# Influence of large-scale flow in the solar interior on the surface small-scale magnetic field

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We carry out the radiative magnetohydrodynamic simulations for the solar quiet region. We imposed a large-scale flow in the deep area and investigated the influence of the velocity on the motion of the small-scale magnetic patch. So far, Imada et al., 2018 discovered that magnetic features with a stronger average magnetic field on the sun's surface more quickly move in the longitudinal direction. This fact may reflect the influence of differential rotation inside the sun. We can explain it by assuming that magnetic patches with a stronger average magnetic field continue more deeply into the sun. In this study, we use the magnetohydrodynamic calculation code R2D2 (Hotta et al., 2019), and confirmed the validity of this assumption. First, we set horizontal flow mimicking the solar differential rotation that is a linear function of depth at a maximum of 2 km/s. We performed numerical calculations in a range of approximately 27 Mm ×27 Mm ×5 Mm. Several millions of magnetic patches were detected and tracked by the magnetic element tracking code using the clamping method. The velocities for each magnetic flux and average magnetic fields were estimated. As a result, We found that the larger the magnetic flux, the faster the magnetic patch would move, confirming the validity of the assumptions used in Imada et al., 2018.

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