The IMG Instrument and Data Set

The IMG instrument is a high spectral resolution Michelson-type infrared Fourier transform spectrometer measuring upwelling radiation from the earth, deep space, and an onboard blackbody. IMG was launched aboard the ADEOS spacecraft in August 1996, and took numerous measurements until the ADEOS spacecraft ceased to transmit data in June 1997. The IMG measured uncalibrated spectrometer measuring upwelling radiation from the earth, deep space, and an onboard blackbody.

Earth views accompanied by a deep space view and blackbody view acquired for calibration purposes. The primary data set used was the Level 0B data set, which consists of raw, uncalibrated spectra eᵣ for all altitudes can be approximated by

\[ eᵣ \approx B(TB↑) \]

where \( e \) is the observed upwelling radiances spectrum, \( B \) is Blackbody function, and \( TB↑ \) is the surface temperature.

The method developed by Kn�on et al. (2001) involves fitting Planck's function to the lognormal brightness temperature spectra for all the IMG sequences contained in a specific geographic region and spectral microwindows: 620-625 cm⁻¹, 900-902 cm⁻¹, 1200-1205 cm⁻¹, and 1300-1320 cm⁻¹. The lognormal brightness temperature spectra are then converted into observed radiance. Emissivity spectra, \( \epsilon \), are derived using Eq. (1) relative to the maximum with the maximum observed radiance which is assumed to have an emissivity of e = 1.

Since this method relies on the assumption of a clear sky, a re-spectral cloud-clearing/data quality control method was applied after the emissivity derivation. The narrow microwindows selected for the re-spectral method were 820 cm⁻¹ (820-825 cm⁻¹ and 825-830 cm⁻¹), 980 cm⁻¹ (960-965 cm⁻¹ and 965-980 cm⁻¹), and 1200 cm⁻¹ (1200-1205 cm⁻¹ and 1210-1220 cm⁻¹). By fitting lines through the mean brightness temperatures in four selected microwindows: 820-825 cm⁻¹, 960-962 cm⁻¹, 1200 cm⁻¹, and 1205-1220 cm⁻¹, the relative emissivity \( \epsilon \) can be calculated.

In using IMG data for studies of land-surface emissivity, a tri-spectral cloud-clearing/data quality control technique assumes that ice and water clouds have an emissivity signature characterized by \( e = 0.1 \) and that data quality flags were retained. Emissivity histograms were then derived for the subset of data labeled both “clear” and “good.”

The main regions of interest were the vegetation and water scenes. These two figures show two interesting results that yield confidence in using IMG data for studies of land-surface emissivity. The left figure shows a land cover map of Africa with areas of study outlined. The right figure shows the brightness temperature and emissivity spectra for ocean, bare soil, and vegetation views. The left figure shows the brightness temperature spectra for ocean, bare soil, and vegetation views. The right figure shows the brightness temperature and emissivity spectra for ocean, bare soil, and vegetation views.