Temperature depending emissions of biogenic secondary organic aerosol and relationship with BVOC

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Atmospheric aerosols are on a great importance to the Global climate and human health. Biogenic secondary organic aerosols (B-SOA) constitute a significant part of the atmospheric aerosols and their production rate is much higher than that of anthropogenic SOA (Han et al., 2014). B-SOA can be formed in the atmosphere upon oxidation of a number of biogenic volatile organic compounds (BVOC), which are primarily derived from terrestrial ecosystems. Biogenic volatile organic compounds play a significant role in sustaining the oxidant balance of the lower layers of the atmosphere (McKinney et al., 2011). Since the BVOCs have been emitted in the atmosphere, they can oxidize leading to an increase in organic aerosol mass concentration. BVOCs emissions in the global scale are found to be higher than anthropogenic volatile organic compounds (Misztal et al., 2015).

The real-time measurements of aerosol mass concentration were investigated at Rūgšteliškis, a rural environment. This site is located in the north-eastern part of Lithuania, in remote coniferous forested area. An Aerosol Chemical Speciation Monitor (ACSM) was used for continuous monitoring of aerosol composition during the warm season of the year. ACSM measures aerosol mass concentration and chemical composition of non-refractory submicron aerosol particles in real-time. It provides information about composition for particulate ammonium, nitrate, sulfate, chloride and organics. The instrument was calibrated using ammonium sulphate and ammonium nitrate. A collection efficiency (CE) was calculated from measured data using algorithm suggested by Middlebrook et al. (2012).

In order to understand which B-SOA emissions from plants are related to heat, emissions at averaged temperature of 20 °C and 5 °C have been compared (Fig. 1). For clarification, the distinction was divided by values of emissions of 5 °C (Eq. 1):

$$\frac{signal(20°C) - signal(5°C)}{signal(5°C)} \quad (1)$$

From mass spectra the methanol (CH_3OH, *m/z* 33), acetone ($C_3H_6O_2$, *m/z* 59), methyl-ethyl-ketone (C_4H_8O, *m/z* 73) and salicyl-aldehydes ($C_7H_6O_2$, *m/z* 123) emissions were identified as heat related. Of all identified emissions only salicyl- aldehyde has be assigned to heat stress marker (Misztal et al., 2015). Meanwhile, methanol, acetone and methyl-ethyl-ketone show great dependency of heat and light (McKinney et al., 2011). The fluxes of these species are highly correlated with one another. The strongest correlation are between acetone and salicyl-aldehyde (r = 0.90), acetone and methyl-ethyl-ketone (r = 0.87) and methyl-ethyl-ketone and salicyl-aldehyde (r = 0.87). This suggests that emissions of these species respond to environmental factors (as heat) in similar manner.

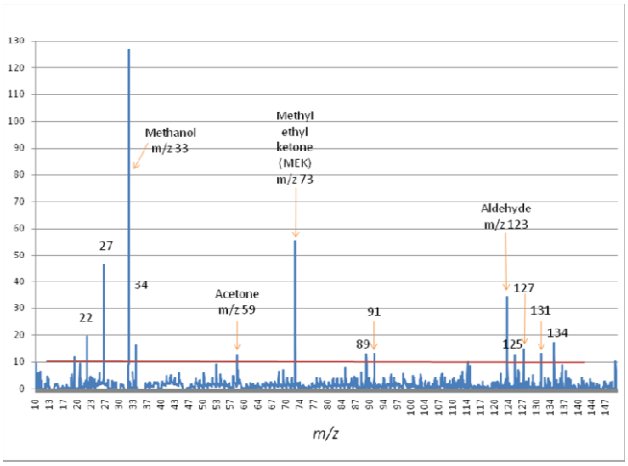

Figure 1. Distinction of *m/z* diurnal spectra at 20 °C and 5 °C temperatures.

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