Rotating Fluids in a Half-Space: The Ekman Boundary Layer Problem

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The *boundary layer* in the theory of rotating fluids, known as the *Ekman layer*, appears between a uniform geostrophic flow and a solid boundary at which the no slip condition applies. The observed effect inside the Ekman layer, i.e. close to the boundary, is that the flow vector behaves as a growing spiral, the *Ekman spiral*, converging to the geostrophic flow by increasing the distance to the boundary.

Mathematically this situation is modeled by the Navier-Stokes equations with Coriolis force in a half-space. The Ekman spiral is an (time-independent) exact solution of this nonlinear problem. We will discuss existence and uniquness of (time-) local strong solutions for a certain class of initial data including the Ekman spiral solution. The main difficulties arising in this approach are caused by the choice of the spaces of initial data. Since the Ekman spiral solution depends on the normal component only, the usual approach by using Lebesgue spaces is not appropriate. Instead we have to deal with spaces of initial data nondecreasing at infinity, which do not share several of the useful properties of Lebesgue spaces.