Evaluation of LES model of MHD turbulence

M. Kessar*, G. Balarac and F. Plunian
University of Leeds

In several geophysical and astrophysical fluids, turbulence is very strong, and involves a large range of scales. Despite the strong development of computational resources the last few decades, it remains impossible to simulate this range of scales for realistic configurations. One solution is known as Large Eddy Simulations (LES). While a LES is performed, only the large scales of the flow are resolved, and the interactions between large and small scales are modeled. Several turbulence models have been developed for LES of turbulence. Nevertheless, the limitations of these models are not always well known for magnetohydrodynamic (MHD) turbulence, i.e for conductive fluids that can be encoutered in geophysics and astrophysics. In the second part of this thesis we will evaluate the functional performances (see Sagaut (2002)) of these models for several flow configurations involving turbulent dynamo action, i.e when a magnetic field is amplified though the action of a turbulent conductive fluid. In particular we will study the capabilities of LES models to reproduce energy exchanges between large and small scales. In order to do so, we will perform several DNS, for both non-helical flows (i.e leading to small scale dynamo) and helical flows (i.e leading to large scale dynamo). Thanks to a filtering operation we will compute the exact subgrid-scale transfers and compare them to the predictions given by several models. Finally we will achieve LES using subgrid-scale models and we will compare them to filtered DNS.
