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Reynolds Number Effects on Vortex Merging Criterion SCOTT CARLSON, PATRICK FOLZ, KEIKO NOMURA, University of California, San Diego — Asymmetric vortex pair interactions are effectively characterized by a mutuality parameter, $MP = S_1/S_2$, which compares the relative straining, $S_i = s_i/w_i$, experienced by each vortex (Folz and Nomura, JFM 2017). When S_1 and S_2 are comparable, $MP \approx 1$, a two-way interaction ensues: both vortices undergo core detrainment ($S_i > S_{cr}$), which enables a mutual entrainment process to form a compound vortex. As relative straining becomes more disparate, mutuality is diminished until $MP > MP_{cr}$, and the interaction is one-way: one vortex detrains and is destroyed by the other, which remains unaffected. The value of the merging criterion, MP_{cr}, differed for the values of Re = 1000 and 5000 considered. In this study, a range of $Re = 250$ to 50000 is investigated using numerical simulations. Three flow regimes are identified: when $Re < 500$, diffusion dominates, and in the absence of convection, MP_{cr} is not observed; when $500 < Re < 5000$, convective processes become significant, MP_{cr} emerges and is inversely dependent on Re; and when $Re > 5000$, convection dominates and MP_{cr} is independent of Re. These results provide insight to more complicated flows, such a 2D turbulence, which are driven by asymmetric vortex interactions occurring over a range of Re.

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