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Adaptive Mesh Modelling of the Thermally Driven Annulus

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The rotating annulus is a well studied problem, and is often used as an analogy for planetary scale atmospheric and oceanic flows. A wide range of rotating fluid experiments have previously been conducted using a number of different experimental configurations.

We are using Fluidity, a numerical model being developed at Imperial College, London. This model uses a three dimensional mesh, unstructured in both the horizontal and vertical directions, which can conform to general boundary topography. Fluidity uses interpolation error driven anisotropic mesh adaptivity, allowing the model mesh to be dynamically reconfigured to resolve more active regions of the flow. These two features allow particularly challenging laboratory experiments to be modelled.

We are applying Fluidity to the thermally driven annulus. Using a three dimensional tetrahedral mesh, the annulus is being modelled in a range of regimes. These results can be compared with experimental data and with other well verified numerical models. This enables quantitative validation of the adaptive model against a well studied and precisely measured fluid dynamics problem. Fluidity will then be applied to experimental configurations that have previously been difficult to model, including an annulus with a sloping base, and a blocked annulus.