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.