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Detection of known biological and non-biological particles by a range of UV-LIF instrumentation

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Biological aerosol particles are an abundant subset of atmospheric aerosol particles which comprise anything biological in nature (commonly referred to as Primary Biological Particles or PBAP). Measurements of atmospheric aerosol particles have been conducted in a range of geographical regions, using real-time, ultra-violet light induced fluorescence (UV-LIF) instruments to investigate PBAP, as opposed to tradition offline measurements methods, such as filter sampling and microscopy. However, understanding the response to different particles by UV-LIF instruments remains uncertain, in particular the way in which these instruments detect and respond to both biological and non-biological particles.

In 2017, a group of UV-LIF instruments participated in a laboratory based experiment using Dstl's Aerosol Challenge Simulator System, in which known particles, including pollens, fungal spores, and bacteria, were released at controlled concentrations. Challenges of pure samples were first conducted for calibration and then used to create time varying mixtures of aerosol particles for evaluation. Instruments participating in the experiment included multiple versions of the Wideband Integrated Bioaerosol Sensor (WIBS), and the Multiparameter Bioaerosol Sensor (MBS).

Here, preliminary results illustrating the ability of different UV-LIF instrumentation to detect different biological and non-biological particles are presented. Analysis of this data using hierarchical agglomerative cluster analysis is also introduced, demonstrating the use of this method for distinguishing and forming clusters for a known range of particles.