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Occurrence of VOC in snow and ice in spring at Jungfraujoch (46.6°N, 8.0°E) in 2005 and 2006 during CLACE 4 and 5

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Volatile organic compounds (VOC) were measured in snow and ice collected directly in-cloud at Jungfraujoch (3,580 m asl) in February and March during the cloud and aerosol characterization experiments CLACE 4 (2005) and CLACE 5 (2006). Melted snow samples were analyzed by Headspace-Solid-Phase-Dynamic-Extraction (HS-SPDE) followed by gas chromatography/mass spectrometry (GC/MS). Benzene and alkylated benzenes, chlorinated hydrocarbons and monoterpenes were identified in snow samples. During CLACE 4 (2005), particularly the biogenic compounds α-pinene, β-pinene and limonene show enhanced concentrations in March than in February. This may reflect increased local emission rates of these compounds as winter gives way to spring. Lower concentrations of VOC were detected in samples collected from snow events without preceding precipitation free days before sampling. Generally there is a tendency in the results that higher concentrations are found after longer precipitation free periods, suggesting that higher concentrations in snow may be caused by the washout effect of precipitation. No dependence of concentrations of VOC in snow on the days of the week could be observed. During CLACE 4 (2005) concentrations of most of the VOC were higher than during CLACE 5 (2006). During the snow sampling performed in CLACE 4, the wind direction was predominately from the Northeast and the wind speeds high. In contrast, during the sampling of CLACE 5 the wind came from the south-south west with much lower wind speeds. Lower concentrations in 2005 could be explained by different transport processes of organic gases from the surrounding valleys to Jungfraujoch. High concentration vari-

ations of VOC in snow samples taken at the same time at the same place demonstrate a heterogeneous nature of snow which causes variable distribution of VOC in snow. Scavenging ratios were determined by relating the gas constant times the ambient temperature to the Henry´s Law constant of the individual compound. Values of W_g varied between 0.1 (limonene) and 5.1 (1,2,3-TMB).From these scavenging ratios and the concentration of VOC measured in snow average concentrations of VOC in air at equilibrium conditions were calculated. Predicted air concentrations between 3 μg m^{-3}(1,2,3-TMB) and42,928 μg m^{-3} were higher than measured ones (Li et al., 2005). These results demonstrate concentrations of VOC in snow are well above that expected for equilibrium with air. This is an indication that snow scavenges VOC very efficiently and that VOC are accumulated in snow.