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Quasi-Geostrophic Dynamos

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Taking advantage of the properties of liquid metals and of rapidly rotating flows, we are able to compute dynamos at high Reynolds number ($Re > 10^5$) and low magnetic Prandtl number ($Pm < 10^{-2}$) We developped a numerical model that uses a quasi-goestrophic approximation to compute the flow (whithout subgrid scale model), leading to two-dimensional equations. The induction equation for the magnetic field is fully resolved in 3D, in a sphere. This approach proves quite efficient for low magnetic Prandtl number and suitable flows, for which there is a scale separation between magnetic field and velocity field, allowing to compute the magnetic field on a coarser grid and whith larger time steps than for the velocity field. We show results of these calculations applied on the turbulent flow produced by the destabilization of a Stewartson shear layer.

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