Abstract Submitted
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Streamwise mean flow and turbulent intensity profiles in turbulent pipe flow JOHN CHRISTOS VASSILICOS, Imperial College London, JEAN-PHILIPPE LAVAL, Universite Lille 1 and CNRS, JEAN-MARC FOUCAUT, MICHEL STANISLAS, Ecole Centrale Lille, IMPERIAL-LILLE COLLABORATION — The Townsend-Perry attached eddy spectral model predicts that theintegral length-scale varies very slowly with distance to the wall inthe intermediate layer. The only way for the integral length scale'svariation to be more realistic while keeping with the Townsend-Perryattached eddy spectrum is to add a new wavenumber range to the modelat wavenumbers smaller than that spectrum. This necessary additionalso accounts for the high Reynolds number outer peak of the turbulentkinetic energy in the intermediate layer. An analytic expression isobtained for this outer peak in agreement with extremely high Reynoldsnumber data by Hultmark, Vallikivi, Bailey & Smits (2012,2013). Townsend's (1976) production-dissipation balance and thefinding of Dallas, Vassilicos & Hewitt (2009) that, in theintermediate layer, the eddy turnover time scales with skin frictionvelocity and distance to the wall implies that the mean flow gradienthas an outer peak at the same location as the turbulent kineticenergy. This is seen in the data of Hultmark, Vallikivi, Bailey Smits (2012, 2013). The same approach also predicts that the mean flowgradient has a logarithmic decay at distances to the wall larger thanthe position of the outer peak. This qualitative prediction is alsosupported by the aforementioned data.

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