3.5.6.6 Special Bureau for the Core

Introduction

Our activities are mainly related to the scientific developments and results concerning the angular momentum exchange between the core and the mantle and the physical mechanisms (torques) at the Core-Mantle Boundary (CMB) and at the Inner Core Boundary (ICB). This angular momentum exchange induces variations in all three components of Earth rotation. Because there are no direct observations of the core flow that could lead to well-constrained models as do exist for the ocean and atmosphere, only calculations of core angular momentum (CAM) can be obtained from core flows derived from variations in the magnetic field observed at the Earth surface. Further, these flows depend on poorly constrained additional assumptions to resolve formal non-uniqueness in the solution. On our web site <www.astro.oma.be/SBC/main.html>, we have collected data of core angular momentum. We have also given explanations related to the different assumptions that may be used for the core angular momentum computations. In addition, we included a review of the candidate coupling mechanisms that are currently under investigation for explaining this angular momentum exchange (possible torques at the CMB).

Data of Core angular momentum computations

We have put 9 series of CAM on our web site, with their physical assumptions and the references to be mentioned.

The assumptions used are based on our understanding of the physical process involved. First of all, based on order of magnitude evaluation at decade time scale, only the induction term is retained in the magnetic induction equation, equivalent to the frozen-flux approximation (the changes in the magnetic field lines follow the flow line changes). Secondly, dealing with more unknowns than equations, it is necessary to further consider an additional constraint. In the literature, one finds four additional constraints (1) toroidal field flow, (2) piecewise steady flow, (3) flow steady in a drifting frame, (4) tangentially geostrophic flow. The series put on the web are mainly related to the last hypothesis.

Further, these additional assumptions are poorly constrained. Consequently, the associated calculated changes of the Earth's angular momentum are quite uncertain. Still, the Length-Of-Day (LOD) changes calculated from these core flows agree remarkably well with the observed LOD changes.

The list of these CAM series is:

- Jackson's three different core angular momentum (CAM) based on the torsional oscillations using the hypothesis of fully time-dependent geostrophic flow and the surface magnetic field UFM1 of Bloxham and Jackson [1992, J. Geophys. Res. 97,

19537–19563] (for three different smoothings) [Jackson, 1997, PEPI 103, 293–311]

- Petrov's three different core angular momentum (CAM) based on the torsional oscillations using (a) the IGMF surface magnetic field and the geostrophic flow approximation, (b) the surface magnetic field and the quasi-steady flow approximation, and (c) the LOD observation, the surface magnetic field and the geostrophic flow approximation [Petrov and Dehant, not published];
- Jault's core angular momentum (CAM) based on the torsional oscillations using the tangential geostrophic flow and the surface magnetic field [Jault, Gire, and Le Mouël, 1988, Nature 333, 353–356];
- Pais' core angular momentum (CAM) based on the torsional oscillations using the tangential geostrophic flow and the surface magnetic field UFM1 of Bloxham and Jackson [1992, J. Geophys. Res., 97, 19537–19563] [Pais and Hulot, 2000, PEPI 118, 291–316];
- Boggs' core angular momentum (CAM) based on the torsional oscillations using the tangential geostrophic flow and the surface magnetic field UFM1 of Bloxham and Jackson [1992, J. Geophys. Res. 97, 19537–19563] [Hide, Boggs, and Dickey, 2000, Geophys. J. Int. 143, 777–786].

Bibliography

Additionally, we have built a bibliography of material relevant to the core that presently contains more than thousand references.

Book on "Earth's Core: Dynamics, Structure, Rotation"

Following an Union Session at the end of 2000 at the American Geophysical Union that we had organised, we have decided to edit a volume. The idea of the session was to bring together specialists of the core from different disciplines: seismology, geochemistry, geomagnetism, geodynamo and geodesy (Earth rotation). The book has the same philosophy and will be published at the end of 2002. The title of the book is "Earth's Core: Dynamics, Structure, Rotation", and the editors are V. Dehant, K. Creager, S. Karato, and S. Zatman. The book is dedicated to Stephen Zatman who died in an accident in July 2002. Stephen did a lot of research in the frame of LOD variations and the Earth core.

Change of Chair

Following the proposition of the present Chair of the SB for the Core, V. Dehant, and as approved by the IERS Directing Board, V. Dehant will be replaced for the next term (starting in July 2002) by her colleague Tim Van Hoolst.

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