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Understanding the link between meteorology and speciated abundance of bioaerosols in an urban environment using colocated flow cytometry and real-time autofluorescence measurements

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The abundance and speciation of primary biological atmospheric particles (PBAP) has been of great interest due to their potential impact on human health, cloud formation and contribution to atmospheric nutrient deposition [1, 2]. During this study state-of-the-art sampling techniques and protocols have been developed and combined with the speciation of PBAP by flow cytometry (FCM). An effective FCM protocol has been developed to identify and quantify speciated bioaerosols populations. In addition, a Wideband Integrated Bioaerosol Sensor (WIBS) has been used to understand the temporal variability of the PBAP, by measuring the autofluorescence of the atmospheric particles [3]. The techniques developed here have been applied to understand the PBAP variability and abundance in downtown Atlanta under different meteorological conditions. FCM results show the presence of a low nucleic acid (LNA) and a high nucleic acid (HNA) content subpopulation. The contribution of each subpopulation to the total biological atmospheric particles (TBAP) varies depending on the predominant meteorological conditions. Results suggest the HNA subpopulation, named fungal spores, dominates the composition of the TBAP during humid and warm days after rain events. However, during dry episodes the HNA subpopulation is diminished and the LNA subpopulation dominates the composition of the TBAP in downtown Atlanta. WIBS size distribution shifts between dry periods and humid and warm periods agreed well with the LNA and HNA subpopulations behavior. Our finding suggests Atlanta average PBAP concentration is around 1-8 x 10^4 part. /m^3during Spring, where WIBS represents the lower bound and FCM the upper bound of the quantification. Additional experiments performed with different types of pollen, fungi and bacteria were used to better understand the scattering and fluorescence properties of them under different growing phases.

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