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Sulfuric acid and OH concentrations in a boreal forest site

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Abstract. As demonstrated in a number of investigations, gaseous sulfuric acid plays a central role in atmospheric aerosol formation. Using chemical ionization mass spectrometer the gas-phase sulfuric acid and OH concentration were measured in Hyytiälä, SMEAR II station, Southern Finland during 24 March to 28 June 2007. Clear diurnal cycles were observed as well as differences between new particle formation event days and non-event days. Typically, the daily maximum concentrations of gas phase sulfuric acid varied from 3×10^5 to 2×10^6 molec cm^{-3} between non-event and event days. Noon-time OH concentrations varied from 3-6×10^5 molec cm^{-3} and not a clear difference between event and non-events was detected. The measured time series were also used as a foundation to develop reasonable proxies for sulfuric acid concentration. The proxies utilized source and sink terms, and the simplest proxy is radiation times sulfur dioxide divided by condensation sink. Since it is still challenging to measure sulfuric acid in ambient concentrations, and due to its significant role in atmospheric particle formation, reasonable proxies are needed. We use all together three different proxies and one chemical box model and compared their results to the measured data. The proxies for the sulfuric acid concentration worked reasonably well, and will be used to describe sulfuric acid concentrations in SMEAR II station, when no measured sulfuric acid data is available. With caution the proxies could be applied to other environments as well.

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