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A decade of firn air sampling in the polar regions of both hemispheres

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Over the past decade we have sampled and analyzed near-surface and deep firn air from multiple sites in both hemispheres. This work has allowed us to explore numerous aspects of deriving trace gas histories from firn-air measurements, such as whether or not consistent histories can be derived from sites with different characteristics, whether or not trace gases become incorporated into the surface firn without artifacts, and further, what alternative techniques for sampling firn air might prove useful. The trace gases typically measured include halocarbons, chlorinated and brominated hydrocarbons, carbonyl sulfide, and benzene. Recent atmospheric trends for these gases are varied; some are rapidly increasing, one is exponentially decreasing, and others undergo substantial seasonal variations. Comparisons between atmospheric changes over the past decade that we have measured at polar surface stations and firn air profiles provide further tests of firn air sampling techniques and our understanding of trace gas incorporation into firn. Results demonstrating these points will be presented. Furthermore, we will touch briefly on results from the Megadunes site, Antarctica, that was sampled in 2004. Air sampled at the bottom of the firn-ice transition zone at this site was on the order of 100 years old, or the oldest we have sampled. Mixing ratios of CFC-12 were 3 ppt (0.5% of modern day levels); those for CH3CCl3 were 0.3 ppt ($<$0.2% of peak levels observed in the 1990s). We will also discuss results from a 60 m deep hole in Greenland that we collected samples from in both the summer of 2004 and 2005.