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Nonlinear propagation of Alfvén waves driven by observed photospheric motions: Application to the coronal heating and spicule formation

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Abstract. We have performed MHD simulations for Alfvén wave propagation along open flux tube in the solar atmosphere.In our numerical model, Alfvén waves are generated by the photospheric granular motion. As the wave generator, we have derived the temporal spectrum of the photospheric granular motion from *G*-band movies of Hinode/SOT. It is shown that the total energy flux at the corona becomes larger and the transition region height becomes higher in the case when we use the observed spectrum rather than white/pink noise spectrum as the wave generator. This difference can be explained by the Alfvén wave resonance between the photosphere and the transition region. After performing Fourier analysis to our numerical solutions, we have found that the region between the photosphere and the transition region becomes Alfvén wave resonant cavity. We have confirmed that there are at least three resonant frequency, 1, 3 and 5 mHz, in our numerical model. Alfvén wave resonance is one of the most effective mechanisms to explain the dynamics of the spicules and the sufficient energy flux to heat the corona.