Diurnal Cycles of Bioaerosols in NW Spain

Ana Calvo[1], Delia Fernández-González[2,3], Darrel Baumgardner[4], Amaya Castro[1], Ana María Vega-Maray[2], Rosa María Valencia-Barrera[2], Roberto Fraile[1]

[1]*Department of Physics, IMARENAB University of León, 24071 León, Spain,*

[2]*Biodiversity and Environmental Management, University of León, Spain*

[3]*Institute of Atmospheric Sciences and Climate-CNR, Bologna, Italy*

[4]*Droplet Measurement Technologies Inc, Boulder, CO USA*

roberto.fraile@unileon.es

Abstract

Measurements of aerosol particles at the university campus of León, Spain (42° 36' 50" N, 5° 33' 38" W, 846 m asl), were made in May and June, 2015 with a Wideband Integrated Bioaerosol Spectrometer (WIBS). In addition, an analysis of pollen concentration, assessed by Optical Microscopy of aerosol samples performed with volumetric Hirst spore trap, has been made. The WIBS inlet and Hirst trap were placed on the roof of the Faculty of Veterinary, approximately 15 m above the ground.

WIBS detects particles in the size range from 0.5 to 20 µm and identifies bioaerosols from their fluorescent emissions. The WIBS further differentiates bioaerosols by their equivalent optical diameter (EOD) and the intensity of emissions in two wavebands when excited at 280 nm and 370 nm wavelength. The bioaerosols can be roughly classified as bacteria, fungal spores or pollen grains using their EOD and spectral fingerprints as metrics to compare with a bio-library of bioaerosols that have been compiled from laboratory studies.

The particle population in general shows a diurnal cycle; however, the bioaerosols not only have a more pronounced oscillation, but the fraction of particles that are bioaerosols tend to maximize in the early hours of the morning. The bioaerosol fraction represents almost 25% of the total particle population in the measured size range during this time period, decreasing to < 10% during the day. In addition, there is a strong correlation with the meteorology, i.e. humidity and wind speed. Humidity controls the release mechanisms of some fungal spore species and the liberation of allergens, so it can be a relevant factor to be considered as a possible cause of respiratory allergy phenomena.

Finally, although the majority of the bioaerosols are identified as fungal spores (*Cladosporium, Aspergillus, Alternaria, Oidium*…) and pollen grains (mainly *Poaceae,*

Quercus, Plantago, Rumex and Urticaceae), the highest concentrations are those that do not match any of those that were classified in the bio-library.

The results of this study will be discussed with respect to what is currently known about the production and transport of pollen and fungal spores and their relation to meteorological conditions.

Finally, this study should be considered as a proof of principle about the possibility of using light induced fluorescence methods for aeroallergens detection in ambient air.