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Satellite Observations of Recent Climate Change in North America

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Many of the observational studies of climate change have concentrated on trends in global averages of atmospheric and surface variables. In this study, we use satellite observations to focus on recent regional climate variations and change over North America. The main satellite data used in the study are from the NOAA series of operational polar-orbiting satellites. They provide a continuous record of global and overlapping observations spanning the last three decades. The variables analyzed are tropospheric and stratospheric temperature, cloudiness, precipitation, insolation, snow/ice cover and vegetation. These long-term time series are verified when possible through comparison with the recent data records from advanced sensors. In addition, comparisons of the satellite-derived time-series are made against conventional non-satellite observations.

The preliminary results do indicate that measurable change and significant variability exists over the last three decades in several key climate records. For example, the temperature of the middle troposphere shows significant warming over the entire North America and the lower-stratospheric temperature shows distinct pattern of warming over the northern part of North America and cooling in the southern part. Analysis of cloudiness indicates a small decrease in total cloudiness and general thinning of clouds over most of North America. Precipitation shows no persistent trend but the data indicates that the 1980's and late 2000's were wetter than the 1990s. Insolation shows no significant trend though the late 1990's exhibited higher values than the early 2000's. Changes in the North American snow cover include a strong decrease of snow extent in 1970s and early 1980s and its gradual increase to close-to-normal values in the last 20-25 years. The most distinct changes in vegetation in North America in the last 26-28 years are a substantial increase in the arctic tundra region and a predominant decrease of the boreal forest zone.