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Magnetohydrodynamics in hot exoplanet atmospheres

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Close in extrasolar planets pose new challenges to our understanding of atmospheric dynamics under extremes not known in our solar system. Due to their proximity to the parent star, their large temperatures imply that there is a strong likelihood that parts of their atmospheres are significantly ionized. This in turn means that an magnetohydrodynamic description of the dynamics taking place in at least part of their atmosphers would be merited. We follow this reasoning and consider the quasi-geostrophic dynamics on a two-layer f-plane model in which one layer is magnetized while the other is neutral. We develop the linear theory of such a configuration which also includes magnetic resistivity and thermal cooling/heating (modeled in terms of a layer height relaxation time). We discuss the features of the linear stability. Nonlinear solutions are developed using numerical (spectral) techniques and compared to global solutions obtained in other studies. A discussion will follow.