Development of a flexible fluid code for planetary sciences

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We have developed a flexible high-resolution fluid code based on a semi-discrete central scheme, which is applicable to a wide variety of planetary atmospheric/ionospheric/magnetospheric phenomena. The requirements for a next-generation fluid code for planetary sciences are threefold: non-HD/MHD terms are accommodated, sharp discontinuities are accurately resolved, and small amplitude waves (turbulence) are accurately resolved. A semi-discrete central scheme is one of the most promising solutions for these requirements. It does not require the use of a computationally expensive Riemann solver and spectral decomposition into characteristic waves, making it easy to implement in HD/MHD as well as non-HD/MHD codes. Although central schemes are generally more dissipative than upwind schemes, there has been remarkable progress in developing less dissipative central schemes. We have developed a flexible fluid code based on a high-order semi-discrete central scheme with a WENO limiter for spatial reconstruction and found it capable of resolving small amplitude/linear waves with a high wavenumber while retaining a shock-capturing capability. We will show some numerical tests and discuss the applicability of the code to planetary atmospheric/ionospheric/magnetospheric phenomena.

Keywords: Fluid code, Central scheme, Planetary atmospheric phenomena, Planetary ionospheric phenomena, Planetary magnetospheric phenomena

