CO AND CH4 COLUMN RETRIEVAL FROM THE SCANNING HIGH RESOLUTION INTERFEROMETER SOUNDER (S-HIS)

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Theoretical Development

The technique to be applied to the observations from the S-HIS instrument is one developed for the NASA SAFARI experiment to map CO distribution from lines. The method makes use of high spectral resolution emission lines observed by the S-HIS spectrometer to derive an optical depth using weak absorption lines. It is less sophisticated than a full profile retrieval approach, but is very useful for a survey result of localized events. A ratio of on-line to off-line emission for selected lines of the gas of interest provides a measure of the gas amount.

The form of the equation to be used can easily be derived from a single-layer atmosphere approximation:

\[ N_{\text{on}} - N_{\text{off}} = N_{\text{on}}(N_{\text{on}} + N_{\text{atm}}) \frac{1}{A(B)} \]

where \( N_{\text{on}} \) is the S-HIS observed upwelling spectral radiance at an altitude of 20 km, \( A \) is the atmospheric transmission for wave number \( v \), \( B \) is the atmospheric emission for \( v \) at a temperature \( T \) which approximates the mean atmospheric temperature in the region of interest, and \( N_{\text{atm}} \) is the contribution from surface reflection and 

\[ \frac{1}{A(B)} \]

is the vertical distribution of the observed gas is known, i.e.

\[ \frac{dz}{dz} \text{is the S-HIS observed upwelling spectral radiance} \]

\[ \nu \text{is the emission from the surface, and} \]

\[ N_{\text{atm}} \text{is the atmospheric transmission for wave number} \]

\[ \text{and} \]

\[ \text{is the atmospheric emission for wave number} \]

\[ \nu \text{at a temperature} \]

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