Title:
Quantification of Odor Landscapes & Big Data Endeavours in Olfaction Team Science

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Abstract:

Motivated by an interest in olfactory navigation by animals and autonomous vehicles, planar laser-induced fluorescence is used to illuminate the time-varying structure of neutrally buoyant, airborne scalar plumes. Quantitative concentration measurements were obtained using acetone vapor as a surrogate odor in a low-speed wind tunnel. When comparing odor plumes with differing release conditions (ambient flow speed and release height relative to the tunnel bed), notable differences are observed in the spatial distributions of mean concentration, root-mean-square fluctuation, and concentration intermittency. Of particular note, however, are the differences in time-dependent characteristics (rather than time-averaged), since this information is more likely that which is available to an animal or vehicle searching for an odor source within a plume in real time. The utility of our full-field, time-resolved plume data is fully demonstrated in the context of recent team science efforts focused on the fluid dynamics and neuroscience of olfaction (NSF IdeasLab and NSF NeuroNex). To facilitate these collaborative and interdisciplinary team science efforts, a comprehensive data science plan was developed to package and distribute odor plume data and train collaborators in numerous CU Research Computing (CURC) resources. Topics of interest to be discussed and demonstrated live include the following: hierarchical data formats (HDF) as self-contained (data + metadata) and self-consistent (standardized organization and data indexing schemes) structures that streamline distribution and access issues related to big data, development of targeted end user guides and technical documentation, and how to access and utilize CURC storage and computing resources (PetaLibrary, Summit, Blanca Condo Cluster, Jupyter Notebooks, EnginFrame, etc.).