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Slow magneto-acoustic wave propagation in solar plage region simulations

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We investigate slow magneto-acoustic waves that are naturally excited by turbulent convection and investigate their role in the energy balance of a plage region using three dimensional (3D) radiation-MHD simulations. We track 25 magnetic field lines both in space and time inside a strong magnetic element and calculate velocity component parallel to the background field and compute the temporal power spectra at various heights above the mean solar surface. Additionally, horizontally averaged power spectra for both longitudinal and vertical components of velocity are calculated using time-series at fixed locations. We also degrade our simulation data to compare our results with observations. The velocity power spectra, averaged horizontally over the whole domain, show that low frequency waves may reach into the chromosphere possibly along the inclined magnetic field lines. In addition, the power spectra at high frequencies follow a power law with an exponent close to -5/3, suggestive of turbulent excitation. The horizontally averaged power spectra of vertical component of velocity at various effective resolutions show that the observed acoustic wave energy fluxes are underestimated, by a factor of three even if determined from observations carried out at a high spatial resolution of 100 km. Since the waves propagate along the non-vertical field lines, measuring the velocity component along the line-of-sight, rather than along the field contributes significantly to this underestimate. Our results show that, in contrast to claims made in the literature, longitudinal waves within magnetic elements carry sufficient energy to heat the chromosphere.

Student poster?

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