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Dynamic high-pass filtered eddy-viscosity models for LES of turbulent boundary layers PHILIPP SCHLATTER, LUCA BRANDT, TOMAS BRUHN, DAN S. HENNINGSON, KTH Mechanics, Stockholm, Sweden — Turbulent flow in a spatially developing boundary layer is simulated by large-eddy simulation (LES) employing a dynamic version of the high-pass filtered (HPF) eddy-viscosity approach. With these models, an a-priori spatial scale separation is performed via a filter with constant filter width acting in physical space. To close the governing equations, only the small- scale (i.e. high-pass filtered) fraction of the velocities are considered to compute the model terms, similar to the multiscale approach. Standard subgrid closures as e.g. the Smagorinsky model or the relaxation-term model are used. The dynamic determination of the model coefficient is based on a consistent formulation of the Germano/Lilly procedure. To this end it is necessary to introduce suitable high-pass filters for both the grid and the test-filter level. Simulations are performed based on spectral discretisation. Results are presented for zero-pressure gradient turbulent boundary-layer flow with Re_θ up to 1800. Additionally, computations with an adverse-pressure gradient, eventually leading to a separated boundary layer, are also shown. Comparisons are made to experimental data, direct numerical simulations and LES employing standard subgrid-scale closures.

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