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Modelling the spatial distribution of four decades of airborne birch pollen levels in Belgium using remotely sensed birch fraction maps

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Emissions of biogenic aerosols such as allergenic pollen affect the public health badly. In combination with air pollution it puts additional distress on people already suffering from cardiovascular and respiratory diseases. In some European countries the prevalence of people with pollinosis is up to 40%. In Belgium, ~10% is sensitive for birch pollen. Patients suffering from pollinosis in Belgium lack access to detailed real-time spatial information and warnings on forthcoming pollen exposures. This is because the only pollen info is coming from five aerobiological stations which monitor off-line daily concentrations of airborne pollen from birches. Only two stations have almost four decades of observations, Brussels from 1982 on and De Haan from 1984 on. Chemistry Transport Models (CTM) can both quantify as well as forecast the spatial and temporal distribution of airborne birch pollen concentrations if the distributions of birch pollen emission sources over time are available.

Here we show the results of the modelled spatio-temporal distributions of almost four decades of birch pollen levels over Belgium using the CTM SILAM (<http://silam.fmi.fi>). This CTM is driven with the ERA5 meteorological reanalysis from ECMWF, and reconstructed birch tree fraction maps. A recent in-house birch map of Belgium derived from forest inventory data is combined with long-term series of the AVHRR-GIMMS3g NDVI to produce birch fraction maps for each year.

For the first time in Belgium, we present time series of modelled birch pollen levels by SILAM compared with daily observations from the aerobiological surveillance network for the period 1982-2019. Preliminary modelling results for Brussels show an overall R^2 value of 0.40 computed from modelled and observed daily birch pollen levels. The R^2 values for the individual birch pollen seasons may range from 0.10 to 0.82 with a median value of 0.53. For De Haan the R^2 values tend to be lower with the median seasonal value of 0.30. Temporal trends computed on the first results of the modelled daily values based on the Theil Sen slope and the Area Under the Curve (AUC) show a substantial increase of birch pollen levels for most parts in Belgium. This agrees well with literature reports.