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PEM10-P01 Room:Convention Hall Time:May 25 15:30-16:45

The magnetic and velocity field structure of the sunspot chromosphere

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It has been known that supersonic flows toward a sunspot are common phenomena in a chromosphere above a sunspot. The flows are called an inverse Evershed flow, and have line-of-sight velocities of 10 to 20 km/s, in some cases over 50 km/s. It is necessary to obtain more knowledge on the phenomenon in terms of how magnetic field structures in the chromosphere drives the flow. In this study, we analyzed the chromospheric magnetic and velocity fields in the sunspot chromosphere utilizing precise polarimetric measurements and the Hanle effect. Recent developments of both observation technologies and theoretical modeling of the Hanle effect have allowed us to perform diagnostics of weak polarization signals in the chromosphere.

The observation data of active region 10781 used in this study were taken on 3 July 2005 with the German Vacuum Tower Telescope (VTT)/Tenerife Infrared Polarimeter (TIP-II) which is the spectro-polarimetric instrument to observe the chromospheric He I 1083 nm line and photospheric Si I 1082.7 nm line. The H alpha filtergrams were also obtained with the Dutch Open Telescope (DOT). The active region had uni-polar spot located at N12 and E5. We retrieved chromospheric magnetic fields using the code HAZEL with He I 1083 nm triplet, and line-of-sight velocities based on a cloud model with H alpha filtergrams. The downflow velocities were over 10 km/s in He I 1083 nm line and over 50 km/s in H alpha. The velocities became faster near the spot. We showed that the Van-Vleck ambiguity, in which we cannot obtain a unique solution of magnetic field inclination and azimuth with the Hanle effect, made it difficult to retrieve magnetic field configuration in the sunspot chromosphere. One possible way to resolve the ambiguity is giving azimuth angle along fibril structures seen in a chromospheric intensity image as an initial guess. As a result, we illustrated the magnetic and velocity field structure of the sunspot chromosphere in the regions where we had enough polarization signals for the Hanle diagnostics. Moreover, observational evidences were identified which indicate that the small flux tube in the lower atmosphere may be essential to drive the chromospheric inverse Evershed flows.

Keywords: sun, chromosphere, active region, spectro-polarimetry

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Effects of January 2005 SPEs on the chemistry of the polar atmosphere

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Intense ionization in the upper stratosphere/mesosphere of the polar regions, caused by two intense Solar Proton Events (SPEs) that occurred in January 2005, led to important changes in the atmospheric chemistry. Aura Microwave Limb Sounder (MLS) and ENVISAT Michelson Interferometer for Passive Atmospheric Sounder (MIPAS) recorded these variations mainly in the northern polar regions. SPE-induced HOx (OH, HO2) production led to mesospheric ozone depletion and changes in chlorine species (e.g., HCl, HOCl, ClO). Furthermore, evidence of SPE-induced ClONO2 changes demonstrates that a significant interplay between NOx and ClOx is present also under SPE conditions.

MLS and MIPAS data are compared with the National Center for Atmospheric Research Whole Atmosphere Community Climate Model (WACCM4) results. WACCM4 generally reproduces the SPE-induced variability in the examined species, nevertheless some small discrepancies between observed data and model predictions (e.g., for stratospheric HCl) still remain.

Finally, comparing SPE-induced changes and year-to year variability for upper stratospheric chlorine species, we show that chlorine variations attributed to intense SPEs are comparable in magnitude to the chlorine variability that is observed after sudden stratospheric warmings.

Keywords: Solar Proton Events (SPEs), atmospheric chemistry, polar regions, middle atmosphere