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Regimes of axisymmetric flow in a rotating annulus with local convective forcing[1] HELENE SCOLAN, Department of Physics, University of Oxford, Atmospheric, Oceanic & Planetary Physics, SYLVIE SU, Ecole Normale Superieure de Lyon, France, ROLAND M.B. YOUNG, PETER L. READ, Department of Physics, University of Oxford, Atmospheric, Oceanic & Planetary Physics
— We present a numerical study of axisymmetric flows in a rotating annulus convectively forced by local thermal forcing via a heated annular ring at the bottom near the external wall and a cooled circular disk near the centre at the top surface. This new configuration is a variant of the classical thermally-driven annulus analogue of the atmosphere circulation, where thermal forcing was previously applied on the sidewalls. Two vertically and horizontally displaced heat sources/sinks are arranged so that, in the absence of rotation, statically unstable convection would be induced above the source and beneath the sink, thereby relaxing strong constraints placed on background temperature gradients in previous setup. By using the Met Office/ Oxford Rotating Annulus Laboratory code, we investigated a series of equilibrated, 2D axisymmetric flows for a large range of dimensionless parameters and characterized them in terms of velocity and temperature fields. Several distinct flow regimes were identified, depending upon the rotation rate and strength of differential heating. These regimes will be presented with reference to variations of horizontal Ekman layer thickness versus the thermal boundary layer thickness and corresponding scalings for various quantities such as the heat transport.

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