**Data-Based Modeling in Turbulent Combustion: Progress, Challenges and Opportunities**

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Data has played a central role in the development and refinement of turbulent combustion models, primarily through model validation. This data also has provided important insight into strategies to tackle challenges of closure, including the separation of scales or the adoption of low-dimensional manifolds. With the increasing availability of high fidelity of simulation and experimental data, additional opportunities have arisen. These opportunities are related to the construction of turbulent combustion models starting from data. In this talk, some progress on data-based modeling in turbulent combustion is presented. The effort is based on abstracting information from data through the identification of a data-based low-dimensional manifolds. Transport equations and their closure based on the variables characterizing these manifolds are developed and solved. The models are illustrated for the case of data consisting of experimental multiscalar measurements in flames. Data from such measurements is “partial”, since not all species needed for a full account of the chemistry are measured. Strategies to “recover” missing information are needed. Moreover, despite the high quality of the data, minor measurement uncertainty can translate into much higher error in determining reaction rates. Additional challenges associated with the development of robust data-based closure models are identified. The challenges offer unique opportunities for research that invariably rely on insight into the physics, simulation and the development and implementation of physics-informed and physics-constrained machine learning tools.