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QUAGMIRE v1.3: a quasi-geostrophic model for investigating rotating fluids experiments

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The QUAGMIRE model has recently been made freely available for public use. QUAGMIRE is a quasi-geostrophic numerical model for performing fast, high-resolution simulations of multi-layer rotating annulus laboratory experiments on a desktop personal computer. This presentation describes the model's main features.

QUAGMIRE uses a hybrid finite-difference/spectral approach to numerically integrate the coupled nonlinear partial differential equations of motion in cylindrical geometry in each layer. Version 1.3 implements the special case of two fluid layers of equal resting depths. The flow is forced either by a differentially rotating lid, or by relaxation to specified streamfunction or potential vorticity fields, or both. Dissipation is achieved through Ekman layer pumping and suction at the horizontal boundaries, including the internal interface. The effects of weak interfacial tension are included, as well as the linear topographic beta-effect and the quadratic centripetal beta-effect. Stochastic forcing may optionally be activated, to represent approximately the effects of random unresolved features. A leapfrog time stepping scheme is used, with a Robert filter. Flows simulated by the model agree well with those observed in the corresponding laboratory experiments.