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DNS-data-driven subgrid-scale scalar flux model for turbulent spatially evolving flows[1] ORIOL LEHMKUHL, Barcelona Supercomputing Center, Barcelona, Spain, GUILLERMO ARAYA, HPCVLab, U. of Puerto Rico-Mayaguez — The evolution of passive scalars (Pr = 0.2 and 0.71) in spatially-developing turbulent boundary layers (SDTBL) is numerically studied in zero-pressure gradient flows. Direct Numerical Simulation (DNS) is performed at high Reynolds numbers ($Re_\theta \approx 2500$). Turbulent inflow information is generated via the dynamic multiscale rescaling-recycling approach (J. Fluid Mech., 670, pp. 581-605, 2011). Furthermore, the Integral Length-Scale Approximation with Subfilter-Scale Stresses (hereafter, ILSA SFS) model, as proposed by Rouhi et al. (PHYSICAL REVIEW FLUIDS 1, 044401, 2016), is extended to consider passive scalar transport in a suite of Large Eddy Simulation (LES) for the first time. Similar to the momentum equation treatment, an SFS activity (based on thermal fluxes) is proposed, which is related to the thermal integral length scale. The model is explored and assessed by direct comparison with the DNS database and the classical turbulent Prandtl number approach. The present LES modelling effort is assessed via low/high order statistics computation, energy budget analysis of thermal fluctuations and coherent structure study.

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Guillermo Araya
HPCVLab, U. of Puerto Rico-Mayaguez

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