

REAL-TIME MEASUREMENTS OF BIOAEROSOLS IN URBAN ENVIRONMENT

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Summary

This study aims to determine health risks and climatic relevance of bioaerosols in urban environment. Two fluorescence based real-time instruments were used to measure bioaerosol concentrations and size distributions during winter, spring, summer and autumn. Supporting PM_{2.5}, PM₁₀, NO_x and meteorological data were utilized to estimate bioaerosol sources. The results showed that there were typically two fluorescent particle modes in urban environment. The modes are probably originating from fungal spores and bacteria. The concentrations and ratio of the fluorescent particle modes varied between the seasons. Strong diurnal variation in the fluorescent particle concentrations indicates that local sources are significant in urban environment. Guidelines for bioaerosol concentration limits in outdoor environment do not exist yet, mainly due to limitation of the data.

Introduction

Bioaerosols such as bacteria and fungal spores can cause adverse health effects for people and animals both in indoor and outdoor environments. Atmospheric bioaerosols have been recognized to have important influence in the climate acting as CCN (Cloud Condensation Nuclei) and IN (Ice Nuclei) and thus contribute cloud formation and precipitation processes. Information of concentrations, particle size distributions and sources of bioaerosols is needed to estimate their health risks and climatic relevance. In urban environment, bioaerosol sources are close to people and population is typically dense, thus health risks are especially high there. However, only few source-tracked bioaerosol studies have been made in urban environment.

Methodology and Results

LIF (Laser Induced Fluorescence) based instruments are modern tools for real-time bioaerosol detection (Saari et al., 2013a; 2013b). In this study, we used two LIF based real-time instruments, the BioScout (developed at TUT, manufactured by Environics Ltd.) and the UVAPS (TSI Inc.), to study bioaerosol concentrations and size distributions in urban environment at Helsinki region during winter, spring, summer and autumn. Real-time LIF data combined with PM_{2.5}, PM₁₀, NO_x and meteorological data enables also to estimate bioaerosol sources.

The results showed that there were typically two fluorescent particle modes during the all seasons, except in the winter, when only one mode was detected. We assume that the modes are mainly originating from fungal spores and bacteria. The concentrations and ratio of the fluorescent particle modes varied between the season periods. Sometimes there was strong diurnal variation in the fluorescent particle concentrations (Fig. 1), which is indication of significant local sources. We found also that the BioScout had much higher fluorescent particle counting efficiency than the UV-APS. This is consistent with our laboratory results.

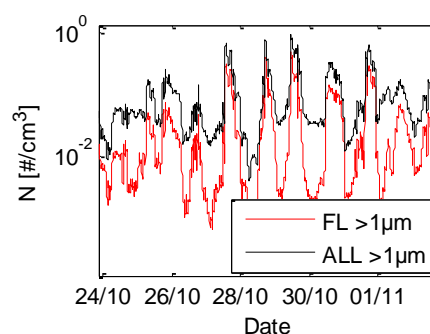


Fig.1 Real-time data of the fluorescent and total particle concentrations measured by the BioScout.

Conclusions

Two LIF based real-time instruments were used to observe bioaerosols in urban environment. Preliminary results of outdoor measurements are promising. Real-time LIF technique seems to be suitable for atmospheric bioaerosol detection, but there are still many questions to answer and work to do. Investigation of the emission sources and transportation of bioaerosols needs meteorological data analysis and long term measurements with several instruments in various environments. Guidelines for bioaerosol concentration limits in urban environment have not progressed yet and the main reason is limitation of the data.

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References

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