Texas Tech University. Applied Mathematics Seminar.

# NAVIER-STOKES EQUATIONS IN THIN DOMAINS WITH NAVIER FRICTION BOUNDARY CONDITIONS

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ABSTRACT. We study some problems in geophysical fluids dynamics. Our focus is the Navier-Stokes equations in a 3D domain $\Omega_\varepsilon$ with non-trivial topography and the depth of order $0(\varepsilon)$, as $\varepsilon \to 0$. The velocity field is subject to the Navier friction boundary condition on the bottom and top boundaries of $\Omega_\varepsilon$. Unlike our previous work, here we consider the case when the friction coefficients are of exact order $\varepsilon^\delta$, for $\delta \in [0, 1]$, and no conditions are imposed on the domains. It is shown that if the initial data, resp., the body force, belongs to a large set of $H^1(\Omega_\varepsilon)$, resp., $L^2(\Omega_\varepsilon)$, then the strong solution of the Navier-Stokes equations exists for all time. For the proof, we establish a uniform Korn inequality without any restrictions on the domains; study of the dependence of the Stokes operator on $\varepsilon$; and obtain a strong non-linear estimate in which we analyze the interactions between the boundary condition and the inertial term in the Navier-Stokes equations.