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A spectral multidomain penalty method model for high Reynolds number incompressible flows JORGE ESCOBAR-VARGAS, PETER DIAMESSIS, Cornell University — We present our latest results towards the development of a spectral multidomain penalty method-based incompressible Navier-Stokes solver for high Reynolds number stratified turbulent flows in doubly non-periodic domains. Temporal discretization of the governing equations is based on three fractional steps (explicit advancement of nonlinear terms and implicit treatment of pressure and viscous terms). The spatial discretization uses a Legendre collocation approach in discontinuous quadrilateral subdomains. Numerical stability is enabled through a penalty scheme, spectral filtering and appropriately defined dealiasing. The conditioning of the linear system associated with the discretized Poisson equation for the pressure is analyzed in detail. In addition, the efficiency of various preconditioning strategies such as diagonal and block Jacobi, finite difference, and additive Schwartz are investigated. Finally, the efficiency and accuracy of the Navier Stokes solver are assessed through application to select test cases.

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