temperatures decreased slightly and cold records increased significantly. This change might easily be missed by analysts seeking climate changes. Another change might occur simply because a nearby tree or group of trees subtly altered the local heat balance and downwind temperature. Again, the local change might be interpreted as part of a regional change.
- Mitchell lists some changes as real, but these changes are still caused by local effects, not global effects. Foremost among real changes is the urban heat island effect. This effect is usually attributed solely to fuel combustion whose waste heat causes urban heating. As early as 1850 the frontier city of St. Louis had an urban heat island that occurred not from fuel combustion but from the exterior surfaces of buildings so constructed that they acted as light traps. Sunlight that is normally scattered back to space is instead multiply reflected from the buildings until it is absorbed. Many nearby buildings can act as absorbing cavities which lead to urban heat islands. Because of this effect, even small towns with no industry can be warmer than the surrounding country. Separating these spurious effects from other real climatic changes is very difficult. The urban heat island has contributed an estimated 0.1 °C increase in the average hemispheric warming of about 0.5 °C observed during the last century, creating a spurious warming trend.

Along with the difficulties in constructing a homogeneous temperature record at one site are complications that arise when averaging several stations together. Since stations are not uniformly spaced, they must be area weighted. Different weighting techniques can produce different reconstructions of regional temperature changes. The largest spatial scales create the most difficult problems when regions such as the oceans are not sampled or are poorly sam-