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# Forecasting pollen in the atmosphere

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People suffering from pollen allergy may benefit from efforts to model pollen levels across Europe. But actual observations and personalised data are also essential.

Runny nose, watery eyes and cough; these are the symptoms associated with respiratory allergies. About 20% to 30% of Europeans suffer from some type of respiratory allergy, according to the European Federation of Allergy and Airway Diseases Patients Associations. Being sensitive to pollen is amongst the most common causes. Atmospheric pollen levels have even increased over the past years, according to a PLoS study published in 2012. But when information about pollen levels is available, people suffering from such allergy can alleviate their symptoms. For example, they can stay indoors to avoid high pollen levels or take their medicine preventatively.

Researchers have now set up a service to forecast when and where pollen occur – from Spain up to Finland. It is part of the EU-funded project MACC II. This approach is based on an ensemble of models. "The service is up and running for birch pollen," says Mikhail Sofiev, one of the project partners and a modelling expert at the Finnish Meteorological Institute in Helsinki. The forecasts are freely available via the project's website. The service will later on include forecasts for grass, olive tree and ambrosia pollen.

Currently, pollen information services use various inputs. "The basis are historic data on the theoretical start of the flowering season, field observations as well as weather data and forecasts," says Uwe Berger,

head of the research group aerobiology and pollen information at the Medical University of Vienna, Austria. "Based on these data, we can estimate the pollen levels," he says. Berger also heads the privately funded European Aeroallergen Network that hosts a database and provides pollen information for European countries. The network is a partner of the project's pollen forecasting efforts.

To resolve the question of how to make pollen forecasts more accurate and timely, project scientists turned to modeling. This is because "the bulk of measurements is manual and arrives too late," Sofiev tells youris.com. The new system is based on the project's air quality modelling system. A phenological model forecasts the beginning of the birch-flowering season with an accuracy of 2-3 days in regions such as Central Europe or Finland, according to Sofiev. The spatial resolution is 20 kilometres. The model also predicts the pollen transport. "Pollen grains can be transported a few hundred kilometres. This is an important addition to local observation-based forecasts," Sofiev says.

Some challenges remain, however. The scientists need to better model the biological processes determining the absolute amounts of pollen released by a plant. "We hope to have something workable around next spring," says Sofiev. There is also a need to include more observations into the modelling. Sofiev hopes that scientists will be able to monitor pollen in real-time within a few years. "This would greatly facilitate the use of data for numerical forecasts," he tells youris.com.

An expert recognises the advantages of such modelling approach "Standard forecasts use pollen data that may be 2 to 9 days old. Numerical models can use previously calculated pollen concentrations as a starting point," says Andreas Pauling, research scientist at the division numerical prediction at MeteoSwiss in Zürich, Switzerland. Moreover, "numerical models calculate the pollen concentration for all grid points within a certain area," Pauling explains. Standard forecasts may also

cover a certain area but are based on single observations. However, "a high resolution is necessary for regions with complex topography, such as alpine regions," he notes.

Berger also welcomes the computerised forecasting service. "We are quite satisfied with the models. They reflect the beginning of the flowering season well. And they include pollen levels in other countries," he says. But to make forecasts really relevant to people with allergies more needs to be done, Berger contends. "People react differently to pollen. The amounts causing a reaction are biogeographically different. Models do not take the different threshold values into account", he says. Berger and colleagues therefore develop a pollen diary where people can record their allergy symptoms. Combined with pollen forecasts, this tool provides personalised pollen information.

Another expert agrees. "People with allergies greatly benefit from pollen diaries," says Jeroen Buters, professor of molecular allergology and head of the environmental toxicology group at the Centre of Allergy and Environment at the Technical University Munich and the Helmholtz Center Munich, Germany. In his view, a daily forecast such as provided by the project is very useful. "If people who are allergic to pollen go outside without being prepared this may cause considerable discomfort and economic loss," he says. But because each individual has different reactions, "it would be desirable if the model estimated the absolute amounts of pollen [in the air]," he adds.

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