Spatial and Temporal Variance of Bi-Hourly Grass Pollen Concentrations in the Local Surroundings of Worcester, UK.

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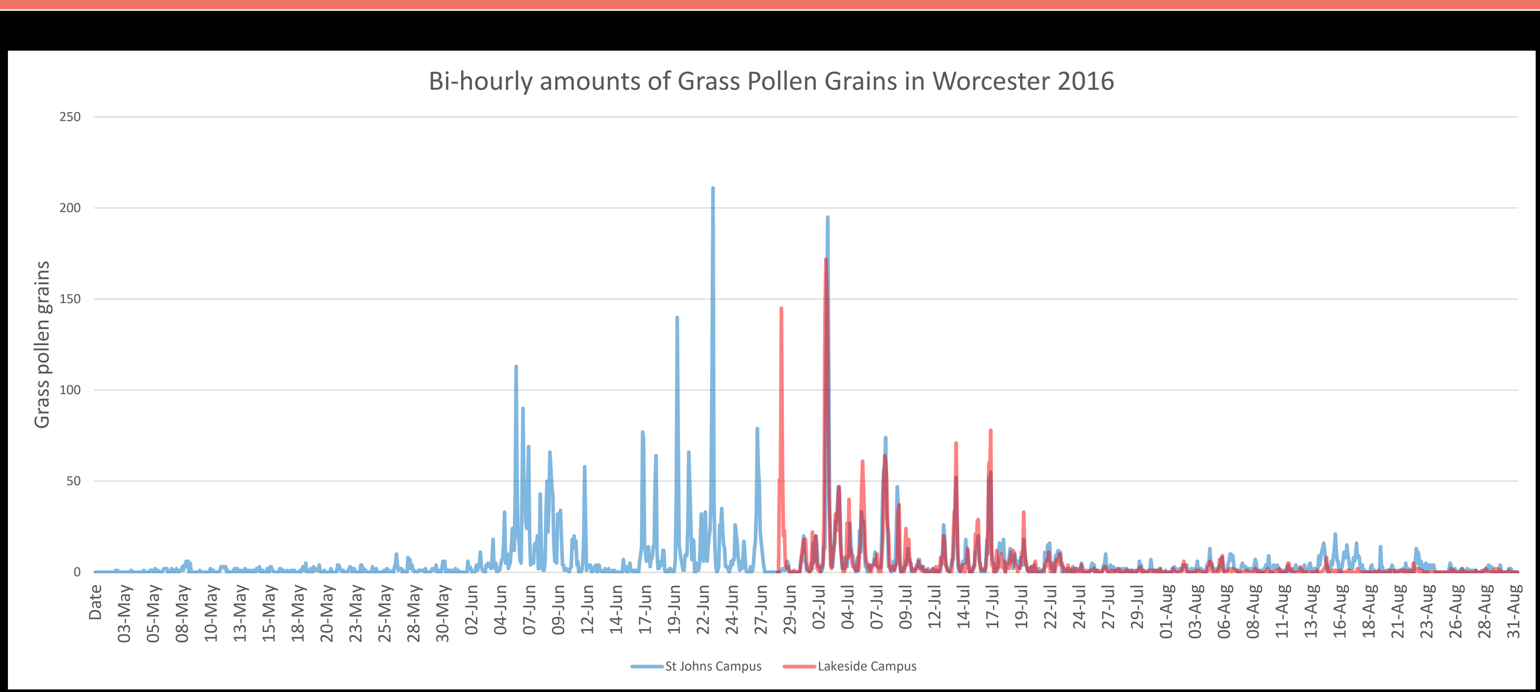
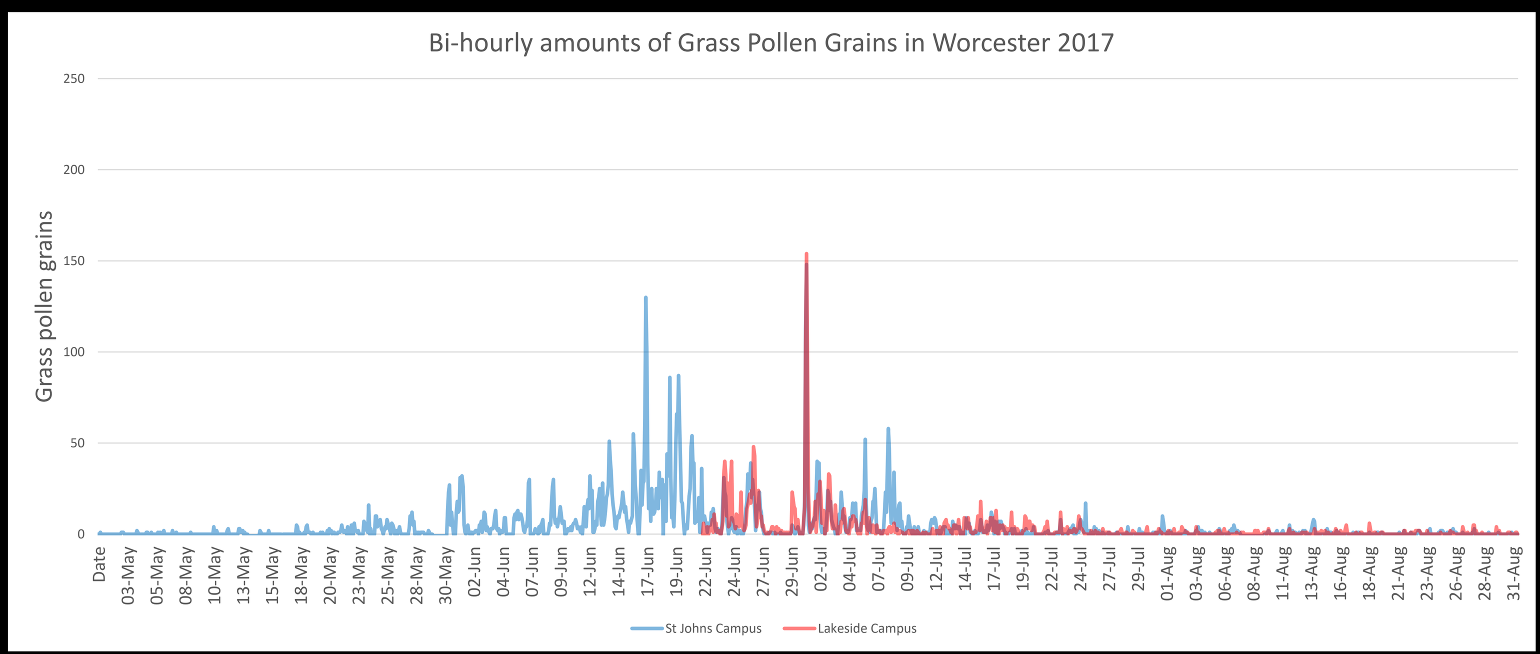
Background

Atmospheric grass pollen concentrations are known to fluctuate both between years[1], over the season[2] and during the day[3]. Grass pollen also varies spatially, with the consensus that nearby areas have similar patterns[4]. Experiments comparing local variation are however rare[5] and time-series of local variation even rarer[6]. In this study we compared two nearby locations over a three year period using bi-hourly data to determine local spatial and temporal variation in grass pollen concentrations.

Methods

To investigate local variation of grass pollen concentration we used Burkard 7-day volumetric spore traps[7]. One was placed on the roof of a building on Lakeside Campus and the other trap belongs to the NPARU pollen-monitoring network located on St Johns Campus roof (**Fig 1.**). The bi-hourly data was counted using the standardized pollen monitoring method[8]. Three years of data were used. The pollen season was defined with overlap and the 95% method[8], and was analysed with Pearson's correlation in the statistical software R.





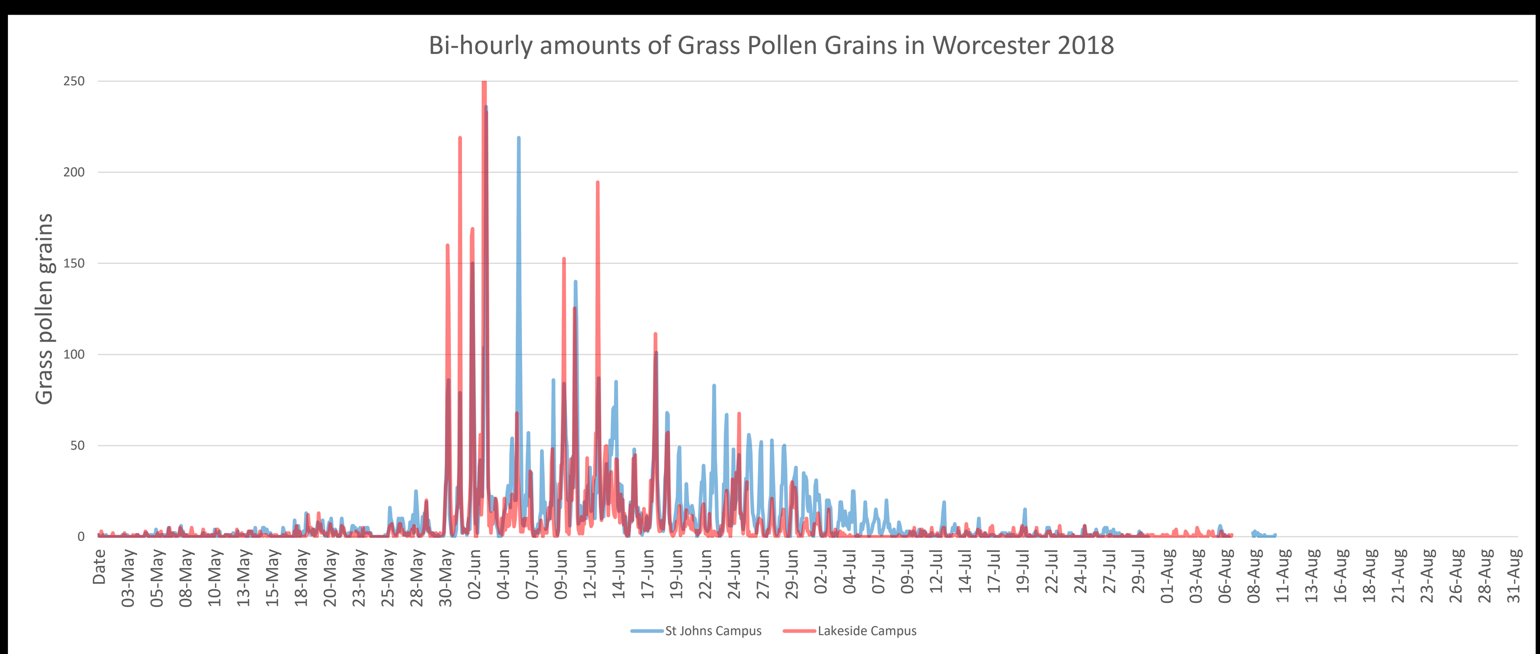


Fig. 2-4. Comparison of bi-hourly counts of Grass pollen grains between the locations St Johns Campus and Lakeside Campus in Worcester, UK between the years 2016-2018.

Fig. 1. Satellite images over Worcester[9], with the upper Burkard Icon[10] being Lakeside Campus and the lower being St Johns Campus. The distance between the sampling stations is 6.43 km.

Results

Overlapping data from 2016 and 2017 is available from the middle of June while the entire season is available in 2018. The 2016 data shows that most of the available peaks are overlapping, with the rest of the data having very little noise (**Fig. 2.**) and a correlation of **0.731** ($p < 0.001$). The 2017 data shows that the biggest peak overlap in size and strength but the rest of the data does not (**Fig. 3.**) and a correlation of **0.753** ($p < 0.001$). The 2018 data shows that most of the bigger peaks overlap in size but not in strength, with Lakeside peaks often being stronger and the St Johns pollen data having higher levels later in the season (**Fig. 4.**) and with a correlation of **0.627** ($p < 0.001$). NB The peak count (549 pollen grains) for Lakeside 2018 exceeds the y-axis maximum.

Discussion and Conclusion

Spatial and temporal variation in grass pollen concentrations fluctuates between years and locations. Peak concentrations tend to have higher overlap compared with times (nights, pre-peak and post-peak season) when pollen concentrations are lower. The results show that at least three years of data are needed to establish potential autocorrelation between nearby sites. It also shows that similar pollen patterns are present on a localized scale, which means that the overarching factors controlling pollen dispersion are probably the same. Future work needs to include longer time-series, more locations and local grass source maps to understand key underlying factors of localized grass pollen concentrations.

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