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Structure of two-dimensional turbulent wall jets[1] SHIVSAI DIXIT, HARISH CHOUDHARY, ABHISHEK GUPTA, THARA PRABHAKARAN, Indian Institute of Tropical Meteorology (IITM), Pune, Maharashtra, India, ABHAY KUMAR SINGH, Institute of Science, Banaras Hindu University, Varanasi, Uttar Pradesh, India — Two-dimensional turbulent wall jets find important applications in engineering and meteorology, and present unique features such the non-monotone mean velocity profile, a region of counter-gradient momentum diffusion etc. that are very different from other canonical turbulent wall-bounded flows. We propose that the wall-jet flow structure consists of universal full free-jet outer flow and wall-scaled inner flow. We further argue that there exists strong, nonlinear inner-outer interaction which could lead to the Reynolds number dependence of the overlap layer in wall jets. We present experimental hotwire and PIV data from our wall jet setup, over a range of Reynolds numbers, to substantiate this view. Further, an overlap analysis of the mean velocity profile shows that the Reynolds-number-dependence of the overlap layer can be effectively absorbed into an intermediate coordinate leading to universal overlap description in terms of the intermediate variable. Spectra and correlation maps also show promising support for the proposed structure of wall jets.

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