

Investigation of flow structures in the solar interior through the surface magnetic elements' tracking

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We investigate the correlation of meridional flow and rotation velocity in the solar interior by tracking huge number of the surface magnetic elements.

As reported in JpGU2017 meeting, we found that the meridional flow velocity from the magnetic elements' tracking depends positively on their flux and size. We discussed that it may come from that the larger magnetic elements are rooted in the deeper solar interior. We further investigate this issue by correlating the meridional flow velocity and rotation velocity.

We use line-of-sight magnetograms obtained by SDO/HMI in July 2016. Time cadence is 45 seconds, in which the travel distance of magnetic element is smaller than 1 pixel. The magnetograms are transposed from the Earth-view coordinate to the Stonyhurst coordinate. We use the data within 75 degree from the disk center. Magnetic field strength is converted with an assumption that magnetic field is vertical to the surface and interpolated with a cubic spline interpolation.

We detected approximately 8,000 elements in each magnetogram and 4.5×10^8 displacements in our data set. The meridional flow and rotation velocity on magnetic flux are investigated. The rotation velocity shows negative dependence on the flux at the latitude within 45 degree while it shows weekly positive dependence at the latitude higher than 45 degree. This result is consistent with the depth dependence of rotation velocity obtained by previous helioseismology researches.

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