Atmos. Chem. Phys. Discuss., 10, C704–C705, 2010
www.atmos-chem-phys-discuss.net/10/C704/2010/

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Post-coring entrapment of modern air in polar ice cores collected near the firn-ice transition: evidence from CFC-12 measurements in Antarctic firn air and shallow ice cores" *by* M. Aydin et al.

Anonymous Referee #1

Received and published: 18 March 2010

Aydin et al. report on previously unrecognized alteration of air composition in shallow ice core based on measurements of CFC-12 in three Antarctic ice cores and firn air. They give evidence of entrapment of modern air in shallow ice cores within and slightly below firn-ice transition. The evidence is clear and there would be no explanations other than moden air entrapment for the observed high CFC-12 levels, as the authors conclude. They also show complexity in predicting the depth of bubble close-off completion by comparing those from an empirical equation and those obtained by firn air sampling and ice core CFC-12 data.

The paper describes the new data well and raises important issues on atmospheric reconstruction using shallow ice cores. However, the paper in the current form is incomplete without reviewing and discussing of existing shallow ice core and firn air data that have shown no contamination. I know two papers by Etheridge et al. (1996 for CO2; 1998 for CH4) that show no sign of moden air contamination in Law Dome ice cores. One of the Etheridge et al.'s papers is cited but not discussed in this manuscript. The Law Dome results show no detectable disagreement between firn air and ice core data within the firn-ice transition. This is inconsistent with the conclusion of this paper that nearly half or more of air could be trapped after coring for the samples within firn-ice transition. The Law Dome data must show significant contamination in CO2 and CH4 if the entrapment occurs in this core. A possible explanation for this discrepancy is that the ambient CFC-12 concentraton during storage were orders of magnitude higher than atmospheric concentration than assumed in this study, so the actual fraction of modern air is correspondingly low. CFC-12 may be good for detecting small mixing of modern air but it may not give quantitative estimates. To answer this problem, Aydin et al. should use gas records of other CFCs, CFC alternatives or other gases (such as CH4, CO2, N2O, SF6) that has no usage in air conditioning or form insulator (so that their concentration during storage may be similar to atmospheric value), in order to quantify the modern air entrapment.

Interactive comment on Atmos. Chem. Phys. Discuss., 10, 1631, 2010.