SIMULATIONS AND RADIATIVE DIAGNOSTICS OF TURBULENCE AND WAVE PHENOMENA IN THE MAGNETISED SOLAR PHOTOSPHERE

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Despite the overall success of radiative magneto-convective models to reproduce the observational properties of solar photosphere, we still do not fully understand the physical processes involved in the solar magnetised photospheric plasma. In particular, it is difficult to use the results of these simulations for studies of acoustic wave propagation through the solar atmosphere and interior. Strong turbulent motions of the convectively unstable photospheric plasma hide the signatures of acoustic waves, making them a difficult subject in both numerical and observational investigations.

The development of new methods for inferring the properties of solar plasma using sound waves have been followed by the successful modelling of the magneto-acoustic properties in the solar atmosphere and interior. However, due to non-locality of radiative processes in the solar atmosphere, a comparison of the plasma parameters at a certain geometrical depth in the computational box with the solar radiation parameters may not be entirely correct. The non-locality of radiative transport must be taken into account.

Numerical simulations of solar wave phenomena require a static magnetic configuration model which incorporates as many physical properties of the real Sun as possible. We provide such a model, based on dynamic model of magneto-convection in the photosphere. The magnetic field is extracted from dynamic simulations of solar radiative magneto-convection and reconstructed using the self-similarity assumption. We demonstrate that the radiative properties of the magnetic configuration we created successfully reproduce those of magnetic bright points. We have used the model to examine the observational consequences of sound wave propagation though the magnetic field concentration. We show that the variation of continuum intensity is more pronounced in the magnetic bright point compared to the average granule. Using the radiative diagnostics, we demonstrate the detectability of the magnetic field variation in the bright point.