CO_2 Vertical Profiles from Simultaneous Retrievals of Near Infrared and Thermal Infrared Satellite Data

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We are developing atmospheric CO_2 vertical profile data products from simultaneous retrievals of near infrared and thermal infrared satellite observations (Figure 1). These data will significantly improve the estimation of atmospheric carbon sources and sinks by providing powerful observational constraints on vertical as well as horizontal and temporal distributions of atmospheric CO_2 in data assimilation and data fusion approaches. Accurate vertical transport is essential within the source/sink inversion to avoid systematic flux errors of up to 2 GtC/yr since convection over land is strongly correlated in time with photosynthesis, the dominant surface sink for CO_2.

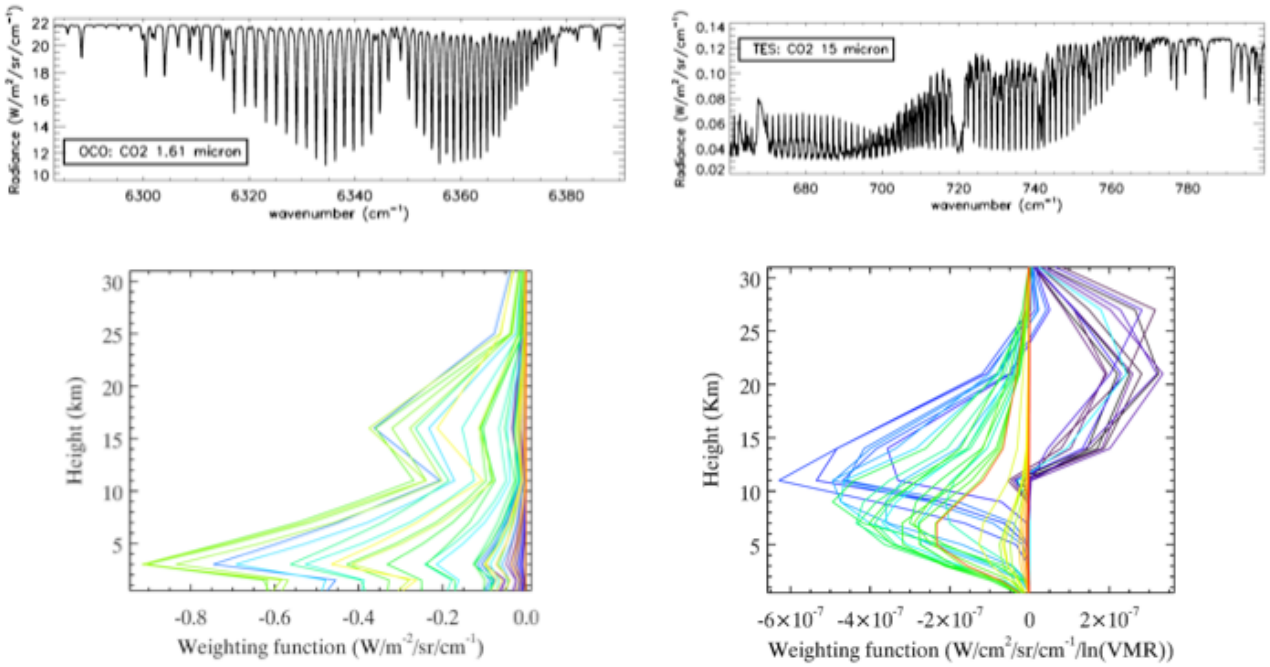

Figure 1. Spectra (top) and averaging kernels (bottom) for simulated space-based near infrared and infrared atmospheric CO_2 observations. Simulations are based on NASA's Orbiting Carbon Observatory (OCO, left) and Thermal Emission Spectrometer (TES, right) instruments. The complementarity of the vertical components in the two averaging kernels provides multiple degrees of freedom for signal in the CO_2 vertical profile solution. Similar results are possible using (nearly) simultaneous thermal emission observations from the Atmospheric Infrared Sounder (AIRS), or from collocated near infrared and thermal infrared observations of JAXA's GOSAT (IBUKI) sensors.