Anthropogenic enhancement of biogenic secondary aerosols, *ABSOA*

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- Introduction and motivation

Atmospheric aerosols play an important role in the global climate balance as they affect the formation and lifetime of clouds, the atmospheric chemistry and the global radiation budget.
Aerosols are known to have a net cooling effect on the climate, but according to the Intergovernmental Panel on Climate Change (IPCC), they are "the dominant uncertainty in radiative forcing".
Therefore we need to improve our knowledge about the chemical composition of aerosols and the chemical processes involved.
In this study we will focus our attention on SOA (Secondary Organic Aerosols) and more in detail on BSOA (Biogenic Secondary Organic Aerosols) which are the product of the oxidative processes occurring to BVOC (Biogenic Volatile Organic Compounds) emitted by vegetation, this natural contribution to SOA is estimated to exceed the contribution from anthropogenic emissions by approximately a factor of three.

- Scientific objectives

Terpene oxidation products contribute to organic condensable material available for growth of aerosols after particle nucleation. Organosulfates of terpenes are of special interest due to their low volatility and as indicators of anthropogenic enhancement of biogenic secondary aerosols.
We want to investigate variation in composition and concentration levels of terpene oxidation products and their organosulfates and, with the help of supplementary data, how this composition and concentration is affected by SO_2, O_3, NO_x and the VOCs emitted by the vegetation.
This will contribute to understanding the chemical processes involved in the formation of BSOA in the boreal environment and in the processes affecting particle growth as well.

- Reason for choosing station

As we decided to focus our study on BSOA the SMR Station for Measuring Forest Ecosystem-Atmosphere Relations - SMEAR II was the ideal location as the station is located in a rather homogenous Scots pine (Pinus sylvestris L.) stand on a flat terrain. The station represents boreal coniferous forests, which cover 8% of the earth's surface and store about 10% of the total carbon in the terrestrial ecosystem.
The station has top class instrumentation for measurements of aerosol microphysics, atmospheric chemistry, and micrometeorology and in this way we can obtain easy access to supplementary data which can help to understand and interpretate the results of our study.

- Method and experimental set-up

We installed a high-volume (23.1 m^3/h) sampler with a PM_1 sampling inlet and a home-made denuded low-volume (2.3 m^3/h) sampler with $PM_{2.5}$ sampling inlet for collection of aerosols. High-volume samples were collected automatically on a diurnal basis for most of the study period, while low-volume samples were collected manually on a diurnal basis during intensive sampling periods (otherwise on a daily basis).
In this way we collected aerosol samples for qualitative and quantitative analysis of terpene oxidation products and organosulfates. In particular the samples collected with the denuder system will help to understand the gas-particle partition of the aforementioned compounds.
Aerosol samples will be analyzed at Aarhus University by HPLC quadrupole time-of-flight mass spectrometry after extraction. Data analysis and interpretation will benefit from the huge amount of data obtained from on-going measurements at the site.

- Preliminary results and conclusions

We successfully collected 51 samples with the high-volume sampler and 13 samples with the low-volume sampler. The samples were shipped to Aarhus at cold conditions and they are stored in controlled conditions at -20°C. The analysis of these samples for the terpene oxidation products and organosulfates is not straightforward, and they require a careful extraction procedure. We will start this within the coming month.

- Outcome and future studies

With this study we expect to improve our understanding of the chemical processes involved in the formation of the oxidation products of terpenes and the gas-particle partion of them as well, in a forest environment.

This can lead to a better understanding of the aerosol and cloud formation processes happening over forests and to improve climate models as well.

- References

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