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Intercomparison of numerical models simulating rotating annulus flows

Uwe Harlander, Yongtai Wang, Kiril Alexandrov, Torsten Seelig, Christoph Egbers, and the MetStröm rotating annulus Team

Brandenburg University of Technology (BTU) Cottbus, Aerodynamics and Fluid Mechanics, Cottbus, Germany (haruwe@tu-cottbus.de, 0049 355 694891)

An ubiquitous feature of geophysical flows is the occurrence of multiple scales. Numerical models of geophysical flows have to consider this fact and in modern codes flexible or adaptive grids are therefore implemented. However, it is not clear yet how to implement parameterizations and closure schemes into such models.

In 2007, the German Science Foundation (DFG) has started the priority program METSTROEM to investigate this crucial topic. The differentially heated rotating annulus has been chosen as a reference laboratory experiment to generate a data base for the numerical models used within METSTROEM. This classical laboratory experiment can be considered as an analogue to atmospheric flows sharing the multiple flow structure of the atmosphere.

This paper shows first results from a model intercomparison. In total seven different models (from low-order to highly resolved, in spectral or grid formulation) simulate the annulus flow. All models capture the flow and flow transitions qualitatively well. However, models and experiment predict regime transitions at different non-dimensional numbers (Taylor number and thermal Rossby number) that are used to characterize the annulus flow. Therefore a systematic analysis of these differences has been started with the goal to answer some of the questions addressed by METSTROEM.