

# Relaxation approximation and asymptotic stability of stratified solutions to the Incompressible Porous Media equation

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## Abstract

In this joint work with Roberta Bianchini and Marius Paicu, we address the existence of stably stratified solutions to the two-dimensional Boussinesq equations with damped vorticity. We justify its nonlinear asymptotic stability for initial perturbations in  $\dot{H}^{1-\tau}(\mathbb{R}^2) \cap \dot{H}^s(\mathbb{R}^2)$  with  $s > 3$  and  $0 < \tau < 1$ . In addition, uniform estimates with respect to the damping parameter allow us to establish the strong relaxation limit of the Boussinesq system towards the Incompressible Porous Media equation (IPM) under a suitable scaling. And, as a byproduct, we deduce the global well-posedness of (IPM) in the same regularity setting. A crucial point of our analysis is the use of an anisotropic Littlewood-Paley decomposition to derive new bounds on the vorticity.