GeoFlow as Thermal Convection Experiment for Modelling Mantle Dynamics

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Research on thermal convection in spherical shells is a fundamental model in geophysical fluid dynamics. GeoFlow covers this hydrodynamical problem being an experiment, which takes place at the International Space Station in the European COLUMBUS module inside the Fluid Science Laboratory.

Focus here is the thermal convective fluid motion in the gap between two concentric spheres, in the case of homogeneously heated inner and cooled outer sphere under a central dielectrophoretic force field in microgravity environment. In GeoFlow I a fluid with approximately constant viscosity is considered for modelling the convective motion of the liquid inner earth core. The chosen fluid is the silicone oil M5.

Our purpose with GeoFlow II is to model earth mantle convection. Therefor a fluid with temperature dependent viscosity is considered. Verifying several alcane fluids as well as alcohols like octanol and nonanol shows that especially 1-nonanol gives a significat change of viscosity in temperature regime of the experiment. Additionally preliminary numerical simulations shall be carried out for this fluid to found out the significant parameter range for the experiments.



Figure 1: Temperature dependency of viscosity for different fluids regarded for thermal convection experiment GeoFlow