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Multiscale Problems in Fluid and MHD: Combining direct numerical simulations and models ANNICK POUQUET, PABLO MININNI, NCAR, DAVID MONTGOMERY, Dartmouth — Geophysical flows, with a huge number of interacting scales, cannot be studied with direct numerical simulations (DNS) without proper modeling. In this context, DNS, Lagragian-averaged (LAMHD) and Large-Eddy Simulations (LES) runs of magnetohydrodynamics are presented. The models allow for a significant reduction of computer resources at given Reynolds numbers; e.g., with LAMHD, one reproduces the growth rate of magnetic energy and captures the saturation level of the dynamo instability. Combining DNS, LAMHD and LES, low magnetic Prandlt number dynamos have then been explored. Several forcing, from Beltrami to fully non-helical, are used and give similar though not identical results. In the case of the Taylor-Green vortex with a well defined structure at large scales and strong turbulent fluctuations, dynamos are observed down to the lowest PM=0.01 that can be modeled accurately; the critical magnetic Reynolds number increases sharply with PM as turbulence sets in and then saturates; in the linear phase, the most unstable magnetic modes move to small scales as PM is decreased; a Kazantsev 3/2 spectrum develops with strong non-local nonlinear transfer.

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