Title

Carbonyl sulfide in polar ice cores from Antarctica

Authors

Saltzman, ES

Aydin, MK

Verhulst, KR

et al.

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Authors: Aydin, K. M.; Verhulst, K. R.; Saltzman, E. S.
Affiliation: AA(Earth System Science, University of California, Irvine, Irvine, CA, USA maydin@uci.edu), AB(Earth System Science, University of California, Irvine, Irvine, CA, USA kverhuls@uci.edu), AC(Earth System Science, University of California, Irvine, Irvine, CA, USA eric.saltzman@uci.edu)
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Abstract

Atmospheric carbonyl sulfide (COS) has received increased attention because of its potential use as a carbon cycle tracer. The uptake of atmospheric COS by terrestrial vegetation represents about 80% of its total atmospheric sink, thus potentially linking temporal variability in atmospheric COS levels to changes in gross primary productivity. We are exploring the use of polar ice cores to develop a long-term atmospheric history of atmospheric COS. In prior work, we presented a South Pole ice core record of COS for the last 2,000 years suggesting that mean COS levels in the Southern Hemisphere preindustrial atmosphere were 331±18 ppt (±1σ) (Aydin et al., 2008). Here, we present a new COS record based on ice cores from the West Antarctic Ice Sheet - Divide (WAIS-D) that covers the last 1,000 years. The mean COS mixing ratio in the WAIS-D record is 348.7±32.3 ppt (±1σ), in agreement with the South Pole record where the data from the two cores overlap in time. One of the questions regarding COS in ice core air is chemical stability towards hydrolysis. The WAIS-D site has a mean annual temperature 20°C warmer than South Pole (-30°C vs -50°C). The agreement between the two records suggests that temperature-dependent hydrolysis of COS does not significantly effect the COS mixing ratio in ice core air on these time scales and the measurements likely reflect atmospheric COS levels. This study suggests that it may be possible to develop COS ice core records over glacial-interglacial time scales.