Abstract Submitted
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Thermodynamic effects during vortex reconnection JEAN-PIERRE HICKEY, University of Waterloo — Thermodynamic and compressibility effects during vortex reconnection are studied using fully-resolved, high-order direct numerical simulations. The bridging and reconnection of coherent structures is believed to play a key role in the understanding of the turbulent energy cascade as it provides a mechanism for the energy transfer from the large scale down to the dissipation scale. Previous studies have focused on the incompressible cases to understand the hydrodynamics of reconnection process. Here, the focus lies on the thermodynamic effects, more specifically, the temperature and density changes and concomitant thermophysical variations resulting from the large pressure gradients at the time of reconnection. The initial setup replicates the anti-parallel vortex configuration proposed by Melander and Hussain (CTR Summer program, 1988). The simulations are conducted with a third-order in time, sixth-order compact finite difference (in space) schemes for the solution of the fully compressible, Navier–Stokes equations at Reynolds numbers (circulation/viscosity) from 1000 to 5000. The results will highlight the importance of the thermodynamic effects during the reconnection process and the dependence on the local Mach number of the flow.

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