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**Metadata: Ethane measurements in air extracted from Greenland and Antarctic ice cores**

The data file includes the results of ethane ( $C_2H_6$ ) analysis in air extracted from 27 ice core samples from Summit, Greenland (GISP2B ice core) and 33 samples from West Antarctic Ice Sheet Divide, Antarctica (WDC-05A ice core). The file is in Excel (.xlsx) format with data from the two sites provided in separate worksheets named after the ice cores.

A “wet-extraction” technique was implemented to extract 15-30 ml STP of air from 200-300 g ice core samples. All analyses were completed using a gas chromatograph/high-resolution mass spectrometer (GC/MS) system in the PI’s laboratory at UC Irvine. The ethane in the samples is cryogenically pre-concentrated (at  $-196^\circ C$ ) under vacuum prior to injection into the GC/MS for analysis. During the pre-concentration of the sample, a known amount of  $^{13}C$ -labeled  $C_2H_6$  is mixed in to act as an internal standard. The calibration of the GC/MS system is achieved via ppt-level ethane standards prepared in our laboratory by diluting pure ethane in ultra-pure  $N_2$  in two steps. Please refer to Aydin et al. [2007] for details of the analytical system and the calibration practices.

Each ice core gas extraction is accompanied by at least one nitrogen ( $N_2$ ) blank run to determine the background ethane levels in the extraction and analytical systems. Ethane in the ice core air is calculated by subtracting the system blank from the sample signal and the results are reported as dry-air molar mixing ratios (ppt). The  $\pm 1\sigma$  uncertainties reported with the measurements reflect the cumulative error estimate based on the uncertainty associated with the GC/MS analysis and the variability in the system blanks. In addition to ethane, we also report dichlorodifluoromethane (CFC-12) measurements for all samples. The presence of CFC-12 can indicate presence of modern air in an ice core sample. Please refer to Nicewonger et al. [in review, 2015] for detailed descriptions of the ice core air extraction methods and the system background determination with  $N_2$  blanks as they apply to these data, and the scientific interpretation of ethane and CFC-12 measurements. PI contact encouraged before data usage.

**Contact:**

Murat Aydin  
University of California, Irvine  
Dept. of Earth System Science  
Irvine, CA 92697  
Phone: 949-824-5693  
Email: [maydin@uci.edu](mailto:maydin@uci.edu)

## References

Aydin, M., M. B. Williams, and E. S. Saltzman (2007), Feasibility of reconstructing paleoatmospheric records of selected alkanes, methyl halides, and sulfur gases from Greenland ice cores, *J. Geophys. Res.*, 112, D07312, doi:10.1029/2006JD008027.

Nicewonger M. R., K. R. Verhulst, M. Aydin, and E. S. Saltzman (in review, 2015), Preindustrial atmospheric ethane levels inferred from polar ice cores: a constraint on the geologic sources of atmospheric ethane and methane, *Geophys. Res. Lett.*