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Oscillations in solar magnetic elements of numerical simulations

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Abstract. We investigate the temporal fluctuation of magnetic elements in the solar photosphere. Oscillations in sunspots have been observed and studied intensively in the past (see, e.g. reviews by Lites 1992; Solanki 2003; Staude 2003). Recently, photospheric oscillations of pores and intergranular magnetic elements have been observed with *Hinode*/SOT. Results of such observations are reported by Fujimura & Tsuneta (2009). However, the observed oscillations are likely to consist in a mixture of intrinsic velocity and magnetic field oscillations and atmospheric fluctuations produced by the variation of the optical depth scale, the so-called opacity effect. In order to disentangle the intrinsic oscillation from the opacity effect, we study the temporal behavior of photospheric magnetic elements from radiation magnetohydrodynamic (RMHD) simulations by using the CO5BOLD code (Schaffenberger et al. 2005).
We track the temporal evolution of a vertical magnetic flux sheet embedded in a two-dimensional non-stationary atmosphere that reaches all the way from the upper convection zone to the lower-chromosphere, similar to the simulation of Steiner et al. (2007). Examining its temporal behavior at the photospheric boundary, we find 5-min oscillations in the height of the $\tau = 1$ surface, the density, the velocity, and the magnetic field.
Here we report the details of such photospheric oscillations in our RMHD experiments. We differentiate between oscillations on the geometrical and on the optical depth scale and discuss implications for the interpretation of observational results.