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Geophysical Fluid Dynamics in Space: spherical convection with low viscosity contrasts

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Rayleigh Bénard convection in spherical geometry plays an important role in geophysical and astrophysical research. However, laboratory experiments with a central symmetry buoyancy field are hardly to realize, since the microgravity condition is not fulfilled on earth. The GeoFlowII experiment, which is mounted in the ISS, is set-up by means of a high voltage potential in microgravity conditions. We are using the working fluid 1-Nonanol to investigate the influence of temperature dependent viscosity on the fluid flow and the temperature field. During the experiment two routes are traced, i.e. the Rayleigh number is varied in two different regimes of higher and lower viscosity respectively. The achieved viscosity ratio remains below two. Nevertheless, single spots of plume-like upwelling are observed. The temporal characteristics is highly chaotic, already for lower Rayleigh number. This is in contrast to the isoviscous spherical convection patterns of GeoFlowI, which are large-scaled upwellings. Additionally to the experimentally performed parameters of the experiment, numerical simulations based on a pseudo spectral method have been performed. The full experimental parameter space is covered in terms of various Rayleigh numbers and viscosity ratios. The numerical output as artificial interferogram is compared with the experimental outcome. In both cases we reproduce a highly chaotic flow structure even for small viscosity ratios, which is not observed in the iso-viscous experiment.