Geophysical Research Abstracts
Vol. 17, EGU2015-5833, 2015
EGU General Assembly 2015

Time-dependent convective flows with high viscosity contrasts under micro gravity conditions.

Florian Zaussinger, Christoph Egbers, Andreas Krebs, Felix Schwarzbach, and Christian Kunze
BTU-Cottbus, Aerodynamics and Fluid Mechanics, Cottbus, Germany (florian.zaussinger@tu-cottbus.de)

Thermal driven convection in spherical geometry is of main interest in geo- and astrophysical research. To capture certain aspects of temperature dependent viscosity we investigate the micro-gravity experiment GeoFlow-IIb, located on the ISS. This unique experimental setup consists of a bottom heated and top cooled spherical gap, filled with the silicon oil 1-Nonanol. However, rotation and varying temperature gradients can be applied, to spread the experimental parameter space. The main focus of the current mission is the investigation of time dependent convective flow structures. Since the ISS requirements makes it impossible to use tracer particles, the flow structures are captured by interferometry, whose outcome is analysed by an ground based adapted image processing technique. To guarantee valid results the experimental time of each parameter is in the order of the thermal time scale, which is about 40 min. We are presenting latest results of plume-like and sheet-like time-dependent convective patterns in the spherical shell, their evolution and temporal behaviour under high viscosity contrasts.

Due to an unexpected nonlinear coupling between the temperature dependent viscosity of the working fluid and the applied dielectrophoretic force field, we are able to maintain a viscosity contrast of 50 and more. This gives the chance to compare cautiously our experimental results with theoretical assumptions of the mantle convection theory. Besides, numerical simulations in the same parameter regime are performed, which give the opportunity to deduce the internal structure of the experimental
flow flied. The main focus of the presented results are the long time temporal evolution of convective plumes in the spherical gap, image capturing- and processing techniques and the deduction of the internal flow field based on planar interferometry pictures.