

Interactive comment on “Distribution of VOCs between air and snow at the Jungfraujoeh high alpine research station, Switzerland, during CLACE 5 (winter 2006)” by E. Starokozhev et al.

Anonymous Referee #2

Received and published: 11 August 2008

General Comments:

The manuscript presents results from a field study where concentrations of volatile organic compounds (VOCs) in snow and air near a high alpine research station were measured. The scavenging efficiencies of snow for each of the individual compounds have been calculated and the distribution of the chemicals between snow and the gaseous phase of the atmosphere were compared to theoretically derived equilibrium distributions. The field study produced interesting results that should be the basis of a worthy publication. However, the paper in parts lacks clarity and accurate scientific language. The concepts used to calculate scavenging efficiencies are not convinc-

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ingly explained. I would recommend major revisions before it should be considered for publication in ACP.

Specific Comments:

One of my major concerns is related to the days March 11, 12 that were declared as initial state of the thermodynamic system atmosphere. The true initial state conditions prior to the snowfalls on Feb 24 and Mar 01 may have been different to the conditions on Mar 11, 12. The Jungfraujoch presumably receives a large fraction of its atmospheric pollution from nearby industrialized urban regions. The wind conditions and oxidative capacity of the atmosphere may have been different and accordingly the atmospheric VOC concentrations as well. Another question is related to the use of fluxes to calculate the removal efficiencies instead of using just atmospheric gaseous concentrations. The reasoning why the amounts of organic chemicals in the gas phase can be better described using their fluxes, is not described in a conclusive way. Incidentally, it is not mentioned where the wind speed was measured, at which height above the ground and in which distance to the other measurements. Especially in high alpine regions wind conditions are very heterogeneous.

(14348, 6) It should be clearly stated which fluxes are referred to. (14348, 10) efficiency of removal from the atmosphere should clearly be mentioned (14349, 12) Gröllert and Puxbaum published that paper in 2000. (14349, 17 - 20) What information does this sentence provide? (14349, 20 - 23) This sentence should be a little more scientifically accurate. (14349, 25 - 28) Research has been earlier conducted (e.g. Schöndorf and Herrmann, 1987). The references Hoff et al., 1995 and Wania et al., 1999 describe experimental and modeling work and are not suitable to substantiate the detection of organic pollutants in remote areas. (14350, 9) Aerosols are contaminants? (14350, 18 - 19) This is already included in the statement made two sentences before. (14351, 12 - 14) The chemical flux towards higher altitudes in the atmosphere can also be influenced by strong upward fluxes of air masses. (14351, 17) equation (2): The equal sign was used instead of the proportionality sign. (14351, 23 - 25) (Eq.3) The influence

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of chemical partitioning between the phases is missing in this equation. (14352, 10 - 13) This coefficient will never approach infinity. Better use the expressions high values and/or low values. (14353, 10) Is the location of the inlet uninfluenced by possible emissions from the building? (14356, 4) Here and several times later in the text the authors refer to water as the condensed phase in the system air-snow. If the authors refer to the quasi-liquid layer at the surfaces of the snow grains, the properties of water and the quasi-liquid layer are too different to let water act as a substitute for the QLL. (14357, 6) with decreasing temperature (14357, 6) What does it mean: enhances air/ice partitioning? This sentence should be written in a more accurate way. (14357, 7) low temperatures - This is already said within the previous sentence. (14359, 2 - 6) This is not really an explanation. (14359, 22 - 24) For compounds with a low distribution coefficient ($K_{air/snow}$), sorption to the snow surface should play a dominant role. (14362) References: Pochanart et al. 2001 and Rouviere et al. 2005 are not listed, although referred to within the text. (14363) Table 1: Why are the meteorological parameters listed for March 03 but not for March 12. The latter date is important because it represents the initial state chosen by the authors. (14364) Table 2: Rather use the SI unit for the Henrys law constant. (14365) Table 3: The calculations used in Lei and Wania (2004) assume a specific snow surface area which may largely differ from that of the snowflakes during snowfall in this field study. Specific snow surface areas are highly variable. (14368) Fig. 3: Maybe it is more meaningful to show the chemicals at the x-axes of both plots in the same order.

Interactive comment on Atmos. Chem. Phys. Discuss., 8, 14347, 2008.

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