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# MHD turbulence in the atmosphere of hot extrasolar giant planets

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A large number of extra solar giant planets orbit very close to their host stars and are expected to have strongly ionized atmospheres due to the intense stellar irradiation they experience. To study the effects of ionization on the global atmospheric dynamics, we model the atmosphere of these planets as a stratified, magnetohydrodynamic (MHD) fluid layer on a rotating sphere. Specifically, we perform a series of high Reynolds number simulations of freely-evolving MHD "shallow-water" turbulence, initialized with isotropic random stirring at small scales. Our focus is on the effects of ionization-induced magnetic fields and currents on the formation of stable flow structures prevalent in neutral (hydrodynamic) atmospheres. We find that the turbulent evolution is sensitive to the global-mean magnetic field strength $B$, which is proportional to the level of ionization in the fluid. At a critical $B$, the anisotropic flow structures (jets and vorticity bands), typically observed in rapidly-rotating hydrodynamic systems, are disrupted by the emergence of current "spikes" associated with coherent vortices. At large $B$, the flow field is susceptible to loss of balance, accompanied by gravity waves, and blows up in finite time.