

# Helicity injections in various regions

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In this study, we investigate the amount of magnetic helicity injection rate (hereafter, helicity flux) among active regions having different magnetic fluxes. We analyzed 78 active regions (more than 600 magnetograms), using the vector magnetograms obtained with the Solar Flare Telescope of NAOJ and SOHO/MDI magnetograms. These data are analyzed with a method proposed by Kusano et al. (2002). Ten active regions are tracked for several days, while other regions are studied based on single-day observation. The time cadence of data is 96 minutes. Magnetic fluxes of these regions ranges from  $2.e+12$  Wb to  $4.e+14$  Wb, and Unsigned helicity fluxes are from  $1.e+17$  Wb<sup>2</sup>/s to  $2.e+22$  Wb<sup>2</sup>/s.

From a scatter plot of the magnetic flux and the helicity flux, we found that the helicity flux has an upper limit for a given value of the magnetic flux, and the upper limit is nearly proportional to the magnetic flux. We can interpret these results with the model of helicity injection due to helical turbulence (Sigma-Effect; Longcope et al. 1998).