Geophysical Research Abstracts
Vol. 16, EGU2014-16940, 2014
EGU General Assembly 2014

Simulation of large scale motions and small scale structures in planetary atmospheres and oceans: From laboratory to space experiments on ISS

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Baroclinic waves are responsible for the transport of heat and momentum in the oceans, in the Earth′s atmosphere as well as in other planetary atmospheres. The talk will give an overview on possibilities to simulate such large scale as well as co-existing small scale structures with the help of well defined laboratory experiments like the baroclinic wave tank (annulus experiment). The analogy between the Earth′s atmosphere and the rotating cylindrical annulus experiment only driven by rotation and differential heating between polar and equatorial regions is obvious. From the Gulf stream single vortices seperate from time to time. The same dynamics and the co-existence of small and large scale structures and their separation can be also observed in laboratory experiments as in the rotating cylindrical annulus experiment. This experiment represents the mid latitude dynamics quite well and is part as a central reference experiment in the German-wide DFG priority research programme (“METSTRÖM”, SPP 1276) yielding as a benchmark for lot of different numerical methods.

On the other hand, those laboratory experiments in cylindrical geometry are limited due to the fact, that the surface and real interaction between polar and equatorial region and their different dynamics can not be really studied. Therefore, I demonstrate how to use the very successful Geoflow I and Geoflow II space experiment hardware on ISS with future modifications for simulations of small and large scale planetary atmospheric motion in spherical geometry with differential heating between inner and outer spheres as well as between the polar and equatorial regions.

References:
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