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Modeling Planetary Atmospheres with the Spectral Mapping Atmospheric Radiative Transfer (SMART) Model

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The Spectral Mapping Atmospheric Radiative Transfer (SMART) model was used to generate solar and thermal spectra, radiative heating and cooling rates and radiance Jacobians (weighting functions) for the atmospheres of Venus and Mars and Titan. For each planet, these simulations used the best available information about the atmospheric thermal structure and composition. On Venus, the solar and thermal optical properties are dominated by the 90-bar predominately CO2 atmosphere, but absorption by H2O, CO, SO2, HF, HCl, OCS and scattering and absorption by the planet-enshrouding sulfuric acid cloud deck also produces significant contributions. For Mars, CO2 absorption dominates the thermal radiances and heating rates, while dust scattering and absorption dominate the solar radiation field. On Titan, the thermal radiation field is controlled by H2 continuum absorption as well as absorption by CH4 and other hydrocarbons, while the solar radiation field is dominated by CH4 absorption and multiple scattering by hydrocarbon aerosols. Wavelength dependent radiances, heating rates and radiance Jacobins will be derived at high spectral resolution for each of these atmospheres to illustrate the radiative input to the atmosphere energetics and the information content of the spectra.