SILAM in South of Europe: application to birch pollen episodes in Catalonia (NE Spain)

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INTRODUCTION

Pollen grains are particles related to the sexual reproduction of flowering plants. In anemophilous plants, pollen comes into the atmosphere and a sector of the population experiences allergic symptoms in its presence. Birch (Betula) pollen (Figure 1) is one of the important causes of respiratory allergy in Northern and Central Europe (Figure 2) due to the abundance of birch trees in forests. In Southern Europe, birch trees are not frequent, they grow only in mountain landscapes (between 800 and 2000 m.a.s.l.), and give rise to low pollen concentrations. Nevertheless, punctual pollen peaks are observed in Southern Europe (Catalonia) (Figure 3) due to the long-range transport from North to South under concrete meteorological circumstances.

Figure 1. SEM image of a birch pollen grain (left panel) and male elements of birch (right panel).

Similar to air quality forecast systems, the modeling system prepared to forecast pollen concentrations would be an important improvement in the assessment for that population that suffers annoying health effects caused by pollens in the air. We will focus on the study of birch pollen season in Catalonia for years 2006 and 2007.

RESULTS AND DISCUSSION

Model results include hourly birch pollen concentrations. Some examples are shown in Figure 5 for the two years simulated. On day 29th April 2006 and 19th April 2007, it can be observed the effect of the transport over areas where there are no birches, as the Mediterranean sea or the Atlantic ocean. The same occurs in some land regions, such as NE of the Iberian Peninsula, where the advection from central Europe under favorable meteorological conditions can be the major contributor to the measured pollen concentrations.

The measurements obtained in the aerobiological stations (blue lines in Figure 6) seem to agree with that reproduced by models, low values in most of the period and some peaks with higher pollen concentrations. In 2006, the peaks on 26th-27th April, where reproduced by the model, at least one of the two days, in all the stations (not shown). The peak on 29th April was partially reproduced by the model. In 2007, the peak on 15th April was not reproduced, but the peak on 19th-20th April was enough well reproduced; in some cases there was a delay of a day in the model. Differences between the two simulations are important in the local contribution (see Figure 6), where IPo8 simulation seems to make to improve, avoiding the extra peaks that appear in base simulation (red).

In summary, the two simulations show front of long-range transport but local differences in concentrations appear, as it was expected. From the comparison with the observations in the eight measurement points in Catalonia for years 2006 and 2007 we can derived that the update of the birch fraction map in Spain improves the behavior of the model in the measurement-sites.

CONCLUSIONS

This work shows the application of a dispersion model (SILAM) to the study of Betula pollen distribution in South of Europe. The model takes into account a European map fraction of birch, since some uncertainty existed in the central and south part of Europe from initial map a modification in the Spanish territory was done with IFN3 simulation.

Two pollen seasons have been reproduced and evaluated with airborne pollen data recorded at XAC for both input maps. In general, model results are closer to measurements in the simulation with the IPo8 birch model. The results given by the simulation at birch peaks was originated in France, which could be an error as a necessity of a revision in the birch fraction for France. The evaluation of the model should be extended to other regions in order to obtain more general conclusions.

REFERENCES


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