Atmospheric Correction of TIMS Data

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The TIMS is a unique sensor for two reasons, it is multispectral in the thermal-IR and it has on board, active calibration sources. The existence of the calibration permits the recorded DN's to be converted unambiguously to absolute energy units. However, to relate the data to energy originating from a target on the ground it is necessary to remove the atmosphere's contribution to the signal, specifically its transmittance and emittance. These can be obtained fairly easily by use of the atmospheric model provided by LOWTRAN-6 and the data from the U.S. Weather Service's network of bi-daily radiosondes. Using these data with the TIMS responsivity curves an equation can be obtained which permits the unambiguous correction of the TIMS data for the atmosphere.

$$DV_T = \int(SR_\lambda)d\lambda \cdot \left[\frac{DV_r - m\cdot\int(SR_\lambda \cdot E_{RA_\lambda})d\lambda - b}{\int(SR_\lambda \cdot \tau_{A_\lambda})d\lambda}\right] + b$$

DV_r - recorded digital value

DV_T - corrected digital value, the "true or proper" digital value for the target

E_{RA_λ} - energy radiated by the atmosphere by wavelength

m - slope of system transfer equation (gain)

b - offset of system transfer equation

τ_{A_λ} - transmissivity of the atmosphere by wavelength

SR_λ - sensor responsibility by wavelength