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On the distribution of the streamwise fluctuation velocity in wall bounded flows P. HENRIK ALFREDSSON, RAMIS OERLUE, ANTONIO SEGALINI, Linne FLOW Centre, KTH Mechanics, Royal Institute of Technology, Stockholm, Sweden — The streamwise velocity fluctuations in wall-bounded flows has recently received renewed interest. Measurements and simulations at low Reynolds numbers (Re), as well as high Re wind tunnel studies and data from the atmospheric boundary layer (ABL) are at hand but show sometime conflicting trends with Re. However, high Re data often have some uncertainties associated with them, such as poor spatial resolution for laboratory data or other uncertainties associated with ABL experiments. Several models for the wall normal distribution of u_{rms} have recently been proposed, based on various physical ideas together with empirical inputs. Here we propose a new model based on two observations: a) u_{rms} normalized with the local velocity U decreases linearly with respect to U/U_∞ in the outer part of the flow, b) in the inner region u_{rms}/U deviates from the linear trend at a specific value of $U/u_\tau(\approx 17)$, where u_τ is the friction velocity. Using this information it is possible to formulate a composite description of u_{rms} in the wall normal direction for all Reynolds numbers. This shows two important results, namely the increase in u_{rms}/u_τ with Re as well as a prediction of a second "outer" maximum when Re is high enough, a debated feature that has been observed in ABL experiments as well as in some laboratory experiments at high Re.

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