



Spatio-temporal modelling of birch pollen levels in Belgium

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Air pollution is mainly driven by anthropogenic emissions of pollutants, but also airborne biogenic aerosols such as pollen affect the human health badly. In Belgium, ~10% of the people is estimated to suffer from allergies due to pollen emitted by the birch family trees. Timely information on forthcoming pollen exposure episodes using a forecasting system, can allow patients to take preventive measures. To date, the only available information on pollen concentrations in Belgium is obtained through five stations that monitor daily airborne birch pollen concentrations, but real-time and detailed spatial information is lacking. Pollen transport models can both quantify and forecast the spatial and temporal distribution of airborne birch pollen concentrations if accurate and updated maps of birch pollen emission sources are available, and if the large inter-seasonal variability of birch pollen is considered.

We have applied the SILAM model (System for Integrated modeLLing of Atmospheric coMposition) to assess the spatio-temporal birch pollen levels over Belgium. SILAM is driven by ECMWF ERA5 meteorological data. Pollen release is based on the temperature degree days approach. We have implemented the spatial distribution of birch trees from MACIII updated for Belgium using forest inventory data of the Flemish and Walloon regions. Spaceborne MODIS vegetation activity is combined with an updated birch fraction map and updated start and end dates of the birch pollen season were integrated into SILAM. The correlation (R^2) between SILAM modelled and observed time series of daily birch pollen levels of 50 birch pollen seasons (multiple sites, period 2008-2018) increased up to ~50%. The slopes of the linear correlation increased on average with ~60%. Finally, SILAM is able to capture the threshold of 80 pollen grains m^{-3} exposure from the observations.