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Long-Term Changes in Cloudiness from Surface Observations

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Abstract: Cloudiness is an important climate variable for detection of climate change, understanding meteorological processes and climate feedbacks, and evaluation of climate models. Since clouds are a major determinant of surface solar radiation, changes in cloud cover also have implications for future solar energy development. Current cloud datasets from satellites and human visual observations do not agree on some major aspects of long-term variability. Resolving these differences requires closer attention to data homogeneity issues.
Although human observations of cloud cover are not as objective as other methods and do not have the global coverage of satellite data, they provide a much longer record. Furthermore, satellite cloud datasets appear to contain time-dependent inhomogeneities arising from changes in satellite view angle and other problems. Comparisons with other physically related climatic variables suggest that cloud data from trained human observers are actually quite reliable for climate change studies when averaged over time and space. Nevertheless, changes in observing and reporting methods have created potential discontinuities in the record which require careful scrutiny.

Existing cloud datasets based on reports in the synoptic code do not include all available data, creating a discontinuity in cloud data that is particularly severe over the United States and Canada for the period after the mid-1990s. We will improve the record of past cloud cover by creating a cloud dataset that combines different observing networks whose data are included in NCDC's Integrated Surface Database and cloud observations made at radiosonde stations. The homogeneity of this dataset will be improved by testing it using statistical change-point detection methods and validating it using other independent sources of climatological information. Finally, we will assess long-term variability and trends in the dataset.