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Wave properties in footpoints of coronal loops as a result of an inclined acoustic-gravity wave driver in 3D MHD simulations

There is strong evidence that the energy required to heat the solar chromosphere and corona may be caused by the strong magnetic field interacting with convective motions from the photosphere. Acoustic-gravity waves, or "p-modes", are resonant modes of the solar interior driven by pressure gradients and are known to leak into the solar atmosphere. It is thought that these p-modes may be guided by magnetic flux bundles in the solar atmosphere and convert to MHD tube waves which can then transport energy to the upper atmospheric layers. Using 3D MHD numerical simulations, we model a straight, expanding coronal loop as a magnetic field enhancement in a gravitationally stratified solar atmosphere which includes a transition region and chromosphere. We implement a driver at one footpoint modeled by an acoustic-gravity wave which is slightly inclined with respect to the vertical axis. We aim to analyse how the, initially acoustic wave energy flux, may be converted into magnetic energy and, if so, in what form. To do this, we calculate the ratio of acoustic to magnetic flux and compare this against an analytical conversion factor. As a result of the cylindrical domain, eigenmodes of a magnetic cylinder are excited and we show that the kink mode may be guided by the loop, as a result of the inclined driver breaking the azimuthal symmetry of the system. We discuss the resulting wave dynamics, energetics and potential observable features, including the transverse velocities and density perturbations at the loop apex, due to the driver implemented.

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