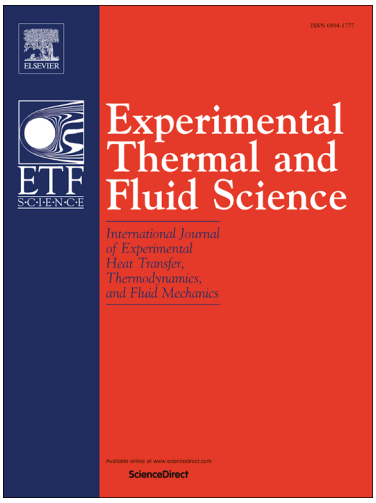

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Local dissipation scales in turbulent jets

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Abstract: This work characterizes the local dissipation length-scale η and its related quantities in turbulent (round and square) jets. It is revealed that the probability density function (PDF) of η, denoted by $Q(\eta)$, displays different shapes in the jet's central region and shear layer. In the central jet of full turbulence, the distribution of $Q(\eta)$ is insensitive to changes in the initial flow conditions and the degree of anisotropy, and agrees well with those obtained previously from a pipe flow and DNS of a box turbulence. On the other hand, the left tail of $Q(\eta)$ at small η rises with increasing lateral distance from the centerline (towards the jet outer region), where the turbulent/non-turbulent intermittency occurs due to jet engulfment of ambient fluid; such large-scale intermittency is expected to enhance fine-scale dissipation intermittency. Therefore, the present work demonstrates that the smallest-scale dissipation fluctuations behave universally as in fully turbulent flows, irrespective of the flow type; but this universality is broken in partially turbulent flows or in flow regions where large-scale intermittency emerges.

Keywords: Turbulent jet; Local dissipation scales; Intermittency; Engulfment

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