Abstract Submitted
for the DFD20 Meeting of
The American Physical Society

Revisiting Townsend's attached eddy model with resolvent analysis: computations up to extremely high Reynolds number NIKOLAOS SKOULOUDIS, YONGYUN HWANG, Imperial College London — The quasi-linear approximation subject to a stochastic forcing was recently found to be able to qualitatively replicate spanwise wavenumber spectra and turbulent intensities at a significantly lower cost compared to DNS. In this study the quasi-linear approximation is revisited in the resolvent analysis framework, further reducing the computational cost and hence making the latter a useful tool for high Re_τ regimes. The velocity field was decomposed such that the non-linear form of the mean was used whilst the fluctuating velocity was modelled by replacing the non-linear term with an eddy-viscosity-based turbulent diffusion and forcing. Under this model the fluctuating velocity equation allows the superposition of solutions, making the current approximation directly comparable to Townsend's attached eddy model. Thus the forcing was determined self-consistently by minimising the difference between the Reynolds shear stresses obtained from the mean and fluctuating velocity equations. The proposed quasi-linear approximation up to $Re_\tau = 2 \times 10^5$ showed that the near-wall streamwise peak intensity scales favourably with the one proposed by Monkewitz & Nagib (2015, J. Fluid Mech. 783:474-503). In the final presentation the result up to $Re_\tau = 2 \times 10^6$ will be shown.

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Date submitted: 02 Aug 2020 Electronic form version 1.4