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Space-scale unfolding mechanism in canonical multi-scale flows¹ PAWEL BAJ, PAUL J.K. BRUCE, OLIVER R.H. BUXTON, Imperial College London — Some recent studies on fractal generated turbulence revealed a highly increased transverse turbulent scalar flux downstream of fractal grids compared to regular grids. The complexity of these flows makes it impossible to track the origins of this phenomenon, often referred to as the space-scale unfolding mechanism (SSU). Thus research on flows past canonical examples of single and multi-scale obstacles, which are arrays of bars of the same and different thicknesses, was undertaken in order to investigate the SSU's roots. The velocity field and the scalar concentration field were measured simultaneously downstream of the obstacles by means of particle image velocimetry and laser induced fluorescence techniques. It is observed that the concentration field behind the multi-scale obstacle undergoes intense quasiperiodic transverse scalar bursts, which are believed to be the manifestation of the SSU, whereas such events are either weak or absent in the single scale configuration. Investigation of the velocity field reveals a phase locking between wakes of different scale objects in terms of the phase-conditioned transverse integral length scale. Both phenomena are observed to be triggered at the downstream position corresponding to the wakes' intersection point.

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