Modeling climate change effects on spatiotemporal patterns of allergenic pollen emissions and airborne concentrations

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Abstract: Emission and transport of allergenic pollens is expected to be affected by climate change, and potentially increase occurrence of allergic airway disease (AAD). A novel modeling system is presented for studying emission and transport of representative allergenic pollens under climatic change conditions. The emission module is parameterized based on historical data of observed meteorology/climate, phenology and airborne pollen count. The transport of pollen was simulated via the combined application of the Weather Research and Forecasting (WRF) model, the Sparse Matrix Operator Kernel Emissions (SMOKE) model and an adapted version of Community Multiscale and Air Quality (CMAQ) model.

Simulation results from the SMOKE-WRF-CMAQ modeling system could characterize reasonably well the observed allergenic pollen timing and levels; and that the simulation estimates were comparable with those from observed climatologic means. It is also shown that responses of pollen timing and levels to future climatic conditions will be different for different allergenic genus and different climate regions. Simulation results improve our understanding of climatic change effects on allergenic pollen timing and levels, and provide information useful in managing public health problems associated with expected increases in cases of AAD.
Keyword: Climate change, Allergy, Pollen, Birch, Oak