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Modelling stratified wall-bounded turbulence using resolvent analysis[1] MUHAMMAD AHMED, ANDREW THOMPSON, BEVERLEY MCKEON, California Institute of Technology — The effects an active scalar has on incompressible wall-bounded turbulence are investigated using the resolvent framework (McKeon & Sharma, 2010, JFM). The state of the flow system is expressed as the result of applying the linear resolvent operator to the nonlinear terms in the governing Navier-Stokes equations with the Boussinesq approximation. To investigate the relationship between velocity and scalar fluctuations, the formulation is extended to include a scalar equation (Dawson et al., 2018, AIAA) and a scalar component acting in the wall-normal direction in the momentum equations. It is found that the Richardson number has a significant effect on the shape and phase of the velocity and scalar modes across the critical layer. In addition, it is shown that active scalar modes have a significant impact on the energy transfer between velocity mode components at varying scales. Furthermore, we visualise mode combinations that are representative of coherent structure observed in the atmosphere and oceans to gain a better understanding of the spatial wavenumber spectrum observed in nature.

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Muhammad Ahmed
California Institute of Technology

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