Abstract Submitted
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**Measuring the departures from the Boussinesq approximation in Rayleigh-Bénard convection experiments**[1] HÜSEYIN KURTULDU, MICHAEL SCHATZ, Georgia Institute of Technology, KONSTANTIN MISCHAIKOW, Rutgers University — Algebraic topology (homology) is used to characterize quantitatively non-Oberbeck-Boussinesq (NOB) effects in weakly turbulent Rayleigh-Bénard convection patterns from laboratory experiments. For fixed parameter values, homology analysis yields a set of Betti numbers that can be assigned to hot upflow and, separately, to cold downflow in a convection pattern. Analysis of data acquired under a range of experimental conditions where NOB effects are systematically varied indicates the difference between time-averaged Betti numbers for hot and for cold flow can be used as an order parameter to measure the strength of NOB-induced pattern asymmetries. This homology-based measure not only reveals NOB-effects that Fourier methods and measurements of pattern curvature fail to detect, but also permits distinguishing pattern changes caused by modified lateral boundary conditions from NOB pattern changes. These results suggest a new approach to characterizing data from either experiments or simulations where NOB effects are expected to play an important role.

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