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Improved CRDS δ^{13}C Stability Through New Calibration Application For CO_2 And CH_4

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Stable carbon isotope ratio measurements of CO_2 and CH_4 provide valuable insight into global and regional sources and sinks of the two most important greenhouse gases. Methodologies based on Cavity Ring-Down Spectroscopy (CRDS) have been developed and are capable of delivering δ^{13}C measurements with a precision better than 0.12 permil for CO_2 and 0.4 permil for CH_4 (1 hour window, 5 minute average). Here we present a method to further improve this measurement stability. We have developed a two-point calibration method which corrects for δ^{13}C drift due to a dependence on carbon species concentration. This method calibrates for both carbon species concentration as well as δ^{13}C. In addition, we further demonstrate that this added stability is especially valuable when using carbon isotope data in linear regression models such as Keeling plots, where even small amounts of error can be magnified to give inconclusive results. Furthermore, we show how this method is used to validate multiple instruments simultaneously and can be used to create the standard samples needed for field calibrations.