

Simulation of Recent Global Temperature Trends

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Abstract

Observations show that global average tropospheric temperatures have been rising during the past century, with the most recent portion of record showing a sharp rise since the mid-1970s. Whether these changes are real and, if so, what processes are responsible are subjects of much discussion. A suite of observational evidence collected during the past 40 years suggests that the temperature changes may be a manifestation of an enhancement in the tropical hydrologic cycle driven by increasing tropical ocean temperatures. New results show that the most recent portion of the global temperature record (1970-1988) can be reproduced by atmospheric models forced with observed ocean surface temperatures. Analysis of the model atmospheric heat budget shows that the upward trend in simulated global air temperature is due principally to an increase in the flux of moisture through the tropical hydrologic cycle, a response to increasing tropical ocean temperatures. This behavior has been especially evident in the tropical Pacific. Other recently completed model experiments using decadal-composited SST data show that major features of the global surface air temperature record during the 20th century can also be reproduced by a GCM and that these changes also arise in large part as a response to fluctuations in the tropical hydrologic cycle.