Abstract Submitted
for the DFD05 Meeting of
The American Physical Society

MHD Shallow-Water Turbulence on the Sphere ERICA STAEHLING, Bucknell University Department of Physics, JAMES CHO, Carnegie Institution of Washington, DTM — Motivated by astrophysical-geophysical applications, we have performed a series of high Reynolds number simulations of freely-evolving, magnetohydrodynamic shallow-water turbulence (MHDSWT) on a rotating sphere. MHDSWT is the simplest turbulence model that includes the effects of stratification, differential rotation, and magnetic field that can be studied over long durations. A systematic exploration of the full physical and numerical parameter-space shows novel as well as consistent behavior, compared to those of pure hydrodynamic (HD) and 2-D MHD counterparts. In the case without rotation, our simulations show that the turbulent evolution is sensitive to initial conditions, most strongly to the peak of the energy spectrum. With increasing magnetic field strength, the flow field is more susceptible to loss of balance; the field blows up in finite time. In addition, the pronounced anisotropic structures (jets and vorticity bands) observed in differentially-rotating HD systems do not form. An application of the model to the solar tachocline is also presented.

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Date submitted: 09 Aug 2005

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