



Pollen Forecast and Dispersion Modelling

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The aim of this study is monitoring, mapping and forecast of pollen distribution for the city of Rome using in-situ measurements of 10 species of common allergenic pollens and measurements of PM10. The production of daily concentration maps, associated to a mobile phone app, are innovative compared to existing dedicated services to people who suffer from respiratory allergies.

The dispersal pollen is one of the most well-known causes of allergic disease that is manifested by disorders of the respiratory functions. Allergies are the third leading cause of chronic disease and it is estimated that tens millions of people in Italy suffer from it.

Recent works reveal that during the last few years there was a progressive increase of affected subjects, especially in urban areas. This situation may depend: on the ability to transport of pollutants, on the ability to react between pollutants and pollen and from a combination of other irritants, existing in densely populated and polluted urban areas.

The methodology used to produce maps is based on in-situ measurements time series relative to 2012, obtained from networks of air quality and pollen stations in the metropolitan area of Rome.

The monitoring station aerobiological of University of Rome "Tor Vergata" is located at the Department of Biology. The instrument used to pollen monitoring is a volumetric sampler type Hirst (Hirst 1952), Model 2000 VPPS Lanzoni; the data acquisition is carried out as reported in Standard UNI 11008:2004 - "Qualità dell'aria – Metodo di campionamento e conteggio dei granuli pollinici e delle spore fungine aerodisperse" - the protocol that describes the procedure for measuring of the concentration of pollen grains and fungal spores dispersed into the atmosphere, and reported in the "Manuale di gestione e qualità della R.I.M.A" (Travaglini et. al. 2009).

All 10 allergenic pollen are monitored since 1996. At Tor Vergata university is also operating a meteorological station (SP2000, CAE Bologna, Italy). With pollen and meteorological dataset was created a provisional model for Poaceae. A PLSDA (Partial Least Squares Discriminant Analysis) approach was used in order to predict Poaceae pollen critical concentration (Brighetti et al. 2013)

To preserve spatial correlation between pollens and PM10, we choose a Multiivariate Linear Spatial Interpolation Method to quantify pollen concentration in function of PM10, wind, rain and temperature. A test and validation procedure have been conducted to estimate the error associated to the pollen concentration.

Validation for the year 2012 shows a good agreement between measured and estimated data, in each area depending of orography and of road traffic ($r > 0.83$, $1\% < \text{RRMSE} < 5\%$).

This study aims to be a added value to agro-meteorological data in a different branch from the classic sector of defence and of crop production, emphasizing the importance of monitoring and forecast the pollen dispersal in urban areas, evaluated its effect on health and quality of life. In the health area the combined analysis between climate, pollution and dispersal of pollen allows to realize significant operational tools and to develop a reference for subsequent implementations.