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Yearly Variation of Magnetic Field in the Solar Polar Regions observed with *Hinode*/SOT

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The polar region of the Sun has not been well understood yet despite the long history of the solar observation. The polarity of the polar regions reverses around the maximum of the solar cycle. For several years around the solar activity minimum a stable and large coronal hole is present in each the polar region. The polar regions has the unipolar magnetic fields open to the interplanetary space. The mechanisms of the polarity reversal and to form, to maintain, and to decay the coronal holes remain to be completely clarified. The polar regions have the polarity opposite to each other and almost occupy the unipolar magnetic field. Therefore, the variation of the polar magnetic field is extremely significant for the polarity reversal. Observations of the polar region of the Sun are critically important for understanding the solar dynamo and the acceleration of solar wind. In order to obtain clues of those problems, we investigated the photospheric magnetic field properties using the high-resolution observation with Solar Optical Telescope (SOT) aboard *Hinode* in this study.

we report the yearly time variation (2006 - 2011) of the magnetic field in the polar regions around solar minimum with high spatial resolution of *Hinode*/SOT. The fraction of the dominant polarity in the both polar regions increases with latitude. We examined the time variation (2008 - 2011) of the vertical and horizontal magnetic fields. The comparison of the areal fraction of the intrinsic magnetic field strength showed that those of the kilo-Gauss vertical field and the horizontal field vary in the North polar region. In the South polar region, however, the areal fraction of the kilo-Gauss vertical field and the horizontal field are almost the same. The magnetic flux density of vertical magnetic field fluctuates in both the polar regions, while that of horizontal magnetic field almost stay flat.

Keywords: photosphere, magnetic field, coronal holes, solar activity, *Hinode*, spectropolarimetry