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Inter-scale modulation in pipe flows at high Re_τ[1] XIAOBO ZHENG, YE LI, NAOCE, Shanghai Jiao Tong University, GABRIELE BELLANI, LUCIA MASCOTELLI, ALESSANDRO TALAMELLI, Dipartimento di Ingegneria Industriale, Università di Bologna — Hot-wire measurements of streamwise velocity are conducted in the large-scale pipe-flow facility CICLoPE in the friction Reynolds number range $7800 < Re_\tau < 40\,000$. Measurements have been performed both with a rake of 5 synchronized probes arranged at different radial locations, and through radial scans with a single wire traversing the whole pipe radius. Correlation analysis is used to extract geometric features of coherent structures and inter-scale modulation in turbulent pipe flows. The Re_τ-independence of geometric features is shown. Very-large-scale motions keep inclining and vertical coherence to the wall in the whole pipe radius, while large-scale motions with local coherence gradually become isotropy as reference moves far away from the wall. One-point and two-point amplitude modulation (AM) show that phase difference between large- and small-scales is linear to logarithm of y/R for AM, but is independent on wall-normal location for opposite modulation. In log layer, time-delay for zero-modulation present linear-log relation to y/R, but in whole pipe radius, zero-modulation keeps inclining with 4 degree in ρ^{12}_{AM} map.

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