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Realistic Simulations of the Turbulent Plasma Dynamics on the Sun ALEXANDER G. KOSOVICHEV, HEPL, Stanford University, LAETITIA JACOUTOT, IRINA N. KITIASHVILI, Center for Turbulence Research, Stanford University, NAGI N. MANSOUR, ALAN A. WRAY, NASA Ames Research Center
— The objective of this research is to model the turbulent dynamics of the upper convective boundary layer of the Sun and investigate how magnetic field affects the structure and dynamics of solar convection and the sources that drive the waves in the Sun. We use a 3D, compressible, non-linear radiative magnetohydrodynamics code developed by Alan Wray for simulating the upper solar convection zone and the lower atmosphere. We have carried out the numerical simulations using a hyperviscosity approach and various physical Large-Eddy Simulation (LES) models (Smagorinsky and dynamic models) to investigate how the differences in turbulence modeling affect the damping and excitation of the oscillations and their spectral properties and to compare with observations from the SOHO and Hinode space missions. We find that the dynamic turbulence model provides the best agreement with the observations. We have studied the effects of magnetic field on the spatial-temporal spectrum of the turbulent convection, and found that these simulations can explain the observed changes of the granular dynamics and the enhanced emission of high-frequency waves in magnetic regions (effect of "acoustic halo").

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