Abstract Submitted
for the DFD14 Meeting of
The American Physical Society

On the two families of instability waves in rotating stratified media CHRISTOPHE MILLET, CEA, DAM, DIF, JACQUES VANNESTE, University of Edinburgh, FRANCOIS LOTT, LMD, Ecole Normale Superieure — We re-examine the related problems of baroclinic instability of parallel shear flows, concentrating on the unbounded rotating stratified case. Two families of instability waves, each having a distinct 3D wave pattern and propagation characteristics, have been found. The key feature of one of the families of waves is the spatial transition, at the inertial critical level, from a balanced edge wave near the ground to gravity waves aloft. It is shown that at small Rossby numbers the classical WKB approach would fail to give even a first-order instability wave solution. A global solution based on the method of matched asymptotic expansions is constructed. Matching is carried out in a region where both the quasi-geostrophic and linear approximations hold. Matching the exponentially small terms that arise from the feedback of the inertia-gravity waves on the surface motion can be used to close the potential-temperature dynamics thereby providing a new model of surface dynamics. For large Rossby numbers, another family of instability waves has been found. This family of waves does not appear to have been clearly identified and systematically studied before. The physical mechanisms which give rise to this family of waves are discussed and reported here.

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Date submitted: 31 Jul 2014 Electronic form version 1.4