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Wood burning emissions in an Alpine valley: Measurements of oxygenated volatile organic compounds, hydrocarbons and organic acids

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Wood burning emissions are a source for atmospheric volatile organic compounds (VOCs) and particulate matter. In Roveredo, a small village in an Alpine valley, the major local particulate emissions in winter are coming from wood stoves, which are used for heating and cooking. The aim of the study was to test if emissions of non-methane hydrocarbons (NMHCs), oxygenated VOCs (OVOCs) and organic acids are also dominated by wood burning or are more influenced by both local and trans-Alpine traffic.

Measurements were performed in December 2005 with a gaschromatograph with mass spectrometer (GC-MS), GC-flame ionisation detection (GC-FID) and an ionchromatograph with mass spectrometer (IC-MS) together with other instruments. Measurements of the acids were done semi-continuously with a wet effluent diffusion denuder/aerosol collector (WEDD/AC) for sampling water-soluble gas phase and aerosol compounds. After adsorption on a concentrator column, they were then analyzed using IC-MS with a time resolution of 1 hour. For the OVOCs every 50 minutes a sample was taken and collected on a two-stage adsorbent system connected to a GC-MS. NMHCs were analysed by GC-FID and measured with a time resolution of 1 hour.

CO and NO_x data were used as indicators the relative importance of wood combustion or traffic. The diurnal cycle of the two differs in the early morning where NO_x shows a distinct morning peak, whereas CO exhibits an enhancement during

evening/early night. The comparison of the diurnal cycles to the measured substances shows that most of them are strongly influenced by wood combustion, even substances like benzene and 1,3-butadiene, which have often been attributed to traffic. Also the benzene/toluene ratio indicates wood burning as the major source for this region. As further indicators, the ratio of Sunday to working day and night to morning ratios were evaluated. Comparing the data to measurements performed in Zürich (the largest city in Switzerland) in the same winter, six substances show clear association to wood burning, which are 1,3-butadiene, acrolein, methacrolein, methylacetate, methanol and methyl-vinyl-ketone (MVK). In the Alpine village the concentrations of butadiene were more than twice as high as in Zürich, which is important concerning health effects, since this compound is carcinogenic.