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ANALYSIS OF QUERCUS LONG-TERM POLLEN SEASON TRENDS IN THE SOUTHWEST OF THE IBERIAN PENINSULA

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ANALYSIS OF QUERCUS LONG-TERM POLLEN SEASON TRENDS IN THE SOUTHWEST OF THE IBERIAN PENINSULA

1. Purpose

The possible impact of global warming on *Quercus* phenology is also discussed taking into account the great ecological and economical importance of this genus in the Mediterranean area. The most frequent natural vegetation in Extremadura is the mediterranean forest handling called as "dehesas", being *Quercus* the main tree genera. In spite of their ecological importance, the acorn production of southern Mediterranean oak ecosystems is of vital economic importance, since acorns are a major component in the feeding systems of high-quality Iberian domestic pigs. *Quercus* genera include an important number of anemophilous species (wind pollinated). In Extremadura 5 species are the most representative: *Quercus ilex subsp. ballota, Q. suber, Q. pyrenaica, Q. coccifera* and *Q. faginea.*They pollinated essentially in spring and their pollen is captured by aerobiological samplers mainly in two months. Traditionally, correlation and regression analyses statistical techniques has been employed to study pollen-season trends. In the present study a parametric model is proposed, been calibrated with the Shuffle Complex Evolution Metropolis Algorithm (SCEM-UA) using as optimization function the Root Mean Square Error (RMSE). Long-term trends in flowering phenology were analysed using a 21-year database of *Quercus* pollen records for Badajoz. The main objective is to model the *Quercus* pollen concentration (CQ) from of the relation with the temporal distribution of five different climatic variables for 21 years (t).

2. Design, Methodology or Approach

Daily concentration of airborne pollen concentration were obtained by using a Hirst type pollen trap located at the roof of a building at the University of Extremadura of Extremadura in Badajoz (SW Spain). Data were provided in daily pollen grains concentration for cubic meter. *Quercus* data from the period 1993-2013 were compared using time series analysis. Climate parameters as rainfall (R), relative humidity (RH), maximum (Tmax), mean (Tmean) and minimum temperature (Tmin). In order to achieve the best fit and due to the full period (21 years), it has been selected 5 years uniform correlative for four years period analyzing separately the data from the main pollen seson (PS, 5-95%): 1993-1998, 1999-2003, 2004-2008 and 2009-2013.

3. Results/Findings

Quercus main pollen season lasted on average 60 days, ranging from 31 to 85 days, from 28th March to 27th May. The model proposed to forecast the airborne pollen concentration is described by the eq. (1)

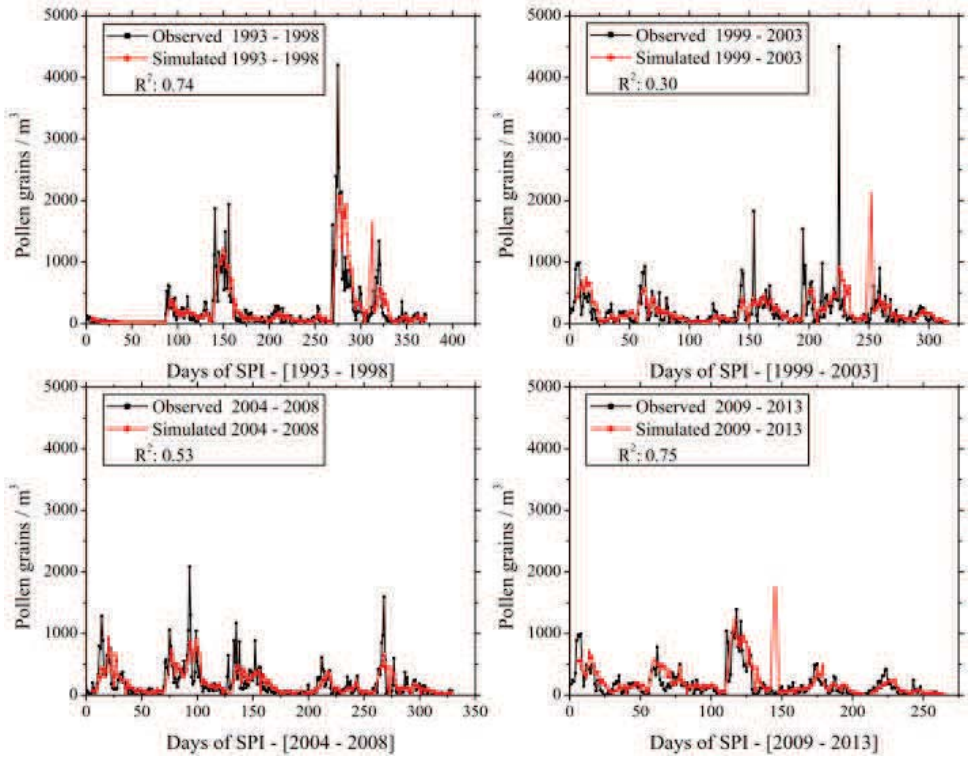
$$\frac{\Sigma}{\sum} \qquad \frac{\Sigma}{\sum}$$

where a, b, c, d, e, f, g and h are the coefficients to be calibrated for our time series of climatic and airborne pollen concentration, and is composed by the integration of the different climatic variables for each time step regarding to the actual airborne pollen concentration value join to the mean concentration value of the previous 10 days for each time step. Beside the value of each variable is evaluated for each time step, it has been added the aggregated variables of the mean temperature for 10 previous days as well as the cumulative rainfall of the 10 previous days to analysis the influence of the temporal variation of these variables over the airborne pollen concentration.

Regardless the degree of influence of some climatic variables could be previously neglected by its apparently low relevance, it has been therefore considered appropriate to maintain them due the range of variations of are different among them as well as its mean value.

In the Figure 1 it is shown the comparsion between observed and simulated pollen grains/m^3 of the SP for the period 1993-2013 join to the coefficient of determination R^2.

Figure 1. Comparison betweeen observed and simulated data for the periods 1993-1998, 1999-2003,2004-2008 and 2009-2013.



4. Conclusions

The temporal distribution of the *Quercus* pollen season lasted two months, with higher variations among years. Fortunately, it is not hardly an allergenic pollen but it is very important for acorn productions in Extremadura (SW Spain). Using long-term pollen trends, it has been developed an autoregressive parametric model to analyze the fitting degree for different 5-year partial time series. It could be appreciated that despite the global fit of the model is quite accurate (R^2: 0,58), this value is not constant for different partial time series due likely to the influence of climatic variables.