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Long-Term Time Variability of Thermal Emission in Jupiter

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Mid-infrared images of Jupiter's thermal emission in discrete filters between 4.8 and 24.5 μm from 1996 to the present day, spanning over a Jovian year, enable time-domain studies of its temperature field, minor-constituent distribution and cloud properties. The behavior of stratospheric ($\sim$10-mbar) and upper-tropospheric ($\sim$100-400 mbar) temperatures is generally consistent with predictions of seasonal variability. There also appear to be long-term periodicities of tropospheric temperatures, with meridionally dependent amplitudes, phases and periods. Temperatures near and south of the equator vary the least. During the "global upheaval" or the corresponding "revival" events that have produced dramatic changes in Jupiter's visible appearance and cloud cover, there were few large-scale variations of zonal mean temperatures in the stratosphere or troposphere, although there are colder discrete regions associated with the updraft events that marked the early stages of revivals. Changes in visible albedo during the upheavals are accompanied by increases in cloudiness at 700 mbar and higher pressures, along with increases in the ammonia-gas mixing ratio. In contrast to all these changes, the meridional distribution of the 240-mbar para-hydrogen fraction appears to be time-invariant. Jupiter also exhibits prominent temperature waves in both the upper troposphere and stratosphere that move slowly westward in System III.

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