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High-Reynolds number turbulent boundary layers studied by numerical simulation PHILIPP SCHLATTER, QIANG LI, GEERT BRETHOUWER, ARNE V. JOHANSSON, DAN S. HENNINGSON, KTH Mechanics, Stockholm, Sweden — Direct and large-eddy simulations (DNS and LES) of spatially developing high-Reynolds number turbulent boundary layers (Re_θ up to 4300) under zero pressure gradient are studied. The inflow of the computational domain and the tripping of the boundary layer is located at low Reynolds numbers $Re_\theta \approx 350$, a position where natural transition to turbulence can be expected. The simulation thus includes the spatial evolution of the boundary layer for an extended region, providing statistics and budget terms at each streamwise position. The data is obtained with up to $O(10^{10})$ grid points using a parallelised, fully spectral method. The DNS and LES results are critically evaluated and validated, in comparison with other relevant data, *e.g.* the experiments by Österlund *et al.* (1999). Quantities difficult or even impossible to measure, *e.g.* pressure fluctuations and complete Reynolds stress budgets, shall be discussed. In addition, special emphasis is put on a further quantification of the large-scale structures appearing in the flow, and their relation to other wall-bounded flow as *e.g.* channel flow. The results clearly show that with today's computer power Reynolds numbers relevant for industrial applications can be within reach for DNS/LES.

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