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Investigations on spatial and vertical variations of airborne pollen in Sydney, Australia

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The prevalence of pollen allergy is increasing worldwide, as is the proportion of people living in cities. Thus, there is an increasing importance to investigate pollen distribution across city districts. We conducted two sampling campaigns to investigate the spatial and temporal variation of airborne pollen in the Sydney metropolitan area and the vertical variation within a forest in north-western Sydney.

Spatial assessment of pollen deposition was made for eight weeks in the exceptionally dry summer in 2019/2020 using gravimetric samplers. These samplers were set up at ten locations characterised by different degrees of urbanisation and distance to the sea. We focussed on the most abundant pollen types and investigated statistical relationships with land use and meteorology. In addition, we compared our results with pollen data of previous years sampled at a pollen monitoring station located in north-western Sydney in a semi-rural environment. We measured vertical pollen concentrations in a native forest, which mostly consists of Eucalypt trees (family Myrtaceae) in north-western Sydney. A scaffolding was equipped with five portable volumetric pollen samplers installed at different heights (1, 4, 10, 16, 20.5 m above ground level (agl)). We measured pollen concentration every second hour between 9 am and 4 pm on a total of four days in January 2020. We compared concentrations between days, heights, and times of the day.

The most abundant pollen type registered within our sampling campaigns belonged to the family Myrtaceae. Grass pollen (Poaceae) was also detected, but in much smaller quantities which can be attributed to the drought and temporal setting of the campaign, which started in the post-peak period of a comparably weak pollen season associated with a smaller number of days with medical relevance (> 50 pollen grains/m³). Our data showed spatial variations between the ten locations, but no relationship with land use (grass and tree cover) and meteorology could be found. This suggests the influence of other factors such as long-range pollen transport or resuspension of pollen. In the forest, Myrtaceae concentrations varied between days, sampling height and time of the day: the highest concentration was recorded on the second day of measurement between 9 and 10 am at 10 m agl. Peak values were generally reached between 1 and 2 pm. Considering sampling height, concentrations were on average highest at 4 m agl. The

location of pollen sources as well as meteorological conditions such as turbulence and variation in wind speed may be key determinants of small-scale differences of pollen concentrations.

The drought preceding this study did not only influence the length but also the strength of the pollen season. Data on vertical variations could support investigations related to turbulence, which is also responsible for resuspension processes.