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A numerical study of flow around a sedimenting particle in a linearly stratified fluid at small Reynolds numbers HOJUN LEE, CHANGHOON LEE, Yonsei Univ — Falling heavy particles are frequently found in the atmosphere or the ocean which is typically thermally stratified. In this study, numerical simulations are conducted for flow around a sedimenting sphere at low Reynolds number embedded in linearly stably stratified or linearly unstably stratified fluid using the decoupled monolithic projection method in order to investigate the effect of the stratification on the characteristics of flow over a sphere. Fluid considered in this study is air and water. The range of Reynolds number considered is $0.01 \leq Re \leq 10$ based on the sedimenting velocity and the sphere diameter, and the Rayleigh numbers are in the range of $10^{-5} \leq Ra \leq 1$, where Ra is defined by $Ra = g\beta\gamma d^4/\kappa\nu$ based on the temperature gradient γ and the sphere diameter d. From simulations we observed a modification in drag and the flow structure due to stratification. The normalized enhanced drag coefficient linearly increases with Ra for very low Ra and increases with 1/3 power of Ra for large Ra. The unstably stratified fluid is found to decrease the drag for limited range of Rayleigh numbers beyond which the flow becomes unstable.

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