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Quality and reliability of general purpose finite volume solvers for the simulation of atmospheric boundary layer flow BEATRICE GIACOMINI, MARCO GIOMETTO, Columbia University in the City of New York — In the present work, the quality and reliability of a colocated, unstructured, finite-volume solver (OpenFOAM framework) is analyzed for the simulation of a pressure-driven atmospheric boundary layer flow. First and second order statistics, as well as velocity spectra and two-point velocity correlations, are compared to predictions from a "battle-tested" pseudo-spectral solver. The solution is found to be particularly sensitive to the grid aspect ratio and to the chosen numerical scheme. First and second order statistics obtained using a non-dissipative setup compare well between the solvers, with the finite volume one featuring an overdissipative behavior that leads to enhanced sub-grid scale stress contributions. When considering velocity spectra, the finite volume solver features a rapid decay of energy density within the inertial subrange, irrespectively of the discretization scheme that is adopted. In addition, a spurious pile up of energy density at high wave numbers is observed across all of the considered cases. The cause of this behavior will be discussed and mitigation strategies proposed.

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