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PIV- and LDV-measurements of baroclinic wave interactions in a thermally driven rotating annulus

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We present results of experiments in a rotating, baroclinic annulus of fluid. The apparatus is a differentially heated cylindrical gap with a flat bottom topography and a free surface, rotated around its vertical axis of symmetry, cooled from within, and filled with de-ionised water as working fluid.

We used multivariate statistical techniques to understand better the variability of the heated rotating flow (a) in the transition region between regular waves of different zonal wave number, and (b) in the transition region to the quasi-chaotic regime. The former regime is studied by applying the Complex Empirical Orthogonal Function (CEOF) method to Particle-Image-Velocimetry (PIV) data, the latter by applying the Multi-Channel Singular Spectrum Analysis (M-SSA) to Laser-Doppler-Velocimetry (LDV) data. In the annulus, interactions between the dominant mode and so called weaker modes can lead to low-frequency amplitude and wave structure vacillations. Our results complement previous observations recovered primarily by thermocouple arrangements.