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Flux dependence of magnetic cancellation on the solar photosphere

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We report the flux dependence of magnetic cancellations on the photosphere by using the long-term observation and automatic detection. Various solar energetic activities, such as X-ray bright points and solar jets, are caused by magnetic field. It is very important to know the flux distribution for understanding of statistical characters of such solar activities. Parnell et al.(2009) reports the power law distribution of magnetic flux content on solar photosphere, which continues from large active regions to network field in quiet Sun. This flux distribution is thought to be achieved and maintained by four magnetic activities, namely emergence, splitting, merging, and cancellation. There are few statistical investigation of these activities so far. We reported the flux dependence of splitting and merging in the PEM029-P08 of the JpGU meeting 2010. We discussed that emergence and cancellation in the investigated range do not take large roles in flux balance from the result that they are much less frequent than splitting and merging. However, there is a possibility that tiny cancellations below the observational threshold take a large part of flux balance. We can evaluate cancellations below the observational from the flux dependence of cancellation frequency.

Line of sight magnetograms obtained by Solar Optical Telescope(SOT)/ Narrowband Filter Imager(NFI) on board Hinode satellite is used in this study. The data period of this data set is from 2008 December 30th 10:29UT to 2009 January 5th 5:37UT. The time interval of data is 5 minutes and full field of view is 121”x121”. The observation period is long enough to investigate the statistical property of cancellations. Same algorithm for detection and tracking of magnetic patches is employed as the previous study (see JpGU meeting 2010 PEM029-P08). 18000 positive patches and 13000 negative patches are detected in this data set. The flux dependence of cancellations are a power-law distribution with an index of -2.5. The power-law index steeper than -2 means cancellations between smaller patches take larger part of magnetic flux content. We will also discuss the relationship between a power-law index of flux content and that of cencellation.

Keywords: the Sun, photosphere, magnetic field, magnetic flux cancellation, quiet Sun