FLUX TUBE EMERGENCE THROUGH A TURBULENT ROTATING CONVECTIVE SPHERICAL SHELL

L. Jouve and A. S. Brun

DSM/DAPNIA/SAp, CEA-Saclay, 91191 Gif-sur-Yvette, Cedex

We present recent 3D MHD numerical simulations of the non-linear dynamical evolution of magnetic flux tubes in a turbulent rotating convection zone in spherical geometry, using the anelastic spherical harmonic (ASH) code. Mean flows such as differential rotation and meridional circulation are taken into account when computing the evolution of the tube-like structure. We seek to understand the mechanism of emergence of strong toroidal fields through a turbulent layer from the base of the solar convection zone to the surface as active regions. We confirm the results obtained in cartesian geometry that two parameters influence the tubes during their rise through the convection zone : the initial field strength and amount of twist. We also find that the tube rise almost radially independently of the initial latitude (either low or high) and that towards the end meridional flows seem to influence the tube evolution. However we do not see a clear influence of the differential rotation on the flux tube evolution. Finally we see that the tube rise at different speed as a function of longitude depending on whether or not it is locally embedded in an up or downflows.