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AtmoFlow - Investigation of atmospheric-like fluid flows under micro-gravity conditions

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The main objective of the *AtmoFlow* experiment is the investigation of convective flows in the spherical gap geometry. Gaining fundamental knowledge on the origin and behavior of flow phenomena such as global cells and planetary waves is interesting not only from a meteorological perspective. Understanding the interaction between atmospheric circulation and a planet's climate, be it Earth, Mars, Jupiter, or a distant exoplanet, contributes to various fields of research such as astrophysics, geophysics, fluid physics, and climatology. The main feature of AtmoFlow is its spherical geometry and aims to observe flows in a thin gap that are subjected to a central force field. Such a condition, obviously impossible to reach on ground, is achieved by simulating buoyancy driven convection through a central dielectrophoretic field in micro-gravity conditions e.g. on the ISS. Without losing its overall view on the complex physics, circulation in planetary atmospheres can be reduced to a simple model of the in- and outgoing energy (e.g. radiation) and rotational effects. Both input parameters are determined by the boundaries of the system. This strongly simplified assumption makes it possible to break some generic cases down to test models which can be investigated by laboratory experiments and numerical simulations. Varying differential rotation rates and temperature boundary conditions represent different types of planets. This is a very basic approach, but various open questions regarding local pattern formation or global planetary cells can be investigated with that setup. A concept has been defined for developing a payload that could be installed and utilized on-board the International Space Station. This concept is based on the micro-gravity experiment *GeoFlow*, which has been conducted successfully between 2008 and 2016 on the ISS. We present the scientific goals, the experimental setup, the concept for implementation of the AtmoFlow experiment on the ISS and first numerical results.