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Characteristic development of magntic shear in a flare-producing sunspot obtained from vector magnetic field measurements by HINODE

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Abstract. One of the promising models for the initiation of a solar flare requires observation-based information at the solar surface where the energy released during a flare is injected in the way limited by a real environment. Hinode provides a time series of vector-field maps of the photospheric magnetic field in NOAA10930 that shows strong flaring activity. We use these maps to investigate the structure and evolution of the magnetic field in a major sunspot of this active region. By dividing the sunspot into a number of small regions and assuming a linear force-free-field state in each divided region, we derive the spatial variation of magnetic shear and its temporal development in this sunspot. The magnetic shear first increases in magnitude and area with time, while it decreases before the onset of an X-class flare. A relation between the evolution of magnetic shear and the motions of an accompanying sunspot has also been found. We discuss the physical processes responsible for those observational features, suggesting that the characteristic development of magnetic shear in the major sunspot and the translational motion followed by rotational motion of the accompanying sunspot might be caused by the emergence of a twisted flux tube into the solar atmosphere.