

Abstract Submitted
for the DFD12 Meeting of
The American Physical Society

The critical layer for gravity waves in sheared rotating stratified flows CHRISTOPHE MILLET, CEA, DAM, DIF, F-91297 Arpajon, France, FRANCOIS LOTT, LMD-CNRS, ENS Paris, F-75231 Paris cedex 5, France — We re-examined the propagation of gravity waves through a critical layer surrounded by two inertial levels in the case of a constant vertically sheared flow. This problem involves a transition from balanced (where the quasi-geostrophic approximation applies) to sheared gravity waves. The three-dimensional disturbance is described analytically using both an exact solution and a WKB approximation valid for large Richardson numbers. In contradiction with past studies which show that there is finite reflection and did not analyse the transmission (Yamanaka and Tanaka, 1984), we find that reflection is extremely too small to be significant. The reasons that previous authors made incorrect evaluations are related to the fact that (i) the equations yielding to these results are extremely involved and (ii) the values of reflection and transmission coefficients are exponentially small or null, e.g. quite difficult to cross check numerically. Interestingly, these values are exactly like in the much simpler non-rotating case analysed by Booker and Bretherton (1966). Some practical implications for the problem of the emission of gravity waves by potential vorticity anomalies, analysed recently in Lott et al. (2013), are also discussed.

Christophe Millet
CEA, DAM, DIF, F-91297 Arpajon, France

Date submitted: 24 Oct 2012

Electronic form version 1.4