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**Mixing of temperature and helium in turbulent co-axial jets**[1]
ALAIS HEWES, LAURENT MYDLARSKI, McGill University — There are relatively few studies of turbulent multi-scalar mixing, despite the occurrence of this phenomenon in common processes (e.g. chemically reacting flows, oceanic mixing). In the present work, we study the mixing of two passive scalars (temperature and helium concentration) in turbulent co-axial jets using a novel, 3-wire, thermal-anemometry-based probe designed to simultaneously measure velocity, temperature, and concentration. We emphasize that unlike most previous investigations of multi-scalar mixing, the instantaneous velocity field is measured in addition to the scalar fields, as it is required to fully describe turbulent scalar mixing. Our experiments are performed in vertically oriented co-axial jets consisting of a central jet of helium and air and an annular flow of (unheated) pure air, emanating into a slow co-flow of (pure) heated air (similar to the experimental set-up of Cai et al. (J. Fluid Mech., 2011)). We present measurements made in the near field of the jets, including variances and scalar fluxes, and focus on the evolution of the joint velocity-scalar PDFs, joint scalar PDFs, and the conditional Laplacians of the scalars, which provide valuable data for the testing and development of mixing models.

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