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The Primitive equations at small viscosity

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In this presentation, we are interested in the behavior of the solution of the primitive equations (PEs) when the viscosity is very small. The PEs are the central equations for the large scale motion of the ocean and the atmosphere. Beside the general interest of determining the behavior at small (realistic) viscosity of the PEs, there is another major motivation of this study. Indeed, it is already known that the inviscid PEs are well-posed for many different sets of boundary conditions and it is then important to determine the boundary conditions corresponding to the inviscid limit of the viscous equations. One of the aims of this work is to solve this problem for the case under consideration. It is then proved that the PEs solution behaves like the corresponding inviscid problem solution inside the domain plus an explicit corrector function in the neighborhood of some parts of the boundary. Two cases are considered; the subcritical and supercritical modes depending on the fact that the frequency mode is less or greater than the ratio between the reference stratified flow (around which we linearized) and the buoyancy frequency. The problem of boundary layers for the PEs is of new type since the corresponding limit problem displays a set of (unusual) nonlocal boundary conditions.