

Interactive comment on “Automatic pollen recognition with the Rapid-E particle counter: the first-level procedure, experience and next steps” by Ingrida Šaulienė et al.

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First of all, we would like to thank the reviewers for their detailed comments to the paper. We used their comments and criticism to improve the manuscript. Below, we provide point-by-point response to the issues raised by the reviewers.

Reviewer 3

General comments

(1) adding a column indicating the percentage of pollen that were deemed above the fluorescence threshold would be of help in table 1. Was this consistent from sample to

C1

sample? le Was approximately the same fraction of each pollen type deem fluorescent in each calibration test?

The column has been added, together with the comment that the fractions were not exactly the same.

(2) how reflective of pollen in the atmosphere would the test pollen be? The collection method used in Payerne seems to significantly different than that seen in the other sites.

The basic idea was to use as fresh pollen as possible but after drying it somewhat. This is generally consistent with what is happening in the environment because pollen grains tend to loose water during the first minutes of the atmospheric transport providing that the weather is good and relative humidity is comparatively low – also the conditions facilitating the pollen release.

(3) Was the compressed air, zero grade air from a cylinder or from a compressor for the Siauliai tests?

Zero grade air from the cylinder.

(4) the instrument was run in pollen mode between 5-100 micron. Can this be changed? The majority of pollen is far larger than 5 micron. What is the expected lifetime of the instrument? Increasing the lower size threshold would likely extend it. Were the authors interested in fractionated pollen also?

The lower bound of 5 micrometres is the factory setting, hardcoded into hardware. The lifetime of the instrument is yet-unknown but estimates circle around 3-4 years depending on the level of pollution, amount of calibration exercises, etc. None of our instruments reached its end till today.

(5) L189: Do the authors have any idea how many pollen particles are not classified due to partly or fully missed the particle if the deep-UV laser fired at a wrong moment of time?

C2

In the table 1, the “fluorescent” particles compare to “total particles” is the fraction of the sufficiently good hits.

(6) L196: Is saturation of the fluorescence spectra still a possibility? Were some pollen more likely to cause this than others?

The devices behaved differently: the saturation was more a problem in Siauliai than in other labs. But after exclusion of the first spectrum, the impact of this problem became small.

(7) why was fluorescence lifetime not used in the Siauliai data analysis.

It has been noticed that the lifetime signal was often saturated in-between the rise and fall sections when the value remains constant over some time.

(8) how was the threshold of the particle fluorescence intensity level (> 1500 units) determined? This would be interesting for the reader and is generally discussed for other instruments? What was undertaken at the other sites?

This threshold is an empirical parameter and it had to vary between the devices. Somehow, the strength of the signal was substantially different between the labs. This was one of the reasons for normalization of the spectra. We added a clarifying sentence in the revised paper.

(9) for the Swiss data analysis, why was the optical size corresponding to 10 micrometers estimated? Was it simply due to the practicality of not having 10 micron PSLs?

Partly, for the historical reasons, following the work of Crouzy et al. For the tested pollen it is the same: they all are much larger. But the tighter threshold was effective in eliminating the ambient particles, which, despite in low numbers, were still reaching the device.

(10) The beginning of the results section has both general and site specific research questions (Lithuania). This seems out of place (consider moving to intro).

C3

The results from all three sites are collected together.

(11) Consider cutting section 3.2.1. Recognition using scattering images only to a sentence and removing table 2 or moving it to a supplemental section. It does not add to the results and is far and away the weakest procedure.

We have moved the details of the separate recognition with scattering and fluorescence only into an Annex but still consider this analysis useful as it shows the relative importance of each information channel. Therefore, a few sentences comparing these channels are retained in the revised paper.

(12) Should there be results sections for the other two sites as well? Or is the results section an amalgam of the other sites also. Currently it reads like the results originate only from Siauliai.

The results from all three sites are collected together.

(13) A very interesting observation that *Festuca* pollen was seen with the signal amplitude growing during the first 500 ns (Figure 8) do the author have any suggestion as to why this is so?

Unfortunately, no, this is just the empirical fact.

(14) A line on chemical interactions and degradation should be added L 405.

A sentence is added.

(15) A brief mention of the work undertaken by the WBS instrument should be discussed in 4.3. Comparison with other studies on pollen recognition.

A short discussion is added. We added information to Introduction and 4.3 section.

(16) authors have suggested lifetime could be utilized to discriminate between pollen I feel this should be discussed, for example “O’Connor et al Using spectral analysis and fluorescence lifetimes to discriminate between grass and tree pollen for aerobiological

C4

applications Anal. Methods, 2014,6, 1633-1639”.

Thank you for the reference! We have added the reference and corresponding discussion.

(17) What are the R2 values between the Rapid E and the Hirst? Is the Hirst a true reflection of what is in the atmosphere?

The R2 values are provided. Hirst is certainly not the true reflection but the best we have for last 60 years.

(18) Could large fungal spores or clumps of fungal spores act as an interferant in the Rapid E for its current task?

No, they will not. During next steps of calibrations, not shown in this paper, we included spores and the first impression is that the difference is substantial, first of all, in fluorescence spectra, which do not depend on agglomeration.

(19) Did only the Swiss site compare the Rapid E to a Hirst type trap? If yes why? If not, why are the results talked not about? This would be a good way to evaluate the ANN at each sampling site.

Not only but the Payerne group has the longest experience with the Plair device (albeit with its previous version). Therefore, they faced the problem of the false-positives, which is discussed in this section.

(20) Does the Rapid E come with any classifier? Or is it incumbent on the purchaser to develop their own? If the creator has an algorithm 5-10% better than seen here why is this not part of the commercial instrument?

In theory, it can have it. However, none of our devices were equipped with it. In all cases, the algorithm is closed and requires calibration to adapt to the specific machine. All machines are provided as “experimental devices”, with reduced warranty period and some features disabled. However, the conclusions of the paper imply that the details of

C5

such algorithm are not too relevant: pre-processing and pre-filtering the input datasets may have stronger influence on the recognition quality than setup of the ANN.

Specific comments:

L19 specialized rather specialization.

L65 “it has become a necessity to develop new methods enabling the information on airborne pollen to become available in real-time”.

L66 were related.

L87 experiments.

L128 fitted rather than fit.

L136 a new bottle.

L137 “previously sampled” rather than “blown”.

L142 clarify for the reader what you mean by busy slides.

L212 which aimed.

L312 a challenging task.

Thank you! All corrected.

On behalf of authors Ingrida Šauliėne

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C6