Talks

Excitation mechanism of waves in the Earth's core

C. A. Jones*, R. J. Teed, K. Hori and S. M. Tobias

University of Leeds

Axisymmetric torsional waves have been observed in the Earth's core, and it has been suggested that the waves may originate near the tangent cylinder, the axial cylinder in the Earth's liquid core which touches the solid inner core. There is a theoretical expectation that the fluid inside the tangent cylinder will be more thermally and compositionally buoyant than the fluid outside the tangent cylinder. At the tangent cylinder, there will be strong thermal and compositional gradients, exciting convection in the form of travelling magnetic Rossby waves. These magnetic Rossby waves can have periods close to that of the torsional Alfven waves in the core, and hence they can trigger trains of torsional waves travelling outwards from the tangent cylinder region.

We have investigated this resonant excitation mechanism using a magnetoconvection based approach, which has been adapted from a spherical shell convection driven dynamo code. This enables us to get to a regime of strong fields and low Ekman numbers, at the cost of specifying the form of the magnetic field rather than allowing it to arise naturally from the dynamo model. Low Ekman number is essential to see the wave excitation, as the tangent cylinder convecting layer is expected to be only a few hundred kilometres thick, and viscosity must be small enough to allow convection on these scales. We are currently exploring the conditions under which the resonance between the convection and the torsional oscillations can occur.

We have also investigated non-axisymmetric magnetic Rossby waves in the outer core, as these wave also have frequencies which might be detectable by magnetic satellite observations in the near future.
