ICA2018
11th International Congress on Aerobiology
3-7 September 2018, Parma, Italy

Real time monitoring of the biological particles in the air: Rapid-E example in France

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BACKGROUND

The biological particles transported by the wind, as pollen grains and mold spores, are present in the air sometimes in very important concentrations according to the seasons. These particles cause symptoms to around 20 % of the European population. For several years, the main method to monitor the biological particle concentrations has been the Hirst method which produces accurate but past data. Nowadays, many researches are focused on the development on new devices to get real time information.

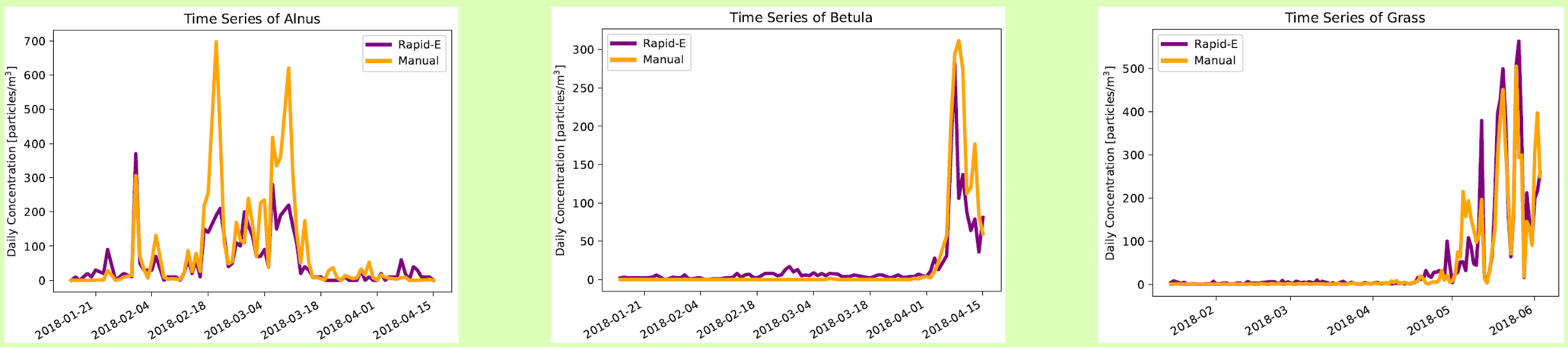
MATERIAL AND METHOD

In France, the pollens monitoring is based on the recommendations of the European norm “EN/TS 16868 Sampling and analysis of airborne pollen grains and fungal spores". The sampling and the analysis follow the protocol of the Hirst method: a volumetric pollen trap is set up to measure in a continuous way the concentrations of pollens and molds in the air (particles.day/m^3).
The RAPID-E from PLAIR company is a device using a red laser beam to determine the size and the shape of sucked particles and an ultraviolet ray to measure the fluorescence of these particles. The measures allow to discriminate pollens and molds.
RNSA (French Network of Aerobiology) set up a RAPID-E in March 2017 in front of a Hirst type pollen trap. Numerous calibrations of the device were made in 2017 and 2018 in the aim to “teach” to the device to recognize and discriminate pollens and molds.

Rapid-E

RESULTS

The correlation coefficients got between Rapid-E and Hirst trap measures are higher than 0.7 for most of calibrated pollens, this correlation reaching 0.87 for all pollen taxa. The confusion matrix show that the discrimination of pollens by RAPID-E is very good.



Comparison of 2018 daily pollen concentrations of Alnus, Betula and Poaceae measured with Hirst method (orange) and with Rapid-E (purple)

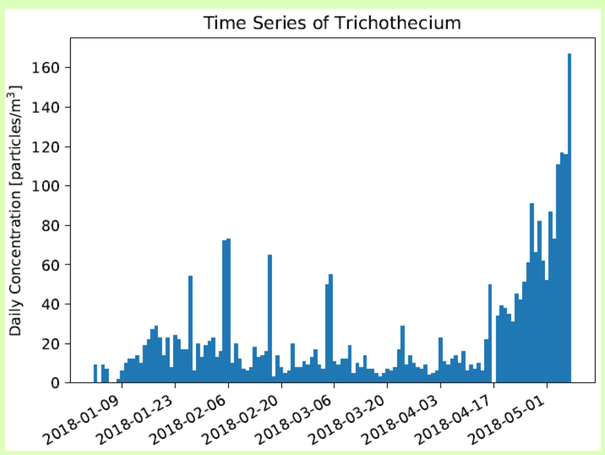
Pollens	Correlation (Pearson) HIRST / RAPID-E
Alnus	0.84
Betula	0.91
Carpinus	0.92
Corylus	0.81
Cupressaceae	0.85
Pinus	0.98
Plantago	0.82
Poaceae	0.92
Platanus	0.98
Quercus	0.84
Urticaceae	0.73
All taxa	**0.87**

Correlation coefficients

	Quercus	*Platanus*	*Ambrosia*	*Urticaceae*	*Pinus*	*Poaceae*	*Plantago*	*Cupressus*	*Betula*	*Olea*
Quercus	**0.86**	0.01	0.00	0.00	0.01	0.01	0.01	0.00	0.09	0.00
Platanus	0.03	**0.90**	0.00	0.00	0.01	0.00	0.05	0.00	0.00	0.00
Ambrosia	0.00	0.00	**0.97**	0.00	0.00	0.02	0.00	0.00	0.00	0.00
Urticaceae	0.00	0.00	0.00	**0.91**	0.00	0.08	0.00	0.00	0.00	0.00
Pinus	0.00	0.00	0.01	0.01	**0.97**	0.00	0.00	0.01	0.00	0.00
Poaceae	0.01	0.00	0.03	0.02	0.00	**0.93**	0.01	0.00	0.00	0.01
Plantago	0.06	0.04	0.01	0.02	0.00	0.02	**0.82**	0.02	0.02	0.00
Cupressus	0.00	0.00	0.02	0.00	0.00	0.01	0.01	**0.94**	0.01	0.00
Betula	0.15	0.00	0.00	0.00	0.00	0.00	0.05	0.00	**0.78**	0.00
Olea	0.06	0.01	0.02	0.03	0.00	0.03	0.00	0.00	0.00	**0.85**

Confusion matrix

Rapid-E has also been calibrated with several molds (*Absidia, Acremonium, Alternaria, Aspergillus, Botrytis, Chaetomium, Cladosporium, Epicoccum, Fusarium, Penicillium, Trichothecium, Ulocladium*). Molds have been grown on Petri dishes (Malt Extract Agar). Some molds are less airborne than pollens which made it a bit more difficult for calibrations.



Daily mold concentrations of Trichothecium measured with Rapid-E device

CONCLUSION

Pollen grains and mold spores cause symptoms to at least 20% of European people. The Hirst method provide a good but past information. People need a real time information to adapt their treatment. Rapid-E already allows to set up a real time information for the main pollens and soon for mold spores too.

Conflict of interest: (1): RNSA employees and (2): PLAIR SA employees