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Three-dimensionality of one- and two-layer electromagnetically driven thin-layer flows BENJAMIN MARTELL, JEFFREY TITHOF, DOUGLAS KELLEY, University of Rochester — We measure and compare the out-of-plane motion in a variety of experimental models for approximating two-dimensional chaotic and turbulent flow. It was previously found that out-of-plane motion grows suddenly when the viscous Reynolds number Re exceeds a critical value Re_c in a two-layer miscible electromagnetically driven flow model. Here, our goal is to determine whether similar onsets occur in two-layer immiscible models and in single-layer models, and how the critical values depend on thickness. We use particle tracking to measure the flow velocity and use a least-squares projection onto stream function modes, boundary modes, and potential modes to quantify out-of-plane motion. We also consider how the magnitude of out-of-plane motion depends on the Rayleigh friction Reynolds number Rh. We find that immiscible and single-layer models approximate two-dimensional flow better than miscible models in most situations.

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