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Towards an automated monitoring solution of pollen concentrations using light scattering properties

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The monitoring of airborne pollen concentrations has become of a crucial importance over the past decades, as the number of allergy sufferers is continuously increasing and the symptoms becoming more severe due to pollution and climate change. The historical method usually used to identify pollen species present in the air and quantify them is manual with limitations such as a delay in pollen information availability and a high operational cost.

Here, we introduce a new automated solution aimed at identifying pollen grains and evaluating their concentrations based on their light scattering properties. More specifically, we introduce a low-cost and real-time optical pollen sensor named Beenose, which performs measurements at multiple scattering angles. We present an analysis of the data obtained in laboratory and the first results of the validation campaign in comparison with the historical method. Laboratory measurements were first conducted by inserting aerosols including carbonaceous particles, droplets, and different pollen species into the instrument. The collected data were then pre-processed to extract reference speciation indexes, which were used to train classification algorithms and to perform pollen identification outdoor. The results are promising and demonstrate the ability to correctly recognise some pollen species and to differentiate them from carbonaceous and droplets. In particular, among 24 species of interest, 9 are classified with an accuracy above 80%. Additionally, the total airborne pollen concentrations recorded by Beenose and the historical method are consistent. Finally, we discuss the remaining challenges to achieve a robust monitoring of the concentrations per specie and how to improve the identification of the pollen species having a similar optical behaviour.