Title: **Explaining real exposure to allergenic pollen and fungal spores across urban-rural gradient**

Airborne fungal spores and pollen grains may be harmful to human acting as allergy triggers. Compared to anthropogenic air pollutants, spores and pollen measurement stations are sparse and unevenly distributed. Therefore the information on spatial distribution of pollen in the atmosphere are ambiguous, especially at fine spatial scales along urban-rural gradient. Moreover, the typical pollen and spore measurements are performed in only one or two places per city, usually on the roof top of a high building. Although the roof-top measurements reflect the mean seasonal pollen or spore concentration pattern of a particular spore and pollen types in a region/city, there are evidences that the concentration at a "pedestrian nose level" (or hereafter: ground level) may markedly differ from the roof-top concentrations. Consequently, there is an inconsistency between real concentrations at the ground level (where people mostly commute and reside) and the pollen/spore forecasts that are primarily based on roof-top concentrations.

What is more, the concentration measurements are rarely performed at a pollen or spore sources, so the information of the local pollen and spores source locations and abundance is poorly known. Although pollen sources are easy to be detected approximately at continental and regional level the information on local sources in the vicinity of the living places is frequently lacking or is too general. Even more difficult is the detection and quantification of fungal spore sources as they cannot be identified by the plant presence as in the case of pollen. Many different fungal species may have the same plant hosts and the same hosts may be infected by fungi or not. Also the infection level may markedly differ between sites, as recent study estimated that in the UK woodlands are much more infected (maximally ~80 times) than in Southern Europe. Therefore the primary objectives of this project are (1) to assess ground level pollen and spore concentrations across urban-rural gradient (2) detect pollen and spore sources at fine spatial scales, (3) explain the source impact on local, ground level of airborne concentration of spores and pollen and (4) to explain how the mentioned bioaerosols are transported from sources in a heterogeneous environment across urban – rural gradient

To realize the project goals we consider several taxa to be used in experiments/analyses, tree species (alder *Alnus* sp., birch *Betula* sp., plane *Platanus* sp., oak *Quercus* sp.) , herb species (grasses Poaceae, sorrel *Rumex* sp., mugwort *Artemisia* sp., ragweed *Ambrosia* sp.) pollen and *Alternaria* sp. as a representative of major spore allergens. The project will answer the questions how ground pollen concentration changes in the city, between land use types, districts, estates, streets, how obstacles such as buildings affect spore/pollen concentration, how the maintenance or agricultural practices impact pollen loads.

Getting answers to questions asked in the project will broaden the knowledge on pollen and spore emission and transport in various environments at fine spatial and temporal scales. The project results will substantially deepen the understanding the role of pollen sources present in the close proximity of human settlements. The pollen and spore sources will be detected using remote sensing methods and species distribution models providing precious data to create novel, easy to use, low-labour method for assessing abundance, intensity and timing of sources remotely. This results may also be used to improve pollen forecasting models. It is likely, that the results will revolutionize aerobiological research leading to the necessity of redefining a well-established terms such as pollen season. We think, that pollen season calculated for specific sites separately based on ground pollen/spore data will better reflect the reason behind establishing the pollen season term as they better asses potential exposure to allergens for people. The successful achievement of project goals ensures contribution to atmospheric and biological sciences by creating a platform to propose new ideas on the border between these two disciplines in the future.