



A snow pack source of aldehydes and acetone in West Antarctica between 76 and 90 degrees S

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The investigation of snow-atmosphere exchange of many chemical species driven by physical and photochemical processes is key for understanding atmospheric chemistry above snow covered regions and has important implications for ice core interpretation. A number of recent field and modeling studies indicates that a source of aldehydes and ketones exists in polar snowpacks, and the emission of these species may significantly impact organic and HO₂ radical levels in the overlying boundary layer. However, most of the studies took place in the northern hemisphere and only few data are available from Antarctica.

Here we present new measurements from the US International Trans-Antarctic Scientific Expedition (ITASE) carried out in summers of 2000-2003. 1-2 day average mixing ratios of formaldehyde (CH₂O), acetaldehyde (CH₃CHO) and acetone (CH₃COCH₃) were determined in ambient and firn air across the West Antarctic Ice Sheet (WAIS) between 76°S and 90°S. Organic chemical species were collected on 2,4-Dinitrophenylhydrazine (DNPH) filter cartridges and analyzed after elution using HPLC. Median (range) ambient levels of CH₂O, CH₃CHO and CH₃COCH₃ were 65 (15-205) pptv, 35 (10-195) pptv and 65 (25-150) pptv, respectively. Firn air concentrations of CH₂O and CH₃CHO were increased up to 15fold compared to ambient air, suggesting significant emission fluxes, while CH₃COCH₃ gradients between the air above and below the snow surface were less pronounced..

We discuss implications for the oxidation capacity of the WAIS boundary layer and for the interpretation of ongoing surface studies at the WAIS Divide deep coring site.