Simulations for satellite based remote sensing of Carbon Monoxide

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Carbon Monoxide (CO) is a major atmospheric pollutant and a precursor to greenhouse gases. It is a good tracer to study the long range transport of atmospheric pollution. Considering the importance of CO in atmospheric studies, regular observations at several locations are needed to understand the spatial and temporal variation in its concentration, and transport processes. Ground based observations, being point measurements, cannot provide such details of spatial variation. These limitations can be overcome by satellite based measurements. To this end, using the Reference Forward Model (Anu Dudhia, Oxford University), we have calculated the Weighting Function, Transmittance and Radiance for satellite based remote sensing of CO. Weighting Function represents the sensitivity of the signal to the change of CO mixing ratio profile. Sufficient radiance must be available at the sensor altitude for successful measurement of the species. Further, since the wavelengths used for CO monitoring are possibly contaminated by other species having overlapping bands, it is necessary to remove their contribution from the total measured signal. For these calculations, tropical atmosphere is assumed. All absorbing gases in the spectral range 2100-2200 cm^{-1} are taken into account. Based on computations using the aforementioned parameters, it is found that the radiance at the top of atmosphere at 2143 cm^{-1} is about 270 nW/(cm^2 sr cm^{-1}). It is found that H_2O has absorption throughout the spectral range considered. The transmittance of CO_2 is unity above about 2130 cm^{-1} whereas that of O_3 above 2135 cm^{-1}. N_2O has absorption above 2150 cm^{-1}. Thus, once the absorption by H_2O has been accounted for, the wavelengths 2135-2150 cm^{-1} of CO are least affected by other absorbing species.

References:

1- J. A. Logan, M. J. Prather, S. C. Wofsy, and M. B. McElroy (1981), Tropospheric chemistry- A global perspective, *J. Geophys. Res.*, doi: 10.1029/JC086iC08p07210.

2- J. T. Houghton, F. W. Taylor and C. D. Rodgers (1984), Remote sensing of atmospheres, Cambridge University Press

3- Reference Forward Model, Anu Dudhia at http://www.atm.ox.ac.uk/RFM/

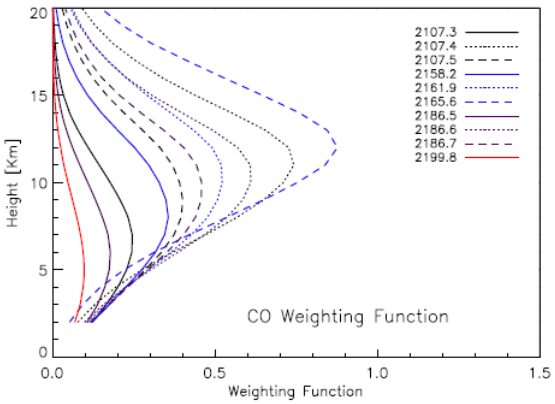

Figure 1. Carbon Monoxide Weighting Function for selected wavelengths in the 2100-2200 cm^{-1} range.