SPEED DEPENDENT LINE SHAPES IN 1.61 μm AND 2.07 μm CO_2 ATMOSPHERIC RETRIEVALS FOR THE OCO-2 MISSION

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We are validating line parameters for CO_2 at 1.61 μm and 2.07 μm using high resolution atmospheric spectra and a new retrieval algorithm [1, 2] being developed for the Orbiting Carbon Observatory (OCO-2) in order to estimate column-averaged mixing ratio of CO_2, X_{CO2}, to a sub-1% precision. This requirement demands highly accurate molecular line shape models. We tested a combination of line mixing [3] with speed dependent Voigt shapes [4,5] obtained from laboratory spectra using a state of the art multi-spectrum fitting procedure [6, 7]. The atmospheric tests were made with a diverse set of over 400 soundings including upward- and downward-looking FT-IR data from the Total Carbon Column Observing Network (TCCON), and the data from TANSO-FTS spectrometer aboard the Greenhouse gases Observing SATellite (GOSAT), respectively. The new absorption cross sections significantly reduced residuals in the spectral fit in the 2.07 μm region, while the effects on the 1.61 μm band are less definitive but still suggest some improvement. Overall these tests favor the adoption of the new models.[ab]

[a] [1] O'Dell C.W., et al. *AMT* 2012; 5:99-121. [2] Crisp, D., et al. *AMTD* 2012; 5:1 - 60. [3] Hartmann, J. M., et al. *ACP* 9:7303-7312. [4] Devi et al., *J. Mol.Spec.* 2007; 245:52-80. [5] Benner et al. 66th International Symposium on Molecular Spectroscopy, Columbus OH (2011). [6] Benner, D.C., et al., *JQSRT* 1995; 53(6):705 - 721. [7] Letchworth, K.L., et al. *JQSRT*, 107: 173 - 192.

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