Dynamic and thermodynamic forcing of bioaerosol spore production

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Measurements with the Wideband Integrated Bioaerosol Spectrometer (DMT Inc.) have been made in the city of Leon, Spain (42° 36' 50" N, 5° 33' 38" W, 846 masl), during an 18 day period from May 20 – June 6, 2015. Hourly filter samples were also taken for pollen count analysis.

The WIBS measures the equivalent optical diameter (EOD) and the fluorescence of individual particles in three spectra bands when the particle is excited at two wavelengths: 280 nm and 370 nm (Kaye et al., 2005, Huffman et al. 2010). Fluorescing particles are classified into 7 types (Perring et al., 2015) and compared with a library of bacteria, fungi and pollen (Hernandez et al., 2016). Those particles that don't match library types are classified as "other".

Figure 1 is a segment of the time series of wind speed, relative humidity (RH) and the fluorescence fraction (FF) defined as the ratio of all fluorescing particles to the total particles detected. We observe a clear diurnal cycle of all three parameters but out of phase with one another. The maxima in FF always occurs near midnight following the decrease in wind speed to near zero. The FF and RH are increasing at the same time but the FF maximizes before the RH. The cross correlational analysis shows that the FF reaches its maximum approximately two hours after the decrease in wind speed and three hours before the maximum in RH.

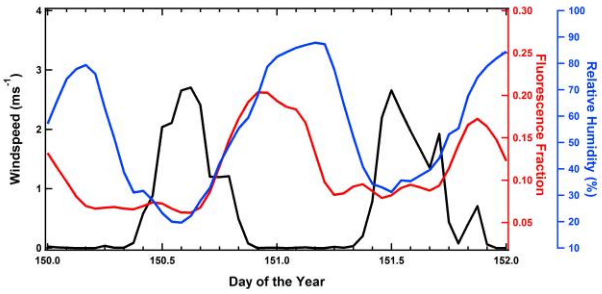

Figure 1. This illustrates the daily trends in wind speed (black), RH (blue) and fluorescence fraction (red).

Table 1. tabulates the bioaerosol components and shows that the increase in FF is partially due to the decrease in the total particle concentration but that the total bioaerosol concentration increases by about 60%, dominated by the increase in pollen-like and "other" bioaerosols. The bacteria remains constant throughout the day, i.e. it is not responding along with either wind speed or RH. In this table we also observe that bacteria, fungi and pollen are 16%, 20% and 25% of the total bioaerosol population. The other remaining 37% of the bioaerosols remain to be identified.

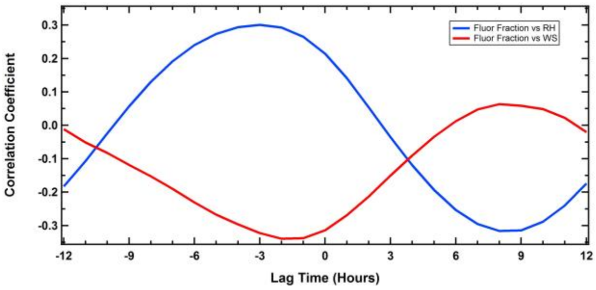

Figure 2. The cross correlations between fluorescence fraction and relative humidity (blue) and wind speed (red) show the temporal relationships.

Table 1. Partitioning of aerosol particle stratified by fluorescent fraction (FF). Concentrations in L^{-1}

Description	Total	FF < 10%	FF ≥ 10%
Total	1501	830	670
Fluorescing	156	60	95
Bacteria Conc.	25	13	13
Bacteria Fraction	0.16	0.2	0.13
Fungi Conc.	31	14	18
Fungi Fraction	0.2	0.22	0.18
Pollen Conc.	40	14	26
Pollen Fraction	0.25	0.23	0.26
Other Conc.	59	20	39
Other Fraction	0.37	0.32	0.41

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