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FORECAST MODEL OF ALLERGENIC HAZARD USING TRENDS OF PLATANUS AIRBORNE POLLEN OVER AN URBAN AREA IN SW IBERIAN PENINSULA (EUROPE)

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FORECAST MODEL OF ALLERGENIC HAZARD USING TRENDS OF PLATANUS AIRBORNE POLLEN OVER AN URBAN AREA IN SW IBERIAN PENINSULA (EUROPE)

1. Purpose

Ornamental trees play an outstanding role in any environmental urban, peri-urban and rural landscape designs. Plane trees are chosen due to their tolerance to water shortage and high levels of pollution, rapid growth and development of wide shadow. But despite of their growing advantages, the pollen of ornamental plane trees causes respiratory allergies in Western Mediterranean countries. Clinical symptoms most often associated with *Platanus* pollen allergy are seasonal rhinoconjunctivitis and asthma. *Platanus* pollen has been established for the estimation of the potential allergy risk. On behalf of the increasing number of pollen allergy sufferers in built-up areas, new strategies are required to improve the biological urban air quality.

2. Design, Methodology or Approach

The main objective of this work is to model daily average *Platanus* airborne pollen concentrations from Badajoz, a city located in the SW of the Iberian Peninsula (Spain), in relation to the temporal distribution of five different meteorological variables from 20 years of continuous recording. This is achieved by the development of a forecasting model which is calibrated using the Shuffle Complex Evolution Metropolis Algorithm with the Root Mean Square Error (RMSE) as an optimization function. Aerobiological sampling was conducted from 1997 to 2015 using a seven-day Hirst type volumetric sampler.

3. Results/Findings

The *Platanus* Main Pollen Season (5-95%) lasted, on average, 22 days from March 15th to April 6th (Figure 1). The model proposed to forecast airborne pollen concentrations is described in eq (1). This model evaluates the actual pollen concentration value, which is calculated based on the most representative meteorological variables multiplied by a fitting coefficient (eq 1):

$$CP^{t+\Delta t} = CP^t (a \cdot T_{max}^t + b \cdot T_{mean}^t + c \cdot T_{min}^t + d \cdot R^t + e \cdot RH^t) \quad (1)$$

After the calibration process, the coefficients related with average and minimum temperature, and relative humidity are neglected because they have not relevance in the model. As consequence, the model is reduced to the variables of maximum temperature and rainfall (eq 2):

$$CP^{t+\Delta t} = CP^t (a \cdot T_{max}^t + b \cdot R^t) \quad (2)$$

The suitability of the model was examined for a forecast horizon of 1 day. The R^2 value obtained for the calibration period (1997-2009) was 0.346 (Table 1). The R^2 value obtained for the validation period (2010-2015) was 0.427. This result, compared with other reference values of ornamental trees such as *Cupressaceae* (Silva-Palacios et al., 2015), confirm the goodness-of-fit of the proposed model.

Table 1. Parameters and statistical analysis of the model proposed to forecast airborne pollen concentration

Parameters	1-Day
a	0.042
b	0.004
Comparison criteria	
R ²	0.346
RMSE	89.755

4. Conclusions

This research highlights the importance of knowing *Platanus* pollen concentration to reduce the natural risk hazard of organic aerosols from plane trees and to improve the quality of life or urban allergy sufferers in the SW Iberian Peninsula. Furthermore, the results may benefit allergy sufferers, medical professionals and those who produce and stock health care products in Badajoz. The model obtained provides a good level of confidence to forecast *Platanus* airborne pollen concentration with an R² of 0.346 for a forecast horizon of 1 day. This result and R² have confirmed the suitability of the proposed model.

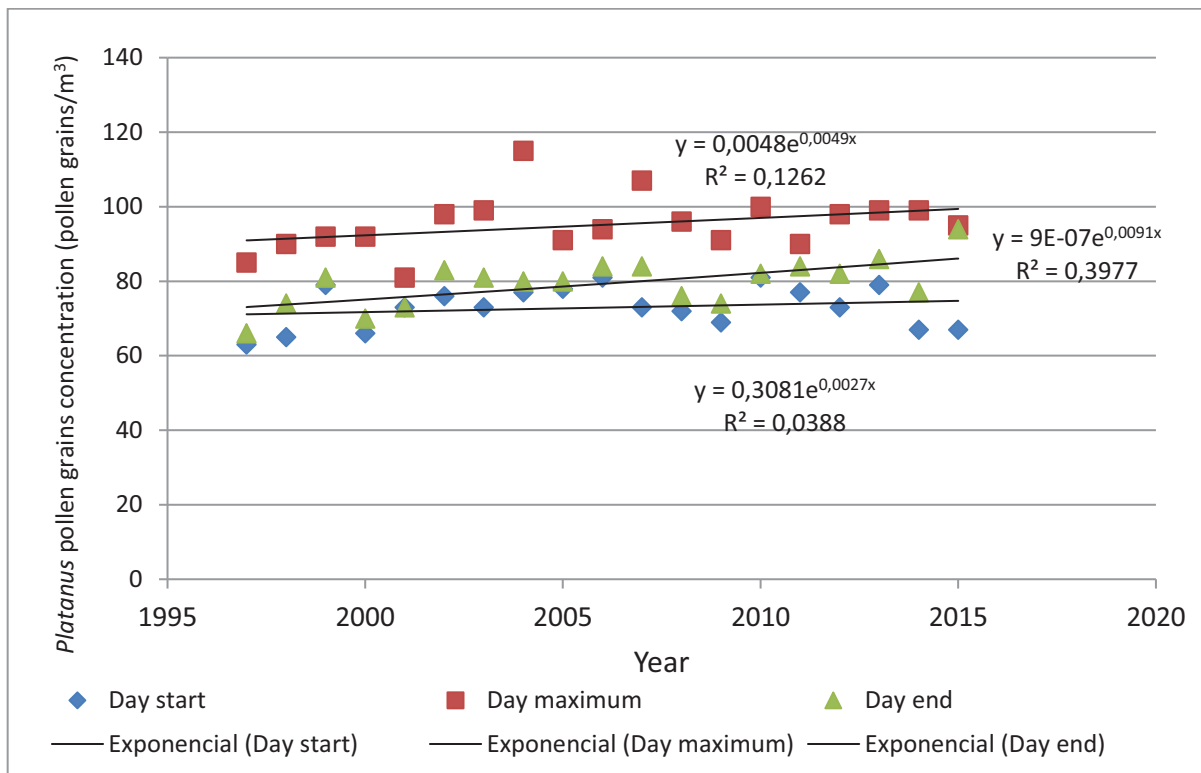


Figure 1. *Platanus* pollen season.

Silva-Palacios, I., Fernández-Rodríguez, S., Durán-Barroso, P., Tormo-Molina, R., Maya-Manzano, J.M., Gonzalo-Garijo, Á., 2015. Temporal modelling and forecasting of the airborne pollen of Cupressaceae on the southwestern Iberian Peninsula. *International Journal of Biometeorology* 60, 297-306.