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Modeling relative magnetic helicity in solar active regions and interplanetary magnetic clouds

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It is obvious that solar eruption, such as flares and CMEs, is a kind of whole heliospheric turbulence. The transport process of magnetic energy is important to solar eruption, but not exactly for now. Helicity is just a proper physical quantity to quantitatively describe the topological structure of magnetic field, whose conservative property and transport process is vital to understand the release of magnetic energy. Some algorithms of helicity, such about interplanetary magnetic cloud, transportation through photospheric boundary and 3-D magnetic model, have been used maturely. We use space satellite's data and solar active region's vector magnetic field data of Huairou solar observation station to analyze the helicity's transport during solar storm. For convenience of calculation, we select some regions from Yang's work because change of helicity is large in these regions. If there have CME in active region, we can compare the helicity in corona during eruption and the helicity in interplanetary MC. For the calculation of helicity in corona, we adopt two approaches. First, using NLFF extrapolation, we can obtain a 3-D vector magnetic field, and our algorithm is based on this 3-D vector magnetic field. Second, using Chae's method to obtain the variation curve of helicity and magnetic flux, then interpolate to get helicity at specified time. As for calculation of helicity in interplanetary MC, we adopt Wang's method.we compare 9 active regions' magnetic helicity of HSOS and MDI, finding the correlation between those two helicities is high(0.89). Basing on this work, more researches can be done in the future.