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Passive scalar diffusion in stratified sheared turbulence HIDESHI HANAZAKI, Kyoto University — Differential diffusion of a passive scalar and an active scalar/density in stratified shear flow is considered when both the density and the passive scalar have a mean vertical gradient. Using the solution by rapid distortion theory for stratified sheared turbulence (Hanazaki & Hunt, 2004), vertical diffusion of the passive scalar and its difference from the vertical density flux could be obtained. For inviscid and non-diffusive flow, the results show dependence on initial conditions similar to the unsheared flow. Namely, passive scalar flux has a 'slow mode' oscillating at a nearly half frequency of the density flux only if there are some initial correlations between density and passive scalar or if there are some initial potential energy due to the density fluctuations. For the special but typical case of Pr=Sc=1, which is often used in direct numerical simulations, analytical expressions for the turbulent fluxes could be obtained and we note again the similar dependence on initial conditions which would persist as long as the turbulence do not forget the initial conditions due to strong nonlinearity. We will show how the molecular diffusion and the initial conditions affect the subsequent time development of the turbulent fluxes, in particular the difference between the passive and active scalars.

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