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# Atmospheric Wavenumber Spectra of Mars and Venus Derived from Infrared and Visible 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-scal structures in the $CO_2$ 15$\mu$m 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.

In the Venusian atmosphere, the wavenumber spectrum of cloud brightness provides information on the nature of the energy spectrum. If violet/ultraviolet features are caused by the supply of dark material from below, the brightness power is expected to represent the disturbance potential energy. Near-infrared cloud features observed at window wavelengths will have similar information since low-level clouds will be enhanced in upwelling. Previous studies using ultraviolet images taken by Mariner 10 and Pioneer Venus have covered wavelengths 1300-13000km. We have extended the analysis to wavelength of 70km using the violet (404nm) and near-infrared (986nm) images taken by the SSI camera onboard Galileo, and found a spectral slope similar to that of the terrestrial atmosphere for wavelengths >700km and a less slope for <700km.

Keywords: Mars; Venus; wavenumber spectrum; MGS; TES; Galileo; SSI