Abstract Submitted
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Electromagnetically driven dipolar vortices in shallow fluid layers SERGIO CUEVAS, ALDO FIGUEROA, Universidad Nacional Autonoma de Mexico, FRANCOIS DEMIAUX, INSA-Lyon, France, EDUARDO RAMOS, Universidad Nacional Autonoma de Mexico — Steady dipolar vortices continuously driven by electromagnetic forcing in a shallow layer of an electrolytic fluid are studied experimentally and theoretically. The driving Lorentz force is generated by the interaction of a D.C. uniform electric current injected in the thin layer and the magnetic field produced by a small dipolar permanent magnet. Using Particle Image Velocimetry, velocity profiles in the neighbourhood of the zone affected by the non-uniform magnetic field were obtained in planes parallel to the bottom wall, as well as in planes normal to this wall. A quasi-two-dimensional finite difference numerical model, based on the low-magnetic Reynolds number approximation, was developed to describe the experimental results. The Navier-Stokes equation includes not only the forcing term due to the injected current but also a term that involves induced currents and that brakes the flow in the bulk. The effect of the bottom wall was modeled through a Hartmann-Rayleigh friction term that accounts for both the Hartmann braking within the zone of high magnetic field strength and the viscous Rayleigh friction in regions where the magnetic field is negligible. A good quantitative agreement between experimental and numerical results was found within the explored range of Reynolds numbers.

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