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Velocity fields on the solar photosphere estimated from Hinode/SOT data

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We discuss trasverse velocity fields (v_T) on the photosphere estimated from filter magnetograms observed by Solar Optical Telescope (SOT) on board Hinode satellite. The pixel width of the magnetograms is 0.16 arcsec (116 km), and the cadence is 2 minutes. So far, many scientists analyze magnetograms observed by Michelson Doppler Imager (MDI) on board SOHO satellite in order to study magnetic field evolution on the photosphere. The pixel width of MDI magnetograms is about 2 arcsec, and the cadence is 96 minutes. Therefore we expect entirely new results from SOT magnetogram analysis.

The magnetogram that we analyzed are observed on 13 and 14 December 2006. NOAA active region number is 10930. We obtained $v_T$with local correlation tracking method. In order to study temporal evolution of v_T, we divided $v_T$into $v_0$and v_1(v_T=v_0+v_1). Here $v_0$is 10 minutes average velocity fields, and $v_1$is defined as v_T-v_0. These velocity fields are analyzed with equation 6 of Longcope (2004, ApJ, 612, 1181). With Poisson equations derived from this equation, we can estimate rotaion and divergence components of these velocity fields.

As a result, we found local (about 10 arcsec) and temporary (more than 30 minutes) vortex motions on the photosphere. These motions are considered to contribute magnetic helicity injection fluxes and Poynting fluxes. Divergence values estimated from $v_T$is found to distribute like the granule cells. Spatial scales of these cells are about 3 arcsec. We will report and discuss these properties of the velocity fields.

Keywords: Solar photosphere, velocity field, Hinode solar observatory