Abstract Submitted
for the DFD11 Meeting of
The American Physical Society

Linear analysis of transient growth in stably-stratified, turbulent channel flow[1] JUAN CARLOS DEL ALAMO, MAE Department, UC San Diego, CARLOS YANEZ, School of Aeronautics, Universidad Politecnica de Madrid, MANUEL GARCIA-VILLALBA, Dept. of Aerospace Engineering and Bioengineering, U Carlos III Madrid — We studied stably-stratified, fully-developed, turbulent channel flow using linear stability analysis. The analysis considered the mean velocity and density profiles extracted from DNS [1] calculations as base flow, and included a linear model to represent the energy dissipation and scalar diffusion felt at the large scales as a consequence of the small scales. The flow was found to be asymptotically stable in all cases but transient growth of initial perturbations was observed. The perturbations showing maximal transient growth corresponded well with spanwise waves in the center of the channel and with streaks in the near wall region, which were both observed in the DNS. In particular, their sizes and convection velocities were reasonably well predicted by the linear model. Component-wise analysis revealed that, while the streaks were formed by the vertical stirring of mean shear, the transient amplification of the spanwise waves was reminiscent of the Orr mechanism.

[1] M. García-Villalba and Juan C. Del Álamo, Turbulence modification by stable stratification in channel flow. Phys. Fluids, 23:045104, 2011.

[1]Supporte by the German Research Foundation, Project GA 1360/2-1.

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Date submitted: 13 Aug 2011 Electronic form version 1.4