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On the self-preservation of turbulent jet flows with variable viscosity[1] LUMINITA DANAILA, MICHAEL GAUDING, EMILIEN VAREA, University of Rouen Normandy, TURBULENCE AND MIXING TEAM — The concept of self-preservation has played an important role in shaping the understanding of turbulent flows. The assumption of complete self-preservation imposes certain constrains on the dynamics of the flow, allowing to express one-point or two-point statistics by choosing an appropriate unique length scale. Determining this length scale and its scaling is of high relevance for modeling. In this work, we study turbulent jet flows with variable viscosity from the self-preservation perspective. Turbulent flows encountered in engineering and environmental applications are often characterized by fluctuations of viscosity resulting for instance from variations of temperature or species composition. Starting from the transport equation for the moments of the mixture fraction increment, constraints for self-preservation are derived. The analysis is based on direct numerical simulations of turbulent jet flows where the viscosity between host and jet fluid differs. It is shown that fluctuations of viscosity do not affect the decay exponents of the turbulent energy or the dissipation but modify the scaling of two-point statistics in the dissipative range. Moreover, the analysis reveals that complete self-preservation in turbulent flows with variable viscosity cannot be achieved.

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