Abstract Submitted
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Schmidt number effects in turbulence with active scalars[1] P.K. YEUNG, K. RAVIKUMAR, Georgia Tech — Active scalar turbulence refers to problems characterized by two-way couplings between the velocity field and one or more diffusing scalars, typically via small changes in the fluid density leading to buoyancy forces which may either suppress or amplify motions in the vertical. Although the most common examples are of temperature fluctuations in air or water, of Schmidt (Prandtl) numbers (Sc) 0.72 and 7 respectively, important applications also arise where $Sc \gg 1$ (such as salinity in the ocean) and $Sc \ll 1$ (such as in conducting fluids of high diffusivity). The physics is most intriguing when two scalars with different molecular diffusivities having opposing stabilizing versus de-stabilizing influences are present, where differential diffusion clearly plays a pivotal role. We have performed direct numerical simulations with one or two active scalars treated with the well-known Boussinesq approximation, with a focus Schmidt numbers substantially below unity. We use results on Reynolds stress budget and spectral transfer to draw attention to contrasts in particular between flows where the stabilizing influence is provided by a scalar of low versus moderate Schmidt number, with or without another scalar providing a de-stabilizing effect.

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