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Two-Scale Interaction in Near-Wall Turbulence PATRICK DOOHAN, Imperial College London, ASHLEY P. WILLIS, University of Sheffield, YONGYUN HWANG, Imperial College London — It has been shown that the dynamics of individual energy-containing eddies in the hierarchy of wall-bounded turbulence (Townsend,1980) are governed by the self-sustaining process (SSP) (Hwang & Bengana,2016). However, multiscale flows also exhibit interaction between structures of different scales, notably the energy cascade, but the temporal dynamics of multiscale turbulence are not well understood. In this study, the temporal dynamics of a two-scale near-wall flow are investigated using a shear stress-driven model (Doohan et al.,2019). In addition to the SSP at each scale, the energy cascade and feeding from small- to large-scales are identified as the primary scale interaction processes. The energy cascade is most active during the streak-breakdown stage of the large-scale SSP and the timescale of the resulting small-scale dissipation matches that of the large-scale motion i.e. non-equilibrium cascade. The wall-normal cascade can also fuel small-scale production, driving the small-scale SSP. The feeding of large-scale structures is correlated with the streak-breakdown stage of the small-scale SSP and results in increased large-scale pressure transport and dissipation. In the presentation, the dynamics of the two-scale interaction system will be discussed in detail.

Patrick Doohan
Imperial College London

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