HIGH ACCURACY NEAR-INFRARED CARBON DIOXIDE INTENSITY MEASUREMENTS TO SUPPORT REMOTE SENSING

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We used two previously described [1,2] cavity ring-down spectroscopy systems to accurately measure line intensities in the following three $^{12}C^{16}O_2$ rovibrational bands near 1.6 μm: (30012) ← (00001), (30013) ← (00001), and (30014) ← (00001). These bands are commonly used in remote sensing applications, including the Total Carbon Column Observing Network (TCCON) [3]. We estimate relative combined standard uncertainties for these band intensities of less than 0.1% and obtain percent-level deviations in the measured intensities relative to those in the literature and several spectroscopic databases. However, we find 0.1% level agreement with the (30013) and (30014) band intensities given in the HITRAN 2016 [4] database, which were calculated using ab initio dipole moment surfaces. Incorporation of the resulting line intensities into TCCON retrievals leads to significantly reduced biases in the (30012) and (30013) bands. These results indicate that refinements of spectroscopic databases are required to meet increasingly stringent remote sensing uncertainty targets.

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[3] Wunch, D. et. al. Philos. Trans. Royal Soc. A, 369(1943), 2087-211

[4] Gordon, I. E., et al. (2017), J. Quant. Spectrosc. Radiat. Transfer, 203, 3-69.