

Atmospheric wavenumber spectra of Mars derived from MGS/TES radiances

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Wavenumber spectra of wind and temperature in the terrestrial atmosphere have provided wealth of information on the distribution of atmospheric kinetic and potential energies over synoptic to meso-scales.

The comparison of wavenumber spectra among planets might shed light on the principle of energy cascade in planetary atmospheres.

Wavenumber spectra of meso-scale temperature disturbances in the Martian atmosphere were derived from the infrared radiances obtained by the Thermal Emission Spectrometer onboard the Mars Global Surveyor.

We have extracted small-scale structures in the CO₂ 15 μm radiance (brightness temperature) along each orbit in the meridional direction, and calculated their power spectra for different latitude bands and seasons. The temperature spectra were further converted to spectra of disturbance potential energy.

The results show significant variability of the disturbance power with latitude and season, and indicate the generation of meso-scale disturbance near the westerly jets through energy cascade from larger scales. The spectral slope is steeper at low wavenumbers than at high wavenumbers, being similar to the spectral shape in the terrestrial atmosphere.