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Diagnosing balance in rotating stably stratified turbulence

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In this work we perform a number of numerical simulations to investigate freely decaying, rotating stratified turbulence. Previous studies have shown that two distinct types of motion occur in geophysical turbulence: slow motions associated with potential vorticity advection (so called balanced motions) and fast oscillations due to the emission of inertia-gravity waves (imbalanced motions). Here we examine how geophysical turbulence varies with Rossby number. Using a new technique (Dritschel & Viudez, 2004) we extract the balanced and imbalanced part of the flow at particular times and analyse how this varies with Rossby and Froude numbers. Results indicate the dominance of balanced motions for surprisingly large Rossby number. Although imbalanced motions increase with increasing Rossby number, their influence is significantly weaker than the balanced motions. For low Rossby numbers the dynamics of rotating stratified turbulence is extremely similar to quasi-geostrophic turbulence.