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Continuous, high-resolution measurements of $\Delta^{17}O$ of H_2O from ice cores

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The measurement of $\Delta^{17}O$, the deviation in $\delta^{17}O$ from the global meteoric water line, $\ln(\delta^{17}O+1) - 0.528\ln(\delta^{18}O+1)$, offers considerable potential for separating the various influences on water isotope variations recorded in polar ice cores [e.g., *Landais et al*., 2008]. The availability of $\Delta^{17}O$ measurements has been limited by the time-consuming nature of analysis by isotope-ratio mass spectrometery (IRMS) method, which requires conversion of H_2O to O_2 by flourination [*Barkan and Luz*, 2005]. Laser spectroscopy has made it possible to measure $\Delta^{17}O$ without the flourination step [*Steig et al*., 2014]. Such measurements remain challenging because existing instruments are subject to calibration drift and sample-to-sample memory. Nevertheless, when careful protocols are followed, reliable and routine measurements can be achieved, competitive with IRMS [*Schauer et al*., 2016]. Furthermore, laser spectroscopy instruments can be coupled with continuous flow analysis (CFA) systems to provide very-high-resolution ice core measurements. Here, we show the first continuous record of $\Delta^{17}O$ ever obtained from an ice core. We coupled the CFA system described in *Jones et al*. [2017] with a Picarro L214O*i* instrument [*Steig et al*., 2014] to analyze ~500 meters of a 1750-m long ice core from the South Pole, with sub-centimeter resolution for $\delta^{17}O$, $\delta^{18}O$, and δD. Data averaging yields an effective resolution for $\Delta^{17}O$ of 50 cm, with better than 10 per meg precison. Data across the large "Antarctic isotope maximum" (AIM) events in the South Pole ice core show remarkable correpondence with Dansgaard-Oeschger events in $\delta^{18}O$ from Greenland ice cores, illustrating the scientific potential of continous high-resolution $\Delta^{17}O$ measurements.

References

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