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An investigation of the magnetic topology of the inverse Evershed flow

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The chromospheric inverse Evershed flow (IEF) transports material into sunspots along the magnetic field lines that connect the boundary of the moat cell with the outer penumbra. In this study, we combine high-resolution observations of NOAA 12418 taken from the Dunn Solar Telescope and magnetic field measurements from the Helioseismic and Magnetic Imager (HMI) to investigate the driver of the IEF. We use the spectra of Hα and Ca II IR to derive the chromospheric line-of-sight velocities, while the HMI magnetograms are used as an input to non-force-free magnetic field extrapolation to track closed magnetic field lines (MFLs) near the sunspot in the active region. This allows us to determine their length and height, locate their inner and outer foot points and derive flow velocities along them. We find that the MFLs related to the IEF reach on average a height of 3 Mm over a length of 13 Mm and the inner and outer foot points are located at 1.2 and 1.9 sunspot radii respectively. The average field strength difference ΔB between inner and outer foot points is around 400 G, which is anti- correlated to the temperature difference ΔT, which has an average value around -100 K. This leads to an average pressure difference of 2 kPa. We conclude that the IEF is driven along magnetic field lines connecting network elements with the outer penumbra by a gas pressure difference that results from a difference in field strength as predicted by the classical siphon flow scenario.

Student poster?

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